Minerals yearbook: Area reports: domestic 1973. Year 1973, Volume 2 1973

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Minerals Yearbook

1973

Volume II

AREA REPORTS: DOMESTIC

Prepared by staff of the

BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR • Thomas S. Kleppe, Secretary

BUREAU OF MINES • Thomas V. Falkie, Director

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, and park and recreation areas, and for the wise use of all those resources. The Department also has a major responsibility for American Indian reservation communities and for the people who live in Island Territories under U.S. administration.

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Foreword

The Federal Government, through the medium of the Minerals Yearbook or its predecessor volumes, has for 91 years reported annually on mineral industry activities. This edition of the Minerals Yearbook presents the record on worldwide mineral industry performance during 1973. In addition to statistics, the volumes provide background information to help in interpreting the year's developments. The content of the individual volumes is as follows:

Volume I, Metals, Minerals, and Fuels, contains chapters on virtually all metallic, nonmetallic, and mineral fuel commodities important to the domestic economy. In addition, it includes a general review chapter on the mineral industries, a statistical summary, and a chapter on mining and quarrying trends.

Volume II, Area Reports: Domestic, contains chapters on the mineral industry of each of the 50 States, the U.S. island possessions in the Pacific Ocean and the Caribbean Sea, the Commonwealth of Puerto Rico, and the Canal Zone. This volume also has a statistical summary, identical to that in Volume I.

Volume III, Area Reports: International, contains the latest available mineral data on more than 130 foreign countries and discusses the importance of minerals to the economies of these nations. A separate chapter reviews minerals in general and their relationships to the world economy.

The Bureau of Mines continually strives to improve the value of the Yearbook for its users. Therefore, the constructive comments and suggestions of readers will be welcomed.

THOMAS V. FALKIE, *Director.*

Acknowledgments

The chapters of this volume, except the statistical summary, were prepared by the staffs of the Divisions of Coal, Ferrous Metals, Nonferrous Metals, Nonmetallic Minerals and Petroleum and Natural Gas of the Associate Directorate, Mineral and Materials Supply/Demand Analysis.

The Statistical Summary chapter and the tabular material covering total State mineral production, value of mineral production by county, and economic indicators were prepared in the Office of Technical Data Services. The Minerals Yearbook staff of that office reviewed the manuscripts upon which this volume was based, to insure statistical consistency among the tables, figures, and text between this volume and Volume I, and between this volume and those of former years.

Compilations contained in this volume were based largely on statistical data and other facts provided by the mineral industries. The Bureau gratefully acknowledges the willing contribution of these essential data by both companies and individuals.

In the collection of statistical and other mineral-industry information, the Bureau of Mines was also assisted by various State agencies through cooperative agreements. Many of the chapters in Volume II were reviewed by staff members of these agencies, and in some instances the staff members collaborated in preparing the chapters and are shown as coauthors. Our sincere appreciation for this assistance is extended to the following cooperating organizations:

Alabama: Geological Survey of Alabama.
Alaska: Alaska Department of Natural Resources.
Arizona: Arizona Bureau of Mines.
Arkansas: Arkansas Geological Commission.
California: Division of Mines and Geology, California Department of Conservation.
Connecticut: Connecticut Geological and Natural History Survey.
Delaware: Delaware Geological Survey.
Florida: Florida Bureau of Geology.
Georgia: Earth and Water Division, Georgia Department of Natural Resources.
Hawaii: Hawaii Department of Land and Natural Resources.
Idaho: Idaho Bureau of Mines and Geology.
Illinois: Illinois State Geological Survey.
Indiana: Geological Survey, Indiana Department of Natural Resources.
Iowa: Geological Survey of Iowa.
Kansas: State Geological Survey of Kansas.
Kentucky: Kentucky Geological Survey.
Louisiana: Louisiana Geological Survey.
Maine: Geological Survey of Maine.
Maryland: Maryland Geological Survey.
Massachusetts: Department of Public Works, Commonwealth of Massachusetts.
Michigan: Geological Survey Division, Michigan Department of Natural Resources.
Minnesota: Minnesota Geological Survey.
Mississippi: Mississippi Geological, Economic, and Topographical Survey.

Missouri: Division of Geological Survey and Water Resources.
Montana: Montana Bureau of Mines and Geology.
Nebraska: Conservation and Survey Division of the University of Nebraska (Nebraska Geological Survey).
Nevada: Nevada Bureau of Mines. .
New Hampshire: New Hampshire Department of Resources and Economic Development.
New Jersey: Bureau of Geology and Topography, New Jersey Division of Natural Resources.
New York: New York State Museum and Science Service.
North Carolina: Office of Earth Resources, North Carolina Department of Natural and Economic Resources.
North Dakota: State Geological Survey of North Dakota.
Oklahoma: Oklahoma Geological Survey.
Pennsylvania: Pennsylvania Bureau of Topographic and Geologic Survey, Department of Environmental Resources.
Puerto Rico: Mining Commission of Puerto Rico; Economic Development Administration, Commonwealth of Puerto Rico.
South Carolina: South Carolina Division of Geology, State Development Board.
South Dakota: South Dakota State Geological Survey.
Tennessee: Division of Geology, Tennessee Department of Conservation.
Texas: Bureau of Economic Geology, University of Texas at Austin.
Utah: Utah Geological and Mineralogical Survey.
Virginia: Virginia Division of Mineral Resources.
Washington: Washington Division of Mines and Geology.
West Virginia: West Virginia Geological and Economic Survey.
Wisconsin: Geological and Natural History Survey of Wisconsin.
Wyoming: Geological Survey of Wyoming.

ALBERT E. SCHRECK
Editor-in-Chief

Contents

Statistical Summary

By Staff, Office of Technical Data Services—Mineral Supply

This chapter summarizes mineral production data for the United States, its island possessions, and the Commonwealth of Puerto Rico. Tables are also included that show the principal mineral commodities exported from and imported into the United States, and that compare world and U.S. mineral production. The detailed data from which these tables were derived are contained in the commodity chapters of volume I and in the State chapters of volume II of this edition of the Minerals Yearbook.

Mineral production may be measured at any of several stages of extraction and processing. The stage of measurement used in this chapter is what is normally termed "mine output." It usually refers to minerals or ores in the form in which they are first extracted from the ground, but customarily includes the product of auxiliary processing at or near the mines.

Because of inadequacies in the statistics available, some series deviate from the foregoing definition. In the case of gold, silver, copper, lead, zinc, and tin, the quantities are recorded on a mine basis (as the recoverable content of ore sold or treated). However, the values assigned to these quantities are based on the average selling price of refined metal, not the mine value. Mercury is measured as recovered metal and valued at the average New York price for the metal.

The weight of volume units shown are those customarily used in the particular industries producing the commodities. Values shown are in current dollars, with no adjustment made to compensate for changes in the purchasing power of the dollar.

Table 1.—Value of mineral production [1] in the United States, by mineral group

(Millions)

Year	Mineral fuels	Nonmetals (except fuels)	Metals	Total [2]
1969	$17,965	$5,624	$3,333	$26,921
1970	20,152	5,712	3,928	29,792
1971	21,247	6,058	3,403	30,708
1972 [r]	22,061	6,482	3,642	32,185
1973	25,012	7,413	4,362	36,788

[r] Revised.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Data may not add to totals shown because of independent rounding.

Table 2.—Mineral production[1] in the United States

Mineral	1970		1971		1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
MINERAL FUELS								
Asphalt and related bitumens (native): Bituminous limestone, sandstone, gilsonite ——short tons	1,980,562	$8,879	1,668,928	$8,291	1,995,374	$10,303	2,088,657	$8,464
Carbon dioxide, natural ——thousand cubic feet	1,109,530	191	1,271,995	216	1,228,741	165	1,134,986	259
Coal:								
Bituminous and lignite[2] ——thousand short tons	602,932	3,772,662	552,192	3,901,496	595,386	4,561,983	591,738	5,049,612
Pennsylvania anthracite ——do	9,729	105,341	8,727	103,469	7,106	85,251	6,830	90,260
Helium:								
Crude ——million cubic feet	3,953	46,820	3,988	47,856	r 3,467	r 41,604	2,558	30,696
High purity ——do	647	17,405	577	14,539	r 629	r 15,673	647	16,121
Natural gas ——do	21,920,642	3,745,680	22,493,012	4,085,482	22,531,698	r 4,180,462	22,647,549	4,894,072
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels	206,305	603,024	200,181	616,657	193,480	604,423	187,390	668,784
LPG ——do	399,611	672,088	417,634	769,397	444,736	847,810	447,033	1,188,289
Peat ——thousand short tons	526	5,986	600	7,011	607	7,112	621	7,547
Petroleum (crude) ——thousand 42-gallon barrels	3,517,450	11,173,726	3,453,914	11,692,998	3,455,368	11,706,510	3,360,903	13,057,905
Total mineral fuels	XX	20,152,000	XX	21,247,000	XX	r 22,061,000	XX	25,012,000
NONMETALS (EXCEPT FUELS)								
Abrasive stones[3] ——short tons	3,055	635	2,349	563	3,241	670	3,466	667
Asbestos ——do	125,314	10,696	130,882	12,174	131,663	13,408	150,036	16,288
Barite ——thousand short tons	854	12,800	825	13,491	906	14,883	1,104	16,688
Boron minerals ——do	1,041	86,827	1,047	89,856	1,121	95,882	1,225	113,648
Bromine ——thousand pounds	349,748	60,560	355,946	61,750	386,864	63,689	418,250	67,131
Calcium-magnesium chloride ——short tons	632,500	15,225	W	W	W	W	609,300	17,581
Cement:								
Portland ——thousand short tons	71,629	1,268,718	75,881	1,421,388	77,973	1,588,290	82,718	1,810,292
Masonry ——do	2,978	67,537	3,341	84,556	3,777	100,269	4,057	119,547
Clays ——do	54,853	267,912	56,666	274,431	59,456	303,022	64,351	354,058
Diatomite ——short tons	597,636	32,649	535,318	34,392	576,089	37,554	608,906	36,083
Emery ——do	W	W	W	W	2,883	W	2,884	W
Feldspar ——do	726,069	9,638	742,810	9,969	r 746,212	r 10,623	791,900	12,830
Fluorspar ——do	269,221	13,923	272,071	17,263	250,347	17,315	248,601	17,337
Garnet (abrasive) ——do	18,837	1,936	18,984	1,934	18,916	1,957	22,772	2,381
Gem stones[6]	NA	2,396	NA	2,589	NA	2,728	NA	2,739
Gypsum ——thousand short tons	9,436	35,132	10,418	39,057	12,328	48,504	13,558	56,650
Lime ——do	19,747	286,155	19,591	308,100	20,290	339,304	21,090	365,849
Magnesium compounds from sea water and brine (except for metal) ——short tons, MgO equivalent	707,874	62,434	668,649	62,322	729,472	63,915	853,907	77,733
Mica:								
Scrap ——thousand short tons	119	2,527	127	2,917	160	4,353	177	6,082
Sheet ——pounds	--	--	17,005	7	14,280	7	--	--
Perlite ——short tons	456,134	4,904	432,208	4,941	544,594	6,231	543,683	5,591
Phosphate rock ——thousand short tons	38,739	203,218	38,886	203,828	40,831	207,910	42,137	238,667
Potassium salts ——thousand short tons, K_2O equivalent	2,729	98,123	2,587	100,527	2,659	106,680	2,603	112,613
Pumice ——thousand short tons	3,036	4,671	3,391	5,214	3,813	6,539	3,772	8,770
Pyrites ——thousand long tons	W	W	808	7,137	741	6,652	559	4,961
Salt ——thousand short tons	45,896	304,759	44,077	303,687	45,022	296,772	43,910	306,103
Sand and gravel ——do	943,941	1,115,705	919,593	1,148,969	r 914,324	r 1,200,701	983,629	1,359,370

Sodium carbonate (natural) ---------- do----	2,688	56,320	2,878	60,774	3,218	71,689	3,722	94,385
Sodium sulfate (natural) ---------- do----	602	10,932	688	11,008	701	11,396	672	11,597
Stone [4] ---------- do----	874,512	1,474,917	876,123	1,594,065	r 920,423	r 1,672,293	1,060,124	1,990,463
Sulfur: Frasch process ---------- thousand long tons--	6,419	151,779	6,738	117,894	7,613	132,385	7,438	138,578
Talc, soapstone, pyrophyllite ---------- short tons--	1,027,929	7,773	1,037,297	7,634	1,107,404	r 7,828	1,246,534	9,144
Tripoli ---------- do----	68,105	520	75,134	569	87,864	797	101,519	930
Vermiculite ---------- thousand short tons--	285	6,501	301	7,198	337	8,092	365	9,464
Value of items that cannot be disclosed: Aplite, brucite (1970–71), natural and slag cement, graphite, iodine, kyanite, lithium minerals, magnesite, greensand marl, olivine, staurolite, wollastonite, and values of nonmetal items indicated by symbol W ----------	XX	34,401	XX	47,358	XX	39,730	XX	28,926
Total nonmetals ----------	XX	5,712,000	XX	6,058,000	XX	r 6,482,000	XX	7,413,000
METALS								
Antimony ore and concentrate short tons, antimony content--	1,130	W	1,025	933	489	386	545	688
Bauxite ---------- thousand long tons, dried equivalent--	2,082	30,070	1,988	28,543	1,812	23,238	1,879	26,635
Copper (recoverable content of ores, etc.) ---- short tons--	1,719,657	1,984,484	1,522,183	1,583,071	1,664,840	1,704,796	1,717,940	2,044,346
Gold (recoverable content of ores, etc.) ---- troy ounces--	1,743,322	63,439	1,495,108	61,673	1,449,943	84,967	1,175,750	115,000
Iron ore, usable (excluding byproduct iron sinter) thousand long tons, gross weight--	87,176	941,739	77,106	891,002	77,884	950,365	90,654	1,163,710
Lead (recoverable content of ores, etc.) ---- short tons--	571,767	178,609	578,550	159,679	618,915	186,046	603,024	196,465
Manganese ore (35% or more Mn) short tons, gross weight--	4,737	W	142	W	578	W	239	W
Manganiferous ore (5% to 35% Mn) ---------- do----	368,302	W	198,334	W	147,161	W	203,055	W
Mercury ---------- 76-pound flasks--	27,296	11,130	17,883	5,229	r 7,333	r 1,601	2,171	621
Molybdenum (content of concentrate) -- thousand pounds--	110,381	190,077	97,882	164,917	102,197	170,530	135,097	217,701
Nickel (content of ore and concentrate) ---- short tons--	15,933	W	17,036	W	16,864	W	18,272	W
Rare-earth metal concentrates ---------- do----	W	W	17,194	7,538	19,520	8,479	31,278	13,780
Silver (recoverable content of ores, etc.) thousand troy ounces--	45,006	79,697	41,564	64,258	37,233	62,737	37,827	96,762
Titanium concentrate, ilmenite -- short tons, gross weight--	920,964	18,626	713,610	15,936	r 739,801	r 16,739	804,355	19,829
Tungsten ore and concentrate thousand pounds contained W--	r 9,312	23,790	r 6,827	20,184	r 7,045	18,104	7,059	19,154
Uranium (recoverable content U_3O_8) -- thousand pounds--	24,682	149,464	24,515	151,996	25,758	162,272	25,820	167,830
Vanadium (recoverable in ore and concentrate) short tons--	5,319	34,923	5,252	37,690	4,887	30,867	4,377	26,611
Zinc (recoverable content of ores, etc.) ---------- do----	534,136	163,650	491,407	158,234	478,318	169,803	478,850	197,861
Value of items that cannot be disclosed: Beryllium, cobalt (1970–71), magnesium chloride for magnesium metal, manganiferous residuum, platinum-group metals (crude), tin (content of concentrate), titanium concentrate (rutile 1972–73), zircon concentrate, and value of metal items indicated by symbol W ----------	XX	58,430	XX	51,690	XX	r 50,650	XX	55,216
Total metals ----------	XX	3,928,000	XX	3,403,000	XX	r 3,642,000	XX	4,362,000
Grand total mineral production ----------	XX	29,792,000	XX	30,708,000	XX	r 32,185,000	XX	36,788,000

e Estimate. r Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Includes a small quantity of anthracite mined in States other than Pennsylvania. In 1971, value excluded that of Arizona, which is withheld to avoid disclosing individual company confidential data; value included with "Nonmetal items that cannot be disclosed."

[3] Grindstones, pulpstones, grinding pebbles, sharpening stones, and tube mill liners.

[4] Excludes abrasive stone, bituminous limestone, bituminous sandstone, and soapstone, all included elsewhere in table.

Table 3.—Minerals produced in the United States and principal producing States in 1973

Mineral	Principal producing States, in order of quantity	Other producing States
Antimony ore and concentrate	Idaho, Mont., Nev.	
Aplite	Va.	
Asbestos	Calif., Vt., Ariz., N.C.	
Asphalt (native)	Tex., Utah, Ala., Mo.	
Barite	Nev., Mo., Ark., Alaska	Calif., Ga., Tenn.
Bauxite	Ark., Ala., Ga.	
Beryllium concentrate	Utah.	
Boron minerals	Calif.	
Bromine	Ark., Mich., Calif.	
Calcium-magnesium chloride	Mich., Calif.	
Carbon dioxide (natural)	N. Mex., Calif., Colo., Utah.	
Cement	Calif., Pa., Tex., Mich	Ala., Ariz., Ark., Colo., Fla., Ga., Hawaii, Idaho, Ill., Ind., Iowa, Kans., Ky., La., Maine, Md., Minn., Miss., Mo., Mont., Nebr., Nev., N. Mex., N.Y., N.C., Ohio, Okla., Oreg., S.C., S. Dak., Tenn., Utah, Va., Wash., W. Va., Wis., Wyo.
Clays	Ga., Tex., Ohio, N.C	All other States except Alaska, R.I., Vt.
Coal	Ky., W. Va., Pa., Ill	Ala., Alaska, Ariz., Ark., Colo., Ind., Iowa, Kans., Md., Mo., Mont., N. Mex., N. Dak., Ohio, Okla., Tenn., Tex., Utah, Va., Wash., Wyo.
Copper (mine)	Ariz., Utah, N. Mex., Mont	Calif., Colo., Idaho, Maine, Mich., Mo., Nev., Okla., Oreg., Pa., Tenn., Wash.
Diatomite	Calif., Nev., Wash	Oreg.
Emery	N.Y	Oreg.
Feldspar	N.C., Calif., Conn., Ga	Ariz., Colo., S. Dak., Wyo.
Fluorspar	Ill., Colo., Mont., Nev	Ariz., Ky., Tex., Utah.
Garnet, abrasive	N.Y., Idaho.	
Gold (mine)	S. Dak., Utah, Nev., Ariz	Alaska, Calif., Colo., Idaho, Mont., N. Mex., Oreg., Tenn., Wash.
Graphite	Tex.	
Gypsum	Mich., Calif., Tex., Iowa	Ariz., Ark., Colo., Idaho, Ind., Kans., La., Mont., Nev., N. Mex., N.Y., Ohio, Okla., S. Dak., Utah, Va., Wash., Wyo.
Helium	Kans., Tex., Okla., Ariz.	
Iodine	Mich.	
Iron ore	Minn., Mich., Calif., Mo	Ala., Ariz., Ark., Colo., Ga., Idaho, Mont., Nev., N. Mex., N.Y., N.C., Pa., Tex., Utah, Wis., Wyo.
Kyanite	Va., Ga., Fla.	
Lead (mine)	Mo., Idaho, Colo., Utah	Alaska, Ariz., Calif., Ill., Maine, Mont., N. Mex., N.Y., Va., Wash., Wis.
Lime	Ohio, Pa., Tex., Mo	Ala., Ariz., Ark., Calif., Colo., Conn., Fla., Hawaii, Idaho, Ill., Ind., Iowa, Kans., Ky., La., Md., Mass., Mich., Minn., Miss., Mont., Nebr., Nev., N.J., N. Mex., N.Y., N. Dak., Okla., Oreg., S. Dak., Tenn., Utah, Va., Wash., W. Va., Wis., Wyo.
Lithium minerals	N.C., Nev., Calif.	
Magnesite	Nev.	
Magnesium chloride	Tex.	
Magnesium compounds	Mich., Calif., N.J., Fla	Del., Miss., Tex., Utah.
Manganese ore	Mont.	
Manganiferous ore	Minn., N. Mex.	
Manganiferous residuum	N.J.	
Marl, greensand	N.J.	
Mercury	Calif., Nev., Alaska, Tex	Oreg.
Mica, scrap	N.C., Ala., Ga., S.C	Ariz., Conn., N. Mex.
Molybdenum	Colo., Ariz., Utah, N. Mex	Calif., Nev.
Natural gas	Tex., La., Okla., N. Mex	Ala., Alaska, Ariz., Ark., Calif., Colo., Fla., Ill., Ind., Kans., Ky., Md., Mich., Miss., Mo., Mont., Nebr., N.Y., N. Dak., Ohio, Pa., Tenn., Utah, Va., W. Va., Wyo.

Table 3.—Minerals produced in the United States and principal producing States in 1973—Continued

Mineral	Principal producing States, in order of quantity	Other producing States
Natural gas liquids	Tex., La., Okla., N. Mex	Ala., Alaska, Ark., Calif., Colo., Fla., Ill., Kans., Ky., Mich., Miss., Mont., Nebr., N. Dak., Pa., Utah, W. Va., Wyo.
Nickel	Oreg.	
Olivine	Wash., N.C.	
Peat	Mich., Ill., Ind., N.J	Calif., Colo., Fla., Ga., Iowa, Maine, Md., Mass., Minn., Mont., N. Mex., N.Y., Ohio, Pa., S.C., Vt., Wash., Wis.
Perlite	N. Mex., Ariz., Calif., Nev	Colo., Idaho, Tex.
Petroleum, crude	Tex., La., Calif., Okla	Ala., Alaska, Ariz., Ark., Colo., Fla., Ill., Ind., Kans., Ky., Mich., Miss., Mo., Mont., Nebr., Nev., N. Mex., N.Y., N. Dak., Ohio, Pa., S. Dak., Tenn., Utah, W. Va., Wyo.
Phosphate rock	Fla., Idaho, Tenn., N.C	Mo., Mont., Utah, Wyo.
Platinum-group metals	Alaska.	
Potassium salts	N. Mex., Utah, Calif.	
Pumice	Oreg., Ariz., Calif., Hawaii	Colo., Idaho, Kans., Nev., N. Mex., Okla., Utah, Wash., Wyo.
Pyrites ore and concentrate	Tenn., Colo., Ariz.	
Rare-earth metal concentrate	Calif., Ga., Fla.	
Salt	La., Tex., N.Y., Mich	Ala., Calif., Colo., Hawaii, Kans., Nev., N. Mex., N. Dak., Ohio, Okla., Utah, Va., W. Va.
Sand and gravel	Calif., Mich., Ohio, Ill	All other States.
Silver (mine)	Idaho, Ariz., Mont., Colo	Alaska, Calif., Ill., Maine, Mich., Mo., Nev., N. Mex., N.Y., Okla., Oreg., S. Dak., Tenn., Utah, Wash.
Sodium carbonate (natural)	Wyo., Calif.	
Sodium sulfate (natural)	Calif., Tex., Utah.	
Staurolite	Fla.	
Stone	Pa., Ill., Fla., Tex	All other States except Del.
Sulfur (Frasch)	Tex., La.	
Talc, soapstone, pyrophyllite	Vt., N.Y., Tex., Mont	Ala., Ark., Calif., Ga., Md., Nev., N.C., Oreg., Va., Wash.
Tin	Colo., N. Mex	Alaska.
Titanium concentrate	N.Y., Fla., N.J., Ga.	
Tripoli	Ill., Okla., Ark., Pa.	
Tungsten concentrate	Calif, Colo., Nev	Ariz., Idaho, Mont., Utah, Wash.
Uranium	Wyo., N. Mex., Tex., Utah	Alaska, Colo., Wash.
Vanadium	Ark., Idaho, Colo., Utah	N. Mex.
Vermiculite	Mont., S.C.	
Wollastonite	N.Y.	
Zinc (mine)	Mo., N.Y., Tenn., Colo	Ariz., Calif., Idaho, Ill., Ky., Maine, Mont., N.J., N. Mex., Pa., Utah, Va., Wash., Wis.
Zircon concentrate	Fla., Ga.	

Table 4.—Value of mineral production in the United States and principal minerals produced in 1973

State	Value (thousands)	Rank	Percent of U.S. total	Principal minerals, in order of value
Alabama	$413,056	21	1.12	Coal, cement, petroleum, stone.
Alaska	328,789	25	.89	Petroleum, sand and gravel, natural gas, stone.
Arizona	1,304,988	8	3.55	Copper, molybdenum, sand and gravel, cement.
Arkansas	273,705	29	.75	Petroleum, bromine, natural gas, cement.
California	2,041,686	3	5.55	Petroleum, cement, sand and gravel, natural gas.
Colorado	532,776	19	1.45	Petroleum, molybdenum, coal, sand and gravel.
Connecticut	36,804	44	.10	Stone, sand and gravel, feldspar, lime.
Delaware	3,889	50	.01	Sand and gravel, magnesium compounds, clays.
Florida	601,100	17	1.63	Phosphate rock, petroleum, stone, cement.
Georgia	305,479	26	.83	Clays, stone, cement, sand and gravel.
Hawaii	35,147	45	.10	Stone, cement, sand and gravel, pumice.
Idaho	136,081	33	.37	Silver, phosphate rock, lead, zinc.
Illinois	825,608	12	2.24	Coal, petroleum, stone, sand and gravel.
Indiana	351,405	24	.96	Coal, cement, stone, sand and gravel.
Iowa	158,800	31	.43	Cement, stone, sand and gravel, gypsum.
Kansas	646,299	16	1.76	Petroleum, natural gas, natural gas liquids, cement.
Kentucky	1,164,762	9	3.17	Coal, stone, petroleum, natural gas.
Louisiana	5,819,610	2	15.82	Petroleum, natural gas, natural gas liquids, sulfur.
Maine	33,493	46	.09	Sand and gravel, cement, zinc, stone.
Maryland	131,907	34	.36	Stone, cement, sand and gravel, coal.
Massachusetts	59,682	43	.16	Stone, sand and gravel, lime, clays.
Michigan	789,022	14	2.14	Iron ore, cement, copper, sand and gravel.
Minnesota	852,785	11	2.32	Iron ore, sand and gravel, stone, cement.
Mississippi	281,738	27	.77	Petroleum, natural gas, sand and gravel, cement.
Missouri	512,634	20	1.39	Lead, cement, stone, iron ore.
Montana	385,285	22	1.05	Copper, petroleum, coal, sand and gravel.
Nebraska	80,821	42	.22	Petroleum, cement, sand and gravel, stone.
Nevada	201,813	30	.55	Copper, gold, sand and gravel, diatomite.
New Hampshire	14,119	48	.04	Sand and gravel, stone, clays, gem stones.
New Jersey	114,016	37	.31	Stone, sand and gravel, zinc, titanium concentrate.
New Mexico	1,305,644	7	3.55	Petroleum, natural gas, copper, natural gas liquids.
New York	375,866	23	1.02	Cement, stone, salt, sand and gravel.
North Carolina	146,930	32	.40	Stone, sand and gravel, cement, feldspar.
North Dakota	111,853	38	.30	Petroleum, coal, sand and gravel, natural gas.
Ohio	806,979	13	2.19	Coal, stone, cement, lime.
Oklahoma	1,323,626	6	3.60	Petroleum, natural gas, natural gas liquids, stone.
Oregon	81,466	40	.22	Sand and gravel, stone, cement, nickel.
Pennsylvania	1,401,900	5	3.81	Coal, cement, stone, sand and gravel.
Rhode Island	4,340	49	.01	Sand and gravel, stone, gem stones.
South Carolina	88,361	39	.24	Cement, stone, clays, sand and gravel.
South Dakota	81,139	41	.22	Gold, sand and gravel, cement, stone.
Tennessee	275,690	28	.75	Stone, coal, cement, zinc.
Texas	8,442,494	1	22.95	Petroleum, natural gas, natural gas liquids, cement.
Utah	674,210	15	1.83	Copper, petroleum, coal, gold.
Vermont	29,366	47	.08	Stone, asbestos, sand and gravel, talc.
Virginia	540,595	18	1.47	Coal, stone, sand and gravel, cement.
Washington	114,329	36	.31	Sand and gravel, cement, coal, stone.
West Virginia	1,503,045	4	4.09	Coal, natural gas, stone, cement.
Wisconsin	114,339	35	.31	Sand and gravel, stone, iron ore, cement.
Wyoming	928,105	10	2.52	Petroleum, sodium compounds, uranium, natural gas.
Total	36,788,000	--	100.00	

Table 5.—Value of mineral production per capita and per square mile in 1973, by State

State	Area (square miles)	1970 population (thousands)	Value of mineral production				
			Total (thousands)	Per square mile		Per capita	
				Dollars	Rank	Dollars	Rank
Alabama	51,609	3,444	$413,056	$8,004	20	$120	21
Alaska	586,412	300	328,789	561	50	1,096	4
Arizona	113,909	1,771	1,304,988	11,456	14	737	7
Arkansas	53,104	1,923	273,705	5,154	31	142	18
California	158,693	19,953	2,041,686	12,866	12	102	25
Colorado	104,247	2,207	532,776	5,111	32	241	14
Connecticut	5,009	3,032	36,804	7,348	25	12	47
Delaware	2,057	548	3,889	1,891	40	7	49
Florida	58,560	6,789	601,100	10,265	16	89	27
Georgia	58,876	4,590	305,479	5,189	30	67	32
Hawaii	6,450	769	35,147	5,449	29	46	36
Idaho	83,557	713	136,081	1,629	43	191	16
Illinois	56,400	11,114	825,608	14,638	8	74	29
Indiana	36,291	5,194	351,405	9,681	18	68	31
Iowa	56,290	2,824	158,800	2,821	36	56	34
Kansas	82,264	2,247	646,299	7,856	22	288	13
Kentucky	40,395	3,219	1,164,762	28,834	5	362	12
Louisiana	48,523	3,641	5,819,610	119,935	1	1,598	2
Maine	33,215	992	33,493	1,008	48	34	39
Maryland	10,577	3,922	131,907	12,471	13	34	40
Massachusetts	8,257	5,689	59,682	7,228	26	10	48
Michigan	58,216	8,875	789,022	13,553	10	89	26
Minnesota	84,068	3,805	852,785	10,144	17	224	15
Mississppi	47,716	2,217	281,738	5,904	28	127	19
Missouri	69,686	4,677	512,634	7,356	24	110	24
Montana	147,138	694	385,285	2,619	38	555	9
Nebraska	77,227	1,483	80,821	1,047	47	54	35
Nevada	110,540	489	201,813	1,826	41	413	11
New Hampshire	9,304	738	14,119	1,518	45	19	45
New Jersey	7,836	7,168	114,016	14,550	9	16	46
New Mexico	121,666	1,016	1,305,644	10,731	15	1,285	3
New York	49,576	18,237	375,866	7,582	23	21	44
North Carolina	52,586	5,082	146,930	2,794	37	29	42
North Dakota	70,665	618	111,853	1,583	44	181	17
Ohio	41,222	10,652	806,979	19,576	6	76	28
Oklahoma	69,919	2,559	1,323,626	18,931	7	517	10
Oregon	96,981	2,091	81,466	840	49	39	37
Pennsylvania	45,333	11,794	1,401,900	30,924	4	119	22
Rhode Island	1,214	947	4,340	3,575	33	5	50
South Carolina	31,055	2,591	88,361	2,845	35	34	38
South Dakota	77,047	666	81,139	1,053	46	122	20
Tennessee	42,244	3,924	275,690	6,526	27	70	30
Texas	267,338	11,197	8,442,494	31,580	3	754	6
Utah	84,916	1,059	674,210	7,940	21	637	8
Vermont	9,609	444	29,366	3,056	34	66	33
Virginia	40,817	4,648	540,595	13,244	11	116	23
Washington	68,192	3,409	114,329	1,677	42	34	41
West Virginia	24,181	1,744	1,503,045	62,158	2	862	5
Wisconsin	56,154	4,418	114,339	2,036	39	26	43
Wyoming	97,914	332	928,105	9,479	19	2,795	1
Total	3,615,055	202,455	36,788,000	10,176	--	182	--

Table 6.—Mineral production[1] in the United States, by State

Mineral	1970		1971		1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
ALABAMA								
Cement:[2]								
Masonry ---thousand short tons	336	$7,601	349	$8,657	407	$11,221	425	$13,074
Portland ---do	3,018	51,114	2,284	42,281	2,360	48,577	2,396	55,820
Clays ---do	2,748	8,213	[3] 2,915	[3] 6,913	[3] 2,850	[3] 7,512	[3] 2,934	[3] 8,788
Coal (bituminous) ---do	20,560	166,308	17,944	146,180	[r] 20,814	200,430	19,230	211,695
Iron ore (usable) ---thousand long tons, gross weight	W	W	415	2,773	327	1,912	271	1,408
Lime ---thousand short tons	749	10,286	761	11,454	739	11,751	881	14,050
Natural gas ---million cubic feet	627	87	355	54	3,644	1,282	11,271	4,307
Petroleum (crude) ---thousand 42-gallon barrels	7,263	20,627	7,832	23,496	9,934	30,466	11,677	41,772
Sand and gravel ---thousand short tons	6,725	8,144	6,674	7,513	6,352	8,530	9,805	13,870
Stone[4] ---do	19,982	37,166	17,773	34,413	18,485	42,027	20,043	40,117
Value of items that cannot be disclosed: Asphalt (native), bauxite, cement (slag), clays (bentonite, 1971–73), mica (scrap), natural gas liquids, phosphate rock (1970), salt, stone (dimension), talc, and values indicated by symbol W	XX	13,699	XX	7,758	XX	7,533	XX	8,155
Total	XX	323,245	XX	291,492	XX	371,241	XX	413,056
ALASKA								
Antimony ore and concentrate short tons, antimony content	63	109	--	--	--	--	--	--
Barite ---thousand short tons	134	835	102	1,075	W	W	W	W
Coal (bituminous) ---do	549	4,059	698	5,710	668	W	694	W
Gem stones	NA	W	NA	W	NA	57	NA	57
Gold (recoverable content of ores, etc.) ---troy ounces	34,776	1,265	13,012	537	8,639	506	7,107	695
Lead (recoverable content of ores, etc.) ---short tons	--	--	--	--	--	--	6	2
Natural gas ---million cubic feet	111,576	27,448	121,618	17,878	125,596	18,463	131,007	19,483
Petroleum (crude) ---thousand 42-gallon barrels	83,616	251,684	79,494	257,562	72,893	235,444	72,323	261,877
Sand and gravel ---thousand short tons	25,825	41,092	23,617	32,806	14,187	15,214	14,999	19,913
Silver (recoverable content of ores, etc.) thousand troy ounces	2	4	1	1	(5)	(5)	1	2
Stone ---thousand short tons	6,470	10,014	2,658	5,066	652	3,012	5,967	12,741
Tin ---long tons	W	W	17	47	W	W	5	12
Value of items that cannot be disclosed: Mercury, natural gas liquids (1971–73), platinum-group metals, uranium (1971–73), and values indicated by symbol W	XX	1,761	XX	2,141	XX	13,442	XX	14,007
Total	XX	338,271	XX	322,823	XX	286,138	XX	328,789
ARIZONA								
Clays ---thousand short tons	199	454	[3] 119	[3] 84	[3] 134	[3] 355	[3] 117	[3] 459
Coal (bituminous) ---do	132	W	1,146	W	W	W	3,247	W
Copper ---short tons	917,918	1,059,277	820,171	852,978	908,612	930,419	927,271	1,103,453
Gem stones	NA	155	NA	160	NA	168	NA	170
Gold (recoverable content of ores, etc.) ---troy ounces	109,853	3,998	94,038	3,879	102,996	6,036	102,848	10,060

Gypsum ---thousand short tons	98	358	W	W	W	W	158	669
Helium, high purity ---million cubic feet	62	1,186	W	W	W	W	W	W
Iron ore (usable) ---thousand long tons, gross weight	W	W	16	W	W	W	W	W
Lead (recoverable content of ores, etc.) ---short tons	285	89	859	237	1,763	530	763	248
Lime ---thousand short tons	309	4,523	296	4,474	356	6,024	365	7,019
Molybdenum (content of concentrate) ---thousand pounds	15,672	26,700	22,684	39,872	27,216	46,791	37,657	59,372
Natural gas (marketed) ---million cubic feet	1,101	188	868	153	r 442	r 80	125	23
Petroleum (crude) ---thousand 42-gallon barrels	1,784	5,281	1,236	3,918	993	3,226	804	3,103
Pumice ---thousand short tons	824	627	949	625	915	722	853	715
Sand and gravel ---do	17,822	19,804	19,791	24,391	24,842	32,420	27,440	38,503
Silver (recoverable content of ores, etc.) thousand troy ounces	7,330	12,981	6,170	9,538	6,653	11,210	7,199	18,416
Stone ---thousand short tons	3,511	7,094	2,873	5,848	4,638	8,018	4,265	9,469
Zinc (recoverable content of ores, etc.) ---short tons	9,618	2,947	7,761	2,499	10,111	3,589	8,427	3,482
Value of items that cannot be disclosed: Asbestos, cement, clays (fire, 1971–73, bentonite), diatomite (1970–72), feldspar, fluorspar (1971–73), mica (scrap), perlite, pyrites, tungsten, and values indicated by symbol W	XX	21,105	XX	32,364	XX	r 41,416	XX	49,827
Total	XX	1,166,767	XX	981,020	XX	1,091,004	XX	1,304,988
ARKANSAS								
Barite ---thousand short tons	168	3,721	W	W	W	W	W	W
Bauxite ---thousand long tons, dried equivalent	1,869	26,293	1,781	24,979	1,634	21,010	1,686	23,884
Clays ---thousand short tons	1,014	2,902	[3] 936	[3] 1,499	[3] 885	[3] 990	[3] 1,446	[3] 1,412
Coal (bituminous) ---do	268	2,225	276	2,848	428	4,676	434	5,806
Gem stones	NA	25	NA	30	NA	32	NA	50
Lime ---thousand short tons	186	2,680	157	2,313	150	2,456	177	2,742
Natural gas ---million cubic feet	181,351	29,560	172,154	29,426	166,522	28,808	157,529	28,985
Natural gas liquids: Natural gasoline and cycle products thousand 42-gallon barrels	643	1,824	517	1,686	261	854	204	861
LP gases ---do	1,205	2,482	1,035	2,650	546	1,420	449	1,688
Petroleum (crude) ---do	18,035	51,760	18,263	56,805	18,519	58,335	18,016	70,618
Sand and gravel ---thousand short tons	13,301	16,036	11,630	15,603	11,574	16,558	12,465	20,625
Stone ---do	15,284	22,786	17,647	28,776	16,317	25,020	16,223	26,209
Value of items that cannot be disclosed: Abrasive stones, bromine, cement, clays (kaolin, 1971–73), gypsum, iron ore (1973), mercury (1970–71), soapstone, tripoli, vanadium, and values indicated by symbol W	XX	63,331	XX	79,703	XX	81,020	XX	90,825
Total	XX	225,625	XX	246,318	XX	241,179	XX	273,705
CALIFORNIA								
Antimony ore and concentrate short tons, antimony content	4	10	--	--	--	--	--	--
Asbestos ---short tons	78,966	6,332	87,144	7,806	90,967	8,673	105,663	10,886
Barite ---thousand short tons	W	W	W	W	4	34	11	152
Boron minerals ---do	1,041	86,827	1,047	89,856	1,121	95,882	1,225	113,648
Cement ---do	9,306	173,126	9,117	169,921	9,086	182,308	9,395	201,892
Clays ---do	2,824	6,506	[3] 2,822	[3] 7,103	2,706	7,387	2,723	6,853
Copper (recoverable content of ores, etc.) ---short tons	2,308	2,663	515	536	598	612	369	440
Gem stones	NA	200	NA	205	NA	215	NA	220

See footnotes at end of table.

Table 6.—Mineral production[1] in the United States, by State—Continued

Mineral	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
CALIFORNIA—Continued								
Gold (recoverable content of ores, etc.) --troy ounces--	4,999	$182	2,966	$122	3,974	$233	3,647	$357
Gypsum ----thousand short tons--	1,132	3,271	1,352	3,884	1,525	4,965	1,778	5,834
Lead (recoverable content of ores, etc.) ---short tons--	1,772	553	2,284	630	1,153	347	44	14
Lime ----thousand short tons--	572	9,911	630	10,846	608	13,059	632	13,602
Magnesium compounds from seawater and bitterns (partly estimated) ------short tons, MgO equivalent--	73,726	7,489	152,918	16,836	175,654	18,421	184,105	19,233
Mercury ----76-pound flasks--	18,593	7,582	13,489	3,944	r 5,835	r 1,274	1,219	349
Natural gas ----million cubic feet--	649,117	208,367	612,629	199,717	487,278	179,318	449,369	167,615
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels--	11,993	38,478	11,045	35,545	8,468	27,664	6,865	23,475
LP gases ----do----	7,051	16,006	6,755	16,482	5,847	15,962	5,329	19,824
Peat ----thousand short tons--	10	W	12	W	29	620	21	373
Petroleum (crude) ---thousand 42-gallon barrels--	372,191	945,365	358,484	975,076	347,022	940,430	336,075	1,045,193
Pumice ----thousand short tons--	499	832	699	1,179	731	1,507	768	3,237
Salt ----do----	1,656	15,053	1,887	21,142	1,621	14,860	1,507	15,533
Sand and gravel ----do----	140,259	174,221	115,468	157,683	117,288	162,619	117,470	176,286
Silver (recoverable content of ores, etc.) thousand troy ounces--	451	799	444	686	175	296	56	143
Stone ----thousand short tons--	46,399	66,950	43,336	86,255	37,213	65,811	43,838	77,175
Talc, soapstone, pyrophyllite ----short tons--	184,660	2,545	153,227	2,084	155,155	1,186	179,191	1,501
Zinc (recoverable content of ores, etc.) ---do----	3,514	1,077	3,003	967	1,202	427	20	8
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, carbon dioxide, cement (masonry 1971–73), coal (lignite, 1970–72), diatomite, feldspar, iron ore, lithium minerals, molybdenum, perlite, phosphate rock (1970), potassium salts, rare-earth metal concentrates, sodium carbonate and sulfate, tungsten concentrate, and values indicated by symbol W ----	XX	125,337	XX	112,218	XX	107,266	XX	137,843
Total ----	XX	1,899,682	XX	1,920,723	XX	r 1,851,376	XX	2,041,686
COLORADO								
Clays ----thousand short tons--	3 637	3 1,503	625	1,334	747	1,533	794	1,710
Coal (bituminous) ----do----	6,025	35,243	5,337	33,813	5,522	35,637	6,233	46,190
Copper (recoverable content of ores, etc.) --short tons--	3,749	4,326	3,938	4,096	3,944	4,039	3,123	3,716
Feldspar ----do----	477	3	571	4	W	W	W	W
Gem stones ----	NA	120	NA	125	NA	131	NA	131
Gold (recoverable content of ores, etc.) --troy ounces--	37,114	1,351	42,031	1,784	61,100	3,580	63,422	6,203
Gypsum ----thousand short tons--	W	W	W	W	W	W	151	568
Lead (recoverable content of ores, etc.) ----short tons--	21,855	6,827	25,746	7,106	31,346	9,423	28,112	9,159
Lime ----thousand short tons--	119	1,613	193	3,039	187	4,070	178	3,371
Mica, sheet ----pounds--	--	--	8,300	4	14,280	7	--	--
Natural gas ----million cubic feet--	105,804	15,553	108,537	16,932	116,949	19,297	137,725	24,304

Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels	745	1,937	929	2,462	1,245	3,349	1,424	4,295
LP gases do	1,542	2,529	1,653	3,190	1,749	3,673	1,978	6,488
Peat thousand short tons	34	210	28	156	39	210	28	163
Petroleum (crude) thousand 42-gallon barrels	24,723	78,619	27,391	92,855	32,015	109,171	36,590	155,507
Pumice thousand short tons	50	268	62	W	59	W	W	W
Sand and gravel do	22,261	24,190	27,000	30,155	28,318	34,631	33,767	45,493
Silver (recoverable content of ores, etc.) thousand troy ounces	2,933	5,194	3,390	5,241	3,664	6,174	3,942	10,083
Stone thousand short tons	3,552	8,076	3,785	7,933	4,507	9,599	6,357	14,003
Uranium (recoverable content U_3O_8) thousand pounds	2,727	15,832	2,536	15,725	1,877	11,825	1,920	12,480
Zinc (recoverable content of ores, etc.) short tons	56,694	17,370	61,181	19,700	63,801	22,649	58,339	24,106
Value of items that cannot be disclosed: Beryllium concentrate (1970–72), carbon dioxide, cement, fluorspar, iron ore, mica (scrap, 1970–71), molybdenum, perlite, pyrites, salt, tin, tungsten, vanadium and values indicated by symbol W	XX	169,060	XX	147,117	XX	146,843	XX	164,806
Total	XX	389,824	XX	392,721	XX	425,841	XX	532,776
CONNECTICUT								
Clays thousand short tons	171	386	174	322	157	292	162	320
Feldspar short tons	W	W	W	W	W	W	77,206	W
Gem stones	NA	8	NA	15	NA	16	NA	16
Mica scrap thousand short tons	W	W	3	W	2	W	3	W
Sand and gravel do	6,765	9,202	6,921	10,262	6,763	11,270	7,806	12,788
Stone do	8,338	16,915	7,193	15,649	8,719	19,695	9,682	21,305
Value of items that cannot be disclosed: Lime and values indicated by symbol W	XX	1,872	XX	1,713	XX	1,850	XX	2,375
Total	XX	28,383	XX	27,961	XX	33,123	XX	36,804
DELAWARE								
Clays thousand short tons	11	11	14	8	15	9	15	9
Gem stones	NA	1	NA	2	NA	W	NA	W
Sand and gravel thousand short tons	1,565	1,603	2,205	2,231	2,257	2,660	3,408	3,678
Value of items that cannot be disclosed: Other nonmetals and values indicated by symbol W	--	--	--	--	XX	202	XX	202
Total	XX	1,615	XX	2,241	XX	2,871	XX	3,889
FLORIDA								
Cement:								
Masonry thousand short tons	W	W	180	4,877	213	6,901	256	8,706
Portland do	W	W	2,177	48,970	2,425	59,773	2,725	72,666
Clays do	872	12,661	[3] 993	[3] 12,834	[3] 922	[3] 10,336	1,139	13,718
Lime do	167	2,810	159	2,958	180	3,527	187	4,026
Natural gas million cubic feet	--	--	903	270	15,521	4,967	33,857	11,613
Peat thousand short tons	46	304	57	412	45	362	44	384
Petroleum (crude) thousand 42-gallon barrels	2,999	W	5,347	W	16,897	W	32,695	150,070

See footnotes at end of table.

Table 6.—Mineral production[1] in the United States, by State—Continued

Mineral	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
FLORIDA—Continued								
Sand and gravel ——thousand short tons	12,482	$12,254	23,228	$18,836	r 22,363	r $17,009	20,167	$21,415
Stone[4] ——do	43,089	61,302	42,816	64,332	53,093	81,621	61,735	103,595
Value of items that cannot be disclosed: Clay (kaolin 1971–72), kyanite, magnesium compounds, natural gas liquids, phosphate rock, rare-earth metal concentrate (1972–73), staurolite, stone (dimension), titanium concentrate, zircon concentrate, and values indicated by symbol W	XX	210,711	XX	190,242	XX	r 242,136	XX	214,907
Total	XX	300,042	XX	343,731	XX	r 426,632	XX	601,100
GEORGIA								
Cement:								
Masonry ——thousand short tons	W	W	63	1,470	68	1,569	67	2,126
Portland ——do	W	W	1,214	22,470	1,260	27,286	1,201	28,124
Clays ——do	5,684	110,149	[3] 5,791	[3] 119,096	[3] 6,227	[3] 132,322	[3] 7,721	[3] 160,419
Feldspar ——short tons	W	W	W	W	W	W	51,523	W
Iron ore (usable) ——thousand long tons, gross weight	243	1,467	W	W	W	W	W	W
Peat ——thousand short tons	W	W	1	13	W	W	(5)	4
Sand and gravel ——do	3,667	4,437	3,697	5,310	3,816	4,729	4,976	6,781
Stone ——do	26,635	59,200	30,669	69,897	37,074	82,484	40,841	97,506
Talc ——short tons	45,900	289	53,000	334	45,842	338	38,000	114
Value of items that cannot be disclosed: Barite, bauxite, fire clay (1971–73), kyanite, mica (scrap), rare-earth metal concentrate, titanium concentrate, zircon concentrate, and values indicated by symbol W	XX	27,683	XX	10,895	XX	r 9,589	XX	10,405
Total	XX	203,225	XX	229,485	XX	r 258,317	XX	305,479
HAWAII								
Cement:								
Masonry ——thousand short tons	11	366	11	431	13	384	16	537
Portland ——do	396	9,968	375	10,196	402	10,732	453	13,213
Clays ——do	2	11	W	W	W	W	W	W
Gem stones	W	W	NA	54	NA	57	NA	W
Lime ——thousand short tons	9	338	8	228	7	266	6	238
Pumice, pumicite, volcanic ash ——do	350	933	289	779	379	762	354	611
Sand and gravel ——do	514	1,679	836	1,967	609	1,893	753	2,012
Stone ——do	[4] 6,332	[4] 15,538	[4] 6,056	[4] 14,357	[4] 5,005	[4] 13,494	7,180	18,466
Value of items that cannot be disclosed: Salt, stone (dimension, 1970–72), and values indicated by symbol W	XX	132	XX	95	XX	486	XX	70
Total	XX	28,965	XX	28,107	XX	28,074	XX	35,147

IDAHO								
Antimony ore and concentrate short tons, antimony content	993	W	857	817	345	303	322	406
Clays thousand short tons	[3] 13	[3] 28	W	W	57	415	42	227
Copper (recoverable content of ores, etc.) short tons	3,612	4,168	3,776	3,927	2,942	3,013	3,625	4,314
Gem stones	NA	90	NA	100	NA	105	NA	110
Gold (recoverable content of ores, etc.) troy ounces	3,128	114	3,596	148	2,884	169	2,696	264
Gypsum thousand short tons	--	--	--	--	--	--	W	W
Lead (recoverable content of ores, etc.) short tons	61,211	19,121	66,610	18,384	61,407	18,459	61,744	20,116
Mercury 76-pound flasks	1,038	423	1,057	309	161	35	--	--
Peat thousand short tons	W	W	W	W	--	--	--	--
Pumice do	53	94	W	W	W	W	80	110
Sand and gravel do	12,953	10,022	11,279	11,437	7,696	10,294	8,393	10,246
Silver (recoverable content of ores, etc.) thousand troy ounces	19,115	33,849	19,140	29,590	14,251	24,012	13,620	34,840
Stone thousand short tons	[4] 4,240	[4] 6,368	4,149	6,118	3,094	7,042	2,972	8,096
Tungsten concentrate thousand pounds contained W	W	W	[r] 24	66	W	W	W	W
Zinc (recoverable content of ores, etc.) short tons	41,052	12,578	45,078	14,515	38,647	13,720	46,107	19,052
Value of items that cannot be disclosed: Cement, clays, (fire clay and kaolin, 1970–71), fluorspar (1971), abrasive garnet, iron ore, lime, perlite, phosphate rock, stone (dimension, 1970), vanadium, and values indicated by symbol W	XX	32.904	XX	26,869	XX	28,639	XX	38,300
Total	XX	119,759	XX	112,280	XX	106,206	XX	136,081
ILLINOIS								
Cement:								
Masonry thousand short tons	71	1,874	73	2,336	80	2,483	88	2,901
Portland do	1,494	25,252	1,425	25,975	1,571	33,124	1,572	36,064
Clays do	[3] 1,676	[3] 3,862	1,788	4,294	[3] 1,716	[3] 3,314	[3] 1,758	[3] 3,613
Coal (bituminous) do	65,119	320,705	58,402	318,878	65,523	402,481	61,572	413,309
Fluorspar short tons	148,208	8,637	138,051	9,883	132,405	9,961	160,305	11,871
Gem stones	NA	W	NA	2	NA	2	NA	2
Lead (recoverable content of ores, etc.) short tons	1,532	479	1,238	342	1,335	401	541	176
Natural gas million cubic feet	4,850	761	498	139	1,194	334	1,688	573
Peat thousand short tons	63	711	72	W	74	935	72	1,037
Petroleum (crude) thousand 42-gallon barrels	43,747	141,994	39,084	135,621	34,874	121,013	30,669	132,490
Sand and gravel thousand short tons	43,926	60,155	45,364	59,397	39,929	61,696	43,649	62,029
Stone do	55,776	86,502	[4] 61,991	[4] 106,084	[4] 56,260	[4] 94,225	66,653	114,068
Zinc (recoverable content of ores, etc.) short tons	16,797	5,146	12,706	4,091	11,378	4,039	5,250	2,169
Value of items that cannot be disclosed: Clay (fuller's earth, 1970, 1972–73), lime, natural gas liquids, silver (1971–73), stone (dimension, 1971–72), tripoli, and values indicated by symbol W	XX	32.619	XX	[r] 33,828	XX	35.729	XX	45,306
Total	XX	688,697	XX	700,870	XX	769,737	XX	825,608
INDIANA								
Cement thousand short tons	[2] 2,151	[2] 41,810	W	W	W	W	W	W
Clays do	1,335	2,139	[3] 1,324	[3] 2,308	[3] 1,419	[3] 2,465	1,436	2,568

See footnotes at end of table.

Table 6.—Mineral production[1] in the United States, by State—Continued

Mineral	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
INDIANA—Continued								
Coal (bituminous) ——thousand short tons	22,263	$102,371	21,396	$110,796	25,949	$144,688	25,253	$153,136
Natural gas ——million cubic feet	153	36	537	89	355	55	276	38
Peat ——thousand short tons	W	W	50	W	45	478	51	475
Petroleum (crude) ——thousand 42-gallon barrels	7,487	23,958	6,658	22,770	6,130	20,964	5,312	20,823
Sand and gravel ——thousand short tons	23,476	25,796	24,982	29,094	27,978	33,290	27,731	35,015
Stone ——do	25,818	45,215	26,233	48,218	27,511	50,919	[4] 32,288	[4] 57,652
Value of items that cannot be disclosed: Abrasive stone, clay (fire, 1971–72), gypsum, lime, sandstone (1973), and values indicated by symbol W	XX	14,461	XX	68,246	XX	69,749	XX	81,698
Total	XX	255,786	XX	281,521	XX	322,608	XX	351,405
IOWA								
Cement:								
Masonry ——thousand short tons	73	1,758	66	1,719	66	1,916	68	2,351
Portland ——do	2,396	45,432	2,392	47,925	2,458	49,635	2,688	59,574
Clays ——do	1,181	1,823	[3] 1,028	[3] 1,702	1,047	2,643	967	2,028
Coal (bituminous) ——do	987	4,059	989	4,609	851	4,138	601	3,279
Gem stones	W	W	W	W	NA	1	NA	W
Gypsum ——thousand short tons	1,136	4,223	1,154	4,460	1,380	5,714	1,470	6,324
Sand and gravel ——do	21,058	20,642	18,279	20,530	17,107	20,140	19,950	25,541
Stone ——do	25,305	41,119	[4] 25,389	[4] 44,977	27,457	48,642	31,541	56,918
Value of items that cannot be disclosed: Clay (fire, 1971), lime, peat, stone (dimension, 1971), and values indicated by symbol W	XX	1,766	XX	1,899	XX	1,667	XX	2,785
Total	XX	120,822	XX	127,821	XX	134,496	XX	158,800
KANSAS								
Cement:								
Masonry ——thousand short tons	46	1,029	50	1,232	59	1,452	73	2,068
Portland ——do	1,729	28,177	1,731	29,961	1,889	35,432	2,026	42,172
Clays ——do	[3] 713	[3] 946	879	1,151	1,170	1,457	1,169	1,490
Coal (bituminous) ——do	1,627	9,102	1,151	6,579	1,227	7,835	1,086	7,979
Helium:								
Crude ——million cubic feet	2,250	30,600	2,510	30,120	[r] 2,278	[r] 27,336	1,539	18,468
High purity ——do	354	8,137	342	7,182	384	8,064	416	8,736
Lead (recoverable content of ores, etc.) ——short tons	80	25	--	--	--	--	--	--
Lime ——thousand short tons	6	W	8	W	9	172	10	199
Natural gas ——million cubic feet	899,955	125,994	885,144	127,267	889,268	127,859	893,118	138,521
Natural gas liquids:								
Natural gasoline ——thousand 42-gallon barrels	6,549	14,617	5,387	12,253	5,505	13,170	5,993	17,685
LP gases ——do	20,814	30,597	23,215	39,001	25,099	43,170	24,463	53,819
Petroleum (crude) ——do	84,853	277,469	78,532	276,433	73,744	259,578	66,227	281,465
Salt [6] ——thousand short tons	1,230	18,206	1,240	18,712	1,369	20,562	1,397	23,460

Sand and gravel ---------- do----	12,968	12,351	11,862	11,351	11,591	10,920	13,261	12,663
Stone ---------- do----	15,161	22,406	[4] 14,908	23,697	[4] 14,547	[4] 23,849	[4] 18,334	[4] 33,601
Zinc (recoverable content of ores, etc.) ---- short tons--	1,186	364	--	--	--	--	--	--
Value of items that cannot be disclosed: Clays (1970), gypsum, pumice, salt (brine), stone (dimension, 1971–73), and values indicated by symbol W ----------	XX	3,969	XX	4,505	XX	3,741	XX	3,973
Total ----------	XX	583,989	XX	589,444	XX	[r] 584,597	XX	646,299
KENTUCKY								
Clays [3] ---------- thousand short tons--	1,020	1,793	956	1,377	920	1,406	1,083	1,961
Coal (bituminous) ---------- do----	125,305	711,163	119,389	774,735	121,188	824,691	127,645	986,654
Natural gas ---------- million cubic feet--	77,892	19,161	72,723	18,253	63,648	15,976	62,396	21,839
Petroleum (crude) -------- thousand 42-gallon barrels--	11,575	36,461	10,692	35,925	9,702	32,599	8,687	34,515
Sand and gravel ---------- thousand short tons--	8,760	10,474	8,202	11,061	8,485	11,967	10,331	14,627
Stone [4] ---------- do----	29,310	45,208	32,514	52,296	34,279	59,690	38,205	70,912
Zinc (recoverable content of ores, etc.) ---- short tons--	4,189	1,283	5,268	1,696	1,780	632	273	113
Value of items that cannot be disclosed: Cement, clay (ball), fluorspar, lime (1971–73), natural gas liquids, and stone (quartzite) ----------	XX	21,922	XX	30,542	XX	29,949	XX	34,141
Total ----------	XX	847,465	XX	925,885	XX	976,910	XX	1,164,762
LOUISIANA								
Clays ---------- thousand short tons--	1,080	1,575	1,073	1,606	1,000	1,454	979	1,329
Lime ---------- do----	1,025	12,811	950	17,625	908	19,614	897	16,801
Natural gas ---------- million cubic feet--	7,788,276	1,503,137	8,081,907	1,632,545	7,972,678	1,626,426	8,242,423	1,846,303
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels--	56,526	174,632	54,424	173,425	52,842	167,768	47,906	167,037
LP gases ---------- do----	80,385	138,262	90,271	166,099	98,233	185,660	102,701	253,671
Petroleum (crude) ---------- do----	906,907	3,061,558	935,243	3,359,710	891,827	3,201,659	831,524	3,327,702
Salt ---------- thousand short tons--	18,584	64,854	13,352	67,950	13,514	67,464	13,152	66,211
Sand and gravel ---------- do----	18,155	22,363	19,228	24,492	18,920	26,996	13,748	21,165
Stone [4] ---------- do----	9,183	11,945	9,688	14,139	9,190	14,836	10,802	21,309
Sulfur (Frasch process) ---------- thousand long tons--	3,618	89,489	3,646	W	3,765	W	3,329	W
Value of items that cannot be disclosed: Cement, gypsum, stone (miscellaneous), and values indicated by symbol W ----------	XX	21,695	XX	94,739	XX	99,666	XX	98,082
Total ----------	XX	5,102,321	XX	5,552,330	XX	5,411,543	XX	5,819,610
MAINE								
Clays ---------- thousand short tons--	[3] 41	[3] 55	[3] 42	[3] 56	40	57	41	74
Copper ---------- short tons--	2,703	3,120	2,510	2,610	1,220	1,249	1,107	1,317
Gem stones ----------	NA	35	NA	40	NA	W	NA	W
Lead ---------- short tons--	--	--	--	--	85	26	204	66
Peat ---------- thousand short tons--	W	W	2	W	2	99	5	177
Sand and gravel ---------- do----	12,971	6,888	8,292	5,881	11,818	7,535	13,583	10,804
Silver ---------- thousand troy ounces--	63	112	41	64	16	27	W	W
Stone ---------- thousand short tons--	W	W	1,133	2,913	1,078	2,996	1,212	3,329
Zinc (recoverable content of ore, etc.) ------ short tons--	9,114	2,792	5,850	1,884	5,820	2,066	19,640	8,115

See footnotes at end of table.

Table 6.—Mineral production[1] in the United States, by State—Continued

Mineral	1970		1971		1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
MAINE—Continued								
Value of items that cannot be disclosed: Beryllium concentrate (1970), cement, clays (1970–71), feldspar (1970), and values indicated by symbol W	XX	$10,778	XX	$8,450	XX	$8,867	XX	$10,111
Total	XX	23,780	XX	21,898	XX	22,922	XX	33,493
MARYLAND								
Clays[3] thousand short tons	1,129	1,433	1,027	1,558	1,104	2,121	897	1,973
Coal (bituminous) do	1,615	8,083	1,644	10,274	1,640	8,961	1,789	13,644
Gem stones	NA	3	NA	8	NA	8	NA	8
Natural gas million cubic feet	813	202	214	43	244	51	298	69
Peat thousand short tons	4	47	3	39	3	29	2	29
Sand and gravel do	12,951	20,434	12,842	23,201	12,594	26,557	12,845	29,625
Stone do	16,015	32,783	15,912	34,770	19,431	41,973	18,585	46,732
Value of items that cannot be disclosed: Cement, selected clays, lime, greensand marl (1970–71), potassium salts (1970), and talc and soapstone	XX	25,231	XX	29,527	XX	35,801	XX	39,827
Total	XX	88,216	XX	99,420	XX	115,501	XX	131,907
MASSACHUSETTS								
Clays thousand short tons	284	582	186	377	219	416	217	404
Gem stones	NA	2	NA	5	NA	5	NA	5
Peat thousand short tons	W	W	2	32	W	W	2	78
Sand and gravel do	17,925	22,244	17,343	23,058	18,883	25,655	18,743	26,910
Stone do	8,136	24,349	7,816	23,582	7,990	23,500	8,580	28,738
Value of items that cannot be disclosed: Nonmetals and values indicated by symbol W	XX	3,183	XX	3,145	XX	2,852	XX	3,547
Total	XX	50,360	XX	50,199	XX	52,428	XX	59,682
MICHIGAN								
Cement:								
Masonry thousand short tons	213	5,253	239	5,872	250	5,959	247	6,185
Portland do	5,605	101,019	6,108	104,665	5,901	111,410	6,242	123,442
Clays do	2,480	2,887	2,458	3,366	2,514	3,715	2,151	3,304
Copper (recoverable content of ores, etc.) short tons	67,543	77,945	56,005	58,245	67,260	68,874	72,221	85,943
Gem stones	NA	W	NA	8	NA	8	NA	8
Gypsum thousand short tons	1,312	5,061	1,433	5,585	1,650	7,267	1,882	8,538
Iron ore (usable) thousand long tons, gross weight	13,100	168,958	11,833	159,854	12,692	177,461	12,389	180,194
Lime thousand short tons	1,538	21,355	1,444	20,549	1,509	22,753	1,545	26,055
Magnesium compounds from seawater and brine (except for metal) short tons, MgO equivalent	411,911	38,050	272,918	27,777	377,675	31,484	455,501	41,790
Natural gas million cubic feet	38,851	10,373	25,662	6,776	34,221	10,506	44,579	17,495

Natural gas liquids:								
Natural gasoline ——thousand 42-gallon barrels	599	1,611	553	1,513	395	1,097	372	1,189
LP gases ——do	1,176	2,764	975	2,623	833	2,274	691	2,529
Peat ——thousand short tons	167	1,896	202	2,497	219	2,190	232	2,172
Petroleum (crude) ——thousand 42-gallon barrels	11,693	36,246	11,893	38,859	12,990	41,556	14,614	59,413
Salt ——thousand short tons	4,899	49,963	4,458	49,007	4,358	50,761	4,818	53,732
Sand and gravel ——do	53,092	54,646	56,613	62,898	59,467	65,445	62,407	73,972
Silver (recoverable content of ores, etc.) thousand troy ounces	892	1,579	670	1,036	785	1,323	850	2,175
Stone ——thousand short tons	41,687	49,501	40,705	49,240	39,754	50,317	45,886	60,494
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, iodine, and potassium salts (1970)	XX	41,622	XX	40,266	XX	40,367	XX	40,392
Total	XX	670,729	XX	640,636	XX	694,767	XX	789,022
MINNESOTA								
Clays ——thousand short tons	227	335	223	335	[3] 167	[3] 251	[3] 156	[3] 233
Gem stones	W	W	NA	13	NA	14	NA	14
Iron ore (usable) ——thousand long tons, gross weight	54,791	571,488	49,054	547,607	50,595	601,869	62,614	782,197
Manganiferous ore (5% to 35% Mn) short tons, gross weight	321,436	W	169,732	W	119,324	W	170,971	W
Peat ——thousand short tons	14	335	W	W	W	W	W	W
Sand and gravel ——do	46,851	38,802	44,916	37,645	36,792	33,454	37,935	39,438
Stone ——do	4,579	12,311	5,838	14,346	5,757	16,318	7,581	20,411
Value of items that cannot be disclosed: Abrasive stones, cement, clays (fire, 1972–73), lime, and values indicated by symbol W	XX	9,735	XX	8,830	XX	7,763	XX	10,492
Total	XX	633,006	XX	608,776	XX	659,669	XX	852,785
MISSISSIPPI								
Clays ——thousand short tons	1,553	8,062	2,278	8,501	1,919	7,837	2,075	9,082
Natural gas ——million cubic feet	126,031	23,190	118,805	24,830	103,989	[r] 22,670	99,706	22,846
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels	544	1,465	W	W	W	W	W	W
LP gases ——do	428	964	W	W	W	W	W	W
Petroleum (crude) ——do	65,119	194,706	64,066	201,808	61,100	192,465	56,102	213,747
Sand and gravel ——thousand short tons	10,859	11,950	11,289	13,526	13,419	16,133	14,251	17,383
Stone ——do	W	W	726	709	1,135	1,199	[4] 760	[4] 809
Value of items that cannot be disclosed: Cement, lime, magnesium compounds, limestone (1973), and values indicated by symbol W	XX	9,636	XX	12,790	XX	14,970	XX	17,871
Total	XX	249,973	XX	262,164	XX	[r] 255,274	XX	281,738
MISSOURI								
Barite ——thousand short tons	230	3,555	232	3,606	213	3,637	196	3,395
Cement:								
Masonry ——do	56	1,234	73	1,629	80	1,859	84	2,400
Portland ——do	3,990	64,261	4,515	77,568	4,277	80,898	4,582	99,858

See footnotes at end of table.

Table 6.—Mineral production[1] in the United States, by State—Continued

Mineral	1970		1971		1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
MISSOURI—Continued								
Clays ---thousand short tons	[3] 2,128	[3] $6,480	[3] 2,354	[3] $7,454	[3] 2,571	[3] $9,096	2,551	$11,626
Coal (bituminous) ---do	4,447	19,526	4,036	19,670	4,551	23,667	4,658	24,999
Copper (recoverable content of ores, etc.) ---short tons	12,134	14,003	8,445	8,783	11,509	11,785	10,273	12,224
Iron ore (usable) ---thousand long tons, gross weight	2,612	38,100	2,727	W	2,695	W	2,630	W
Lead (recoverable content of ores, etc.) ---short tons	421,764	131,751	429,634	118,579	489,397	147,113	487,143	158,711
Lime ---thousand short tons	W	W	W	W	W	W	1,626	23,534
Natural gas ---million cubic feet	87	21	22	5	9	2	33	8
Petroleum (crude) ---thousand 42-gallon barrels	66	W	66	W	60	W	60	W
Phosphate rock ---thousand short tons	--	--	--	--	--	--	42	W
Sand and gravel ---do	12,446	15,379	10,327	15,109	10,082	14,806	10,879	16,950
Silver (recoverable content of ores, etc.) thousand troy ounces	1,817	3,218	1,661	2,568	1,972	3,322	2,058	5,264
Stone ---thousand short tons	39,726	[4] 57,285	41,099	[4] 64,772	42,473	[4] 63,219	49,304	79,921
Zinc (recoverable content of ores, etc.) ---short tons	50,721	15,540	48,215	15,525	61,923	21,983	82,350	34,027
Value of items that cannot be disclosed: Asphalt (native), clays (selected, 1970–72), and values indicated by symbol W	XX	22,643	XX	64,821	XX	70,430	XX	39,717
Total	XX	392,996	XX	400,089	XX	451,817	XX	512,634
MONTANA								
Antimony ---short tons	W	W	135	81	W	W	W	W
Clays[3] ---thousand short tons	41	71	264	1,712	304	1,590	219	1,298
Coal (bituminous and lignite) ---do	3,447	6,394	7,064	12,817	8,221	16,690	10,725	30,238
Copper (recoverable content of ores, etc.) ---short tons	120,412	138,955	88,581	92,125	123,110	126,064	132,466	157,634
Gem stones	NA	109	NA	114	NA	120	NA	150
Gold (recoverable content of ores, etc.) ---troy ounces	22,456	817	15,613	644	23,725	1,390	27,806	2,720
Iron ore (usable) ---thousand long tons, gross weight	14	W	14	W	9	W	13	W
Lead (recoverable content of ores, etc.) ---short tons	996	311	615	169	287	86	176	57
Lime ---thousand short tons	208	W	199	2,416	242	3,003	210	3,028
Manganese ore and concentrate (35% or more Mn) short tons, gross weight	512	W	142	W	578	W	239	W
Natural gas ---million cubic feet	42,705	4,399	32,720	3,959	33,474	4,117	57,175	13,240
Peat ---thousand short tons	W	W	W	W	1	W	1	W
Petroleum (crude) ---thousand 42-gallon barrels	37,879	105,403	34,599	104,128	33,904	103,924	34,620	115,423
Sand and gravel ---thousand short tons	19,275	20,249	15,781	25,207	10,116	17,149	11,694	13,819
Silver (recoverable content of ores, etc.) thousand troy ounces	4,304	7,622	2,748	4,248	3,325	5,603	4,350	11,127
Stone ---thousand short tons	[4] 6,501	[4] 6,896	W	W	4,074	5,627	5,054	9,559
Tungsten ore and concentrate thousand pounds contained W	[r] 8	23	W	W	W	W	W	W
Zinc (recoverable content of ores, etc.) ---short tons	1,457	446	361	116	12	4	73	30
Value of items that cannot be disclosed: Cement, clays (selected), fluorspar, gypsum, natural gas liquids, phosphate rock, stone (1970–71), talc, vermiculite and values indicated by symbol W	XX	21,321	XX	37,337	XX	22,309	XX	26,962
Total	XX	313,016	XX	285,073	XX	307,676	XX	385,285

NEBRASKA								
Clays ---thousand short tons--	90	147	69	82	115	143	158	286
Gem stones	NA	5	NA	10	NA	11	NA	11
Lime ---thousand short tons--	27	W	29	W	34	685	31	651
Liquefied petroleum gases --thousand 42-gallon barrels--	365	858	W	W	W	W	W	W
Natural gas (marketed) ---million cubic feet--	5,991	1,024	3,496	612	3,478	619	3,836	698
Petroleum (crude) ---thousand 42-gallon barrels--	11,451	35,384	10,062	34,010	8,705	29,423	7,240	28,035
Sand and gravel ---thousand short tons--	12,232	12,974	13,224	13,626	13,720	15,063	15,906	18,366
Stone ---do---	4,265	7,378	4,174	7,892	4,251	7,645	5,368	10,958
Value of items that cannot be disclosed: Cement, natural gasoline, pumice (1970–72), and values indicated by symbol W	XX	14,887	XX	17,847	XX	20,086	XX	21,816
Total	XX	72,657	XX	74,079	XX	73,675	XX	80,821
NEVADA								
Barite ---thousand short tons--	192	1,455	192	1,490	317	2,659	549	4,691
Clays ---do---	W	W	W	W	40	183	36	176
Copper (recoverable content of ores, etc.) --short tons--	106,688	123,118	96,928	100,806	101,119	103,545	93,702	111,505
Gem stones	NA	100	NA	105	NA	110	NA	142
Gold (recoverable content of ores, etc.) --troy ounces--	480,144	17,472	374,878	15,464	419,748	24,597	260,437	25,473
Gypsum ---thousand short tons--	451	1,457	695	2,372	860	2,871	1,154	3,662
Iron ore (usable) ---thousand long tons, gross weight--	575	W	W	W	W	W	119	W
Lead (recoverable content of ores, etc.) ---short tons--	364	114	111	30	(5)	(5)	--	--
Mercury ---76-pound flasks--	4,909	2,001	1,589	465	810	177	698	200
Perlite ---short tons--	8,470	73	9,600	114	W	W	W	W
Petroleum (crude) ---thousand 42-gallon barrels--	149	W	113	W	100	W	96	W
Pumice ---thousand short tons--	80	191	112	232	W	W	W	W
Sand and gravel ---do---	8,574	9,819	9,379	12,225	10,081	12,636	12,448	14,614
Silver (recoverable content of ores, etc.) thousand troy ounces--	718	1,271	601	930	595	1,003	624	1,595
Stone ---thousand short tons--	1,860	2,722	2,531	3,800	3,329	5,926	3,595	5,429
Tungsten ore and concentrate thousand pounds contained W--	r 115	306	r 31	88	r 157	W	150	377
Zinc (recoverable content of ores, etc.) ---short tons--	127	39	71	23	--	--	--	--
Value of items that cannot be disclosed: Antimony, brucite (1970–71), cement, diatomite, fluorspar, lime, lithium minerals, magnesite, molybdenum, pyrites (1970–71), salt, talc (1970, 1972–73), and values indicated by symbol W	XX	26,207	XX	26,630	XX	27,995	XX	33,949
Total	XX	186,345	XX	164,774	XX	181,702	XX	201,813
NEW HAMPSHIRE								
Clays ---thousand short tons--	40	32	37	34	51	70	43	64
Gem stones	W	W	NA	40	NA	42	NA	42
Sand and gravel ---thousand short tons--	6,529	4,753	8,404	6,777	6,020	6,256	7,795	8,597
Stone ---do---	W	845	429	3,433	528	3,743	1,836	5,416
Value of items that cannot be disclosed: Mica (scrap, 1970) and values indicated by symbol W	XX	3,100	--	--	--	--	--	--
Total	XX	8,730	XX	10,284	XX	10,111	XX	14,119

See footnotes at end of table.

Table 6.—Mineral production[1] in the United States, by State—Continued

Mineral	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
NEW JERSEY								
Clays ---thousand short tons--	262	$990	201	$864	212	$856	183	$666
Gem stones	NA	10	NA	15	NA	16	NA	16
Peat ---thousand short tons--	45	557	46	526	W	W	44	514
Sand and gravel ---do---	16,732	31,571	18,511	38,279	17,679	38,020	19,040	43,098
Stone[4] ---do---	15,160	40,567	13,469	36,057	r 15,223	r 42,044	15,902	45,585
Zinc (recoverable content of ores, etc.) ---short tons--	28,683	8,788	29,977	9,653	38,096	13,524	33,027	13,647
Value of items that cannot be disclosed: Lime, magnesium compounds, manganiferous residuum, greensand marl, stone (dimension), titanium concentrate, and values indicated by symbol W	XX	6,798	XX	8,178	XX	8,261	XX	10,490
Total	XX	89,281	XX	93,572	XX	r 102,721	XX	114,016
NEW MEXICO								
Clays ---thousand short tons--	67	91	[3] 76	[3] 114	[3] 65	[3] 108	[3] 88	[3] 169
Coal (bituminous) ---do---	7,361	21,249	8,175	26,657	8,248	29,794	9,069	31,862
Copper (recoverable content of ores, etc.) --short tons--	166,278	191,885	157,419	163,716	168,034	172,067	204,742	243,643
Gem stones	NA	60	NA	65	NA	68	NA	70
Gold (recoverable content of ores, etc.) ---troy ounces--	8,719	317	10,681	441	14,897	873	13,864	1,356
Gypsum ---thousand short tons--	W	W	W	W	W	W	255	1,220
Helium:								
Crude ---million cubic feet--	1	18	--	--	--	--	--	--
High purity ---do---	(5)	6	W	W	--	--	--	--
Iron ore (usable) ---thousand long tons, gross weight--	W	W	W	W	W	W	5	114
Lead (recoverable content of ores, etc.) ---short tons--	3,550	1,109	2,971	820	3,582	1,077	2,556	833
Lime ---thousand short tons--	37	W	35	W	28	W	44	793
Manganese ore (35% or more Mn) short tons, gross weight--	4,225	W	--	--	--	--	--	--
Manganiferous ore (5% to 35% Mn) ---do---	46,166	W	28,490	W	27,837	W	32,084	W
Mica, scrap ---thousand short tons--	W	W	W	W	14	W	10	82
Natural gas ---million cubic feet--	1,138,980	162,874	1,167,577	175,137	1,216,061	225,420	1,218,749	287,889
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels--	9,606	25,548	9,952	28,465	10,338	29,970	9,848	32,449
LP gases ---do---	25,999	37,179	27,082	43,331	27,859	45,689	29,652	74,427
Peat ---thousand short tons--	(5)	7	1	W	2	46	3	50
Perlite ---do---	382	4,321	386	4,559	476	5,698	478	5,024
Petroleum (crude) ---thousand 42-gallon barrels--	128,184	410,320	118,412	402,602	110,525	376,778	100,986	414,041
Potassium salts --thousand short tons, K_2O equivalent--	2,390	85,877	2,291	86,689	2,296	91,115	2,168	91,996
Pumice ---thousand short tons--	203	442	287	601	311	809	339	1,001
Salt ---do---	W	W	146	1,130	W	W	W	W
Sand and gravel ---do---	10,666	10,516	8,869	7,975	7,600	8,553	10,641	15,753
Silver (recoverable content of ores, etc.) thousand troy ounces--	782	1,385	782	1,210	1,017	1,713	1,111	2,843
Stone ---thousand short tons--	[4] 3,110	[4] 4,030	[4] 2,913	[4] 5,337	2,768	5,499	2,830	5,894

Tin ---------- long tons	--	--	--	--	--	--	W	W
Uranium (recoverable content U_3O_8) -- thousand pounds	11,574	69,970	10,567	65,517	10,808	68,091	9,140	59,410
Zinc (recoverable content of ores, etc.) ---- short tons	16,601	5,086	13,959	4,495	12,735	4,521	12,327	5,094
Value of items that cannot be disclosed: Carbon dioxide, cement, clay (fire), fluorspar (1970–72), molybdenum, stone (1970–71), vanadium, and values indicated by symbol W ----------	XX	28,068	XX	27,424	XX	29,403	XX	29,631
Total ----------	XX	1,060,358	XX	1,046,285	XX	1,097,292	XX	1,305,644
NEW YORK								
Clays ---------- thousand short tons	1,707	1,897	[3] 1,588	[3] 1,742	[3] 1,601	[3] 1,919	[3] 1,799	[3] 2,146
Emery ---------- short tons	W	W	1,585	W	2,883	W	2,883	W
Gem stones ----------	NA	10	NA	15	NA	16	NA	16
Gypsum ---------- thousand short tons	425	2,737	415	2,376	486	3,079	525	3,369
Lead (recoverable content of ores, etc.) ---- short tons	1,280	400	877	242	1,089	327	2,304	751
Mercury ---------- 76-pound flasks	28	11	W	W	W	W	--	--
Natural gas ---------- million cubic feet	3,358	1,017	2,202	661	3,679	1,199	4,539	1,590
Peat ---------- thousand short tons	15	145	15	196	15	200	11	166
Petroleum (crude) -------- thousand 42-gallon barrels	1,194	5,397	1,126	5,292	1,018	4,897	967	5,412
Salt ---------- thousand short tons	5,990	47,254	5,303	43,601	5,604	43,866	5,202	42,364
Sand and gravel ---------- do	35,537	38,839	23,221	28,328	26,722	36,952	29,544	41,396
Silver (recoverable content of ores, etc.) thousand troy ounces	24	42	18	28	25	42	54	139
Stone ---------- thousand short tons	37,616	68,118	37,778	73,418	38,138	77,825	44,393	94,698
Zinc (recoverable content of ores, etc.) ---- short tons	58,577	17,947	63,420	20,421	60,749	21,566	81,455	33,657
Value of items that cannot be disclosed: Cement, clay (ball, 1971–73), garnet (abrasive), iron ore, lime, talc, titanium concentrate, wollastonite, and values indicated by symbol W ----------	XX	115,750	XX	122,963	XX	[r] 128,566	XX	150,167
Total ----------	XX	299,564	XX	299,283	XX	[r] 320,454	XX	375,866
NORTH CAROLINA								
Clays [3] ---------- thousand short tons	3,318	3,102	3,503	3,802	3,862	4,473	4,109	5,057
Feldspar ---------- short tons	386,608	5,173	393,811	4,681	439,838	6,030	523,595	8,820
Gem stones ----------	NA	20	NA	30	NA	32	NA	40
Mica:								
Scrap ---------- thousand short tons	64	1,457	67	1,770	91	2,942	106	4,423
Sheet ---------- pounds	--	--	8,705	3	--	--	--	--
Sand and gravel ---------- thousand short tons	12,772	13,277	14,240	14,690	[r] 12,823	[r] 13,812	15,897	19,327
Stone ---------- do	30,363	54,121	30,917	58,026	32,297	62,741	38,782	80,065
Talc and pyrophyllite ---------- short tons	92,639	544	85,289	522	89,334	594	95,833	1,094
Value of items that cannot be disclosed: Asbestos, cement, clay (kaolin), copper (1971), gold (1971), iron ore, lead (1971), lithium minerals, olivine, phosphate rock, silver (1971), tungsten (1970–71), zinc (1971) --------	XX	20,671	XX	25,996	XX	24,896	XX	28,104
Total ----------	XX	98,365	XX	109,520	XX	[r] 115,520	XX	146,930
NORTH DAKOTA								
Coal (lignite) ---------- thousand short tons	5,639	11,009	6,075	11,580	6,632	13,416	6,906	14,328
Gem stones ----------	NA	1	NA	2	NA	2	NA	2

See footnotes at end of table.

Table 6.—Mineral production[1] in the United States, by State—Continued

Mineral	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
NORTH DAKOTA—Continued								
Natural gas ——million cubic feet	34,889	$5,722	33,864	$5,655	32,472	$5,455	27,703	$5,457
Natural gas liquids:								
Natural gasoline ——thousand 42-gallon barrels	504	1,376	W	W	W	W	W	W
LP gases ——do	1,840	2,944	W	W	W	W	W	W
Petroleum (crude) ——do	21,998	67,107	21,653	70,805	20,624	67,647	20,235	78,916
Sand and gravel ——thousand short tons	8,090	6,336	8,196	6,210	6,681	5,757	6,011	6,021
Stone ——do	103	126	W	W	--	--	W	W
Value of items that cannot be disclosed: Clays, lime, peat (1970–71), pumice (1972), salt, and values indicated by symbol W	XX	1,426	XX	5,649	XX	5,809	XX	7,129
Total	XX	96,047	XX	99,901	XX	98,086	XX	111,853
OHIO								
Cement:								
Masonry ——thousand short tons	121	3,116	142	3,811	161	4,684	176	5,641
Portland ——do	2,209	39,997	2,897	54,338	2,968	57,953	3,456	73,362
Clays ——do	3,920	10,100	3,973	11,380	4,125	11,273	4,732	12,456
Coal (bituminous) ——do	55,351	262,390	51,431	269,601	50,967	303,819	45,783	338,792
Gem stones	NA	3	NA	8	NA	8	NA	8
Lime ——thousand short tons	3,951	61,197	4,007	65,258	4,413	75,569	4,389	77,028
Natural gas ——million cubic feet	52,113	14,123	79,903	27,007	89,995	35,271	93,610	39,786
Peat ——thousand short tons	6	95	6	84	4	67	4	64
Petroleum (crude) ——thousand 42-gallon barrels	9,864	32,914	8,286	29,801	9,358	35,179	8,796	44,690
Salt ——thousand short tons	5,329	47,498	5,709	46,651	6,147	47,710	4,657	41,643
Sand and gravel ——do	42,069	57,506	40,797	54,044	43,506	59,932	48,987	69,982
Stone ——do	47,244	81,506	46,891	88,372	48,498	90,821	[4] 55,107	[4] 98,009
Value of items that cannot be disclosed: Abrasive stone, gypsum, and stone (dimension, 1973)	XX	1,721	XX	1,796	XX	2,462	XX	5,518
Total	XX	612,166	XX	652,151	XX	724,748	XX	806,979
OKLAHOMA								
Clays[3] ——thousand short tons	769	1,120	845	1,255	938	1,398	1,298	1,871
Coal (bituminous) ——do	2,427	15,211	2,234	15,004	2,624	19,112	2,183	16,779
Gypsum ——do	874	2,616	1,022	3,073	1,196	3,888	1,429	5,796
Helium:								
High purity ——million cubic feet	149	5,214	123	4,305	[r] 176	[r] 6,160	181	6,335
Crude ——do	245	2,940	270	3,240	163	1,956	115	1,380
Lead (recoverable content of ores, etc.) ——short tons	797	249	--	--	--	--	--	--
Natural gas ——million cubic feet	1,594,943	248,811	1,684,260	273,945	1,806,887	294,523	1,770,980	334,110
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels	14,813	39,933	14,197	40,856	14,559	42,709	14,674	49,070
LP gases ——do	28,029	52,975	27,540	56,732	27,148	57,011	29,044	95,264

Petroleum (crude) ---------- do	223,574	712,419	213,313	725,611	207,633	709,033	191,204	723,273
Pumice ---------- thousand short tons	--	--	W	W	W	W	1	W
Salt ---------- do	13	78	W	W	W	W	5	36
Sand and gravel ---------- do	5,675	7,258	5,713	8,259	7,901	11,138	12,154	14,941
Stone ---------- do	18,177	23,701	19,449	27,125	19,448	26,574	22,316	34,999
Zinc (recoverable content of ores, etc.) ---- short tons	2,650	812	(5)	(5)	W	W	--	--
Value of items that cannot be disclosed: Cement, clay (bentonite), copper, lime, silver, tripoli, and values indicated by symbol W ----------	XX	24,935	XX	30,111	XX	37,296	XX	39,772
Total ----------	XX	1,138,272	XX	1,189,516	XX	r 1,210,798	XX	1,323,626
OREGON								
Clays ---------- thousand short tons	[3] 134	[3] 180	157	255	151	238	168	291
Copper ---------- short tons	W	W	3	3	W	W	W	W
Diatomite ---------- do	500	5	70	1	W	W	W	W
Gem stones ----------	NA	750	NA	755	NA	793	NA	700
Gold (recoverable content of ores, etc.) -- troy ounces	256	9	244	10	W	W	W	W
Lead ---------- short tons	(5)	(5)	--	--	--	--	--	--
Lime ---------- thousand short tons	96	1,777	106	1,989	96	2,129	106	2,552
Mercury ---------- 76-pound flasks	274	112	W	W	--	--	W	W
Nickel (content of ore and concentrate) ---- short tons	15,933	W	17,036	W	16,864	W	18,272	W
Pumice ---------- thousand short tons	939	1,221	943	1,389	W	W	1,006	1,902
Sand and gravel ---------- do	17,532	25,978	20,230	28,707	24,489	34,981	22,802	32,751
Silver (recoverable content of ores, etc.) thousand troy ounces	4	6	4	6	2	4	1	3
Stone ---------- thousand short tons	13,439	20,948	13,794	26,708	10,915	18,380	18,411	21,843
Value of items that cannot be disclosed: Bauxite (1970), cement, clay (fire, 1970), talc and soapstone, tungsten (1971–72), and values indicated by symbol W --------	XX	17,095	XX	18,212	XX	19,991	XX	21,424
Total ----------	XX	68,081	XX	78,035	XX	76,516	XX	81,466
PENNSYLVANIA								
Cement:								
Masonry ---------- thousand short tons	527	8,324	559	11,247	451	12,401	490	14,443
Portland ---------- do	7,691	121,100	7,850	140,460	8,214	156,008	8,563	171,653
Clays ---------- do	[3] 2,665	[3] 15,845	[3] 2,325	[3] 8,940	2,682	15,829	[3] 2,975	[3] 16,664
Coal:								
Anthracite ---------- do	9,729	105,341	8,727	103,469	7,106	85,251	6,830	90,260
Bituminous ---------- do	80,491	585,057	73,835	620,196	75,939	694,267	76,403	786,792
Copper (recoverable content of ores, etc.) -- short tons	2,539	2,930	3,349	3,483	2,611	2,673	1,845	2,195
Gem stones ----------	NA	4	NA	9	NA	9	NA	9
Lime ---------- thousand short tons	1,887	29,279	1,760	30,008	1,891	33,802	2,260	40,949
Mica, scrap ---------- do	1	60	W	W	W	W	--	--
Natural gas ---------- million cubic feet	76,841	21,439	76,451	20,770	73,958	22,389	78,514	32,976
Natural gas liquids:								
Natural gasoline ------ thousand 42-gallon barrels	19	50	W	W	W	W	W	W
LP gases ---------- do	34	87	W	W	W	W	W	W
Peat ---------- thousand short tons	44	517	38	461	22	320	28	411
Petroleum (crude) ---------- thousand 42-gallon barrels	4,093	18,500	3,798	17,699	3,441	16,414	3,282	18,440
Sand and gravel ---------- thousand short tons	18,504	33,915	19,668	36,162	18,757	36,804	20,576	42,830
Stone ---------- do	66,119	120,187	64,467	118,469	67,307	124,340	78,564	150,346

See footnotes at end of table.

Table 6.—Mineral production[1] in the United States, by State—Continued

Mineral	1970		1971		1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
PENNSYLVANIA—Continued								
Zinc (recoverable content of ores, etc.) ____short tons__	29,554	$9,055	27,438	$8,835	18,344	$6,512	18,857	$7,792
Value of items that cannot be disclosed: Clay (kaolin 1970–71, 1973), cobalt (1970–71), gold (1970–71), iron ore, pyrites (1970–71), pyrophyllite (1970), silver (1970–71), tripoli, and values indicated by symbol W _____	XX	24,053	XX	28,899	XX	24,466	XX	26,140
Total _____	XX	1,095,743	XX	1,149,107	XX	1,231,485	XX	1,401,900
RHODE ISLAND								
Sand and gravel _____thousand short tons__	2,387	2,913	2,252	3,052	2,079	3,336	2,429	3,095
Stone _____do____	W	W	3	422	[4] 329	[4] 23	W	W
Value of items that cannot be disclosed: Other nonmetals and values indicated by symbol W _____	XX	1,473	XX	825	XX	932	XX	1,245
Total _____	XX	4,386	XX	4,299	XX	4,291	XX	4,340
SOUTH CAROLINA								
Clays _____thousand short tons__	1,974	9,878	[3] 2,049	[3] 10,201	2,221	11,268	[3] 2,250	[3] 12,877
Gem stones _____	--	--	--	--	--	--	NA	5
Peat _____thousand short tons__	W	W	W	W	W	W	14	W
Sand and gravel _____do____	5,864	7,766	6,488	9,119	7,916	12,121	8,179	12,628
Stone _____do____	9,710	[4] 14,734	11,047	17,852	12,482	21,819	14,985	24,280
Value of items that cannot be disclosed: Cement, clays (selected, 1971, 1973), feldspar (1970–72), mica (scrap), certain stone (1970), vermiculite, and values indicated by symbol W _____	XX	23,987	XX	29,716	XX	37,105	XX	38,571
Total _____	XX	56,365	XX	66,888	XX	82,313	XX	88,361
SOUTH DAKOTA								
Clays _____thousand short tons__	165	946	[3] 150	[3] 128	[3] 185	[3] 156	[3] 201	[3] 181
Feldspar _____short tons__	19,276	114	24,640	539	[r] 25,000	[r] 400	W	W
Gem stones _____	NA	35	NA	40	NA	42	NA	42
Gold (recoverable content of ores, etc.) __troy ounces__	578,716	21,059	513,427	21,179	407,430	23,875	375,575	34,974
Gypsum _____thousand short tons__	15	61	21	83	24	43	W	W
Lead (recoverable content of ores, etc.) ____short tons__	3	1	--	--	--	--	--	--
Lime _____thousand short tons__	W	W	W	W	W	W	63	1,206
Mica (scrap) _____do____	[5]	34	W	W	W	W	--	--
Petroleum (crude) _____thousand 42-gallon barrels__	160	374	233	604	219	574	275	988
Sand and gravel _____thousand short tons__	16,556	16,656	16,727	18,392	12,748	14,793	13,963	16,587
Silver (recoverable content of ores, etc.) thousand troy ounces__	120	212	107	165	100	168	72	184
Stone _____thousand short tons__	1,979	13,375	2,199	8,874	2,665	10,864	2,745	11,607
Zinc (recoverable content of ores, etc.) ____short tons__	1	[5]	--	--	--	--	--	--

Value of items that cannot be disclosed: Beryllium concentrate (1970–72), cement, clays (bentonite 1971–73), uranium (1970–72), vanadium (1970, 1972), and values indicated by symbol W	XX	8,709	XX	12,984	XX	14,535	XX	15,370
Total	XX	61,576	XX	62,988	XX	r 65,450	XX	81,139
TENNESSEE								
Barite—thousand short tons	19	286	21	342	W	W	W	W
Cement:								
Masonry—do	136	2,749	159	3,649	176	4,104	201	7,908
Portland—do	1,669	29,832	1,718	33,733	1,695	37,176	1,711	42,402
Clays [3]—do	1,401	7,123	1,537	6,595	1,718	7,719	1,719	9,083
Coal (bituminous)—do	8,287	40,372	9,271	59,368	11,260	81,386	8,219	66,827
Copper (recoverable content of ores, etc.)—short tons	15,535	17,928	13,916	14,473	11,310	11,581	8,500	10,115
Gold (recoverable content of ores, etc.)—troy ounces	124	5	192	8	176	10	68	7
Natural gas—million cubic feet	64	13	89	20	25	8	20	6
Petroleum (crude)—thousand 42-gallon barrels	309	W	398	W	198	W	201	W
Phosphate rock—thousand short tons	3,073	15,005	2,571	12,151	2,154	10,732	2,512	12,799
Sand and gravel—do	6,715	10,639	8,018	11,845	10,839	15,328	12,010	20,145
Silver (recoverable content of ores, etc.)—thousand troy ounces	95	168	131	203	83	141	73	187
Stone—thousand short tons	35,374	50,013	32,369	48,665	35,942	55,512	42,742	71,116
Zinc (recoverable content of ores, etc.)—short tons	118,260	36,233	119,295	38,413	101,722	36,111	64,172	26,516
Value of items that cannot be disclosed: Clay (fuller's earth), lime, pyrites, and values indicated by symbol W	XX	10.099	XX	10.197	XX	10,006	XX	8,579
Total	XX	220,465	XX	239,662	XX	269,814	XX	275,690
TEXAS								
Cement:								
Masonry—thousand short tons	141	3,769	169	4,514	217	5,812	234	6,606
Portland—do	6,386	122,960	7,198	140,206	7,813	171,642	8,320	189,368
Clays—do	4,148	9,587	4,615	10,432	5,175	11,554	5,667	13,115
Coal (lignite)—do	W	W	W	W	4,045	W	6,944	W
Gem stones	NA	150	NA	155	NA	163	NA	163
Gypsum—thousand short tons	1,220	4,252	1,303	4,806	1,542	5,284	1,616	6,469
Helium:								
Crude—million cubic feet	1,157	13,262	1,208	14,496	1,026	12,312	904	10,848
High purity—do	82	2,862	50	1,750	--	--	--	--
Lime—thousand short tons	1,673	24,427	1,612	24,583	1,631	22,181	1,677	26,887
Natural gas—million cubic feet	8,357,716	1,203,511	8,550,705	1,376,664	8,657,840	1,419,886	8,513,850	1,735,221
Natural gas liquids:								
Natural gasoline and cycle products—thousand 42-gallon barrels	97,511	284,871	96,286	299,981	92,437	294,163	92,743	347,393
LP gases—do	204,177	334,850	210,435	380,887	226,624	428,319	221,686	589,685
Perlite—short tons	--	--	--	--	2,391	24	602	W
Petroleum (crude)—thousand 42-gallon barrels	1,249,607	4,104,005	1,222,926	4,261,775	1,301,685	4,536,077	1,294,671	5,157,623
Pumice—thousand short tons	W	W	4	4	W	W	--	--
Salt—do	10,184	45,000	9,217	40,838	9,744	36,544	10,354	45,350
Sand and gravel—do	31,438	46,362	32,788	51,814	35,151	56,328	38,546	60,706
Stone—do	45,557	64,422	41,168	[4] 62,144	49,314	[4] 66,573	62,574	91,379
Sulfur (Frasch process)—thousand long tons	2,801	62,290	3,092	W	3,847	W	4,109	W

See footnotes at end of table.

Table 6.—Mineral production[1] in the United States, by State—Continued

Mineral	1970		1971		1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
TEXAS—Continued								
Talc and soapstone ---------- short tons	171,420	$878	193,830	$1,024	221,022	$1,262	232,514	$1,246
Value of items that cannot be disclosed: Asphalt (native), fluorspar (1972–73), graphite, iron ore, magnesium chloride (for metal), magnesium compounds (except for metal), mercury, sodium sulfate, stone (dimension, 1971–72), uranium, and values indicated by symbol W ----------	XX	74,541	XX	132,210	XX	143,427	XX	160,435
Total ----------	XX	6,401,999	XX	6,808,283	XX	7,211,551	XX	8,442,494
UTAH								
Carbon dioxide, natural ---------- thousand cubic feet	60,754	4	55,178	4	61,103	4	80,490	6
Clays ---------- thousand short tons	189	1,237	198	1,064	[3] 266	[3] 790	[3] 243	[3] 771
Coal (bituminous) ---------- do	4,733	34,472	4,626	34,082	4,802	42,868	5,500	61,566
Copper (recoverable content of ores, etc.) ---- short tons	295,738	341,282	263,451	273,989	259,507	265,735	256,589	305,341
Fluorspar ---------- do	19,214	595	10,947	341	2,977	84	4,778	144
Gem stones ----------	NA	85	NA	90	NA	95	NA	95
Gold (recoverable content of ores, etc.) ---- troy ounces	408,029	14,848	368,996	15,221	362,413	21,237	307,080	30,035
Iron ore (usable) ---- thousand long tons, gross weight	1,990	13,837	1,681	11,886	1,788	W	1,986	13,581
Lead (recoverable content of ores, etc.) ---- short tons	45,377	14,175	38,270	10,562	20,706	6,224	13,733	4,474
Lime ---------- thousand short tons	186	3,756	172	3,569	171	4,216	185	3,804
Manganiferous ore (5% to 35% Mn) ---------- short tons	700	W	112	W	--	--	--	--
Natural gas ---------- million cubic feet	42,781	6,460	42,418	7,084	39,474	6,711	42,715	8,159
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels	W	W	W	W	458	1,406	W	W
LP gases ---------- do	W	W	W	W	1,742	2,787	W	W
Petroleum (crude) ---------- do	23,370	65,603	23,630	71,886	26,570	80,773	32,656	117,743
Pumice ---------- thousand short tons	W	18	6	10	14	29	42	57
Salt ---------- do	450	4,192	614	5,213	660	4,955	717	6,913
Sand and gravel ---------- do	12,010	10,439	10,505	10,190	14,619	17,071	15,410	15,986
Silver (recoverable content of ores, etc.) thousand troy ounces	6,030	10,678	5,294	8,185	4,300	7,245	3,619	9,257
Stone ---------- thousand short tons	1,650	4,320	2,556	5,335	3,384	6,005	2,848	6,318
Uranium (recoverable content (U_3O_8) ---- thousand pounds	1,635	10,023	1,445	8,959	1,496	9,425	1,940	12,610
Vanadium (recoverable in ore and concentrate) short tons	257	W	226	W	188	W	142	W
Zinc (recoverable content of ores, etc.) ---------- do	34,688	10,628	25,701	8,276	21,853	7,758	16,800	6,942
Value of items that cannot be disclosed: Asphalt (gilsonite), beryl concentrate, cement, clays (kaolin, 1972–73), gypsum, magnesium chloride (1972–73), magnesium compounds, molybdenum, perlite (1970), phosphate rock, potassium salts, sodium sulfate, tungsten, and values indicated by symbol W ----------	XX	55,899	XX	49,754	XX	57,391	XX	70,408
Total ----------	XX	602,551	XX	525,700	XX	542,809	XX	674,210

VERMONT								
Peat ---------- thousand short tons	(5)	6	W	W	(5)	1	(5)	2
Sand and gravel ---------- do	4,046	4,122	3,761	3,518	3,302	3,214	4,041	3,581
Stone ---------- do	1,514	19,088	2,496	27,940	3,300	26,170	1,871	19,523
Talc ---------- short tons	W	W	W	W	180,239	1,326	251,087	1,497
Value of items that cannot be disclosed: Asbestos, clays, gem stones, and values indicated by symbol W ----------	XX	4,627	XX	4,631	XX	4,157	XX	4,763
Total ----------	XX	27,843	XX	36,089	XX	34,868	XX	29,366
VIRGINIA								
Clays ---------- thousand short tons	1,633	1,672	1,710	1,800	1,634	1,783	1,646	1,886
Coal (bituminous) ---------- do	35,016	246,181	30,628	254,870	34,028	344,061	33,961	377,679
Gem stones ----------	NA	7	NA	12	NA	13	NA	13
Lead (recoverable content of ores, etc.) ---- short tons	3,356	1,048	3,386	934	3,441	1,034	2,637	859
Lime ---------- thousand short tons	1,046	14,090	759	11,049	758	11,789	782	12,205
Natural gas ---------- million cubic feet	2,805	864	2,619	822	2,787	892	5,101	1,688
Petroleum (crude) ---------- thousand 42-gallon barrels	1	W	1	W	(5)	(5)	--	--
Sand and gravel ---------- thousand short tons	11,126	15,229	12,796	20,201	14,085	21,696	14,511	26,246
Soapstone ---------- short tons	3,760	9	3,704	8	W	W	4,600	12
Stone ---------- thousand short tons	35,415	60,477	34,643	63,482	39,986	74,090	43,895	82,719
Zinc (recoverable content of ores, etc.) ---- short tons	18,063	5,534	16,829	5,419	16,789	5,960	16,683	6,894
Value of items that cannot be disclosed: Aplite, cement, feldspar (1970–71), gypsum, kyanite, salt (1970–72), titanium concentrate (1970–71), and values indicated by symbol W ----------	XX	29,210	XX	26,564	XX	28,523	XX	30,394
Total ----------	XX	374,321	XX	385,161	XX	489,791	XX	540,595
WASHINGTON								
Cement:								
Masonry ---------- thousand short tons	6	158	5	145	6	170	6	169
Portland ---------- do	1,221	24,832	1,149	23,735	1,239	26,848	1,194	26,651
Clays [3] ---------- do	240	436	255	549	264	584	287	664
Coal (bituminous) ---------- do	37	470	1,134	7,614	2,635	17,424	3,270	21,440
Copper (recoverable content of ores, etc.) -- short tons	9	11	W	W	W	W	W	W
Gem stones ----------	NA	150	NA	155	NA	163	NA	160
Gypsum ---------- thousand short tons	--	--	W	W	5	13	W	W
Lead (recoverable content of ores, etc.) ---- short tons	6,784	2,119	5,117	1,429	2,567	772	2,217	722
Peat ---------- thousand short tons	17	71	17	72	18	89	21	110
Pumice ---------- do	W	W	W	W	W	W	1	1
Sand and gravel ---------- do	25,089	27,902	22,702	26,658	23,065	26,069	27,935	30,132
Silver (recoverable content of ores, etc.) thousand troy ounces	W	W	W	W	221	372	W	W
Stone ---------- thousand short tons	13,701	19,100	12,436	20,489	14,712	[4] 23,764	11,384	19,284
Zinc (recoverable content of ores, etc.) ---- short tons	11,956	3,663	5,782	1,862	6,483	2,301	6,378	2,635
Value of items that cannot be disclosed: Abrasives (1971), bauxite (1970), clays (fire), diatomite, gold, lime, olivine, stone (dimension, 1972), talc, tungsten (1972–73), uranium, and values indicated by symbol W	XX	12,010	XX	11,893	XX	11,237	XX	12,361
Total ----------	XX	90,922	XX	94,601	XX	109,806	XX	114,329

See footnotes at end of table.

Table 6.—Mineral production[1] in the United States, by State—Continued

Mineral	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
WEST VIRGINIA								
Clays[3] thousand short tons	191	$238	232	$336	274	$403	348	$516
Coal (bituminous) do	144,072	1,142,245	118,258	1,128,282	123,743	1,275,813	115,448	1,340,338
Gem stones	NA	W	NA	2	NA	2	NA	2
Lime thousand short tons	262	3,757	197	3,073	W	W	W	W
Natural gas million cubic feet	242,452	61,583	234,027	60,613	214,951	64,485	208,676	64,481
Petroleum (crude) thousand 42-gallon barrels	3,124	11,871	2,969	11,609	2,677	12,047	2,385	11,965
Salt thousand short tons	1,190	5,171	1,174	4,778	1,232	5,963	1,217	6,082
Sand and gravel do	4,396	11,473	7,107	16,756	5,765	15,031	5,893	16,257
Stone[4] do	9,740	16,722	9,880	18,066	11,649	21,293	11,732	22,821
Value of items that cannot be disclosed: Cement, clays (fire), natural gas liquids, stone (dimension), and values indicated by symbol W	XX	32,304	XX	30,445	XX	35,595	XX	40,583
Total	XX	1,285,364	XX	1,273,960	XX	1,430,632	XX	1,503,045
WISCONSIN								
Clays thousand short tons	8	14	4	8	4	7	2	3
Gem stones	NA	W	NA	W	NA	1	NA	1
Iron ore (usable) thousand long tons, gross weight	806	W	824	W	887	W	956	W
Lead (recoverable content of ores, etc.) short tons	761	238	752	207	757	228	844	275
Lime thousand short tons	247	4,503	246	4,570	263	5,009	310	6,004
Peat do	2	W	2	153	2	179	2	208
Sand and gravel do	41,103	35,107	38,561	32,748	36,430	31,324	40,250	43,647
Stone do	17,577	25,167	15,568	25,105	19,394	29,681	23,818	36,917
Zinc (recoverable content of ores, etc.) short tons	20,634	6,322	10,645	3,428	6,873	2,440	8,672	3,583
Value of items that cannot be disclosed: Abrasive stones, cement, and values indicated by symbol W	XX	16,319	XX	17,817	XX	20,484	XX	23,701
Total	XX	87,670	XX	84,036	XX	89,353	XX	114,339
WYOMING								
Clays thousand short tons	1,950	18,829	1,798	17,378	1,873	18,509	2,343	24,043
Coal (bituminous) do	7,222	24,423	8,052	27,335	10,928	40,898	14,886	60,939
Feldspar short tons	W	W	W	W	W	W	2,588	56
Gem stones	NA	130	NA	135	NA	142	NA	142
Gypsum thousand short tons	216	868	232	918	W	W	312	1,348
Iron ore (usable) thousand long tons, gross weight	W	W	1,808	W	2,030	W	2,070	W
Lime thousand short tons	22	W	27	W	W	W	30	548
Natural gas million cubic feet	338,520	49,762	380,105	58,156	375,059	60,760	357,731	64,749
Natural gas liquids:								
Natural gasoline thousand 42-gallon barrels	2,597	7,085	2,514	7,415	3,015	8,951	3,351	10,647
LP gases do	4,556	7,472	5,474	10,127	7,691	15,536	7,237	22,507
Petroleum (crude) do	160,345	469,811	148,114	459,079	140,011	432,071	141,914	541,820
Sand and gravel thousand short tons	9,447	9,298	9,820	8,750	9,098	14,916	6,201	11,635
Stone do	1,266	2,758	2,894	4,789	3,549	5,768	3,191	6,716

Uranium (recoverable content U_3O_8) --thousand pounds--	6,346	38,768	6,986	43,311	8,544	53,827	10,060	65,390
Value of items that cannot be disclosed: Cement, phosphate rock, pumice (1972–73), sodium carbonate, sodium sulfate (1970), and values indicated by symbol W ----	XX	76,329	XX	80,544	XX	95,365	XX	117,565
Total ----------	XX	705,533	XX	717,937	XX	746,743	XX	928,105

r Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes certain cement, included with "Value of items that cannot be disclosed."
[3] Excludes certain clays, included with "Value of items that cannot be disclosed."
[4] Excludes certain stones, included with "Value of items that cannot be disclosed."
[5] Less than ½ unit.
[6] Excludes salt in brine, included with "Value of items that cannot be disclosed."

Table 7.—Mineral production[1] in the Canal Zone and islands administered by the United States

Area and mineral	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
American Samoa:								
Pumice thousand short tons	2	$6	10	$35	--	--	37	$214
Sand and gravel do	26	25	--	--	--	--	--	--
Stone do	49	69	33	30	49	$414	63	152
Total	XX	100	XX	65	XX	414	XX	366
Canal Zone:								
Sand and gravel thousand short tons	60	97	--	--	--	--	--	--
Stone do	85	265	--	--	--	--	--	--
Total	XX	362	XX	--	XX	--	XX	--
Guam: Stone thousand short tons	636	1,289	718	1,705	831	1,983	1,246	3,139
Virgin Islands:								
Stone do	514	2,226	543	W	726	2,255	664	2,860
Wake: Stone do	4	18	3	16	--	--	--	--

W Withheld to avoid disclosing individual company confidential data. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 8.—Mineral production[1] in the Commonwealth of Puerto Rico

Mineral	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Cement thousand short tons	1,778	$29,515	2,001	$38,413	1,946	$31,756	2,062	$41,203
Clays do	429	486	342	358	361	382	464	473
Lime do	41	W	44	W	42	1,776	42	2,215
Salt do	32	395	29	570	29	580	29	580
Sand and gravel do	11,506	28,001	12,998	34,980	7,478	21,237	7,480	21,243
Stone do	7,296	13,947	12,130	29,847	13,504	32,793	15,647	41,857
Total	XX	[2] 72,344	XX	[2] 104,168	XX	88,524	XX	107,571

W Withheld to avoid disclosing individual company confidential data. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Total does not include value of items withheld.

Table 9.—U.S. exports of principal minerals and products

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
METALS				
Aluminum:				
Ingots, slabs, crude—short tons	108,319	$51,879	229,578	$121,951
Scrap—do	66,039	21,072	115,120	39,936
Plates, sheets, bars, etc—do	144,987	115,279	202,371	178,482
Castings and forgings—do	4,467	11,681	5,277	14,613
Aluminum sulfate—do	4,968	181	21,134	642
Other aluminum compounds—do	942,084	83,490	836,659	92,643
Antimony: Metals and alloys crude—do	121	85	515	469
Bauxite, including bauxite concentrates—thousand long tons	29	1,299	12	811
Beryllium—pounds	95,492	839	109,199	1,220
Bismuth: Metals and alloys—do	264,276	493	151,053	446
Cadmium—thousand pounds	1,017	2,363	305	598
Chrome:				
Ore and concentrates:				
Exports—thousand short tons	20	824	21	789
Reexports—do	57	1,946	34	989
Ferrochrome—do	13	4,342	15	5,091
Cobalt—thousand pounds	2,597	5,005	3,890	8,932
Columbium metals, alloys and other forms—do	29	453	96	790
Copper:				
Ore, concentrate, composition metal and unrefined (copper content)—short tons	r 35,612	26,548	45,957	48,559
Refined copper and semimanufactures—do	215,591	278,059	242,856	386,993
Other copper manufactures—do	6,299	7,400	7,431	12,160
Copper sulfate or blue vitriol—do	2,646	1,767	1,716	2,043
Copper-base alloys—do	90,377	105,586	149,888	205,249
Ferroalloys:				
Ferrosilicon—do	7,367	2,196	15,984	4,051
Ferrophosphorus—do	1,179	111	19,030	773
Gold:				
Ore and base bullion—troy ounces	265,783	14,531	334,255	29,692
Bullion, refined—do	1,206,386	48,522	2,650,962	116,273
Iron ore—thousand long tons	2,095	26,776	2,747	37,922
Iron and steel:				
Pig iron—short tons	15,018	931	15,160	882
Iron and steel products (major):				
Semimanufactures—do	2,309,583	400,820	3,317,118	713,292
Manufactured steel mill products—do	1,236,897	605,600	1,644,412	867,594
Iron and steel scrap: Ferrous scrap, including rerolling materials—thousand short tons	7,683	252,617	11,412	606,556
Lead:				
Pigs, bars, anodes—short tons	8,376	4,500	66,576	27,097
Scrap—do	35,233	4,264	59,873	12,227
Magnesium: Metal and alloys and semimanufactured forms, n.e.c—do	17,556	11,702	39,585	28,242
Manganese:				
Ore and concentrate—do	25,108	3,137	57,448	4,535
Ferromanganese—do	6,842	1,512	8,574	2,137
Mercury:				
Exports—76-pound flasks	400	129	342	170
Reexports—do	563	121	--	--
Molybdenum:				
Ore and concentrates (molybdenum content)—thousand pounds	45,362	73,039	73,958	120,387
Metals and alloys, crude and scrap—do	89	199	148	252
Wire—do	173	1,551	357	3,105
Semifabricated forms, n.e.c—do	181	987	209	1,216
Powder—do	50	192	195	672
Ferromolybdenum—do	r 909	1,163	2,224	3,151
Nickel:				
Alloys and scrap (including Monel metal), ingots, bars, sheets, etc—short tons	16,694	42,677	16,545	50,712
Catalysts—do	2,573	6,794	2,478	6,584
Nickel-chrome electric resistance wire—do	553	2,638	697	3,818
Semifabricated forms, n.e.c—do	1,851	11,659	2,350	14,689
Platinum:				
Ore, concentrate, metal and alloys in ingots, bars, sheets, anodes, and other forms, including scrap—troy ounces	417,037	r 44,258	439,452	61,379
Palladium, rhodium, iridium, osmiridium, ruthenium, and osmium (metal and alloys including scrap)—do	r 121,957	r 7,518	188,074	16,246
Platinum-group manufactures, except jewelry	NA	4,255	NA	4,282

See footnotes at end of table.

Table 9.—U.S. exports of principal minerals and products—Continued

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
METALS—Continued				
Rare earths: Cerium ore, metal, alloys, lighter flints ---pounds--	202,206	$610	109,766	$286
Silver:				
Ore, concentrates, waste and sweepings thousand troy ounces--	2,964	4,899	3,007	7,322
Bullion, refined ---do---	26,693	44,361	8,208	20,316
Tantalum:				
Ore, metal, other forms ---thousand pounds--	r 165	r 2,310	360	3,962
Powder ---do---	171	3,572	202	5,312
Tin:				
Ingots, pigs, bars, etc.:				
Exports ---long tons--	857	2,915	2,540	12,099
Reexports ---do---	277	1,055	866	3,236
Tin scrap and other tin-bearing material except tinplate scrap ---do---	8,548	3,392	4,862	3,262
Titanium:				
Ore and concentrate ---short tons--	1,802	394	1,494	353
Sponge (including iodide titanium and scrap) ---do---	3,510	2,165	4,142	3,601
Intermediate mill shapes and mill products, n.e.c ---do---	562	6,265	745	8,748
Dioxide and pigments ---do---	r 10,335	4,882	20,769	14,021
Tungsten: Ore and concentrates:				
Exports ---thousand pounds--	95	211	90	239
Reexports ---do---	--	--	--	--
Vanadium ore and concentrate, pentoxide, etc. (vanadium content) ---do---	351	756	464	1,157
Zinc:				
Slabs, pigs, or blocks ---short tons--	4,324	714	14,566	8,259
Sheets, plates, strips, or other forms, n.e.c ---do---	2,419	2,138	2,480	2,100
Scrap (zinc content) ---do---	1,446	431	7,032	2,717
Semifabricated forms, n.e.c ---do---	6,052	3,076	15,077	10,565
Zirconium:				
Ore and concentrate ---do---	17,360	940	28,921	2,288
Metals, alloys, other forms ---pounds--	1,314,219	11,509	1,016,437	12,425
NONMETALS				
Abrasives:				
Dust and powder of precious or semiprecious stones, including diamond dust and powder ---thousand carats--	8,263	21,986	9,928	25,071
Crushing bort ---do---	55	305	40	138
Industrial diamonds ---do---	484	1,899	516	4,208
Diamond grinding wheels ---do---	554	3,073	746	4,223
Other natural and artificial metallic abrasives and products	NA	36,956	NA	49,329
Asbestos, unmanufactured:				
Exports ---short tons--	51,792	7,621	65,900	9,251
Reexports ---do---	6,832	1,430	542	91
Boron: Boric acid, borates, crude and refined ---do---	189,778	22,530	210,233	26,216
Cement ---do---	100,889	3,712	324,740	8,980
Clays:				
Kaolin or china clay ---do---	667,519	26,332	731,798	30,528
Fire clay ---do---	124,307	2,905	196,337	3,820
Other clays ---do---	1,053,892	36,979	1,168,495	45,426
Fluorspar ---do---	2,764	184	2,478	196
Graphite ---do---	7,289	888	7,953	992
Gypsum:				
Crude, crushed or calcined thousand short tons--	51	2,582	63	3,135
Manufactures, n.e.c	NA	2,694	NA	4,225
Kyanite and allied minerals ---short tons--	73,911	3,737	93,714	5,552
Lime ---do---	37,659	1,242	36,914	1,208
Mica sheet, waste and scrap and ground ---pounds--	13,957,313	1,842	14,588,464	2,201
Mica, manufactured ---do---	1,001,639	2,910	1,155,852	3,064
Mineral-earth pigments: Iron oxide, natural and manufactured ---short tons--	8,194	5,087	14,363	6,702
Nitrogen compounds (major) thousand short tons--	4,004	222,441	4,538	318,436
Phosphate rock ---do---	13,992	107,438	13,932	113,295
Phosphatic fertilizers (superphosphates) --do---	967	52,465	967	70,990

See footnotes at end of table.

Table 9.—U.S. exports of principal minerals and products—Continued

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
NONMETALS—Continued				
Pigments and compounds(lead and zinc):				
Lead pigments ---short tons--	1,867	$818	2,240	$1,025
Zinc pigments ---do----	7,567	2,764	8,624	3,440
Potash:				
Fertilizer ---do----	1,353,471	45,858	1,578,716	57,997
Chemical ---do----	31,435	6,890	39,229	10,660
Quartz, natural, quartzite, cryolite, chiolite ---do----	677	130	724	134
Salt:				
Crude and refined ---thousand short tons--	869	5,544	609	4,400
Shipments to noncontiguous Territories ---do----	21	2,303	18	1,585
Sodium and sodium compounds:				
Sodium sulfate ---do----	29	926	45	2,049
Sodium carbonate ---do----	480	r 18,911	425	16,064
Stone:				
Dolomite, block ---do----	77	1,025	59	652
Limestone, crushed, ground, broken --do----	1,730	3,802	2,316	5,400
Marble and other building and monumental thousand cubic feet--	NA	755	NA	1,244
Stone, crushed, ground, broken thousand short tons--	1,035	4,298	765	4,819
Manufactures of stone	NA	1,227	NA	948
Sulfur:				
Crude ---thousand long tons--	1,847	32,409	1,771	34,330
Crushed, ground, flowers of ---do----	5	1,278	6	1,461
Talc, crude and ground ---short tons--	171,007	5,791	180,102	6,618
MINERAL FUELS				
Carbon black ---thousand pounds--	r 111,238	r 14,856	192,665	24,056
Coal:				
Anthracite ---thousand short tons--	743	10,922	717	11,240
Bituminous ---do----	r 55,997	r 973,189	52,903	1,002,457
Briquets ---do----	r 73	r 4,264	92	5,107
Coke ---do----	1,232	30,720	1,395	33,138
Natural gas ---thousand cubic feet--	89,499,088	42,176	84,805,211	43,152
Petroleum:				
Crude ---thousand barrels--	192	565	697	2,620
Gasoline ---do----	493	4,396	1,692	20,737
Jet fuel ---do----	258	r 1,113	824	4,087
Naphtha ---do----	1,438	r 16,397	1,561	19,671
Kerosine ---do----	84	778	81	811
Distillate fuel oil ---do----	755	3,055	2,526	25,680
Residual fuel oil ---do----	11,576	34,349	8,388	23,578
Lubricating oil ---do----	12,149	169,424	10,728	173,546
Asphalt ---do----	r 331	3,572	338	3,262
Liquefied petroleum gases ---do----	11,475	46,581	9,927	57,191
Wax ---do----	1,105	25,840	942	24,176
Coke ---do----	30,667	111,950	34,668	127,182
Petrochemical feedstocks ---do----	r 4,545	r 23,215	6,815	32,500
Miscellaneous ---do----	1,042	r 21,310	1,168	27,886
Total	XX	r 4,634,224	XX	6,535,790

r Revised. NA Not available. XX Not applicable.

Table 10.—U.S. imports for consumption of principal minerals and products

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
METALS				
Aluminum:				
Metal ---short tons	661,042	$304,536	508,025	$225,256
Scrap ---do	52,301	17,747	46,808	16,740
Plates, sheets, bars, etc ---do	r 81,142	r 52,451	58,773	43,222
Aluminum oxide (alumina) ---do	2,849,995	173,413	3,375,488	209,329
Antimony:				
Ore (antimony content) ---do	17,212	9,437	16,679	10,903
Needle or liquated ---do	78	75	51	73
Metal ---do	2,302	2,092	692	745
Oxide ---do	5,032	5,766	4,651	6,095
Arsenic: White (As_2O_3 content) ---do	13,613	1,956	11,496	1,714
Bauxite: Crude ---thousand long tons	11,428	151,012	11,240	143,075
Beryllium ore ---short tons	3,345	1,101	1,586	481
Bismuth ---pounds	1,562,934	5,235	2,676,271	9,655
Boron carbide ---do	11,622	61	322,236	395
Cadmium:				
Metal ---short tons	r 1,211	4,886	1,946	12,799
Flue dust (cadmium content ---do	r 370	685	82	243
Calcium:				
Metal ---pounds	248,080	r 181	110,407	78
Chloride ---short tons	6,128	225	7,357	317
Chromate:				
Ore and concentrates (Cr_2O_3 content) thousand short tons	r 499	r 27,605	412	21,028
Ferrochrome ---do	90	34,588	100	35,175
Metal ---do	2	3,791	3	6,080
Cobalt:				
Metal ---thousand pounds	13,082	30,650	18,360	53,625
Oxide (gross weight) ---do	1,134	2,330	1,150	2,714
Salts and compounds (gross weight) ---do	82	44	r 62	r 51
Columbium ore ---do	3,227	1,927	2,826	2,201
Copper: (copper content)				
Ore and concentrates ---short tons	80,740	81,055	19,582	16,029
Regulus, black, coarse ---do	1,453	1,134	139	106
Unrefined, black, blister ---do	77,162	72,514	128,166	159,922
Refined in ingots, etc ---do	175,703	172,772	206,297	262,706
Old and scrap ---do	10,787	9,766	18,266	21,967
Ferroalloys: Ferrosilicon (silicon content) ---do	23,154	8,815	63,388	21,087
Gold:				
Ore and base bullion ---troy ounces	265,453	14,023	234,692	19,388
Bullion ---do	5,860,749	343,666	3,610,073	336,762
Iron ore ---thousand long tons	35,761	415,934	43,296	533,488
Iron and steel:				
Pig iron ---short tons	636,932	33,518	445,626	28,925
Iron and steel products (major):				
Iron products ---do	41,428	18,158	38,043	19,113
Steel products ---do	18,117,041	r 2,974,072	15,571,833	3,026,099
Scrap ---do	295,000	14,304	336,693	18,716
Tinplate ---do	17,040	437	11,940	384
Lead:				
Ore, flue dust, matte (lead content) ---do	51,642	10,554	94,355	17,409
Base bullion (lead content) ---do	895	238	4	1
Pigs and bars (lead content) ---do	245,598	64,096	178,095	52,927
Reclaimed scrap, etc. (lead content) ---do	1,753	450	2,745	522
Sheet, pipe, shot ---do	r 179	r 69	38	18
Magnesium:				
Metallic and scrap ---do	4,298	1,990	2,874	1,404
Alloys (magnesium content) ---do	168	464	389	1,104
Sheets, tubing, ribbons, wire and other forms (magnesium content) ---do	13	103	20	129
Manganese:				
Ore (35% or more manganese) (manganese content) ---do	792,695	34,315	722,635	37,403
Ferromanganese (manganese content) ---do	274,717	49,846	303,867	53,308
Mercury:				
Compounds ---pounds	9,028	45	3,543	30
Metal ---76-pound flasks	28,834	r 5,881	46,026	12,151
Minor metals: Selenium and salts ---pounds	448,964	4,362	590,173	6,023
Nickel:				
Pigs, ingots, shot, cathodes ---short tons	125,364	r 330,825	120,083	343,494
Scrap ---do	2,306	3,517	2,642	3,906
Oxide ---do	5,988	12,038	6,301	13,466
Platinum group:				
Unwrought:				
Grains and nuggets (platinum) troy ounces	58,284	7,254	19,146	2,396

See footnotes at end of table.

Table 10.—U.S. imports for consumption of principal minerals and products—Continued

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
METALS—Continued				
Platinum group—Continued				
Unwrought—Continued				
Sponge (platinum) ---troy ounces	350,143	$42,622	499,271	$73,108
Sweepings, waste, scrap ---do	75,210	7,600	84,534	10,229
Iridium ---do	24,827	4,038	19,701	4,816
Palladium ---do	289,055	12,929	496,065	36,613
Rhodium ---do	47,378	8,735	72,856	15,587
Ruthenium ---do	61,191	2,602	67,218	3,375
Other platinum-group metals ---do	r 103,419	r 12,134	243,584	33,877
Semimanufactured:				
Platinum ---do	207,960	22,869	155,715	22,949
Palladium ---do	613,174	22,488	658,240	43,500
Rhodium ---do	3,426	543	20,355	1,761
Other platinum-group metals ---do	r 2,282	r 278	3,806	621
Radium: Radioactive substitutes	NA	4,444	NA	5,537
Rare earths: Ferrocerium and other cerium alloys ---pounds	27,867	94	38,206	127
Silver:				
Ore and base bullion--thousand troy ounces	33,768	49,979	33,990	74,927
Bullion ---do	25,680	41,579	81,219	215,697
Tantalum ore ---thousand pounds	1,229	2,663	1,097	2,858
Tin:				
Ore (tin content) ---long tons	4,216	12,475	4,480	17,081
Blocks, pigs, grains, etc ---do	52,451	195,421	45,845	195,246
Dross, skimmings, scrap, residues and tin alloys, n.s.p.f ---do	1,304	2,140	1,281	1,322
Tin foil, powder, flitters, etc	NA	6,501	NA	6,956
Titanium:				
Ilmenite [1] ---short tons	395,218	14,237	453,650	16,981
Rutile ---do	195,068	21,733	174,180	23,786
Metal ---pounds	8,769,356	8,041	13,648,385	11,389
Ferrotitanium ---do	181,326	76	512,547	178
Compounds and mixtures ---do	173,597,069	33,908	121,789,426	28,057
Tungsten: (tungsten content)				
Ore and concentrates ---thousand pounds	5,739	12,139	10,552	23,037
Metal ---do	r 122	342	93	276
Other alloys ---do	r 1,091	r 3,541	1,433	4,947
Zinc:				
Ore (zinc content) ---short tons	174,063	24,275	153,898	24,667
Blocks, pigs, slabs ---do	516,643	176,707	587,429	270,213
Sheets ---do	485	310	236	159
Old, dross, skimmings ---do	2,882	r 592	4,052	1,074
Dust ---do	9,197	3,822	4,671	2,298
Manufactures	NA	2,040	NA	3,407
Zirconium: Ore, including zirconium sand---do	67,537	3,291	98,023	5,415
NONMETALS				
Abrasives: Diamonds (industrial) thousand carats	15,134	52,619	19,154	65,594
Asbestos ---short tons	735,515	87,732	792,473	98,914
Barite:				
Crude and ground ---do	624,634	5,658	724,813	7,767
Witherite ---do	1,311	169	4,611	716
Chemicals ---do	23,592	3,959	32,780	6,719
Cement ---do	r 4,911	r 71,757	6,683	104,084
Clays:				
Raw ---do	62,576	1,095	46,044	1,303
Manufactured ---do	4,138	214	6,598	576
Cryolite ---do	25,642	3,451	38,276	5,104
Feldspar: Crude ---long tons	167	23	264	22
Fluorspar ---short tons	1,181,533	47,851	1,212,347	52,620
Gem stones:				
Diamond ---thousand carats	5,506	626,679	[2] 5,181	[2] 821,090
Emeralds ---do	573	22,176	749	32,600
Other	NA	67,281	NA	83,968
Graphite ---short tons	64,135	3,847	77,376	4,455
Gypsum:				
Crude, ground, calcined thousand short tons	7,720	18,494	7,663	17,695
Manufactures	NA	3,548	NA	4,242
Iodine, crude ---thousand pounds	6,207	10,184	6,118	10,484
Kyanite ---short tons	124	6	221	13
Lime:				
Hydrated ---do	37,468	724	47,309	941
Other ---do	210,995	3,224	286,703	4,302
Magnesium compounds:				
Crude magnesite ---short tons	--	--	--	--

See footnotes at end of table.

Table 10.—U.S. imports for consumption of principal minerals and products—Continued

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
NONMETALS—Continued				
Magnesium compounds—Continued				
Lump, ground, caustic calcined magnesia ---short tons--	10,376	$675	10,967	$734
Refractory magnesia, dead-burned fused magnesite, dead-burned dolomite ---do----	133,734	9,695	158,007	13,877
Compounds ---do----	25,301	1,111	57,029	1,880
Mica:				
Uncut sheet and punch --thousand pounds--	1,494	1,162	1,169	1,269
Scrap ---do----	2,641	62	5,072	116
Manufactures ---do----	5,644	3,183	4,785	4,325
Mineral-earth pigments: Iron oxide pigments:				
Natural ---short tons--	2,777	236	1,858	378
Synthetic ---do----	34,274	7,602	37,436	10,700
Ocher, crude and refined ---do----	93	6	66	9
Siennas, crude and refined ---do----	1,272	196	1,192	205
Umber, crude and refined ---do----	8,234	412	9,665	569
Vandyke brown ---do----	621	77	966	144
Nitrogen compounds (major), including urea thousand short tons--	2,683	125,037	2,837	146,455
Phosphate, crude ---do----	[2] 55	[2] 1,416	[2] 65	[2] 1,288
Phosphatic fertilizers ---do----	70	3,184	68	3,042
Pigments and salts:				
Lead pigments and compounds short tons--	26,550	9,244	20,515	8,602
Zinc pigments and compounds ---do----	25,934	6,891	36,479	13,792
Potash ---do----	4,996,415	128,548	6,082,444	157,800
Pumice:				
Crude or unmanufactured ---do----	9,094	149	5,026	95
Wholly or partly manufactured ---do----	589,758	1,351	305,400	1,038
Manufactures, n.s.p.f ----	NA	24	NA	19
Quartz crystal (Brazilian pebble) ---pounds--	r 762,740	331	1,064,774	364
Salt ---thousand short tons--	3,463	11,979	3,187	12,457
Sand and gravel:				
Glass sand ---do----	49	201	48	340
Other sand and gravel ---do----	712	1,178	752	1,236
Sodium sulfate ---do----	299	5,358	320	5,658
Stone and whiting ----	NA	r 43,436	NA	48,678
Strontium: Mineral ---short tons--	30,677	830	27,040	657
Sulfur and pyrites:				
Sulfur ore and other forms n.e.s. thousand long tons--	1,138	16,288	1,222	14,742
Pyrites ---do----	125	472	20	113
Talc: Unmanufactured ---short tons--	29,085	1,669	22,993	1,658
MINERAL FUELS				
Carbon black:				
Acetylene ---pounds--	6,022,118	1,581	7,268,499	2,030
Gas black and carbon black ---do----	1,149,099	176	8,669,196	991
Coal:				
Bituminous, slack, culm and lignite short tons--	47,098	691	126,641	1,607
Briquets ---do----	5,849	96	7,425	123
Coke ---do----	185,023	4,649	1,077,737	39,263
Natural gas, ethane, methane, and mixtures thereof ---thousand cubic feet--	r 1,307,774,412	r 403,151	995,329,121	341,470
Peat:				
Fertilizer grade ---short tons--	307,233	16,951	317,639	18,390
Poultry and stable grade ---do----	r 3,288	222	5,862	372
Petroleum:				
Crude petroleum ---thousand barrels--	896,991	2,369,176	1,295,719	4,231,682
Distillate fuel oil ---do----	107,905	254,529	188,553	716,651
Residual fuel oil ---do----	r 480,031	r 1,170,366	548,265	1,860,279
Unfinished oils ---do----	1,812	5,324	3,103	34,365
Gasoline ---do----	1,744	8,730	17,330	139,528
Jet fuel ---do----	r 65,572	r 222,891	71,819	294,951
Motor fuels, n.e.s ---do----	171	669	1,303	7,672
Kerosine ---do----	270	1,299	1,078	6,946
Lubricants ---do----	r 970	r 988	2,023	1,516
Wax ---do----	73	1,342	380	8,899
Naphtha ---do----	86,279	213,857	97,469	334,939
Liquefied petroleum gases ---do----	32,485	73,340	47,873	151,259
Asphalt ---do----	9,653	23,852	8,669	20,868
Miscellaneous ---do----	10,573	36,810	13,339	51,596
Total ----	XX	r 12,498,581	XX	17,035,294

r Revised. NA Not available. XX Not applicable.
[1] Includes titanium slag averaging about 70% TiO_2. For detail see Titanium Chapter, table 5.
[2] Adjusted by Bureau of Mines.

Table 11.—Comparison of world and United States production of principal mineral commodities

(Thousand short tons unless otherwise specified)

Minerals	1972			1973 p		
	World production [1]	U.S. production	U.S. percent of world production	World production [1]	U.S. production	U.S. percent of world production
MINERAL FUELS						
Carbon black ---million pounds--	7,059	3,201	45	7,721	3,500	45
Coal:						
Bituminous	[2] 2,343,848	584,387	25	[2] 2,385,506	577,574	24
Lignite	886,414	10,999	1	903,072	14,164	2
Pennsylvania anthracite	192,612	7,106	4	191,919	6,830	4
Coke (excluding breeze):						
Gashouse [3]	21,671	--	--	20,787	--	--
Oven and beehive	381,315	60,507	16	401,849	64,325	16
Natural gas (marketable) million cubic feet--	42,568,899	22,531,698	53	45,917,032	22,647,549	49
Peat	116,029	577	(4)	106,481	635	1
Petroleum (crude) thousand barrels--	18,600,501	3,455,368	19	20,560,852	3,360,903	16
NONMETALS						
Asbestos	4,160	132	3	4,606	150	3
Barite	4,362	906	21	4,761	1,104	23
Cement	728,601	[5] 84,556	12	780,349	[5] 87,498	11
China clay	15,352	[6] 5,318	35	16,390	[6] 5,993	37
Corundum	8	--	--	NA	--	--
Diamond ---thousand carats--	43,810	--	--	43,489	--	--
Diatomite	1,700	576	34	1,738	609	35
Feldspar	2,805	732	26	2,794	792	28
Fluorspar	4,974	250	5	4,928	249	5
Graphite	398	W	NA	NA	W	NA
Gypsum	66,142	12,328	19	67,032	13,558	20
Lime (sold or used)	113,566	[5] 20,332	18	118,820	[5] 21,132	18
Magnesite	9,842	W	NA	9,864	W	NA
Mica (including scrap) thousand pounds--	525,709	319,086	61	577,276	354,152	61
Nitrogen, agricultural [7]	38,716	[5] 8,919	23	42,202	[5] 9,339	22
Phosphate rock	98,981	40,831	41	108,060	42,137	39
Potash (K_2O equivalent)	22,497	2,659	12	24,212	2,603	11
Pumice [8]	17,465	3,819	22	15,698	3,772	24
Pyrites ---thousand long tons--	22,783	741	3	22,038	559	3
Salt	162,941	[5] 45,050	28	165,526	[5] 43,940	27
Strontium [8]	110	--	--	103	--	--
Sulfur, elemental thousand long tons--	28,209	9,240	33	31,555	10,021	32
Talc, pyrophyllite, soapstone	5,241	1,107	21	5,666	1,247	22
Vermiculite [8]	512	337	66	551	365	66
METALS, MINE BASIS						
Antimony, (content of ore and concentrate) ---short tons--	73,259	489	1	76,419	545	1
Arsenic, white ---do---	46,338	--	NA	52,317	W	NA
Bauxite ---thousand long tons--	64,021	[9] 1,812	3	69,614	[9] 1,879	3
Beryl ---short tons--	4,634	W	NA	4,291	W	NA
Bismuth ---thousand pounds--	8,330	W	NA	8,798	W	NA
Chromite	6,977	--	--	7,507	--	--
Cobalt (contained) ---short tons--	25,925	--	--	28,255	--	--
Columbium-tantalum concentrate [8] thousand pounds--	34,309	--	--	53,001	--	--
Copper (content of ore and concentrate)	7,329	[10] 1,665	23	7,857	[10] 1,718	22
Gold ---thousand troy ounces--	44,718	1,450	3	43,070	1,176	3
Iron ore ---thousand long tons--	767,679	[11] 75,434	10	850,477	[11] 87,669	10
Lead (content of ore and concentrate)	3,764	[10] 619	16	3,806	[10] 603	16
Manganese ore (35% or more Mn)--	22,990	1	(4)	24,290	(4)	(4)
Mercury-thousand 76-pound flasks--	278	7	3	276	2	1
Molybdenum (content of ore and concentrate) ---thousand pounds--	174,418	112,138	64	181,152	115,859	64
Nickel (content of ore and concentrate)	683	17	2	726	18	2
Platinum group thousand troy ounces--	4,269	17	(4)	5,174	20	(4)
Silver ---do---	294,159	37,233	13	305,916	37,827	12
Tin (content of ore and concentrate) ---long tons--	239,610	W	NA	232,404	W	NA
Titanium concentrates:						
Ilmenite [8]	2,668	682	26	2,939	804	27
Rutile [8]	357	--	--	368	--	--

See footnotes at end of table.

Table 11.—Comparison of world and United States production of principal mineral commodities—Continued

(Thousand short tons unless otherwise specified)

Minerals	1972			1973 [p]		
	World production [1]	U.S. production	U.S. percent of world production	World production [1]	U.S. production	U.S. percent of world production
METALS, MINE BASIS—Continued						
Tungsten concentrate (contained tungsten) _____thousand pounds__	84,470	8,150	10	85,320	7,575	9
Uranium oxide (U_3O_8) [8] short tons__	25,625	12,900	50	25,486	13,235	52
Vanadium (content of ore and concentrate) _____short tons__	20,679	4,887	24	21,285	4,377	21
Zinc (content of ore and concentrate) _____	6,221	478	8	6,377	479	8
METALS, SMELTER BASIS						
Aluminum _____	12,115	4,122	34	13,359	4,529	34
Cadmium _____short tons__	18,388	[12] 4,145	23	18,747	[12] 3,714	20
Copper _____	7,340	[13] 1,690	23	7,838	[13] 1,744	22
Iron, pig _____	502,768	88,876	18	555,852	100,929	18
Lead _____	3,745	[14] 689	18	3,801	[14] 688	18
Magnesium _____	256	121	47	261	122	47
Selenium [8] _____thousand pounds__	2,687	739	28	2,458	627	26
Steel ingots and castings _____	692,557	[15] 133,241	19	765,832	[15] 150,799	20
Tellurium [8] _____thousand pounds__	384	257	67	420	241	57
Tin _____long tons__	236,473	[16] 4,300	2	227,251	[16] 4,500	2
Zinc _____	5,646	633	11	5,795	541	9

[p] Preliminary. [r] Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data.

[1] May not represent total world production because confidential U.S. data are excluded for some commodities. World totals include reported figures and reasonable estimates; however, for some commodities where data were not available, no reasonable estimates could be made and none have been included.

[2] Includes small quantities of lignite for People's Republic of China, and Pakistan, and anthracite for Colombia.

[3] Includes low- and medium-temperature and gashouse coke.

[4] Less than ½ unit.

[5] Includes Puerto Rico.

[6] Kaolin sold or used by producers.

[7] Year ended June 30 of year stated (United Nations).

[8] World total exclusive of the U.S.S.R.

[9] Dry bauxite equivalent of crude ore.

[10] Recoverable.

[11] Includes byproduct ore.

[12] Includes secondary.

[13] Smelter output from domestic and foreign ores, exclusive of scrap.

[14] Lead refined from domestic and foreign ores; excludes lead refined from imported base bullion.

[15] Data from American Iron and Steel Institute. Excludes production of castings by companies that do not produce steel ingot.

[16] Includes tin content of alloys made directly from ore.

The Mineral Industry of Alabama

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Alabama for collecting information on all minerals except fuels.

By Joseph F. Corey [1]

Notwithstanding the year 1971, the value of mineral production in Alabama, since 1963, has mirrored an annual growth rate of 7.5%. However, when related to the Bureau of Mines Index of Implicit Unit Value, the annual growth rate was only approximately 3.1% (1967=100). Nonmetals represented 36% of the total mineral output value reported in 1973, fossil fuels, 63%, and metals were responsible for approximately 1%. In terms of 1967 dollars, the value of mineral production in Alabama fell approximately 1% from that reported in 1972.

The index of industrial production for Alabama leveled out in mid-1973 and by the end of the year ran concurrent with the index for the entire United States. The average for the United States was 126 (1967=100) while the average for Alabama was 125.

In terms of current dollars, the value of mineral production in Alabama increased 11.3% from that reported in 1972. In most cases, mineral production rose; however, it was increases in value rather than the increases in the quantities produced that accounted for a greater portion of the 11.3% increase.

Although production of bituminous coal decreased 7.6% from that reported in 1972, the value per ton increased by $1.38, the result of which accounted for the increase in the total value of the product. Moreover, the value of bituminous coal production generated 51% of the total value of mineral production in 1973. Lime production rose 19.2% in 1973. Sand and gravel, clay, natural gas, petroleum, and stone followed suit with increases in production of 54.3%, 2.9%, 209%, 17.5%, and 8.4%, respectively.

The value of exports from the port of Mobile, Ala., increased from $172 million in 1972 to $421 million in 1973, an increase of 145%. The value of imports over the same period experienced a modest increase of 38% with the value of $263 million in 1973, $73 million more than that reported in 1972.

[1] Mineral specialist, Division of Coal—Mineral Supply.

Table 1.—Mineral production in Alabama [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Cement:[2]				
Masonry thousand short tons	407	$11,221	425	$13,074
Portland do	2,360	48,577	2,396	55,820
Clays [3] do	2,850	7,512	2,934	8,788
Coal (bituminous) do	20,813	200,430	19,230	211,695
Iron ore thousand long tons	327	1,912	271	1,408
Lime thousand short tons	739	11,751	881	14,050
Natural gas million cubic feet	3,644	1,282	11,271	4,307
Petroleum (crude) thousand 42-gallon barrels	9,934	30,466	11,677	41,772
Sand and gravel thousand short tons	6,352	8,530	9,805	13,870
Stone do	18,485	42,027	20,043	40,117
Value of items that cannot be disclosed: Asphalt (native), bauxite, cement (slag), clays (bentonite), mica (scrap), natural gas liquids, salt, stone (dimension), and talc	--	7,533	--	8,155
Total	--	371,241	--	413,056
Total 1967 constant dollars	--	306,303	--	p 303,270

p Preliminary. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes slag cement; included with "Value of items that cannot be disclosed."
[3] Excludes bentonite; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Alabama, by county [1 2]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Autauga	W	W	Sand and gravel, clays.
Baldwin	W	W	Petroleum.
Barbour	W	$1,568	Bauxite, sand and gravel, clays.
Bibb	$6,494	6,168	Coal, stone, clays, sand and gravel.
Blount	2,359	W	Coal, cement, stone.
Calhoun	3,594	W	Clays, stone, sand and gravel.
Chilton	W	46	Clays.
Choctaw	4,551	W	Petroleum, natural gas.
Clarke	W	W	Sand and gravel, petroleum.
Coffee	40	74	Sand and gravel.
Colbert	2,656	W	Stone, native asphalt.
Conecuh	--	W	Sand and gravel.
Covington	W	--	
Crenshaw	W	W	Iron ore, sand and gravel.
Cullman	3,441	5,362	Coal.
Dale	35	41	Sand and gravel.
Dallas	W	W	Sand and gravel, clays.
De Kalb	W	W	Stone.
Elmore	W	1,625	Sand and gravel.
Escambia	6,498	13,881	Petroleum, natural gas, sand and gravel, clays.
Etowah	W	W	Stone, sand and gravel, coal.
Fayette	--	W	Sand and gravel, coal.
Franklin	3,578	3,245	Stone, iron ore, sand and gravel, clays.
Geneva	W	W	Sand and gravel.
Hale	W	W	Do.
Henry	W	W	Clays, bauxite.
Houston	W	W	Sand and gravel.
Jackson	W	W	Coal, stone.
Jefferson	133,209	136,829	Coal, cement, stone, clays, sand and gravel.
Lamar	12	W	Natural gas, petroleum.
Lee	491	W	Stone.
Limestone	28	--	
Lowndes	W	W	Clays, sand and gravel.
Macon	1,056	1,296	Sand and gravel.
Madison	W	W	Stone, clays.
Marengo	W	W	Cement, stone.
Marion	W	2,818	Coal, clays.
Marshall	W	W	Stone, clays.
Mobile	36,325	36,764	Petroleum, cement, stone, sand and gravel, natural gas liquids, clays.

See footnotes at end of table.

Table 2.—Value of mineral production in Alabama, by county [1] [2]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Monroe	W	$699	Petroleum, natural gas, sand and gravel.
Montgomery	W	3,017	Sand and gravel, clays.
Morgan	W	W	Stone.
Randolph	W	W	Mica.
Russell	W	W	Sand and gravel, clays.
St. Clair	$8,864	W	Cement, clays, stone.
Shelby	31,129	36,892	Lime, cement, stone, coal, clays.
Sumter	W	W	Clays, sand and gravel.
Talladega	14,277	W	Stone, talc.
Tallapoosa	--	32	Clays.
Tuscaloosa	16,927	14,524	Coal, sand and gravel.
Walker	59,698	W	Coal, clays, sand and gravel.
Washington	W	W	Stone, salt, sand and gravel.
Winston	2,070	1,726	Coal.
Undistributed [3]	33,913	146,445	
Total [4]	371,241	413,056	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Baldwin, Bullock, Butler, Chambers, Cherokee, Clay, Cleburne, Coosa, Greene, Lauderdale, Lawrence, Perry, Pickens, Pike, and Wilcox.

[2] Values for petroleum were based on an average price per barrel for the State.

[3] Includes some sand and gravel and petroleum that cannot be assigned to specific counties and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Alabama business activity

		1972	1973 [p]	Change, percent
Monthly average employment:				
Total nonagricultural	thousands	1,072.3	1,132.5	+5.6
Manufacturing	do	330.0	346.3	+4.9
Nonmanufacturing	do	742.3	786.2	+5.9
Personal income:				
Total	millions	$12,004.0	$13,180.0	+9.8
Per capita		$3,420.0	$3,724.0	+8.9
Construction activity:				
Highway construction contracts awarded	millions	[e] $100.0	$102.0	+2.0
New housing units authorized		28,365.0	20,647.0	−27.2
Value of nonresidential construction	millions	$181.5	$254.4	+40.2
Farm marketing, cash receipts	do	$986.1	$1,364.8	+38.4
Mineral production value	do	$371.2	$413.1	+11.3
Utility consumption:				
Consumption for industrial purposes	billion kilowatt hours	21.1	22.1	+4.7

[e] Estimate. [p] Preliminary.

Sources: Alabama Business, Center for Business and Economic Research, University of Alabama; Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Roads and Streets; and U.S. Bureau of Mines.

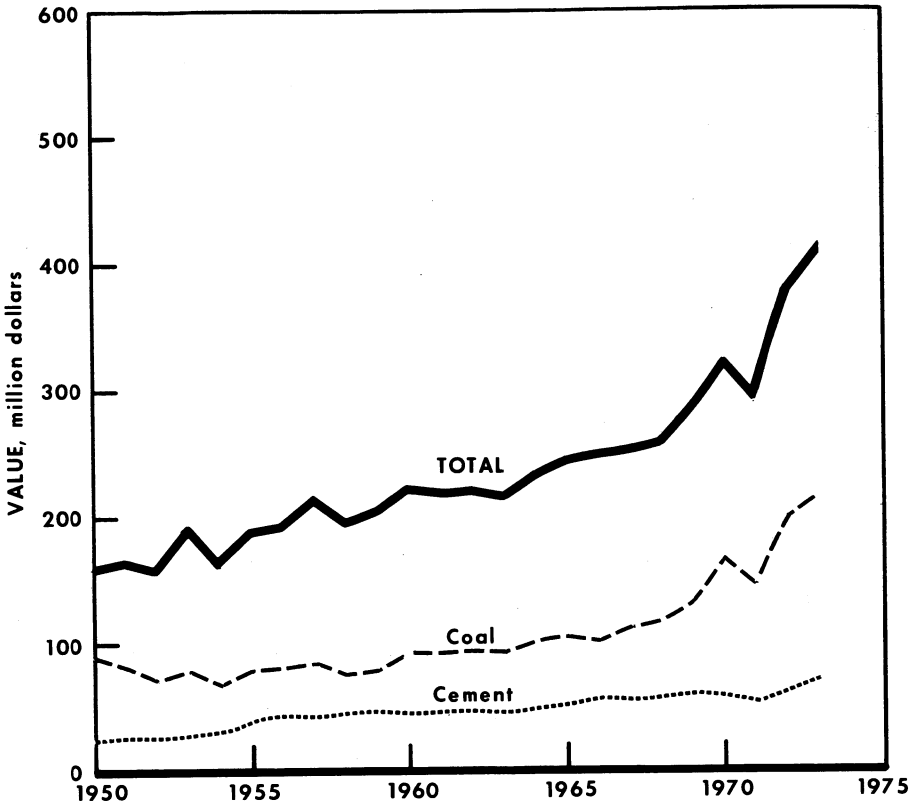

Figure 1.—Value of coal, cement, and total value of mineral production in Alabama.

International Trade.—The international trade passing through the Mobile Customs District was valued at $1,226 million in 1973, up 72% from that of the previous year. Of this total in 1973, 72% was imports and 49% was exports landed at or embarked from the port of Mobile, Ala. With the completion of the Alabama State Docks bulk handling facility, scheduled for completion in 1974, the port of Mobile will have the capacity to handle 10 million tons of coal annually. In 1973, bituminous coal exports from the port of Mobile totaled 1,123,000 short tons, a decrease of 1.7% from that of the previous year. However, total exports of bituminous coal decreased nationally over the same period; hence, coal exports out of Mobile maintained their relative export share when compared with the rest of U.S. ports. In 1973, as well as in 1972, coal exports from Mobile comprised approximately 2% of the total coal exports from the United States. In 1972, U.S. exports of bituminous coal were 56 million short tons.

Trends and Developments.—As the year closed, U.S. Pipe & Foundry Co. was the sole producer of brown-ore in the state. Two companies ceased production of brown-ore citing a lack of demand and strong foreign competition as the cause for liquidation. In a related industry, Woodward Co., a division of Mead Corp., went out of business, citing increasing costs of labor and raw materials, cheap scrap iron, and foreign competition as causes for the decision. At yearend, U.S. Pipe & Foundry in Birmingham, Ala., was the sole merchant iron producer in the South.

Citing cracks in the Selma chalk forma-

tion as the basis for its decision, Alabama Power Co. announced the cancellation of its proposed $500 million nuclear plant near Selma. Geologic data revealed that the underlying chalk formation could not meet the formation requirements established by the Atomic Energy Commission.

Universal Atlas Cement, a division of United States Steel Corp., announced plans to expand its plant at Leeds, thereby doubling its present capacity. The plant will utilize the latest in pollution control equipment. Citadel Cement Corp. announced a new $50 million plant in Demopolis. The plant will have an annual capacity of 750,000 tons.

Dredging of oyster shell was permitted by the Army Corps of Engineers after nearly 2 years of comprehensive studies. The permit was issued to Radcliff Materials, Inc. Several new restrictions were specified in the permit to insure environmental protection.

A number of oil and gas related projects surfaced in 1973. Southern Natural Gas Co. contracted to import 350 million cubic feet of liquified natural gas (LNG) from Algeria. According to the Federal Power Commission, Southern will pay 83 cents per million Btu. Hunt Oil Co. announced a $13.5 million refinery expansion program at its Tuscaloosa facility. This addition is designed to double throughput to 30,000 barrels per day. Odessa Refining Co. announced plans for construction of a 120,000-barrel-per-day crude oil refinery in the Theodore Industrial Park, 15 miles south of Mobile. Plans are to incorporate $20 million of Russian equipment due to its availability. Exxon announced plans to construct a natural gas liquids processing plant at Brewton, Ala., with a capacity to handle 90 million cubic feet of natural gas per day.

Two pipelines with a capacity of approximately 24,000 barrels of crude oil per day were put into operation. One will move crude from Choctaw County to the Hunt Oil Co. refinery at Tuscaloosa. The other will transport crude from Choctaw County to a terminal on the Tombigbee River for barge shipment to a refinery.

In July, production from Alabama oil wells went over the 1-million-barrel-per-month mark. The Alabama Oil and Gas Board reported that in July, the State's 576 oil wells produced 1.037 million barrels of oil. Also, the 27 gas wells produced over 1 billion cubic feet of natural gas.

On the coal front, Kellerman Mining Co. announced a $7 million expansion program at its operation north of Brookwood. The major thrust will be to purchase a 78-cubic-yard dragline to uncover four seams of metallurgical-grade coal for export to Japan, West Germany, and South America.

Alabama Power Co. and Alabama By-Products Corp. have jointly agreed to open an underground coal mine in Walker County. The mine, to be located near High Level, will have a production capacity of 1 million tons of low-sulfur coal. The coal will be used at the Gorgas Steam Plant and the Barry Steam Plant.

Legislation and Government Programs.—In an effort to control strip mining, the Attorney General's office introduced to the Alabama Water Improvement Commission a set of surface regulations based upon existing pollution statutes. Also, the Attorney General's office filed suit against surface operators on numerous occasions. The suits were designed to enjoin surface operations owing to stream and noise pollution. Also, trucks servicing strip mines were being checked for weight violations.

Two bills concerning surface reclamation legislation were introduced in both the Alabama House and Senate. However, with the close of the session, neither branch passed legislation affecting surface mine reclamation.

Oil and gas regulations governing petroleum activity off the Alabama coast were adopted by the Alabama Oil and Gas Board. Funds to monitor offshore activity were granted by the Alabama State Legislature. The Alabama Air Pollution Control Commission (AAPCC) reduced regulations on sulfur dioxide emissions adopted last year. The action was approved by the Environmental Protection Agency (EPA) because EPA agreed that the original regulations could not be met under current technology.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—In 1973, bituminous coal production in Alabama totaled 19,230,000 short tons and was valued at $211,695,000. Unit value increased 14.3% over that reported in 1972. Transportation of the coal produced in Alabama was by rail or water, 74%; truck, 16%; and 10% was used at the mine mouth. Coals distributed in Alabama in 1973 totaled 26,582,000 short tons with 64% going to utilities, 27% to coke ovens, and the remaining 9% going to retailers (90,000 short tons) and other uses. Of the total coal distributed in Alabama in 1973, 82% was shipped by rail or water; 11%, by truck; and the remaining 7%, used at the mine mouth. In 1963, underground production accounted for 77% of the total Alabama coal production; however, it accounted for only 40% of the total in 1973. Conversely, surface production has increased over the same period and in 1973 accounted for 60% of Alabama coal production. Nationally, underground production, over the same time frame, has remained static while surface production has grown. In 1963, underground production in the United States accounted for approximately 66% of the national total; however, in 1973, it dropped to 50%.

Over the last 10 years, the number of underground coal mines in Alabama fell from 129 in 1963 to 21 in 1973. The total number of producing mines has dropped from 180 in 1963 to 105 in 1973. Nationally, the same trend is encountered. Over the same referrence period, the total number of mines fell from 7,900 in 1963 to 4,700 in 1973. The number of underground mines tumbled from 6,100 in 1963 to 1,700 in 1973. Conversely the number of surface mines has increased and in 1973 totaled 2,300.

The projections for Alabama coal production to 1983 run concurrent with the previous 10-year trend. By 1983, production of bituminous coal is expected to total approximately 32 million tons per year. This projection is subject to upward revisions as economic conditions warrant the need for expanded production.

Table 4.—Alabama: Bituminous coal production, by type of mine and county
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total[1]	
Bibb	--	2	--	2	--	828	--	828	$5,857
Blount	--	5	--	5	--	219	--	219	2,456
Cullman	--	9	--	9	--	767	--	767	5,362
Etowah	--	1	--	1	--	7	--	7	W
Fayette	1	--	--	1	21	--	--	21	W
Jackson	--	1	--	1	--	818	--	818	W
Jefferson	14	22	1	37	4,840	3,684	84	8,608	99,405
Marion	3	2	--	5	28	241	--	269	2,574
Shelby	--	1	--	1	--	106	--	106	766
Tuscaloosa	--	8	--	8	--	1,528	--	1,528	13,427
Walker	3	29	--	32	2,729	3,171	--	5,900	74,847
Winston	--	3	--	3	--	161	--	161	1,726
Undistributed	--	--	--	--	--	--	--	--	5,273
Total[1]	21	83	1	105	7,618	11,530	84	19,230	211,695

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Data may not add to totals shown because of independent rounding.

Coke.—Alabama's seven coke plants produced 5,132,000 short tons of coke in 1973, a decrease of 4% from that of the previous year. The yield of coke from coal also decreased but only very slightly. However, in 1973, the coal required per ton of coke rose approximately 20 pounds. Of the 5,132,000 short tons of coke produced in 1973, 3,191,000 short tons (62%) was used by producers in blast furnaces. Nationally, 90% of the coke used by producing companies went to blast furnaces.

Natural Gas.—The marketed production of natural gas increased to 11,271 million cubic feet, 209% more than was produced the previous year. Unit value rose slightly from 35 cents per million cubic feet in 1972 to 38 cents per million cubic feet in 1973, an 8.6% increase. Over the last 3 years, natural gas production has grown at an exponential rate especially when compared with production since 1963. From 1963 to 1970, gas production remained relatively stable, however, it has shown marked growth since 1971. The production for 1971, 1972, and 1973 was 355, 3,644, and 11,271 million cubic feet per year, respectively.

The value for 1971, 1972, and 1973 was 15.2 cents, 35.2 cents, and 38.2 cents, respectively. Although the total number of oil and gas wells drilled in 1973 decreased slightly from the total drilled in 1972, the 102 wells drilled in 1973 still amounted to over twice the number drilled in 1970. Proportionately, the ratio of exploratory wells to development wells drilled since 1970 is approximately 1 to 2.4. With 1970 as the focal year, the footage per well has increased from an average of 10,059 feet per well in 1970 to 10,985 feet per well in 1973.

Petroleum.—Petroleum production increased in 1973 by 1,743,000 barrels, a 17.5% change from that produced the previous year. The reported unit value increased 16.6% from that reported in 1972. In 1973, the total value of petroleum production accounted for approximately 10.1% of the total mineral value in Alabama. Increased exploration has been the prime factor for this short-term growth. Looking at petroleum production in the State since 1963, one finds the lowest production year to be 1970, the year total U.S. production reached its peak.

The unit value of Alabama crude oil remained relatively stable from 1963 to 1970, averaging $2.63 a barrel; however, from 1970 to the present, it has increased at an annual rate of approximately 8.1%, and in 1973, the unit value of Alabama crude oil stood at $3.58 per barrel, 31 cents below the national average of $3.89 per barrel.

Table 5.—Alabama: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Baldwin	--	--	--	--	--	3	3	51,770
Choctaw	5	--	2	1	--	13	21	256,620
Clarke	4	--	3	--	--	7	14	164,960
Conecuh	--	--	--	--	--	4	4	49,102
Escambia	4	5	4	3	--	9	25	389,536
Fayette	--	--	2	--	3	3	8	22,028
Greene	--	--	--	--	--	1	1	12,850
Lamar	--	--	--	--	--	2	2	6,358
Lauderdale	--	--	--	--	--	1	1	3,459
Marion	--	--	--	--	--	4	4	8,316
Monroe	1	--	--	--	--	4	5	69,602
Pickens	--	--	--	--	--	2	2	14,790
Walker	--	--	--	--	--	5	5	11,878
Washington	--	--	2	--	--	2	4	52,814
Winston	--	--	--	--	2	1	3	6,412
Total	14	5	13	4	5	61	102	1,120,495

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 6.—Alabama: Crude oil production by county
(Thousand 42-gallon barrels and thousand dollars)

County	Production 1972	1973
Baldwin	(1)	(1)
Choctaw	1,484	2,750
Clarke and Baldwin	168	150
Escambia	1,681	2,913
Lamar	4	5
Mobile	6,447	5,721
Monroe	150	138
Total	9,934	11,677
Value	30,466	41,772

[1] Baldwin combined with Clarke.

Source: Alabama State Oil and Gas Board.

NONMETALS

Cement.—Although the number of active plants remained unchanged, production of portland cement decreased slightly from 2,419,344 short tons in 1972 to 2,403,806 short tons in 1973, a 0.6% change. Although production remained relatively stable, shipments of portland cement in 1973 rose by 36,794 short tons or approximately 1.6% over the amount shipped in 1972. Unit value in 1973 increased 13.2% over that reported the previous year and at year end was reported at $23.30 per short ton. The value of portland cement accounted for approximately 13.5% of the total mineral value in Alabama in 1973.

Over the last 10 years, portland cement production remained relatively stable. Shipments averaged in the neighborhood of approximately 2.5 million short tons per year.

A breakdown of the end use of portland cement reveals that of the 2,396,347 short tons shipped by Alabama producers, 61% went to the ready-mix concrete industry, 17% went to the concrete product manufacturers, 8% went to building materials dealers, and the remaining 14% went to highway contractors, Federal and State agencies, other contractors, and miscellaneous users. Shipments to ready-mix consumers fell 1.4% from that shipped in 1972 and decreased 8.1% in the building materials sector. Shipments to the concrete products and contractors/other user sectors increased 18.9% and 3.7%, respectively.

Table 7.—Alabama: Portland cement salient statistics

	1972	1973
Number of active plants	7	7
Production—short tons	2,419,344	2,403,806
Shipments from mills:		
Quantity —do—	2,359,553	2,396,347
Value	$48,577,395	$55,820,066
Stocks at mills, Dec. 31—short tons	151,646	99,727

Production and shipments of masonry cement increased in 1973 by 1.3% and 4.6%, respectively, from that reported in 1972. The unit value also increased from $27.57 per short ton in 1972 to $30.76 in 1973, an increase of 11.6%. Over the last 10 years, the general trends of the Alabama masonry cement industry have mirrored those of the Alabama portland cement indutry. Masonry cement shipments from 1963 to 1970 averaging 350,000 short tons per year, while from 1970 to 1973, shipments grew at a rate of 7.7% per year. Portland and masonry cement used in the state totaled 1,407,000 and 119,000 short tons, respectively.

Clays.—Clay production rose 2.9% above the amount produced the previous year and totaled 2.9 million short tons, 4.8% of the national total. The value of this production increased $1,276,000 a 17.0% increase over the value reported in 1972. Most of the fire clay produced was used by the refractory mortar and cement industry. Most of the kaolin went into making firebrick, blocks, and shapes, while most of the common clay and shale was used to make brick and as lightweight aggregate. Common clay and shale accounted for 80.1% of total clay production in Alabama while only accounting for 34.1% of the total value.

Over the period covering 1963 to 1973, the production of clay in Alabama has grown at a rate of approximately 6.2% annually. Over this time frame, Alabama has contributed an average of 4.6% of the total U.S. production of clay. From 1963 to 1973, the value of Alabama clay production has increased at an annual rate of 11.3%.

Lime.—Production of lime in 1973 totaled 881,000 short tons, 19.2% more than was produced last year. Unit value remained relatively stable from the average reported last year.

In 1973, the paper industry consumed 36% of the total lime produced. Water purification and metallurgical uses were next with consumption of 1,133,000 and 1,079,000 short tons, respectively. Of the 880,500 short tons of lime produced, 413,300 were consumed within the State with the remaining production being shipped to Florida, Georgia, Tennessee, and other destinations.

Table 8.—Alabama: Lime sold or used by producers, by use

Uses	1972		1973	
	Quantity (short tons)	Value	Quantity (short tons)	Value
Paper and pulp	231,000	$3,586,000	317,300	$4,785,000
Water purification	95,250	1,478,000	113,300	1,710,000
Steel, basic oxygen furnace	120,000	1,862,000	109,700	1,654,000
Sewage treatment	38,840	603,000	66,140	997,400
Steel, electric	48,810	758,000	34,380	518,500
Soil stabilization	23,690	464,000	30,880	604,600
Aluminum and bauxite	10,540	164,000	11,300	170,400
Miscellaneous chemicals	34,740	539,000	7,114	107,300
Sugar refining	3,678	57,000	5,682	85,680
Other [1]	133,000	2,239,000	184,700	3,417,000
Total [2]	r 739,500	r 11,750,000	880,500	14,050,000

r Revised.
[1] Includes mason's lime, open hearth steel furnaces, magnesium, other metallurgy, finishing lime, petrochemicals, alkalies, calcium carbide, food, chrome, ore concentration, tanning, silica brick, oil well drilling (1973), agriculture, petroleum refining, paint, glass, manganese (1972), insecticides (1972), fertilizer (1972), sulfur removal (1972), and wire drawing (1972).
[2] Data may not add to totals shown because of independent rounding.

Sand.—Sand and gravel production increased 54% above the amount produced in 1972 while the value of this production increased 63%. The building, paving, and fill sectors increased their consumption of sand and gravel by 3,318,000 short tons, a 60% increase over that used in 1972. In 1972, these sectors consumed 87% of the total sand and gravel produced and 90% of the total produced in 1973. Of the 9,805,000 short tons produced in 1973, approximately 73% reached consumers by truck; 23%, by railroad; and 4%, by waterway.

When averaged over the last 10 years, sand and gravel production in Alabama grew at an annual rate of 6.8%. Production figures for the specified time frame however show an irregular pattern, with steady growth from 1963 to 1969, declining output from 1970 to 1972 and finally ending with 9,805,000 short tons in 1973. The value of Alabama's production has increased 11.5% annually since 1963.

Table 9.—Alabama: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,796	1,937	2,491	2,882
Fill	98	94	140	102
Fire or furnace	--	--	4	16
Paving	814	1,299	1,452	2,274
Other uses [1]	625	1,028	502	984
Total [2]	3,334	4,358	4,590	6,207
Gravel:				
Building	992	1,727	1,577	2,427
Fill	W	W	249	149
Paving	1,796	2,220	2,918	4,578
Miscellaneous	W	147	138	130
Other uses [3]	230	78	327	368
Total [2]	3,018	4,171	5,208	7,652
Government-and-contractor operations:				
Sand: Paving	--	--	3	4
Gravel: Paving	--	--	4	6
Total sand and gravel [2]	6,352	8,530	9,805	13,870

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes blast (1973), engine, molding, chemicals (1972), railroad ballast, and other industrial sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast (1973) and other gravel.

Table 10.—Alabama: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Calhoun	--	--	--	1	W	121
Coffee	1	50	40	1	W	74
Crenshaw	1	9	25	1	W	W
Dale	1	48	35	1	38	41
Elmore	1	W	W	4	817	1,625
Etowah	1	--	--	1	60	113
Jefferson	1	2	3	1	6	19
Macon	5	W	1,056	4	W	1,296
Monroe	1	42	44	1	43	83
Montgomery	3	874	996	5	2,238	2,666
Sumter	2	W	W	3	77	132
Tuscaloosa	3	226	470	5	648	1,097
Washington	1	74	75	3	W	W
Undistributed [1]	r 26	5,029	5,788	29	5,880	6,602
Total [2]	46	6,352	8,530	60	9,805	13,870

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes Autauga, Barbour, Bibb, Chilton (1972), Clarke, Conecuh (1973), Dallas, Escambia, Fayette (1973), Franklin, Geneva, Hale,Houston, Lowndes, Marion (1972), Mobile, Russell, St. Clair (1972), and Walker (1973) Counties, and some sand and gravel that cannot be assigned to specific counties.
[2] Data may not add to totals shown because of independent rounding.

Stone.—Production of stone in Alabama rose to 20,043,000 short tons and was valued at $40.1 million in 1973. Although production rose 8.4% from that produced the previous year, the total value fell $1.9 million or 4.6%. In 1973, the value of stone production accounted for 9.7% of the total mineral value in Alabama, down 1.6% from that of the previous year. Approximately 56.0% of the crushed limestone and dolomite produced in 1973 was consumed as aggregate and roadbase material. Jefferson and Shelby Counties were the largest producers of crushed limestone and dolomite, producing 52.7% of the total 17,966,000 short tons in 1973.

Production of stone in Alabama over the last 10 years has grown at an average annual rate of 3.9% with most of the growth occurring from 1963 to 1966. From 1966 to the present, stone production has averaged 19.5 million tons per year. Over the same time frame, Alabama has contributed approximately 2.2% to total U.S. production.

Table 11.—Alabama: Crushed limestone and dolomite sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value
Colbert	4	1,079	1,986	4	W	1,476
Jefferson	6	3,025	4,413	7	3,946	6,441
Limestone	1	19	28	--	--	--
Shelby	10	4,961	7,641	10	5,525	9,106
Talladega	--	--	--	1	W	406
Undistributed [1]	24	7,222	10,542	24	8,495	10,058
Total [2]	45	16,306	24,610	46	17,966	27,485

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes Bibb, Calhoun, Covington (1972), De Kalb, Etowah, Franklin, Jackson, Lee, Madison, Marengo, Marshall, Morgan, St. Clair, and Washington Counties.
[2] Data may not add to totals shown because of independent rounding.

Table 12.—Alabama: Crushed limestone and dolomite sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	1,219	1,649	1,614	2,299
Concrete aggregate	1,552	2,295	3,845	5,178
Dense graded roadbase stone	1,199	1,619	2,311	3,368
Surface treatment aggregate	W	W	1,276	1,867
Unspecified aggregate and roadstone	3,182	5,407	1,026	1,846
Agricultural limestone	541	942	728	1,317
Cement	3,489	4,029	3,122	3,866
Flux	487	1,080	656	1,264
Lime	1,331	2,666	2,025	3,679
Other uses [1]	3,304	4,922	1,363	2,801
Total [2]	16,306	24,610	17,966	27,485

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes stone used in macadam aggregate, refractories, chemicals, acid neutralization, railroad ballast, riprap and jetty stone, and uses not specified. 1973 data also include stone used in manufactured fine aggregate, terrazzo and exposed aggregate, asphalt and other fillers, and filter stone.
[2] Data may not add to totals shown because of independent rounding.

Talc.—The American Talc Co., Inc., operated an open pit talc mine in Talladega County near Winterboro. The talc was used primarily for toilet preparations, and the remainder was sold abroad.

Mullite.—Harbison-Walker Refactories Co. manufactured synthetic mullite at Eufaula in Henry County.

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Bauxite.—Bauxite was produced in Barbour and Henry Counties. The amount produced decreased from that produced the previous year.

Iron Ore.—Iron ore production decreased 17% from the amount produced last year. However, the unit value has remained relatively stable.

Table 13.—Principal producers

Commodity and company	Address	Type of activity	County
Alumina: Aluminum Co. of America	1501 Alcoa Bldg. Pittsburgh, Pa. 15219	Plant	Mobile.
Aluminum smelters:			
Revere Copper & Brass, Inc	Box 191 Rome, N.Y. 13440	do	Jackson.
Reynolds Metals Co	Reynolds Metals Bldg. Richmond, Va. 23218	do	Colbert.
Bauxite:			
United States Gypsum Co.: A. P. Green Refractories Co.	Mexico, Mo. 65265	5 open pit mines and plant.	Barbour.
Wilson-Snead Mining Co. Inc.	Box 568 Eufaula, Ala. 36027	do	Do.
Cement:			
Alpha Portland Industries Inc.[1]	15 S. Third St. Easton, Pa. 18043	Plant	Jefferson.
Citadel Cement Corp	2625 Cumberland Parkway, N.W. Atlanta, Ga. 30339	do	Do.
Ideal Basic Industries Inc.: Ideal Cement Co.	821 17th St. Denver, Colo. 80202	do	Mobile.
Lone Star Industries, Inc.	One Greenwich Plaza Greenwich, Conn. 06830	2 plants	Jefferson and Marengo.
Martin Marietta Corp.[2]	277 Park Ave. New York, N.Y. 10017	do	Jefferson and Shelby.
National Cement Co., Div. of Mead Corp.	Box 3358 Birmingham, Ala. 35205	Plant	St. Clair.
Universal Atlas Cement, Div. of United States Steel Corp.	600 Grant St. Pittsburgh, Pa. 15230	do	Jefferson.
Clays:			
Fire:			
R. T. Vanderbilt Co.; Dixie Clay Co.	Box 361 Anniston, Ala. 36202	Open pit mine and plant.	Calhoun.
Donoho Clay Co	Box 843 Anniston, Ala. 36202	do	Do.
Dresser Industries: Harbison-Walker Refractories Co.	2 Gateway Center Pittsburgh, Pa. 15222	2 open pit mines	Henry and Walker.
Marigold Coal, Inc	Box 420 Jasper, Ala. 35501	Open pit mine	Walker.
Common clay and shale:			
Bickerstaff Clay Products Co., Inc.	Box 1178 Columbus, Ga. 31902	4 open pit mines and plants.	Jefferson and Russell.
W. S. Dickey Clay Mfg. Co	P.O. Box 6 Pittsburg, Kan. 66762	Pit and 2 mines	Bibb and Jefferson.
Henry Brick Co	Box 857 Selma, Ala. 36701	Mine	Dallas.
Ideal Basic Industries, Inc.: Ideal Cement Co.	Ideal Cement Bldg. Denver, Colo. 80202	Open pit mine	Mobile.
Jenkins Brick Co	Box 91 Montgomery, Ala. 36101	2 open pit mines and plants.	Elmore and Montgomery.
Marigold Coal, Inc	Box 420 Jasper, Ala. 35501	Open pit mine	Walker.
Martin Marietta Corp	18th Floor Daniel Bldg. Birmingham, Ala. 35233	do	Shelby.
Mead Corp	Box 3358 Birmingham, Ala. 35205	Open pit mine and plant.	St. Clair.
Tombigbee Lightweight Aggregate Co.	Box 1247 Nashville, Tenn. 37202	do	Sumter.
Vulcan Materials Co	Box 7324-A Birmingham, Ala. 35223	do	Jefferson.

See footnotes at end of table.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clays—Continued			
Kaolin:			
Dresser Industries: Harbison-Walker Refractories Co.	2 Gateway Center Pittsburgh, Pa. 15222	Open pit mine and plant.	Henry.
Thomas Alabama Kaolin Co.	15 Charles Plaza Baltimore, Md. 21201	Open pit mine	Marion.
United States Gypsum Co.: A.P. Green Refractories Co.	Mexico, Mo. 65265	2 open pit mines and plants.	Barbour.
Coal:			
Alabama By-Products Corp	Box 354 Birmingham, Ala. 35210	5 underground, 1 strip mine and 2 plants.	Jackson and Jefferson.
Arch Minerals Corp	400 Mansion House Center St. Louis, Mo. 63100	Strip mine	Jackson.
Peabody Coal Co	301 N. Memorial Dr. St. Louis, Mo. 63102	2 strip mines and plants.	Tuscaloosa.
Southern Electric Generating Co.	600 North 18th St. Birmingham, Ala. 35203	Underground mine and plant.	Walker.
United States Steel Corp	Box 599 Fairfield, Ala. 35064	----do	Jefferson.
Woodward Co	Woodward, Ala. 35189	2 underground mines and plants.	Do.
Coke:			
Alabama By-Products Corp	Box 354 Birmingham, Ala. 35210	Plant	Do.
Empire Coke Co	2201 First Ave., North Birmingham, Ala. 35203	----do	Tuscaloosa.
Republic Steel Corp	Box 6778 Cleveland, Ohio 44101	2 plants	Etowah and Jefferson.
U.S. Pipe & Foundry Co	3300 First Ave., North Birmingham, Ala. 35202	Plant	Jefferson.
United States Steel Corp	600 Grant Street Pittsburgh, Pa. 15230	----do	Do.
Woodward Co	Woodward, Ala. 35189	----do	Do.
Ferroalloys:			
Airco Alloys and Carbide	P.O. Box 368 Niagara Falls, N.Y. 14302	----do	Mobile.
Alabama Metallurgical Corp	P.O. Box 348 Selma, Ala. 36701	----do	Selma.
Tennessee Alloys Corp	818 National Bank Bldg. Chattanooga, Tenn. 37402	----do	Jackson.
Tennessee Valley Authority	Muscle Shoals, Ala. 35660	----do	Colbert.
Union Carbide Corp., Ferroalloys Div.	Marietta Financial Control Center P.O. Box 176 Marietta, Ohio 45750	2 plants	Colbert and Jefferson.
Woodward Co	Woodward, Ala. 35189	Plant	Jefferson.
Iron ore:			
Limonite:			
U.S. Pipe & Foundry Co	3300 First Ave., North Birmingham, Ala. 35202	Open pit mine and plant.	Franklin.
Lime:			
Alabaster Lime Co	Siluria, Ala. 35144	Limekiln and plant.	Shelby.
Allied Products Co	Drawer 1 Montevallo, Ala. 35115	----do	Do.
Cheney Lime & Cement Co	Algood, Ala. 35013	----do	Do.
Longview Lime Co	Woodward, Ala. 35189	----do	Do.
Martin-Marietta Cement	18th Floor Daniel Bldg. Birmingham, Ala. 35233	----do	Do.
Mica, flake: United States Gypsum Co.	101 S. Wacker Dr. Chicago, Ill. 60606	Open pit mine and plant.	Randolph.
Natural gas liquids, including LPG and natural gasoline: Cities Service Oil Co.	Box 300 Tulsa, Okla. 74102	Plant	Mobile.
Petroleum:			
Refineries:			
Alabama Refining Co	Mobile, Ala. 36600	Plant	Do.
Hunt Oil Co	Tuscaloosa, Ala. 35401	----do	Tuscaloosa.
Vulcan Asphalt Refining Co.	Cordova, Ala. 35550	----do	Walker.
Warrior Asphalt Co	Tuscaloosa, Ala. 35401	----do	Tuscaloosa.
Pig Iron:			
Republic Steel Corp	1629 Republic Bldg. Cleveland, Ohio 44115	Blast furnaces and mills.	Etowah and Jefferson.
U.S. Pipe & Foundry Co	Box 2651 Birmingham, Ala. 35202	----do	Jefferson.

See footnotes at end of table.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Pig Iron—Continued			
United States Steel Corp	Box 599 Fairfield, Ala. 35604	Blast furnaces and mills.	Jefferson.
Woodward Co	Woodward, Ala. 35189	do	Do.
Salt: Olin Corp	120 Long Ridge Rd. Stanford, Conn. 06904	Brine wells	Washington.
Sand and gravel:			
Dallas Sand and Gravel Co	2196 Water Ave. Selma, Ala. 36701	Mine	Autauga.
Dixie Sand & Gravel	P.O. Box 1128 Montgomery, Ala. 36102	4 dredges and 1 plant.	Montgomery.
Radcliff Materials, Inc	Mobile, Ala. 36601	Dredge	Mobile.
W. T. Ratliff Co., Inc	Box 1111 Knoxville, Tenn. 37901	Open pit mine and plant.	Clarke.
C. T. Thackston	Box 3211 Montgomery, Ala. 36101	Pit	Montgomery.
Vulcan Materials Co	Box 7324-A Birmingham, Ala. 35223	2 open pit mines and plants.	Elmore and Montgomery.
Stone:			
Dolomite:			
Dolcito Quarry Co	Box 6565 Birmingham, Ala. 35217	Quarry	Jefferson.
Montevallo Limestone Co., Inc.	P.O. Box 6493 Tarrant, Ala. 35217	do	Shelby.
United States Steel Corp	Box 599 Birmingham, Ala. 35064	3 quarries and plants.	Jefferson.
Limestone, crushed:			
Lone Star Industries, Inc	Box 6237 West End Br. Richmond, Va. 23230	4 quarries and plants.	Jefferson, Marengo, Washington.
Madison Limestone Co., Inc.	Box 46 Huntsville, Ala. 35804	do	Madison.
Martin Marietta Corp	18th Floor Daniel Bldg. Birmingham, Ala. 35223	2 quarries and plants.	Shelby.
Trinity Stone Co., Inc	P.O. Drawer E 907 10th Ave., N.E. Decatur, Ala 35601	4 quarries	Morgan.
Vulcan Materials Co	Box 7324-A Birmingham, Ala 35223	6 quarries and plants.	Colbert, Etowah, Franklin, Jackson, Shelby.
Limestone, dimension: Georgia Marble Co.	Russellville, Ala. 35653	do	Franklin.
Marble, crushed:			
Georgia Marble Co	Gantts Quarry, Ala. 35069	2 quarries and plant.	Talladega.
Moretti-Harrah Marble Co	Box 330 Sylacauga, Ala. 45150	Quarry and pit	Do.
Thompson-Weinman & Co	Cartersville, Ga. 30120	2 quarries and plant.	Do.
Oystershell: Radcliff Materials, Inc.	Box 1288 Mobile, Ala. 36601	2 dredges and plants.	Mobile.
Sandstone, crushed:			
Enos Vann	Box 1288 Trussville, Ala. 35173	do	Jefferson.
United States Steel Corp	Box 2969 Pittsburgh, Pa. 15230	2 quarries and plants.	Do.
Talc: American Talc Co., Inc	Alpine, Ala. 35014	Open pit mine and plant.	Talladega.

[1] Portland and masonry cement.
[2] Portland, masonry, and slag cement.

The Mineral Industry of Alaska

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Alaska Department of Natural Resources, for collecting information on all minerals.

By Robert J. Jaske [1] and Donald C. Hartman [2]

An important and newsmaking event in Alaska during 1973 was Congressional approval of the trans-Alaska pipeline from Prudhoe Bay on the North Slope to Valdez on Prince William Sound on the southern coast. It will have an initial capacity of 1.2 million barrels per day and an ultimate capacity of 2.0 million barrels per day. The bill, Public Law 93-153, was signed by the President on November 16, 1973. It was the culmination of a legal struggle between Alyeska Pipeline Service Co. who filed a formal right-of-way application with the Department of the Interior in January 1970 and environmentalists. The next major issue, the issuance of a construction permit for the 789-mile, 48-inch diameter, $4.5 billion line by the Department of the Interior, is expected to be resolved shortly. There remained some possibility of a court challenge but this was not considered to be a serious threat. A 60-day time limit to file constitutional challenges will expire on January 15, 1974. When these factors are resolved, a State right-of-way lease along with other Federal, State, and local matters will still have to be worked out. In all Alyeska will require some 1,500 permits to build the pipeline and meet the 1977 completion target date.

Another pipeline from the North Slope to Gravina Point on Prince William Sound is under study. The second line would carry natural gas to the lower 48 States through a line as large as 42 inches in diameter. Estimates are that as much as 3.375 billion cubic feet of gas daily would be transported. The gas would be cooled by refrigeration and many of the problems encountered when transporting warm crude oil by pipeline would be eliminated. On arriving at the southern coast, the gas would be liquefied and then shipped by cryogenic tanker to the U.S. west coast. Natural gas reserves on the North Slope depending on the pipeline for movement to market areas are estimated at 26 trillion cubic feet. There are also large reserves in the Canadian Mackenzie Delta and Beaufort Sea area which could also be involved with pipeline connections to the North Slope. A competing proposal by a consortium of companies, known as Alaskan Arctic Gas, would have a line from Prudhoe Bay to Canada's McKenzie Valley area and thence across Canada to the northcentral United States. The line would supply 4.5 billion cubic feet a day to markets in Canada and the United States.

The State of Alaska held another oil and gas lease sale, the 28th competitive sale, on December 13, 1973, which netted $24.8 million for 98 tracts in the Cook Inlet area. Most of the acreage is in Kachemak Bay near Homer. This is the second largest sale in the State's history, second only to the 1969 Prudhoe Bay sale that brought $900 million to the State treasury. The still delayed 1967 attempted Lower Cook Inlet sale is approaching another turn in the State vs. Federal dispute over ownership of the lower inlet. The U.S. Ninth District Circuit Court of Appeals will hear an appeal by the Federal Government of a 1972 decision by a U.S. District Court. That court held that the

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lower Cook Inlet is a historic bay and not an arm of the ocean, and consequently that the estimated $2 billion worth of oil and gas reserves below it belong to the State of Alaska.

The total value of mineral production in 1973 was $328.8 million, an increase of $42.6 million or 14.9% over the 1972 value of $286.1 million. Hard mineral exploration expenditures in 1973 amounted to $8.0 million, up from the $6.5 million expended in 1972. A 0.57-million-barrel drop in crude production, equivalent in value to $2.0 million at current prices, was offset by a crude price rise from $3.23 per barrel in 1972 to $3.62 per barrel in 1973. This resulted in 1973 crude value of $261.9 million compared to $235.4 million in 1972. Stone contributed $9.7 million to the mineral production value gain in 1973. Sand and gravel came next, adding a $4.7 million increase in 1973. In terms of value, petroleum accounted for 80% of the total worth of the 1973 minerals produced.

Table 1.—Mineral production in Alaska [1]

Mineral	1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Coal (bituminous) ----- thousand short tons --	668	W	695	W
Gem stones ----------	NA	$57	NA	$57
Gold (recoverable content of ores, etc.) troy ounces --	8,639	506	7,107	695
Lead (recoverable content of ores, etc.) short tons --	--	--	6	2
Natural gas ---------- million cubic feet --	125,596	18,463	131,007	19,483
Petroleum (crude) thousand 42-gallon barrels --	72,893	235,444	72,323	261,877
Sand and gravel ------- thousand short tons --	14,187	15,214	14,999	19,913
Stone [2] ---------- do ----	652	3,012	5,967	12,741
Silver (recoverable content of ores, etc.) thousand troy ounces --	(3)	(3)	1	2
Value of items that cannot be disclosed: Barite, mercury, natural gas liquids, platinum-group metals, tin, uranium, and values indicated by symbol W ----------	XX	13,442	XX	14,019
Total ----------	XX	286,138	XX	328,789
Total 1967 constant dollars ----------	XX	236,092	XX	p 241,397

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Includes additional reporting source over prior years.
[3] Less than ½ unit.

Table 2.—Value of mineral production in Alaska, by region [1 2]
(Thousands)

Region	1972	1973	Minerals produced in 1973 in order of value
Alaska Peninsula ---	(3)	$990	Stone, sand and gravel.
Aleutian Islands ----	$1,898	--	
Bristol Bay ---------	753	91	Sand and gravel.
Cook Inlet-Susitna --	230,065	246,774	Petroleum, natural gas, sand and gravel, stone, gold.
Copper River -------	W	W	Sand and gravel, stone, gold.
Kenai Peninsula ----	31,792	40,051	Petroleum, natural gas liquids, sand and gravel.
Kodiak -------------	W	W	Sand and gravel, stone.
Kuskokwim ---------	W	1,537	Sand and gravel, platinum-group metals, mercury, gold.
Northern Alaska ----	827	W	Natural gas, sand and gravel.
Northwestern Alaska	W	2,553	Petroleum.
Seward Peninsula --	W	W	Gold, platinum-group metals, tin, stone.
Southeastern Alaska-	5,446	13,880	Stone, barite, uranium, sand and gravel.
Yukon River --------	12,452	20,640	Sand and gravel, coal, gold, stone.
Undistributed [4] -----	2,906	2,271	
Total [5] -------	286,138	328,789	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] No production was reported in the Bering Sea region.
[2] Value of petroleum is based on an average price per barrel for the state.
[3] Less than ½ unit.
[4] Includes gem stones, some sand and gravel and stone (1972) that cannot be assigned to specific regions, and values indicated by symbol W.
[5] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Alaska business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total labor force ---- thousands	1,383.7	1,437.5	+3.9
Unemployment ---- do	12.9	13.9	+7.8
Employment:			
Construction ---- do	7.9	8.0	+1.3
Mining ---- do	2.1	1.9	−9.5
Transportation and public utilities ---- do	10.0	10.2	+2.0
Wholesale and retail trade ---- do	17.2	17.9	+4.1
Manufacturing ---- do	8.1	9.2	+13.6
Services ---- do	14.8	15.9	+7.4
Government ---- do	40.5	41.3	+2.0
Finance, insurance, and real estate ---- do	3.7	4.1	+10.8
Personal income:			
Total ---- millions	$1,671	$1,852	+10.8
Per capita	$5,141	$5,613	+9.2
Construction activity:			
Value of authorized nonresidential construction ---- millions	$25.2	$58.3	+131.3
Number of authorized, new housing units	2,388	1,668	−30.2
Highway construction contracts awarded ---- millions	e $50.0	$50.9	+1.8
Mineral production value ---- do	$286.1	$328.8	+14.9
Foreign trade:			
Exports ---- do	$182.5	$205.4	+12.5
Imports ---- do	$49.0	$39.9	−18.6

e Estimate. p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Highlights of U.S. Import and Export Trade; and U.S. Bureau of Mines.

Table 4.—Alaska: Expenditures by major companies for exploration, excluding petroleum

(Thousands)

Region	1969	1970	1971	1972	1973
Arctic Alaska	NA	$775	$850	$400	$500
Interior Alaska	NA	1,325	1,100	400	700
Western Alaska	NA	1,225	1,500	2,400	2,000
Southwestern Alaska	NA	150	150	--	--
South-central Alaska	NA	1,100	1,400	r 1,000	500
Southeastern Alaska	NA	2,275	4,000	r 4,000	3,000
Total	$6,900	6,850	9,000	r 8,200	6,700

r Revised. NA Not available.

Source: State of Alaska Department of Natural Resources, Division of Geological Survey.

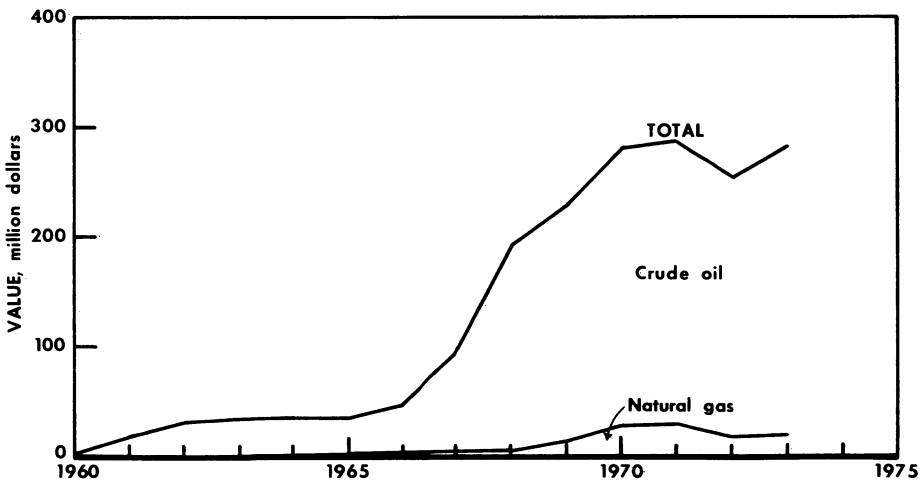


Figure 1. Total value of mineral production in Alaska.

Legislation and Government Programs.—Since the signing of the Alaska Native Claims Settlement Act (ANCSA) on December 18, 1971, by President Nixon, several significant issues concerning Alaska's 365.48 million acres have arisen. The foremost of these was a recommendation to Congress made by the Secretary of the Interior, on December 18, 1973, to withdraw about 83.5 million acres of unreserved public lands for further study and consideration by Congress for inclusion into four national systems. These are the National Park System, National Wild Life Refuge System, National Forest System, and the National Wild and Scenic River System. The withdrawal action, which was initiated on September 17, 1972, has progressed to the 83.5-million-acre withdrawal from the original 79-million-acre proposal. The increase came about during the 2-year study period mandated under Section 17(d)2, of the ANCSA, before submitting the proposal to Congress. Mining would be prohibited on about 75% of the 83.5 million acres. This has brought about considerable opposition from Alaskan officials. Conversely, conservationists are anxious to see the amount withdrawn increased to 104 million acres or more.

In addition to the Section 17(d)2 withdrawals, an additional 47 million acres of land had been withdrawn on March 17, 1972, under ANCSA Section (d) 1. This earlier withdrawal was done in accord with a 90-day period mandated in ANCSA for action, and was "to insure that the public interest in these lands is properly protected." Unlike the (d) 2 withdrawals, the (d) 1 lands are in a multiple-use category which permits metalliferous mining but excludes development for oil and gas for an indefinite period of time. A controversy has arisen because of the (d) 2 withdrawal in that some 23 million acres of (d) 2 lands were also included in some 77 million acres that the State of Alaska had intended to select in accord with the 1959 Alaska Statehood Act. The Statehood Act provided for a total State selection of 104.45 million acres to be completed not later than 1984. Also, some 10 million of the 77 million acres were set aside for Native deficiency areas and 9 million put into the (d) 1 withdrawal category. Lands in the deficiency category are those withdrawn pending selection by regional corporations and village corporations in cases when sufficient lands surrounding a village were not available because of the proximity of swamps, glaciers, wildlife refuges, rivers, and State, Federal, and private ownership of land, etc.

As a result of the conflicting land claims issues between the Department of the Interior and the Alaska government, the Governor of Alaska filed a court action in 1972 in the U.S. District Court challenging the (d) 2 withdrawal. This was later resolved in an out of court agreement. Because the lands were reclassified as (d) 1 and were still later included in the plans for parks and wildlife refuges, the court action may be reinstated by the Alaska Attorney General.

Table 5.—Alaska: Leases and acreage under Federal supervision, at yearend

Year	Oil and gas leases		Mining leases	
	Number of leases	Acres (thousands)	Number of leases	Acres (thousands)
1968	4,147	6,841	16	20
1969	4,290	6,936	13	16
1970	3,638	6,168	14	16
1971	2,926	5,344	r 9	r 25
1972	2,641	4,832	r 9	r 25
1973	2,400	4,430	9	25

r Revised.

Source: U.S. Geological Survey and Alaska Division of Lands

Continued opposition to the 83.5-million-acre withdrawal proposal can be expected at the State level because most of the acreage, which could have valuable mineral worth, would be set aside and would not be prospected for coal, oil, copper, and other valuable minerals. However, the 40 million acres which the estimated 90,000 Eskimos, Indians, and Aleuts are entitled to select, will be classed as pri-

vately owned land which they can open up to prospecting. Management authority for all lands at issue is the Bureau of Land Management of the U.S. Department of the Interior. Making recommendations in matters concerning disposition of lands will be the Federal-State Land Use Planning Commission which was authorized and created by passage of ANCSA. This group is the principal advisor to the Secretary of the Interior and the U.S. Congress concerning land use recommendations in Alaska.

In regard to the provisions in ANCSA for awards of 40 million acres of land and a cash settlement of $962.5 million which is to be paid over a 5-year period for settlement of aboriginal claims, the U.S. District Court released $130 million to the natives on December 19, 1973. Also, the first selection of lands by a Native Corporation was made in 1973 and was in the Cook Inlet region.

A ruling on January 19, 1973, by the Superior Court in Anchorage held that the North Slope Borough created in mid-1972 was a valid local government entity. One day earlier, voters had approved a sales and use tax ordinance, but the Fairbanks Superior Court subsequently issued an injunction against taxing oil and gas leases within the borough with certain exceptions allowed. This left the borough with a real property tax base of about $165 million compared to the expected base of over $1 billion. The borough then raised the mill rate tax from the prior 6.6 to 24.5 mills. Some oil companies met the August 10, 1973, deadline for paying the taxes imposed but some did not and appealed the Superior Court ruling to the State Supreme Court. Hearings by that court were concluded in September 1973. Depending on the Court's decision,[3] the matter could ultimately go before the U.S. Supreme Court.

The trans-Alaska pipeline came into the legislative picture by way of three bills in the Alaska Senate Community and Regional Affairs Committee and the Senate and House Finance Committees. These are the "Ad Valorem," "Rights-of-Way," and the "Alaska Pipeline Commission" bills. The "Ad Valorem" bill concerns ways to levy a property tax on the trans-Alaska pipeline and oil and gas properties. An alternate plan being considered, in the Senate, would have the pipeline treated in the same manner as a major transportation facility. Discussions on the "Rights-of-Way" bill concern the elimination of the rental formula, a revision of the provision for the State to purchase an interest in the pipeline, and alterations and/or replacement of some of the provisions contained in the original bill. The "Alaska Pipeline Commission" bill is under consideration for a modification which would pass most regulatory powers to the Interstate Commerce Commission. Progress on five other major oil bills is not expected until the three bills mentioned above have been cleared.

Transportation.—Highway construction funds which were nearly depleted were renewed with an additional $58.7 million under the Federal-Aid Highway Act of 1973. These funds will be used for paving the Haines Cutoff of the Alaska Highway. Another major roadway event in 1973 was the beginning of construction of the ice bridge across the Yukon River in December. This temporary bridge is essential to the trans-Alaska pipeline in that it is an important link in supplying construction camps north of the Yukon. In order to provide for a more permanent link on the 360-mile-long road to Prudhoe Bay north of the Yukon, the State of Alaska advertised for bids in December for a 2,300-foot, $15 million permanent bridge across the Yukon at Livengood. Cost of the bridge will be borne half by Alyeska and half by State highway funds.

Plans are being considered for a highway system north to Prudhoe Bay, west to Kobuk and the Seward Peninsula, and southwest toward Bristol Bay. Such a system would interconnect with the network in the Anchorage-Fairbanks area. The future of such a system depends on financing, possible opposition from environmentalists, and land ownership and management, etc.

The Copper River Highway to the Cordova area is now enmeshed in environmental problems parallel to those which plagued the trans-Alaskan pipeline. The Federal Government has announced that a full environmental impact statement will be required prior to any further consideration.

Flood-caused damage in the Ketchikan area amounted to about $2.2 million and Federal funds have been made available

[3] The State Supreme Court ruled in favor of the North Slope Borough on January 16, 1974.

to make needed repairs. Included is the Carlanna bridge which was destroyed causing closing of a State Federal-aid highway. Cause of the damage was the bursting of the Carlanna Lake Dam which in turn was the result of heavy rains. Cost of replacing the dam is estimated at $1 million.

Table 6.—Coastwise receipts and foreign mineral trade
(Short tons)

Commodity	1971 [r]			1972		
	Coastwise receipts	Imports	Exports	Coastwise receipts	Imports	Exports
Bituminous coal and lignite	204	--	--	242	--	--
Gasoline, including natural gasoline	444,013	26,786	--	501,725	14,452	--
Kerosine	156,411	641,547	--	128,227	519,575	--
Distillate fuel oil	588,043	575	--	776,874	7,423	--
Residual fuel oil	243,625	8,176	194,018	211,452	6,409	42,121
Asphalt, tar, pitches	11,606	--	--	57,666	--	--
Lubricating oil and greases	1,923	2	--	1,475	130	--
Petroleum and coal products, not elsewhere classified	17,056	144,227	--	19,950	171,224	--
Building cement	54,801	24,036	--	17,015	56,439	--
Building stone, unworked	--	--	--	74	--	--
Clay, ceramic and refractory materials	6,115	--	--	5,875	--	--
Structural clay products including refractories	1,875	77	--	2,848	17	--
Sulfur, dry and liquid	11,600	5,924	--	12,319	5,539	--
Sand, gravel and crushed rock	876	1,728	--	3,043	21,147	--
Iron ore and concentrates	--	--	--	--	--	--
Iron and steel scrap	607	801	629	9	--	8,676
Primary iron and steel products	37,552	115,959	36	53,885	6,925	--
Aluminum and aluminum alloys, unworked	174	--	--	128	--	--
Lead and zinc including alloys, unworked	311	--	--	--	--	--
Nonferrous metal ores and concentrates	54	--	718,570	--	7,200	857,107
Nonferrous metals, primary smelter products, basic shapes, wire, casting and forgings, except copper, lead, zinc, and aluminum	1,248	744	--	1,061	9	--
Chemical fertilizer and fertilizer materials	5,105	122	88,824	2,735	1,352	135,106

[r] Revised.

Source: U.S. Army Corps of Engineers, Waterborne Commerce of the United States, Part 4, Pacific Coast, Alaska and Pacific Islands.

In air traffic both Alaska Airlines and Wien Air Alaska continued to service the contested runs to Nome, Kotzebue, and other points in northern Alaska. However, Wien is requesting the Civil Aeronautics Board (CAB) to remove a stay on a previously granted order to Alaska Airlines to discontinue their northern service. Enjoying exclusive rights to service between Anchorage and Valdez on a scheduled basis is Polar Airways. A snarl of other appeals on disputed routes in Alaska and to Seattle and other points in the lower 48 States still faces the CAB and more are certain to arise. Three carriers are certificated to fly passengers on the run between Anchorage and Seattle. Merger talks concerning Wien Air Alaska and Alaska Airlines continued at yearend.

The Anchorage airport continues to be the busiest in the State with projected 1973 figures from October 1973 showing 1.75 million passengers and a $9.4 million revenue for 1973. The combined Anchorage Fairbanks total amounted to nearly two million passengers. At Ketchikan, the new International Airport opened in June 1973.

Construction projects related to air transportation during 1973 involved 45 projects with a total cost of about $43.5 million. This amounts to a 29% increase over 1972 which itself was a record year.

In marine transportation, the new 235-foot State ferry, built at Sturgeon Bay, Wisc., is expected to join the Alaska Marine Highway fleet of nine boats in the near future. Talks continued about returning the ferry *Wickershan* to the Marine Highway System to make runs on a tem-

porary basis pending outcome of continued efforts to sell the vessel now tied up in Seattle.

The newest and largest ferry liner which will join the Alaska Marine Highway System, the *Columbia,* will go into service some time in 1974. The *Columbia* will replace the *Wickershan,* is 418 feet long and can carry up to 1,000 passengers per day. The vessel is being constructed at Seattle, Wash.

A record year for the port of Anchorage came in 1973 with more than two million tons of cargo handled. This is the highest level reached in the 12-year history of the port. However, no profit was realized, with revenues and costs at about a break-even point. This compares with a deficit of almost $0.45 million occurring in 1972 and reflects the continued growth of the port facility.

A deepwater port at Lost River appears likely in the near future if the late 1975 or early 1976 date of startup of fluorite mining is to be met. The port would serve as a marine terminal for exporting the tin-tungsten-fluorite ore as well as handling incoming material necessary for mining and other needs on the Seward Peninsula. Dredging would have to be done in order to handle vessels of up to 30,000-ton capacity. Because of the 30-year-plus life expectancy of economic mining operations at Lost River, a marine terminal capable of contributing to the opening up of the northwest region appears to be justified.

The Alaska railroad, operated by the U.S. Department of Transportation, is still up for sale with no reported buyers. There is a movement underway, however, to expand the railroad system to provide rail service to the Lost River area. Reportedly, officials of the Lost River Mining Corp. are pressing the possibility of bringing rail service from Kobuk to the Lost River mining site port on the Seward Peninsula and tying it in with the coal-bearing areas of northwest Alaska around Cape Beaufort.

Employment.—Employment increased about 4% in 1973, to 1.4 million workers. The largest category, local, State, and Federal Government employment, amounted to about 38% of total employment in Alaska. Leading is Federal employment, followed by State, and local. Unemployment rate remained unchanged at the 1972 rate of about 1.0% of the total work force during the year.

Mining employment, conversely, showed a decrease of 9.5% from 1972 figures and is at its lowest level since 1967. There were 1,900 workers on the average in mining during 1973 with a payroll of just over $38 million as reported by the Alaska Department of Economic Development. Crude petroleum and natural gas contributed in excess of $33.3 million, employing an average of 1,671 workers in 1973. These values are expected to increase substantially with the development of the North Slope oil province which will result from accelerating activity related to the construction of the now approved trans-Alaska oil pipeline.

REVIEW OF MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Production of coal increased 3.9% from the 1972 level of 668,000 short tons to 694,900 short tons in 1973. The only source of coal in 1973 was again the Usibelli mine near Healy. The Usibelli coal mine in the Nenana coalfield supplies miltary bases north of the Alaska Range and electric generating plants in the Fairbanks area and fires an electrical generating plant at Healy. Consumption was about the same level as in 1972. Exploration for new coal reserves was concentrated in the Beluga coalfield in the Cook Inlet area and on the potential for coking coal on the Arctic Slope. During 1973 there were 73 prospecting permits issued in relation to just over 266,000 acres. There was some work in progress concerning developing markets for the extensive deposits in the Beluga River coalfields. World energy shortages increased the possibility of exporting Alaskan coal to foreign markets, as well as enhancing the possibility of U.S. west coast usage.

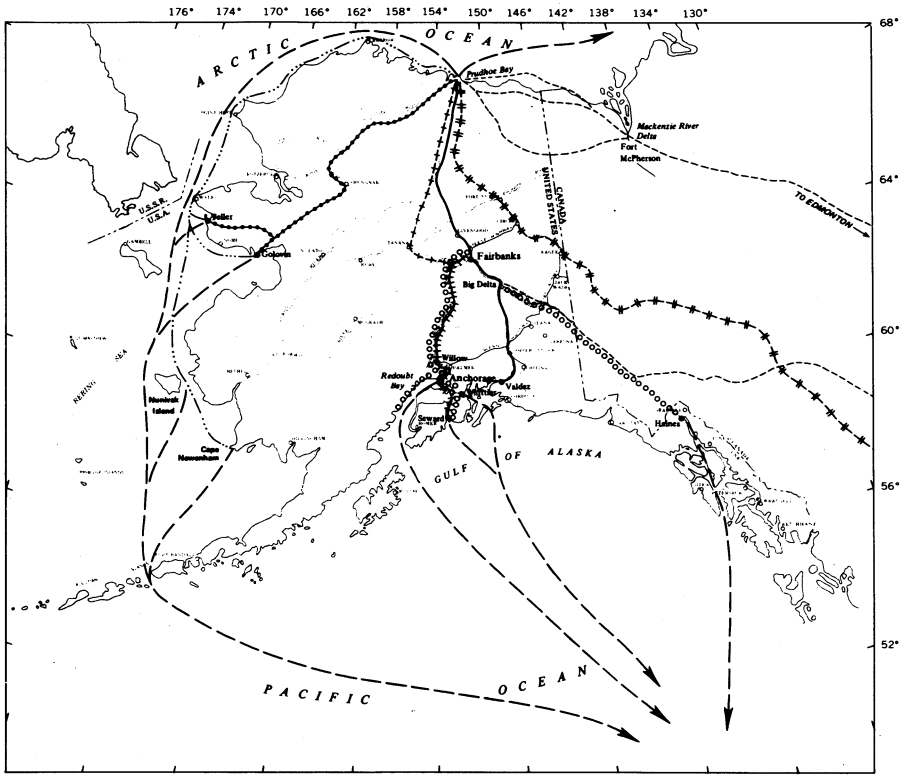
Petroleum and Natural Gas.—Crude petroleum continued to be the leading revenue producer among all minerals in Alaska although there was a very slight decrease of just under 0.6 million barrels in pro-

duction during 1973. However, values of crude petroleum increased from $235.4 million in 1972 to $261.9 million in 1973 or 11.2% as shown in table 1. This is a reflection of crude price increases related to the world energy shortage.

During 1973 oil was produced from five fields in the Cook Inlet area and a small amount from the Prudhoe Bay field for local fuel. The largest drop in oil production during 1973 was at the State's most prolific developed oilfield, McArthur River. It amounted to about 1.9 million barrels. However, this was partially offset by a 1.17-million-barrel increase at Swanson River. Other changes were mostly offsetting with the above minor net decrease resulting.

During 1973 gross withdrawals of gas amounted to about 223.3 billion cubic feet from seven fields in the Cook Inlet area and from the South Barrow field. Of this, 99.3 billion came from oil production operations and 124.0 billion from gas wells. Disposition of the gas was 131 billion marketed, 87.3 billion returned to the ground for pressure maintenance and 5.0 billion vented or flared.

At Prudhoe Bay, oil is produced, run through a small refinery which produces heating oil, diesel fuel, and naphtha and the remainder is injected back into the oil reservoir. The plant is rated at 5,000 barrels of oil per day, but is operating at a 6,300 barrels of oil per day capacity. In December 1973, some 25,900 barrels of Arctic heating fuel and naphtha were obtained by this procedure.



ALTERNATE ROUTES FOR TRANSPORTING NORTH SLOPE OIL

- Proposed trans-Alaska pipeline
- The Alaska Railroad
- Alaska Railroad extension
- Trans-Canada resource railroad route
- Trans-Canada corridor
- Marine transportation route
- Pipeline route to southern Alaska ports
- Overland pipeline route to western Alaska ports
- Offshore pipeline route to western Alaska ports

Figure 2.—Trans-Alaska pipeline.

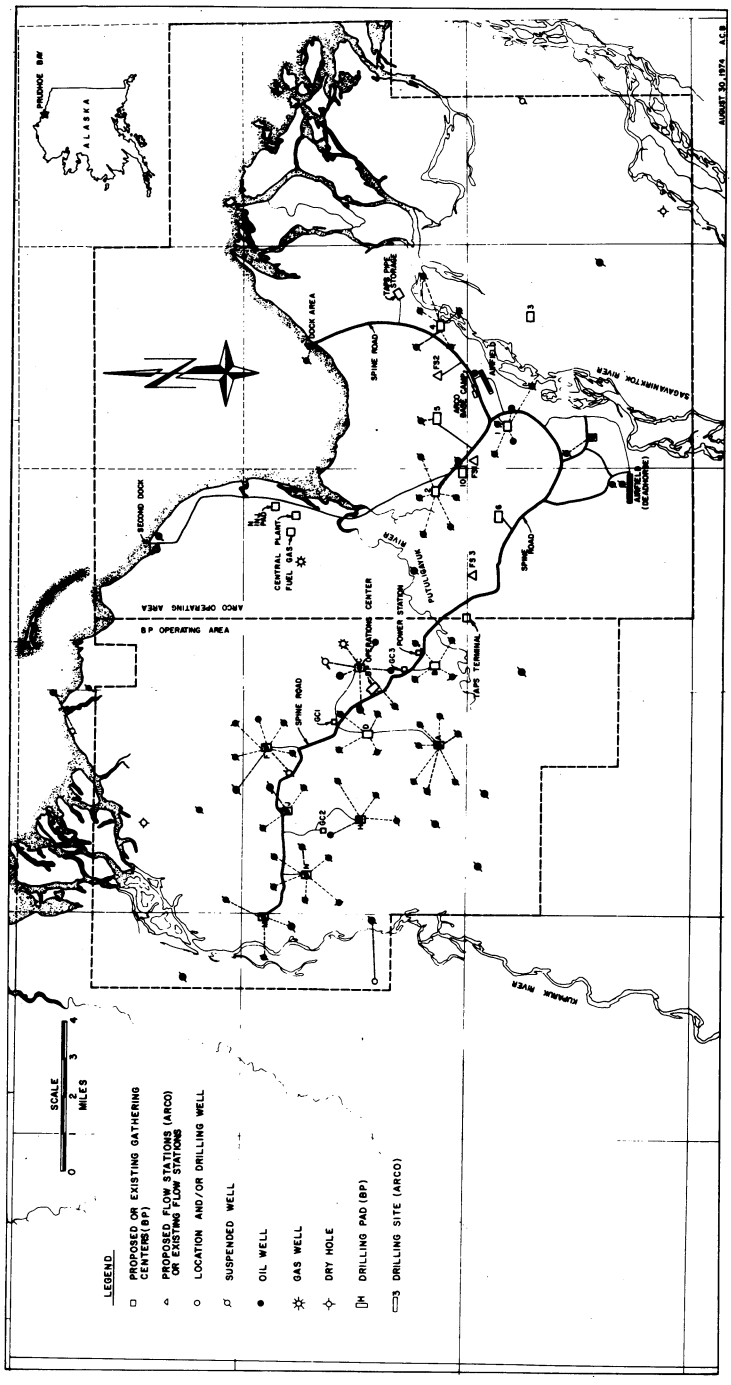


Figure 3.—Prudhoe Bay oilfield map.

Exceptions to the Alaska Oil and Gas Conservation Committee order prohibiting flaring of gas from Cook Inlet wells continued in 1973. The matter of flaring, because of operating necessity, came up in the form of a request by Amoco Production Co. to allow flaring at the Granite Point and Middle Ground Shoal fields when there is no demand for the produced gas. This comes about when the Collier Carbon and Chemical Co. fertilizer plant on the Kenai Peninsula is shut down for maintenance or repairs. There is no alternate outlet for the gas and in such a case production must either be shut-in or the gas flared.

Other operational necessities still cause some gas to be flared because of mechanical repairs and occasional submarine pipeline problems. These cases are reviewed for compliance with the various conservation orders and administrative approval is issued, if justified. Shell Oil Co. obtained such an approval when a compressor broke down on their Platform "A," one of the 14 in the Cook Inlet, at the Middle Ground Shoal field in June 1973. Oil production operations could not continue without the compressor unless the gas was flared. Union Oil Co. likewise was authorized to flare in the McArthur field because of operating difficulties.

According to the American Petroleum Institute (API),[5] the total number of wells in Alaska classified[6] as "drilled during 1973" increased to 34 from the 26 drilled during 1972. The alltime high was in 1970 when a total of 112 wells were drilled. Exploratory work involved the drilling of 14 wells in 1973 with 9 wells located in the Cook Inlet area. Four exploratory wells were drilled on the North Slope. Success was encountered at only 3 wells during 1973. One of them, Marathon Oil Company's No. 4 Beaver Creek, was completed as an oil well at close to 15,000 feet. This is the deepest production established to date in Alaska. Average exploratory footage for the 14 wells drilled was 9,316 feet. This is again down, as was the case in 1972, from the 10,543 feet average for 60 exploratory wells in 1970.

[5] American Petroleum Institute. Quarterly Review of Drilling Statistics for the United States, Annual Summary, 1973, pp. 14–15.

[6] Definitions of API well counts: American Petroleum Institute. Standard Definitions for Petroleum Statistics, 1969, pp. 22–30.

Table 7.—Oil well drilling in Alaska

Province and Area	Wells				Footage
	Oil	Gas	Dry	Total	
Exploratory drilling:					
Southwest area: Kuskokwim River	--	--	1	1	8,230
North Slope:					
Beechey Point	--	--	1	1	3,500
Mt. Michelson	--	--	2	2	22,132
Sagavanirtok	--	--	1	1	16,119
Total	--	--	4	4	41,751
Cook Inlet Basin:					
Kenai	2	1	4	7	63,281
Tyonek	--	--	2	2	17,160
Total	2	1	6	9	80,441
Total exploratory	2	1	11	14	130,422
Development drilling:					
Cook Inlet Basin:					
Kenai	10	--	--	10	98,889
Tyonek	--	1	--	1	6,380
Total	10	1	--	11	105,269
North Slope:					
Beechey Point	8	--	--	8	84,435
Barrow	--	1	--	1	2,349
Total	8	1	--	9	86,784
Total development	18	2	--	20	192,053
Grand total	20	3	11	34	322,475

Table 8.—Oil production in Alaska by field
(42-gallon barrels)

Year	Beaver Creek	Katalla field	Swanson River field	Middle Ground Shoal field	Trading Bay field	Granite Point field	McArthur River field	Prudhoe Bay field	Redoubt Shoal field	Total
Prior to 1968	--	154,000	74,951,420	10,080,139	730,407	7,053,731	753,984	--	--	93,723,681
1968	--	--	13,619,458	14,133,697	3,477,181	13,131,431	21,782,310	--	1,596	66,145,673
1969	--	--	13,150,877	10,467,090	9,935,605	9,183,291	31,300,978	277,377	--	74,315,218
1970	--	--	12,407,889	12,719,458	9,600,293	7,522,329	40,164,706	1,199,414	--	83,614,089
1971	--	--	11,466,356	11,303,651	8,743,637	5,577,411	40,536,998	1,156,812	--	78,784,865
1972	--	--	8,896,198	9,719,674	8,585,287	4,662,955	40,774,241	922,147	--	73,560,502
1973	417,882	--	10,064,499	10,238,961	7,825,330	4,766,975	38,883,671	943,698	--	73,141,016
Cumulative production	417,882	154,000	144,556,697	78,662,670	48,897,740	51,898,123	214,196,888	4,499,448	1,596	543,285,044

Source: Alaska Division of Oil and Gas.

METALS

Antimony.—Although there is widespread antimony mineralization in Alaska, there have not been enough highgrade deposits located to warrant large-scale mining and this continued to hold true in 1973. However, three operators in the Kantishna area and two in the Fairbanks area reportedly did produce antimony for shipment. There was also some activity reported in the Fortymile district.

Copper.—The Alaska Division of Geological and Geophysical Surveys reported that about 400 tons of copper ore were produced during 1973. An estimated 200 tons of copper should be recovered. Exploration work in Southeastern Alaska expanded in 1973 from the Brady Glacier nickel-copper property in Glacier Bay National Monument to include a new drilling program on Yakobi Island, north of Sitka. Exploration also was pursued at Ruby Creek, in the Kobuk Valley, and in the Wrangell Mountains.

Reportedly, Kennecott Mining Corp. was interested in selling much of its Bornite area holdings. It was reported earlier that the ore body, partially developed by Kennecott's Bear Creek Mining subsidiary, was being readied for production. The asking price was said to be in the $10 to $12 million range with Kennecott retaining a percentage of the profits.

In the Wrangell Mountains area east of Chitina, prospecting was underway in 1973 by Inexco Mining Co. near McCarthy, with other operators also reported active in the area.

Gold.—There was no known lode production during 1973 but placer mining operations accelerated due to the fast rising price of gold which followed the removal of the $35 per ounce price restriction by the Federal Government. One gold placer dredge continued to operate on the Hog River. Interest in prospecting continued but more so among the inexperienced prospectors than among the professional miners. Altogether, less gold was reported mined in 1973 than in 1972, about 8,600 ounces in 1972 and 7,100 ounces in 1973, but total value was greater in 1973 due to the higher price.

Exploration work by UV Industries, Inc., successor to United States Smelting, Refining and Mining Company, was reportedly started on their Nome property. Noranda Exploration Inc. was reportedly prospecting lode gold deposits at Chandalar. An additional exploratory effort by an undisclosed company was reported in the Livengood gold district in the form of an investment of about $4 million to purchase lease equipment and mining claims in the area.

Table 9.—Alaska: Placer production of gold

Year	Mines producing	Material [1] treated (thousand cubic yards)	Gold recovered		
			Troy ounces	Value (thousands)	Average value per cubic yard
1969	30	1,081	21,146	$878	$0.812
1970	23	999	34,776	1,265	1.266
1971	27	1,060	12,327	508	.480
1972	25	902	8,639	506	.561
1973	23	972	7,107	695	.715

[1] Excludes material treated primarily for the recovery of platinum.

Iron Ore.—The Japanese-owned Iron Ore Company of Alaska, an affiliate of Mitsubishi of Japan, has purchased 52 acres of land at Lutak Inlet, Alaska. Mitsubishi's plans for the land have not been disclosed. However, it was reported that the company was interested in developing the Klukwan iron ore deposit near Haines. The deposit is in the form of a huge alluvial fan and a much larger deposit of magnetite-bearing mafic rock. It would be strip mined, concentrated, powdered, and sent in a pipeline slurry to Haines where it would be pelletized and shipped out by water.

Lead.—The 14 tons of lead ore mined in 1972 was sent to the smelter at Helena, Mont. In the Kantishna district, several hundred tons of lead ore were produced. The 1973 total lead production is estimated at 6 tons.

Mercury.—The price of mercury increased from $150 to $300 per flask in 1973. However, this had little effect in stimulating cinnabar mining operations. Some exploratory work near Sleetmute was reported but there were no known shipments from the area.

Platinum.—Production during 1973 was at about the same level as in 1971 and 1972. The Goodnews Bay Mining Company continued its Salmon River floating dredge operation in 1973.

Silver.—A new lead-silver deposit was located in the southwestern Brooks Mountain Range. Credit for the discovery goes to members of Alaska's Division of Geological and Geophysical Survey and the U.S. Geological Survey.

Tin.—Placer operations continued in 1973 at locations near Tin City and Manley Hot Springs. The latter operation is primarily a gold placer operation.

NONMETALS

Barite.—The underwater open pit operation by Alaska Barite Co. at Castle Island, near Wrangell and some 12 miles southwest of Petersburg, continued in 1973.

Fluorite.—At Lost River preparatory work for mining the fluorite-tin-tungsten deposits continued in 1973. Estimates are that it will take 3 to 5 years before actual mining begins. There are some 28 million tons of ore at stake. A deepwater port is planned which will provide the means to ship the ore out and will also serve as a marine terminal for incoming materials for the Seward Peninsula.

Plans are to mine about 1,400,000 tons of fluorite yearly at a rate of 4,000 tons per day, of which 30,000 is tentatively scheduled for shipment to Japan. Consideration is being given to installing utilities for exclusive use of the mining operation which would seriously detract from the economic feasibility of constructing the city of Lost River for 1,500 people. This would in turn seriously retard development of the northwest region which was the primary reason that the legislature created the city of Lost River in 1972.

In addition to fluorite, the Lost River Mining Corp. is also looking into markets for the fluorite mining operation byproducts, tin and tungsten.

Sand and Gravel.—Fifteen million short tons of sand and gravel were produced during 1973. Value of this commodity amounted to nearly $20 million, ranking second in value only to oil and gas. Although the 1973 production exceeded that of 1972 by only 5.7%, value in 1973 exceeded that of 1972 by 30.9%, reflecting the trend of rising prices.

Table 10.—Alaska: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	--	--	(1)	(1)
Building	162	294	301	860
Fill	731	433	685	662
Paving	(1)	(1)	14	55
Other uses	(1)	(1)	--	--
Total [2]	893	726	999	1,577
Gravel:				
Building	199	436	815	1,820
Fill	1,800	841	879	776
Paving	991	1,841	1,256	2,076
Railroad ballast	W	W	132	270
Miscellaneous	50	W	46	499
Other uses	318	338	269	(3)
Total [2]	3,358	3,457	3,397	5,442
Government-and-contractor operations:				
Sand:				
Building	1	(4)	6	47
Fill	8	4	34	30

See footnotes at end of table.

Table 10.—Alaska: Sand and gravel sold or used by producers, by class of operation and use—Continued
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Government-and-contractor operations—Continued				
Sand—Continued				
Paving	2,865	2,827	2,881	3,615
Other uses	4	11	--	--
Total [2]	2,878	2,843	2,921	3,692
Gravel:				
Building	--	--	10	53
Fill	70	72	29	26
Paving	6,784	8,075	7,363	9,020
Other uses	205	41	279	102
Total [2]	7,058	8,188	7,681	9,201
Total sand and gravel [2]	14,187	15,214	14,999	19,913

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Included with fill to avoid disclosing individual company confidential data.
[2] Data may not add to totals shown because of independent rounding.
[3] Included with miscellaneous.
[4] Less than ½ unit.

Stone.—Production of stone was almost 6 million short tons in 1973. Value reached over $12.7 million during the year.

Table 11.—Principal producers

Commodity and company	Address	Type of activity	Region
Barite: Alaska Barite Co	Anchorage, Alaska 99510	Open pit	Southeastern Alaska.
Coal: Usibelli Coal Mine, Inc	Usibelli, Alaska 99787	do	Yukon River.
Gold: U.V. Industries, Inc	235 East 42nd Street New York, N.Y. 10017	Bucket line dredge.	Do.
Petroleum, crude:			
Amoco Production Co	Anchorage, Alaska 99510	Oil production	Offshore Cook Inlet.
Atlantic Richfield Co	do	do	Kenai Peninsula, offshore Cook Inlet, North Slope.
BP Alaska, Inc	do	do	North Slope.
Mobil Oil Corp	do	do	Offshore Cook Inlet.
Shell Oil Co	do	do	Kenai Peninsula, offshore Cook Inlet.
Texaco Inc	do	do	Offshore Cook Inlet.
Standard Oil Co. of California	do	do	Kenai Peninsula.
Union Oil Co. of California	do	do	Offshore Cook Inlet.
Petroleum refining:			
Standard Oil Co. of California	225 Bush Street San Francisco, Calif. 94014	Refinery	Kenai Peninsula.
Tesora-Alaskan Petroleum Corp.	Box 6272 Anchorage, Alaska 99502	do	Do.
Platinum-group metals: Goodnews Bay Mining Co	Fairbanks, Alaska 99701	Dredge	Salmon River.
Sand and gravel:			
Anchorage Sand and Gravel Co	Anchorage, Alaska 99501	Stationary plant.	Cook Inlet.
Central Construction Co., Inc	Seattle, Washington 98111	Open pit	Northwestern.
Green Construction Co., Inc	P.O. Box 969 Juneau, Alaska 99801	do	Southeastern.
Rogers and Babler Inc	4607 East Tudor Road Anchorage, Alaska 99507	Pit and plant	Cook Inlet.
Stone:			
Ketchikan Pulp Co	P.O. Box 1619 Ketchikan, Alaska 99901	2 quarries	Southeastern.
Moore Construction Co., Inc	Ketchikan, Alaska 99901	Quarry	Kenai Peninsula.
Walsh & Co., Inc	Anchorage, Alaska 99510	do	Cook Inlet.
Wayne Construction Co	Ketchikan, Alaska 99901	do	Southern Alaska.
Welborn Construction Inc	P.O. Box 634 Kodiak, Alaska 99615	2 quarries	Kodiak.

The Mineral Industry of Arizona

This chapter was prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Arizona Bureau of Mines for collecting information on all minerals except fuels.

By Gertrude N. Greenspoon [1] and H. J. Schroeder [2]

Arizona mineral production totaled $1.3 billion in 1973, 20% above 1972 and a record high. Mining continued as the second most important source of income and exceeded $1 billion for the second consecutive year.

Copper accounted for $1,103 million, 85% of the total value of minerals produced. Arizona continued as the leading copper-producing State, accounting for 54% of the U.S. total. The State ranked second in silver and molybdenum production, and was fourth in gold output.

Increased production values were recorded for all three groups. Value of the metals rose 20%, mainly as a result of higher average annual prices for most of the commodities. In the nonmetallic group, increased values in 11 of the 15 commodities resulted in an increase of 21% for the group. No diatomite was produced in 1973. An 18% increase in the value of coal production more than offset decreases in helium, natural gas, and petroleum production values, and total value of fuels produced rose 7%.

[1] Mineral specialist, Division of Nonferrous Metals—Mineral Supply.

[2] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in Arizona [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays [2] thousand short tons	134	$355	117	$459
Coal (bituminous) do	W	W	3,247	W
Copper (recoverable content of ores, etc.) short tons	908,612	930,419	927,271	1,103,453
Gem stones	NA	168	NA	170
Gold (recoverable content of ores, etc.) troy ounces	102,996	6,036	102,848	10,060
Gypsum thousand short tons	W	W	158	669
Lead (recoverable content of ores, etc.) short tons	1,763	530	763	248
Lime thousand short tons	356	6,024	365	7,019
Molybdenum (W content) thousand pounds	27,216	46,791	37,657	59,372
Natural gas million cubic feet	442	80	125	23
Petroleum (crude) thousand 42-gallon barrels	993	3,226	804	3,103
Pumice thousand short tons	915	722	853	715
Sand and gravel do	24,842	32,420	27,440	38,503
Silver (recoverable content of ores, etc.) thousand troy ounces	6,653	11,210	7,199	18,416
Stone thousand short tons	4,638	8,018	4,265	9,469
Zinc (recoverable content of ores, etc.) short tons	10,111	3,589	8,427	3,482
Value of items that cannot be disclosed: Asbestos, cement, fire clay, diatomite (1972), feldspar, fluorspar, helium, iron ore, mica (scrap), perlite, pyrites, tungsten, and values indicated by symbol W	XX	41,416	XX	49,827
Total	XX	1,091,004	XX	1,304,988
Total 1967 constant dollars	XX	900,187	XX	p 958,122

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes fire clay; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Arizona, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Apache	$5,412	W	Petroleum, helium, clays, sand and gravel, natural gas, pumice.
Cochise	56,957	$57,396	Copper, lime, gold, silver, sand and gravel, stone.
Coconino	W	1,424	Sand and gravel, pumice, stone.
Gila	113,588	122,989	Copper, sand and gravel, lime, stone, silver, asbestos, molybdenum, gold, fluorspar, clays.
Graham	W	824	Copper, stone, sand and gravel, pumice.
Greenlee	124,408	145,467	Copper, silver, lime, gold, stone, sand and gravel.
Maricopa	18,793	27,915	Sand and gravel, molybdenum, lime, stone, mica, clays.
Mohave	37,357	32,529	Copper, sand and gravel, silver, feldspar, stone, gold, tungsten.
Navajo	W	W	Coal, sand and gravel, pumice, iron ore, stone.
Pima	418,267	511,173	Copper, molybdenum, cement, silver, sand and gravel, gold, stone, lime, lead, clays, zinc, mica.
Pinal	255,009	331,140	Copper, molybdenum, silver, gold, sand and gravel, stone, lime, gypsum, perlite, pyrites, clays.
Santa Cruz	765	W	Sand and gravel, stone, tungsten.
Yavapai	48,352	56,782	Copper, cement, zinc, sand and gravel, stone, molybdenum, lime, silver, gypsum, lead, gold, clays, pumice.
Yuma	W	W	Sand and gravel, stone.
Undistributed [2]	12,091	17,345	
Total [3]	1,091,004	1,304,988	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Value of petroleum is based on an average price per barrel for the State.

[2] Includes some sand and gravel and natural gas (1973) that cannot be assigned to specific counties, gem stones, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Arizona business activity

		1972	1973 [p]	Change, percent
Employment and labor force, annual average:				
Total nonagricultural employment	thousands	647.3	701.6	+8.4
Services and miscellaneous	do	111.6	120.1	+7.6
Trade	do	150.9	163.7	+8.5
Mining	do	22.3	24.5	+9.9
Construction	do	56.1	62.6	+11.6
Manufacturing	do	97.9	107.8	+10.1
Government	do	139.2	147.4	+5.9
All other	do	69.3	75.5	+8.9
Personal income:				
Total	millions	$8,292	$9,268	+11.8
Per capita		$4,263	$4,504	+5.7
Construction activity:				
New housing units authorized		55,127	46,678	−15.3
Value of nonresidential construction	millions	$275.5	$387.0	+40.5
Highway construction contracts awarded	do	NA	$61	NA
Portland cement shipments to and within the state	thousand short tons	1,544	W	NA
Farm marketing receipts	millions	$884.9	$1,140.9	+28.9
Mineral production value	do	$1,091	$1,305	+19.6

[p] Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and the U.S. Bureau of Mines.

Table 4.—Major source of income in Arizona [1]
(Thousands)

Source of income	1972	1973 [p]	Change, percent
Manufacturing (value added)	[r] $1,916,900	$2,160,000	+13
Mining [2]	1,091,000	1,305,000	+20
Tourism	650,000	690,000	+6
Livestock	479,986	580,644	+21
Crops	342,253	407,426	+19

[p] Preliminary. [r] Revised.
[1] Valley National Bank Research Department, Phoenix, Ariz.
[2] U.S. Bureau of Mines.

Table 5.—Valuation on centrally assessed groups of property in Arizona [1]
(Thousands)

Group	1972	1973	Change, percent
Utilities	[r] $1,512,949	$1,875,369	+24
Mines	[r] 908,769	940,531	+3
Pipelines	365,379	367,658	+1
Railroads	162,644	181,292	+11
Airlines	25,583	29,434	+15
Oil and gas	3,591	2,953	−18

[r] Revised.
[1] Pay Dirt. No. 408, June 25, 1973, p. 9.

Legislation and Government Programs.—The Arizona State Department of Property Valuation increased the assessed valuation of producing mines for tax purposes approximately 3% to $941 million. Action by the State Property Tax Appeals Board reduced the value by $30 million to a final $911 million assessed valuation. The four highest assessments, as adjusted, were the Morenci Branch of Phelps Dodge Corp. at $164 million, the Sierrita mine of Duval Sierrita Corp. at $126 million, the Ray Mine Division of Kennecott Copper Corp. at $97 million, and the San Manuel Division of Magma Copper Co. at $88 million. Mining properties are taxed on 60% of the assessed cash value by applicable State, county, school district, city, and other taxing units.

The Environmental Protection Agency (EPA) announced in September that it had accepted the "closed loop control concept" which it termed "supplementary control procedures" as a means of achieving a permissible ambient air concentration of sulfur gases during periods of adverse meteorological conditions. In practice the procedure involves a continuous monitoring of stack gas emissions, existing ambient air quality, and meteorological conditions to provide data to control the allowable rate of production so that permissible pollution levels are not exceeded. EPA emphasized that the supplementary control system could only be used where there was no other economic control technology available, a high degree of reliability must be proven, and work towards a permanent control system must continue. This action by EPA brought its sulfur control requirements into substantial agreement with those of the Arizona Board of Health.

An EPA announcement ordered powerplants in the Southwest, including the Navajo powerplant being built at Page, to meet a 70% sulfur emission removal standard by March 15, 1976. Several power companies have joined in a suit against EPA, contending failure by EPA to file environmental impact statements and using faulty data upon which to base its requirements. The Arizona State Board of Health has adopted a policy which would limit coal-fired powerplants to 0.25 pound of sulfur emissions per million British thermal units, approximately equal to 70% sulfur removal, by 1980.

The Arizona Supreme Court upheld constitutionality of a State law allowing loans by public corporations to private corporations to build pollution control facilities. Magma Copper Corp. has taken advantage of the law by means of an agreement with a Pinal County public agency for a $30 million loan to install air pollution equipment at its San Manuel smelter.

REVIEW BY MINERAL COMMODITIES

METALS

Copper production in 1973 was 2% greater than in 1972, and 1% more than the previous record output in 1970. Value of production rose 19% because of higher average prices in 1973. Copper accounted for 92% of the total metals group value and 85% of the total State mineral value. Except for molybdenum and silver, all other commodities in the metals group recorded decreased output.

Copper ore was produced at 27 mines, gold ore at 3 mines, gold-silver ore at 2 mines, silver ore at 2 mines, copper-zinc ore at 1 mine, iron ore at 1 mine, molybdenum concentrate at 11 copper mines, and tungsten at 2 mines. Mercury was not produced in 1973.

Copper.—Production of recoverable copper from Arizona mines increased 2% to a record high 927,271 tons, a quantity 1% above the previous 1970 high output. Approximately 78% of the production came from open pit mines and 22% from underground mines. Of the total copper production 796,542 tons was recovered from processing 163.9 million tons of copper concentrating ore, 63,325 tons was recovered by heap or vat leaching 9.4 million tons of ore, 59,529 tons was recovered in precipitates from "waste dump" leaching, 4,422 tons was recovered from 278,955 tons of direct-smelting copper ore, and 3,453 tons was recovered from noncopper metal ores and miscellaneous categories. A total of 27 mining operations yielded recoverable copper, concentrating ore, leaching ore, direct-smelting ore, cement copper from waste-dump and inplace leaching, and low-grade siliceous copper ore used for smelter flux. Information on individual operations, obtained from company annual reports, trade journals, and other published sources, follows.

Table 6.—Arizona: Total value of mineral production in Arizona, and production and value of copper in Arizona and the United States

Year	Arizona			U.S. copper production		Arizona	
	Total value of mineral production (thousands)	Copper production				Percent of U.S. copper production	Percent of world copper production
		Quantity (short tons)	Value (thousands)	Quantity (short tons)	Value (thousands)		
1969	$859,462	801,363	$761,840	1,544,579	$1,468,400	51.9	12.1
1970	1,166,767	917,918	1,059,277	1,719,657	1,984,484	53.4	14.1
1971	981,020	820,171	852,978	1,522,183	1,583,071	53.9	12.3
1972	1,091,004	908,612	930,419	1,664,840	1,704,796	54.6	12.4
1973	1,304,988	927,271	1,103,453	1,717,940	2,044,346	54.0	11.8

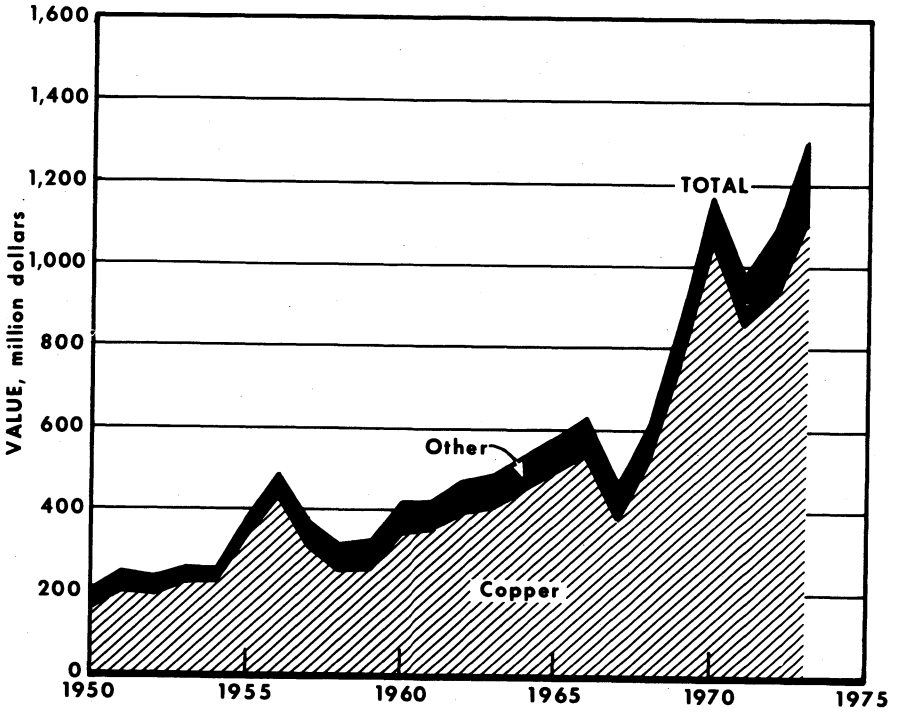


Figure 1.—Value of mine production of copper and total value of mineral production in Arizona.

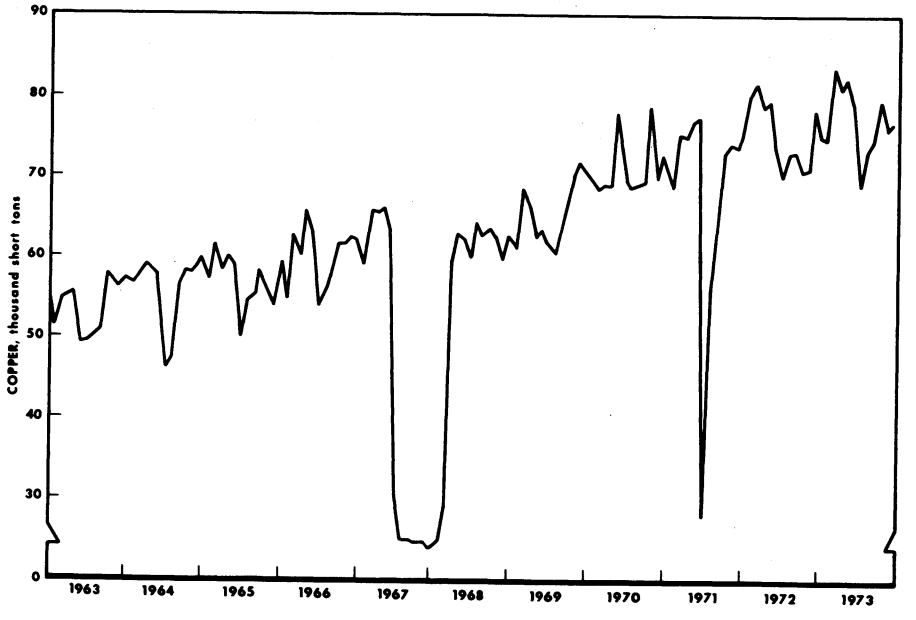


Figure 2.—Mine production of copper in Arizona, by month, in terms of recoverable metal.

Table 7.—Arizona: Fifteen leading copper-producing mines, in order of output

Rank in 1973	Rank in 1972	Mine	County	Operator	Source of copper in 1973
1	1	San Manuel	Pinal	Magma Copper Co	Copper ore.
2	2	Morenci	Greenlee	Phelps Dodge Corp	Copper ore and copper precipitates.
3	3	Ray	Pinal	Kennecott Copper Corp	Do.
4	4	Pima	Pima	Pima Mining Co	Copper ore.
5	6	Sierrita	do	Duval Sierrita Corp	Do.
6	5	Twin Buttes	do	Anamax Mining Co	Do.
7	7	New Cornelia	do	Phelps Dodge Corp	Do.
8	8	Inspiration	Gila	Inspiration Consolidated Copper Co.	Copper ore and copper precipitates.
9	9	Mission	Pima	American Smelting and Refining Company.	Copper ore.
10	13	Silver Bell	do	do	Copper ore and copper precipitates.
11	12	Copper Cities	Gila	Cities Service Co	Do.
12	11	Mineral Park	Mohave	Duval Corp	Do.
13	16	Magma	Pinal	Magma Copper Co	Copper ore.
14	10	Copper Queen	Cochise	Phelps Dodge Corp	Do.
15	14	Lavender Pit	do	do	Copper ore and copper precipitates.

Table 8.—Arizona: Material handled and copper produced at leading fifteen copper open pit and underground mines

Mine	Ore mined (thousand short tons)		Waste material removed (excluding material placed in leach dumps) (thousand short tons)		Material placed in leach dumps (thousand short tons)		Total copper produced [1] (short tons)	
	1972	1973	1972	1973	1972	1973	1972	1973
OPEN PIT								
Morenci	17,215	18,361	19,575	19,445	13,438	17,618	123,176	122,633
Ray	9,754	10,457	--	--	26,600	27,393	87,064	102,534
Pima	15,609	20,208	[2] 14,529	33,088	--	--	82,841	88,140
Sierrita	28,351	30,597	35,614	34,539	13,151	11,613	68,940	75,595
Twin Buttes	18,661	15,076	98,763	115,232	--	--	79,122	64,150
New Cornelia	9,792	10,343	18,518	19,774	--	--	58,656	54,499
Inspiration	7,792	8,722	9,345	9,456	4,987	7,453	[3] 53,986	[3] 48,588
Mission	8,364	8,783	25,506	21,532	--	--	45,371	46,558
Silver Bell	3,840	3,866	7,406	9,975	2,200	3,598	23,560	23,765
Copper Cities	5,053	5,223	123	167	5,461	3,865	24,401	24,075
Mineral Park	7,050	8,394	3,140	3,806	2,562	1,638	26,559	23,676
Lavender Pit	3,761	3,833	--	1,921	1,799	2,191	22,315	20,502
UNDERGROUND								
San Manuel	21,845	21,900	310	91	--	--	135,751	139,829
Copper Queen	643	620	--	--	--	--	27,957	23,522
Magma	441	520	100	--	--	--	18,169	22,891

[1] Gross metal content.
[2] Thousand cubic yards.
[3] Recoverable content.

Table 9.—Arizona: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing [1]		Material sold or treated [2] (short tons)	Gold		Silver	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
1971, total	50	--	149,550,585	94,038	$3,879,070	6,169,623	$9,538,238
1972, total	39	1	166,111,254	102,996	6,035,570	6,652,800	11,209,970
1973:							
Cochise	3	--	4,396,655	22,371	2,188,107	626,805	1,603,367
Gila	11	--	23,718,504	5,204	509,004	298,993	764,824
Graham	1	--	485	--	--	--	--
Greenlee	1	--	18,377,187	12,378	1,210,692	580,135	1,483,985
Mohave	2	--	6,808,056	157	15,356	420,957	1,076,808
Pima	8	1	91,017,444	25,691	2,512,836	3,765,708	9,632,681
Pinal	9	--	35,002,827	36,577	3,577,596	1,399,130	3,578,974
Yavapai	5	--	2,184,918	470	45,970	107,523	275,044
Total	40	1	181,506,076	102,848	10,059,561	7,199,251	18,415,683

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1971, total	820,171	$852,977,580	859	$236,974	7,761	$2,499,139	$869,131,001
1972, total	908,612	930,418,872	1,763	530,083	10,111	3,589,447	951,783,942
1973:							
Cochise	41,382	49,245,134	--	--	--	--	53,036,608
Gila	98,900	117,690,698	--	--	--	--	118,964,526
Graham	346	411,481	--	--	--	--	411,481
Greenlee	117,728	140,095,821	--	--	--	--	142,790,498
Mohave	23,997	28,556,425	--	--	--	--	29,648,589
Pima	361,993	430,772,077	563	183,567	20	8,189	443,108,763
Pinal	259,196	308,442,868	--	--	--	--	315,599,438
Yavapai	23,730	28,238,183	199	64,913	8,407	3,473,828	32,097,938
Total	[3] 927,271	1,103,452,687	[3] 763	248,480	8,427	3,482,017	1,135,657,841

[1] Operations at miscellaneous cleanups not counted as mines.
[2] Does not include gravel washed.
[3] Data does not add to totals shown because of independent rounding.

Table 10.—Arizona: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1973, by class of ore or other source material

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Gold	3	20,755	51	497	88	--	--
Gold-silver	2	79,735	409	30,268	101	--	--
Silver	2	12,273	--	3,419	[2]	--	--
Total	7	112,763	460	34,184	189	--	--
Copper	27	181,218,661	101,923	7,130,066	864,289	571	20
Copper-zinc	1	93,284	453	34,922	3,217	192	8,407
Total	28	181,311,945	102,376	7,164,988	867,506	763	8,427
Other lode material:							
Copper cleanup	[3]	857	6	79	47	--	--
Copper precipitates	15	80,511	--	--	59,529	--	--
Total	15	81,368	6	79	59,576	--	--
Placer	1	--	6	--	--	--	--
Grand total	41	181,506,076	102,848	7,199,251	927,271	763	8,427

[1] Detail will not necessarily add to totals because some mines produce more than one class of material.
[2] Less than ½ unit.
[3] From properties not classed as mines.

Table 11.—Arizona: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1973, by type of material processed and method of recovery

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Acid leaching (vat, tank, heap)[1]	--	--	63,325	--	--
Smelting of concentrates	100,801	7,067,199	799,759	763	8,427
Direct smelting of—					
Ore	2,035	131,973	4,611	--	--
Precipitates	--	--	59,529	--	--
Cleanup	6	79	47	--	--
Total	2,041	132,052	64,187	--	--
Placer	6	--	--	--	--
Grand total	102,848	7,199,251	927,271	763	8,427

[1] Includes copper recovered by electrowinning process.

Phelps Dodge Corp. produced 215,300 tons of copper from its Arizona mines compared with 226,200 tons in 1972. The output comprised 119,500 tons at Morenci, 53,800 tons at Ajo, and 42,000 tons at Bisbee. The Lavender open pit mine at Bisbee was expected to close about mid-1974 owing to exhaustion of ore reserves. Underground mining at the Bisbee Copper Queen mine was planned to continue at least through 1974, with final closure dependent upon production costs and the price of copper. The $200 million Metcalf mine and concentrator project near the Morenci mine was under construction, with scheduled completion of the 60,000-ton-per-year copper-producing facility scheduled for early 1975. Underground development work continued at Safford to determine the feasibility of mining a deep ore body containing an estimated 400 million tons of ore with an average grade of 0.72% copper. Development work planned over the next several years includes deepening the existing shaft, sinking a new 2,500-foot service shaft, construction of underground stations and ore pockets, erection of headframes, and installation of hoists. However, no decision has been made as to when the mine will be brought into production. A drilling program at the Copper Basin project southwest of Prescott resulted in outlining an ore body estimated to contain 175 million tons of 0.55% copper and 0.02% molybdenum minable by open pit methods.

At its Morenci smelter Phelps Dodge was about halfway through a $92 million improvement program which included a new reverberatory with waste heat boilers and electrostatic precipitators, a ninth converter, addition of an 18,000-kilowatt turbine to the power-generating facilities, and a new 2,500-ton-per-day acid plant. The Morenci smelter will be used to smelt the Metcalf concentrates when that production begins; the currently smelted Tyrone concentrates will be largely diverted to a smelter under construction in New Mexico. At the Ajo smelter, construction of new facilities to control sulfur oxide and particulate emissions was substantially completed. The new facilities include reverberatory furnace and converter flues with waste heat boilers, improved electrostatic precipitators, a 600-ton-per-day acid plant, and a 7,500-kilowatt turbine in the powerplant. At the Douglas smelter a $17 million emissions control program was initiated. Part of the emissions control strategy was a plan for a permanent partial curtailment of operations, but a December 1973 order of the Arizona authorities provided that such curtailment could be deferred until November 30, 1974.

Magma Copper Co. operated the San Manuel and Superior mines with a combined output of 158,300 tons of copper compared with 149,500 tons in 1972. At San Manuel the average daily mine production was a record high 61,553 tons of ore, but somewhat below rated capacity owing to limitations in labor availability. At Superior the mine was shut down during July to enable transfer of haulage and hoisting operations to the new tunnel and shaft. By yearend mine production was near 3,000 tons of ore per day, about double the previous rate, and the planned level of 3,300 tons was expected in 1974.

There were some output restrictions at the San Manuel smelter owing to anode

casting problems and the necessity of installing water-cooled converter hoods as part of the air quality control program. An electrostatic precipitator and a 2,000-ton-per-day acid plant were under construction and scheduled for operation in mid-1974. To provide a basis for comparison of conditions before and after the emissions control facilities, an air monitoring network has been in operation for over a year. The smelter is expected to be in compliance with Arizona's ambient air standards for sulfur dioxide and for particulates when the emissions facilities are fully operational.

The Ray Mines Division of Kennecott Copper Corp. milled 12.3 million tons of sulfide ore grading 1.04% copper, compared with 10.4 million tons of 0.98% copper in 1972. Copper production from processing the sulfide ore, plus copper recovered as direct electrowon cathodes and as precipitates at the silicate copper ore leach plant, totaled 98,908 tons, an increase of 10%. An expansion program to enlarge the capacity of the silicate leach plant from 10,000 to 14,000 tons of ore per day was initiated in the latter part of 1973 and will require about 14 months for completion. New facilities will include crushing-grinding-screening equipment and cone-type precipitation tanks. A 165-foot-high dam and a 3½-mile, 16-foot-diameter, flood control diversion tunnel to protect the mine and other facilities from flash floods were completed in late 1973.

The air quality control system at the Hayden smelter of Kennecott was essentially completed and when fully operational in 1974 is expected to bring the smelter into compliance with all ambient air quality standards. Included in the system are a 900-ton-per-day double-contact sulfuric acid plant, improved converter hoods and connecting ducts, and a computer-monitored variable emissions control network. The increased acid production is an integral ingredient of the silicate leach plant expansion.

Cyprus Bagdad Copper Co., formed in 1973 by a merger of Cyprus Mines Corp. and Bagdad Mining Co., operated its copper mine, concentrator, and leach-electrowinning plant in Yavapai County. During 1973 Bagdad mined 2.1 million tons of sulfide ore grading 0.70% copper which yielded approximately 12,000 tons of copper, 250 tons of molybdenum, and 46,700 ounces of silver in concentrates. The leach-electrowinning plant produced 7,133 tons of refined copper cathodes from processing relatively low-grade oxide ore. Cyprus undertook a feasibility study for a major mine and mill expansion and a possible construction of a smelter and refinery. Ore reserves upon which the project is based are 300 million tons averaging 0.49% copper. Also, drilling in progress is expected to add substantial quantities of ore reserves.

Cyprus Pima Mining Co. (formerly Pima Mining Co.) operated the Pima mine near Tucson which produced 88,140 tons of copper, 937 tons of molybdenum, and 898,000 ounces of silver in concentrates from mining 20.3 million tons of ore containing 0.51% copper. At yearend, Pima reserves amounted to 221 million tons grading 0.49% copper, sufficient for about 11 years of operation at the current mining rate. Drilling is in progress to evaluate a potential expansion of reserves to the east and southeast of the present pit. The new plant facilities installed early in 1973, including semiautogenous grinding mills, resulted in increased productive capacity and reduced per-ton costs.

Cyprus Bruce Copper and Zinc Co. (formerly Bruce Mine Division) operated its underground copper-zinc mine near Bagdad and produced about 3,000 tons of copper and 9,500 tons of ore averaging 3.68% copper and 12.7% zinc. Reserves are estimated at 467,000 tons with an average grade of 3.72% copper and 12.4% zinc, equivalent to about 5 years of operation. Exploration in progress will continue into 1974 in the search for additional reserves.

The Cyprus Johnson Co. (formerly Johnson Camp Division) was developing an oxide-copper ore deposit near Johnson, with production scheduled for early 1975 at a rate of 4,000 tons of ore per day. The proven reserve consists of 14.7 million tons of ore averaging 0.80% total copper content. The open pit mining operation will have a stripping ratio of about 1.6 to 1. Ore will be placed in leach dumps and copper recovered from leach solutions by a solvent extraction-electrowinning process. Project costs are estimated at $6 million, and the known reserves are sufficient for about 10 years of operation.

Cyprus Metallurgical Processes Corp. (90% owned by Cyprus Corp.) had a 25-ton-per-day demonstration plant under construction near Tucson to test applicability of a new copper recovery process termed

the Cymet process. The facilities are to be completed in 1974, and initial tests will be on ore from the Bagdad mine. The process uses ferric chloride and hydrochloric acid as solvents, followed by selective precipitation, filtration, and electrolysis steps to recover copper, gold, silver, iron, sulfur, and other byproducts. Although the focus is on copper ore, the process has potential for other ores such as lead and zinc.

The American Smelting and Refining Company (Asarco) operated three copper mines in the vicinity of Tucson with a total output of 73,100 tons of copper. Production at the Mission unit was 46,600 tons of copper in concentrates, compared with 45,000 tons in 1972. At the Silver Bell unit production increased slightly to 23,800 tons of copper in concentrates and precipitates. Production at the San Xavier mine, as copper-bearing flux ore for use at Asarco's Hayden smelter and as precipitates from a new leach plant completed in May, totaled 2,700 tons of copper. The new leach plant cost $12 million and has a design capacity to treat 4,000 tons per day of oxide ore that will yield approximately 12,000 tons of copper in precipitates per year.

Asarco installed an anode casting plant at its Hayden smelter to eliminate blister copper cakes previously remelted and cast into anodes at a refiner, thus improving overall efficiency. A 1,000-foot smelter stack, the tallest in the country, was completed, and when it becomes operational in 1974 the ambient air quality will be improved by better dispersion of the weak sulfur dioxide gases that cannot be handled by the acid plant. A "closed loop" sulfur dioxide monitoring system is under construction; this system will provide data on the sulfur dioxide content at selected points of measurement, and if projected conditions indicate a sulfur dioxide level that could exceed allowable limits, smelting can be curtailed to control the emissions.

Construction work continued at Asarco's Sacaton $40 million mine and mill project near Casa Grande. Initial production, scheduled for early 1974, will be by open pit from a relatively shallow ore body which lies beneath 80 to 100 feet of overburden and contains reserves of 34 million tons of ore averaging 0.76% copper. A deeper ore body, about 1,900 feet beneath the surface, will be mined by an underground block caving method with output expected to begin in 1979. Rated mill capacity is 9,000 tons of ore per day, or 21,000 tons of copper in concentrates per year.

Duval Corp., a subsidiary of Pennzoil Co., operated its Esperanza, Mineral Park, and Sierrita copper-molybdenum mines south of Tucson. The largest of the mines, Sierrita, produced 75,600 tons of copper in concentrates from mining 30.6 million tons of ore. In December a new high average throughput rate of 89,000 tons of ore per day was achieved.

Operations resumed at Esperanza early in 1973 following a 1-year shutdown to reduce the copper concentrate inventory accumulated during a smelter strike. Plant modifications initiated during the shutdown made possible a 25% increase in throughput in 1973.

As a result of pilot plant test work, Duval will build a commercial prototype processing plant using its CLEAR (copper leach electrolosis and regeneration) hydrometallurgical process. The plant will cost $2.6 million and is designed to produce 32,500 tons per year of precipitate copper from Sierrita concentrate.

The Inspiration Consolidated Copper Co. operated open pit copper mines in the vicinity of Inspiration, Ariz.; 16.5 million tons of waste and 8.5 million tons of ore were mined for a combined record high 25 million tons of material handled. Approximately 6.7 million tons of the ore was treated in the concentrator with about 46% of the concentrator feed first processed in leaching tanks to recover acid soluble copper. The combined production was 43,134 tons of copper. Heap leaching of ore too low in copper content for in-plant treatment yielded an additional 8,198 tons of copper. In January, mining of the upper Ox Hide pit was almost completed and mining of the lower Ox Hide pit began. Copper production from the Ox Hide pits was 4,356 tons, a slight reduction from the previous year, but the rate of production was increasing at yearend. At the Christmas open pit mine, southeast of Miami, Ariz., output was 9,508 tons, a 10% decline caused mostly by the lower copper content of ores treated. The ratio of waste removed per ton of ore mined rose from 4.94 to 5.77. Total mine production from all operating mines was 65,196 tons of copper.

The company essentially completed a

$54 million construction program to replace much of its existing smelter at Miami, Ariz., and the facilities should become operational in 1974. The program replaced the reverberatory furnace with an electric furnace and the horizontal rotary converters with siphon-type converters, and it provides new sulfuric acid production facilities.

Anamax Mining Co., formed January 1 as a joint venture of The Anaconda Company and American Metal Climax, Inc., operated the Twin Buttes open pit mine and produced 73,648 tons of copper in concentrates compared with 66,486 tons in 1972. A $200 million expansion program, including open pit expansion, an enlargement of the concentrator, and a leach-electrowinning plant for oxide ore, will increase annual capacity from 75,000 to 130,000 tons of copper, with completion expected in 1975. The development involves new transportation and crushing equipment for the mine and an increase in the capacity of the concentrator from 30,000 to 40,000 tons of sulfide ore per day. Over 20 million tons of oxide ore, stockpiled during removal of overburden above the sulfide ore, will provide 10,000 tons per day of feed for the vat-leach-electrowinning operation to produce 30,000 tons of cathode copper per year. Sulfuric acid for the leaching will be obtained from the acid plant under construction at the San Manuel smelter of Magma Copper Co.

Cities Service Co. operated its open pit Copper Cities mines and produced 24,100 tons of copper in concentrates from mining 5.2 million tons of ore and by recovery of precipitate copper from waste dump-leach solutions. In addition, a quantity of precipitate copper was recovered from the block caving operations of the Miami mine closed in 1959. Development of the 350-million-ton, low-grade Pinto Valley copper ore body, 8 miles east of Miami, was in progress, with initial output scheduled for mid-1974. Approximately 38 million tons of overburden in preparation for mining has been removed, and a total of 60 million tons of preproduction stripping will be required to fully develop the mine. Capacity of the concentrator will be 40,000 tons of ore per day, with 20,000 tons to be achieved by July 1974 and the remainder by November 1974.

Development of Cities Service's Miami East ore body continued; production was to start in 1975 and to reach 2,000 tons per day by 1978. The project is based on a down-faulted segment of the original Miami-Inspiration deposit. This segment occurs at a depth of 2,500 to 3,700 feet and has an estimated ore reserve of 50 million tons grading 1.95% copper.

Hecla Mining Co. essentially completed the 7,500-foot twin 15° declines as a major accomplishment in development of its Lakeshore copper mine south of Casa Grande. Over 45,000 feet of underground openings have been driven, and other facilities were under construction for a scheduled 1975 production with a designed capacity of 69,000 tons per year of copper. Poor ground conditions in the oxide ore body necessitated changed plans for separate crushing and hoisting of the ore through a vertical shaft instead of transfer by ore passes to the sulfide crushing-conveyor belt haulage system. Design engineering for the roast-leach-electrowinning plant, the oxide vat-leach plant, the sponge iron plant, and the byproduct sulfuric acid plant was in progress. Hecla is the operator and owns 50% of the project, and El Paso Natural Gas Co. owns the other 50% interest. Estimated cost of the project has been revised upwards from $140 million to $170 million.

Ranchers Exploration and Development Co. produced a record 7,382 tons of copper cathodes by a leaching-solvent extraction-electrowinning process at its Bluebird mine near Miami, Ariz. A fourfold enlargement of production capacity which would include a change from heap to vat or agitation leaching is under consideration. The *in situ* leaching operation at the Old Reliable deposit near San Manuel, Ariz., had an initial flow of copper-bearing solutions late in 1972 and by February 1973 output stabilized at about 250 tons of copper recovered in precipitates per month.

Gold.—Gold production totaled 102,848 ounces, slightly lower than in 1972. Value, however, rose 67% as a result of a higher annual average price. Most of the gold was recovered as a byproduct from copper operations.

Iron Ore.—CF&I Steel Corp. mined and shipped ore from the Apache pit in Navajo County to the company steel plant in Pueblo, Colo.

Lead.—Production of lead decreased from 1,763 tons in 1972 to 763 tons in 1973; value fell 53% from that in 1972. All of

the lead output was as a byproduct from copper mines.

Molybdenum.—Molybdenum production rose 38% to 37.7 million pounds in 1973 (27.2 million pounds in 1972). All output was a byproduct of copper mining at 11 concentrators having molybdenum circuits. The Silver Bell unit was closed in July 1972. Increased output was recorded at virtually all plants, and production was resumed at Esperanza.

Silver.—Production of silver was 7.2 million ounces, an 8% increase over 1972. Value rose 64% as the average annual price rose to $2.558 per troy ounce from $1.685 per troy ounce in 1972. Most of the silver was recovered as a byproduct of copper mining.

Zinc.—Zinc production declined 17% from 10,111 tons in 1972 to 8,427 tons in 1973. Most of the output was from copper-zinc ore at the Bruce mine.

NONMETALS

Asbestos.—Production of chrysotile asbestos in 1973 was 27% less than that in 1972; value of output, however, rose 12%. Jaquays Mining Corp., operating an underground mine in Gila County, accounted for the total production.

Cement.—Shipments of portland cement increased 8% over those in 1972, but shipments of masonry cement were slightly less in 1973 than in 1972. Types of portland cement shipped were general use and moderate heat (Types I and II), high-early-strength (Type III), and high-sulfur-resistant (Type V). Portland cement consumption totaled 1,709,000 tons, of which 71% was used in ready-mix concrete plants, 9% was used in concrete product manufacturing, 9% was sold to building material dealers, and 11% went to contractors and other miscellaneous customers.

Arizona Portland Cement Co., following completion of an expansion program at its Rillito plant in 1972, announced plans for improvements and construction of additional finish-grinding facilities for 1973. These additions will increase capacity at the plant, located 20 miles from Tucson, from 800,000 to 1 million tons of cement annually.

Clays.—Production of common clay, shale, and bentonite totaled 117,308 tons valued at $458,924. Producers of clay for brickmaking were Phoenix Brick Yard and Wallapai Brick and Clay Products, Inc., Maricopa County; and Phoenix Brick Yard and Tucson Pressed Brick Corp., Pima County. Bentonite was mined by the Filtrol Corp. and McCarrell & Gurley Corp,. Apache County. Kaolin was mined by McKusick Mosaic Co., Gila County, and fire clay was produced by Magma Copper Co., Pinal County.

Feldspar.—Arizona Feldspar Corp. mined and ground feldspar from the Taylor mine near Kingman, Mohave County, for use in glass and pottery manufacture. Production and value rose substantially over those in 1972.

Fluorspar.—All production of fluorspar, substantially below that in 1972, came from the flotation plant of Tonto Basin Mining Co.

Gem Stones.—The estimated value of collected gem stones was $170,000, compared with $168,000 in 1972. Gem stones collected include agate, petrified wood, turquoise, chrysocolla, and obsidian.

Gypsum.—A record output of 157,600 tons of gypsum was mined in 1973. All production came from mines in Pinal and Yavapai Counties. The National Gypsum Co. mined gypsum near Winkelman and produced calcine at its Phoenix plant. Superior Companies mined gypsum near Camp Verde and near Winkelman for use as a cement retarder. Pinal Mammoth Gypsum Co. operated the Thunderbird mine near Coolidge and produced gypsum for agricultural use. Fifty percent of the output was used for cement additive, 43% was calcined, and 7% was used for soil conditioning. Output of calcined gypsum increased 12%.

Lime.—Eight companies produced lime at eight plants in seven counties. Leading counties were Cochise, Greenlee, and Gila. Leading producers were Paul Lime Plant Inc., Phelps Dodge Corp., and Santa Rita Mining Co. Output increased 3% to a record 364,700 tons. The lime was used for copper ore concentration, sugar refining, open-hearth steel furnaces, and other uses. The lime was consumed in Arizona, New Mexico, California, Texas, and Mexico. Total lime consumption in Arizona was 319,600 tons.

The Flintkote Co. announced plans for a $10 million lime plant at Nelson, near Peach Springs, on the edge of the Hualapai Indian Reservation. The plant, which is expected to come on stream in 1974, will

have a capacity for calcining 800 tons of lime per day, replacing an 80-ton-per-day facility. The new plant will be situated on the site of an exceptionally pure high-calcium limestone deposit expected to last more than 100 years.

Mica.—Scrap and flake mica was produced from the Buckeye mine in Maricopa County and the San Antonio mine in Pima County. Ground mica from the Buckeye mine was used in roofing, well drilling, and paint.

Perlite.—Crude perlite was produced by Filters International, Inc., and Harborlite Corp. from open pit operations near Superior, Pinal County. Output fell 20% in quantity and 17% in value. Expanded perlite was not produced in 1973.

Pumice and Pumicite.—Eleven companies, the Arizona Highway Department, and the Coconino County Highway Department produced a total of 851,900 tons of volcanic cinder valued at $713,553 and 688 tons of pumice valued at $1,100 in 1973. Total output decreased 7% in quantity and 1% in value from those in 1972. Of the total output, 43% was used for railroad ballast, 41% for concrete aggregate and other uses, and 16% for road construction.

Pyrite.—A small quantity of pyrite, produced as a byproduct at the Magma Copper Co. concentrator at Superior, was sold to Ray Mines Div. as supplemental feed for sulfuric acid manufacture.

Sand and Gravel.—Sand and gravel sold or used increased 10% in quantity and 19% in value to 27.4 million tons valued at $38.5 million. Output was reported from 153 operations. Of the total quantity, 7.9 million tons valued at $12.6 million was classed as sand and 19.5 million tons valued at $25.9 million as gravel.

Sales from commercial pits totaled 7.3 million tons of sand valued at $11.7 million and 17.4 million tons of gravel valued at $21.3 million. Government-and-contractor output consisted of 0.7 million tons of sand valued at $0.9 million and 2.1 million tons of gravel valued at $4.6 million.

Of the total consumed, building accounted for 50%, paving 36%, fill 10%, and all other 4%. Sand and gravel was produced and used in all 14 counties. Maricopa County produced 64% of the State output and Pima County 10%.

Table 12.—Arizona: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Apache	3	53	138	4	W	218
Cochise	12	806	1,489	13	430	1,063
Coconino	1	76	202	3	306	750
Gila	6	160	553	10	424	1,024
Graham	5	116	283	5	171	189
Maricopa	32	15,675	18,198	34	17,503	20,385
Mohave	8	764	1,774	9	1,551	2,657
Navajo	9	787	933	8	686	1,345
Pima	26	2,704	4,773	26	2,856	4,832
Pinal	8	875	1,408	10	1,100	1,841
Santa Cruz	3	W	W	4	114	256
Yavapai	14	644	970	13	1,158	2,679
Yuma	9	W	1,194	8	490	629
Undistributed [1]	6	2,182	505	6	649	635
Total [2]	142	24,842	32,420	153	27,440	38,503

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes Greenlee and some sand and gravel that cannot be assigned to any specific counties.
[2] Data may not add to totals shown because of independent rounding.

Table 13.—Arizona: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	4,159	6,880	4,695	8,069
Fill	579	655	654	418
Fire and furnace	191	696	210	769
Paving	1,632	2,100	1,571	2,029
Other uses [1]	178	509	126	383
Total [2]	6,738	10,839	7,254	11,667
Gravel:				
Building	7,325	8,610	8,849	9,918
Fill	956	780	2,086	2,099
Paving	7,269	8,050	5,724	8,049
Miscellaneous	119	313	173	346
Other uses [3]	211	538	524	951
Total [2]	15,881	18,292	17,356	21,362
Government-and-contractor operations:				
Sand:				
Building	19	26	(4)	(4)
Fill	57	13	35	11
Paving	564	752	645	884
Total [2]	641	791	680	895
Gravel:				
Building	35	48	58	55
Fill	231	66	99	104
Paving	1,316	2,385	1,993	4,420
Total [2]	1,583	2,499	2,150	4,579
Total sand and gravel [2]	24,842	32,420	27,440	38,503

[1] Includes railroad ballast, blast, filtration, oil (hydrafrac), and other unground sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast and other uses.
[4] Less than ½ unit.

Stone.—Production of stone totaled 4.3 million tons, 8% less than the 4.6 million tons produced in 1972. Value of output rose 18% as the average value increased from $1.73 per ton in 1972 to $2.22 per ton in 1973. Limestone, quartz, quartzite, traprock, marble, sandstone, and other stone were mined and marketed as crushed and broken stone. Sandstone, marble, quartzite, and other stone were sold as dimension stone. Uses of crushed and broken stone included cement, smelter flux, lime, road base, terrazzo, acid neutralizer, concrete aggregate, and bituminous road-mix aggregate. Dimension stone was principally used for rough blocks and stone, dressed architectural stone, and flagging.

Table 14.—Arizona: Stone sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value
Apache	1	10	39	--	--	--
Cochise	11	1,509	2,397	5	W	W
Coconino	11	W	W	14	25	83
Gila	3	W	W	4	265	814
Graham	3	44	95	3	89	215
Maricopa	7	W	142	4	W	W
Navajo	1	W	10	1	W	8
Pima	9	W	2,472	10	W	2,500
Santa Cruz	1	55	W	1	48	W
Yavapai	8	W	W	12	1,119	1,888
Yuma	1	6	W	1	W	W
Undistributed [1]	9	3,012	2,862	11	2,719	3,962
Total [2]	65	4,638	8,018	66	4,265	9,469

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes Greenlee, Mohave and Pinal Counties.
[2] Data may not add to totals shown because of independent rounding.

Table 15.—Arizona: Stone sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Kind of stone	1972		1973	
	Quantity	Value	Quantity	Value
Dimension [1]	7	167	6	128
Crushed and broken:				
Limestone	2,397	3,594	2,310	4,045
Granite	W	W	43	77
Sandstone, quartz, and quartzite	556	1,440	1,026	3,183
Traprock	613	W	W	W
Other stone [2]	1,064	2,816	879	2,037
Total [3]	4,630	7,850	4,259	9,341
Grand total [3]	4,638	8,018	4,265	9,469

W Withheld to avoid disclosing individual company confidential data; included with "Other stone."
[1] Includes marble, sandstone, quartz, and other stone.
[2] Include data for marble.
[3] Data may not add to totals shown because of independent rounding.

Table 16.—Arizona: Stone sold or used by producers, by use
(Thousand short tons and thousand dollars unless otherwise specified)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension:				
Rough blocks	4	83	W	W
Irregular-shaped stone	(1)	3	W	W
Rubble	W	W	2	W
Flagging	W	W	1	33
Dressed architectural - thousand cubic feet	12	23	W	W
Other uses [2]	3	57	3	95
Total (thousand short tons)	7	167	6	128
Crushed and broken:				
Bituminous aggregate [3]	398	597	384	981
Concrete aggregate	135	348	224	540
Dense graded road base stone	958	1,115	441	707
Surface treatment aggregate	52	107	73	199
Lime manufacture	677	1,459	263	517
Flux stone	685	1,781	901	2,369
Riprap and jetty stone	4	W	265	W
Manufactured fine aggregate (stone sand)	89	W	109	W
Refractory stone	10	W	7	W
Filter stone	W	W	82	246
Other uses [4]	1,624	2,443	1,511	3,781
Total [5]	4,630	7,850	4,259	9,341
Grand total [5]	4,638	8,018	4,265	9,469

W Withheld to avoid disclosing individual company confidential data; included in "Other uses."
[1] Less than ½ unit.
[2] Includes data for uses not specified.
[3] Data includes macadam (1972) and unspecified aggregates.
[4] Includes stone used for agricultural purposes, terrazzo, cement manufacture, acid neutralization, and other uses not specified.
[5] Data may not add to totals shown because of independent rounding.

Vermiculite.—Ari-Zonolite Co. exfoliated vermiculite, received from out of State, at its mill in Phoenix. The product was used mainly for block insulation, concrete aggregate, and acoustical and fire proofing.

MINERAL FUELS

Coal (Bituminous).—Production of coal, all from the Peabody Coal Co. Black Mesa No. 1 mine, increased in both quantity and value in 1973. Development continued on the Kayenta open pit mine, located near the Black Mesa on Navajo Indian lands in Navajo County. Production was scheduled to begin in 1974 at an annual capacity of 8 million tons. Coal from the Kayenta operation will go by unit train to the Navajo powerplant near Page.

Construction continued on the Navajo powerplant, which will be operational in 1974. The electric railroad system for the unit trains was completed in mid-1973; regular runs were scheduled to begin when the powerplant goes on stream.

Helium.—Output of helium, all from Apache County, dropped 26% from that in 1972. Kerr-McGee Corp.'s Pinto Dome field and Western Helium Corp.'s Navajo field accounted for the total production.

Natural Gas.—Output of marketed natural gas decreased 72% in quantity and 71% in value in 1973, continuing the downward trend since 1970. All production was from Apache County. Universal Resources Corp. completed a gas extension on a Navajo lease for 1.3 million cubic feet of gas per day. American Fuels Corp. completed a well in the Black Rock field for 190,000 cubic feet of gas and 11 barrels of oil per day.[3]

Petroleum.—Production of petroleum totaled 804,000 barrels valued at $3 million, 19% and 4% less than the 1972 figures. Exxon Corp. completed its exploration program on leases in southern Arizona and began to relinquish its lease position in the area. In Yuma County, Exxon abandoned drilling a wildcat at a total depth of 11,444 feet. This footage exceeded the previous record of 10,179 feet established by Exxon in 1972.[4]

[3] Petroleum Information Corp. Resume Oil and Gas Operations in the Mid-Continent, Rocky Mountain and Northeast Regions. Denver, Colo., 1973, p. RM–28.
[4] Page RM–4 of work cited in footnote 3.

Table 17.—Arizona: Oil and gas well drilling in 1973, by county

County	Proved field wells [1]			Exploratory			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Apache	--	--	4	--	1	2	7	19,061
Gila	--	--	--	--	--	1	1	2,104
Total	--	--	4	--	1	3	8	21,165

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 18.—Principal producers

Commodity and company	Address	Type of activity	County
Asbestos: Jaquays Mining Corp	1219 South 19th Ave. Phoenix, Ariz. 85009	Underground mine and crushing, screening, air-separation plant.	Gila.
Cement:			
Amcord, Inc., Phoenix Cement Co.	610 Newport Center Drive Newport Beach, Calif. 92660	Dry process, 3 rotary-kiln plants.	Yavapai.
Arizona Portland Cement Co., a Div. of California Portland Cement Co.	800 Wilshire Blvd. Los Angeles, Calif. 90017	---- do ----	Pima.
Clays:			
American Cement Corp., Phoenix Div.	2404 Wilshire Blvd. Los Angeles, Calif. 90057	Open pit mine ----	Yavapai.
Filtrol Corp ----	5959 West Century Blvd. Suite 918 Los Angeles, Calif. 90045	---- do ----	Apache.
McCarrell & Gurley Corp ---	Box 1377 Gallup, N. Mex. 87301	---- do ----	Do.
Phoenix Brick Yard ----	1814 South 7th Ave. Phoenix, Ariz. 85007	---- do ----	Maricopa.
Tucson Pressed Brick Corp -	Box 17176 Tucson, Ariz. 85710	---- do ----	Pima.
		---- do ----	Do.
Coal: Peabody Coal Co ----	P.O. Box 605 Kayenta, Ariz. 86033	---- do ----	Navajo.
Copper:			
American Smelting and Refining Co.:			
Mission unit ----	Box 111 Sahuarita, Ariz. 85629	Open pit mine and mill.	Pima.
San Xavier unit ----	---- do ----	Open pit mine ----	Do.
Silver Bell unit ----	Silver Bell, Ariz. 85270 ---	Open pit mine, mill, leach dumps, precipitation plant.	Do.
Cities Service Co., Miami Copper Co. Div.	Box 100 Miami, Ariz. 85539	Open pit mine, mill, leach dumps, in place leaching, precipitation plants.	Gila.
Duval Corp:			
Esperanza property ---	Box 125 Sahuarita, Ariz. 85629	Open pit mine, mill, leach dumps, precipitation plant.	Pima.
Mineral Park property -	Box 1271 Kingman, Ariz. 86401	---- do ----	Mohave.
Duval Sierrita Corp ----	Box 125 Sahuarita, Ariz. 85629	Open pit mine and mill	Pima.
Inspiration Consolidated Copper Co.	Inspiration, Ariz. 85537 ---	Open pit mine, mill vat leaching plant, electrowinning plant, in place leaching, heap leaching, precipitation plant, rod plant rolling mill, custom smelter, electrolytic refinery.	Gila.

Table 18.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Copper—Continued			
Kennecott Copper Corp., Ray Mines Div.	Hayden, Ariz. 85235	Open pit mine, leach dumps, in place leaching, precipitation plant.	Pinal.
		Mill, vat leaching plant, electrowinning plant, smelter.	Gila.
Magma Copper Co.:			
San Manuel Div	Box M San Manuel, Ariz. 85631	Underground mine, mill, smelter, refinery.	Pinal.
Magma Div	Box 37 Superior, Ariz. 85273	Underground mine and mill.	Do.
Phelps Dodge Corp.:			
Copper Queen Branch	Drawer K Bisbee, Ariz. 85603	Open pit mine, underground mine, mill, leach dumps, in place leaching, precipitation plant.	Cochise.
Landover Pit	Bisbee, Ariz. 85603	Custom smelter	Do.
Morenci Branch	Morenci, Ariz. 85540	Open pit mine, mill, leach dumps, precipitation plant, smelter.	Greenlee.
New Cornelia Branch	Drawer 9 Ajo, Ariz. 85321	Open pit mine, mill, smelter.	Pima.
Pima Mining Co	Box 7187 Tucson, Ariz. 85713	Open pit mine and mill	Do.
Diatomite: Superior Companies	Box 6497 Phoenix, Ariz. 85005	Open pit mine and plant.	Pinal.
Feldspar: International Minerals & Chemical Corp., Industrial Minerals Division.	Box 229 Kingman, Ariz. 86401	---- do	Mohave.
Gold:			
Magma Copper Co.:			
San Manuel Div	Box M San Manuel, Ariz. 85631	*See* Copper	Pinal.
Magma Div	Box 37 Superior, Ariz. 85273	---- do	Do.
Phelps Dodge Corp.:			
Copper Queen Branch	Drawer K Bisbee, Ariz. 85603	---- do	Cochise.
Morenci Branch	Morenci, Ariz. 85540	---- do	Greenlee.
New Cornelia Branch	Drawer 9 Ajo, Ariz. 85321	---- do	Pima.
Gypsum:			
Superior Companies:			
Verde Division	Box 6497 Phoenix, Ariz. 85005	Open pit mine and plant.	Yavapai.
Winkelman Division	---- do	---- do	Pinal.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	---- do	Maricopa and Pinal.
Helium:			
Kerr-McGee Corp., Gas Processing Department.	Kerr-McGee Bldg. Oklahoma City, Okla. 73102	6 wells and plant; Pinta Dome field.	Apache.
Iron ore: CF&I Steel Corp	Box 316 Pueblo, Colo. 81002	Open pit mine	Navajo.
Lime:			
Paul Lime Plant, Inc	Douglas, Ariz. 85607	5 rotary-kiln plants	Cochise.
Phelps Dodge Corp., Morenci Branch.	Morenci, Ariz. 85540	1 rotary-kiln, 1 fluidized-bed-kiln plant.	Greenlee.
Mica: San Antonio Mica Co	Box 397 Ajo, Ariz. 85321	Open pit mine	Pima.
Molybdenum:			
American Smelting and Refining Co.:			
Mission Unit	120 Broadway New York, N.Y. 10005	*See* Copper	Do.
Silver Bell Unit	---- do	---- do	Do.
The Anaconda Company	Box 127 Sahuarita, Ariz. 85629	---- do	Do.
Cities Service Co., Miami Copper Co. Div.	Box 100 Miami, Ariz. 85539	---- do	Gila.
Cyprus Bagdad Copper Corp	Box 245 Bagdad, Ariz. 86321	---- do	Yavapai.
Duval Corp.:			
Esperanza property	Box 125 Sahuarita, Ariz. 85629	---- do	Pima.
Mineral Park property	Box 1271 Kingman, Ariz. 86401	---- do	Mohave.
Duval Sierrita Corp	Box 125 Sahuarita, Ariz. 85629	Open pit mine and mill roaster.	Pima.

Table 18.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Molybdenum—Continued			
Inspiration Consolidated Copper Co.	Inspiration, Ariz. 85537	*See* Copper	Gila.
Kennecott Copper Corp., Ray Mines Div.	Hayden, Ariz. 85235	do	Pinal.
Magma Copper Co., San Manuel Div.	Box M San Manuel, Ariz. 85631	do	Do.
Pima Mining Co	Box 7187 Tucson, Ariz. 85713	do	Pima.
Perlite:			
Filters International Inc	10 South La Salle St. Chicago, Ill. 60603	Open pit mine	Pinal.
Harborlite Corp	Box 458 Escondido, Calif. 92025	do	Do.
Petroleum: Kerr-McGee Corp	Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Crude oil; Dineh bi Keyah field.	Apache.
Pumice:			
Apache County Highway Department.	Box 428 St. Johns, Ariz. 85936	Open pit mine	Do.
Atchison Topeka & Santa Fe Railway.	Winslow, Ariz. 86047	Open pit mine and plant.	Coconino.
Superlite Builders Supply, Inc.	5201 North 7th St. Phoenix, Ariz. 85014	Open pit mine	Do.
Pyrites: Magma Copper Co., Superior Div.	Box 37 Superior, Ariz. 85273	*See* Copper	Pinal.
Sand and gravel (commercial):			
Arizona Sand & Rock Co	Box 20067 Phoenix, Ariz. 85036	Pits and plants	Maricopa.
Johnson-Stewart and Materials.	1901 North Alma School Rd. Mesa, Ariz. 85201	do	Do.
Tempe Equipment & Contracting Co.	8200 East Pima St. Tempe, Ariz. 85281	do	Do.
Union Rock & Materials Corp., Bentson Contracting Co.	2800 South Central Ave. Phoenix, Ariz. 85040	do	Maricopa and Pima.
United Metro Materials & Concrete Co., Inc.	Box 13309 Phoenix, Ariz. 85002	do	Maricopa, Pima, Pinal, Yuma.
Silver:			
American Smelting and Refining Co.:			
Mission unit	Box 111 Sahuarita, Ariz. 85629	*See* Copper	Pima.
San Xavier unit	do	do	Do.
Silver Bell unit	Silver Bell, Ariz. 85270	Open pit mine and mill	Do.
Anamax Mining Co	Box 127 Sahuarita, Ariz. 85629	*See* Copper	Do.
Duval Corp.:			
Esperanza property	Box 125 Sahuarita, Ariz. 85629	do	Do.
Mineral Park property	Box 1271 Kingman, Ariz. 86401	do	Mohave.
Duval Sierrita Corp	Box 125 Sahuarita, Ariz. 85629	do	Pima.
Magma Copper Co.:			
San Manuel Div	Box M San Manuel, Ariz. 85631	do	Do.
Magma Div	Box 37 Superior, Ariz. 85273	do	Do.
Phelps Dodge Corp.:			
Copper Queen Branch	Drawer K Bisbee, Ariz. 85603	do	Cochise.
Morenci Branch	Morenci, Ariz. 85540	do	Greenlee.
New Cornelia Branch	Drawer 9 Ajo, Ariz. 85321	do	Pima.
Pima Mining Co	Box 7187 Tucson, Ariz. 85713	do	Do.
Stone:			
American Cement Corp., Phoenix Div.	P.O. Box 428 Clarkdale, Ariz. 86324	Quarry and plant	Yavapai.
Arizona Portland Cement Co.	Rillito, Ariz. 85246	do	Pima.
New Pueblo Constructors	P.O. Box 12765 Tucson, Ariz. 85711	Quarry	Do.
Paul Lime Plant, Inc	Drawer T Douglas, Ariz. 85607	Quarry and plant	Cochise.
Zinc: Cyprus Mines Corp., Bruce Mine Div.	Box 457 Bagdad, Ariz. 86321	*See* Copper	Yavapai.

The Mineral Industry of Arkansas

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Arkansas Geological Commission, under a memorandum of understanding for collecting information on all minerals except fuels.

By Grace N. Broderick [1]

The value of mineral production in Arkansas in 1973, $273.7 million, showed a 13.5% increase over 1972, and was 11.1% over the previous record high of $246.3 million set in 1971. Nonmetallic minerals accounted for the major part of the total mineral value; mineral fuels comprised 39.4%; metals accounted for the remainder. Nationwide, Arkansas led in the production of bauxite, bromine, and vanadium. Petroleum remained the leading commodity in mineral value accounting for $70.6 million.

Among the nonmetallic mineral commodities, bromine ranked first in value, followed by cement, stone, and sand and gravel. Arkansas continued to rank third in the Nation in barite production. With the closing of Dresser Minerals Division of Dresser Industries, Inc.'s barite mine at Magnet Cove, only Baroid Division of NL Industries, Inc., continued to produce crude barite in Arkansas. Other nonmetallic minerals produced were abrasive stone, clays (including kaolin), gem stones, gypsum, lime, soapstone, and tripoli.

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Mineral production in Arkansas [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Bauxite ____ thousand long tons __	1,634	$21,010	1,686	$23,884
Clays [2] ____ thousand short tons __	885	990	1,446	1,412
Coal ____ do ____	428	4,676	434	5,806
Gem stones ____	NA	32	NA	50
Lime ____ thousand short tons __	150	2,456	177	2,742
Natural gas ____ million cubic feet __	166,522	28,808	157,529	28,985
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels __	261	854	204	861
LP gases ____ do ____	546	1,420	449	1,688
Petroleum (crude) ____ do ____	18,519	58,335	18,016	70,618
Sand and gravel ____ thousand short tons __	11,574	16,558	12,465	20,625
Stone ____ do ____	16,317	25,020	16,223	26,209
Value of items that cannot be disclosed:				
Abrasive stone, barite, bromine, cement, clays (kaolin), gypsum, iron ore, soapstone, tripoli, and vanadium _	XX	81,020	XX	90,825
Total ____	XX	241,179	XX	273,705
Total 1967 constant dollars ____	XX	198,997	XX	[p] 200,954

[p] Preliminary. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes kaolin; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Arkansas, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Arkansas	$2	$1	Sand and gravel.
Ashley	188	W	Do.
Baxter	581	W	Stone, sand and gravel.
Benton	W	W	Do.
Boone	537	W	Do.
Bradley	W	W	Sand and gravel.
Calhoun	968	1,306	Do.
Carroll	W	233	Do.
Chicot	--	W	Do.
Clark	W	475	Stone, sand and gravel, clays.
Clay	224	183	Sand and gravel.
Cleburne	221	W	Stone, sand and gravel.
Cleveland	7	3	Sand and gravel.
Columbia	42,476	30,183	Bromine, natural gas liquids, sand and gravel.
Conway	W	591	Stone, sand and gravel.
Craighead	W	W	Sand and gravel, clays, stone.
Crawford	W	W	Stone, sand and gravel.
Crittenden	W	W	Clays, sand and gravel.
Cross	254	419	Sand and gravel.
Dallas	22	6	Do.
Desha	W	W	Do.
Drew	99	170	Do.
Faulkner	W	2	Do.
Franklin	8,895	1,130	Coal, sand and gravel, stone.
Fulton	187	2	Stone.
Garland	W	10,456	Vanadium, abrasive stone, tripoli, sand and gravel.
Grant	W	139	Sand and gravel.
Greene	105	174	Do.
Hempstead	W	W	Sand and gravel, clays.
Hot Spring	5,134	5,077	Barite, sand and gravel, clays, stone.
Howard	9,275	11,429	Cement, stone, gypsum, clays, sand and gravel.
Independence	3,081	3,305	Stone, lime, sand and gravel.
Izard	2,105	2,242	Sand and gravel, stone.
Jackson	W	W	Sand and gravel.
Jefferson	432	W	Sand and gravel, stone.
Johnson	5,453	W	Coal, clays, stone, sand and gravel.
Lafayette	15,259	1,973	Natural gas liquids, sand and gravel.
Lawrence	W	904	Stone, sand and gravel.
Lee	--	8	Sand and gravel.
Lincoln	269	W	Do.
Little River	W	20,936	Cement, stone, sand and gravel, clays.
Logan	W	W	Coal, stone.
Lonoke	W	W	Clays, stone, sand and gravel.
Madison	W	W	Stone, sand and gravel.
Marion	W	W	Sand and gravel.
Miller	13,975	W	Sand and gravel, clays, stone.
Mississippi	34	14	Sand and gravel.
Monroe	(2)	W	Do.
Montgomery	W	W	Stone.
Nevada	W	W	Iron ore, sand and gravel.
Newton	(2)	65	Gypsum, stone, sand and gravel.
Ouachita	8,769	W	Sand and gravel, clays.
Perry	W	80	Stone, sand and gravel.
Phillips	W	W	Sand and gravel.
Pike	814	610	Gypsum, stone, sand and gravel.
Poinsett	347	W	Sand and gravel.
Polk	W	W	Do.
Pope	W	W	Stone, sand and gravel.
Prairie	26	(2)	Sand and gravel.
Pulaski	11,335	12,235	Stone, sand and gravel, clays, bauxite.
Randolph	45	54	Stone, sand and gravel.
St. Francis	W	W	Sand and gravel.
Saline	22,789	26,418	Bauxite, lime, sand and gravel, stone, soapstone, clays.
Scott	207	25	Sand and gravel.
Searcy	153	91	Stone, sand and gravel.
Sebastian	6,066	W	Coal, stone, sand and gravel, clays.
Sevier	W	W	Sand and gravel.
Sharp	67	W	Stone, sand and gravel.
Stone	W	W	Do.
Union	31,389	W	Bromine, sand and gravel.
Van Buren	W	W	Stone.

See footnotes at end of table.

Table 2.—Value of mineral production in Arkansas, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Washington	W	W	Stone, sand and gravel.
White	W	W	Do.
Woodruff	$1	(2)	Sand and gravel.
Yell	22	W	Do.
Undistributed [3]	49,360	$142,765	
Total [4]	241,179	273,705	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Excludes value of petroleum and natural gas by county.
[2] Less than ½ unit.
[3] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.
[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Arkansas business activity

		1972	1973 [p]	Change, percent
Annual labor force and employment:				
Total labor force	thousands	784.4	820.0	+4.5
Unemployment	do	36.1	33.6	−6.9
Nonagricultural employment:				
Mining	do	4.4	4.2	−4.5
Contract construction	do	30.9	33.6	+8.7
Manufacturing	do	184.7	200.7	+8.7
Transportation and public utilities	do	35.0	36.5	+4.3
Wholesale and retail trade	do	117.8	125.5	+6.5
Finance, insurance, and real estate	do	25.7	26.9	+4.7
Services	do	78.4	82.4	+5.1
Government	do	108.5	109.7	+1.1
Personal income:				
Total	millions	$6,656	$7,496	+12.6
Per capita		$3,365	$3,680	+9.4
Construction activity:				
Nonresidential construction contracts	millions	$146.6	$117.1	−20.1
New housing units authorized		13,201	10,568	−19.9
Cement shipments to and within Arkansas	thousand short tons	903	937	+3.8
Farm marketing receipts	millions	$1,438.3	$2,434.3	+69.2
Mineral production value	do	$241.2	$273.7	+13.5

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; and the U.S. Bureau of Mines.

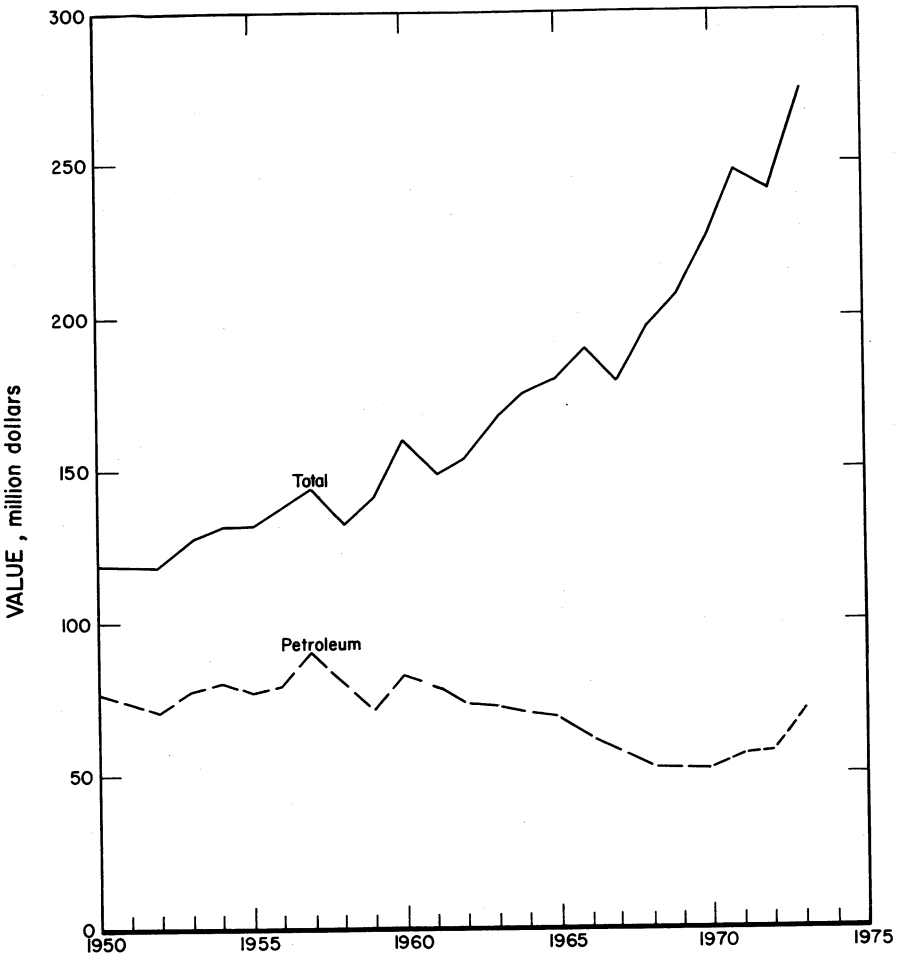


Figure 1.—Value of petroleum and total value of mineral production in Arkansas.

Bauxite continued to account for the largest part of the value of the State's metal production. A new gallium extraction and refining plant, expected to be completed by the middle of 1974, was under construction at the Aluminum Company of America's high-purity metals facility at Bauxite. The Union Carbide Corp., following procedures recommended by the U.S. Soil Conservation Service, has been successfully reclaiming spoil piles resulting from open pit mining of vanadium ore at its Wilson Springs operation. Output of vandium increased in quantity and value over that of 1972. A small amount of iron ore was produced in Nevada County.

Mineral fuels produced in Arkansas in 1973 were coal, natural gas, natural gas liquids, and petroleum. Their combined value totaled $108.0 million. Petroleum production decreased slightly from 18.5 million barrels in 1972 to 18.0 million barrels in 1973; production of marketed gas declined from 166.5 billion cubic feet in 1972 to 157.5 billion cubic feet in 1973. Production of natural gas liquids also de-

clined. Coal output increased from 427,873 to 434,379 short tons.

Arkansas Power and Light Co. planned to construct a 3.2-million kilowatt, coal-fired generating station on the Arkansas River near Redfield in Jefferson County. The facility, a four-unit system, will be the largest steam-electric generating plant in the State. Construction is expected to start in 1974 and the first unit is scheduled for operation in 1978. Plans for another coal-fired plant, with a capacity of 530,000 kilowatts, were announced in September by Southwestern Electric Power Co. (SWEPCO). The plant, to be built near Gentry on Little Flint Creek, Benton County, will be jointly owned by SWEPCO and Arkansas Electric Cooperative Corp. These plants, the first to use coal in generating electricity in Arkansas since 1927, will be fueled by coal from Wyoming.

The first unit of Arkansas Power and Light Co.'s nuclear powerplant near Russellville was not operational in 1973 but is expected to achieve commercial operation in 1974. Their second unit is scheduled for completion in late 1976.

In October 1972, the Arkansas Industrial Development Commission (AIDC) was granted the authority by the Foreign Trade Zones Board to establish the first foreign trade zone on the Arkansas River inland waterway system. The zone will be operated by the Little Rock Port Authority and will be located at the Little Rock Port terminal. Little Rock is the 12th site of a U.S. foreign trade zone. It became a customs port of entry in 1970 in connection with the opening of the Arkansas River to navigation.

Preliminary data on Arkansas River freight movements, by major commodity for 1973, released by the U.S. Corps of Engineers, showed total tonnage of waterborne commerce on the Arkansas River Navigation System to be 5.1 million tons. The tonnages reported were as follows:

Commodity	*Tons*
Bauxite	341,200
Iron and steel	292,029
Sodium hydroxide	116,600
Chemical fertilizer	160,485
Other chemicals	45,690
Petroleum products	789,404
Coal	310,510
Sand and gravel	2,141,812
Rock	620,280
Soybeans	165,438
Other grains	72,127
Miscellaneous	176,784
Total	5,132,359

Tonnage of material entering and leaving the Port of Pine Bluff increased more than 30% in 1973 to 826,427 tons despite heavy rains that forced periodic halts of barge traffic on the Arkansas River. Commodities handled at the port included fertilizer, steel, fuel oil, diesel fuel, vermiculite, and sand and gravel.

Plans were announced for construction of coal docking facilities on the Mississippi River at Helena and West Memphis, Ark. The coal would be brought by rail from mines in western States for transportation upriver by barge to consuming industries. The multimillion dollar facilities would handle unit train shipments, and as much as 6 million tons of coal is expected to be moved annually.

Tennessee Forging Steel Services, Inc., plans to construct a $1 million plant at Hope for the manufacture of bar joists. The firm's parent company, Tennessee Forging Steel Corp., will supply the Hope plant with steel produced at its Newport mill.

According to the Arkansas Geological Commission, areal geologic mapping was continued during the year in parts of the southern Ozarks, the Arkansas valley region, the core and frontal portions of the Ouachita Mountains, and the Gulf Coastal Plain; the new State geologic map (1:500,000 scale) neared completion. The search for economic mineral deposits continued in conjunction with surface mapping, geophysical surveys, and geochemical investigations. Both surface and subsurface investigations were being expanded to aid in the development of fossil fuel supplies.[2]

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Value of mineral fuels was $108.0 million, 39.4% of the total mineral production value. Petroleum remained the most important single mineral contributor to the State's total mineral value. Marketed production of natural gas in 1973 was

[2] State Geologists Journal. V. 25, 1973, p. 7.

157,529 million cubic feet, a decrease of 5.4% from that of the previous year, and 13.1% less than the record high of 181,351 million cubic feet established in 1970. Production of natural gas liquids declined 19.1%. Output of bituminous coal was 434,379 short tons, an increase of 1.5% over that of 1972.

Carbon Black.—Cities Service Company's Columbian Division, sole producer of carbon black in Arkansas, continued production at its El Dorado plant in Union County for the 22d consecutive year. Output increased 9.7% over that of 1972, and value increased 10.8%.

Coal (Bituminous).—Output of coal totaled 434,379 tons with a value of $5.8 million compared with 427,873 tons valued at $4.7 million in 1972. Eleven bituminous coal mines with output greater than 1,000 tons annually were operated, three more than during the previous year. Of these, 1 was underground and 10 were strip mines. Four counties contributed to the State's total output; these were, in order of tonnage and value, Sebastian, Johnson, Franklin and Logan. Prairie Coal Co., Inc.'s underground mine in Johnson County was shut down because of litigation, and contributed less than 1% of the State's total coal production in 1973. Garland Coal & Mining Co. closed and abandoned its Philpot mine in Johnson County in May.

The demonstrated coal reserves base of Arkansas on January 1, 1974, was estimated to total 665 million short tons.[3] Of this total, 402 million tons is potentially minable by underground methods and 263 million tons is potentially minable by surface methods. An evaluation by rank shows that 537 million tons is bituminous coal, 96 million tons anthracite, and 32 million tons lignite.

Table 4.—Arkansas: Bituminous coal production in Arkansas, by type of mine and county, 1973

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines			Production (thousand short tons)			Value (thousands)
	Underground	Strip	Total	Underground	Strip	Total	
Franklin	--	2	2	--	72	72	W
Johnson	1	3	4	3	167	169	$2,349
Logan	--	2	2	--	19	19	W
Sebastian	--	3	3	--	174	174	2,431
Total[1]	1	10	11	3	432	434	5,806

W Withheld to avoid disclosing individual company confidential data; included in "Totals."
[1] Data may not add to totals shown because of independent rounding.

Natural Gas.—Marketed production of natural gas decreased from 166,522 million cubic feet in 1972 to 157,529 million cubic feet in 1973. Value in 1973 was $29.0 million, a slight increase over that of the previous year.

Proved reserves of natural gas in Arkansas, according to the American Gas Association, Inc. (AGA), declined from 2,455,877 million cubic feet in 1972 to 2,269,353 million cubic feet in 1973, a decrease of 7.6%.

Natural Gas Pipelines.—Arkansas Louisiana Gas Co. completed its 298-mile pipeline project, which was undertaken to bring natural gas to Arkansas from the Anadarko Basin in western Oklahoma and the Texas Panhandle. About 200 million cubic feet of gas per day will flow through the line into Arkansas.

Natural Gas Liquids.—Output of natural gas liquids totaled 653,000 barrels valued at $2.5 million. Four gas processing plants were operating in 1973 and a fifth plant plant was in the planning stage. The four operating plants were Arkla Chemical Corp.'s Hamilton plant, Columbia County; H. A. Chapman's plant in the Walker Creek field, Columbia County; Phillips Petroleum Co.'s McKamie plant in Lafayette County; and O. B. Mobley, Jr.'s plant in the Lewisville field, Lafayette County. American Petrofina plans to construct a gas processing plant in Miller County.

[3] U.S. Bureau of Mines. Demonstrated Coal Reserves Base of the United States on January 1, 1974. Mineral Industry Survey. June 1974, 6 pp.

Table 5.—Arkansas: Gross withdrawals and disposition of natural gas
(Million cubic feet)

	Gross withdrawals [1]			Disposition			
				Marketed production [2]			
	From gas wells	From oil wells	Total	Quantity	Value (thousands)	Repressuring	Vented and wasted [3]
1969	119,230	56,105	175,335	169,257	$26,743	4,752	1,326
1970	128,241	55,409	183,650	181,351	29,560	2,073	226
1971	120,454	54,429	174,883	172,154	29,426	995	1,734
1972	125,319	43,852	169,171	166,522	28,808	..	2,649
1973	120,068	39,408	159,476	157,529	28,985	..	1,947

[1] Marketed production plus quantities used in repressuring, vented, and wasted.
[2] Comprises gas sold or consumed by producers, including losses in transmission, quantities added to storage, and increases in gas in pipelines.
[3] Includes direct waste on producing properties and residue blown to air.

Proved reserves of natural gas liquids including condensate, natural gasoline, and LP gases, according to the AGA, were 5.0 million barrels at yearend, compared with 7.8 million barrels the previous year, a decrease of 35.2%.

Petroleum.—Petroleum continued to be the most significant commodity in terms of mineral value in the State, contributing 25.8% of the total. Production of 18.0 million barrels of oil represented a slight decrease from the 1972 level. Oil production came from nine counties: Bradley, Calhoun, Columbia, Hempstead, Lafayette, Miller, Nevada, Union, and Ouachita. Reserves of recoverable crude oil, according to the American Petroleum Institute (API), were 105.6 million barrels on December 31, 1973, a decrease of 7.5 million barrels from the previous year. Walker Creek field in Columbia and Lafayette Counties was the State's leading oilfield.

Secondary recovery operations in 1973 accounted for 4,643,139 barrels of oil. During the year, the Arkansas Oil and Gas Commission approved two secondary recovery projects and one pilot project. The total number of secondary projects was 68; two projects were discontinued.

Table 6.—Arkansas: Oil and gas well drilling completions, by county, in 1973

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Ashley	--	--	--	--	--	4	4	21,745
Bradley	2	--	--	--	--	3	5	15,251
Calhoun	--	--	1	--	--	3	4	16,553
Columbia	40	1	6	1	--	10	58	378,389
Conway	--	--	1	--	--	--	1	3,390
Crawford	--	5	2	--	--	--	7	46,068
Desha	--	--	--	--	--	1	1	5,002
Franklin	--	11	3	--	--	--	14	67,502
Hempstead	--	--	1	--	--	1	2	12,158
Johnson	--	8	2	--	--	2	12	63,665
Lafayette	10	1	18	2	--	7	38	248,858
Logan	--	1	3	--	2	--	6	51,047
Madison	--	--	--	--	--	1	1	1,775
Miller	5	1	5	--	--	13	24	206,790
Nevada	5	--	7	1	--	6	19	67,556
Ouachita	8	--	11	--	--	9	28	110,848
Pope	--	3	3	--	--	--	6	28,267
Scott	--	--	--	--	--	1	1	15,472
Sebastian	--	6	2	--	--	--	8	62,323
Union	17	1	16	--	--	12	46	215,838
Total	87	38	81	4	2	73	285	1,638,497

[1] Development wells as defined by American Petroleum Institute.
Source: American Petroleum Institute.

Petroleum and Natural Gas Exploration and Development.—Total number of well completions in Arkansas, according to the API, decreased from 344 wells in 1972 to 285 wells in 1973. Of the 285 wells drilled, 91 were completed as oil wells, 40 as gas wells, and 154 as dry holes. Overall success ratio was 46.0% but only 7.6% of the exploratory wells were completed as oil and gas producers.

According to the 1973 Annual Oil and Gas Report of the Arkansas Oil and Gas Commission, 1 new field (the Mohawk field in Columbia County), 2 rediscoveries, and 10 new reservoirs resulted from exploration during the year.

Petroleum Refineries.—Arkansas had four petroleum refineries in operation in 1973. These were the refinery of the Lion Oil Co., a division of The Oil Shale Corp., at El Dorado, Union County; MacMillan Ring-Free Oil Co. Inc.'s refinery at Norphlet, Union County; the refinery of Cross Oil and Refining Co. of Arkansas at Smackover, Union County; and Berry Petroleum Co.'s refinery at Stephens, Ouachita County.

A certificate of safety excellence from the State Labor Department was awarded in February to the Lion Oil Co. refinery, the largest in Arkansas, for completing 9 million man-hours of work over 12 years without a lost-time injury. The refinery led the Nation in safety for refineries in the same size capacity (37,500 barrels per day). In July, a major construction project began at the refinery with the completion date scheduled for the first quarter of 1974. Included in the new construction is the installation of a modern catalytic cracking unit to replace two smaller cracking units which have a total capacity of 14,000 barrels per day. Lion's capability to meet environmental requirements for low-lead gasoline and sulfur-free fuels as set forth by the Federal Environmental Protection Agency will be improved by the new equipment.

NONMETALS

A major part of the total Arkansas mineral value in 1973 was contributed by production of a wide variety of nonmetallic minerals.

Abrasive Stone.—Output of novaculite mined for oilstones and whetstones was 7.2% below that of 1972, and value was 17.6% less. Six operators, one less than in 1972, mined novaculite in Garland County. They were Arkansas Abrasives, Inc., John O. Glassford, Cleve Milroy, Norton Pike Division of North Co., Hiram A. Smith, and W. V. Smith. Arkansas Oilstone Co., Inc., was not in operation in 1973.

Barite.—Total barite production remained about the same as in 1972; value declined 2.9%. Ore was mined and processed in Hot Spring County by NL Industries, Inc., Baroid Division, and Dresser Minerals Division of Dresser Industries, Inc. The latter company, however, closed its mine and plant at the end of October. Barite mined in Missouri was processed by The Milwhite Co., Inc. at Bryant, Saline County. All of the barite was used in making drilling muds. Despite the closing of the Dresser operation, the State ranked third in the United States in barite output for the sixth consecutive year. The mine closed by Dresser was opened by the Magnet Cove Barium Corp. in 1940 and was purchased by Dresser in 1949.

Bromine.—Five plants, two in Columbia County and three in Union County, extracted bromine from brine found in the Smackover limestone of Jurassic age. Output and value increased 13.2% and 9.5%, respectively, over those of 1972, and the State continued to rank first in production and value of bromine in the United States. For the fifth consecutive year, bromine was the second most important mineral commodity in value to the State. About 181,689,252 barrels of brine, according to the Arkansas Oil and Gas Commission, were produced in 1973 for the processing of bromine. The plants disposed of 199,858,177 barrels of effluent, which is 10% more liquids than they take in. The effluent was injected into 30 salt water disposal wells that are completed in the Smackover limestone.

Cement.—Portland and masonry cement shipped by the State's two producers—Arkansas Cement Corp. and Ideal Cement Co.—increased 14.5% in quantity and 23.5% in value. About 95% of the cement shipped was portland cement, which was consumed by ready-mix concrete companies (62%), contractors and other users (26%), concrete product manufacturers (9%), and building material dealers (3%). Raw materials used in making

portland cement included limestone, clay, sand, gypsum, and iron-bearing materials. Most of the cement shipments were in bulk form by truck.

Table 7.—Arkansas: Bromine compounds sold or used by primary producers
(Thousand pounds and thousand dolllars)

Year	Quantity		Value
	Gross weight	Bromine content	
1971	199,429	168,198	34,426
1972	233,011	195,949	40,571
1973	266,815	222,819	52,015

Clays.—Clay production was reported from 14 counties. Total clay output increased both in quantity and value with common clay accounting for the major portion of the increases. The five leading clay producing counties (Lonoke, Crittenden, Hot Spring, Pulaski, and Little River) accounted for 82% of the total production. Common clay was utilized for manufacture of building brick, sewer pipe, and cement; one company produced lightweight aggregate at two plants (England and West Memphis). Kaolin (produced by two companies) was used for chemicals and refactory products.

Twin Lakes Rus-tique Brick Co., Inc., a recently formed company, completed facilities in September in the Twin Lakes Industrial Park at Midway. The 10,000-square-foot plant manufactures both standard and commercial type brick and has a capacity to produce 30,000 brick per day.

Gem Stones.—Small quantities of gem stones and mineral specimens including diamonds, quartz crystals, wavellite, and jasper, continued to be collected in Arkansas. Estimated value of material found in 1973 increased 56% over that of the previous year.

The Crater of Diamonds mine near Murfreesboro continued to be operated as a tourist attraction by the Arkansas Department of Parks and Tourism. Among the diamonds found in 1973 were a 3.91-carat quality Silver Cape diamond with an estimated cut value of $10,000,[4] a 2.00-carat Silver Cape diamond with an estimated value of the uncut stone of at least $5,000,[5] and a 2.12-carat brown diamond.[6]

Gypsum.—Output of crude gypsum increased 2% over that of 1972 and established a new annual record. The State's two producing companies—Dulin Bauxite Co., Inc. in Pike County and Weyerhaeuser Co. in Howard County—mined and processed gypsum for use in cement and wallboard manufacturing, respectively. Temple Gypsum, a subsidiary of Temple Industries, manufactured wallboard at its plant in Crittenden County using crude gypsum mined in Oklahoma.

Lime.—Rangaire Corp. produced lime in Independence County for paper and pulp, soil stabilization, and other uses. Reynolds Mining Corp., a subsidiary of Reynolds Metals Co., and Aluminum Co. of America (Alcoa) produced lime in Saline County for processing bauxite to alumina. Output increased 18% but was 14.5% below the 1966 record. The lime was consumed in Arkansas, Louisiana, and Mississippi. Total consumption of lime in Arkansas was 167,100 tons.

Sand and Gravel.—Output and value of sand and gravel incresed 7.7% and 24.6%, respectively, over those of the previous year. Miller County led the State in production followed by Pulaski, Calhoun, Crawford, Chicot, St. Francis, Craighead, Hot Spring, Lafayette, and Izard Counties. Collectively, these 10 counties accounted for 52% of the total tonnage. Most of the production was used for highway construction and building.

Soapstone.—The Milwhite Co., Inc., the only producer of soapstone in Arkansas, mined and processed soapstone in Saline County. Tonnage and value declined 44.8% and 49.4% respectively, compared with 1972. Most of the material was ground for use in roofing, insecticides, and rubber. This was the 21st consecutive year of production from Saline County.

[4] Arkansas Gazette. Oct. 21, 1973.
[5] Arkansas Gazette. Sept. 9, 1973.
[6] Arkansas Gazette. July 22, 1973.

Table 8.—Arkansas: Sand and gravel sold or use by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	2,641	4,359	3,010	4,621
Fill	341	365	249	204
Paving	1,808	2,096	1,745	3,174
Other uses [1]	405	1,071	488	1,376
Total [2]	5,194	7,893	5,491	9,376
Gravel:				
Building	2,029	3,696	2,435	4,694
Fill	115	194	198	180
Paving	2,552	3,158	2,476	4,709
Railroad ballast	(3)	(3)	W	W
Miscellaneous	113	103	424	500
Other uses	--	--	79	164
Total [2]	4,809	7,152	5,612	10,247
Government-and-contractor operations:				
Sand:				
Fill	72	73	--	--
Paving	688	554	305	226
Total [2]	759	628	305	226
Gravel:				
Building	--	--	50	25
Fill	8	9	13	4
Paving	741	840	993	747
Other uses	26	37	--	--
Total [2]	811	886	1,056	776
Total sand and gravel [2]	11,574	16,558	12,465	20,625

W Withheld to avoid disclosing individual company confidential data; included with "Other gravel."
[1] Includes ground and unground sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Less than ½ unit.

Table 9.—Arkansas: Sand and gravel sold or used by producers
(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total [1]	
	Quantity	Value	Quantity	Value	Quantity	Value
1969	10,067	12,919	2,608	2,030	12,674	14,949
1970	10,639	13,553	2,662	2,484	13,301	16,036
1971	9,850	13,993	1,779	1,611	11,630	15,603
1972	10,004	15,045	1,571	1,514	11,574	16,558
1973	11,103	19,623	1,361	1,002	12,465	20,625

[1] Data may not add to totals shown because of independent rounding.

Stone.—Total output of stone in Arkansas in 1973 was 16.2 million tons, valued at $26,209,000. Limestone was most important in value, followed by granite (syenite), sandstone, dolomite, slate, and quartzite. Based on value, stone was the fifth most important mineral commodity in the State, accounting for 9.6% of the total value. Eighty-four quarries supplied the various stone types.

In terms of tonnage, the principal stone producing counties were Pulaski (granite and sandstone), Little River (limestone), Izard (limestone and sandstone), Washington (limestone), Independence (limestone and dimension sandstone), Crawford (sandstone), Howard (limestone), White (sandstone and limestone), Lawrence (dolomite and limestone), Pope (sandstone), Sebastian (sandstone), and Benton (lime-

stone). In terms of value, these counties ranked as follows: Pulaski, Independence, Washington, Crawford, Izard, Howard, White, Little River, Sebastian, Lawrence, Benton, and Pope. Slate was produced in Montgomery and Saline Counties. Quartzite and novaculite were produced in Hot Spring County. Logan County, in addition to Independence County, produced dimension sandstone.

Principal uses of stone were for road base stone, cement, railroad ballast, roofing aggregate, bituminous aggregate, concrete aggregate, flux stone, and riprap and jetty stone. Seventy-one percent of the stone was transported by truck; 25% was hauled by rail; the remainder was divided between waterway and unspecified transportation.

Sulfur (Recovered Elemental).—Bromet Co. at its Columbia County bromine extraction plant continued as a pollution control measure to recover sulfur released from hydrogen sulfide during the processing of brines. Three other plants treated sour natural gas for sulfur recovery in south Arkansas. These were Arkla Chemical Corp. at its Hamilton plant in Columbia County, Phillips Petroleum Co. at its McKamie plant in Lafayette County, and Lion Oil Co. at its El Dorado refinery in Union County. Output from the four plants was 23,737 long tons valued at $343,921, as compared with 25,029 long tons valued at $365,111 in 1972.

Tripoli.—Malvern Minerals Co.'s open pit mine in Garland County was the only producer of tripoli in Arkansas in 1973. Both production and value increased more than 28%. The tripoli was used for abrasives and filler. Tripoli mined from deposits in Missouri and Oklahoma was processed by Mid-Western Mills, Inc., at Rogers, Benton County.

Vermiculite.—Crude vermiculite, mined outside the State, was processed by Strong-Lite Products at its Pine Bluff plant in Jefferson County and by Construction Products Div., W. R. Grace & Co., at its North Little Rock plant in Pulaski County. The exfoliated material was used for concrete aggregate, plaster aggregate, loose fill insulation, fire proofing, horticulture, and other uses.

METALS

Aluminum.—Reynolds Metals Co. continued to be the only producer of aluminum from alumina in Arkansas with operation of its reduction plants in Malvern and Arkadelphia. Aluminum metal was rolled, extruded, and drawn into various semifabricated shapes at several plants. The Dow Chemical Co. leased its aluminum extrusion plant at Russellville to Taber Metals, Inc., a new Arkansas corporation. Vulcan Materials Co. was constructing a $3 million secondary aluminum processing plant in the Haskell-Harmony Grove area of Saline County, near Benton; the new plant will replace the company's existing facility at Hot Springs. The 116,000-square-foot plant will have a 50% greater capacity than the Hot Springs plant and is expected to be put onstream in mid-1974.

Alumina was produced at Reynolds Metals Co.'s Hurricane Creek plant and Alcoa's plant near Bauxite, Saline County. The Hurricane Creek plant received a safety award from the State Labor Department for a record of no lost-time accidents during more than 2 million total hours of work between August 2, 1972, and August 9, 1973. Both companies have expended considerable sums in dust control devices to bring their plants into compliance with Arkansas's Air Pollution Control Code.

Bauxite.—Output and value of bauxite increased 3.2% and 13.7%, respectively, over comparable data for 1972. Reynolds Mining Corp., Alcoa, and American Cyanamid Co. mined in Saline County, and Stauffer Chemical Co. produced in Pulaski County. Reynolds Mining Corp., a subsidiary of Reynolds Metals Co., operated both an underground mine and an open pit operation; the other companies produced from open pits. Bauxite processing plants were operated by American Cyanamid Co., Porocel Corp., and Stauffer Chemical Co. A.P. Green Refractories Co. did not produce or process bauxite in Arkansas in 1973. The State continued to be the leading bauxite producer in the country accounting for 90% of the total U.S. production.

Copper.—Cerro Corp. cancelled its plans to build a copper smelter refinery complex on a 1,500-acre site on the Arkansas River at Pine Bluff. The company cited excessively unexpected high final cost estimates and high interest rates as reasons for cancellation of the project.

Gallium.—Alcoa began construction of a new gallium extraction and refining plant at its Arkansas high-purity metals facility at Bauxite. The plant, which is expected to be completed by the middle of 1974, has been designed to add to existing gallium production capacity to meet increased demand from the electronics industry.

Table 10.—Arkansas: Mine production of bauxite and shipments from mines and processing plants to consumers in the United States
(Thousand long tons and thousand dollars)

Year	Mine production			Shipments from mines and processing plants to consumers		
	Crude	Dry equivalent	Value [1]	As shipped	Dry equivalent	Value [1]
1969	2,116	1,755	24,706	2,044	1,765	26,304
1970	2,251	1,869	26,293	2,194	1,917	29,049
1971	2,157	1,781	24,979	2,161	1,892	28,296
1972	1,973	1,634	21,010	2,128	1,844	25,426
1973	2,040	1,686	23,884	2,079	1,782	27,180

[1] Computed from selling prices and values assigned by producers and from estimates of the Bureau of Mines.

Iron Ore.—Leber Mining Co., which began production of a unique high-purity ferrous carbonate at the Falcon mine in Nevada County in July 1970, continued production of iron ore in 1973.

Iron Oxide Pigments.—Shipments of iron oxide pigment materials were made from the Falcon mine of Leber Mining Co.

Vanadium.—Production of recoverable vanadium from ore mined by Union Carbide Corp. at Wilson Springs, Garland County, increased over that of 1972. Arkansas, for the second consecutive year, was the leading State in production of vanadium. The Wilson Springs operation is the only one in the United States where vanadium is mined as a primary product rather than as a byproduct or coproduct of uranium or phosphate processing.

Following procedures recommended by the U.S. Soil Conservation Service, Union Carbide Corp. has been successfully reclaiming spoil piles resulting from its open pit mining of vanadium ore. The company operated out of two pits in 1973, and was in the process of opening a third pit adjacent to the present two. The soft, clay-like ore at Wilson Springs contains about 1% vanadium pentoxide and yields 20 pounds of contained vanadium for each ton of ore mined. The plant can process up to 1,600 tons of ore per day.

Table 11.—Principal producers

Commodity and company	Address	Type of activity	County
Abrasives:			
Arkansas Abrasives, Inc	P.O. Box 1298 Hot Springs, Ark. 71901	Mine and plant	Garland.
Norton Pike Division, Norton Co	Littleton, N.H. 03561	Mine	Do.
Barite:			
Dresser Minerals	P.O. Box 6504 Houston, Tex. 77005	Mine and plant	Hot Spring.
NL Industries, Inc	P.O. Box 1675 Houston, Tex. 77001	do	Do.
Bauxite:			
Aluminum Co. of America	1501 Alcoa Bldg. Pittsburgh, Pa. 15219	Mine	Saline.
American Cyanamid Co	Berdan Avenue Wayne, N.J. 07470	Mine and plant	Do.
Reynolds Mining Corp, subsidiary of Reynolds Metals Co.	P.O. Box 398 Bauxite, Ark. 72011	do	Do.
Bromine:			
Arkansas Chemicals, Inc	Route 6, Box 98 El Dorado, Ark. 71730	Brine wells and plant.	Union.
Bromet Co	P.O. Box B Magnolia, Ark. 71753	do	Columbia.
The Dow Chemical Co	Midland, Mich. 48640	do	Do.
Great Lakes Chemical Corp	P.O. Box 2200, West Lafayette, Ind. 47901	do	Union.
Michigan Chemical Corp	351 East Ohio St. Chicago, Ill. 60611	do	Do.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Carbon black:			
Cities Service Co., Columbian Division.	3200 W. Market Street Akron, Ohio 44313	Furnace	Union.
Cement:			
Arkansas Cement Corp	P.O. Box 398 Foreman, Ark. 71836	Plant and quarry	Little River.
Ideal Cement Co., Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	do	Howard.
Clays:			
Acme Brick Co	P.O. Box 425 Fort Worth, Tex. 76101	Mine and plant	Hot Spring and Sebastian.
Arkansas Cement Corp	P.O. Box 398 Foreman, Ark. 71836	do	Little River.
Arkansas Lightweight Aggregate Corp.	P.O. Box 99 England, Ark. 72046	do	Crittenden and Lonoke.
W.S. Dickey Clay Manufacturing Co.	P.O. Box 13125 Kanas City, Mo. 64199	do	Miller.
Eureka Brick & Tile Co	Clarksville, Ark. 72830	do	Johnson.
A.P. Green Refractories Co	Mexico, Mo. 65265	do	Pulaski.
Ideal Cement Co., Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80802	do	Howard.
Coal:			
Crown Construction Co., Inc	P.O. Box 477 Fort Smith, Ark. 72901	Strip mine	Johnson.
Farrell Mining Co	P.O. Box 168 Mansfield, Ark. 72944	do	Sebastian.
Garland Coal & Mining Co	P.O. Box 186 Fort Smith, Ark. 72901	do	Franklin and Johnson.
Peabody Coal Co	301 N. Memorial Dr. St. Louis, Mo. 63102	do	Johnson.
Gypsum:			
Dulin Bauxite Co., Inc	835 Valley Hot Springs, Ark. 71901	Mine and plant	Pike.
Weyerhaeuser Co	Route 4, Box 78 Nashville, Ark. 71852	do	Howard.
Iron oxide pigments (crude):			
Leber Mining Co	Stamps, Ark. 71860	Mine	Nevada.
Lime:			
Aluminum Co. of America	1501 Alcoa Bldg. Pittsburgh, Pa. 15219	Plant	Saline.
Rangaire Corp., Batesville White Lime Division.	P.O. Box 1311 Batesville, Ark. 72501	do	Independence.
Reynolds Metals Co	6603 W. Broad Street Richmond, Va. 23226	do	Saline.
Natural gas liquids:			
Arkla Chemical Corp., subsidiary of Arkansas Louisiana Gas Co.	Magnolia, Ark. 71753	do	Columbia.
Phillips Petroleum Co	Stamps, Ark. 71860	do	Layfayette.
Petroleum refineries:			
Berry Petroleum Co., Div. Crystal Oil Co.	Magnolia, Ark. 71753	Refinery	Ouachita.
Cross Oil & Refining Co. of Arkansas, Div. C.J. Wood Petroleum Co.	Smackover, Ark 71762	do	Union.
Lion Oil Co., Div. of the Oil Shale Corp.	El Dorado, Ark. 71730	do	Do.
MacMillan Ring-Free Oil Co., Inc	Norphlet, Ark. 71759	do	Do.
Roofing granules:			
Bird and Son, Inc	East Walpole, Mass. 02032	Plant	Montgomery.
Minnesota Ming. & Mfg. Co	3 M Center (220-13W) St. Paul, Minn. 55101	do	Pulaski.
Sand & gravel:			
Arkhola Sand & Gravel Co	323 Merchants Bank Bldg. Fort Smith, Ark. 72901	Pits; stationary plant; river dredging.	Crawford.
Belvedere Sand & Gravel Co	P.O. Box 421 Hot Springs, Ark. 71901	Pit; portable plant	Hot Spring.
Brasswell Sand & Gravel Co., Inc	P.O. Box 798 Minden, La. 71055	Pit; stationary plant; river dredging.	Little River.
Criss & Shaver Inc	1313 Worthen Bank Bldg. Little Rock, Ark. 72201	Dredge	Pulaski.
Gifford-Hill & Co., Inc	P.O. Box 47127 Dallas, Tex. 75247	Pits; stationary plants.	Layfayette and Miller.
Greenville Gravel Co	P.O. Box 220 Greenville, Miss. 28701	Pit; stationary plant; river dredging.	Chicot.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel—Continued			
Hill Sand & Gravel Co., Inc	Pieler Rd. Benton, Ark. 72015	Pit; stationary plant; river dredging.	Saline.
Jeffrey Sand Co., Inc	P.O. Box 5054 North Little Rock, Ark. 72119	Dredge	Pulaski.
Jet Asphalt & Rock Co	Rt. 3, P.O. Box 237X El Dorado, Ark. 71730	Pits; portable and stationary plants.	Calhoun and Union.
Malvern Gravel Co	P.O. Box 337 Malvern, Ark. 72104	Pit; stationary plant.	Hot Spring.
Mobley Construction Co., Inc	P.O. Box 109 Morrilton, Ark. 72110	Stationary plants; river dredging.	Jackson and Pope.
Pine Bluff Sand & Gravel Co	P.O. Box 7008 Pine Bluff, Ark. 71601	Dredge	Jefferson.
St. Francis Material Co	P.O. Box 999 Forrest City, Ark. 72335	Pits; stationary plants.	Ashley, Calhoun, Craighead, Poinsett, St. Francis.
Silica Products Co., Inc	P.O. Box 248 Guion, Ark. 72540	Underground mine; stationary plant; silica sand used for glass, filter, moulding, hydrafrac.	Izard.
Stone:			
Arkansas Cement Corp	P.O. Box 398 Foreman, Ark. 71836	Quarry	Little River.
Arkhola Sand & Gravel Co	323 Merchants Bank Bldg. Fort Smith, Ark. 72901	do	Crawford, and Sebastian.
Freshour Construction Co	P.O. Box 77 Sweethome, Ark. 72164	do	Lonoke, Sharp, Van Buren, White.
Ben M. Hogan Co., Inc	P.O. Box 2860 Little Rock, Ark. 72203	do	Lawrence, Pope, White.
Ideal Cement Co., Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	do	Howard.
McClinton Brothers Co	P.O. Box 1367 Fayetteville Ark. 72701	do	Benton, Madison, Washington.
McGeorge Contracting Co	P.O. Box 248 Pine Bluff, Ark. 71601	do	Pulaski.
Midwest Lime Co	P.O. Box 608 Batesville, Ark. 72501	do	Independence.
Minnesota Mng. & Mfg. Co	3 M Center 221 13 W St. Paul, Minn. 55101	do	Do.
Rangaire Corp	P.O. Box 1311 Batesville, Ark. 72501	do	Independence and Izard.
Sulfur (recovered):			
Arkla Chemical Corp., subsidiary of Arkansas Louisiana Gas Co.	P.O. Box 9 Magnolia, Ark. 71753	Byproduct sulfur recovery.	Columbia.
Bromet Co	Box B Magnolia, Ark. 71753	do	Do.
Phillips Petroleum Co	Box 30 Bartlesville, Okla. 74004	do	Layfayette.
Lion Oil Co., Div. of the Oil Shale Corp.	El Dorado, Ark. 71730	do	Union.
Talc and soapstone:			
The Milwhite Co., Inc	P.O. Box 15038 Houston, Tex. 77020	Mine and plant	Saline.
Tripoli:			
Malvern Minerals Co	P.O. Box 1246 Hot Springs, Ark. 71901	Mine	Garland.
Vanadium:			
Union Carbide Corp	Route 2, Box 563 Hot Springs, Ark. 71901	Mine and mill	Do.
Vermiculite, exfoliated:			
Constr. Products Div. W.R. Grace & Co.	62 Whittemore Avenue Cambridge, Mass. 02140	Processing plant	Pulaski.
Strong-Lite Products	P.O. Box 8068—Hwy. 79 North Pine Bluff, Ark. 71601	do	Jefferson.

The Mineral Industry of California

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, U.S. Department of the Interior, and the California Department of Conservation, Division of Mines and Geology.

By Walter C. Woodmansee [1]

In terms of output value, the mineral industry of California advanced more than 10% in 1973, following a decrease in 1972. The principal reason for the turnabout was the inflationary trend in mineral commodity prices that prevailed during the year.

Crude petroleum again was the most significant commodity in output value, accounting for slightly more than half the total value, although actual production continued downward. Other major mineral products, in decreasing order of output value, were cement, sand and gravel, natural gas, boron minerals, stone, iron ore, and diatomite.

Most of the nonmetallic minerals showed increased output in 1973. Among the metals, production of iron ore, molybdenum, and rare-earth concentrates also was significantly higher, but most of the other metallic minerals (copper, gold, lead-zinc, mercury, and silver) showed decreases. Reduced output of natural gas, natural gasoline, and liquefied petroleum gases corresponded to the decrease in crude oil production.

Significant oil and gas discoveries were made during the year, although they were not large enough to offset the continuing decline in oil and gas reserves in the State. The existing moratorium on drilling for oil and gas in State offshore areas continued in effect, but it appeared that a resumption of exploration activity in these areas would be permitted in 1974. Efforts were also made by Federal authorities to increase exploration and production in Federal waters.

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in California [1]

Mineral		1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Asbestos	short tons	90,967	$8,673	105,663	$10,886
Barite	thousand short tons	4	34	11	152
Boron minerals	do	1,121	95,882	1,225	113,648
Cement, portland	do	9,086	182,308	9,395	201,892
Clays	do	2,706	7,387	2,723	6,853
Copper (recoverable content of ores, etc.)	short tons	598	612	369	440
Gem stones		NA	215	NA	220
Gold (recoverable content of ores, etc.)	troy ounces	3,974	233	3,647	357
Gypsum	thousand short tons	1,525	4,965	1,778	5,834
Lead (recoverable content of ores, etc.)	short tons	1,153	347	44	14
Lime	thousand short tons	608	13,059	632	13,602
Magnesium compounds from seawater bitterns	short tons MgO equivalent	175,654	18,421	184,105	19,233
Mercury	76-pound flasks	r 5,835	r 1,274	1,219	349
Natural gas	million cubic feet	487,278	179,318	449,369	167,615
Natural gas liquids:					
Natural gasoline and cycle products	thousand 42-gallon barrels	8,468	27,664	6,865	23,475
LP gases	do	5,847	15,962	5,329	19,824
Peat	thousand short tons	29	620	21	373
Petroleum (crude)	thousand 42-gallon barrels	347,022	940,430	336,075	1,045,193
Pumice	thousand short tons	731	1,507	768	3,237
Salt	do	1,621	14,860	1,507	15,533
Sand and gravel	do	117,288	162,619	117,470	176,286
Silver (recoverable content of ores, etc.)	thousand troy ounces	175	296	56	143
Stone	thousand short tons	37,213	65,811	43,838	77,175
Talc	short tons	155,155	1,186	179,191	1,501
Zinc (recoverable content of ores, etc.)	short tons	1,202	427	20	8
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, carbon dioxide, cement (masonry), coal, diatomite, feldspar, iron ore, lithium minerals, molybdenum, perlite, potassium salts, rare-earth metals, sodium carbonates and sulfates, and tungsten		XX	107,266	XX	137,843
Total		XX	r 1,851,376	XX	2,041,686
Total 1967 constant dollars		XX	1,527,570	XX	p 1,499,006

p Preliminary. r Revised. NA Not available. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in California, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Alameda	$26,683	$28,932	Sand and gravel, salt, stone, petroleum, clays.
Alpine	W	W	Gold, silver, sand and gravel, zinc, copper, lead.
Amador	5,149	5,040	Sand and gravel, stone, clays.
Butte	W	W	Sand and gravel, natural gas.
Calaveras	17,966	21,186	Cement, asbestos, stone, sand and gravel, clays.
Colusa	3,419	3,334	Natural gas, stone, sand and gravel.
Contra Costa	10,760	11,301	Stone, natural gas, petroleum, lime, clays, sand and gravel, peat.
Del Norte	649	W	Stone, sand and gravel, gold.
El Dorado	2,596	W	Stone, lime, sand and gravel, talc.
Fresno	49,548	51,828	Petroleum, sand and gravel, natural gas, natural gas liquids, asbestos, stone, gold, clays, silver.
Glenn	W	6,151	Natural gas, sand and gravel, lime.
Humboldt	W	W	Natural gas, sand and gravel, stone.
Imperial	4,673	W	Gypsum, sand and gravel, lime, clays, stone.
Inyo	18,398	19,592	Tungsten, molybdenum, talc, boron minerals, copper, sand and gravel, stone, perlite, silver, clays, lead, gold, zinc.
Kern	469,442	528,711	Petroleum, boron minerals, cement, natural gas, natural gas liquids, stone, sand and gravel, gypsum, sodium carbonates and sulfates, clays, salt, copper.
Kings	7,734	7,045	Natural gas, natural gas liquids, petroleum.
Lake	W	W	Pumice, sand and gravel, stone, mercury.
Lassen	W	W	Stone, sand and gravel, pumice.

See footnotes at end of table.

Table 2.—Value of mineral production in California, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Los Angeles	$346,126	$367,770	Petroleum, sand and gravel, natural gas, natural gas liquids, stone, lime, clays, gold, silver.
Madera	1,530	2,386	Natural gas, stone, sand and gravel, pumice.
Marin	2,357	2,359	Stone, clays, sand and gravel, mercury.
Mariposa	81	86	Sand and gravel, stone, gold, silver.
Mendocino	587	784	Sand and gravel, stone.
Merced	1,658	1,524	Sand and gravel, gold, silver.
Modoc	938	W	Peat, sand and gravel, pumice, stone.
Mono	528	1,727	Pumice, sand and gravel, clays, tungsten, gold, stone.
Monterey	54,351	62,561	Petroleum, magnesium compounds, lime, stone, sand and gravel, feldspar, natural gas.
Napa	3,032	2,829	Stone, salt, clays, sand and gravel, diatomite, mercury.
Nevada	1,876	1,968	Sand and gravel, stone, pumice.
Orange	121,489	137,768	Petroleum, sand and gravel, natural gas liquids, natural gas, clays, lime, stone.
Placer	2,027	2,184	Sand and gravel, clays, stone, gold.
Plumas	W	428	Stone, sand and gravel, pumice, gold.
Riverside	60,262	86,163	Iron ore, cement, sand and gravel, stone, clays, petroleum, natural gas.
Sacramento	23,023	21,885	Natural gas, sand and gravel, stone, gold, petroleum, clays, silver.
San Benito	14,135	14,706	Cement, asbestos, stone, sand and gravel, clays, petroleum, natural gas, mercury.
San Bernardino	151,694	170,492	Cement, boron minerals, sodium carbonates and sulfates, rare-earth metals, stone, sand and gravel, potassium salts, iron ore, lime, salt, petroleum, clays, talc, calcium chloride, pumice, bromine, lithium minerals, tungsten, natural gas, gypsum.
San Diego	25,446	30,934	Sand and gravel, stone, salt, magnesium compounds, clays, tungsten, gold, silver.
San Francisco	W	--	
San Joaquin	21,995	19,162	Natural gas, sand and gravel, stone, lime, peat, gold, silver.
San Luis Obispo	7,619	7,890	Petroleum, stone, sand and gravel, natural gas, clays.
San Mateo	8,825	11,182	Magnesium compounds, stone, salt, sand and gravel, petroleum, clays, natural gas.
Santa Barbara	126,479	105,826	Petroleum, diatomite, natural gas, natural gas liquids, sand and gravel, lime, stone.
Santa Clara	W	36,807	Cement, stone, sand and gravel, mercury, clays.
Santa Cruz	11,426	W	Cement, sand and gravel, stone, clays.
Shasta	7,076	8,867	Cement, sand and gravel, stone, clays, pumice, barite, copper, gold, silver.
Sierra	13	W	Gold, sand and gravel, silver, stone.
Siskiyou	873	W	Sand and gravel, stone, pumice, gold.
Solano	27,407	31,142	Natural gas, stone, petroleum, sand and gravel, clays.
Sonoma	r 5,946	W	Sand and gravel, stone, mercury, clays.
Stanislaus	2,846	W	Sand and gravel, gold, clays, silver.
Sutter	11,472	10,189	Natural gas, sand and gravel, clays.
Tehama	1,808	W	Natural gas, sand and gravel, stone, pumice.
Trinity	512	452	Sand and gravel, stone, gold, silver.
Tulare	2,634	2,428	Sand and gravel, stone, natural gas, petroleum, barite, clays.
Tuolumne	1,272	W	Stone, lime, sand and gravel.
Ventura	87,531	96,535	Petroleum, natural gas, natural gas liquids, sand and gravel, clays, stone, pumice.
Yolo	6,430	8,860	Sand and gravel, natural gas, lime, stone.
Yuba	W	1,204	Sand and gravel, stone, clays.
Undistributed [2]	91,053	109,465	
Total [3]	r 1,851,376	2,041,686	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Value of petroleum is based on an average price per barrel for the State.

[2] Includes Federal offshore petroleum and natural gas, some sand and gravel, stone (1972), and tungsten (1972) that cannot be assigned to specific counties, gem stones, natural carbon dioxide, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of California business activity

		1972	1973 [p]	Change, percent
Employment and labor force, annual average:				
Total labor force	thousands	8,596	8,792	+2.3
Unemployment	do	653	613	−6.1
Employment:				
Mining	do	29.5	30.4	+3.1
Contract construction	do	307.7	333.4	+8.4
Manufacturing	do	1,530.2	1,648.1	+7.7
Government	do	1,494.4	1,521.5	+1.8
Wholesale and retail trade	do	1,620.1	1,719.2	+6.1
Services	do	1,358.3	1,469.2	+8.2
Transportation and public utilities	do	455.7	469.9	+3.1
Finance, insurance, and real estate	do	419.6	443.2	+5.6
Personal income:				
Total	millions	$102,099	$112,038	+9.7
Per capita		$4,988	$5,438	+9.0
Construction activity:				
Total private nonresidential construction	millions	$2,351.6	$2,558.3	+8.8
Number of new housing units authorized		280,955	218,606	−22.2
Portland cement shipments to and within California	thousand short tons	8,491	8,614	+1.4
Farm marketing receipts	millions	$5,618.9	$7,283.6	+29.6
Mineral production value	do	$1,851.4	$2,042.0	+10.3
Exports through California ports	do	$4,152.6	$6,647.2	+60.1
Imports through California ports	do	$6,493.7	$8,595.6	+32.4

[p] Preliminary.

Source: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment; Highlights of U.S. Export and Import Trade, and U.S. Bureau of Mines.

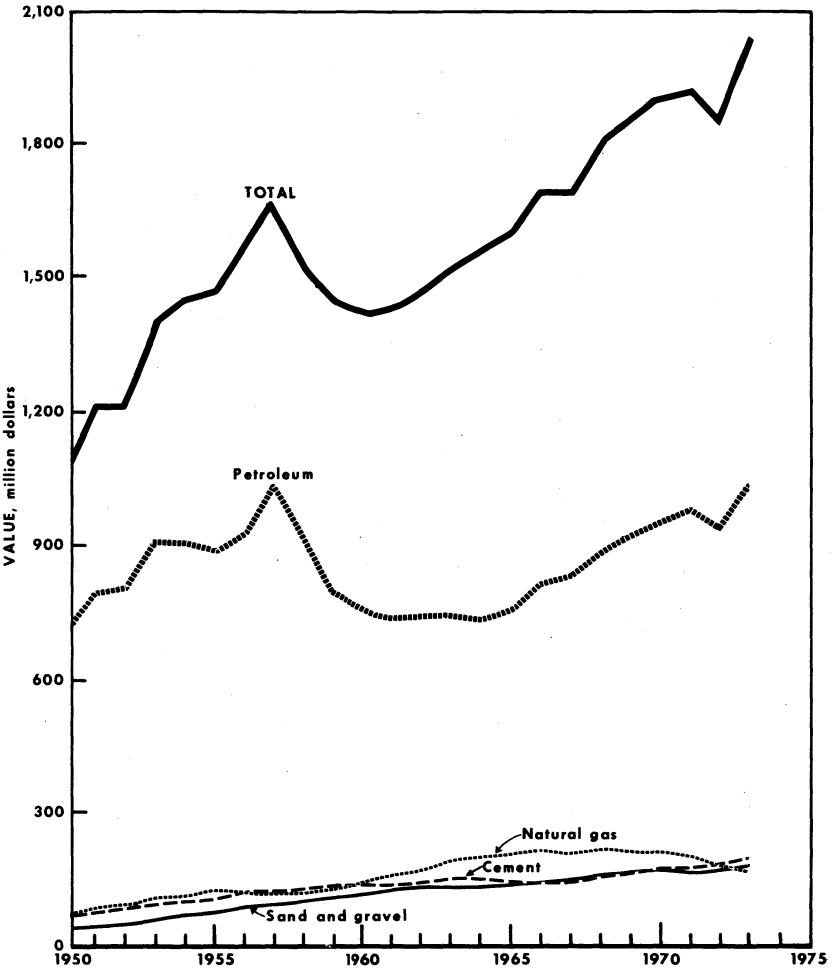


Figure 1.—Value of petroleum, natural gas, cement, sand and gravel, and total value of production in California.

Legislation and Government Programs.—The following eight bills, directly or indirectly affecting the mineral industry in California, were passed by the 1972 Regular Session of the State Legislature, signed by the Governor, and became effective March 7, 1973:

Assembly Bill (AB) 890.—Requires the State Oil and Gas Supervisor to supervise the drilling, maintenance, operation, and abandonment of geothermal resource wells to prevent land subsidence and compaction.

AB 901.—Revises State mining law regarding location work and affidavits; false statements on locations and labor papers ruled a misdemeanor.

AB 2064.—Establishes a State mining and minerals policy with responsibility vested in the State Geologist.

AB 2341.—Authorizes the Governor to adopt an oil spill contingency plan, makes

expenses for this plan recoverable from the State Water Quality Control Fund, and makes offending party liable for cost of cleanup.

Senate Bill (SB) 5.—Creates, within the Resources Agency, the State Solid Waste Management Board and the State Solid Waste Management and Resource Recovery Advisory Council.

SB 520.—Creates a Geologic Hazards Special Fund to finance special studies on earthquake hazards by the California Division of Mines and Geology (CDMG).

SB 1022.—Revises provisions for filing bonds with the California Division of Oil and Gas (CDOG) for oil drilling operations.

SB 1193.—Extends for 2 years (to March 7, 1975) the requirement to notify the California Department of Fish and Game concerning permits to alter the flow or bed of any river, stream, or lake.

The following selected new legislation, also significant to the State's mineral industry, was enacted during 1973:[2]

SB 869.—Revises provisions for abandonment of oil or gas wells; authorizes State Oil and Gas Supervisor to undertake actions deemed necessary to protect life, health, property, or natural resources if emergency arises during oil and gas operations.

SB 868.—Authorizes Oil and Gas Supervisor to adopt a special well-spacing pattern for a designated oil pool, where requirement deemed necessary.

SB 1289.—Requires Oil and Gas Supervisor to order recording of oil or gas development unit agreement in office of County Recorder after approval granted to agreement.

Assembly Joint Resolution (AJR) 42.—Memorializes the President to support, and Congress enact, legislation requiring authorization for offshore superports for large tankers, whether or not port would be located in State waters.

AB 2209.—Requires Oil and Gas Supervisor to promulgate rules and regulations for adequate screening of oil sumps to protect wildlife.

SB 893.—Requires annual report of State Geologist to include sections reviewing status of measures taken concerning geologic hazards and economic utilization and conservation of mineral resources.

Senate Joint Resolution (SJR) 26.—Memoralizes President to restore authorized funding level to Environmental Education Act of 1970 and Congress to enact legislation extending act.

AB 1095.—Requires State Lands Commission, acting with Resources Agency and Office of Planning and Research, to identify State school lands and tide and submerged lands which possess significant environmental values and to submit report to Legislature by January 15, 1975; specifies that leases from State Lands Commission are subject to environmental impact statements by the Environmental Quality Act of 1970.

AB 606.—Makes clarifying technical revisions to California Coastal Zone Conservation Act of 1972, concerning permit areas and membership in Coastal Zone Conservation Commission.

AB 1507.—Requires State Lands Commission to promulgate regulations requiring party extracting oil, gas, or other minerals from lands under jurisdiction of the Commission to remove beach and underwater obstructions.

SB 632.—Revokes, as of January 31, 1984, conveyance to San Diego Unified Port District of tidelands and submerged lands now subject to lease to Western Salt Co.; directs Resources Agency and State Lands Commission to undertake study to determine jurisdiction over these lands.

The Coastal Zone Conservation Act of 1972, which resulted from Proposition 20, the Coastal Zone Conservation Initiative, became effective on February 1. Proposed developments within 3,000 feet of the coastline require a permit, issued by six Regional Coastal Zone Conservation Commissions. These permits were required to insure maximum access to beaches and recreation areas, reservation of public recreation areas and wildlife preserves, and minimum adverse environmental and scenic effects. Impacts of the act included a freeze on proposed construction work, financing problems for such projects, and changing land values in the coastal zone.

In January, the U.S. Forest Service announced that it will study 16 new areas in California, comprising nearly 1.5 million acres, for possible inclusion in the National Wilderness Preservation System.

Also in January, the Bay Area Pollution

[2] California Legislature, Senate Committee on Natural Resources and Wildlife. Final Summary of Selected Legislation Relating to the Environment, Natural Resources, and Wildlife Enacted during 1973. 120 pp.

Control District cited 40 companies for air pollution and recommended appropriate action. Mineral-related industries included the Rodeo petroleum refinery of Union Oil Co. of Calif., the Beneficia refinery of Humble Oil Co., the sulfuric acid plant of Allied Chemical Corp. at the Standard Oil Co. of Calif. at Richmond, and the United States Steel Corp. plant at Pittsburg.

In February, the Resources Agency, California Department of Conservation, released a report entitled, "Energy in California—Its Supply, Demand, Problems," coordinated and prepared by the CDOG. The report examines the energy situation in the State during 1970–85 and forecasts a doubling of energy consumption during that period and a severe shortage of natural gas. In 1985, the State will rely on oil and gas for more than 75% of its energy needs and will require an eightfold increase in oil imports.

Occidental Petroleum Corp. and the County of San Diego signed an agreement for a 200-ton-per-day solid waste processing plant. The plant would utilize a new process developed by Occidental's Garrett research and development division, which would convert solid wastes to marketable products. The plant would be located at Escondido, San Diego County.

In April, the Bay Area Air Pollution Control District issued 30 violations to oil companies for excessive smoke emissions.

In May, 50 specialists on energy, representing the oil, gas, and utility industries, automobile manufacturers, State agencies, and environmental organizations, met under the sponsorship of the Lieutenant Governor to consider energy problems. A number of recommendations were made for energy conservation, development of new forms of energy, and new control agencies.

The basic construction phase of the $2.3 billion California Water Project, designed primarily to carry water from the northern to the southern part of the State, was completed on May 18. The complex system includes 21 dams, 7 powerplants, 22 pumping plants, 486 miles of lined canals, 163 miles of pipelines, 21 miles of conveyance tunnels, and 16 miles of unlined channels. During an operating year, more than 4.2 million acre-feet of water will flow to more than 250 water-delivery turnouts.

A new organization, California Council for Environmental and Economic Balance, will attempt to bridge the differences between development-minded interests and conservationists. Financial support will be provided by oil companies, utilities, and certain trade unions. The Council will comprise up to 60 members from labor, business, and the public sector.

In "Urban Geology—Master Plan for California," a 3-year study of geologic problems in California conducted by the CDOG in cooperation with the State Office of Planning and Research, it was estimated that the economic loss due to urbanization would amount to $55 billion during 1970–2000, if unmitigated. Ten geologic problems discussed included earthquakes, loss of mineral resources, landslides, flooding, erosion, expansive soils, fault displacement, volcanic hazards, tidal wave hazards, and subsidence. Broad recommendations were made that could reduce anticipated damages.

A State report, "Energy Dilemma: California's 20-year Power Plant Siting Plan," was released by the State Resources Agency in October. The report stated that 11 major new powerplants (oil, gas, coal, nuclear, or geochemical) must be approved by 1991 to prevent a shortage of electricity in the State.

In conformance with a Public Utilities Commission edict to utilities in the State, Pacific Gas & Electric Co. (PG&E) outlined a plan for energy conservation, mutual assistance agreements, and possible mandatory curtailments of electric service.

In October, the Governor approved a broad State energy policy calling for resumption of offshore oil drilling, reduced freeway speed limits, deepwater port construction for large tankers, and other related actions to produce and conserve energy. An advisory State Energy Planning Council was established.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Geothermal Resources.—At yearend 1973, 10 geothermal generating units (396,000 kilowatts) were operating at The Geysers geothermal field, Sonoma and Lake Counties, one was under construction, and four were planned. Completion of units 12 to 15, scheduled by 1977, would increase geothermal generating capacity to more than 900,000 kilowatts.[3] Thirty steam wells were completed to production.

Signal Oil and Gas Co. and PG&E, contracted for a 135-megawatt unit in the Castle Rock Springs area, Lake County, where Signal Oil was to drill three additional development wells. One well, 1 mile south of the Castle Rock Springs wells, was drilled to 7,088 feet but was unsuccessful.

Union Oil Co. of Calif. held hearings with the Public Utilities Commission for a 106-megawatt plant, and feasibility tests were underway for a 110-megawatt plant in the Little Geysers area of the field.

PG&E and Pacific Energy Corp. (PEC) contracted for unit 15 near PEC's Rorabaugh production area. PG&E will purchase geothermal steam from PEC's Happy Jack-Sulphur Bank production area, Sonoma County. PEC agreed to continue steam well development work.

At the Salton Sea Project, Imperial Valley, where geothermal potential was considered high, Magma Power Co., Chevron Oil Co. (operating subsidiary of Standard Oil Co. of Calif.), and New Albion Resources Co. (subsidiary of San Diego Gas & Electric Co.) were conducting production and injection tests in the Heber area, south of El Centro, Imperial County. Magma Power Co. completed the third of six wells for New Albion in the Niland area, Salton Sea geothermal field, where one well confirmed a bottom-hole temperature of 610°F at 3,000 feet, the highest temperature recorded, relative to depth, for one geothermal area in the State. Near Heber, New Albion was building a 10-megawatt prototype pilot plant, which will use energy developed by a downhole heat exchanger, developed by Geo-Energy Systems, Inc. Heat would be exchanged by circulating water or some other heat transfer fluid to the bottom of the well in a closed system. Under this process, there would be no corrosion of pipes, valves, and turbines by brines, no removal of brines and possible land subsidence, no depletion of well temperature and pressure, and no atmospheric or watershed pollution.[4]

The Federal Bureau of Reclamation, and Office of Saline Water continued evaluation of the East Mesa area, Imperial Valley. The Bureau planned eight development wells to a maximum depth of 6,000 feet and 30 shallow wells from 100 to 1,500 feet deep. In July, the first fresh water was processed from geothermal brines by a flash distillation unit of Envirogenetics, Inc., El Monte, Calif.[5]

Phillips Petroleum Co., Mono Power Co. (subsidiary of Southern California Edison Co.), and Southern Pacific Land Co. jointly held a 30,000-acre tract of the Buttes field, southeast of the Salton Sea, Imperial County. Drilling was in progress for testing geothermal power potential and recovery of chemicals and minerals from brines. Union Oil Co. of Calif. also had important holdings in the Imperial Valley.

Gulf Oil Corp. was drilling in Honey Lake Valley, Lassen County, and Surprise Valley, Modoc County. Phillips Petroleum Co. completed a shallow geothermal well test in Plumas County.

Natural Gas.—The quantity of natural gas marketed continued its downward trend, decreasing nearly 8% compared with that of 1972. Although production was lower for associated gas and dry gas, both onshore and offshore, new exploration activity resulted in discovery of several new gasfields and extensions to existing fields. A high level of drilling prevailed in the northern San Joaquin Valley and in the Sacramento Valley. Dry gas exploration was more successful than oil exploration. Dry gas reserves increased 90 billion cubic feet during the year, although total gas reserves were slightly lower.

Natural gas within the State remained in tight supply. According to the Conservation Committee of California Oil Producers (CCCOP), an average of 4.5 billion cubic feet per day was delivered from sources in Canada, west Texas, New

[3] California Division of Oil and Gas. Geothermal Hot Line. V. 3, No. 2, April 1973, 5 pp.

[4] Engineering and Mining Journal. Technological "Breakthrough" Promises to Tap Geothermal Power Cheaply. V. 174, No. 3, March 1973, p. 26.

[5] Chemical Week. Will Geothermal Steam Projects Sizzle or Fizzle? V. 113, No. 8, Aug. 22, 1973, pp. 57–58.

Mexico, Colorado, Utah, and Arizona to utility companies in California. A study on natural gas availability for the Public Utilities Commission indicated a worsening gas shortage unless new sources of supply are developed.[6]

Pacific Lighting Corp. announced plans for possible new supplies from coal conversion plants in New Mexico, liquefied natural gas from Alaska and Indonesia, and natural gas pipelined from the Canadian Arctic.

PG&E announced projects designed to increase gas withdrawal capacity in northern California from underground storage facilities on MacDonald Island, near Stockton, and Pleasant Creek, near Winters. New facilities would include storage wells, pipelines, and cleaning, measuring, and control equipment. Withdrawal capacity would be increased from 200 million cubic feet per day to 1.2 billion cubic feet per day at MacDonald Island and from 10 million cubic feet per day to 60 million cubic feet per day at Pleasant Creek.

At hearings before the Public Utilities Commission in August, it was estimated that natural gas supply would decrease by 20% during the next 3 years and that natural gas, which comprised 70% of the fuel supply to power companies in 1973, would provide only 2% in 1976, the large power companies switching to fuel oil.

Table 4.—California: Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

Commodity	Reserves Dec. 31, 1972	Revisions during 1973	Reserves Dec. 31, 1973 (production deducted)	Changes from 1972 (percent)
Crude oil ____ thousand barrels __	3,553,735	(65,635)	3,488,100	−1.8
Natural gas liquids ____ do ____	126,726	(8,527)	105,963	−16.4
Natural gas ____ million cubic feet __	5,328,862	50,488	5,199,837	−2.4

Sources: American Petroleum Institute and American Gas Association.

Petroleum.—*Production.*—Crude oil output was again lower in 1973, continuing a downward trend that started in 1969. However, value of output was rising because of increasing crude oil prices. The principal producing fields were Wilmington (onshore and offshore), Midway-Sunset, Kern River, Dos Cuadras (Federal offshore), and Huntington Beach (State offshore). About 73% of the total output was from onshore wells, 21% from the State waters, and 6% from Federal waters. Steam, other thermal, and water flooding were significant factors in maintaining production. According to the CCCOP, the daily production rate was 910,000 barrels at yearend, a loss of 17,000 barrels from yearend 1972.

[6] Oil and Gas Journal. PUC Paints Black California Gas-Supply Picture. V. 71, No. 48, Nov. 26, 1973, p. 40.

Table 5.—California: Oil and gas salient statistics

	1972	1973
Production:		
Crude oil: [1]		
Quantity ____ thousand 42-gallon barrels __	347,022	336,075
Value ____ thousands __	$940,430	$1,045,193
Daily rate ____ thousand 42-gallon barrels __	951	921
Price, average ____ per barrel __	$2.71	$3.11
Natural gas, marketed:		
Quantity, net ____ million cubic feet __	487,278	449,369
Value ____ thousands __	$179,318	$167,615
Price at wellhead, average per thousand cubic feet __	$0.368	$0.373
Natural gas liquids:		
Quantity ____ thousand 42-gallon barrels __	14,315	12,194
Value ____ thousands __	$43,626	$43,299
Price, average ____ per barrel __	$3.05	$3.55
Number of operating companies (yearend) ____	802	776

See footnotes at end of table.

Table 5.—California: Oil and gas salient statistics—Continued

	1972	1973
Number of producing wells:		
Oilfield (average)	39,586	38,762
Gasfield (maximum)	1,086	1,098
Exploration and development: Well completions:		
Exploration:		
Oil	17	17
Gas	9	17
Dry	160	168
Development: [2]		
Oil	1,028	862
Gas	53	48
Dry (abandoned)	128	95
Total	1,395	1,207
Footage thousands	4,347	4,108
Refineries:		
Number in operation (yearend)	37	36
Crude oil throughput capacity (operating) thousand 42-gallon barrels per day	1,759	1,775
Gasoline output capacity (operating) thousand 42-gallon barrels per day	1,019	1,028

[1] Includes field condensate but not plant condensate; also includes output from offshore State and Federal leases.
[2] Includes service wells.

Sources: California Department of Conservation, Division of Oil and Gas; Conservation Committee of California Oil Producers; American Petroleum Institute; and U.S. Bureau of Mines.

Table 6.—California: Production of crude petroleum and natural gas in 1973, by county [1]

County	Number of Producing wells		Production		
			Petroleum	Natural gas (net)	
	Oil (average)	Dry gas (maximum)	(thousand barrels)	Oil zones (million cubic feet)	Dry gas zones (million cubic feet)
Alameda	7	--	103	--	--
Butte	--	21	--	--	3,370
Colusa	--	94	--	--	9,227
Contra Costa	44	54	[2] 378	3,116	7,700
Fresno	2,524	6	[2] 12,276	9,451	1,067
Glenn	--	111	--	--	13,952
Humboldt	--	25	--	--	2,989
Kern	21,329	44	111,845	74,920	1,557
Kings	147	8	475	9,293	331
Los Angeles	6,077	3	98,486	56,347	361
Madera	--	15	--	--	3,230
Monterey	912	--	12,677	493	--
Orange	3,241	--	36,262	9,989	--
Riverside	13	5	56	17	223
Sacramento	--	106	[2] 24	--	43,611
San Benito	16	--	51	20	--
San Bernardino	38	--	238	119	--
San Joaquin	--	127	--	--	43,834
San Luis Obispo	205	--	1,765	1,243	--
San Mateo	10	--	17	1	--
Santa Barbara	1,595	26	[2] 19,235	21,869	24,559
Solano	--	190	[2] 153	--	88,410
Sutter	--	142	--	--	30,690
Tehama	--	41	--	--	3,971
Tulare	21	17	38	--	923
Ventura	2,583	6	23,593	25,566	1,589
Yolo	--	57	--	--	10,390
Total	38,762	1,098	[2] 317,672	212,444	291,984

[1] Includes State offshore but not Federal offshore production.
[2] Includes field condensate from dry gas zones.

Source: California Department of Conservation, Division of Oil and Gas.

Table 7.—California: Offshore oil and gas production in 1973, by field [1]

Field or area	Number of producing wells	Production	
		Oil (thousand barrels)	Gas (million cubic feet)
State:			
Algeria	1	42	164
Belmont	77	2,218	367
Caliente: Gas zone	2	--	1,473
Carpinteria	58	1,605	2,477
Coal Oil Point	2	29	61
Conception	3	39	18
Cuarta: Gas zone	2	--	4
Elwood	12	59	395
Elwood, South	10	1,176	66
Gaviota: Gas zone	2	--	398
Huntington Beach	332	16,050	2,287
Molino: Gas zone	7	--	7,800
Montalvo, West	6	98	--
Newport, West	15	118	37
Point Conception	2	124	45
Rincon	80	587	310
Summerland	21	260	1,663
Torrance	22	404	335
Venice Beach	4	145	59
Wilmington	948	47,526	12,638
Total	1,606	70,480	30,597
Federal:			
Carpinteria	49	2,190	1,474
Dos Cuadras	129	16,591	7,684
Total	178	18,781	9,158
Grand total	1,784	89,261	39,755

[1] Includes production from offshore portions of onshore fields.

Source: California Department of Conservation, Division of Oil and Gas.

Exploration and Development.—Activity continued relatively slow, owing to economic factors, the ongoing moratorium on offshore development, and the impact of environmental controls. Of 34 wells listed as discoveries, 5 oil wells were significant.[7] The most important discovery was the Tule Elk field, 2 miles north of the Elk Hills field, in Kern County. Standard Oil Co. of Calif., the operator, reported a flow of 6,940 barrels per day at 8,985 to 9,240 feet. At yearend, five drill rigs were on development work, defining the field limits. Recoverable reserves were estimated at 30 million to 80 million barrels.[8]

[7] Pfeiffer, D. H. Developments in West Coast Area in 1973. AAPG Bull., v. 58, No. 8, August 1974, pp. 1536–1546.

[8] Oil and Gas Journal. Socal Moving Fast in Big New Oilfield. V. 71, No. 45, Nov. 5, 1973, p. 27.

Table 8.—California: Oil and gas well drilling completion in 1973, by county

County	Development wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Butte	--	--	--	--	--	1	1	3,600
Colusa	1	4	1	--	--	5	11	72,040
Contra Costa	--	--	1	--	1	6	8	57,619
Fresno	51	4	5	--	--	10	70	265,312
Glenn	--	1	3	--	--	1	5	30,083
Kern	527	1	30	4	--	28	590	1,177,786
Kings	--	--	1	--	--	2	3	7,162
Los Angeles:								
Onshore	49	--	3	--	--	8	60	283,579
Offshore [2]	24	--	--	--	--	--	24	106,063
Madera	--	1	--	--	--	3	4	22,069
Merced	--	1	1	--	1	2	5	32,813
Monterey	45	--	1	--	--	5	51	137,708

See footnotes at end of table.

Table 8.—California: Oil and gas well drilling completions in 1973, by county—Continued

County	Development wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Orange:								
Onshore	24	--	--	--	--	2	26	62,904
Offshore [2]	23	--	1	--	--	--	24	70,943
Sacramento	--	1	--	--	--	5	6	27,209
San Benito	--	1	--	--	--	3	4	16,071
San Bernardino	--	--	--	--	--	1	1	3,477
San Joaquin	--	3	1	--	--	7	11	84,229
San Luis Obispo	4	--	--	--	--	4	8	46,136
San Mateo	--	--	--	--	--	1	1	2,453
Santa Barbara	76	--	3	7	--	8	94	430,581
Solano	--	9	15	--	5	12	41	298,275
Stanislaus	--	--	--	--	--	3	3	21,986
Sutter	--	5	2	--	--	5	12	60,814
Tehama	--	1	3	--	--	5	9	36,820
Tulare	--	2	4	--	--	2	8	23,849
Ventura	37	--	8	5	--	7	57	338,103
Yolo	--	14	12	--	10	30	66	369,180
Yuba	--	--	--	--	--	2	2	3,446
Other: Federal offshore	1	--	--	1	--	--	2	15,675
Total	862	48	95	17	17	168	1,207	4,107,985

[1] As defined by American Petroleum Institute.
[2] State leases.

Source: American Petroleum Institute.

Geophysical work was higher than in 1972. Onshore, crew-months totaled 77 (50 crew-months in 1972), largely in the Sacramento Valley. Offshore, crew-months increased from 3.2 in 1972 to 13 in 1973. Much of this offshore work was in the Outer Basins areas, south of the Santa Barbara Channel islands.

Great Basins Petroleum Co. established a new depth record at its Buttonwillow well, Kern County.[9] The well was bottomed at 21,640 feet. The former record had been held by Ohio Oil Co. (now Marathon Oil Co.), which drilled a well 21,482 feet deep in the Paloma field in 1953. Great Basins reported a flow of 900 barrels per day from an undetermined zone below 17,728 feet and planned to test several intervals. This was the first successful test of deep structures in central California.

In August and September, public hearings were held by the State Lands Commission on resumption of drilling in State waters. In December, the Commission lifted the ban on development drilling from fixed platforms and artificial islands, but approval was also required by the regional Coastal Zone Conservation Commissions.[10] The trend toward renewal of drilling permits in State waters was prompted by the need for oil supplies, stricter drilling regulations to avoid oil spills, and development of new oil spill cleanup procedures.

Concerning Federal waters of the Outer Continental Shelf (OCS), beyond the State 3-mile limit, the Department of the Interior scheduled public hearings and sales of island tracts during 1974, following environmental, technologic, and economic studies. The prospective area comprised 6.5 million acres in 1,100 tracts extending from the seaward side of the Santa Barbara Channel islands southward to the Mexican border.[11]

A U.S. Geological Survey report conservatively indicated production of 75,000 barrels per day and recoverable reserves of 730 million barrels to 1.1 billion barrels in the Santa Ynez field of Exxon USA on the OCS. Other estimates indicated reserves at 1 billion to 3 billion barrels. Exxon planned development with deepwater platforms and a prototype submerged production system.[12] In the large Dos Cuadros field, 5 miles offshore from Santa Barbara and also in the OCS, two operators were seeking permits for additional platforms.

[9] Oil and Gas Journal. Great Basins' 21,518-Foot Test Breaks California Depth Record. V. 71, No. 14, Apr. 2, 1973, p. 27.
[10] Oil and Gas Journal. California Agency Relaxes Offshore Drilling Ban. V. 71, No. 51, Dec. 17, 1973, p. 37.
[11] Oil and Gas Journal. Interest Keen in Southern California's Outer Banks. V. 71, No. 30, July 23, 1973, pp. 9–12.
[12] Rintoul, W. Operations Off West Coast Stay Locked in the Doldrums. Offshore, v. 33, No. 7, June 20, 1973, pp. 95–104.

Refineries.—A total of 36 refineries were operating in California, one less than in 1972. However, owing to several expansions, crude oil refining capacity increased slightly. Standard Oil Co. of Calif. planned major expansions at the Richmond refinery, Contra Costa County, and the El Segundo refinery, Los Angeles County. At Richmond, the expansion included wharf enlargement, new mooring and pipeline facilities to permit handling of tankers in the 100,000-deadweight-ton class, a 175,000-barrel-per-day crude oil distillation unit, two sulfur-removal units, and a plant for low-lead gasoline. At El Segundo, new units included a 130,000-barrel-per-day facility for low-sulfur distillates.

Atlantic Richfield Co. announced plans for refinery expansion at Carson, Los Angeles County. Getty Oil Co. was considering a 100,000-barrel-per-day refinery for low-sulfur fuel oil in the Kern River field, Kern County. San Diego Gas and Electric Co. and Pacific Resources, Inc., announced a feasibility study for a 100,000-barrel-per-day refinery and synthetic natural gas complex at Carlsbad, San Diego County.

NONMETALS

Asbestos.—Production at four mines increased 16% over that of 1972. Leading producer and shipper was Pacific Asbestos Corp. at its mine and mill near Copperopolis, Calaveras County. The other producers were Atlas Asbestos Co. at the Santa Cruz mine and Coalinga Asbestos Co. at the Christie mine, both in Fresno County, and Union Carbide Corp. at the Santa Rita mine, San Benito County.

Barite.—Barite was mined by Industrial Minerals Co. at the Castella mine, Shasta County, and by L. G. Embree at the La Paloma mine, Tulare County.

A barite circuit was completed in 1972 at the Molybdenum Corp. of America (Molycorp) rare-earths mill at Mountain Pass, San Bernardino County, where mill heads contain 20% $BaSO_4$, but no production was reported in 1973. Capacity is 60 tons per day of product averaging 4.25% gravity.

A total of 56,125 tons of barite was processed by four companies—Wilbur Ellis Co., Fresno County; Calada Materials Co., Los Angeles County; Industrial Minerals and Chemical Co., Sacramento County; and FMC Corp., Stanislaus County. Uses were approximately as follows: Chemicals, 62%; well drilling mud, 37%; and filler and extender, 1%.

Boron.—Output of boron compounds, in terms of B_2O_3 content continued upward in 1973. United States Borax and Chemical Corp. accounted for a large share of total output. The company produced borax, anhydrous sodium tetraborate, boric acid, and rasorite at its chemical plant from sodium and calcium borate minerals mined at the large open pit.

Kerr-McGee Chemical Corp. recovered borax products, anhydrous sodium tetraborate, and boric acid from Searles Lake brines at Trona, San Bernardino County. A study was underway on possible new products from the Searles Lake brines, and a pilot plant was planned for testing new processing techniques.

Stauffer Chemical Co. produced borax in its chemical plant at the west end of the lake.

Tenneco Oil Co., an affiliate of Tenneco, Inc., produced colemanite (hydrous calcium borate) at its open pit near Ryan, in Death Valley National Monument. Mining was underway in Boraxo pits 2 and 3, and waste rock was backfilled into pit 1, which was mined out in 1972. The ore receives primary crushing (to minus 8 inches) before shipment by truck 31 miles to the calcining plant in Nevada. The colemanite ore body occurs on the northern limb of a tight east-west fold. The ore bed is up to 40 feet thick. The mineral extends to a depth of 175 feet and a 2,000-foot strike length. High-quality mineral specimens were collected near the water table in pit 1.[13]

Cement.—Production and shipments of portland cement increased slightly over those of 1972, but sales value rose nearly 11%, owing to increasing prices. Uses were distributed as follows: Ready-mix concrete, 70%; concrete products, 12%; building materials dealers, 9%; and miscellaneous, 9%.

Ideal Basic Industries, Inc., abandoned plans for a new cement plant at San Juan Bautista, San Benito County, to replace the existing 60-year-old facilities, which had operated since 1971 under temporary air pollution control variances. Production was phased out during August and September.

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[13] Minette, J. W., and G. Muehle. Colemanite From the Thompson Mine. Miner. Record, v. 5, No. 2, March–April 1974, pp. 67–73.

Table 9.—California: Portland cement salient statistics
(Short tons)

	1972	1973
Number of active plants	13	13
Production	9,392,509	9,502,477
Shipments from mills:		
Quantity	9,085,891	9,395,462
Value	$182,307,515	$201,891,876
Stocks at mills, Dec. 31	572,846	554,805

Table 10.—California: Salient portland cement statistics
(Short tons)

	Northern California		Southern California	
	1972	1973	1972	1973
Number of active plants	5	5	8	8
Production	2,783,076	2,797,471	6,609,433	6,705,006
Shipments from mills:				
Quantity	2,854,914	3,074,722	6,230,977	6,320,740
Value	$57,319,542	$64,952,633	$124,987,973	$136,939,244
Stocks at mills, Dec. 31	267,184	230,768	305,662	324,037

Clays and Shale.—There were 89 recorded operations in 31 counties in 1973. Production increased slightly over that of 1972. Nearly 93% of that sold or used was common clay; the remainder was largely fire clay, bentonite, and kaolin. The principal producers, accounting for nearly half the total output, were Lightweight Processing Co., The Flintkote Co., Interpace Corp., Homestake Mining Co., and Pacific Clay Products Co.

Industrial Mineral Ventures, Inc., located a number of placer claims for hectorite, a magnesium-bearing bentonitic clay, near Death Valley Junction. The deposit was sampled to a depth of 30 feet, using a 4-inch auger drill. If tests prove successful, a pilot plant will be erected near the deposit. The hectorite would be sold for use in cosmetics, pharmaceuticals, ceramics, and paints.

White kaolin was mined from a deposit in Trabuco Canyon, Orange County, and processed by Schaeppe Clay Products Co. in Modjeska Canyon. The high-grade kaolin product, prepared by washing, was sold to Norris Industries, Inc., for use in whiteware china.

The American Olean Tile Co., a subsidiary of National Gypsum Corp., built a tile plant, located north of Roseville. Placer County. Clay raw materials will be obtained from deposits near Lincoln, Placer County.

Paul Brothers Excavating Co., Ridgecrest, San Bernardino County, acquired rights to the Pacific bentonite mine, 6 miles north of Johannesburg, San Bernardino County. Early in the year, truckload lots of crude bentonite were sold to Calcite Corp. for processing at its mill in Rosamond. The product was for use in oil well drilling mud.

Diatomite.—Production at four operations increased 6% over that of 1973. Processed material was used in filtration (66%), filters (22%), insulation (5%), and miscellaneous applications (7%). Johns-Manville Products Corp., Celite Div., at Lompoc, Santa Barbara County, accounted for about 73% of the total output. Other producers were Airox, Inc., and GREFCO, Inc., both in Santa Barbara County, and Basalt Rock Co., Inc., which mined pozzolan in Napa County for special uses.

Feldspar.—Owens-Illinois, Inc., and Wedron Silica Co. were the only active feldspar producers in 1973. The former, which accounted for a large share of the output, produced a feldspar-silica mixture; the latter produced a crude flotation concentrate. Total crude feldspar output was 6% below that of 1972.

Gypsum.—Output of crude and calcined gypsum was 17% higher than in 1972. United States Gypsum Co. again was the leading producer at its Plaster City open pit mine and calcining plant, Imperial County. H. M. Holloway, Inc. (Lost Hills mine), Temblor Gypsum Co. (Richfield mine), and C. L. Fannin, all in Kern County, also were important producers.

Seven companies produced calcined gypsum. Following United States Gypsum, major producers were National Gypsum Co. at Long Beach, Los Angeles County, and at Richmond, Contra Costa County; Kaiser Cement & Gypsum Corp. at Long Beach, Los Angeles County, and at Antioch, Contra Costa County; The Flintkote Co. at Fremont, Butte County; and California Gypsum Co.'s Pabco plant, Alameda County. Kaiser completed installation of new manufacturing equipment and a pollution control system at its wallboard plant at Long Beach.

Valley Nitrogen Producers, Inc., Occidental Petroleum Corp., and Collier Carbon and Chemical Corp. recovered byproduct gypsum in Fresno, San Joaquin, and Contra Costa Counties, respectively.

Lime.—Production of quicklime and hydrated lime recovered during 1973, increasing 4%, following a sharp drop in 1972. Ten companies were active at 15 plants in 12 counties. The leading producer was Kaiser Aluminum & Chemicals Corp. at Natividad, Monterey County.

Consumption totaled 872,400 tons, used for precipitating magnesia from seawater, sugar refining, soil stabilization, refractories, and miscellaneous minor applications.

Magnesium Compounds.—Kaiser Refractories, a division of Kaiser Industries Corp., produced increased quantities of refractory magnesia, caustic-calcined magnesia, and magnesium hydroxide from seawater at Moss Landing, Monterey County. In 1973, Kaiser installed Venturi scrubbers for dust abatement at the last of three rotary kilns and started effluent discharge into the bay rather than in the harbor area.

Other products derived from seawater were the extra-light to heavy oxide, carbonate, hydroxide, and trisilicate by Merck & Co., Inc., in San Mateo County, and magnesium chloride flakes and brines by FMC Corp., San Diego County.

Perlite.—American Perlite Co., sole producer of crude perlite in the State, increased by 58% sales and plant consumption of crude perlite produced at its Fish Springs quarry, near Big Pine, Inyo County. Six companies, four of which were in Los Angeles County, prepared expanded perlite for use (in order of importance) as filter aids, horticultural aggregate, plaster aggregate, concrete aggregate, and in miscellaneous small applications. Production of expanded perlite was 24,442 tons, 15% more than in 1972.

Potassium Salts.—The production rate of Kerr-McGee Chemical Corp., the only producer in the State, was similar to the 1972 level. Marketed products were K_2SO_4, which contained about 52.5% K_2O equivalent, and standard and coarse muriate containing 60% K_2O equivalent.

Pumice.—Combined output of crude and prepared pumice, pumicite (volcanic ash), and scoria (volcanic cinder) continued upward in 1973. There were 27 companies, 56 mines, and 30 preparation plants in operation during the year. The U.S. Forest Service used about 36% of total output for road construction. The Forest Service mined volcanic cinder at 23 operations, mainly in Lassen, Modoc, and Siskiyou Counties. About two-thirds of the total consumed was in road building. The remainder was used in concrete aggregate (12%), railroad ballast (3%), and a number of miscellaneous applications.

Table 11.—California: Pumice sold or used by producers in 1973, by county[1]

County	Crude		Prepared		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Lake	--	--	113,452	$553,703	113,452	$553,703
Lassen	171,089	$135,119	43,100	127,177	214,189	262,296
Madera	--	--	W	W	W	W
Modoc	W	W	W	W	W	W
Mono	--	--	W	W	W	W
Nevada	340	325			340	325
Plumas	--	--	5,500	28,315	5,500	28,315
San Bernardino	--	--	67,671	269,458	67,671	269,458
Shasta	37,444	29,786	39,946	100,413	77,390	130,199
Siskiyou	36,031	29,419	115,848	344,211	151,879	373,630
Tehama	W	W	W	W	W	W
Ventura	--	--	W	W	W	W
Undistributed	96,786	55,567	40,979	1,563,753	137,765	1,619,320
Total	341,690	250,216	426,496	2,987,030	768,186	3,237,246

W Withheld to avoid disclosing company confidential data; included with "Undistributed."
[1] Includes pumicite, scoria, volcanic cinder, and tuff.

Salt.—Production, essentially all from harvesting in coastal evaporation basins, totaled 1,610,108 tons, although sales were lower than in 1972. Leslie Salt Co. was the predominant producer, accounting for 84% of total output. Leslie Salt reported production from four counties—Alameda, Napa, San Mateo, and San Bernardino (rock salt). Reduced sales were reported for the company's salt works at Redwood City, San Mateo County, because of discontinued shipments to Japan, traditionally a major market.

Sand and Gravel.—Although production was reported at fewer operations, output was about the same as that of 1972, and value increased substantially, owing to prevailing higher prices. The heaviest activity was in and near the large urban areas of southern California (Los Angeles, Orange, San Bernardino, and San Diego Counties) and in the San Francisco Bay area (Alameda County). Sand and gravel was used in road paving (48%), building (37%), fill (6%), and miscellaneous (9%).

A CDMG study indicated a growing sand-and-gravel supply problem in Orange County.[14] In 1973, there were 17 major deposits, 31 ready-mix concrete plants, and 14 asphalt batch plants in the county. Material available under existing political and economic conditions was rapidly being depleted and, unless a number of new deposits are found, it may be necessary to obtain 12 million tons per year from adjacent counties by 1980. Reserves in the county were estimated at 50 million tons of salable sand and gravel, as of January 1, 1973. The report cited the need for zoning for sand and gravel extraction and long-range planning, including regional studies and intercounty cooperation.

At the Livingston-Graham, Inc., El Monte pit, Los Angeles County, material above the water table will be mined out before a decision is made to use a dragline for extraction below the water table. A city of Irwindale zoning ordinance would permit extraction to a depth of 150 feet. About 2,200 to 2,400 tons per hour was mined with 15-yard shovels and a fleet of six 90-ton bottom-dump trucks. The company planned expansion by installing a conveyor system. Rehabilitation plans were developed for the 400-acre El Monte pit and the 100-acre pit at Duarte.

In addition to its new 1,200-ton-per-hour fully automated Reliance plant at Irwindale, Los Angeles County, Consolidated Rock Products Co. (Conrock) also operated a plant at Durbin downstream from the Reliance plant, and three plants in Orange County. During the year, Conrock acquired control of plants formerly operated by California Materials Co. at Sun Valley, Los Angeles County, and Triangle Rock Products, Inc., in San Bernardino, San Bernardino County.

[14] Evans, J. R. Extraction of Sand and Gravel in Orange County, Calif.—A Technical and Planning Problem. Calif. Geol., v. 26, No. 11, November 1973, pp. 255–266, 271–272.

Table 12.—California: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Alameda	13	8,746	11,988	12	9,044	13,140
Alpine	2	37	8	1	8	11
Amador	6	933	4,213	5	W	W
Butte	10	878	1,180	8	1,018	1,355
Contra Costa	6	400	351	5	207	198
Del Norte	5	214	W	3	149	W
El Dorado	6	189	210	6	163	206
Fresno	10	3,758	5,028	10	3,781	5,351
Glenn	6	356	433	5	W	W
Humboldt	12	545	881	11	451	746
Imperial	7	619	330	7	714	681
Inyo	8	236	400	8	124	294
Kern	18	2,178	3,511	11	1,714	2,413
Kings	1	21	40	--	--	--
Lake	11	332	460	9	323	450
Lassen	5	147	267	5	267	494
Los Angeles	28	21,306	29,303	27	22,195	33,054
Marin	2	3	6	2	33	82
Mariposa	4	39	68	4	23	44
Mendocino	13	403	582	10	403	763
Merced	6	1,249	1,656	8	1,108	1,520
Modoc	4	136	250	6	274	192
Mono	6	153	201	7	198	267
Monterey	10	689	2,590	9	643	W
Napa	2	W	W	3	43	89
Nevada	6	1,226	1,806	4	871	1,958
Orange	19	9,340	12,311	21	13,343	17,434
Placer	8	906	1,644	5	W	W
Plumas	6	93	79	6	117	132
Riverside	17	5,039	8,520	15	3,149	6,266
Sacramento	11	5,836	8,594	12	4,476	6,429
San Bernardino	22	12,995	9,316	23	12,268	10,031
San Diego	29	9,813	20,326	26	9,377	24,799
San Joaquin	6	2,360	3,033	8	2,083	3,403
San Luis Obispo	6	278	636	5	361	696
Santa Barbara	8	1,536	1,780	7	1,504	1,864
Santa Clara	13	4,337	6,008	10	1,884	2,612
Santa Cruz	7	2,126	2,508	6	2,367	3,030
Shasta	17	824	937	17	1,115	1,130
Sierra	3	21	13	1	7	2
Siskiyou	7	474	499	11	830	1,544
Solano	1	86	285	1	90	312
Sonoma	12	3,213	4,933	13	4,079	6,542
Stanislaus	11	1,912	2,568	9	1,403	2,196
Tehama	7	164	217	6	170	222
Trinity	9	183	266	9	135	W
Tulare	6	1,069	1,530	4	W	W
Tuolumne	5	271	W	5	W	W
Ventura	10	4,430	4,608	11	5,119	6,239
Yolo	9	2,616	2,643	9	3,862	4,516
Yuba	5	742	871	4	568	912
Undistributed [1]	r 20	1,830	2,732	20	5,410	12,664
Total [2]	481	117,288	162,619	450	117,470	176,286

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Calaveras, Colusa, Madera, San Benito, San Francisco (1972), San Mateo, Sutter, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 13.—California: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	223	1,095	149	638
Building	23,370	34,737	22,276	34,924
Engine	56	180	51	186
Fill	4,338	3,560	4,395	3,895
Foundry	113	586	W	W
Glass	878	4,547	1,421	7,154
Paving	17,507	23,313	17,856	24,316
Other uses [1]	1,197	6,077	622	3,346
Total [2]	47,681	74,096	46,773	74,460
Gravel:				
Building	23,334	35,278	21,107	32,662
Fill	1,590	1,356	1,611	1,381
Paving	29,964	40,990	27,019	39,383
Railroad ballast	W	W	313	433
Miscellaneous	689	938	909	1,389
Other uses	1,161	1,886	1,147	1,735
Total [2]	56,737	80,448	52,106	76,982
Government-and-contractor operations:				
Sand:				
Building	36	37	(3)	1
Fill	1,154	397	875	266
Paving	1,094	1,563	4,766	9,576
Other uses	2	4	69	153
Total [2]	2,285	2,000	5,710	9,996
Gravel:				
Building	77	139	1	2
Fill	6,599	862	451	170
Paving	3,906	5,069	6,591	12,909
Other uses	2	4	5,837	1,768
Total	10,584	6,074	12,880	14,849
Total sand and gravel [2]	117,288	162,619	117,470	176,286

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes fire or furnace, glass, filtration, oil (hydrofrac), filler, foundry (1973), molding, pottery (1972), railroad ballast, and other unground sand.

[2] Data may not add to totals shown because of independent rounding.

[3] Less than ½ unit.

Kaiser Sand and Gravel Co., Chevreaux Materials, Inc., and Fresno Paving Co. worked jointly to provide rock, sand, and plant mix for highway construction near Auburn, Placer County. Quarry-run rock was reduced in a portable crushing unit supplied by Kaiser, mixed with sand from Chevreaux's nearby Bear River plant, and delivered to an asphalt plant of Fresno Paving for preparation of road-surfacing material.

Teichert Aggregates, Inc., installed a modern, electrically operated, semiportable asphalt plant near its sand and gravel operation at Woodland, Yolo County. Batching, mixing, and discharge of aggregate and asphalt were automatically controlled.

Lone Star Industries, Inc., was seeking a new operating site; a use permit for the pit and crushing plant at Fair Oaks, Sacramento County, was scheduled for expiration on June 30, 1975.

Granite Construction Co. was granted a 10-year permit on a 55-acre site near Mather Air Force Base, Sacramento County.

Early in the year, Owens-Illinois, Inc., closed its sand-processing plant near San Juan Capistrano, Orange County, for plant adjustments. The company's Corona plant, Riverside County, was temporarily reopened until the San Juan Capistrano plant was readied for full operation.

Wedron Silica Co. purchased a property 2 miles west of Byron, Contra Costa County, which was formerly owned by Delta Silica Co. A massive sandstone bed will be mined with a self-loading scraper and delivered to a screening plant via conveyor belt. The sandstone will be screened, washed, graded, flotation-created to re-

move iron and feldspar impurities, dried, and ground to specifications for the glass industry.

Sodium Compounds.—Production of sodium carbonate (soda ash) and sodium sulfate (salt cake) was at a rate similar to that of 1972. Kerr-McGee Chemical Corp. and Stauffer Chemical Co. recovered both chemical products from Searles Lake brines, San Bernardino County, and U.S. Borax & Chemical Corp. produced salt cake at its open pit and chemical plant at Boron, Kern County.

Stone.—The number of stone quarries reporting production decreased sharply in 1973 from 1972. The quantity produced and its value was substantially higher, owing to steadily rising prices. Demand for crushed rock continued to expand during the year. Limestone and dolomite accounted for about half the crushed rock sold or used. Crushed granite, sandstone, and traprock were also in high demand. Principal uses were in cement (34%), roadbase (19%), construction aggregate and roadstone (13%), concrete aggregate (9%), and bituminous aggregate (9%).

Table 14.—California: Stone sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973			Type of stone produced in 1973
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Alameda	8	2,638	3,588	7	3,602	4,306	Limestone, sandstone, traprock, other stone.
Colusa	1	35	121	1	55	194	Sandstone.
Contra Costa	7	1,902	3,955	8	2,244	5,126	Sandstone, traprock, other stone.
El Dorado	8	377	W	8	442	1,917	Limestone, other stone.
Humboldt	10	99	113	2	W	W	Other stone.
Imperial	3	24	91	1	1	(1)	Do.
Kern	13	2,975	4,314	8	3,211	4,856	Limestone, granite, quartzite, other stone.
Kings	1	1	2	--	--	--	
Lake	7	W	19	6	W	W	Traprock, other stone.
Lassen	2	276	W	2	298	W	Do.
Los Angeles	8	1,586	2,952	12	683	1,321	Granite, limestone, other stone.
Mariposa	4	1	13	2	W	41	Slate.
Mendocino	2	3	5	3	5	21	Traprock.
Modoc	6	188	206	4	13	10	Sandstone, traprock, other stone.
Mono	--	--	--	1	(1)	(1)	Other stone.
Nevada	5	W	W	4	19	10	Quartzite.
Plumas	4	141	219	5	W	265	Granite, marble, other stone.
Riverside	15	2,492	3,948	17	3,479	5,004	Limestone, granite, quartzite, traprock.
San Bernardino	30	6,770	11,300	30	7,173	13,339	Dolomite, granite, sandstone, quartzite, other stone.
San Diego	14	1,689	3,981	17	2,051	4,665	Granite, traprock.
San Mateo	6	749	1,507	8	1,652	3,351	Limestone, sandstone, traprock, other stone.
Santa Barbara	22	W	W	6	4	42	Limestone, sandstone, granite, other stone.
Santa Clara	12	W	5,089	10	6,323	8,248	Limestone, sandstone, traprock, other stone.
Santa Cruz	6	W	W	4	1,076	1,684	Limestone, granite.
Sierra	--	--	--	1	(1)	(1)	Other stone.
Siskiyou	12	141	211	3	385	419	Traprock, other stone.
Sonoma	10	426	734	8	760	1,063	Shell, traprock, other stone.
Stanislaus	1	93	246	--	--	--	
Tehama	--	--	--	2	17	39	Other stone.
Tuolumne	14	92	464	10	172	703	Dolomite, marble, sandstone, other stone.
Ventura	8	466	1,716	7	213	559	Limestone, granite, sandstone, traprock, other stone.
Yuba	4	W	185	2	74	241	Traprock, other stone.
Undistributed [2]	r 110	14,051	20,832	76	9,886	19,753	
Total [3]	353	37,213	65,811	275	43,838	77,175	

r Revised.
W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Less than ½ unit.
[2] Includes Alpine (1972), Amador, Calaveras, Del Norte, Fresno, Inyo, Madera, Marin, Monterey, Napa, Orange (1973), Placer, Sacramento, San Benito, San Joaquin, San Luis Obispo, Shasta, Solano, Trinity, Tulare, Yolo and counties for which no breakdown is available (1972).
[3] Data may not add to totals shown because of independent rounding.

Table 15.—California: Stone sold or used by producers, by type

(Thousand short tons and thousand dollars)

Type of stone	1972		1973	
	Quantity	Value	Quantity	Value
Dimension:				
Granite	5	329	8	591
Sandstone, quartz, and quartzite	1	23	1	24
Traprock	(1)	2	(1)	4
Slate	W	13	W	W
Other stone [2]	17	138	7	149
Total [3]	24	503	16	767
Crushed and broken:				
Limestone and dolomite	18,058	29,270	21,796	37,450
Granite	5,337	9,604	6,108	10,119
Marble [4]	192	368	155	384
Sandstone	5,097	10,164	5,506	8,847
Quartzite [5]	221	580	231	593
Traprock	4,068	7,548	5,359	9,423
Miscellaneous stone	4,217	7,774	4,668	9,591
Total [3]	37,190	65,307	43,822	76,407

W Withheld to avoid disclosing individual company confidential data.
[1] Less than ½ unit.
[2] Includes data for limestone, miscellaneous stone, and any data with symbol W in dimension stone.
[3] Data may not add to totals shown because of independent rounding.
[4] Data include shell.
[5] Data include quartz.

Table 16.—California: Stone sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension:				
Rough stone:				
Rough blocks	8	261	4	274
Construction	11	83	5	79
Flagging	W	W	1	18
Dressed stone:				
Architectural	1	31	3	220
Construction	2	26	2	23
Flagging	1	17	W	10
Roofing slate (architectural)	W	W	W	30
Other uses [1]	1	85	2	114
Total [2]	24	503	16	767
Crushed and broken:				
Bituminous aggregate	2,628	6,185	3,865	8,568
Concrete aggregate	3,460	5,017	4,160	5,604
Dense graded roadbase stone	8,253	13,373	8,289	13,173
Macadam aggregate	W	W	367	927
Surface treatment aggregate	695	850	409	601
Unspecified construction aggregate and roadstone	2,285	3,917	5,616	8,991
Agricultural purposes [3]	155	960	156	821
Cement manufacture	12,981	15,384	15,080	19,121
Fill	455	559	352	429
Glass manufacture	233	1,355	389	2,250
Lime manufacture	465	1,434	470	1,838
Mineral fillers, extenders and whiting [4]	W	W	403	3,003
Riprap and jetty stone	2,499	6,300	1,502	3,682
Manufactured fine aggregate (stone sand)	59	552	W	W
Filter stone	W	W	W	840
Sugar refining	216	W	230	W
Terrazzo and exposed aggregate	51	412	126	879
Roofing aggregates, chips and granules	W	W	733	1,616
Other uses [5]	2,757	9,009	1,677	4,065
Total [2]	37,190	65,307	43,822	76,407
Grand total [2]	37,213	65,811	43,838	77,175

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes stone used for monumental purposes, curbing, flooring slate (1973), and uses not specified (1972).
[2] Data may not add to totals shown because of independent rounding.
[3] Includes agricultural limestone, soil conditioners, and poultry grit and mineral food.
[4] Includes whiting or whiting substitute and other fillers or extenders.
[5] Includes stone used for railroad ballast, dead-burned dolomite, ferrosilicon, flux stone, refractory stone, chemicals, magnesium metal manufacture, waste material (1973) and uses not specified. 1972 data also include stone used for building products, abrasives, and neutralization and paper manufacture.

Sulfur.—Thirteen producers, including 12 oil companies, recovered 414,121 long tons of sulfur, compared with 330,157 long tons in 1972. Sales totaled 432,564 long tons ($4,539,087). Principal producers were Texaco, Inc., at the Long Beach oil refinery, Los Angeles County; Standard Oil Co. of Calif. at El Segundo, Los Angeles County, and Richmond, Contra Costa County; and Exxon USA at Benicia, Solano County.

Talc, Soapstone, and Pyrophyllite.—Mine production increased 15% over that of 1972. There were 14 producing mines, most of which were talc producers; two (Interpace Corp. at the Holiday mine, Inyo County, and at Victorville, San Bernardino County) produced only pyrophyllite, and one (Commercial Minerals Co. at the Doc mine, El Dorado County) mined only soapstone. Leading talc producer was L. Grantham Corp. at the Warm Springs mine in Death Valley, Inyo County. Other major producers were Pfizer, Inc., R. T. Vanderbilt, and Cyprus Mines Corp. The Panamint mine in the Panamint Range, Death Valley, Inyo County, was reopened by the United Sierra Div., Cyprus Mines Corp. The company also acquired rights to the Monarch mine, near Ibex Springs, San Bernardino County, which was in operation during the year. Pfizer, Inc., also acquired rights to talc properties in Death Valley, Inyo County.

Sales of prepared, ground material in-

creased 35%, reaching 238,144 tons valued at $7.65 million, for use in ceramics (33%), paint (16%), refractories (6%), paper (5%), a number of other applications, and for the export market.

Vermiculite.—Output increased 18% over that of 1972. There were two producers—W. R. Grace & Co., Zonolite Construction Products Div., at Los Angeles, Los Angeles County, Newark, Alameda County, and Santa Ana, Orange County; and La Habra Products Inc., at Anaheim, Orange County.

Consumption, by end use, during the year was as follows: Acoustical and fireproofing, 48%; concrete aggregate, 27%; fertilizer carrier, 13%; and miscellaneous (ceiling textures, plaster aggregate, insulation, horticulture, soil conditioner), 12%.

Wollastonite.—Western American Minerals Co. obtained a conditional land use permit from the Inyo County Planning Commission for 24 lode claims, located north of Hunter Mountain, Inyo County. The company planned wollastonite quarrying, a crushing and grinding plant at Olancha or Lone Pine, and rail shipment of a minus 200- and minus 325-mesh product in bulk and in bags. Principal uses are as filler-extender in ceramics, paints, plastics, rubber, and paper, and in abrasives.

METALS

Copper.—The small production of recoverable copper, largely a byproduct at Union Carbide Corp.'s Pine Creek mine, Inyo County, was substantially lower than that of 1972. Six other producers recovered byproduct copper at precious metal, lead, and lead-zinc operations, and a 65% copper precipitate was recovered from mine waters by Stauffer Chemical Co. at Iron Mountain, near Redding, Shasta County.

There was renewed interest in copper exploration in the Copper Basin, San Bernardino and Imperial Counties, and in the Foothill Copper Belt and Moonlight Valley, both in Plumas County. Louisiana Land and Exploration Co. was drilling in the Copper Basin and was considering a heap-leaching operation.

Prices for scrap copper and brass were rising in the bay area and Los Angeles markets during the year. Supplies were often short, and demand continued high. In the bay area, No. 1 heavy copper scrap was selling at 50 cents per pound early in the year and at 80 cents per pound late in the year.

Table 17.—California: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing [1]		Material sold or treated [2] (short tons)	Gold		Silver	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
1971, total	8	5	89,757	2,966	$122,351	443,761	$686,055
1972, total	5	4	18,005	3,974	232,876	175,467	295,661
1973:							
Del Norte	--	1	--	1	98	--	--
Fresno	--	--	--	655	64,066	82	210
Los Angeles	--	--	--	135	13,204	10	26
Mariposa	1	--	45	12	1,174	20	51
Merced	--	--	--	41	4,010	4	10
Plumas	--	3	--	32	3,130	--	--
San Diego	1	--	10	15	1,467	50	128
San Joaquin	--	--	--	522	51,057	50	128
Shasta	1	--	58	209	20,442	19	49
Stanislaus	--	--	--	603	58,980	60	154
Trinity	1	--	1,300	25	2,445	20	51
Undistributed [3]	4	3	5,528	1,397	136,639	55,582	142,180
Total	8	7	6,941	3,647	356,712	55,897	142,987

See footnotes at end of table.

Table 17.—California: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county—Continued

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1971, total	515	$535,704	2,284	$630,356	3,003	$967,016	$2,941,482
1972, total	598	612,246	1,153	346,736	1,202	426,768	1,914,287
1973:							
Del Norte	--	--	--	--	--	--	98
Fresno	--	--	--	--	--	--	64,276
Los Angeles	--	--	--	--	--	--	13,230
Mariposa	--	--	--	--	--	--	1,225
Merced	--	--	--	--	--	--	4,020
Plumas	--	--	--	--	--	--	3,130
San Diego	--	--	--	--	--	--	1,595
San Joaquin	--	--	--	--	--	--	51,185
Shasta	37	43,622	--	--	--	--	64,113
Stanislaus	--	--	--	--	--	--	59,134
Trinity	--	--	--	--	--	--	2,496
Undistributed [3]	332	396,074	44	14,320	20	8,229	697,442
Total	369	439,696	44	14,320	20	8,229	961,944

[1] Operations from which gold and silver are recovered as byproducts from sand and gravel operations not counted as producing mines.
[2] Does not include gravel washed.
[3] Alpine, Inyo, Kern, Mono, Placer, Sacramento, Sierra, and Siskiyou Counties combined to avoid disclosing individual company confidential data.

Table 18.—California: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1973, by type of material processed and method of recovery

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Smelting of concentrates [1]	427	53,018	331	10	12
Direct smelting of ore	54	2,618	1	34	8
Copper precipitates	--	--	37	--	--
Gold cleanup	56	24	--	--	--
Total lode material	537	55,660	369	44	20
Placer	3,110	237	--	--	--
Grand total	3,647	55,897	369	44	20

[1] Includes byproduct recovery from tungsten ore.

Table 19.—California: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1973, by class of ore or other source material

Source	Number of mines [1]	Material sold or treated [2] (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Dry gold, gold-silver [3]	4	3,412	403	13,125	(4)	1	2
Copper, lead, lead-zinc, tungsten ore [3]	3	[5] 3,468	78	42,511	332	43	18
Total	7	6,880	481	55,636	332	44	20
Other lode material:							
Gold cleanup	--	3	56	24	--	--	--
Copper precipitates	1	58	--	--	37	--	--
Total	1	61	56	24	37	--	--
Total lode material	8	6,941	537	55,660	369	44	20
Placer	7	--	3,110	237	--	--	--
Grand total	15	6,941	3,647	55,897	369	44	20

[1] Operations from which gold and silver are recovered as byproducts from sand and gravel operations not counted as producing mines.
[2] Does not include gravel washed.
[3] Combined to avoid disclosing individual company confidential data.
[4] Less than ½ unit.
[5] Excludes tungsten ore tonnage.

Gold.—Gold production was mainly from placer operations, including recovery from 15 sand-gravel washing operations. Because of prevailing high prices for gold, interest continued strong in prospecting and exploration throughout the State. According to the Office of Minerals Exploration (OME), U.S. Geological Survey, at Menlo Park, numerous applications were made for exploration assistance. The California Department of Fish and Game reported a large increase in permits for suction dredges. Discoveries of large nuggets were reported.

An OME-assisted project continued at the Brown Bear mine of American Primary Resources Co. near Lewiston, Trinity County. This mine has 20 miles of underground workings. Exploratory drilling was scheduled at 15 sites. OME projects were also underway at the Rex Montis mine, Mono County, and the Lucky Jack mine, Plumas County.

Alhambra-Atlanta Gold Mining Co. was rehabilitating the Yellowjack mine, near Kelsey, in the Mother Lode area. Homestake Mining Co. was conducting exploratory drilling programs at the Mountain King and Royal mines, Calaveras County.

Iron Ore and Concentrate.—Production increased 25%, following the reduced operations of 1972. Kaiser Steel Corp. reported record shipments of 2,497,000 long tons from the Eagle Mountain mine, Riverside County, and the other producer, Standard Slag Co., continued to expand operations following initial production in 1972 at the Beck mine, San Bernardino County. Kaiser shipped a 57% iron concentrate and a 63% iron agglomerate to its steelworks at Fontana, San Bernardino County. Early in the year, the company ordered a new 17-cubic-yard power shovel for use at Eagle Mountain. A modular hoist would permit removal of the hoist assembly as a unit, saving on downtime cost. Standard Slag marketed a 57% iron direct shipping ore and a 60% iron concentrate.

Iron and Steel.—Kaiser Steel Corp. reported new production and shipment records for crude steel at its Fontana steelworks.[15] Production of crude steel was 3,168,000 tons, and shipments totaled 2,381,000 tons. Mill production was 2,225,000 tons.

In August, Kaiser announced a $6 million program for design and construction of new air pollution control facilities at Fontana in order to meet emission standards. The program includes installation of afterburners on five coke-oven battery stacks, supplementary hoods and ducts at two oxygen steel furnaces, smoke collection and control devices in the oxygen steel and open hearth shops, and emission control devices at scrap preparation facilities.

Slag.—One million tons of blast furnace slag from Kaiser's Fontana steelworks was reclaimed by International Mill Services, Inc., for use in highway construction. Metallic content was recovered by magnetic separation and returned to Kaiser under a contractual agreement. Since 1968, 7 million tons of this slag has been recovered for use in road building, railroad ballast, filter media, roofing and landscraping, and concentrate aggregate.[16]

Scrap.—Demand for steel scrap was high in the Los Angeles and bay area markets, and prices were raised throughout the year. In the Los Angeles market, No. 1 heavy melting scrap was $40 per ton at the beginning of the year and about $60 per ton late in the year. In the bay area, prices were somewhat higher—about $50 per ton in January and $70, or more, at yearend. Exports to the Far East, mainly Japan, continued strong on contracts concluded early in the year. A price freeze and temporary export controls tended to cause uncertainty in the market.

Mercury.—Mining activity and output continued in a decline. Output was only 1,219 flasks, whereas in 1970, the annual rate had exceeded 18,000 flasks. Production was intermittent from 19 properties, many of which produced only a few flasks. The leading producers, both in Santa Clara County, were Guadalupe Mining Co., lessee at the Guadalupe mine, and Santa Clara Quicksilver Co., lessee at the neighboring New Almaden mine. At the latter, a limited exploration program was conducted at two underground locations. The Culver-Baer mine, near The Geysers geothermal field in Sonoma County, was sold to Pacific Energy Corp.

[15] Kaiser Steel Corp. 1973 Annual Report 1973. P. 2.

[16] Skillings' Mining Review. Million Tons of Slag for Building Freeway. V. 62, No. 47, Nov. 24, 1973, p. 25.

Table 20.—California: Mercury production, by method of recovery

Year	Operating mines	Recovery method: Furnaced: Ore treated (short tons)	Furnaced: 76-pound flasks	Retorted: Ore treated (short tons)	Retorted: 76-pound flasks	Retorted: Unclassified (76-pound flasks)[1]	Total: 76-pound flasks	Total: Value[2] (thousands)
1969	72	[3] 215,495	16,093	37,199	2,387	W	18,480	$9,333
1970	51	[3] 222,495	17,587	15,005	547	459	18,593	7,582
1971	39	[3] 131,120	12,485	19,089	698	306	13,489	3,944
1972 [r]	30	58,942	5,835	W	W	W	5,835	1,274
1973	18	14,280	1,133	W	W	86	1,219	349

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Furnaced."
[1] Includes mercury recovered from old surface ores, dumps, and placers.
[2] Value calculated at average New York price.
[3] Includes ore and mercury from dumps not separable.

Molybdenum.—Production more than doubled at the Union Carbide Corp. Pine Creek mine, Inyo County, where oxide and sulfide concentrates are recovered as a byproduct of tungsten.

A molybdenum deposit was located by M. S. & W. Resources, Inc., on the west slope of the Panamint Range in the Saline Valley area. The highest grade of molybdenite, the ore mineral, occurs in a monzonite, which intrudes a sequence of Paleozoic shale and limestone.

Nickel.—Hanna Mining Co. acquired lateritic nickel deposits at Red Mountain and Little Red Mountain, northwest of Laytonville, Mendocino County.

Rare-Earth Minerals.—Continued expansion of production at the Molycorp mine at Mountain Pass, San Bernardino County, was attributed to growing demand for rare-earth elements. Concentrate production increased 64% over that of 1972. Rare-earth oxide (REO) content was 19,341 tons. New mill capacity completed in 1973 will permit production of 30,000 tons REO. According to Molycorp's annual report, production at Mountain Pass was restricted by shortages of certain chemical reagents during the year.

Silver.—Output of mine silver again was sharply reduced in 1973. Principal producers were Union Carbide Corp. at the Pine Creek mine, Inyo County; Claude B. Lovestedt at the Zaca mine, Alpine County; Montecito Minerals Corp. at the Darwin mine, Inyo County; and Brownstone Mining Co. at the Santa Rosa mine, Inyo County. In January, Montecito Minerals commenced mining a complex silver-lead-copper-tungsten ore in the Thompson workings, at and above the 400 level at the Darwin mine. The company also controlled a low-grade silver-bearing mill tailings pile, which it planned to run through its new 200-ton-per-day mill. The mill, operated intermittently during the year, produced a silver-lead-copper bulk flotation concentrate, which was shipped to American Smelting and Refining Co. at El Paso, Tex.

Tungsten.—There were 10 recorded producers in 1973, although the Union Carbide Corp., Pine Creek mine, Inyo County, accounted for about 98% of total output. The marketed product is ammonium paratungstate (APT). In March, Union Carbide opened a new plant for removal of sodium sulfate from the APT mill effluent, prior to release of this effluent into the Pine Creek drainage.

An exploratory diamond drilling program and geological studies were in progress at the Strawberry mine, Madera County. The mine was leased by Teledyne Wah Chang Corp. in 1972.

Table 21.—Principal producers

Commodity and company	Address	Type of activity	County
Asbestos:			
Atlas Asbestos Co	P.O. Box 805 Coalinga, Calif. 93210	Open pit mine	Fresno.
Coalinga Asbestos Co	P.O. Box 1045 Coalinga, Calif. 93210	---- do ----	Do.
Pacific Asbestos Corp	P.O. Box 127 Copperopolis, Calif. 95228	---- do ----	Calaveras.
Union Carbide Corp	P.O. Box K King City, Calif. 93930	---- do ----	San Benito.
Barite: Industrial Minerals Co	1057 Commercial St. San Carlos, Calif. 94070	---- do ----	Shasta.
Boron minerals and compounds:			
Kerr-McGee Chemical Corp	OMB–508, Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Dry lake brines	San Bernardino.
Stauffer Chemical Co	636 California St. San Francisco, Calif. 94119	---- do ----	Do.
Tenneco, Inc	Tenneco Bldg. Houston, Tex. 77002	Open pit mine	Inyo.
United States Borax & Chemical Corp.	P.O. Box 75128 Stanford Station Los Angeles, Calif. 90005	---- do ----	Inyo and Kern.
Bromine and compounds: Kerr-McGee Chemical Corp.	OMB–508, Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Dry lake brines	San Barnardino.
Calcium-magnesium chloride:			
Leslie Salt Co	P.O. Box 364 Newark, Calif. 94560	---- do ----	Do.
National Chloride Co. of America.	Suite 803, Wilflower Bldg. 615 South Flower St. Los Angeles, Calif. 90017	---- do ----	Do.
Carbon dioxide: Standard Oil Co	225 Bush St. San Francisco, Calif. 94120	Natural gasoline processing plant.	Kern.
Cement:			
Amcord Inc	610 Newport Center Drive Newport Beach, Calif. 92660	Dry process portland cement plants.	Riverside and San Barnardino.
Calaveras Cement Div., The Flintkote Co.	215 Market St. San Francisco, Calif. 94104	Wet and dry process portland cement plants.	Calaveras and Shasta.
California Portland Cement Co.	800 Wilshire Blvd. Los Angeles, Calif. 90017	Dry process portland cement plants.	Kern and San Bernardino.
Ideal Cement Co., a division of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Wet process portland cement plants.	San Benito and San Mateo.
Kaiser Cement & Gypsum Corp.	300 Lakeside Dr. Oakland, Calif. 94612	---- do ----	San Bernardino and Santa Clara.
Monolith Portland Cement Co	3326 San Fernando Rd. Los Angeles, Calif. 90065	Wet process portland cement plants.	Kern.
Lone Star Industries, Inc	400 Alabama St. San Francisco, Calif. 94110	---- do ----	Santa Cruz.
General Portland, Inc	3810 Wilshire Blvd. Los Angeles, Calif. 90005	---- do ----	Kern.
Southwestern Portland Cement Co.	1034 Wilshire Blvd. Los Angeles, Calif. 90017	Wet and dry process portland cement plant.	San Bernardino.
Clays and shale:			
Amcor, Inc., Riverside Cement Co.	P.O. Box 832 Riverside, Calif. 92501	Open pit mine	Orange, Riverside, San Bernardino.
Basalt Rock, Co., Inc	Eighth and River Sts. Napa, Calif. 94458	---- do ----	Napa.
Calaveras Cement Div., The Flintkote Co.	San Andreas, Calif. 95249	---- do ----	Amador, Calaveras, Shasta.
Crestlite Inc., a division of Susquehanna Corp.	Camino De Estrella San Clemente, Calif. 92672	---- do ----	Orange.
Homestake Mining Co	650 California St. San Francisco, Calif. 94108	---- do ----	Contra Costa.

Table 21.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clays and shale—Continued			
Interpace Corp	2901 Los Feliz Blvd. Los Angeles, Calif. 90039	Open pit mine	Amador, Placer, Riverside, San Bernardino, Sutter, Yuba.
Kaiser Industries Corp	300 Lakeside Dr. Oakland, Calif. 94612	do	Alameda.
Lightweight Processing Co	650 South Grand Ave. Los Angeles, Calif. 90017	do	San Bernardino and Ventura.
Pacific Cement & Aggregates, Div. of Lone Star Industries, Inc.	400 Alabama St. San Francisco, Calif. 94100	do	Santa Cruz.
Pacific Clay Products, Inc	1255 West Fourth St. Los Angeles, Calif. 90017	do	Amador, Orange, Riverside.
Port Costa Products Co	P.O. Box 5 Port Costa, Calif. 94569	do	Contra Costa.
Southwestern Portland Cement Co.	1034 Wilshire Blvd. Los Angeles, Calif. 90017	do	San Bernardino.
Copper: Union Carbide Corp., Mining & Metals Div.	270 Park Ave., 38th Floor New York, N.Y. 10017	Underground mine.	Inyo.
Diatomite:			
GREFCO, Inc	630 Shatto Pl. Los Angeles, Calif. 90005	Open pit mine	Santa Barbara.
Johns-Manville Products Corp., Celite Div.	Lompoc, Calif. 93436	do	Do.
Feldspar:			
Wedron Silica Co	P.O. Box 150 Pacific Grove, Calif. 93950	do	Monterey.
Owens-Illinois, Inc	P.O. Box 1035–1036 Toledo, Ohio 43601	do	Do.
Gold: Santoni & Santoni	5078 West Shields Fresno, Calif. 93705	Byproduct recovery.	Fresno, Merced, Sacramento, San Joaquin, Shasta, Stanislaus, Tulare.
Gypsum:			
H. M. Holloway, Inc	714 Sixth St. Wasco, Calif. 93280	Open pit mine	Kern.
Temblor Gypsum Co	Carrisa Plains, Star Route Box 80 Santa Margarita, Calif. 93453	do	Do.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	Open pit mine and calcining plant.	Imperial.
Iron ore:			
Kaiser Steel Corp	P.O. Box 158 Eagle Mountain, Calif. 92241	Mine, concentrator and pelletizing plant.	Riverside.
Standard Slag Co	Box 4400 Reno, Nev. 89505	Mine and concentrator.	San Bernardino.
Lime:			
American Crystal Sugar Co	Box 419 Denver, Colo. 80201	Shaft kiln	Yolo.
Diamond Springs Lime Co	P.O. Box 407 Diamond Springs, Calif. 95619	Rotary kiln and continuous hydrator.	El Dorado.
The Flintkote Co	P.O. Box 57367 Flint Station Los Angeles, Calif. 90057	Shaft and rotary kilns, continuous hydrator.	Contra Costa and Tuolumne.
Holly Sugar Corp	Box 1052 Colorado Springs, Colo. 80901	Shaft kilns and continuous hydrator.	Glenn, Imperial, Orange, San Joaquin.
Kaiser Aluminum & Chemicals Corp.	Moss Landing, Calif. 95039	Rotary kiln and continuous hydrator.	Monterey.
Pfizer, Inc	P.O. Drawer AD Victorville, Calif. 92392	Fluidized-bed kiln and continuous hydrator.	San Bernardino.
Stauffer Chemical Co	636 California St. San Francisco, Calif. 94119	Rotary kiln and continuous hydrator.	Do.
Union Sugar Div	230 California St. San Francisco, Calif. 94111	Shaft kiln	Santa Barbara.
Lithium minerals: Kerr-McGee Chemical Corp.	OMB–508, Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Dry lake brines.	San Bernardino.

Table 21.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Magnesium compounds:			
FMC Corp	P.O. Box 344 Newark, Calif. 94560	Salt works bitterns.	San Diego.
Kaiser Aluminum & Chemical Corp.	Moss Landing, Calif. 95039	Sea water processing.	Monterey.
Merck & Co., Inc	Rahway, N.J. 07065	do	San Mateo.
Mercury:			
Guadalupe Mining Co	14900 Guadalupe Mine Rd. San Jose, Calif. 95120	Underground mine.	Santa Clara.
Santa Clara Quicksilver Co	21731 Almaden Rd. San Jose, Calif. 95120	do	Do.
Sulphur Creek Mining	201 Ridge Rd. Ukiah, Calif. 95482	do	Sonoma.
Molybdenum: Union Carbide Corp., Mining & Metals Div.	270 Park Ave., 38th Floor New York, N.Y. 10017	do	Inyo.
Natural gas liquids:			
Standard Oil Co. of California.	225 Bush St. San Francisco, Calif. 94120	Natural gasoline plants.	Fresno, Kern, Kings, Los Angeles, Orange, Santa Barbara, Ventura.
Union Oil Co. of California	P.O. Box 7600 Los Angeles, Calif. 90054	do	Fresno, Kern, Los Angeles, Orange, Santa Barbara, Ventura.
Peat:			
Delta Humas Co	P.O. Box 89 Holt, Calif	Reed-sedge bog	San Joaquin.
Peter J. Gambetta	Route 1, Box 78 Brentwood, Calif. 94513	do	Contra Costa.
Radel, Inc	P.O. Box 7075 Reno, Nev. 89502	Pit and plant	Alameda.
Perlite (crude): American Perlite Co.	11831 Vose St. North Hollywood, Calif. 91605	Open pit mine	Inyo.
Perlite (expanded):			
Harborlite Corp	P.O. Box 458 Escondido, Calif. 92025	Plant	San Diego.
Paramount Perlite Co., Inc	16236 South Illinois P.O. Box 83 Paramount, Calif. 90723	do	Los Angeles.
Redco, Inc	11831 Vose St. North Hollywood, Calif. 91605	do	Do.
Petroleum:			
Atlantic Richfield Co	5900 Cherry Ave. Long Beach, Calif. 90805	Oilfields	Kern, Los Angeles, Orange, San Luis Obispo, Santa Barbara, Ventura.
Belridge Oil Co	1300 West Fourth St. Los Angeles, Calif. 90017	do	Kern and Santa Barbara.
Chanslor-Western Oil & Development Co.	4549 Produce Plaza Los Angeles, Calif. 90058	do	Kern, Los Angeles, Orange, Ventura.
Continental Oil Co	Box 2197 Houston, Tex. 77001	do	Various.
Getty Oil Co	3810 Wilshire Blvd. Los Angeles, Calif. 90005	do	Fresno, Kern, Los Angeles, Monterey, Orange, Riverside, San Bernardino, Santa Barbara, Ventura.
Mobil Oil Corp	612 South Flower St. Los Angeles, Calif. 90017	do	Fresno, Kern, Kings, Los Angeles, Monterey, Orange, San Benito, San Luis Obispo, Santa Barbara, Ventura.
Shell Oil Co	1008 West Sixth St. Los Angeles, Calif. 90017	do	Contra Costa, Fresno, Kern, Los Angeles, Orange, San Benito, Santa Barbara, Ventura.

Table 21.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Petroleum—Continued			
Signal Oil and Gas Co	1010 Wilshire Blvd. Los Angeles, Calif. 90017	Oilfields	Fresno, Kern, Los Angeles, Orange, San Luis Obispo, Santa Barbara, Ventura.
Standard Oil Co. of California.	225 Bush St. San Francisco, Calif. 94120	do	Contra Costa, Fresno, Kern, Kings, Los Angeles, Orange, San Luis Obispo, Santa Barbara, Ventura.
Texaco, Inc	3350 Wilshire Blvd. Los Angeles, Calif. 90005	do	Fresno, Kern, Los Angeles, Monterey, Orange, Santa Barbara, Ventura.
Thumas Long Beach Co	840 Van Camp St. Long Beach, Calif. 90801	do	Los Angeles.
Union Oil Co. of California	461 South Boylston Los Angeles, Calif. 90017	do	Fresno, Kern, Los Angeles, Orange, San Luis Obispo, Santa Barbara, Ventura.
Potassium salts: Kerr-McGee Chemical Corp.	OMB–508, Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Dry lake brines	San Bernardino.
Pumice:			
Aiken Builders Products	P.O. Box 878 Las Vegas, Nev. 89101	Open pit mine	Do.
Cinder Products Co	3450 Lakeshore Ave. Oakland, Calif. 94610	do	Lake.
Red Lava Products of California.	Star Rte. Clearlake, Calif. 94523	do	Do.
Sanford Sand & Cinders	P.O. Box 184 Fall River, Calif. 96028	do	Shasta.
Rare-earth metals: Molybdenum Corp. of America.	Mountain Pass via Nipton, Calif. 92366	do	San Bernardino.
Salt:			
Leslie Salt Co	505 Beach St. San Francisco, Calif. 94111	Solar evaporation and open pit mine.	Alameda, Napa, San Bernardino, San Mateo.
Metropolitan Water Dist. of Southern California.	P.O. Box 54153 Los Angeles, Calif. 90054	Solar evaporation.	San Bernardino.
Pacific Salt & Chemical Co	4262 Wilshire Blvd. Los Angeles, Calif. 90021	do	Do.
Southwest Salt Co	714 West Olympic Blvd. Los Angeles, Calif. 90015	do	Do.
Western Salt Co	P.O. Box 149 San Diego, Calif. 92112	do	Kern and San Diego.
Sand and gravel:			
Azusa Western, Inc	P.O. Box 575 Azusa, Calif. 91702	Open pit mine	Los Angeles.
Conrock Co	Box 2950, Terminal Annex Los Angeles, Calif. 90051	do	Los Angeles, Orange, San Bernardino.
The Flintkote Co., Associated Rock Div.	P.O. Box 416 Upland, Calif. 91786	do	Los Angeles, Orange, San Bernardino, Ventura.
Kaiser Sand and Gravel Co., division of Kaiser Industries Corp.	300 Lakeside Dr. Oakland, Calif. 94612	do	Alameda, Contra Costa, Glenn, Santa Clara, Santa Cruz, Sonoma.
Livingston-Graham, Inc	5500 North Peck Rd. El Monte, Calif. 91731	do	Los Angeles, Orange, San Bernardino, Ventura.
Owl Rock Products Co	P.O. Box 47 Irwindale, Calif. 91707	do	Fresno, Los Angeles, Orange, Riverside.

Table 21.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel—Continued			
Pacific Cement & Aggregates, Div. of Lone Star Cement Corp.	400 Alabama St. San Francisco, Calif. 94110	Open pit mine	Alameda, Fresno, Monterey, Sacramento, San Joaquin, San Mateo, Santa Cruz, Tulare, Yolo.
Rhodes & Jamieson Ltd	P.O. Box 118 Oakland, Calif. 94604	Pit and plant	Alameda.
Sully-Miller Construction Co	P.O. Box 432 Orange, Calif. 92669	Pit and 4 plants	Orange.
Teichert Aggregates, Inc., a subsidiary of A. Teichert & Son, Inc.	P.O. Box 15002 Sacramento, Calif. 95813	Open pit mine	Neveda, Sacramento, San Joaquin, Yolo, Yuba.
Silver: Union Carbide Corp., Mining & Metals Div.	270 Park Ave., 38th Floor New York, N.Y. 10017	Underground mine.	Inyo.
Sodium compounds:			
Kerr-McGee Chemical Corp	OMB–508, Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Dry lake brines.	San Bernardino.
Stauffer Chemical Co	Box 3050, Rincon Ave. San Francisco, Calif. 94108	do	Do.
United States Borax & Chemical Corp.	P.O. Box 75128 Sanford Station Los Angeles, Calif. 90005	Open pit mine	Kern.
Stone:			
American Cement Corp	P.O. Box 832 Riverside, Calif. 92501	Open quarry and underground mine.	Los Angeles, Riverside, San Bernardino.
Basalt Rock Co., Inc	P.O. Box 2540 Napa, Calif. 94558	Open quarry	Marin, Napa, Sonoma.
Calaveras Cement Div., The Flintkote Co.	San Andreas, Calif. 95249	do	Calaveras and Shasta.
California Portland Cement Co.	612 South Flower St. Los Angeles, Calif. 90017	do	Kern and San Bernardino.
East Bay Excavating Co	28814 Mission Blvd. Hayward, Calif. 94544	do	Do.
Granite Rock Co	P.O. Box 151 Watsonville, Calif. 95076	do	San Benito.
Kaiser Cement & Gypsum Corp.	Permanente Rd. Permanente, Calif. 95014	do	San Bernardino and Santa Clara.
Kaiser Industries Corp	300 Lakeside Dr. Oakland, Calif. 94612	do	Contra Costa.
Lone Star Industries, Inc	400 Alabama St. San Francisco, Calif. 94110	do	Contra Costa, San Mateo, Santa Cruz.
Monolith Portland Cement Co.	Box 65677, Glassell Station Los Angeles, Calif. 90065	2 quarries	Kern.
Southwestern Portland Cement Co.	1034 Wilshire Blvd. Los Angeles, Calif. 90017	Open quarry	San Bernardino.
Talc, pyrophylite, soapstone:			
Cyprus Mines Corp	P.O. Box 1201 Trenton, N.J. 08606	Open pit and underground mines.	Inyo and San Bernardino.
L. Grantham Corp	1915 South Coast Hwy. Laguna Beach, Calif. 92651	Underground mine.	Inyo.
Minerals, Pigments & Metals Div., Pfizer, Inc.	P.O. Drawer AD Victorville, Calif. 92394	Open pit and underground mines.	Inyo and San Bernardino.
Pomona Tile Manufacturing Co.	216 South Reservoir St. Pomona, Calif. 91766	Underground mine.	San Bernardino.
Tungsten: Union Carbide Corp., Mining & Metals Div.	270 Park Ave., 38th Floor New York, N.Y. 10017	do	Inyo.

The Mineral Industry of Colorado

By Andrew Kuklis [1]

The mining and petroleum industries of Colorado produced commodities valued at $532.8 million, a 25% increase compared with that of 1972. A substantial rise in the values of cement, coal, gold, molybdenum, natural gas liquids, petroleum, sand and gravel, and silver caused the 1973 increase. The State continued as the principal domestic source of molybdenum and tin.

Thirty mineral commodities were produced in Colorado in 1973, one less than in 1972. Of these, 6 were classified as fuels, 11 as metals, and 13 as nonmetallic minerals. Twenty minerals registered increases in value, eight declined in value, and two remained unchanged compared with 1972. The production of mica was reportedly discontinued.

Mineral fuels rose 38% in value over that of 1972 and accounted for 44% of the total mineral production value in Colorado. Most of the mineral fuels showed an increase in value; only carbon dioxide and peat registered declines compared with 1972. Based on value, petroleum and coal were the leading mineral fuels produced in 1973.

Valued output of metals rose $18.8 million and was 11% higher than in 1972. Metals accounted for 36% in value of minerals produced, 4% less than in 1972. Based on value, molybdenum and zinc were the leading metals produced in 1973.

Nonmetallic minerals collectively accounted for 20% of the value of Colorado's mineral production, the same as in 1972. The leading nonmetallic minerals were sand and gravel and cement, both of which increased significantly in valued output compared with 1972.

Of the 62 counties, only Hinsdale County had no mineral production. Forty-five of the 62 counties registered increases in value of mineral production, while 17 showed decreases. Fourteen counties produced minerals valued in excess of $10 million. Lake County with $118.0 million and Rio Blanco County with $94.5 million were the leading counties; output from the two counties together represented nearly 40% of the State's value.

[1]Physical scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Mineral production in Colorado [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays ---- thousand short tons	747	$1,533	794	$1,710
Coal (bituminous) ---- do	5,522	35,637	6,233	46,190
Copper (recoverable content of ores, etc.) - short tons	3,944	4,039	3,123	3,716
Gem stones	NA	131	NA	131
Gold (recoverable content of ores, etc.) troy ounces	61,100	3,580	63,422	6,203
Gypsum ---- thousand short tons	W	W	151	568
Lead (recoverable content of ores, etc.) - short tons	31,346	9,423	28,112	9,159
Lime ---- thousand short tons	187	4,070	178	3,371
Mica, scrap ---- pounds	14,280	7	--	--
Natural gas ---- million cubic feet	116,949	19,297	137,725	24,304
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels	1,245	3,349	1,424	4,295
LP gases ---- do	1,749	3,673	1,978	6,488
Peat ---- thousand short tons	39	210	28	163
Petroleum (crude) ---- thousand 42-gallon barrels	32,015	109,171	36,590	155,507
Pumice ---- thousand short tons	59	W	W	W
Sand and gravel ---- do	28,318	34,631	33,767	45,493
Silver (recoverable content of ores, etc.) thousand troy ounces	3,664	6,174	3,942	10,083
Stone ---- thousand short tons	4,507	9,599	6,357	14,003
Uranium (recoverable content) ---- thousand pounds	1,877	11,825	1,920	12,480
Zinc (recoverable content of ores, etc.) -- short tons	63,801	22,649	58,339	24,106
Value of items that cannot be disclosed: Beryllium (1972), carbon dioxide, cement, feldspar, fluorspar, iron ore, molybdenum, perlite, pyrites, salt, tin, tungsten, vanadium, and values indicated by symbol W ----	XX	146,843	XX	164,806
Total ----	XX	425,841	XX	532,776
Total 1967 constant dollars ----	XX	351,361	XX	p 391,164

pPreliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed". XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Colorado, by county [1]
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adams	$17,705	$19,451	Petroleum, sand and gravel, natural gas, natural gas liquids, lime, gold, stone, silver.
Alamosa	112	W	Sand and gravel, peat.
Arapahoe	15,429	18,225	Petroleum, sand and gravel, natural gas liquids, natural gas, stone.
Archuleta	W	W	Petroleum, natural gas, sand and gravel.
Baca	1,088	1,021	Natural gas, petroleum, sand and gravel, stone.
Bent	162	176	Sand and gravel, petroleum, natural gas, clays, stone.
Boulder	15,972	18,366	Cement, sand and gravel, stone, fluorspar, lime, clays, gold, peat, petroleum, lead, silver, copper, zinc.
Chaffee	W	W	Stone, sand and gravel, peat.
Cheyenne	W	W	Petroleum, sand and gravel, natural gas.
Clear Creek	W	W	Molybdenum, sand and gravel, gold, lead, stone, silver, copper.
Conejos	102	183	Sand and gravel, gold, silver, copper, zinc.
Costilla	W	W	Pumice, sand and gravel.
Crowley	W	W	Sand and gravel.
Custer	W	W	Sand and gravel, perlite.
Delta	1,587	W	Coal, sand and gravel, lime, stone.
Denver	736	W	Sand and gravel, stone.
Dolores	945	2,166	Petroleum, natural gas, silver, lead, copper, stone, zinc, gold.
Douglas	W	W	Sand and gravel, clays, stone.
Eagle	W	W	Zinc, sand and gravel, lead, silver, stone, copper, gold, pumice.
Elbert	706	856	Petroleum, sand and gravel, natural gas, clays, stone.
El Paso	3,117	W	Stone, sand and gravel, clays.

See footnotes at end of table.

Table 2.—Value of mineral production in Colorado, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Fremont	$15,353	$17,220	Cement, stone, coal, gypsum, sand and gravel, clays, petroleum, uranium, feldspar.
Garfield	2,675	1,328	Sand and gravel, stone, uranium, natural gas, coal.
Gilpin	W	W	Gold, peat, zinc, silver, copper, lead, stone.
Grand	90	109	Sand and gravel.
Gunnison	7,049	W	Coal, sand and gravel.
Hinsdale	2	--	
Huerfano	W	162	Sand and gravel, stone.
Jackson	5,529	6,147	Fluorspar, petroleum, natural gas, sand and gravel.
Jefferson	12,258	15,889	Sand and gravel, uranium, stone, clays, gold, silver.
Kiowa	W	W	Petroleum, natural gas, sand and gravel.
Kit Carson	258	W	Sand and gravel, petroleum.
Lake	93,275	117,994	Molybdenum, zinc, tungsten, lead, silver, gold, copper, tin, sand and gravel, pyrites.
La Plata	7,335	10,287	Natural gas, natural gas liquids, sand and gravel, coal, petroleum, stone.
Larimer	13,996	18,669	Cement, stone, sand and gravel, petroleum, lime, gypsum, natural gas.
Las Animas	W	W	Coal, sand and gravel, clays.
Lincoln	W	164	Sand and gravel.
Logan	6,168	7,109	Petroleum, natural gas liquids, natural gas, sand and gravel, lime, stone.
Mesa	3,965	3,755	Uranium, sand and gravel, vanadium, natural gas liquids, natural gas, stone.
Mineral	4,953	6,491	Silver, lead, zinc, copper, sand and gravel.
Moffat	8,847	11,174	Natural gas, petroleum, coal, sand and gravel, copper, silver.
Montezuma	r 1,048	1,331	Petroleum, sand and gravel, natural gas, carbon dioxide, stone.
Montrose	6,805	5,810	Uranium, vanadium, sand and gravel, coal, salt, stone.
Morgan	4,274	4,444	Petroleum, natural gas liquids, natural gas, lime, sand and gravel.
Otero	W	W	Sand and gravel, lime, stone.
Ouray	5,239	W	Zinc, lead, copper, silver, gold, sand and gravel.
Park	W	W	Peat, sand and gravel, stone, gold.
Phillips	W	W	Sand and gravel.
Pitkin	5,126	6,665	Coal, iron ore, sand and gravel, natural gas, stone.
Prowers	W	W	Sand and gravel, petroleum.
Pueblo	4,181	W	Sand and gravel, lime, clays, stone.
Rio Blanco	59,095	94,487	Petroleum, natural gas, natural gas liquids, sand and gravel, stone.
Rio Grande	217	W	Sand and gravel.
Routt	9,360	W	Coal, petroleum, sand and gravel, natural gas.
Saquache	6	W	Sand and gravel, stone.
San Juan	W	8,380	Gold, zinc, lead, silver, copper.
San Miguel	19,297	19,556	Vanadium, zinc, uranium, lead, copper, gold, silver, natural gas, petroleum, sand and gravel.
Sedgwick	W	W	Lime, natural gas, sand and gravel.
Summit	W	897	Sand and gravel, silver, lead, copper.
Teller	W	W	Stone, peat, gold, sand and gravel.
Washington	W	11,083	Petroleum, natural gas, sand and gravel.
Weld	10,390	18,218	Petroleum, coal, sand and gravel, natural gas, natural gas liquids, lime, stone.
Yuma	W	W	Sand and gravel, natural gas.
Undistributed [2]	r 61,383	84,965	
Total [3]	425,841	532,776	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Values for petroleum are based on an average price per barrel for the State. Values for uranium have been estimated for 1973.

[2] Includes some sand and gravel that cannot be assigned to specific counties, gem stones, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent roundings.

Table 3.—Indicators of Colorado business activities

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ---------- thousands --	985.2	1052.7	+6.9
Employment ---------- do ----	950.0	1016.7	+7.0
Unemployment ---------- do ----	35.2	36.0	+2.3
Wholesale and retail trade ---------- do ----	205.5	219.4	+6.8
Finance, insurance, and real estate ---------- do ----	47.0	48.8	+3.8
Mining ---------- do ----	13.7	14.1	+2.9
Construction ---------- do ----	64.2	75.9	+18.2
Government ---------- do ----	186.7	189.6	+1.6
Services ---------- do ----	150.7	158.5	+5.2
Transportation and public utilities ---------- do ----	54.9	57.5	+4.7
Personal income:			
Total ---------- millions --	$10,782	$12,298	+14.1
Per capita ----------	$4,574	$5,046	+10.3
Construction activity:			
New housing units authorized ----------	65,664	45,495	−30.7
Value of nonresidential construction ------- millions --	$286.2	$376.9	+31.7
Highway construction contracts awarded ------ do ----	[e] $69.2	$79.0	+14.2
Cement shipments to and within Colorado thousand short tons --	1,470	1,639	+11.5
Farm marketing receipts ---------- millions --	$1,779.1	$2,147.1	+20.7
Mineral production value ---------- do ----	$425.8	$532.8	+25.1

[e] Estimate. [p] Preliminary.

Source: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

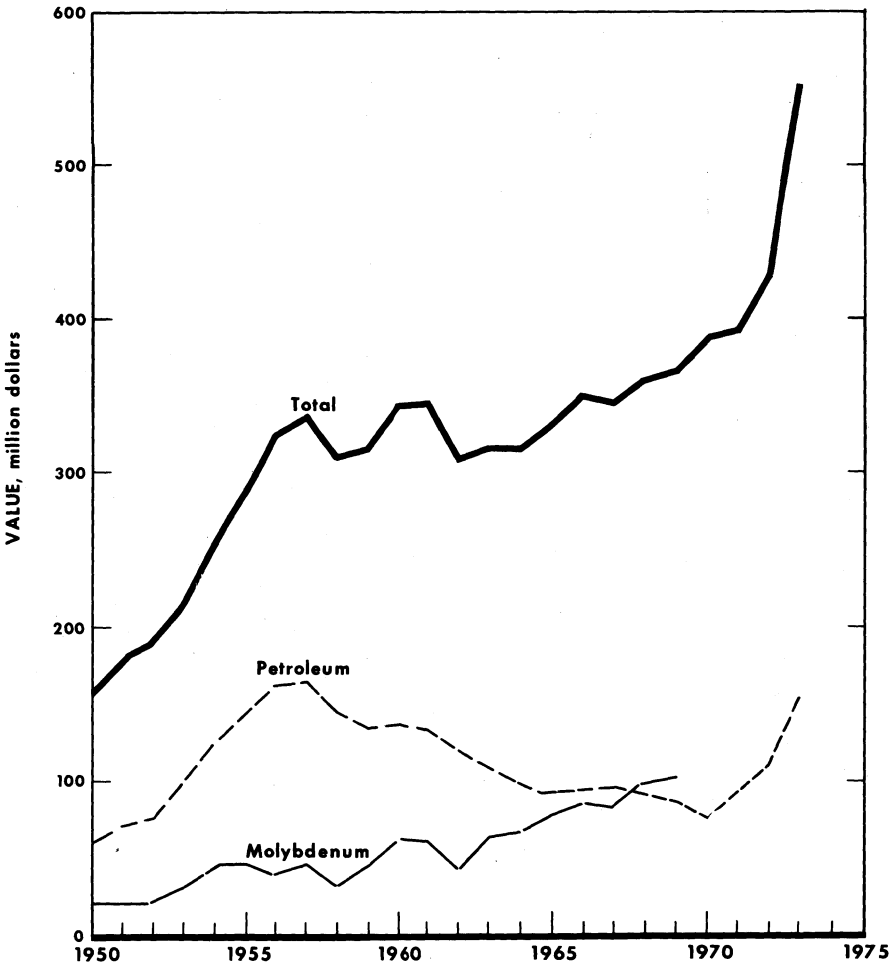

Figure 1.—Value of molybdenum, petroleum, and total value of mineral production in Colorado.

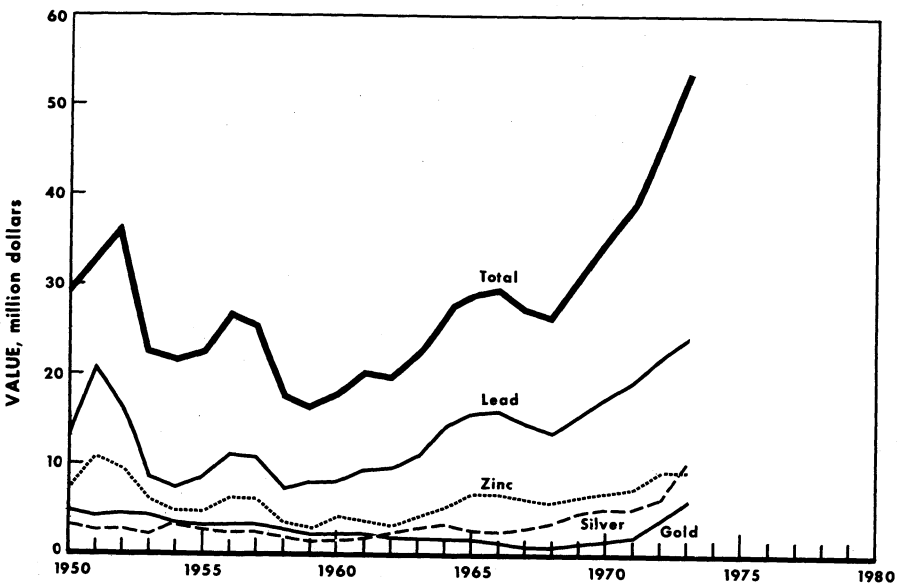

Figure 2.—Value of mine production of gold, silver, lead, copper, and zinc and total value of these minerals in Colorado.

Legislation and Government Programs.—The National Science Foundation provided a $96,000 grant to Denver Research Institute (DRI) to investigate waste disposal problems and the environmental effects of large-scale mining and retorting of oil shales in Mesa County. Specifically, the potential impact on the environment (water runoff, ground water, and vegetation) by residual polycondensed aromatics and other organic materials will be studied, including their translocation into plants and animals. The research contract also provided funds for investigating the economic potential of processed shale.

The Colorado State Board of Land Commission sold at auction 1,045 acres of State land near Craig, Moffat County, to a consortium of electric utility corporations. An additional 144 acres containing coal resources were leased to a major mining company for development of a mine and construction of a cleaning plant. The State received $221,000 for the land. Royalties on coal also were negotiated that were expected to return an estimated $15 million to the State.

Colorado State University announced development of a new technique to determine carbon monoxide levels in blood samples. The technique is based on the phenomena of the amount of energy required to cause carbon and oxygen atoms to vibrate in respect to each other. The energy differential was measured by infrared spectrophotometer on samples of normal hemoglobin and one saturated with carbon monoxide.

For the first time on record and in accordance with the new Department of the Interior coal leasing policy, the Bureau of Land Management (BLM) offered for leasing 40 acres of prime land containing coal resources on the basis of competitive royalty bids. The coal is located 6 miles east of Somerset, Gunnison County, adjacent to coal mined by Western Slope Carbon Co.

BLM was conducting a detailed land use study on approximately 176,000 acres of National Resource Lands in Craig County and public lands in Routt and eastern Moffat Counties. An intensive inventory of resources will be compiled, thence the data used to evaluate capabilities and limitations of the land.

A water rights bill was signed into law by Governor John Love authorizing the State to appropriate water to maintain

stream flow and lake levels for environmental purposes.

A Western Museum of Mining and Industry was under construction on 63 acres of land adjacent to the Air Force Academy. The display building will contain many hundreds of items related to mining, especially application of electricity, steam, and diesel engineering. At yearend, the site was prepared and shop and storage facility constructed. The museum was scheduled to be completed and open to the public in 1974.

BLM proposed to withdraw over 40,000 acres of National Resource Lands for the establishment of the Powderhorn primitive area. The Federally owned land is located in Gunnison and Hinsdale Counties in south-central Colorado. The withdrawal was requested by BLM to protect the unique and ecological aspects of the area. In addition, the outstanding wildlife habitat, scenic, and pristine features associated with the Powderhorn primitive area also was a determining factor in the decision to withdraw the land.

REVIEW BY MINERAL COMMODITIES

METALS

Aluminum.—The Southwire Co., National Steel Corp., and Earth Sciences Inc., in a joint venture for research and technological development, initiated construction of two buildings containing 20,000 square feet at the Colorado School of Mines industrial park near Golden. The buildings costing $1 million will be known as the Alunite Metallurgical Center. One building will contain a pilot plant that will process 12 tons of alunite ore daily to produce 1.7 tons of alumina (Al_2O_3). The pilot plant study will ascertain the economic feasibility of utilizing domestic resources of alunite as a source of aluminum metal. The United States currently is dependent on imports of bauxite for about 90% of its aluminum. Alunite ore tested at the mill came from company mineral prospects located in Arizona, Colorado, Nevada, and Utah.

Beryllium.—For the first time in 17 years, beryllium concentrate was not produced in Colorado. The Boomer mine, a persistent producer since the mid-1950's, was inactive in 1973.

Cadmium, Indium, and Thallium.—American Smelting and Refining Co. (Asarco) recovered cadmium, indium, and thallium metal and thallous sulfate at its Denver plant from flue dust, dross, and other byproduct materials from out-of-State smelter and processing plants. The value of these products is not included in the State's mineral value because of their out-of-State origin.

Copper.—Output of copper decreased 22% in quantity and 9% in value. Reduced recovery of copper at the Idarado, Camp Bird, and Sunnyside mines accounted for most of the drop in output. The average price for copper was 59.5 cents per pound compared with 51.2 cents for 1972. During the year 14 operations in 13 counties yielded copper compared with 17 operations in 14 counties during 1972.

The Idarado mine of Idarado Mining Co., located in the Red Mountain and Upper San Miguel mining districts, accounted for 58% of the output compared with 60% in 1972. The Camp Bird mine of Federal Resources Corp. ranked second in production of copper followed by the Sunnyside mine of Standard Metals Corp. The three mines were responsible for over 87% of the State's copper output.

Table 4.—Colorado: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing[1]		Material sold or treated[2] (short tons)	Gold		Silver	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
1971, total	20	1	1,239,271	42,031	$1,733,783	3,389,748	$5,240,549
1972, total	14	4	1,276,795	61,100	3,580,461	3,663,832	6,173,558
1973:							
Adams	--	--	--	884	86,464	91	233
Clear Creek	1	--	690	25	2,445	398	1,018
Dolores	1	--	12,204	130	12,715	49,967	127,816
Eagle	1	--	225,460	460	44,993	147,792	378,052
Gilpin	2	3	932	90	8,803	1,088	2,783
Jefferson	--	--	--	601	58,784	86	220
Moffat	1	--	70	--	--	28	72
Ouray	1	--	137,381	2,701	264,185	157,853	403,789
San Juan	2	--	191,350	30,926	3,024,872	290,316	742,628
San Miguel	1	--	321,428	14,710	1,438,785	373,898	956,430
Summit	1	--	11	--	--	1,323	3,384
Teller	1	--	70,000	411	40,200	--	--
Undistributed[3]	4	2	337,987	12,484	1,221,060	2,918,942	7,466,655
Total	16	5	1,297,513	63,422	6,203,306	3,941,782	10,083,080

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1971, total	3,938	$4,096,352	25,746	$7,105,812	61,181	$19,700,525	$37,877,021
1972, total	3,944	4,038,969	31,346	9,422,556	63,801	22,649,280	45,864,824
1973:							
Adams	--	--	--	--	--	--	86,697
Clear Creek	(4)	334	5	1,629	--	--	5,426
Dolores	60	70,937	218	70,984	118	48,746	331,198
Eagle	54	63,865	2,600	847,203	21,313	8,806,604	10,140,717
Gilpin	1	1,442	4	1,332	10	4,064	18,424
Jefferson	--	--	--	--	--	--	59,004
Moffat	2	1,836	--	--	--	--	1,908
Ouray	842	1,001,907	4,041	1,316,676	5,684	2,348,737	5,335,294
San Juan	343	408,687	4,737	1,543,255	6,436	2,659,505	8,378,947
San Miguel	1,529	1,819,996	7,310	2,381,456	8,663	3,579,634	10,176,301
Summit	(4)	46	(4)	160	--	--	3,590
Teller	--	--	--	--	--	--	40,200
Undistributed[3]	292	347,367	9,197	2,996,339	16,115	6,658,402	18,689,823
Total	3,123	3,716,417	28,112	9,159,034	58,339	24,105,692	53,267,529

[1] Operations from which gold, silver, copper, lead, or zinc were recovered as byproducts from fluorspar, sand and gravel, or cleanup, not counted as mines.
[2] Does not include gravel washed.
[3] Includes Boulder, Conejos, Lake, Mineral, and Park Counties, combined to avoid disclosing individual company confidential data.
[4] Less than ½ unit.

Table 5.—Colorado: Mine production (recoverable) of gold, copper, silver, lead, and zinc in 1973, by type of material processed and method of recovery

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Amalgamation	15,381	347,109	--	--	--
Smelting of concentrates	46,016	3,566,855	3,093	28,001	58,117
Direct smelting of:					
Ore	28	16,937	27	1	--
Cleanup	336	10,704	3	110	222
Total	61,761	3,941,605	3,123	28,112	58,339
Placer	1,661	177	--	--	--
Grand total	63,422	3,941,782	3,123	28,112	58,339

Table 6.—Colorado: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1973, by class of ore or other source material

Source	Number of mines	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Dry gold [1]	2	70,001	435	4	--	--	--
Dry gold-silver and dry silver [2]	4	131,911	972	2,458,036	61	1,818	974
Copper	2	588	26	15,568	27		
Copper-lead-zinc	3	390,354	17,435	489,848	1,859	8,817	10,310
Lead	2	692	27	444	([3])	5	--
Lead-zinc	4	471,903	42,091	834,160	1,145	14,752	25,520
Zinc	1	224,942	434	132,252	29	2,600	21,313
Lead-zinc cleanup, zinc cleanup, fluorspar [2]	--	7,122	341	11,293	3	119	222
Total	16	1,297,513	61,761	3,941,605	[4]3,123	[4]28,112	58,339
Placer	[5]5	--	1,661	177	--	--	--
Grand total	21	1,297,513	63,422	3,941,782	[4]3,123	[4]28,112	58,339

[1] Includes material that was leached.
[2] Combined to avoid disclosing individual company confidential data.
[3] Less than ½ unit.
[4] Data does not add to totals shown because of independent rounding.
[5] Sand and gravel operations not counted as producing mines.

Gold.—Gold output increased 2,322 troy ounces above 1972 production of 61,100 ounces. Value for the year rose significantly because the weighted average price of gold increased from $58.60 per troy ounce in 1972 to $97.81 per troy ounce in 1973. Most of the gold was recovered as a byproduct from base metal ores. A few ounces of gold were obtained from mill tailings and smelter cleanup.

Standard Metals Corp. operations accounted for 49% of the total output. Other principal gold production was from the Idarado mine of Idarado Mining Co. with 17,305 ounces (down 4,424 ounces), the Black Cloud mine of Asarco with 11,350 ounces (up 3,168 ounces), and the Mammoth Revenue mine of Coronado Silver Corp. in Conejos County.

Thirteen lode mines and 12 placer operations yielded gold compared with 14 and 11, respectively, in 1972. Of the placer operations, accounting for 3% (1,661 ounces) of the State production, only five were primarily for gold, the rest were sand and gravel pits. Nine lode mines yielded more than 100 ounces of gold each.

Among the fourteen counties with gold production during the year, San Juan and San Miguel were the leading sources; their output in 1973 was respectively, 30,926 and 14,710 ounces, totaling 72% of the output in the State.

The free market gold price rose from about $64 per ounce at the beginning of the year to $120 per ounce in June due to weakness of the U.S. dollar. The price peaked in July at $127 for the year, thence dropped to $90 in November. At yearend the price rose to $112 because of an agreement to end the two-tier gold price.

The rehabilitation of the Ajax gold mine by Golden Cycle Corp. was continued in 1973. Work projects underway included pumping water from the mine and rebuilding the concentrator and leaching plant. Drainage to the 2,000-foot level was reached at yearend. The water would be lowered to the 3,100-foot level by March 1974 and thence the mine shaft deepened for about 250 feet by November 1974. Limited production at the concentrator and leaching plant was expected by yearend 1974. Ore reserves at the Ajax have not been determined, but at mine shutdown in 1961, the grade averaged 1 ounce per ton of ore. Mine operations were scheduled to commence in late 1975. The property is one of a dozen of about 500 old abandoned mine sites in the Cripple Creek mining district that were in the process of rehabilitation.

Iron Ore.—After declining for 3 consecutive years, production of iron ore increased 27%; value increased 33%. The increase was due to a higher production rate at

the Cooper Basin mine operated by Pitkin Iron Corp. in Pitkin County. The ore, magnetite with 67% iron, was shipped to the Pueblo steel mill of CF&I Steel Corp.

Lead.—Output of lead decreased 10%; however, because of a price increase, the value of production was down only 3%. The price increased from 14.5 cents per pound at the beginning of the year to 19.0 cents at yearend, averaging 16.3 cents per pound for the year. There were 13 producing mines in 11 counties; 6 mines with production in excess of 500 tons accounted for 99% of the State output.

The Idarado mine in Ouray and San Miguel Counties was the largest producer with 9,420 tons of lead. Other principal mines, in order of output, were the Black Cloud mine (Asarco), Sunnyside mine (Standard Metals Corp.), Camp Bird mine (Federal Resources Corp.), Eagle mine (New Jersey Zinc Co.), and Bulldog Mountain mine (Homestake Mining Co.).

Six of the 11 counties with lead production had output of over 500 tons. Ranked according to output, the principal counties were San Miguel, Lake, San Juan, Ouray, and Eagle. Supplying 26% of the State output, San Miguel County had the highest production.

A fire of undetermined origin destroyed buildings and other property valued at $60,000 at the Camp Bird mine near Ouray. The mine, operated by Camp Bird Colorado Inc., a subsidiary of Federal Resources Corp., commenced production of copper, lead, silver, and zinc ore at midyear 1970.

Mineral Engineering Co. negotiated a limited partnership agreement with Statesman Mining Inc. to develop base metal prospects formerly owned by Emperius Mining Co. and Humphreys Mining Co. near Creede. A total of $1 million will be expended on exploration over a 3-year period. During the year, a mining crew, geologist, and an assayer were employed in testing copper, gold, lead, silver, and zinc mineralization in the sulfide and oxide zones. Roads were improved to the Chance and Commodore mines to allow haulage of about 400,000 tons of stockpiled ore to the mill. Engineering and design studies were underway to determine the optimum operating rate at the mill. Production was scheduled for early 1974.

Molybdenum.—Molybdenum remained the second most valuable mineral produced in Colorado. Shipments rose 9.9 million pounds in 1973 and were 18% higher than in 1972. Domestic markets received about 65% of the shipments; the remainder was exported.

The two mines in Colorado—Climax in Lake County and Urad in Clear Creek County—provided nearly 48% of the Nation's output of molybdenum and about 35% of the world's production. Both mines are owned and operated by American Metal Climax, Inc. (AMAX).

Development of an open pit mine at Climax by AMAX was completed at yearend. The initial production rate ranged from 3,000 to 4,000 tons but was expected to increase eventually to 25,000 tons of molybdenum ore per day. The open pit mine will provide flexibility in operation at the Climax property to meet changing market conditions and offset production losses due to gradual closing of the Urad mine.

During 1973 an additional flotation stage was added to the regrind circuit at the Climax mill to improve concentrate grade.

AMAX continued development of the Henderson molybdenum mine near Empire. Major work projects underway in 1973 were driving a haulage tunnel through the Continental Divide and construction of a concentrator. Approximately one-half of the 9.3-mile-long tunnel was completed at yearend. Satisfactory progress was made on the concentrator, but its completion was not expected until late 1974. Production at the Henderson mine was scheduled to begin in 1976 at a rate of about 30,000 tons of ore per day. Ultimately, the mine will produce about 50 million pounds of molybdenum annually.

AMAX mined the 300 millionth ton of molybdenum ore at the Climax operation on January 11, 1973. Published information on mine production indicated that more ore had been produced at the Climax mine than at any underground mine in North America. According to production data, the record "ore ton" came from the Phillipson level of the mine, a producing area in operation for over 40 years. The 200 millionth "ore ton" was reached on January 27, 1966, less than 7 years ago. Estimated ore reserves at Climax were considered sufficient to operate the mine for an additional 40 years. To maintain the current underground production rate of 43,000 tons per day,

a new 600 level was developed at a cost of over $50 million.

Silver.—Output of silver from 23 operations in 16 counties increased 277,950 troy ounces (8%) over that of 1972; value increased 63%. The average price of silver rose from $1.68 per troy ounce in 1972 to $2.56; however, the New York selling price fluctuated between a low of $1.96 in January and a high of $3.28 in December. All but 177 ounces were produced from lode mines; the seven placer operations were byproduct enterprises at sand and gravel pits. Of the 16 lode mines yielding silver, 9 had production exceeding 20,000 ounces and each registered increases in output. The two principal mines —Bulldog Mountain and Idarado—accounted for 64% of the State output. As with gold, almost all of the silver was recovered as a byproduct of base metal ores.

The Bulldog Mountain mine of Homestake Mining Co. was the major source of silver during the year. Production from the mine exceeded the output of the next largest producer, Idarado, by an appreciable amount. Other mines having silver production in excess of 20,000 troy ounces were Eagle (New Jersey Zinc Co.), Sunnyside (Standard Metals Corp.), Mammoth Revenue (Coronado Silver Corp.), Sherman Tunnel (Leadville Corp.), Black Cloud (Asarco), Silver Bell (Silver Bell Industries, Inc.), and Camp Bird (Federal Resources Corp.).

Supplying 98% of the output, leading counties in silver output were, in order of production, Mineral, Lake, San Miguel, San Juan, Ouray, and Eagle.

Mill throughput at the Bulldog Mountain mine of Homestake Mining Co. totaled 86,683 tons from which over 2 million ounces of silver, and 1,854 tons of lead concentrate were recovered. At yearend, ore reserves were reported totaling 517,950 tons having an average grade of 21.4 ounces of silver and 2.6% lead. Exploratory drilling during 1973 increased ore reserves 29% over yearend 1972. Mine development was resumed on the 9,200 level after being hindered by inflow of excessive water.

Earth Science Inc. (ESI) obtained an option to purchase the assets of Moritz Mining Co. consisting of mining leases in the Central City-Blackhawk gold mining district. An underground mine, including mine equipment capable of producing 50 to 100 tons of ore, was obtained by ESI.

Continental Oil Co. concluded an agreement with Silver Bell Industries Inc. to conduct geological studies of its properties near Ophir. Should the study result in discovery of mineralization of economic value, a joint venture would be incorporated to mine the deposit. Continental Oil Co. would obtain 51% ownership in the property by providing funds for exploration and development purposes.

Crested Butte Silver Mining Inc. reportedly sold over 40% of the outstanding shares in the Keystone mine, mill, and other properties to U.S. Energy Corp. The sale included over 1,500 acres in the Elk Mountain mining district and about 800 acres in the Ruby mining district. At yearend, U.S. Energy Corp. was evaluating the best mineral targets in preparation for exploratory drilling.

Tin.—Byproduct tin concentrate was produced at the Climax mill of AMAX. Shipments were 52% higher than in 1972. Colorado, again the leading producing State with 83% of the nation's output, was followed by New Mexico and Alaska.

Tungsten.—Tungsten concentrate was produced as a byproduct of milling operations by AMAX in Lake County. A small tonnage of tungsten was produced by Joe A. Chavez near Netherland, but not shipped. The mines operated by C.D.C. Associates, Inc. and Domain Minerals Inc. were inactive during 1973. Domestic consumers received 94% of the production; the remaining 6% was exported.

Uranium.—Output of uranium oxide (U_3O_8) increased 43,000 pounds in 1973 and was 2% higher than in 1972. Despite higher production, Colorado dropped in rank to fourth in the nation in uranium output; however, the State accounted for over 7% of domestic production of U_3O_8, the same as in 1972.

Colorado mines produced 303,473 tons of uranium ore in 1973 compared with 364,215 tons in 1972. Average grade of the ore was 0.34% U_3O_8, considerably better than the average of 0.28% in 1972.

An active exploration and development drilling program was continued during the year. The uranium mining industry of Colorado reportedly drilled a total of 473,000 linear feet in its search for new

uranium resources. Exploratory drilling accounted for about 66% of the footage, the remainder was development drilling.

Two uranium mills were active during 1973; the Uravan mill of Union Carbide Corp. and the Cannon City mill of Cotter Corp. The two mills have a capacity to process 1,750 tons of uranium ore per day.

Geo-Industries Inc. was developing a mine (Geo No. 1) on a uranium-vanadium deposit at Wray Mesa. Sufficient ore reserves were outlined by company drilling to justify an economic operation. The uranium-vanadium ore will be sold under a long-term contract to Union Carbide Corp. for processing at the Uravan mill. In addition to developing the mine, Geo-Industries Inc. acquired two large blocks of land in the area. One block, comprising 131 claims, was adjacent to the mine on the east, south, and west. The other block of land contains 121 claims and is located about 3 to 4 miles west of the mine.

The Atomic Energy Commission (AEC) offered for lease purposes, on a basis of competitive royalty bids, about 26,000 acres of land containing potential uranium resources valued at $40 to $50 million in the Uravan Mineral Belt of Western Colorado. The land included mining claims acquired from the Manhattan Engineering District in World War II and land withdrawn from public domain in the late 1940's and early 1950's. The AEC leasing policy was defined in a Domestic Uranium Program, Circular 8 (Revised) and published in the Federal Register dated August 10, 1973.

The land will be offered in 43 tracts and invitations for competitive bids on all tracts will be released simultaneously. Each lease will provide for payment of royalties on all production based on uranium and vanadium values. Drilling data and maps of the tracts were on open file and available for inspection at the Technical Library of the Grand Junction AEC Office. Eighteen of these tracts were set aside for bids by small mining companies; those employing less than 100 workers.

Homestake-Wyoming Partners continued exploratory work at the Pitch mine to increase reserves of uranium ore. Expenditures during 1973 reportedly totaled $634,000. The company exercised an option to acquire a 40% interest in the property.

At yearend Silver Bell Industries Inc. commenced mining uranium ore in the Uravan Mineral Belt of Western Colorado. Uranium reserves were reportedly sufficient to produce about 15 million pounds of U_3O_8.

Union Carbide Corp. completed construction of a uranium-vanadium products liquid circuit at the Uravan mill. Mine-run ore containing uranium-vanadium is treated with a solvent and an amine reagent in a concrete tank. Brine and soda ash are added to the pregnant solution to precipitate uranium as yellow cake. Thence the solution containing vanadium is tank-trucked to the Rifle mill for final processing, and packaging.

Vanadium.—Colorado, ranked third among States producing vanadium, accounted for about 25% of the Nation's production. Output, however, declined for the fifth consecutive year. Production was in the form of fused vanadium oxide recovered from the processing of uranium-vanadium ores at the Rifle mill.

Montrose and San Miguel Counties were the leading sources of vanadium-bearing ores.

Zinc.—Output of zinc was down 9% in quantity but up 6% in value because of higher zinc prices. Average price per pound in 1973 was 20.7 cents, 17% higher than the average for 1972. Prices during 1973 ranged from 18.5 cents per pound during the first week in January to 32 cents at yearend.

Ten counties had 11 operating mines. Eagle County ranked first in production, followed, in order of output, by Lake, San Miguel, San Juan, and Ouray Counties. The five counties accounted for 98% of the State total zinc output.

Of the 11 producing mines, 6 had outputs of over 500 tons. The five largest producers were the same as in 1972, the Eagle mine in Eagle County, Black Cloud mine in Lake County, Idarado mine in Ouray and San Miguel Counties, Sunnyside mine in San Juan County, and the Camp Bird mine in Ouray County. Other mines having over 100 tons of output were the Bulldog Mountain mine in Mineral County, and the Silver Bell mine in Dolores County.

Standard Metals Corp. announced discovery of two significant ore zones at its Silverton mine. The announcement stated that one was an extension of the 2,150 zone and contained an estimated 170,000

tons of high-grade ore. The other zone had not been fully delineated at yearend.

New Jersey Zinc Co. shipped zinc concentrate from a stockpile near Leadville. The material was trucked from the Eagle mine to Leadville and was allowed to accumulate for the past 2 years. Some 40 carloads per week were shipped by railroad to the company's smelter near Acquashiocolo, Pa.

The Eagle mine was shut down temporarily at midyear because of a fire on the 16th level. The fire was caused by oxidation of sulfides in the presence of wood (mine timber). The area was sealed off to prevent a complete shutdown of the mine, but some production of ore was lost from that section of the mine.

MINERAL FUELS

Carbon Dioxide.—Marketed production of carbon dioxide from the McElmo field, Montezuma County declined 16,664 Mif in 1973 and was nearly 10% lower than in 1972.

Coal (Bituminous).—Coal output increased 711,000 tons in 1973 and was 13% higher than in 1972. The 6.2 million tons mined in Colorado in 1973 was the highest on record and exceeded the previous record year of 1970 by 208,000 tons. Greater demand for coal as fuel in steam-powered electric utility plants accounted for the higher output.

Coal production was reported from 30 mines, five less than in 1972. Twenty-one underground mines produced about 54% of the State's output. Eight strip and one auger mine produced nearly 3 million tons of coal. During the year, one mine was closed, five were idle but shipped coal from stocks.

Four underground and two strip mines reported production between 1,000 to 10,000 tons; five underground and one strip mine, between 10,000 to 100,000 tons; 10 underground and three strip mines, between 100,000 to 500,000 tons; two underground and two strip mines, between 500,000 to 1 million tons; and one strip mine over 1 million tons. Three underground mines had production of less than 1,000 tons. The reported output of coal exceeding 1 million tons per year by a mine was a first in history of the coal mining industry in Colorado.

Table 7.—Colorado: Bituminous coal production in Colorado, by type of mine and county, 1973

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total	
Delta	2	--	--	2	212	--	--	212	W
Fremont	4	2	1	7	80	129	38	247	$1,347
Garfield	1	--	--	1	1	--	--	1	W
Gunnison	3	--	--	3	846	--	--	846	9,969
La Plata	1	--	--	1	9	--	--	9	W
Las Animas	1	--	--	1	624	--	--	624	W
Moffat	2	--	--	2	290	--	--	290	W
Montrose	--	1	--	1	--	107	--	107	680
Pitkin	4	1	--	5	778	4	--	782	5,075
Routt	1	4	--	5	11	2,595	--	2,605	11,238
Weld	2	--	--	2	510	--	--	510	W
Undistributed	--	--	--	--	--	--	--	--	17,884
Total[1]	21	8	1	30	3,361	2,834	38	6,233	46,190

W Withheld to avoid disclosing individual company confidential data.
[1] Data may not add to totals shown because of independent rounding.

The five largest mines, in order of output, were Edna strip mine of the Pittsburg & Midway Coal Mining Co.; Energy strip No. 1 mine of Energy Coal Co.; Somerset underground mine of United States Steel Corp.; Seneca strip No. 2 mine of Peabody Coal Co.; and the Allen underground mine of CF&I Steel Corp. Coal from the Allen and Somerset underground mines was consumed for steel manufacture and

that from the Edna, Energy No. 1, and Seneca No. 2 strip mines for electric power generation.

Routt County, with five mines, again had the highest output with over 2.6 million tons, 42% of the State production. It also was the only county with production of more than 2 million tons. Four other counties had output over 500,000 tons.

The average price of coal mined in 1973 was $7.41 per ton. Coal from underground mines averaged $9.95 while that from strip mines averaged $4.43 per ton; comparable figures for 1972 were $7.75 and $4.95 respectively.

Colorado's coal mining industry provided direct employment to 1,534 workers; of these, 1,123 worked in underground mines, 205 at strip mines, and the remainder at miscellaneous surface jobs. The average number of days worked in 1973 by an employee was 213 compared with 204 in 1972. Underground coal was mined principally by continuous mining machines. About 2% was produced by other mechanical means. A small quantity of coal was from pick and shovel mines. Almost all underground coal was mechanically loaded. A small quantity was hand loaded into mine cars and onto mechanical conveyors.

Colorado mined coal was transported to markets by either rail or truck. The former method was responsible for 4.8 million tons, or 78% of the total coal transported.

By far, most of the coal was consumed in the State; almost 28% was shipped to out-of-State markets. A small quantity was consumed at the mines. Most of the coal was consumed as mine-run coal. Twenty-six percent of the State coal output was processed in five washing and cleaning plants.

Of the 6.2 million tons of coal mined during the year, 1.3 million tons was captive production and 4.9 million tons was sold on the open market. Nearly all the captive production was used in making steel in Colorado and Utah. The principal purchaser and/or consumer of merchant coal was the electric utility industry; most of the steam-operated plants in the State use coal for electric power generation.

BLM rejected three applications by Kemmerer Coal Co. for new prospecting permits covering over 6,000 acres in the Tongue Mesa coal field. The mining company was interested in developing a new coal mine and plant in the area. The Tongue Mesa coal field is situated principally in Ouray and Montrose Counties with a small section in Gunnison County, in the Cimarron Ridge area.

Public Service Co. of Colorado (PSC) reported that the first unit train, consisting of 98 cars, arrived at the Comanche power plant facility near Pueblo on July 12, 1973. It took approximately 35 hours to complete the trip from the AMAX coal mine in northeast Wyoming to the PSC plant. Coal deliveries will continue over the 600-mile route on a regular schedule until a sizeable surplus is stockpiled at the plant. Each unit train hauled a total of 9,800 tons per trip. It was reported that over 1.6 million tons of coal per year will be delivered to the facility which will produce 350,000 kilowatt-hours (kWhr) of electricity.

BLM issued a temporary freeze order on 117 pending prospecting permits for coal on National Resources Lands. The freeze on permits covers an area of over 350,000 acres. However, the possessors of 109 leases encompassing over 120,000 acres and the 32 applicants for coal leases on over 88,000 acres were not affected by the order. BLM required additional time to develop a leasing program which will assure a more orderly development of coal resources on public lands, including taking into consideration the protection of the environment.

Utah International Inc. agreed to supply 78 million tons of coal over a 35-year period to a 350,000-kWhr electric generating facility near Craig. The coal would be mined at a newly developed mine producing from coal reserves on Federal land currently under ease. Construction of a mining and cleaning plant that would produce coal at a rate of 2.1 million tons annually was expected to be completed in 1977. The mine and electric generating plant ultimately would provide employment to about 250 workers. The company estimated the value of the contract at more than $300 million.

The Cosley Co. auger mine, the only such operation in Colorado, was employing a 21-inch auger machine in a 30- to 50-inch coal seam in Fremont County. In areas where the coal seam is thick enough, a double cut was made in the seam.

Startup of the nuclear generating plant

near Plattesville was delayed early in the year because of a minor failure in the helium circulator, a pumplike mechanism which distributes helium coolant in the system. This was the third such delay in the initial testing procedures for the plant.

Natural Gas.—Marketed natural gas increased 18% in quantity and 26% in value compared with 1972. According to the Colorado Oil and Gas Conservation Commission, production of natural gas during the year was 143.8 billion cubic feet, 17.8 billion cubic feet more than in 1972.[2]

Marketed natural gas, by counties, was similar to that of the previous year; La Plata ranked first with 31.1 billion cubic feet, Moffat second with 26.2 billion, and Rio Blanco third with 24.8 billion. Adams County, with 12.0 billion cubic feet, ranked fourth chiefly because of operations at the Third Creek gasfield.

The principal source of dry gas was the Ignacio-Blanco field, La Plata County, with production of 28.8 billion cubic feet. The productive horizons were Cretaceous in age—the Dakota, Fruitlands-Pictured Cliffs, and Mesaverde formations. Second most productive field was Piceance Creek with output of 9.6 billion cubic feet of dry gas; Hiawatha with 9.4 billion was a close third; Powder Wash and Dragon Trail ranked fourth and fifth, respectively, with 9.0 and 7.5 billion cubic feet.

The Wattenberg reservoir, Adams and Weld Counties, yielded the largest quantity of wet gas. All of the output, 4.8 billion cubic feet, was processed for removal of liquids. About 3.8 billion feet of gas was produced at the Peoria field, Arapahoe County, none was returned to the reservoir.

The American Gas Association (AGA) and the American Petroleum Institute (API) estimated Colorado natural gas reserves at 1.9 trillion cubic feet as of December 31, 1973, an increase of 213.1 billion cubic feet. New fields, revisions, and extensions added 347.4 billion cubic feet; this exceeded production, and resulted in an increase in reserves.[3]

Panhandle Eastern Pipeline Co. was building a pipeline and gas-gathering system in the Wattenberg gasfield at a cost of $43 million. The company negotiated a natural gas sales and exchange agreement with Colorado Interstate Gas Co. (CIG). The pipeline will join CIG's existing line near Watkins where natural gas will be received in exchange for delivering to Panhandle Eastern Pipeline Co. an equivalent volume at Latkin, Kans. In addition, CIG contracted to purchase 25% of the first 600 billion cubic feet of annual production at the Wattenberg gasfield and 10% of the amount in excess of 600 billion cubic feet. The exchange and/or sale was expected to accelerate development of gasfields in eastern Colorado, particularly the Wattenberg gasfield.

Development of the Wattenberg gasfield was continued during 1973 which ultimately would include drilling about 400 wells. The Colorado Oil and Gas Conservation Commission defined the area encompassing the gasfield to embrace 11 townships in Adams and Weld Counties. Spacing of the drill holes was established at one well for each 320 acres.

Michigan-Wisconsin Pipeline Co. and Trend Exploration Ltd. obligated $30 million in a joint exploration venture for hydrocarbon resources in Colorado. A 200,000-acre area in the North Park Basin, Jackson County, will be intensively studied for possible oil and gas production.

CIG was seeking permission from the AEC to market natural gas produced as the result of the 1969 Project Rulison underground nuclear detonation project. Rulison produced gas has been tested extensively and results indicate that radiation levels are minimal and that there is no risk to public health and safety in its use.

Petro-Lewis Corp. completed two producing gas wells thus confirming the discovery of a new gasfield straddling the Garfield-Mesa County lines. A well in Garfield County flowed 490,000 cubic feet of natural gas per day from the Dakota sandstone. In adjoining Mesa County, a well in the same strata tested 135,000 cubic feet of natural gas per day.

The State's five active gas-storage projects, Asbury Creek, Fort Morgan, Fruita, Leyden mine, and Springdale, had 17.9 billion cubic feet of gas in storage at the beginning of 1973, 9.9 billion were injected,

[2] Colorado Department of Natural Resources. Oil and Gas Conservation Commission, Oil and Gas Statistics 1973, Production review, p. 12; all natural gas and petroleum production figures cited in the text of this chapter are from this publication.

[3] American Gas Association, Inc., American Petroleum Institute, and Canadian Petroleum Association. Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas in the United States and Canada and United States Productive Capacity as of Dec. 31, 1973. V. 28, June 1974, pp. 22, 23, 114, 115.

and 5.1 billion withdrawn during the year for a yearend balance of 22.5 billion cubic feet. Again the Fort Morgan field was the most active, 6.8 billion cubic feet injected and 3.1 billion withdrawn. Second most active was the Leyden mine, a converted coal mine north of Denver, with 1.9 billion cubic feet injected and 1.8 billion withdrawn.

Natural Gas Liquids.—Production of natural gas liquids rose only 14% in quantity but 54% in value compared with that of 1972. A substantial increase in the weighted average value for natural gas liquids accounted for the difference in the percentage rates. The weighted average value for LP gases nearly doubled and that for natural gasoline rose 16% over 1972 figures.

Natural gasoline throughput at 21 gasoline plants in Colorado, according to the Oil and Gas Conservation Commission, was 130.9 billion cubic feet for the year; output was 4.1 million barrels of products.[4] Gas input and products output rose 14% and 34%, respectively, compared with that of 1972.

Oil Shale.—Garrett Research and Development Co., subsidiary of Occidental Petroleum Corp., produced high-grade liquid petroleum from kerogen-bearing rock by application of a newly developed in situ oil shale processing technology. The company conducted research on oil shale for the past several years at a 4,000-acre site about 15 miles west of Grand Valley. An underground chamber containing broken oil shale rock was fire flooded to produce 25 to 30 barrels of oil per day.

[4] Reference cited in footnote 2, pp. 114–119.

Table 8.—Colorado: Gas input and products at natural gas liquids extraction plants in 1973

Plant	County	Owner	Gas input (million cubic feet)	Products (thousand barrels)
Adena	Morgan	Union Oil Co. of Calif	3,427	319
Bennett	Adams	Halliburton Resource Mgt	399	35
Bombing Range	Arapahoe	Sun Oil Co	84	2
Comanche Creek	Elbert	do	412	21
Dragon Trail	Rio Blanco	do	4,770	178
Dragoon	Arapahoe	do	1,089	112
Fruita	Mesa	Continental Oil Co	6,355	144
Irondale	Adams	Halliburton Resource Mgt	2,708	175
Latigo	Arapahoe	Darenco, Inc	1,063	35
McClave	Kiowa	Fleetwood Drilling Co	1,772	56
Peoria	Arapahoe	Amoco Production Co	5,434	579
Piceance Creek	Rio Blanco	Chadbourne Corp	9,546	101
Rangely	do	Chevron Oil Co	1,734	191
San Juan	La Plata	El Paso Natural Gas	79,371	1,397
Spindle	Weld	Amoco Production Co	2,449	214
Third Creek	Adams	Koch Oil Co. & Amoco Production Co	3,825	184
Vallery	Morgan	Vallery Corp	814	62
Wattenburg	Weld	Production Operators, Inc	2,024	10
Wilson Creek	Rio Blanco	Texaco, Inc	1,051	101
Yenter	Logan	Excelsior Oil Co	1,340	147
W. Douglas Creek	Rio Blanco	Western Slope Gas	1,257	9
Total[1]			130,925	4,075

[1] Data may not add to totals shown because of independent rounding.

Source: Colorado Department of Natural Resources. Oil and Gas Conservation Commission. Oil and Gas Statistics 1973. Plant Intake and Products, p. 114–119.

Peat.—Production of peat was 28,040 tons (28%) less than in 1972. Eight operations were located in six counties; three were in Teller County; and one each were in Alamosa, Boulder, Chaffee, Gilpin, and Park Counties. Park County was the leading source with 15,769 tons, followed by Teller with 9,312 tons. Ninety-seven percent of the output was moss type, and the rest was reed-sedge. The average value of $5.81 per ton for peat was 43 cents per ton more than in 1972 and 24 cents more than for 1971.

Most of the output was shipped in bulk; the rest was packaged. Of the total, 26,804 tons were not processed. Fifty-one

percent of the production, 14,251 tons, was used for general soil improvement; the remainder for other uses.

Petroleum.—Output of petroleum was up 15% in quantity but increased 42% in value because of a dramatic rise in price during 1973.

Leading county in production was Rio Blanco, with 57% of the State total; the county had the two leading oilfields, Rangely-Weber and Wilson Creek. Arapahoe and Weld Counties again ranked second and third, each with 8% of the output.

The Rangely-Weber reservoir continued to dominate the State oil yield. With a cumulative output, at yearend, of 480.3 million barrels of oil, it had produced 46% of Colorado's cumulative oil production. Output of 19.2 million barrels in 1973 was 42% higher than that of 1972.

Table 9.—Colorado: Crude petroleum production, by county
(Thousand 42-gallon barrels)

County	Production		Principal fields in 1973 in order of production
	1972	1973	
Adams	2,775	2,045	Third Creek, Irondale, Nile, Hombre Trapper.
Arapahoe	3,249	2,901	Peoria, Lowry, Dragoon.
Archuleta	57	49	Price Gramps.
Baca	51	60	Flank, Greenwood.
Bent	13	14	Sniff Ranch, Purgatoire.
Boulder	1	1	Boulder.
Cheyenne	485	504	Cheyenne Wells, Ladder Creek, Smoky Creek.
Dolores	139	365	Papoose Canyon.
Elbert	144	89	Comanche Creek.
Fremont	21	19	Florence-Canon City.
Jackson	347	423	Lone Pine, McCallum, Battleship.
Kiowa	1,067	727	Brandon, Cavalry.
Kit Carson	4	7	Smoky Hill.
La Plata	26	20	Red Mesa.
Larimer	119	86	Clark Lake, Wellington.
Logan	1,461	1,418	Padroni-West, Saber, Emerald, Yenter.
Moffat	910	1,036	Buck Peak, Powder Wash, Mandlin Gulch.
Montezuma	222	225	Cache, Flodine Park.
Morgan	644	498	Adena, Boxer.
Prowers	4	2	Comanche.
Rio Blanco	15,775	20,779	Rangely-Weber, Rangely, Wilson Creek.
Routt	67	63	Grassy Creek, Sage Creek.
San Miguel	25	19	Lisbon.
Washington	3,031	2,545	Rush Willadel, Cimmaron, Big Beaver.
Weld	1,378	2,693	Spindle, Pierce, Single Tree.
Total [1]	32,015	36,590	

[1] Data may not add to totals shown because of individual rounding.

Source: Colorado Department of Natural Resources, Oil and Gas Conservation Commission, Oil and Gas Statistics 1973. Oil and Gas Statistics by Counties, pp. 12–99.

Table 10.—Colorado: Principal producing oilfields and gasfields in 1973 and cumulative production

Fields	County	Oil (thousand barrels)	Gas (thousand cubic feet)	Cumulative production to Jan. 1, 1973	
				Oil (thousand barrels)	Gas (thousand cubic feet)
Rangely-Weber	Rio Blanco	19,110	1,666,341	480,291	670,934,418
Peoria	Arapahoe	1,746	3,458,958	7,274	9,846,876
Wilson Creek	Rio Blanco	1,218	1,013,388	50,430	50,751,645
Spindle	Weld	1,072	3,080,484	1,521	3,771,443
Brandon	Kiowa	629	647	6,329	3,044
Pierce	Weld	498	39,922	8,336	395,018
Lowry	Arapahoe	438	1,050,115	645	1,212,492
Buck Peak	Moffat	416	12,160	492	12,160
Third Creek	Adams	411	2,915,158	1,257	4,818,009
Single Tree	Weld	372	391,554	394	435,023
Ingnacio-Blanco	La Plata	--	28,779,704	5	507,272,056
Piceance Creek	Rio Blanco	--	9,570,741	--	116,615,588
Hiawatha	Moffat	52	9,401,583	3,691	185,802,346
Powder Wash	do	182	8,985,159	1,022	88,981,039
Dragon Trail	Rio Blanco	1	7,513,745	11	50,665,357
McCallum	Jackson	177	5,036,511	7,027	633,164,711
Wattenberg	Adams and Weld	136	4,845,250	221	9,688,901
Sugar Loaf	Moffat	8	4,179,331	202	41,912,771
Lower Horse Drawn	Rio Blanco	--	4,112,642	--	18,690,299

Source: Colorado Department of Natural Resources, Oil and Gas Conservation Commission, Oil and Gas Statistics, 1973, pp. 13–99.

Active fluid-injection projects during the year totaled 38 in 36 fields—35 were waterflood, 1 was combined gas and water-injection, and 2 were gas-injection projects. Water injected in all of the projects amounted to 144.2 million barrels; of this, 91.8 million barrels were injected in the Rangely-Weber reservoir. Again, the State data do not differentiate between "new" water and water produced with the oil and reinjected.

The API and AGA estimated crude oil reserves for Colorado, as of December 31, 1973, at 304.8 million barrels, a decline of 21.6 million barrels from 1972 figures. An additional 93.8 million barrels were considered economically available by fluid injection. New fields and new pools added 3.6 million barrels; revisions and extensions added 11.7 million barrels.[5]

The State's two operating refineries were Continental Oil Co. and the Refinery Corp., both in the Denver area. The refinery at Grand Junction remained closed during 1973. In January a fire severely damaged the gasoline and fuel oil section of the American Gilsonite Co. refinery near Fruita. The facility remained closed during the year. Total refining capacity for the State was 48,500 barrels of crude oil per calendar day, a decline of 6% compared with that of 1972.

Gary-Western Inc. purchased the American Gilsonite Co. refinery near Fruita for a reported price of $11 million. The company plans to rebuild and expand the gasoline and fuel oil products section that was damaged by fire. Throughput at the refinery will be increased from 8,500 barrels to 10,000 barrels per day. Crude oil to the refinery will be delivered by way of a company-owned pipeline and others operated by oil firms in western Colorado. The plant will continue to produce metallurgical coke of exceptionally high grade from gilsonite for use in atomic reactors and the aluminum industry.

The refineries processed 14.2 million barrels of crude oil, of which 11.1 million were from other States. Wyoming continued as the principal supplier of the interstate receipts with 8.5 million barrels. Also supplying crude oil to Colorado were Montana and Utah. Colorado producers shipped 30.9 million barrels of crude oil out of the State. Utah received 18.6 million barrels, Kansas 5.4 million, Illinois 2.8 million, and Indiana 2.2 million barrels; other recipients were North Dakota, New Mexico, Wyoming, and Texas.

Exploration and Development.—Colorado ranked second in total well completions among States in the Rocky Mountain Region (RMR). However, the State

[5] Reference cited in footnote 3., pp. 22, 23, 114, and 115.

led in wildcat completions and had the highest ratio of success in overall exploration (15%) in the RMR. Colorado's 840 wells accounted for about 25% of drilling in the RMR. The activity resulted in drilling 376 producing wells; of which, 228 were oil and 148 gas.

The State's wildcat drilling declined to 442 wells from the 512 wells drilled in 1972. However, wildcat drilling resulted in 67 successful wells; of which, 38 were new oilfields, and 29 new gasfields. There were 15 new pool discoveries, and 13 wells were successful wildcat extensions.

In eastern Colorado, 54 of 364 wildcats drilled were successful producers. Eleven discovered new pools and 11 were field extensions.

Twenty-seven of the new fields discovered in eastern Colorado were within the Denver Julesburg Basin. Eighteen of these discoveries produced oil and/or gas from "J" sandstone, and eight from "D" sandstone, both of Cretaceous age.

Table 11.—Colorado: Oil and gas well drilling completions in 1973, by county [1]

County	Proved field wells			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Adams	26	22	15	13	4	37	117	841,422
Arapahoe	12	--	10	5	--	34	61	456,967
Archuleta	--	--	--	--	--	1	1	4,100
Baca	--	2	--	--	2	11	15	54,406
Bent	--	1	2	--	2	8	13	65,177
Boulder	--	--	--	--	--	5	5	26,013
Cheyenne	5	--	3	--	--	2	10	55,005
Crowley	--	--	--	--	--	1	1	7,000
Delta	--	--	--	--	--	5	5	16,678
Dolores	2	--	1	--	1	3	7	36,986
Douglas	--	--	--	--	--	1	1	9,284
Elbert	--	--	2	2	--	18	22	172,000
Fremont	1	--	--	--	--	--	1	1,555
Garfield	--	8	--	--	3	3	14	74,440
Grand	--	--	--	--	--	3	3	9,613
Huerfano	--	--	--	--	--	1	1	4,700
Jackson	5	--	1	3	--	13	22	96,255
Kiowa	4	5	4	--	1	3	17	74,945
Kit Carson	--	--	--	--	--	2	2	11,195
La Plata	--	5	1	--	1	--	7	33,412
Larimer	--	--	--	--	--	8	8	38,800
Las Animas	--	--	2	--	--	--	2	2,865
Lincoln	--	--	--	--	--	1	1	7,888
Logan	7	--	7	2	1	45	62	311,639
Mesa	--	2	3	--	6	9	20	71,341
Moffat	3	9	1	--	--	13	26	168,197
Montezuma	2	--	1	--	--	6	9	40,750
Montrose	--	--	--	--	--	1	1	6,015
Morgan	1	--	8	--	2	18	29	166,239
Park	--	--	--	--	--	1	1	6,223
Phillips	--	--	--	--	--	3	3	11,059
Prowers	--	1	--	--	--	5	6	24,823
Rio Blanco	25	15	5	2	2	10	59	308,040
Routt	--	--	--	--	1	1	2	13,937
San Miguel	--	--	--	--	--	1	1	9,465
Sedgwick	--	--	--	--	--	1	1	3,551
Washington	4	1	11	2	2	63	83	391,031
Weld	93	48	12	9	1	35	198	1,204,293
Yuma	--	--	--	--	--	3	3	11,710
Total	190	119	89	38	29	375	840	4,849,019

[1] Development wells as defined by American Petroleum Institute.
Source: American Petroleum Institute.

Development drilling in the huge Wattenberg gasfield and adjacent areas of southwestern Weld and northwestern Adams Counties resulted in a number of pool discoveries and field extensions. The Wattenberg gasfield also was responsible for a very intensive infield drilling program during 1973. Amoco Production Co. initiated a 200-well development program and drilled 77 producing wells during the year in the "J" sandstone reservoir.

Infield development drilling in the Spindle oilfield resulted in the completion of 54 successful wells with an initial production average of 114 barrels of oil per day.

Cretaceous strata was the major objective of drillers in western Colorado, although some new production came from Jurassic and Pennsylvanian formations. Discoveries of gas were reported in Garfield, Mesa, Rio Blanco, and Routt Counties and oil in Jackson and Rio Blanco Counties.

Infield development drilling continued in the huge Rangely-Weber oilfield where Chevron Oil Co. had an active secondary recovery project and pressure maintenance program in progress. Twenty-one wells were drilled in the oilfield during 1973.

Drilling was reported in 39 counties compared with 37 counties in 1972. Weld County again was the leader in drilling activity with 198 completions. Development drilling in the Spindle oilfield and Wattenberg gasfield accounted for most of the county's completion in 1973. At yearend, the oilfield and gasfield had 195 producing wells compared with 103 in 1972. The 117 well completions in Adams County were 65 wells below that drilled in 1972, but the county ranked second in completions in Colorado. Most of the county's drilling activity also was in the Wattenberg gasfield. Washington County, with 83 well completions, remained in third place. Other counties, in order of well completions, were Logan, Arapahoe, and Rio Blanco. The six above-mentioned counties accounted for 69% of total wells drilled in Colorado in 1973.

Colorado had 38 oilfield discoveries in 1973. Based on initial potential, the most important discovery was the Ambush oilfield in Adams County. The discovery well Box-Elder, located in the SW¼NE¼ sec. 24, T 2 S, R 65 W, was drilled to 8,175 feet, and flowed 242 barrels of oil and 200,000 cubic feet of natural gas per day. The well was drilled by Exter Drilling Co. At yearend, the field had five producing wells.

Allison Drilling Co. drilled the discovery well in the Double Eagle oilfield in Adams County. The discovery well Wailes, located in the SW¼SW¼ sec. 1, T 2 S, R 63 W, was completed to a depth of 7,552 feet. It flowed 234 barrels of oil per day through a 24/64-inch choke from a perforation at 7,335 to 7,342 feet in the "D" sandstone of Cretaceous age. The field was located two miles west of the Totem oilfield which was discovered in 1972.

In Arapahoe County, the most significant discovery was the Antler oilfield. The discovery well No. 1 Young, located in the NE¼NE¼ sec. 22, T 5 S, R 63 W, was drilled to a total depth of 8,018 feet. It flowed 457 barrels of oil per day from a perforation at 7,763 to 7,773 feet in the "D" sandstone of Cretaceous age. Brownlie, Wallace, & Armstrong Inc., owner of the lease, contracted with Toltek Drilling Co. for drilling the well.

Table 12.—Colorado: Principal oil and gas discoveries in 1973

County and field	Well	Operator	Location			Producing formation	Barrels of oil per day	Thousand cubic feet of gas per day	Remarks
			Section	Township	Range				
Adams:									
Ambush	Box Elder-G	Koch Exploration Co	24	2S	65W	J sandstone	242	200	Flowing.
Bootjack	Deganhart	Ventura Resources, Inc	26	2S	58W	do	90	--	Pumping.
Double Eagle	Wailes	Edward Mike Davis, Inc	1	2S	63W	D sandstone	234	--	Do.
Homestead	Linnebur	Claud B. Hamill, Inc	13	1S	59W	do	108	512	Flowing.
	Ford	Exeter Drilling & Exploration Co.	22	2S	60W	J sandstone	--	730	Do.
	McLennan	Summit Oil Co	36	1S	60W	do	--	1,037	Do.
Arapahoe:									
Antler	Young	Brownlie, Wallace & Armstrong Inc.	22	5S	63W	D sandstone	457	--	Do.
Poncho	Midwest-Baughman.	Doyle Huckabay Trustee Inc	10	4S	59W	J sandstone	155	--	Do.
Sidewinder	State-Koenig	Petroleum Inc	24	4S	62W	D sandstone	244	--	Do.
Bent: Wagon Trail	No. 1 Sniff	Anschutz Corp	8	23S	48W	Morrow	--	4,510	Do.
Elbert: Doubletree	Whitehead	Zoller & Danneberg, Inc	2	6S	62W	J sandstone	89	120	Do.
Jackson: Coalmont	No. 1 Government	Trend Exploration Co	35	7N	81W	Niobara	157	--	Pumping.
Kiowa: Pioneer	Pyles-Estate	Anschutz Corp	13	19S	48W	Morrow	--	shut-in	--
Logan: Stampede	No. 1 Sherwin	Burns & Gear Drilling Co	8	7N	51W	Niobara	--	4,800	Flowing.
Morgan: Tom-Tom	Peters-Federal	Patrick A. Doheny Inc	4	1N	55W	D sandstone	--	2,919	Do.
Rio Blanco:									
Banta Ridge	Banta Ridge	Chorney Oil Co	8	1S	103W	Dakota	100	300	Do.
Foundation Creek	Steele	Norris Oil Co	35	4S	102W	Ceder Mountain	120	890	Do.
Weld: Grover	Bauman-Ranch	Tom Vessels Inc	20	11N	61W	J sandstone	159	200	Do.

Source: Petroleum Information Corp., 1973 Resume, Oil and Gas Operations in the Rocky Mountain Region.

The State had 29 new gasfield discoveries, the same as in 1972. On the basis of initial potential, the most significant discovery was the Wagon Trail gasfield in Bent County. The discovery well No. 1 Sniff, located in the NW¼SE¼, sec. 8, T 23 S, R 48 W, was tested at 4.5 million cubic feet of natural gas per day from a perforation at 4,261 to 4,631 feet in the Morrow sandstone formation.

Exploratory drilling that discovered the Wagon Trail gasfield was the first in a series of a number of wells scheduled for drilling by Anschutz Corp. and Texas Oil and Gas Corp. The two companies jointly were evaluating a 100,000-acre lease in Bent, Kiowa, and Powers Counties for potential sources of hydrocarbons. The Pioneer gasfield in the Morrow formation in Kiowa County also was discovered by Anschutz Corp. and Texas Oil and Gas Corp. during the year.

At yearend exploration activities for natural gas were intensified in western Colorado. Norris Oil Co. initiated test drilling in the North Park Basin area. Also, Trend Exploration Co. and Michigan-Wisconsin Pipeline Co., in a joint venture, were evaluating some 200,000 acres in northwest Moffat and Routt Counties. The two companies were spending $30 million for a drilling program aimed primarily at discovery of new natural gas resources.

Petro-Lewis Corp. and PSC announced a joint venture research study in exploration and development of geothermal steam for electric power generation. Firstly, exploratory wells will be drilled to determine the existence, depth, volume, and pressure of geothermal steam. The discovery of a suitable steam source would result in construction of a 1,500-kW pilot power plant. Thence the economic potential of geothermal steam would be evaluated. Should the production of electric energy by geothermal steam prove economical, then a commercial facility having a capacity of 55,000 kWhr would be designed for operation by 1982.

NONMETALS

Cement.—Compared with 1972 shipments, portland cement increased 16% and masonry increased 5%. The cement was produced by Ideal Cement Co., a division of Ideal Basic Industries Inc. at its Boettcher and Portland plants, and by Dewey Rocky Mountain Cement Co., a division of Martin Marietta Corp., at its Lyon plant. Increased shipments were due to higher levels of activity in the construction sector. At yearend, cement stocks at mills declined 20,641 tons, or 18% compared with yearend 1972.

Ready-mix concrete companies were the biggest customers for portland cement with 78% of total shipments. Other customers, in order of quantity, were concrete product manufacturers, building material dealers, highway contractors, and miscellaneous customers.

Expansion of the portland cement plant of Ideal Cement Co. was near completion at yearend. Major production components added included a new crushing plant, raw and finish grinding mills, rotary kiln, and cement product storage silos. The capacity of the plant was increased to nearly 1 million tons of cement annually. An important feature in the design of the plant was equipment to consume coal instead of natural gas. Ideal Cement Co. negotiated a 20-year supply agreement with a major coal mining company.

Clays.—Output of clay was 794,000 tons, 6% more than that of 1972. Increased production was apparently due to a strong demand for clay products by the building industry Miscellaneous clay (including shale) accounted for about 93% of total clay production, the remainder was fire clay and bentonite. Of the total output, one-fourth was produced and sold; the balance was captive production.

Output of clay came from 65 mines operated by 21 companies, compared with 60 mines and 23 companies in 1972. Six companies produced fire clay, 2 bentonite, and 13 common and undifferentiated clay. The largest producer, the Idealite Co., a division of Ideal Basic Industries, mined shale for making lightweight aggregate.

Clay was produced in nine counties. Jefferson County had the most production; over 60% of the total output of the State.

The average unit price for miscellaneous clay and shale was $2.01 per ton, that of fire clay $3.87 per ton compared with $1.91 and $3.80 per ton, respectively for 1972.

Table 13.—Colorado: Clays sold or used by producers, by county
(Short tons)

County	1972		1973	
	Quantity	Value	Quantity	Value
Bent	229	$1,143	632	$3,159
Boulder	7,315	22,852	W	W
Douglas	87,990	163,046	92,818	264,278
Elbert	W	W	35,953	W
Fremont	29,821	82,448	27,384	83,257
Jefferson	486,425	901,794	503,102	923,764
Las Animas	22,673	58,031	24,750	51,417
Pueblo	61,752	152,715	76,482	225,311
Other counties [1]	50,736	151,185	32,552	158,665
Total	746,941	1,533,214	793,623	1,709,851

W Withheld to avoid disclosing individual company confidential data.
[1] Includes El Paso County and data indicated by symbol W.

Feldspar.—Feldspar was produced at the Mica Lode mine in Fremont County by Lockhart & Sons. Output declined for the second consecutive year. The product was used for decorative aggregate.

Fluorspar.—Output of fluorspar increased 16% in quantity and 14% in value compared with 1972. Two mines in two counties were productive; Burlington mine, Boulder County, operated by Allied Chemical Corp., and the Northgate mine, Jackson County, operated by Ozark Mahoning Co. Fluorspar was consumed in making hydrofluoric acid and for metallurgical purposes.

Gypsum.—Output of gypsum increased but value approximated that reported in 1972. Production was from four mines in two counties—two each in Fremont and Larimer Counties. All mines were open pit operations. One producer calcined gypsum for use in manufacturing building products, principally wallboard. Uncalcined gypsum was marketed as a cement retarder and soil conditioner, the former to cement manufacturing plants, the latter to farm supply stores.

Johns-Manville Corp. sold its gypsum plant at Florence to the Flintkote Co. The facility employs about 60 workers and has the capability to produce 90 million square feet of wallboard per year. The purchase price was not disclosed.

Lime.—Output of lime declined 9,000 tons for a 5% loss compared with that of 1972. Ten of 11 plants were at sugar refineries; eight were operated by the Great Western Sugar Co. and one each by Holly Sugar Corp. and American Crystal Sugar Co. The other one was at a steel mill operated by CF&I Steel Co.

Lime was consumed in sugar refining and manufacturing steel. A small quantity was sold to local markets for soil stabilization. Ten counties produced lime, the same as last year. Leading counties were Pueblo, Morgan, and Larimer.

Perlite.—The only crude perlite produced in Colorado was mined at the Rosita mine of Persolite Products, Inc., in Custer County. Output was 41% greater than in 1972. Production from the mine was shipped to the company's expanding plant near Florence. A small quantity of crude perlite was sold to local markets.

Perlite was expanded at three mills in Colorado—the Antonito operated by Grefco, Inc., the Florence plant operated by Persolite Products, Inc., and the Denver plant operated by W.R. Grace & Co. Sources of the crude perlite for the Grefco, Inc., and W.R. Grace & Co. mills were in New Mexico.

Expanded perlite was used principally as filter aid material (82%). Other uses included concrete, plaster, horticulture aggregate, and for low-temperature insulation.

Pumice.—Output of pumice, in the form of volcanic scoria, increased 31% in value compared with that of 1972. Production came from two mines operated by Colorado Aggregate Co., Inc., and Dotsero Block Co., Inc. The McCoy Aggregate Co. mine in Routt County was inactive during 1973. Thirty-seven percent of the pumice produced was consumed in concrete aggregate. The remaining was consumed for roofing, landscaping, road construction, and other uses.

Salt.—Salt, in the form of brine, was recovered from a well in Montrose County

by Union Carbide Corp. for use in the Company's uranium-vanadium mill at Uravan. Production was essentially unchanged from that of the previous year, but value rose 27%.

Sand and Gravel.—Production of sand and gravel increased 19% compared with that of 1972. The increase reflected a higher level of construction activity in the State. Sand and gravel remained the most nonmetallic mineral in Colorado, comprising 43% of the value of the nonmetallics and 9% of the value of all minerals. Sand and gravel ranked fourth in value after petroleum, molybdenum, and coal.

Of the total production, 80% was gravel and 20% was sand. Average value for gravel was $1.29 per ton; average for sand was $1.56; overall average was $1.35. Most of the sand and gravel, 25.3 million tons was processed before use; that is, washed, screened, crushed, or a combination of these. The balance, 8.6 million tons, was pit run. Average value of the processed material was $1.48 per ton, compared with $1.02 for pit run sand and gravel.

Output of commercial operators was 24.4 million tons, 72% of total production. Leading producers, those with output of more than 500,000 tons, in order of output, were Cooley Gravel Co., Western Paving Construction Co., Mobile Pre-Mix Sand and Gravel Co., the Brannan Sand and Gravel Co., and Schmidt Construction Inc. These companies accounted for 8.6 million tons of sand and gravel, 25% of the State output.

Noncommercial production, that produced by Governmental agencies either by Government employees or by contractors, amounted to 9.3 million tons, 28% of total output. The number of sand and gravel mines increased from 258 in 1972 to 268 in 1973.

Road construction consumed 18.6 million tons of sand and gravel, building construction used 9.2 million tons, and fill requirements used 4.0 million tons. The remaining 2.0 million tons was utilized for railroad ballast, industrial sands, and miscellaneous uses.

Among the 63 counties in Colorado, all except Dolores, Gilpin, Hinsdale, and San Juan had sand and gravel production. Adams County had the greatest production, 5.1 million tons; it was followed, in order of output, by Jefferson, Boulder, Pueblo, and Larimer Counties, all of which had production of over 2.0 million tons. Output of the five counties was 50% of Colorado's total.

Cooley Gravel Co. was developing a gravel deposit on Rocky slats, 15 miles northwest of Denver. The company leased 500 acres of land containing high quality road aggregate resources. Construction of a mine and plant having a capacity of 1 million tons per year was scheduled for completion in early 1975. The gravel deposits are associated with the massive outwash fans formed along the Front Ranges of the Rocky Mountain.

Table 14.—Colorado: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Adams	22	5,203	6,982	21	5,054	8,120
Alamosa	3	210	110	3	W	W
Arapahoe	8	W	W	11	1,567	2,615
Arcnuleta	3	46	60	1	(1)	(1)
Boulder	9	2,311	3,164	13	2,866	4,393
Chaffee	3	152	133	3	184	198
Cheyenne	1	64	59	1	45	90
Costilla	1	8	7	2	W	W
Custer	1	46	13	2	W	W
Delta	6	274	351	6	279	535
Denver	4	586	736	1	W	W
Douglas	4	177	69	4	W	W
Eagle	6	512	718	6	536	858
Elbert	2	34	17	2	W	W
El Paso	9	1,321	1,751	12	1,655	2,177
Fremont	6	190	129	4	235	W
Garfield	3	386	464	3	W	W
Gilpin	1	2	2	--	--	--
Grand	4	55	90	4	70	109
Huerfano	2	W	W	4	121	161
Jefferson	18	3,331	4,492	20	4,577	7,055
Kiowa	2	W	28	1	W	W
Kit Carson	3	241	241	2	51	W
Lake	4	80	W	3	171	W
La Plata	4	93	132	6	216	352
Larimer	15	1,926	1,949	16	2,010	2,202
Lincoln	4	124	W	5	142	164
Mesa	10	1,109	1,177	10	917	962
Mineral	--	--	--	1	W	W
Moffat	5	220	87	4	304	290
Montezuma	4	738	154	5	208	251
Montrose	6	313	403	6	609	976
Morgan	5	163	112	7	194	168
Otero	3	248	169	4	217	229
Ouray	1	15	15	2	W	W
Pueblo	7	1,340	1,877	9	2,534	4,378
Rio Blanco	2	W	W	2	8	14
Rio Grande	3	73	95	2	W	W
Routt	4	63	W	4	234	238
Saguache	1	11	6	1	W	W
San Miguel	2	W	W	1	W	37
Summit	6	740	907	6	607	894
Teller	1	9	8	2	W	W
Washington	1	W	5	2	W	W
Weld	8	1,186	1,616	8	1,907	1,752
Yuma	3	87	35	2	W	W
Undistributed [2]	r38	4,631	6,268	34	6,251	6,275
Total [3]	258	28,318	34,631	268	33,767	45,493

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Includes Baca, Bent, Clear Creek, Conejos, Crowley, Gunnison, Jackson, Las Animas, Logan, Mineral (1973), Park, Phillips, Pitkin, Prowers, Sedgwick, and some sand and gravel that cannot be assigned to specific counties.

[3] Data may not add to totals shown because of indepedent rounding.

Table 15.—Colorado: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,832	5,732	3,587	5,765
Fill	292	326	264	181
Paving	882	1,351	1,760	2,375
Other uses [1]	108	317	493	1,283
Total [2]	5,114	7,727	6,103	9,604
Gravel:				
Building	4,849	8,199	4,829	8,736
Fill	370	352	522	454
Paving	11,096	13,026	11,425	14,482
Railroad ballast	90	105	242	391
Miscellaneous	506	581	859	1,305
Other uses	187	294	447	697
Total [2]	17,098	22,558	18,324	26,065
Government-and-contractor operations:				
Sand:				
Building	55	116	57	122
Fill	37	39	1	2
Paving	316	265	710	1,008
Other uses	4	2	2	3
Total [2]	412	422	770	1,135
Gravel:				
Building	103	193	722	1,320
Fill	1,337	425	3,174	1,735
Paving	4,224	3,306	4,675	5,723
Other uses [1]	31	1	--	--
Total [2]	5,695	3,924	8,570	8,678
Total sand and gravel [2]	28,318	34,631	33,767	45,482

[1] Includes railroad ballast, blast, engine, filtration, glass (1973), oil (hydrafrac), and other sand.
[2] Data may not add to totals shown because of independent rounding.

The Flatiron Sand and Gravel Co. received a 10-year special-use permit to mine pasture land south of the Red Rocks National Monument for sand and gravel. The natural landmark is situated south of Boulder. The company agreed to reclaim the land each year. Ultimately, about 4,000 trees and 3,000 shrubs will be planted around small lakes in reclaiming the land.

Stone.—Output of stone totaling 6.4 million tons was the second highest on record. Dam construction in Jefferson County and an increased demand for cement rock in Fremont and Larimer Counties accounted for the higher production. Output in these three counties totaled 3.5 million tons, or over 50% of the State's stone production.

There were 91 quarries in operation during the year; of which 71 produced crushed stone and 20 produced dimension stone. Seventy quarries had outputs of less than 25,000 tons, 12 between 25,000 and 200,000 tons, four between 200,000 and 600,000 tons, four between 600,000 and 900,000 tons, and one quarry produced stone in excess of 900,000 tons. The Colorado State Highway Department operated 20 quarries in 1973.

The five companies with the largest production were, in order of output, Ideal Basic Industries Inc. (two quarries), Cooley Gravel Co. (one quarry), Castle Concrete Co. (two quarries), Martin-Marietta Corp. (one quarry), and CF&I Steel Corp. (two quarries). The five companies accounted for 78% of Colorado's stone production.

About 90% of the stone quarried in Colorado was hauled by truck. The remaining 10% was transported by railroad.

Stone was quarried in 33 counties. El Paso County had the greatest output. Other counties exceeding 100,000 tons were, in order of production, Jefferson, Freemont, Larimer, Boulder, Chaffee, and Garfield.

Table 16.—Colorado: Stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973			Kind of stone produced in 1973
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Adams	3	4	6	1	4	8	Granite.
Arapahoe	--	--	--	1	1	1	Do.
Baca	1	W	94	1	(1)	1	Do.
Bent	--	--	--	1	1	1	Do.
Clear Creek	2	8	14	1	1	2	Do.
Custer	1	1	7	--	--	--	Other stone.
Delta	1	W	W	1	(1)	(1)	Granite.
Denver	1	W	W	1	3	5	Do.
Dolores	1	W	50	1	61	59	Sandstone.
Eagle	4	13	19	2	W	W	Granite, other stone.
Elbert	--	--	--	1	3	5	Granite.
Fremont	15	W	W	13	1,190	2,471	Limestone,dolomite, granite, marble, sandstone, quartz.
Garfield	1	5	7	2	134	252	Limestone, granite.
Gunnison	2	3	5	--	--	--	Granite.
Hinsdale	1	(1)	2	--	--	--	Do.
Huerfano	--	--	--	1	1	1	Do.
Kit Carson	1	2	3	--	--	--	Do.
La Plata	1	9	13	1	1	1	Do.
Logan	--	--	--	1	(1)	1	Do.
Mesa	2	5	43	3	9	23	Sandstone, granite, traprock.
Moffat	3	5	7	--	--	--	Granite.
Montezuma	2	3	4	2	2	8	Do.
Montrose	--	--	--	2	3	4	Granite, sandstone.
Otero	2	6	9	1	1	1	Granite.
Park	1	W	W	1	2	5	Do.
Pitkin	--	--	--	1	1	1	Do.
Pueblo	1	(1)	1	1	(1)	(1)	Do.
Saguache	1	(1)	(1)	1	(1)	2	Quartz.
San Miguel	1	W	6	--	--	--	Limestone.
Summit	2	13	20	--	--	--	Granite.
Weld	2	108	143	1	(1)	(1)	Do.
Undistributed [2]	r 64	4,324	9,146	49	4,938	11,153	
Total [3]	116	4,507	9,599	91	6,357	14,003	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Includes Archuleta (1972), Boulder (1973), Chaffee (1973), Cheyenne (1972), Douglas, El Paso, Gilpin, Grand (1972), Jefferson, Larimer, Lincoln (1972), Mineral (1972), Prowers (1972), Rio Blanco (1973), Sedgwick (1972), and Teller Counties and production for which no county breakdown is available.

[3] Data may not add to totals shown because of independent rounding.

Table 17.—Colorado: Stone sold or used by producers, by use
(Thousand short tons and thousand dollars unless otherwise specified)

Use	1972 Quantity	1972 Value	1973 Quantity	1973 Value
Dimension stone:				
Rough:				
Irregular-shaped stone and rubble	2	38	2	55
Architectural ____ thousand cubic feet	[1] 29	72	29	55
Monumental ____ do				
Flagging [2] ____ do	14	17	28	29
Dressed:				
Architectural ____ do	26	61	30	56
Monumental [3] ____ do	15	58	13	116
Total [5] ____ (short tons)	9	247	10	311
Crushed and broken stone:				
Bituminous aggregate	W	W	W	W
Concrete aggregate	W	2,273	1,346	2,763
Dense-graded road base stone	W	W	752	989
Surfac treatment aggregate	94	129	151	305
Unspecified construction aggregate and roadstone	1,311	439	388	944
Riprap and jetty stone	212	439	474	1,079
Manufactured fine aggregate (stone sand)	W	52	W	W
Terrazzo and exposed aggregate	W	W	10	105
Other uses [4]	2,882	6,020	3,226	7,507
Total [5]	4,499	9,352	6,347	13,692
Grand total [5]	4,507	9,599	6,357	14,003

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Rough monumental and architectural stone combined to avoid disclosing individual company confidential data.
[2] Data include uses not specified (1972).
[3] Data include stone for flagging and uses not specified (1973).
[4] Data include stone used for agricultural limestone, cement manufacture, flux and refractory stone, and unspecified uses (1972). 1973 data also include stone used for railroad ballast, sugar refining, and mine dusting.
[5] Data may not add to totals shown because of independent rounding.

Table 18.—Colorado: Stone sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Kind of stone	1972 Quantity	1972 Value	1973 Quantity	1973 Value
Dimension:				
Dolomite	W	W	W	W
Granite	W	W	W	W
Sandstone	8	155	9	191
Quartz	(1)	(1)	--	--
Undistributed	1	92	1	120
Total [2]	2	247	10	311
Crushed and broken:				
Limestone and dolomite	3,343	7,217	4,200	9,750
Granite	W	W	1,672	2,767
Marble	W	W	1	4
Sandstone, quartz, and quartzite	215	616	409	1,029
Traprock	--	--	(1)	(1)
Other stone	W	189	65	143
Undistributed	941	1,330	--	--
Total [2]	4,499	9,352	6,347	13,692
Grand total [2]	4,507	9,599	6,357	14,003

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Less than ½ unit.
[2] Data may not add to totals shown because of independent rounding.

Sulfur.—Continental Oil Co. recovered elemental sulfur from acid gases at its petroleum refinery in Denver. Output decreased compared with 1972. Elemental sulfur was not included in table 1 because it is considered a secondary product.

Vermiculite.—Crude vermiculite from Montana was exfoliated by W. R. Grace & Co. at its plant in Denver. Quantity sold and used in 1973 was greater than in 1972. The product was sold for use in concrete aggregate, fire proofing, horticulture, loose fill insulation, and plaster aggregate.

Table 19.—Principal producers

Commodity and company	Address	Type of activity	County
Carbon dioxide, natural: Tenneco Oil Co.	Box 2410 Denver, Colo. 80201	Well in McElmo field.	Montezuma.
Cement:			
Ideal Basic Industries, Inc	1111 S. Colo. Blvd. Denver, Colo. 80222	Dry process, 1-rotary-kiln plant.	Boulder.
Martin Marietta Cement	Box 231 Florence, Colo. 81226	Wet process, 2-rotary-kiln plant.	Fremont.
	Box 579 Fort Collins, Colo. 80521	Dry process, 2-rotary-kiln plant.	Larimer.
Clays:			
Conda Wesley	5323 Eldorado Springs Dr., Boulder, Colo. 80302	2 mines	Boulder.
Denver Brick & Pipe Co	Box 2329 Denver, Colo. 80201	Mine	Elbert.
The Idealite Co., a division of Ideal Basic Industries, Inc.	Box 1140 Boulder, Colo. 80302	Open pit mine and expanding plant.	Jefferson.
George W. Parfet Estate Inc	Box 266 Golden, Colo. 80401	Mine	Do.
Robinson Brick & Tile Co	Box 1619 Denver, Colo. 80223	Underground mine and 3 open pit mines.	Douglas.
H. M. Rubey Clay Co	Box 266 Golden, Colo. 80401	Mine	Jefferson.
Summit Press & Brick Co	Box 14 Trinidad, Colo. 81082	2 mines	Las Animas, and Pueblo.
Wisenhunt Inc	P.O. Box 208 Castle Rock, Colo. 80104	2 pits and 2 mines	Boulder and Douglas.
Coal, bituminous:			
CF&I Steel Corp	Box 316 Pueblo, Colo. 81002	Underground mine	Las Animas.
Energy Coal Co	2850 North Meridian St. Indianapolis, Ind. 46208	Strip mine and crushing plant.	Routt.
Mid-Continent Coal and Coke Co.	Carbondale, Colo. 81623	3 underground mines; cleaning and thermal drying plant.	Pitkin.
Peabody Coal Co	301 North Memorial Drive St. Louis, Mo. 63102	Strip mine and crushing plant.	Montrose.
		---- do	
Pittsburgh & Midway Coal Mining Co.	Ten Main Center Kansas City, Mo. 64105	Strip mine; crushing and oil treatment plant.	Routt.
United States Steel Corp. Western District-Coal.	Box 807 Dragerton, Utah 84520	Underground mine; cleaning and crushing plant.	Do. Delta and Gunnison.
Copper:			
Federal Resources Corp	Ouray, Colo. 81427	*See* Zinc	Ouray and San Miguel.
Idarado Mining Co	---- do	---- do	Ouray.
Fluorspar: Ozark-Mahoning Co	Box O Cowdrey, Colo. 80434	Underground mine and plant.	Jackson.
Gold:			
American Smelting and Refining Co.	120 Broadway New York, N.Y. 10005	*See* Zinc	Lake.
Idarado Mining Co	Ouray, Colo. 81427	---- do	Ouray and San Miguel.
Standard Metals Corp	Telluride, Colo. 81435 Box 247 Silverton, Colo. 81433	---- do	San Juan.
Gypsum: The Flintkote Co	101 E. Vine Drive Fort Collins, Colo. 80521	Open pit mine and wallboard plant.	Fremont and Larimer.
Iron Ore: Pitkin Iron Corp	105 West Adams St. Chicago, Ill. 60603	Open pit mine	Pitkin.
Lead:			
American Smelting & Refining Co.	Box 936 Leadville, Colo. 80461	*See* Zinc	Lake.

Table 19.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Lead—Continued			
Federal Resources Corp	Ouray, Colo. 81427	*See* Zinc	Ouray.
Homestake Mining Co	Box 98 Creede, Colo 81130	*See* Silver	Mineral.
Idarado Mining Co	Ouray, Colo. 81427 Telluride, Colo. 81435	*See* Zinc	Ouray and San Miguel.
New Jersey Zinc Co	Gilman, Colo. 81634	do	Eagle.
Standard Metals Corp	Box 2471 Silverton, Colo. 81433	do	San Juan.
Lime:			
CF&I Steel Corp	Box 316 Pueblo, Colo. 81002	Natural-frequency-vibrating kiln plant.	Pueblo.
The Great Western Sugar Co	Box 5308 Denver, Colo. 80217	Pot-kiln plant	Adams.
		2 pot-kiln plants	Boulder.
		do	Larimer.
		Pot-kiln plant	Logan.
		Shaft-kiln plant	Morgan.
		Pot-kiln plant	Sedgwick.
		2 pot-kiln plants	Weld.
Molybdenum:			
American Metal Climax, Inc	Mines Park Golden, Colo. 80401	Underground mine and mill.	Clear Creek.
Peat:			
H&H Trucking Co	136 Cornell St. Colorado Springs, Colo. 80911	Bog	Teller.
Universal Peat Co	5926 West Arizona Ave. Denver, Colo. 80226	Bog	Park.
Ver-Ja Peat Moss	Woodland Park, Colo. 80863	Bog	Gillette.
Perlite: Persolite Products, Inc	Box 105 Florence, Colo. 81226	Open pit mine	Custer.
		Expanding plant	Fremont.
Petroleum:			
Amoco Production Corp	Box 591 Tulsa, Okla. 74102	Crude oil: Black Jack field.	Arapahoe.
			Montezuma.
		Crude oil: Cache field.	Washington.
			Moffat.
		Crude oil: Big Beaver field.	
		Crude oil: Danforth Hills and Maudlin Gulch fields.	
Chevron Oil Co., Western Division.	Box 599 1700 Broadway Denver, Colo. 80201	Crude oil: Black Hollow and Pierce fields.	Weld.
		Crude oil plant: Rangely field.	Rio Blanco.
Continental Oil Co	Box 2197 Houston, Tex. 77001	Crude oil: McCallum field.	Jackson.
		Crude oil: Big Beaver, Bobcat, Little Beaver, and Plum Bush Creek fields.	Washington. Adams.
First General Resources Company The Refinery Corp.	P.O. Box 1498 Denver, Colo. 80201	Refinery	
		do	Do.
Gary-Western Co	4 Inverness Court East Englewood, Colo. 81010	do	Mesa.
Texaco Inc	Box 2100 Denver, Colo. 80201	Crude oil: Wilson Creek field.	Rio Blanco.
Pumice:			
Colorado Aggregate Co., Inc	Box 106 Mesita, Colo. 81142	Open pit mine and plant.	Costilla.
Pyrites:			
Climax Molybdenum Co., a division of American Metal Climax Co.	Climax, Colo. 80429	*See* Molybdenum	Lake.
Sand and gravel (commercial):			
Asphalt Material and Paving Co.	14802 West 44th Ave. Golden, Colo. 80401	Pit and plant	Douglas.
		do	Garfield.
		Pit and 2 plants	Jefferson.
		Pit and plant	Lincoln.
Brannan Sand & Gravel Co	4800 Brighton Blvd. Denver, Colo. 80216	Pit and 4 plants	Adams.
		Pit and plant	Arapahoe.
		do	Jefferson.
		7 pits and plant	Pueblo.
Cooley Gravel Co	Box 313 Pueblo, Colo. 81002 5631 Tennyson St. Arvada, Colo. 80002	Pit and plant	Adams.
		2 pits and plants	Arapahoe.

Table 19.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and Gravel (commercial)—Continued			
L. G. Everist Inc	313 South Phillips Sioux Falls, S.Dak. 57102	Pit	Jefferson.
Golden Gravel Co	311 Kimbark St. Longmont, Colo. 80501	3 plants	Boulder.
Mobile Pre-Mix Sand and Gravel Co.	7620 Madison St. Denver, Colo. 80204	Pit and plant	Adams.
Peter Kiewit & Sons Co	5200 West Clifton Rd. Littleton, Colo. 80120	---- do	Douglas.
Plains Aggregate Co	P.O. Box 229 Boulder, Colo. 80302	Pit	Arapahoe.
Schmidt Construction Inc	P.O. Box 545 Arvada, Colo. 80002	Pit and plant	Larimer.
Western Paving Construction Co.	5105 Washington St. Denver, Colo. 80216	---- do	Pueblo.
Silver: Homestake Mining Co	Box 98 Creede, Colo. 81130	Underground mine and mill.	Adams.
Stone:			Mineral.
Castle Concrete Co	Box 2379 Colorado Springs, Colo. 80901	2 quarries and plants.	El Paso.
CF&I Steel Corp	Box 489 Salida, Colo. 81201	Quarry and plant	Chaffee.
	Box 847 Canon City, Colo. 81212	---- do	Fremont.
Cooley Gravel Co	Box 5485 Denver, Colo. 80217	Quarry	Jefferson.
Ideal Basic Industries, Inc	Box 231 Florence, Colo. 81226	Quarry and plant	Fremont.
	Box 579 Fort Collins, Colo. 80521	---- do	Larimer.
Martin Marietta Cement Western Division.	Box 467 Lyons, Colo. 80540	Quarry	Boulder.
Tin:			
Climax Molybdenum Co., a division of American Metal Climax Co.	Climax, Colo. 80429	*See* Molybdenum	Lake.
Tungsten:			
Climax Molybdenum Co., a division of American Metal Climax Co.	---- do	---- do	Do.
Uranium:			
Cotter Corp	Box 468 Golden. Colo. 80401	Underground mines and mill.	Fremont and Jefferson.
Union Carbide Corp., Mining and Metals Div.	Box 43, Rt. 1 Rifle, Colo. 81650	---- do	Montrose and San Miguel.
Vanadium:			
Union Carbide Corp., Mining and Metals Div.	Box 43, Rt. 1 Rifle, Colo. 81650	*See* Uranium	Do.
Zinc:			
American Smelting & Refining Co.	Box 936 Leadville, Colo. 80461	Mine and mill	Lake.
Idarado Mining Co	Ouray, Colo. 81427	Underground mine and mill.	Ouray.
	Telluride, Colo. 81426	---- do	San Miguel.
New Jersey Zinc Co	Gilman, Colo. 81634	---- do	Eagle.

The Mineral Industry of Connecticut

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Connecticut Geological and Natural History Survey for collecting information on all minerals except fuels.

By Robert A. Clifton [1]

The 11% increase in Connecticut's mineral production value in 1973, from $33.1 million to $36.8 million, was led by sand and gravel and stone. These commodities continued as the principal mineral products and their combined production increased 13% in weight and 10% in value.

There was a significant increase in the activities of State agencies and their contractors.

The Connecticut Geological and Natural History Survey in 1973, published Quadrangle Report No. 29, Bedrock Geology of the Clinton Quadrangle, Conn. No U.S. Geological Survey maps of Connecticut were published in 1973.

In 1973, Connecticut became a true pioneer in solving solid waste management and secondary resource recovery problems. The General Electric Co. with the State's Department of Environmental Protection developed a 25-year solid waste management plan. Enabling legislation, which created a Solid Waste Authority and provided for a $250 million bond issue, was passed. A chairman of the Solid Waste Authority was appointed, and design of the first waste recovery unit (costing $20 million and to be located at Bridgeport) was completed and put out for bids. This initial unit should be operable in 1976, marketing $16 million worth of recovered materials.

[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Mineral production in Connecticut [1]

Mineral		1972		1973	
		Quantity	Value (thousands)	Quantity	Value (thousands)
Clays	thousand short tons	157	$292	162	$320
Feldspar	short tons	W	W	77,206	W
Gem stones		NA	16	NA	16
Mica (scrap)	thousand short tons	2	W	3	W
Sand and gravel	do	6,763	11,270	7,806	12,788
Stone	do	8,719	19,695	9,682	21,305
Value of items that cannot be disclosed: Lime and values indicated by symbol W		XX	1,850	XX	2,375
Total		XX	33,123	XX	36,804
Total 1967 constant dollars		XX	27,330	XX	p 27,021

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Connecticut, by county

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Fairfield	$711	$699	Sand and gravel.
Hartford	10,659	12,385	Stone, sand and gravel, clays.
Litchfield	4,385	W	Stone, sand and gravel, lime.
Middlesex	2,044	2,574	Feldspar, sand and gravel, stone, mica, clays.
New Haven	10,368	12,108	Stone, sand and gravel, clays.
New London	1,543	W	Stone, sand and gravel.
Tolland	W	W	Sand and gravel.
Windham	W	942	Stone, sand and gravel.
Undistributed [1]	3,415	8,097	
Total [2]	33,123	36,804	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes gem stones, some sand and gravel which cannot be assigned to specific counties, and values indicated by symbol W.
[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Connecticut business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total labor force—thousands	1,370.5	1,364.7	−0.4
Unemployment—do	112.0	77.3	−31.0
Employment:			
Mining—do	(1)	(1)	
Construction—do	56.2	58.3	+3.7
Manufacturing—do	401.0	421.8	+5.2
Government—do	165.2	168.5	+2.0
Other [2]—do	567.2	592.8	+4.5
Personal income:			
Total—millions	$16,421	$18,114	+10.3
Per capita	$5,328	$5,889	+10.5
Construction activity:			
Number of private and public residential units	25,151	21,468	−14.6
Valuation of nonresidential construction authorized—millions	$246.1	$290.4	+18.0
Mineral production value—thousands	$33,123	$36,804	+11.1

p Preliminary.
[1] Combined with construction.
[2] Includes transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; and services.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; and the U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—There are no cement manufacturing plants in Connecticut, and all cement consumed comes from out of state. Cement shipment origin data are unavailable. However, preliminary data on shipments by destination suggest a 5% increase in the apparent consumption of all cements from 874,484 short tons in 1972 to 922,000 short tons in 1973.

Clays.—Common clay production increased 3% in volume and was 10% above the 1972 value. The four mines operated by four companies were in Hartford, Middlesex, and New Haven Counties. Most of the clay was consumed in the manufacture of building brick; 5% was utilized by the ceramic and specialty clay products industry.

Feldspar.—The Feldspar Corp. mined feldspar from the Middleton and Hale mines and ground it at their Middleton plant in Middlesex County. The ground feldspar was shipped to various States and Canada for use in manufacturing glass and pottery. Feldspar produced in Connecticut in 1973 decreased in quantity from 1972, but the production value increased 37% above the 1972 value.

Gem Stones.—Mineralogical societies, dealers, and individuals collected specimens from dumps, quarries, and pegmatite de-

posits in the State. The value of the collectors' items was about $16,000.

Gypsum.—National Gypsum Co. imported crude gypsum for processing into finished building plaster products and board and sheathing materials at its New Haven plant. Output increased 10% for a new annual record.

Lime.—Pfizer, Inc., produced lime in Litchfield County for mason's lime, sewage treatment, and other uses. Output in 1973 was 20% higher than in 1972 but 14% below the 1965 record. The lime was consumed in Connecticut, Massachusetts, and other States. Total consumption of lime in Connecticut was 79,700 tons.

Sand and Gravel.—Commercial production of sand and gravel increased 26% in both total volume and value from 1972 to 1973. Government-and-contractor production decreased greatly and only reached 40% of the volume and 41% of the value of 1972. The total sand and gravel value was 13% over that in 1972 with a decrease in the unit selling price from $1.67 per ton to $1.64.

Of the 7.8 million tons produced, commercial operators sold or used 96% and Government-and-contractor operations used 4%. The 7.8 million tons produced, 15% above 1972, was used primarily as aggregate in concrete for structural and paving construction. Other uses were fill, railroad ballast, molding sand, and other.

Table 4.—Connecticut: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,365	2,308	1,661	2,748
Fill	251	237	396	328
Paving	1,596	2,717	1,498	2,754
Other uses [1]	206	259	260	406
Total [2]	3,418	5,522	3,816	6,236
Gravel:				
Building	925	1,791	925	1,908
Fill	319	235	589	419
Paving	995	1,593	1,489	2,692
Miscellaneous	142	197	541	588
Other uses	125	221	111	245
Total [2]	2,507	4,038	3,655	5,852
Government-and-contractor operations:				
Sand:				
Fill	12	3	34	34
Paving	27	29	27	24
Other uses	14	14	54	34
Total [2]	53	46	115	92
Gravel:				
Building	(3)	(3)	--	--
Fill	W	43	--	--
Paving	W	1,621	220	609
Total [2]	786	1,664	220	609
Total sand and gravel [2]	6,763	11,270	7,806	12,788

W Withheld to avoid disclosing individual company confidential data; included with total gravel.
[1] Includes other unground sand (1973).
[2] Data may not add to totals shown because of independent rounding.
[3] Less than ½ unit.

Sand and gravel was produced in each of the State's eight counties; the leaders were Hartford and New Haven Counties. Connecticut Sand and Stone Corp., Waterbury Sand and Gravel Co., Roncari Industries, Inc., and Balf Co. were the leading producers.

Stone.—Production of stone increased 11% in volume and 8% in value as compared with that of 1972.

Crushed basalt, used chiefly as construction aggregate and railroad ballast, was the major product in both volume and value. It was produced in Hartford, Litchfield, and New Haven Counties.

Crushed limestone and dolomite were

produced in Litchfield County only, by four operators. It was marketed for metallurgical flux, soil neutralizer, lime manufacturing, and filler.

Crushed sandstone produced in Middlesex County was used in manufacturing fine aggregate and terrazzo. Quartz and quartzite were also produced for use in glass, asphalt filler, and abrasives. Dimension sandstone was produced in Windham County and sold primarily for use as rubble and in rough construction work. The dressed stone was marketed as building stone veneer.

Ashland Oil, Inc., Balf Co., and Roncari Industries, Inc., were the leading stone producers.

METALS

The Abbott Ball Co., Hartford County, produced steel shot and grit in significant quantities during 1973. Pfizer Inc., at Canaan, Litchfield County, is the only known producer of calcium metal in the United States, which is used to remove impurities during steelmaking and in the production of aluminum, magnesium, uranium oxide, and thorium. Pfizer also produces barium metal, which is used by the electronics, metals, and chemical industries and also Prefiltron, an iron-copper powder, which is used in the manufacture of electrodes.

The State has six steel mills that produced bars, rods, coils, strip, and wire rope. Approximately 75 foundries produced ferrous and nonferrous castings, and 11 foundries produced ferrous and nonferrous forgings and ingots.

About 25 scrap metal dealers collected and processed ferrous metal for export, and for sale to area foundries.

Table 5.—Principal producers

Commodity and company	Address	Type of activity	County
Clays:			
The Michael Kane Brick Co	654 Newfield St. Middletown, Conn. 06475	Pit	Middlesex.
Keller Pottery Corp. of Conn	Four Rod Road Kensington, Conn. 06037	Pit	Hartford.
Kelsey-Ferguson Brick Co	Route 5 East Windsor Hill, Conn. 06028	Pit	Do.
Plasticrete Corp., Stiles Brick Division.	P.O. Box 248 North Haven, Conn. 06473	Pit	New Haven.
Feldspar:			
The Feldspar Corp.[1]	Spruce Pine, N.C. 28777	Pit	Middlesex.
Lime:			
Pfizer, Inc	Daisy Hill Road Canaan, Conn. 06018	Plant	Litchfield.
Gypsum (calcined):			
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	New Haven.
Sand and gravel:			
Balf Co.[2]	Hartford, Conn. 06111	Pit	Hartford.
Connecticut Sand and Stone Corp.	7 West Main St. Plainsville, Conn. 06062	Pits	Hartford and Litchfield.
Leverty & Hurley	Beacon Falls, Conn. 06403	Pit	New Haven.
Monaco & Sons Paving Construction.	240 Commerce St. Glastonbury, Conn. 06033	Pit	Hartford.
Newington Construction Co	187 Richard St. Newington, Conn. 06111	Pit	Do.
Roncari Industries, Inc	1776 South Main St. East Granby, Conn. 06026	Pit	Do.
Sega Sand & Gravel, Inc	271 Danbury Rd. New Milford, Conn. 06776	Pit	Litchfield.
Shadow Lane Gravel Co	7 Nordland Ave. Cromwell, Conn. 06416	Pit	Middlesex.
Silliman Co	290 North Ave. Bridgeport, Conn. 06601	Pit	New Haven.
Waterbury Sand and Gravel Co.	551 So. Leonard St. Waterbury, Conn. 06708	Pit	Do.
Stone:			
Basalt, crushed and broken:			
Balf Co	P.O. Box 11190 Newington, Conn. 06111	Quarry	Hartford.
New Haven Trap Rock Co., div. of Ashland Oil, Inc.[3]	P.O. Box 5033 Hamden, Conn. 06518	Quarries	Hartford and New Haven.
Roncari Industries, Inc	1776 South Main St. East Granby, Conn. 06026	Quarry	Hartford.
York Hill Trap Rock Quarry Co.	Westfield Rd. Meriden, Conn. 06450	do	New Haven.

[1] Also quartzite and scrap mica.
[2] Two operations.
[3] Also sand and gravel.

The Mineral Industry of Delaware

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Delaware Geological Survey for collecting information on all minerals except fuels.

By David G. Willard [1]

Sand and gravel remained Delaware's only significant mineral product in 1973. A major increase in sand and gravel output was the principal cause of a 35% increase in total value of the State's mineral production. The first full year of operation of a plant producing magnesium hydroxide from seawater also contributed to the gain. Minor quantities of brick clay and gem stones were also produced.

Other mineral-related activities included the recovery of sulfur from petroleum refining and the calcining of gypsum. Because these mineral products are recovered from raw materials produced outside the State, they are not counted as part of Delaware's mineral production. No change in these activities took place during 1973.

Legislation and Government Programs.—Delaware's glauconite (greensand) resource was found not suitable as a construction material, but showed promise as an industrial filter medium in tests conducted as part of a cooperative investigation by the Bureau of Mines and the Delaware Geological Survey. Laboratory attempts to expand the glauconite produced a semibloated, lightweight aggregate that possessed insufficient weight and strength to be suitable for construction use. However, in initial tests involving percolation of polluted water through a greensand bed, the material appeared to cause a significant reduction in such toxic metals as arsenic, copper, cadmium, and lead. Further studies, including larger scale tests, were being planned.

The start of petroleum exploration on the continental shelf off Delaware and other Atlantic Coast States was delayed while the ownership of the continental shelf (the Federal Government or the several States) is being decided in the U.S. Supreme Court. Federal officials refused to permit offshore oil drilling until a Federal suit against the State of Maine, which Delaware and several other States have joined, is decided. Arguments were being heard before a Special Master of the Supreme Court (an official appointed by the

[1] Economist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Mineral production in Delaware [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays ----------thousand short tons--	15	$9	15	$9
Gem stones, ----------	NA	W	NA	W
Sand and gravel ----------thousand short tons--	2,257	2,660	3,408	3,678
Value of items that cannot be disclosed: Other nonmetals and values indicated by symbol W --	XX	202	XX	202
Total ----------	XX	2,871	XX	3,889
Total 1967 constant dollars ----------	XX	2,369	XX	p 2,855

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Indicators of Delaware business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Civilian work force ---------- thousands	243.6	250.1	+2.7
Unemployment ---------- do	11.4	11.6	+1.8
Manufacturing ---------- do	72.1	73.2	+1.5
Contract construction ---------- do	15.5	16.0	+3.2
Nonmanufacturing ---------- do	157.9	146.4	−7.3
Personal income:			
Total ---------- millions	$2,931	$3,191	+8.9
Per capita	$5,188	$5,540	+6.8
Construction activity: Cement shipments to Delaware ---------- thousand short tons	191	232	+21.5
Mineral production value ---------- thousands	$2,871	$3,889	+35.5

p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; U.S. Bureau of Mines.

Court to hear arguments and make determinations of fact in cases which originate in the Supreme Court), and a decision was expected sometime in mid-1974. If the Federal Government is awarded ownership of all lands beyond the statutory 3-mile limit, the States will lose all rights and powers over revenues and environmental controls.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Delaware Brick Co. remained the sole producer of clay in the State, operating a pit in New Castle County. The clay was used for making building brick.

Gem Stones.—Collectors of gem stones and mineral specimens again were active along the Delaware beaches.

Magnesium Compounds.—The Barcroft Co. plant at Lewes continued to produce magnesium hydroxide (milk of magnesia) from sea water. Although the plant opened last year, production was minor; 1973 was its first year of full-scale production.

Sand and Gravel.—Output of sand and gravel was up 51% in quantity and 38% in value in 1973. The increase resulted mainly from unusually large shipments of gravel for use in interstate highway construction, and output was expected to decline in 1974 after the work is completed.

Production was reported by 11 companies operating a total of 15 pits. New Castle County contained nine of the pits; four were located in Kent County, and two in Sussex County. Sand production amounted to 1.3 million tons valued at $1.7 million, and gravel production totaled 2.1 million tons worth $2.0 million.

Paving consumed 64% of the combined sand and gravel output, with building construction and fill each accounting for 18%. A negligible amount was produced for other purposes. Unprocessed sand and gravel comprised 76% of the total. All production was transported by truck.

Table 3.—Principal producers

Commodity and company	Address	Type of activity	County
Clays: Delaware Brick Co	River Rd. New Castle, Del. 19720	Pit	New Castle.
Gypsum, calcined: Georgia-Pacific Corp.	900 SW Fifth Ave. Portland, Oreg. 97204	Plant	Do.
Magnesium compounds: Barcroft Co.	P. O. Box 474, Henlopen Dr. Lewes, Del. 19958	----do----	Sussex.
Sand and gravel:			
Barber Sand and Gravel	R.F.D. 1 Harrington, Del. 19952	Pit	Kent.
Clough & Caulk Sand & Gravel	Route 1, Box 129 Wyoming, Del. 19934	Pit	Do.
Delaware Sand & Gravel	R.D. 2, Box 286 New Castle, Del. 19720	Pit	New Castle.
George Nashold, Inc	Box 286 Frederica, Del. 19946	Pit	Kent.
Material Transit, Inc	Box 210 924 South Herald St. Wilmington, Del. 19800	Pit	New Castle.
Parkway Gravel, Inc	4048 New Castle Ave. New Castle, Del. 19720	5 Pits	Do.
St. Jones River Gravel Co	Box 426 Dover, Del. 19901	Pit	Kent
Sussex Sand and Gravel Co	Millsboro, Del. 19966	Pit	Sussex.
Swain Construction Co	Lincoln, Del. 19960	Pit	Do.
Whittington's Sand & Gravel Co.	U.S. Route 40 Bear, Del. 19701	Pit	New Castle.
Woodlawn Gravel Co	Box 2501 Wilmington, Del. 19805	Pit	Do.

The Mineral Industry of Florida

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Florida Bureau of Geology.

By William F. Stowasser [1] and Charles W. Hendry, Jr.[2]

The value of mineral production in Florida increased from $426.6 million in 1972 to $601.1 million in 1973. The increase of $174.5 million, or 41% more than the value in 1972, was principally caused by increases in the value of crude petroleum, natural gas, cement, stone, and phosphate rock. A general increase in the value of all minerals produced helped to create this record reported value.

Of the 42.1 million tons of phosphate rock produced in the United States, Florida and North Carolina produced 34.4 million. Of this total, Florida was the predominant producer and, for the 80th consecutive year, supplied more than any other State. The State ranked first in the value of fuller's earth, second in the value of production of titanium concentrates, and third in the value of peat and kyanite production. Staurolite was produced only in Florida. Florida and North Carolina supplied 82% of the domestic phosphate rock market and about 95% of the exports from the United States. Only Morocco exported more phosphate rock than was exported from the ports of Tampa, Boca Grande, and Jacksonville. Shipments were made to 29 countries. The principal recipients were West Germany, Canada, and Japan.

Crude petroleum production from the Jay field in the northern Panhandle near the Alabama border was responsible for the State's surge in production, from 16.9 million barrels in 1972 to 32.7 million barrels in 1973. Florida's onshore oil production was important, but interest in 1973 shifted to offshore sites. On December 20, 1973, the Bureau of Land Management, U.S. Department of the Interior, opened sealed bids made by some 51 oil firms on 147 tracts off Mississippi, Alabama, and Florida (MAFLA). The industry winners spent $1.491 billion for the right to drill on 87 tracts covering 485,000 acres of ocean floor. The Bureau of Land Management estimated the reserves in the December MAFLA sale as 2 to 3.2 billion barrels of oil and 2.4 to 3.9 trillion cubic feet of gas. Recovery of the petroleum will require 925 to 1,500 wells drilled from 100 to 300 platforms. Some 500 to 800 miles of pipeline will be needed to transport the crude oil to shore facilities. The MAFLA sale was divided into four sections. Twenty-nine tracts were identified in the Pascagoula, La., to Pensacola area. Another 32 tracts are located in the Gulf of Mexico, about halfway between Fort Walton Beach and Panama City, called the Apalachicola South area. Fourteen tracts are located south of Tallahassee and west of Homosassa. Twelve tracts are located west of Tarpon Springs. Most are located between 50 and 150 miles out into the Gulf of Mexico.

Legislation and Government Programs.—The State did not enact any new significant legislation that directly concerned mineral production. The Department of Natural Resources issued interim guidelines for State acquisition of environmentally endangered lands. The criteria for identifying these lands will be their ecological value, their vulnerability, and their endangerment. Priority will be given where the degree of urgency for environmental protection is high and where specific objectives are iden-

[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

[2] Chief, Bureau of Geology, Florida Department of Natural Resources.

tified for land protection; if possible, other laws will be used to acquire land rather than direct purchase by the State.

On June 10, 1973, the Governor signed into law the act creating an Energy Study Commission. The law is designed to assure monitoring of the State's resources. The Commission will be required to study the national energy situation and its relationship to the Florida energy position. The Commission will also be required to recommend comprehensive energy policies to assure that Florida will have sufficient energy for future needs.

Florida's oil spill law was ruled valid by a unanimous U.S. Supreme Court decision. The law imposes absolute and unlimited liability on shipowners whose vessels pollute and damage the State's territorial waters and coastal zone. The State Department of Natural Resources will enforce the law.

The Governor and cabinet approved the drilling of one 13,000-foot oil well in the Apalachicola National Forest on October 16.

The Bureau of Mines Albany Metallurgy Research Center, Albany, Oreg., initiated studies to demonstrate the physical and economic feasibility of phosphoric acid manufacture by direct sulfuric acid digestion of Florida land-pebble matrix. It was shown that direct sulfuric acid digestion of a Florida phosphate matrix sample could be controlled to produce phosphoric acid and achieve a high P_2O_5 recovery. The waste product, a quartz-gypsum filter cake, was characterized as sandy, readily dewatered, and suitable for backfilling mined-out areas to reclaim land. Elimination of the slime storage areas that cover up to 70% of Florida phosphate mined land, and a 20% to 30% increase in phosphate recovery were the principal justifications for developing a process to produce phosphoric acid directly from Florida phosphate matrix.

A number of samples from operating mines in Florida were tested in a continuous-circuit miniplant. Phosphoric acid, containing from 21% to 30% P_2O_5, was produced with recoveries ranging from 90% to 95%. A larger pilot plant capable of processing 100 pounds per 24-hour day was designed and is under construction. It will have an acid attack-gypsum crystallization section and a matching rotating tilting pan filter.

The Bureau of Mines Tuscaloosa Metallurgy Research Laboratory, Tuscaloosa, Ala., had seven active programs related to Florida phosphate mining and beneficiation problems.

The Florida Hawthorn Formation that underlies the phosphate matrix contains some phosphate minerals. The Hawthorn is characterized, for the most part, as a tan, cream- or white-colored, sandy argillaceous-appearing, hard dolomitic limestone. The upper part of the formation contains traces to large amounts of black phosphate nodules. Recovery of the phosphate minerals was attempted by calcining and slaking a sized fraction of the material to separate the lime from the phosphate. Laboratory flotation tests were also made on Hawthorn Formation samples. Floating the phosphate minerals from the dolomitic gangue was attempted with petroleum sulfonate. The results from these tests were not promising.

The research program to develop a system to dewater phosphate slimes sponsored by the Florida Phosphate Council, representing 10 operating Florida companies, and the Bureau of Mines continued through 1973. The program, conducted by The Tuscaloosa Metallurgy Research Laboratory, was divided into a number of studies. Phosphate slime samples were characterized, and the identification of attapulgite clay as the major factor responsible for the poor settling rate of the slimes was confirmed. The study also confirmed that the quantity and character of slime solids discharged to settling ponds were highly variable. The relationship of electrophoretic mobilities and cation exchange capacities of phosphate slimes to their mineralogical, chemical, and physical properties was investigated during the year. Results indicated that the hydrogen ion was potential-determining for the slime systems, and the mobility was reduced to zero at a pH of about 2.5. Anions in the slime systems were also found to have significant effects on particle mobility. The studies indicated that the conditons for maximum mobility correspond to conditions for minimum slime viscosity and minimum amount of flocculant needed to agglomerate and settle the slime particles.

Studies were made of phosphate rock matrix in place to determine if selective mining could be used to reduce the quantity of attapulgite in the feed to washing

plants. In one pit attapulgite did occur near the bottom, thus opening the potential for selective mining.

Flocculation studies were made with a wide variety of anionic, cationic, and nonionic polymers. Dow AP–30 was found to be most effective.

Research on the consolidation behavior of sand-slime mixtures showed that addition of sand tailings to slime improved dewatering rates.

Table 1.—Mineral production in Florida [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Cement:				
Masonry ____ thousand short tons __	213	$6,901	256	$8,706
Portland _____ do ____	2,425	59,773	2,725	72,666
Clays _____ do ____	[2] 922	[2] 10,336	1,139	13,718
Lime _____ do ____	180	3,527	187	4,026
Natural gas _____ million cubic feet __	15,521	4,967	33,857	11,613
Peat _____ thousand short tons __	45	362	44	384
Petroleum (crude) thousand 42-gallon barrels __	16,897	W	32,695	150,070
Sand and gravel __ thousand short tons __	r 22,363	r 17,009	20,167	21,415
Stone [3] _____ do ____	53,093	81,621	61,735	103,595
Value of items that cannot be disclosed: Clay (kaolin, 1972), kyanite, magnesium compounds, natural gas liquids, phosphate rock, rare-earth metal concentrates, staurolite, stone (shell), titanium concentrates, zircon concentrates, and values indicated by symbol W _____	XX	r 242,136	XX	214,907
Total _____	XX	r 426,632	XX	601,100
Total 1967 constant dollars _____	XX	352,014	XX	p 441,328

p Preliminary. r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin; included with "Value of items that cannot be disclosed."

[3] Excludes shell; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Florida, by county [1 2]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Alachua _____	$1,741	$1,971	Stone.
Bay _____	W	W	Sand and gravel.
Bradford _____	W	W	Natural gas liquids.
Brevard _____	W	392	Stone, sand and gravel.
Broward _____	18,226	20,346	Stone, sand and gravel.
Calhoun _____	W	W	Sand and gravel.
Charlotte _____	W	W	Do.
Citrus _____	W	W	Stone, clays, phosphate rock.
Clay _____	W	W	Titanium concentrates, zircon, staurolite, clays, rare-earth metal concentrates, kyanite.
Collier _____	5,548	8,762	Stone, petroleum, natural gas.
Dade _____	r 69,966	88,330	Cement, stone, sand and gravel.
Escambia _____	9,079	30,735	Petroleum, natural gas, sand and gravel, clays.
Franklin _____	3	W	Peat, sand and gravel.
Gadsden _____	9,563	W	Clays, sand and gravel.
Gilchrist _____	W	W	Phosphate rock.
Gulf _____	W	W	Magnesium compounds, lime.
Hamilton _____	W	W	Phosphate rock.
Hendry _____	W	18,978	Petroleum, sand and gravel, natural gas.
Hernando _____	W	W	Stone, lime, phosphate rock.
Hillsborough _____	W	W	Cement, sand and gravel, peat.
Indian River _____	W	--	
Jackson _____	W	W	Stone, sand and gravel.
Lake _____	1,767	2,160	Sand and gravel.
Lee _____	W	3,879	Stone, petroleum, natural gas.
Leon _____	W	W	Sand and gravel.
Levy _____	W	W	Stone.
Manatee _____	--	59	Do.
Marion _____	3,205	4,306	Stone, clays, sand and gravel, phosphate rock.
Monroe _____	W	1,336	Stone.

See footnotes at end of table.

Table 2.—Value of mineral production in Florida, by county [1] [2]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Okaloosa	W	W	Sand and gravel.
Orange	W	W	Peat.
Palm Beach	W	$326	Stone.
Pasco	--	420	Do.
Pinellas	W	W	Stone, sand and gravel.
Polk	$155,238	175,605	Phosphate rock, sand and gravel, stone, peat.
Putnam	1,571	W	Sand and gravel, clays, peat.
St. Lucie	W	W	Sand and gravel.
Santa Rosa	35,625	110,404	Petroleum, natural gas.
Sarasota	W	--	
Sumter	7,135	W	Stone, lime, peat.
Suwannee	W	W	Stone.
Taylor	W	W	Do.
Walton	W	W	Sand and gravel.
Washington	--	W	Do.
Undistributed [3]	r 107,963	133,092	
Total [4]	r 426,632	601,100	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Baker, Columbia, De Soto, Dixie, Duval, Flagler, Glades, Hardee, Highlands, Holmes, Jefferson, Lafayette, Liberty, Madison, Martin, Nassau, Okeechobee, Osceola, St. Johns, Seminole, Union, Volusia, and Wakulla.

[2] Values of petroleum are based on an average price per barrel for the State.

[3] Includes value of counties indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Florida business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total nonagricultural employment ____ thousands __	2,474.6	2,708.2	+9.4
Manufacturing ____ do ____	344.0	372.5	+8.3
Mining ____ do ____	9.1	8.9	−2.2
Contract construction ____ do ____	221.0	265.7	+20.2
Other nonagricultural employment [1] ____ do ____	1,900.5	2,061.1	+8.5
Personal income:			
Total ____ millions __	$31,779	$35,680	+12.3
Per capita	$4,378	$4,647	+6.1
Construction activity:			
Housing units authorized	283,900	277,254	−2.3
Value of nonresidential construction ____ millions __	$1,237.9	$1,421.5	+14.8
Highway construction contract awards ____ do ____	e $210.0	$366.3	+74.4
Farm marketing receipts ____ do ____	$1,590.1	$1,936.9	+21.8
Mineral production value ____ do ____	$426.6	$601.1	+40.9
Export trade ____ do ____	$1,390.4	$1,775.3	+27.7
Import trade ____ do ____	$1,610.1	$1,939.7	+20.5

e Estimate. p Preliminary.

[1] Includes transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; service; and government.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; Highlights of U.S. Export and Import Trade; and U.S. Bureau of Mines.

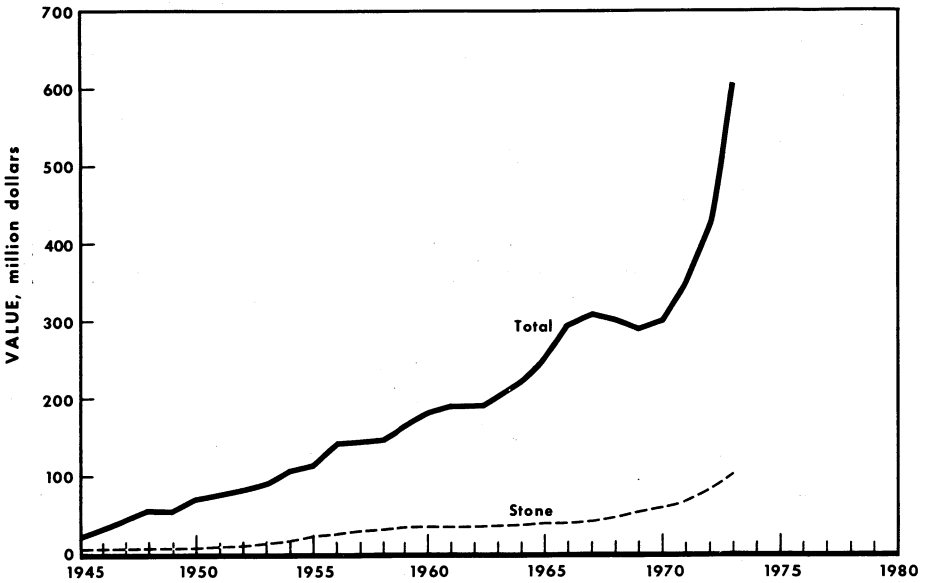

Figure 1.—Value of phosphate rock, stone, and total value of mineral production in Florida.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Nonmetals represented 70%, fuels 28%, and metals 2% of the total value of the State's mineral production in 1973. The principal nonmetals produced were, in decreasing order of value, phosphate rock, stone, cement, sand and gravel, and clays.

Cement.—Although shipments of both portland and masonry cement significantly increased over 1972 levels, 12% and 20% respectively, the supply was insufficient to meet the demand. Portland cement shipments were 2.7 million short tons, and masonry cement shipments were 256,000 short tons. The value of portland and masonry cement shipments was $72.7 million and $8.7 million respectively. The gains in values were 22% for portland cement and 26% for masonry cement compared with values reported in 1972.

The number of cement plants in Florida has remained constant since 1966. The expansion of existing plants has accounted for the annual increases in production. The consumption pattern of portland cement in the State was 66% to ready-mix concrete companies, 8% to building material dealers, 15% to concrete product manufacturers, and 11% for miscellaneous applications.

Maule Industries, Inc., Miami, is expanding its cement mill capacity from 0.43 to 1.2 million tons per year. The new capacity is expected to become available in May 1974. Plans to increase the mill's capacity to 2.1 million tons per year were authorized. The scheduled completion date was the end of 1975.[3]

Florida Mining and Materials Corp., Tampa, announced construction of a 0.56-million-ton-per-year cement plant in Brookville. The plant is scheduled to go on-stream in the fourth quarter of 1975.[4]

Clays.—Total clay production and value increased from 1972 levels by 24% and 33% respectively.

Fuller's earth production increased 19% and its value increased 24% above those of 1972. Florida's fuller's earth production ranked second highest in the Nation. Three mines were operating in Gadsden County, and one operated in Marion County. Full-

[3] Pit & Quarry. Maule To Expand Florida Aggregate Plant Cement Mill. V. 65, No. 10, April 1973, p. 19.
[4] Rock Products. V. 77, No. 3, March 1974, p. 108.

er's earth was used for fillers, absorbers, pesticides, drilling mud, filter aids, and other purposes.

Kaolin production increased 3% and its value increased 7%. Kaolin was produced from one mine in Putnam County. It was principally used for manufacturing china and dinnerware.

Production of common clay used to manufacture cement, lightweight aggregate, and building brick increased 22% in quantity, and 48% in value. Four mines in Citrus, Clay, Escambia, and Gadsden Counties operated in 1973.

Gypsum.—Crude gypsum was imported from mines in Nova Scotia, Canada, and processed into various building products at two plants in Duval County and one plant in Hillsborough County. U.S. Gypsum Co., National Gypsum Co., and Kaiser Cement & Gypsum Corp. calcined crude gypsum in kettles, a rotary kiln, and a Holoflite unit. A total of 642,000 short tons of calcined gypsum was produced, an increase of 8% over 1972 production. The value of the production increased 17% over that of 1972 to $8.2 million.

Kyanite.—E. I. du Pont de Nemours & Co. recovered a small quantity of a kyanite-sillimanite mixture from a beach sand deposit in Clay County. It is a byproduct of a titanium mineral recovery operation. Both producton and value decreased 76% from 1972 levels. The kyanite-sillimanite mixture was sold to refractory manufacturers.

Lime.—Quicklime and lime hydrate were produced by Basic Magnesia, Inc., Gulf County; Chemical Lime, Inc., Hernando County; and Dixie Lime & Stone Co., Sumter County. The total sold or used was 186,769 short tons and was valued at $4 million. Compared with those of 1972, quantity and value increased 3.9% and 14.1% respectively. The lime was consumed in pulp and paper industries, in the recovery of magnesia from seawater, in construction, and in waste neutralization, water treatment, and other chemical processes. Lime consumption exceeded the production in the State.

Magnesia.—Basic Magnesia, Inc., Port St. Joe, Gulf County, produced caustic-calcined magnesia and refractory-grade magnesia from seawater. Production was less than the plant's design capacity of 60,000 short tons per year. Shipments increased 8.5% and the value increased 22.3% compared with 1972 shipments and values.

Perlite.—Four companies produced expanded perlite from ore mined in Colorado and New Mexico. Production increased to 23,378 short tons in 1973 from 19,124 short tons in 1972. The quantity sold or used was 22,613 short tons, an increase of 24% over that of 1972. The value of the quantity sold or used was $1,287,000, an increase of 29% over the comparable value in 1972. Production from plants in Broward, Duval, Escambia, and Indian River Counties was used in plaster aggregate, concrete aggregate, formed products, horticultural aggregate, and miscellaneous filter aids and fillers.

Phosphate Rock.—Because Texasgulf, Inc., was the only phosphate rock producing company in North Carolina and it was necessary to conceal that company's production data, North Carolina and Florida statistics were combined. Combined production was 34.4 million short tons, an increase of 0.9% over that of 1972. The value of the marketable rock increased to $192 million, 10% greater than the 1972 value. Florida and North Carolina produced 81.7% of the total production in the United States.

The quantity of marketable rock sold or used from Florida and North Carolina was similar to that of 1972, 36.9 million short tons; however, its value was $205 million, an increase of 9% over that of 1972. With sales and consumption continuing to exceed production, stocks declined from 10.5 to 8.5 million short tons during the year.

Of the total sold or used, 63% was used to produce fertilizer and 36% was exported. The minor balance was used in industrial applications and as animal feed supplements. The distribution pattern of this fraction was 0.2% for elemental phosphorus and 1.2% for defluorinated rock and other miscellaneous applications.

Most of the 13,173,000 short tons of marketable phosphate rock exported from Florida and North Carolina was from Florida. Exports declined 3% from 1972 levels.

The percent distribution by grade of

marketable rock sold or used from Florida and North Carolina was as follows:

Grade, percent BPL [1]	*Percent distribution*
Less than 60	0.3
60 to 66	9.7
66 to 70	45.9
70 to 72	14.1
72 to 74	18.5
Over 74	11.5

[1] 1.0 BPL (bone phosphate of lime or tricalcium phosphate) = 0.458% P_2O_5.

The average grade of phosphate ore mined was 12.8% P_2O_5 and the average grade of marketable rock was 31.9% P_2O_5. These are less than the reported 1972 average ore grade of 13.9% P_2O_5 and the average marketable rock grade of 32.2% P_2O_5 and reflect the continuing trend in the reduction of matrix grade and the difficulty of maintaining an acceptable product grade. The average weight recovery of concentrate was 27% compared with 29.1% in 1972, and the average P_2O_5 recovery was 67.4%, about the same as reported in 1972. Production capacity of Florida and North Carolina phosphate mines was limited in 1973 to less than 34.5 million short tons of marketable rock. This capacity is considerably less than that estimated in prior years. The new assessment of the industry's capacity recognizes closing of older plants, power interruptions, lower grade ores, and plant breakdowns.

Soft phosphate rock was produced by four companies operating six open pit mines in four Florida counties. Total soft rock sold or used was 22,028 short tons, equivalent to 4,426 short tons P_2O_5 and was valued at $154,828. It was sold for direct application to soil and for animal feed supplements.

Marketable rock was produced from Florida land-pebble phosphate mines by Agrico Chemical Co., Borden, Inc., Brewster Phosphates, Gardinier, Inc., W. R. Grace & Co., International Minerals & Chemical Corp., Mobil Oil Corp., Poseidon Mines, Inc., P.S.A. Enterprises, Occidental Petroleum Corp., U.S.S. Agri-Chemicals, Inc., and Swift Chemical Co.

Agrico Chemical Co., a subsidiary of the Williams Co. of Tulsa, Okla., awarded contracts for an 80-ton-per-hour granular triple superphosphate plant and a 1,800-ton-per-day sulfuric acid complex at South Pierce, Fla. In addition, contracts were awarded for a 200,000-ton-per-year P_2O_5 phosphoric acid plant and a 100-ton-per-hour single-train diammonium phosphate plant at Faustina, La., that will use Florida rock. Plans were advanced to design and construct the Fort Green mine in Polk County to produce 3.5 million short tons per year of marketable phosphate rock.

Beker Industries Corp., Greenwich, Conn., signed options to purchase 8,000 acres of phosphate reserves from PPG Industries, Inc., Pittsburgh, Pa. From these reserves, located in eastern Manatee County, Beker plans to produce 3 million tons per year of marketable phosphate rock to supply fertilizer plants in Illinois and Louisiana.

Conserve, Inc., Nichols, Fla., started operating the modernized fertilizer plant at this location and produced the first monoammonium phosphate in commercial quantities in the United States.

CF Industries completed and dedicated a new phosphate fertilizer terminal on Tampa Bay. The terminal has the capability of handling 500,000 tons per year. Vessels and barges loaded on Tampa Bay can distribute fertilizer to farm cooperatives in the Midwest and Canada. CF Industries is constructing an 800-ton-per-day P_2O_5 wet-process phosphoric acid plant in Plant City, Fla. Completion is scheduled for 1974.

The Cities Service Co. sold its Tampa Agricultural Chemical Operations to Société des Participation Gardinier of Paris, France. The new name will be Gardinier, Inc.–U.S. Phosphoric Products.[5]

W. R. Grace & Co. announced plans to expand its chemical plant at Bartow, Fla., with a 250,000-ton-per-year phosphoric acid plant and a 700,000-ton-per-year sulfuric acid plant. A 60-cubic-yard dragline was ordered for Hooker's Prairie mine, planned for Polk County in 1977.[6]

International Minerals & Chemical Corp. started construction on a 600,000-ton-per-year P_2O_5 fertilizer plant near Bartow, Fla. Mining rights to 20 million tons of Florida phosphate rock reserves were acquired in 1973.[7] The screening plant at the Phosphoria mine is scheduled to start in 1974. Deslimed ore will be pumped 6 miles to the Noralyn recovery plant.

Occidental Petroleum Corp. purchased 24,000 acres of phosphate reserves from

[5] Phos Pholks. V. 9, No. 1, February 1973.
[6] Engineering and Mining Journal. V. 147, No. 5, June 1973.
[7] Industrial Minerals, No. 69, June 1973, p. 41.

Owens-Illinois Corp. and Monsanto Co. Occidental estimated that 23 million short tons of marketable phosphate rock could be recovered from this reserve, located near the Suwannee River phosphate mine and chemical complex.[8] A 45-cubic-yard dragline was assembled and will be used to increase mining capability. The washing plant expansion will increase capacity to 3.5 million short tons per year of marketable phosphate rock. The Suwanee River complex will increase phosphoric acid capacity by 350,000 tons of P_2O_5 per year, and diammonium phosphate capacity will be increased by 350,000 tons per year. A new but unspecified amount of sulfuric acid capacity will be added to furnish sufficient acid for rock digestion.

Sand and Gravel.—Sand and gravel production totaled 20.2 million tons valued at $21.4 million. Production decreased 10% from that of 1972 because of reduced output of fill sand. The value increased 26% over that of 1972. The distribution pattern of sand and gravel in commercial operations was building sand 51%, fill sand 31%, paving sand 11%, and other sand and gravel uses 7%.

Stone.—Crushed limestone and dolomite were produced from 89 quarries in 18 counties in 1973, compared with production from 75 quarries in 16 counties in 1972. Production increased from 53.1 million tons in 1972 to 61.7 million tons in 1973. The value increased correspondingly from $81.6 million to $103.6 million. Dade, Hernando, and Broward Counties, in that order, were the principal producing counties in the State, supplying 71% of the total production and accounting for 72% of the total value. Sixteen companies produced 76% of the total tonnage and generated 77% of the total value. This production was from 37 of the State's 91 operating quarries. Eighty-five percent of the stone was hauled by truck, 12% was moved by rail, and the remaining 3% was unspecified. One company processed oystershells for roadbase material. Of the total crushed limestone and dolomite sold or used by producers, 78% was used for concrete aggregate, dense graded roadbed stone, construction aggregate, and roadstone.

[8] The Tampa Tribune. Aug. 1, 1973.

Table 4.—Florida: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Brevard	1	W	W	1	57	165
Broward	3	760	W	3	1,430	1,455
Dade	6	W	W	5	2,541	3,389
Escambia	8	978	622	5	506	688
Hendry	2	W	W	1	1,529	1,816
Hillsborough	1	W	W	1	263	W
Lake	5	1,852	1,767	4	2,137	2,160
Polk	8	3,760	4,645	8	4,371	5,567
Santa Rosa	1	3	(1)	--	--	--
Undistributed [2]	r 25	r 15,009	r 9,974	23	7,335	6,175
Total [3]	r 60	r 22,363	r 17,009	51	20,167	21,415

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Less than ½ unit.
[2] Includes Bay, Calhoun, Charlotte, Franklin, Gadsden, Indian River (1972), Jackson, Leon, Marion, Okaloosa, Pinellas, Putnam, St. Lucie, Sarasota (1972), Walton, and Washington Counties (1973).
[3] Data may not add to totals shown because of independent rounding.

Table 5.—Florida: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations: Sand:				
Building	r 7,446	r 7,601	10,299	11,522
Paving	r 4,344	r 4,556	2,246	2,758
Fill	W	W	6,183	3,128
Other sand and gravel [1]	r 10,573	r 4,851	1,439	4,007
Total [2]	r 22,363	r 17,009	20,167	21,415

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Other sand and gravel."

[1] Includes glass, blast, engine, filtration, filler (1973), and other sands; building gravel, paving gravel, fill gravel (1973), and railroad ballast (1973).

[2] Data may not add to totals shown because of independent rounding.

Table 6.—Florida: Crushed limestone and dolomite sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value
Alachua	4	2,166	1,741	4	2,438	1,971
Brevard	1	185	192	1	196	227
Broward	19	9,278	14,613	17	10,271	18,891
Citrus	4	W	1,039	5	1,072	1,593
Collier	4	1,766	W	9	2,705	5,473
Dade	15	21,100	26,752	19	23,185	33,478
Hernando	5	8,617	17,186	5	10,399	21,853
Levy	3	415	W	3	304	W
Marion	5	1,099	2,486	6	1,543	3,032
Monroe	1	W	W	1	625	1,336
Palm Beach	3	W	W	3	313	326
Pasco	--	--	--	1	300	420
Polk	--	--	--	1	127	145
Sumter	3	4,693	W	4	5,274	W
Undistributed [1]	8	3,773	17,611	10	2,982	14,792
Total [2]	75	53,093	81,621	89	61,734	103,536

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Jackson, Lee, Suwannee and Taylor Counties.

[2] Data may not add to totals shown because of independent rounding.

Table 7.—Florida: Crushed limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	3,843	6,488	2,671	4,424
Concrete aggregate	16,573	28,042	20,067	40,176
Dense graded roadbase stone	17,270	24,678	22,930	34,139
Macadam aggregate	348	492	1,446	2,612
Surface treatment aggregate	W	W	828	1,392
Unspecified construction aggregate and roadstone	4,324	4,249	5,399	4,877
Agricultural purposes [1]	1,034	4,273	1,425	4,326
Cement manufacture	W	W	1,775	2,271
Fill	3,029	3,219	1,020	1,476
Manufactured fine aggregate (stone sand)	2,335	3,100	2,210	3,297
Railroad ballast	361	633	295	566
Other uses [2]	3,977	6,448	1,668	3,980
Total [3]	53,093	81,621	61,734	103,536

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Data include agricultural limestone and stone used in poultry grit and mineral food.

[2] Data include stone used in other fillers, lime manufacture, rip rap and jetty stone and uses not specified. 1973 data also include stone used in drain fields.

[3] Data may not add to totals shown because of independent rounding.

Staurolite.—This complex iron and aluminum silicate mineral was recovered as a byproduct from the heavy minerals separation plants of E. I. du Pont de Nemours & Co. at its Highland and Trail Ridge plants. Florida was the only State that produced commercial quantities of staurolite. It was principally used in sand blasting equipment. Production increased 22% and its value increased 37%, compared with respective production and value in 1972.

Sulfur.—Recovered sulfur from oil and natural gas production in Escambia and Santa Rosa Counties increased from 87,842 long tons in 1972 to 224,416 long tons in 1973. Sulfur sales increased from 85,915 long tons in 1972 to 225,407 long tons with a reported value of $3.5 million. As oil and gas production increase, byproduct sulfur is expected to proportionately increase in Florida.

Vermiculite.—Exfoliated vermiculite was produced at four plants in Broward, Duval, and Hillsborough Counties. Production, the quantity sold or used, and the value of sales increased over those of 1972 by 28%, 68%, and 72% respectively.

METALS

Ferroalloys.—Two companies produced ferrophosphorus as a coproduct with elemental phosphorus from electric furnace smelting of phosphate rock in Florida. The value of ferroalloys is not included in the State mineral production statistics.

Rare Earth Minerals.—Production of monazite concentrate from the Green Cove Springs plant of Titanium Enterprises increased 330% over that of 1972. The value increased 336%. The monazite concentrate contains rare-earth metals and thorium oxide. Production and value cannot be published.

Titanium Concentrates.—Both E. I. du Pont de Nemours & Co. and Titanium Enterprises produced ilmenite concentrate from plants in Clay County. Shipments declined 2% and value increased 2% over that of 1972. Titanium Enterprises increased the production and value of rutile 151% and 145% respectively, compared with 1972 levels, from the Green Cove Springs mine in Clay County.

Zircon Concentrates.—Production of zircon concentrates from the E. I. du Pont de Nemours & Co. Trail Ridge plant, and Titanium Enterprises Green Cove Springs mine in Clay County increased 29% over that of 1972. The value was 37% higher than that reported in 1972. The zirconium sands were used in ferrous foundries, refractory shapes, and ceramics.

MINERAL FUELS

Mineral fuels produced were natural gas, natural gas liquids, crude petroleum, and peat.

Natural Gas.—Total net sales of natural gas in Florida in 1973 was about 27 billion cubic feet. The difference between the total net sales volume and the 34 billion cubic feet measured at the wellhead was a 12.3% H_2S, CO_2, and N_2 content, plus plant losses and inplant consumption for combustion purposes. All of the gas sold was from the Jay field, except a small quantity that was produced from the nearby Mt. Carmel field. The Florida Gas Transmission Pipeline Co. marketed over 90% of the sales volume for intrastate consumption. The remainder was sold through Five Flags Pipeline Co. to industrial customers in the Pensacola area.

Prior to distribution by the Florida Gas Transmission Pipeline Co., the gas was stripped of natural gas liquids at its processing plant in north-central Florida. The Btu value of the gas was reduced from 1,450 to 1,040 Btu per cubic foot before distribution through the intrastate pipeline.

Peat.—Peat production decreased from 45,000 short tons valued at $362,000 in 1972 to 43,800 short tons valued at $384,000 in 1973. The 3% decrease in production was accompanied by a 6% increase in value. Eight companies produced moss, reed-sedge, and humus peat. Shipments totaled 44,000 short tons and consisted of 38% moss, 20% reed-sedge, and 42% humus peat. All but a few tons were shipped in bulk and used to pack flowers, plants, and shrubs; for general soil improvement and potting soils; and for earthworm culture.

Petroleum.—Total oil production in Florida was nearly 33 million barrels in 1973. This was almost double the 17 million barrels produced in 1972. The increase was primarily attributed to further development of the Jay field. The Jay field yielded 85.3% of the total crude oil production in the State. The wellhead value of northwest Florida high-grade crude ranged from $3.64 per barrel in January 1973 to $10.06 per barrel in December 1973. The yearly

average value was approximately $5.88 per barrel. Northwest Florida's oil production was primarily derived from the Smackover Limestone Formation. Additional production from the Blackjack Creek field, some 10 miles from Jay, is scheduled. A 12,000-barrel-per-day facility was being readied to be operational by the end of 1974. The field life was estimated to be 20 years.

Crude petroleum production from south Florida was derived entirely from the Lower Cretaceous Sunniland Limestone Formation. The average depth of a development well in the Sunniland trend is about 11,500 feet. There are 66 producing wells in 7 fields in this trend. A new field in Hendry County, not named, was brought in by Weiner Oil Properties in November 1973. No other discoveries were made in 1973.

Approximately 4.6 million barrels of crude oil ranging from 25 to 32 API gravity, representing 14% of Florida's total production, was produced from south Florida's fields. Wellhead prices ranged from $2.58 per barrel in January to over $8 per barrel in December 1973 for new oil.

Table 8.—Florida: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Bay	--	--	--	--	--	1	1	12,313
Charlotte	--	--	--	--	--	1	1	11,500
Collier	--	--	--	1	--	7	8	96,071
Columbia	--	--	--	--	--	2	2	6,086
De Soto	--	--	--	--	--	1	1	13,000
Escambia	4	--	--	--	--	1	5	80,835
Gulf	--	--	--	--	--	1	1	14,297
Hendry	3	--	1	--	--	2	6	69,703
Lake	--	--	--	--	--	1	1	5,778
Lee	--	--	3	--	--	3	6	53,286
Pasco	--	--	--	--	--	1	1	9,600
Santa Rosa	14	--	5	2	--	9	30	485,259
Union	--	--	--	--	--	3	3	9,111
Washington	--	--	--	--	--	1	1	11,593
Total	21	--	9	3	--	34	67	878,432

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 9.—Principal producers

Commodity and company	Address	Type of activity	County
Cement, portland and masonry:			
General Portland, Inc., Florida Division.	4400 Republic National Bank Tower Box 324 Dallas, Tex. 75221	2 plants	Dade and Hillsborough.
Lehigh Portland Cement Co	718 Hamilton St. Allentown, Pa. 18105	Plant	Dade.
Pennsuco Cement & Aggregates, a subsidiary of Maule Industries, Inc.	P.O. Box 2035 P V S Hialeah, Fla. 33012	do	Do.
Clays:			
Fuller's earth:			
Engelhard Minerals & Chemicals Corp.	Menlo Park Edison, N. J. 08817	Open pit mines	Gadsden.
Floridin Co	Box 187 Berkley Springs, W. Va. 25411	Open pit mine	Do.
Mid-Florida Mining	Box 68-F Lowell, Fla. 32663	do	Marion.
Kaolin:			
Edgar Plastic Kaolin Co	Edgar, Fla. 32049	do	Putnam.
Miscellaneous:			
Appalachee Correctional Institute.	Box 699 Sneads, Fla. 32460	do	Gadsden.
Bickerstaff Clay Products Co., Inc.	Box 1178 Columbus, Ga. 31902	Open pit mine and plant.	Escambia.
Florida Solite Co	P.O. Box 27211 Richmond, Va. 23261	Open pit mine and plant.	Clay.

Table 9.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clays—Continued			
Miscellaneous—Continued			
General Portland Cement Co.	Box 22348 Tampa, Fla. 33622	Open pit mine	Citrus.
Gypsum, calcined:			
Kaiser Cement & Gypsum Corp	300 Lakeside Dr. Oakland, Calif. 94612	Plant	Duval.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Hillsborough.
U.S. Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	do	Duval.
Lime: Primary:			
Basic Magnesia, Inc	Box 160 Port St. Joe, Fla. 32456	do	Gulf.
Chemical Lime, Inc	Box 250 Ocala, Fla. 32670	do	Hernando.
Dixie Lime & Stone Co	Drawer 217 Ocala, Fla. 32670	do	Sumter.
Magnesium compounds:			
Basic Magnesia, Inc	Box 160 Port St. Joe, Fla. 32456	do	Gulf.
Peat:			
Oxford Peat Co	Box 154 Oxford, Fla. 32684	Bog	Sumter.
Peace River Peat, Inc	P.O. Box 1192 Bartow, Fla. 33830	Bog	Polk.
F. E. Stearns Peat	Rt. 1 Box 347–I Valrico, Fla. 33594	Bog	Hillsborough.
Traxler Peat Co	Box 10 Florahome, Fla. 32635	Bog	Putnam.
Raymond Johnson	Box 555 Zellwood, Fla. 32798	Bog	Orange.
Perlite, expanded:			
Airlite Processing Corp. of Florida.	Rt. 2 Box 740 Vero Beach, Fla. 32960	Plant	Indian River.
Armstrong Cork Co	Box 1991 Pensacola, Fla. 32589	do	Escambia.
Chemrock Corp	End of Osage St. Nashville, Tenn. 37208	do	Duval.
W. R. Grace & Co	62 Whittemore Ave. Cambridge, Mass. 02140	do	Broward.
Petroleum:			
Exxon Co., U.S.A	Box 2024 Houston, Tex. 77001	Jay field	Santa Rosa.
Sun Oil Company	Box 2880 Dallas, Tex. 75221	Sunoco-Felda field.	Collier and Hendry.
Refinery: Seminole Asphalt Refining, Inc.	Box 128 St. Marks, Fla. 32355	Plant	Wakulla.
Phosphate rock:			
Land pebble:			
Agrico Chemical Co	Box 3166 Tulsa, Okla. 74101	3 open pit mines	Polk.
Borden, Inc	Box 790 Plant City, Fla. 33566	Open pit mine	Do.
Brewster Phosphates	Wayne, N.J. 07470	do	Do.
Gardinier, Inc	Box 3269 Tampa, Fla. 33601	do	Do.
W.R. Grace & Co	Box 471 Bartow, Fla. 33830	do	Do.
International Minerals & Chemical Corp.	Box 867 Bartow, Fla. 33830	3 open pit mines	Do.
Mobil Oil Corp., Chemical Div.	Box 311 Nichols, Fla. 33863	2 open pit mines	Do.
Occidental Petroleum Corp., Suwannee River Phosphate Div.	White Springs, Fla. 32096	Open pit mine	Hamilton.
Swift Chemical Co	Box 208 Bartow, Fla. 33830	2 open pit mines	Polk.
U.S.S. Agri-Chemicals, Inc	Box 867 Ft. Meade, Fla. 33841	Open pit mine	Do.
Phosphorus, elemental:			
Mobil Chemical Co	Box 311 Nichols, Fla. 33863	Electric furnace	Do.

Table 9.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel:			
General Development Corp	1111 South Bayshore Dr. Miami, Fla. 33131	3 open pit mines	Brevard, Charlotte, St. Lucie.
E. R. Jahana Industries, Inc	First & East Tillman Lake Wales, Fla. 33853	Open pit mine	Lake and Polk.
Ortona Sand Co	do	Dredge	Hendry.
Seminole Rock Products, Inc	8100 NW. 74th St. Miami, Fla. 33166	do	Dade.
Standard Sand & Silica Co	Box 35 Davenport, Fla. 33837	Open pit mine	Polk.
Staurolite: E. I. du Pont de Nemours & Co.	Du Pont Bldg., D–10084 Wilmington, Del. 19898	Plant	Clay.
Stone:			
Limestone, crushed:			
Florida Crushed Stone Co	P.O. Box 668 Ocala, Fla. 32670	2 quarries	Hernando.
Florida Mining and Materials Corp., Div. of Miami Stone Co.	Box 59351 Miami, Fla. 33159	Quarry	Dade.
Florida Rock Industries Inc.	Box 4667 Jacksonville, Fla.32201	6 quarries	Collier, Hernando, Lee, Sumter, Suwannee.
Maule Industries, Inc	Box 2601 Hialeah, Fla. 33012	2 quarries	Broward and Dade.
Sterling Crushed Stone Co	Box 630877 OJUS Branch Miami, Fla. 33163	do	Dade.
Oystershell:			
Bay Dredging & Construction Co.	Box 1484 Tampa, Fla. 33601	Dredge	Hillsborough.
Benton & Company, Inc	Box 1347 St. Petersburg, Fla. 33731	do	Pinellas.
Houdaille-Duval-Wright Co	Box 1588 Jacksonville, Fla. 32201	do	Duval.
Radcliff Materials, Inc	Box 1288 Mobile, Ala. 36601	do	Walton.
Titanium concentrates:			
E. I. du Pont de Nemours & Co	Du Pont Bldg. D–10084 Wilmington, Del. 19898	2 dredges and plants.	Clay.
Titanium Enterprises	Box 1036 Greencove Springs, Fla. 32043	Mine and plant	Do.
Vermiculite, exfoliated:			
W. R. Grace & Company	62 Whittemore Ave. Cambridge, Mass. 02140	3 plants	Broward, Duval, Hillsborough.
Zircon concentrates:			
E. I. du Pont de Nemours & Co	Du Pont Bldg. D–10084 Wilmington, Del. 19898	Mine and plant	Clay.
Titanium Enterprises	Box 1036 Greencove Springs, Fla. 32043	do	Do.

The Mineral Industry of Georgia

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Georgia Department of Natural Resources, Earth and Water Division, under a cooperative agreement for collecting information on all minerals except fuels.

By J. Robert Wells [1] and Sam M. Pickering, Jr.[2]

Without exception since 1953, the value of minerals produced in Georgia has risen in each successive year. Total value of the State's 1973 mineral production approached one-third of a billion dollars, 18% above the corresponding figure for 1972 and six-fold greater than that of two decades ago.

Energy problems were a frequent source of concern in Georgia throughout 1973. Natural gas service to about 10 major consumers on interruptible schedules was restricted in February, and some deliveries of diesel fuel were suspended at the same time. The State's mineral industries, although threatened by potential shortages and sometimes obliged to observe tight rationing of fuel supplies, especially in the early part of the year, were not forced to curtail operations significantly on that account. A number of mineral producers reported plans, however, to construct or lease supplementary storage tanks for fuel oil to hold reserves sufficient for several weeks of operation if and when normal supplies might be delayed.

It was announced in September that the State Geologist had established a South Georgia Section of the Earth and Water Division, Georgia Department of Natural Resources. The new field offices, located in Albany, Dougherty County, and Brunswick, Glynn County, are expected to enable the Division to expedite mapping, geological studies, and water resources work in the State's southern areas.

[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.
[2] State Geologist and Director, Earth and Water Division, Georgia Department of Natural Resources.

Table 1.—Mineral production in Georgia [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Cement:				
Masonry ---------- thousand short tons	68	$1,569	67	$2,126
Portland ---------- do	1,260	27,286	1,201	28,124
Clays [2] ---------- do	6,227	132,322	7,721	160,419
Feldspar ---------- short tons	W	W	51,523	W
Peat ---------- thousand short tons	W	W	(3)	4
Sand and gravel ---------- do	3,816	4,729	4,976	6,781
Stone ---------- do	37,074	82,484	40,841	97,506
Talc ---------- short tons	45,842	338	38,000	114
Value of items that cannot be disclosed: Barite, bauxite, fire clay, iron ore, kyanite, mica (scrap), rare-earth metal concentrates, titanium concentrates, zircon, and values indicated by symbol W ----------	XX	r 9,589	XX	10,405
Total ----------	XX	r 258,317	XX	305,479
Total 1967 constant dollars ----------	XX	213,137	XX	p 224,283

p Preliminary. r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes fire clay; included with "Value of items that cannot be disclosed."
[3] Less than ½ unit.

Table 2.—Value of mineral production in Georgia, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Bacon	--	W	Sand and gravel.
Baldwin	--	W	Do.
Banks	--	$460	Stone.
Bartow	r $4,021	4,873	Barite, stone, iron ore pigments, sand and gravel, clays.
Bibb	1,310	2,393	Clays, sand and gravel.
Charlton	W	W	Titanium, zircon, rare-earth metals.
Chatham	W	W	Sand and gravel.
Cherokee	W	W	Mica.
Clarke	1,088	1,400	Stone.
Clayton	W	W	Do.
Cobb	W	W	Do.
Coffee	--	W	Sand and gravel.
Columbia	3	W	Clays.
Cook	W	W	Sand and gravel.
Coweta	--	391	Stone.
Crawford	W	W	Sand and gravel.
Dawson	W	W	Stone.
Decatur	W	W	Clays, sand and gravel.
De Kalb	6,401	W	Stone, sand and gravel.
Dougherty	W	W	Sand and gravel.
Douglas	W	W	Stone.
Early	W	W	Do.
Effingham	W	W	Sand and gravel.
Elbert	W	W	Stone, sand and gravel.
Evans	W	W	Sand and gravel.
Fannin	--	W	Stone.
Fayette	1,534	1,492	Do.
Floyd	2,694	W	Stone, clays.
Forsyth	W	2,313	Stone.
Fulton	19,892	20,818	Cement, stone, clays, sand and gravel.
Gilmer	1,145	5,615	Stone.
Greene	W	W	Stone, sand and gravel.
Gwinnett	W	W	Stone.
Habersham	--	W	Do.
Hall	W	W	Do.
Hancock	W	W	Stone, clays.
Hart	W	W	Mica.
Houston	W	12,768	Cement, stone, clays.
Jasper	W	W	Feldspar, stone.
Jefferson	1,134	W	Clays.
Jones	W	W	Stone.
Lee	W	147	Sand and gravel.
Lincoln	W	W	Kyanite.
Long	W	W	Sand and gravel.
Lowndes	W	--	
Lumpkin	--	W	Stone.
McDuffie	W	25	Sand and gravel.
Madison	W	W	Stone.
Miller	W	4	Peat.
Mitchell	W	W	Stone.
Monroe	W	W	Do.
Montgomery	W	W	Sand and gravel.
Murray	371	114	Talc.
Muscogee	3,316	W	Stone, sand and gravel, clays.
Oglethorpe	1,075	1,368	Stone.
Paulding	--	51	Do.
Pickens	W	W	Do.
Pike	W	W	Sand and gravel.
Polk	8,355	8,619	Cement, stone, clays.
Quitman	W	W	Iron ore.
Rabun	W	W	Stone.
Richmond	5,803	7,367	Stone, clays, sand and gravel.
Spaulding	--	W	Stone.
Stevens	W	537	Do.
Stewart	W	W	Iron ore.
Sumter	5,693	W	Clays, bauxite.
Talbot	W	W	Sand and gravel.
Thomas	4,209	4,902	Clays, sand and gravel.
Troup	W	W	Stone.
Twiggs	44,386	51,346	Clays.
Union	W	W	Stone.
Upson	--	W	Sand and gravel.
Walker	W	W	Stone, clays.
Walton	--	264	Stone.
Ware	W	W	Sand and gravel.
Warren	9,159	11,281	Clays, stone.
Washington	44,198	49,723	Clays.
Wheeler	--	W	Sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Georgia, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Whitfield	$2,100	W	Stone.
Wilkinson	17,970	$21,313	Clays.
Undistributed [2]	72,460	95,894	
Total [3]	r 258,317	305,479	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Appling, Atkinson, Baker, Barrow, Ben Hill, Berrien, Bleckley, Brantley, Brooks, Bryan, Bullock, Burke, Butts, Calhoun, Camden, Candler, Carroll, Catoosa, Chattahoochee, Chattooga, Clay, Clinch, Colquitt, Crisp, Dade, Dodge, Dooly, Echols, Emanuel, Franklin, Glascock, Glynn, Gordon, Grady, Haralson, Harris, Heard, Henry, Irwin, Jackson, Jeff Davis, Jenkins, Johnson, Lamar, Lanier, Laurens, Liberty, McIntosh, Macon, Marion, Meriwether, Morgan, Newton, Oconee, Peach, Pierce, Pulaski, Putnam, Randolph, Rockdale, Schley, Screven, Seminole, Taliaferro, Tattnall, Taylor, Telfair, Terrell, Tift, Toombs, Towns, Treutlen, Turner, Wayne, Webster, White, Wilcox, Wilkes, and Worth.

[2] Includes values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Georgia business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total work force available ——— thousands	2,013	2,070	+2.8
Total unemployed ——— do	83	81	−2.4
Employment:			
Manufacturing ——— do	478.5	494.3	+3.3
Transportation and public utilities ——— do	111.2	117.3	+5.5
Mining ——— do	7.0	7.2	+2.9
Contract construction ——— do	101.5	108.4	+6.8
Services ——— do	224.9	239.7	+6.6
Government ——— do	320.9	330.7	+3.1
Wholesale and retail trade ——— do	373.7	392.6	+5.1
Finance, insurance, and real estate ——— do	87.4	92.4	+5.7
Personal income:			
Total ——— millions	$18,451	$20,307	+10.1
Per capita	$3,909	$4,243	+8.5
Construction activity:			
Number of private and public residential units authorized	65,523	46,303	−29.3
Value of authorized nonresidential construction millions	$426.6	$559.9	+31.2
Cement shipments to and within Georgia:			
Portland ——— thousand short tons	2,506	2,421	−3.3
Masonry ——— do	243	242	--
Farm marketing receipts ——— millions	$1,449.7	$2,041.7	+40.8
Mineral production value ——— do	$258.3	$305.5	+18.3
Export trade ——— do	$413.4	$590.4	+42.8
Import trade ——— do	$464.5	$583.8	+25.7

p Preliminary.

Source: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Highlights of U.S. Export and Import Trade; and U.S. Bureau of Mines.

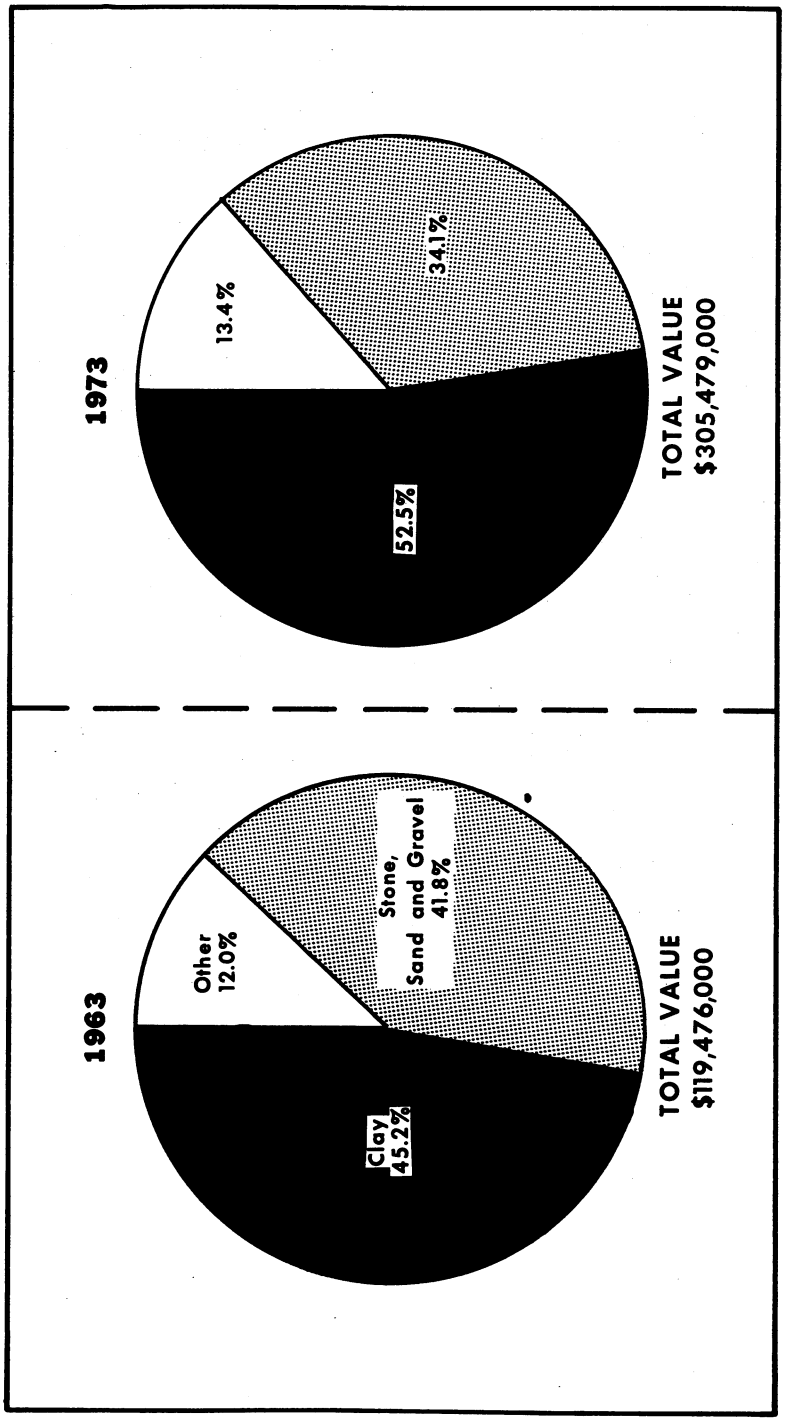

Figure 1.—Value of clays, and total value of mineral production in Georgia.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—New Riverside Ochre Co. produced barite in 1973 from an open pit mine in Bartow County, and Paga Mining Co. recovered the mineral by reprocessing tailings that were accumulated during previous operations in the same county. Total output was less in tonnage but more in value than in 1972. The mineral was ground for use as a raw material in the manufacture of barium chemicals, a filler or extender for rubber products and paints, an ingredient in glass furnace feeds, a weighting agent in oil-well drilling muds, and a component in heavy-aggregate concrete.

Cement.—Cement was manufactured in Georgia by three companies in 1973. Marquette Cement Manufacturing Co. produced dry-process portland cement at Rockmart, Polk County; Martin-Marietta Corp.'s division, Southern Cement Co., operated a dry-process plant producing both portland and masonry cements at Atlanta, Fulton County; and Medusa Cement Co., a division of Medusa Corp., produced both portland and masonry cements in a wet-process plant at Clinchfield, Houston County. Shipments of portland cement from State producers in 1973 were 5% less in tonnage and 3% more in total value than in 1972; masonry cement shipments were down 1% in volume but up 36% in value. Consumption of cement in Georgia totaled 2,663,000 tons, 3% below the comparable figure for 1972.

Clays.—Clays in four classifications—kaolin, fuller's earth, common clay and shale, and fire clay—were produced in Georgia in 1973 in amounts more than sufficient to retain the State's established distinction of leading the nation in both tonnage and value of clays produced. Marked increases affecting all except fire clay raised the total output of clays to a level almost one-fourth higher than that reached in 1972.

Georgia kaolin, consistently topping the list of the State's money-earning minerals, was produced in greater quantities in 1973 than ever before. Total output was 14% greater than in 1972 and exceeded the 4-million-ton-per-year mark for the first time in history. Kaolin was produced in 1973 in eight of Georgia's counties, seven of them in a diagonal belt across the State's mid-section. American Industrial Clay Co. (Warren and Washington Counties), Engelhard Minerals & Chemicals Corp. (Washington and Wilkinson Counties), Freeport Kaolin Co. (Twiggs County), Georgia Kaolin Co. (Twiggs County), J. M. Huber Corp. (Twiggs and Warren Counties), and Thiele Kaolin Co. (Warren and Washington Counties) jointly accounted for 71% of the total quantity (81% of the total value), and the remainder was made up by 14 smaller producers. The principal end uses served by Georgia kaolin in 1973, together accounting for approximately nine-tenths of the total tonnage, were papermaking (coating and filling), ceramics (grog, sanitary ware, pottery, whiteware, glass, glazes, etc.), filler for rubber and plastics, chemical manufacturing, refractories and cements, and paints.

Georgia's kaolin (sometimes referred to with respect as "the multi-million-dollar mud") was the subject of a magazine review,[3] and its geological genesis was discussed by a participant in an international conference.[4] In regard to this valuable and versatile clay, officials of J. M. Huber Corp. stated that a 12-year international search for the most favorable location for a kaolin industry had ended right where it started—along the Fall Line of central Georgia. Nowhere else in the world were deposits found that could compare in either extent or quality with those in Georgia's kaolin belt.

The excellent worldwide reputation enjoyed by the State's kaolin and other ceramic raw materials was further attested to by announcements in February and May 1973 that two Japanese firms plan to locate ceramic fabrication plants in Georgia. Murata Manufacturing Co. will construct a plant at Cartersville, Bartow County, to produce specialty articles of electrical porcelain, and Noritake Co., Ltd., will manufacture chinaware at Port Wentworth on the Savannah River in Chatham County.

Perhaps indicative of a bright future for the State's immense resources of kaolinitic clays hitherto rated as submarginal was the launching by the Federal Bureau of Mines of a new and comprehensive research pro-

[3] Murray, H. H. Kaolin: Annual Review '73. Min. Eng., v. 26, No. 2, February 1974, p. 112.
[4] Hower, W. F. Clay Minerals Conference. Geotimes, v. 18, No. 3, March 1973, pp. 22–23 (discussion of paper presented by R. S. Austin).

gram on the extraction of alumina suitable for aluminum smelter potline feed from nonbauxitic sources. The first lot of starting material for this study consisted of 30 tons of east Georgia kaolin.

A suggestion that Georgia's kaolin deposits may still offer a public service even after they are mined out was contained in a proposal sponsored by the Southern Railway Co. According to this proposition, empty kaolin pits in Twiggs County would become disposal sites for shredded and compacted municipal refuse shipped by rail from Atlanta. The sponsoring organization gave assurances that thorough precautions would be taken to prevent any possible water pollution or other environmental damage.

Table 4.—Georgia: Kaolin sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Sumter	4	W	W	7	394	12,192
Twiggs	6	1,301	44,175	26	1,424	51,346
Warren	2	149	5,998	W	W	W
Washington	17	1,490	44,198	26	1,605	49,723
Wilkinson	5	632	17,970	5	697	21,313
Other counties [1]	5	395	8,156	7	390	10,152
Total [2]	39	3,966	120,496	71	4,510	144,726

W Withheld to avoid disclosure of individual company confidential data.
[1] Includes Fulton (1973), Houston (1973), McDuffie (1972), and Richmond Counties, and data indicated by symbol W.
[2] Data may not add to totals shown because of independent rounding.

Table 5.—Georgia: Kaolin sold or used by producers, by kind

Kind	1972		1973	
	Quantity (short tons)	Value	Quantity (short tons)	Value
Airfloat	788,023	$10,317,785	839,625	$11,629,755
Calcined	132,895	10,196,168	146,425	11,934,459
Delaminated	186,230	8,574,354	194,180	10,193,638
Unprocessed	217,527	4,832,833	421,905	10,981,783
Waterwashed	2,641,768	86,574,679	2,908,128	99,986,424
Total	3,966,443	120,495,819	4,510,263	144,726,059

Table 6.—Georgia: Kaolin sold or used by producers, by use
(Short tons)

Use	1972	1973
Domestic:		
Paper coating	1,433,916	1,610,911
Paper filling	757,687	813,044
Sanitary ware	111,318	160,865
Fiberglass	130,625	134,604
Chemicals	28,795	131,942
Rubber	143,395	112,827
Paint	127,460	111,302
Firebrick, block and shapes	92,897	79,652
Plastics	66,844	61,889
Adhesives	54,012	44,218
Whiteware	51,278	31,290
Floor and wall tile, ceramic	18,385	21,485
Other	265,697	402,762
Exports	684,134	793,472
Total	3,966,443	4,510,263

Table 7.—Georgia: Kaolin sold or used by producers, by kind and use
(Short tons)

Use	1972				1973			
	Air-float	Unprocessed	Water-washed [1]	Total	Air-float	Unprocessed	Water-washed [1]	Total
Domestic:								
Adhesives	W	--	W	54,012	W	--	W	44,218
Alum (aluminum sulfate) and other chemicals	--	(2)	(2)	(2)	--	W	W	131,942
Animal feed	(2)	--	--	(2)	117	--	--	117
Brick, face	--	13,250	--	13,250	565	--	--	565
Catalysts (oil refining)	(2)	--	(2)	(2)	W	--	W	43,699
China/dinnerware	(2)	--	--	(2)	W	--	W	18,084
Crockery and other earthenware	19,995	--	--	19,995	3,556	--	--	3,556
Fiberglass	W	--	W	130,625	W	--	W	134,604
Firebrick, block, shapes	73,509	19,388	--	92,897	32,400	47,252	--	79,652
Floor and wall tile, ceramic	18,385	--	--	18,385	W	--	W	21,485
Grogs and crudes, refractory	(2)	(2)	--	(2)	W	W	--	153,179
Gypsum products	--	--	(2)	(2)	W	--	W	52,023
Paint	W	--	W	127,460	11,982	--	99,320	111,302
Paper coating	16,100	--	1,417,816	1,433,916	71,502	--	1,539,409	1,610,911
Paper filling	256,903	--	500,784	757,687	182,570	--	630,474	813,044
Plastics	W	--	W	66,844	W	--	W	61,889
Pottery	W	--	W	10,765	W	--	W	9,650
Roofing granules	(2)	--	--	(2)	W	--	W	306
Rubber	122,553	--	20,842	143,395	95,208	--	17,619	112,827
Sanitary ware	W	--	W	111,318	119,920	--	40,945	160,865
Miscellaneous:								
Animal feed; caulking, putty, sealers; linoleum; pesticides, related products	5,520	--	--	5,520	--	--	--	--
Catalysts (oil refining); foundry sand; unknown uses	15,763	--	--	15,763	--	--	--	--
China/dinnerware; glazes, glass, enamels; roofing tile	21,012	--	--	21,012	--	--	--	--
Electrical porcelain; refractory grogs and crudes; roofing granules	53,381	--	--	53,381	--	--	--	--
Electrical porcelain; glazes, glass, enamels; high alumina refractories; linoleum; pesticides, related products; unknown uses	--	--	--	--	67,279	--	--	67,279
Aluminum sulfate; flue linings; refractory grogs and crudes; unknown uses	--	126,162	--	126,162	--	--	--	--
Flue linings, portland cement	--	--	--	--	--	39,481	--	39,481
Catalysts (oil refining); chemical manufacturing; aluminum sulfate	--	--	41,842	41,842	--	--	--	--
Face brick; gypsum products; refractory mortar, cement	--	--	433	433	--	--	--	--
Fertilizers; ink; textiles	--	--	15,566	15,566	--	--	--	--
Medical, pharmaceutical, cosmetic; foundry sand; ceramic tile; unknown uses	--	--	22,081	22,081	--	--	--	--
Fertilizers; mineral oil filtering, clarifying, decolorizing; ink; medical, pharmaceutical, cosmetic; foundry sand; refractory mortar, cement; textiles; unknown uses	--	--	--	--	--	--	46,113	46,113
Undistributed	171,993	--	329,031	(3)	241,062	251,085	178,932	(3)
Total	775,114	158,800	2,348,395	3,282,309	826,161	337,818	2,552,812	3,716,791

See footnotes at end of table.

Table 7.—Georgia: Kaolin sold or used by producers, by kind and use—Continued
(Short tons)

Use	1972				1973			
	Air-float	Unprocessed	Water-washed [1]	Total	Air-float	Unprocessed	Water-washed [1]	Total
Exports:								
Paint	--	--	23,395	23,395	--	--	18,916	18,916
Paper coating	--	--	361,431	361,431	8,464	--	471,495	479,959
Paper filling	1,834	--	181,632	183,466	--	--	35,085	35,085
Refractories	10,000	58,727	33	68,760	5,000	84,087	--	89,087
Rubber	1,075	--	3,109	4,184	--	--	3,681	3,681
Other	--	--	42,898	42,898	--	--	166,744	166,744
Total	12,909	58,727	612,498	684,134	13,464	84,087	695,921	793,472
Grand total	788,023	217,527	2,960,893	3,966,443	839,625	421,905	3,248,733	4,510,263

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes calcined and delaminated.
[2] Included in "Miscellaneous" uses.
[3] "Undistributed" total included with total for each specific use.

Production of fuller's earth in Georgia established a new record high in 1973, a total of 444,326 tons valued at $10.5 million, up 10% in quantity and 16% in value from the respective 1972 figures and three to four times greater than those of a decade ago. This type of clay, most of which was used for absorbent purposes (as pet litter or to soak up oil and grease spills), was mined in Decatur County by Engelhard Minerals & Chemical Corp. and Milwhite Co., Inc.; in Jefferson County by Georgia-Tennessee Mining & Chemical Co.; and in Thomas County by Oil-Dri Corp. of Georgia, Thor Mining Co. Div. of Pennsylvania Glass Sand Co., and Waverly Mineral Products Co.

Among the four classifications of Georgia clays produced in 1973, the most notable increase was scored by common clay and shale, 49% more in tonnage and 87% more in total value than in 1972. The largest outlet for this type of material is brickmaking, and a large part of the upsurge was attributable to the continuing expansions and new installations taking place at the Atlanta facility of Bickerstaff Clay Products Co., Inc.[5] Also used in the manufacture of sewer pipe and portland cement, common clay was produced by 14 firms from pits in 10 counties, mostly in the northern half of the State. The outputs of Bickerstaff Clay Products Co. (Floyd and Muscogee Counties), Burns Brick Co. (Bibb County), Chattahoochee Brick & Tile Co. (Floyd, Fulton, and Polk Counties), Cherokee Brick Co. (Bibb County), Georgia-Carolina Brick & Tile Co. (Richmond County), and Merry Companies, Inc. (Richmond County), when added together, amounted to a little over four-fifths of the State total.

The 1973 output of fire clay was solely by Georgia Vitrified Brick Co. from operations in adjoining Columbia and Richmond Counties and was used in the manufacture of firebrick and flue lining. Production was lower in both quantity and value than in 1972, and close in both respects to the level of 1971.

Feldspar.—The Feldspar Corp. produced flotation-concentrate feldspar from ore mined from pegmatite bodies in Jasper County and ground the product for use in the manufacture of glass and ceramics. The ground feldspar produced, only slightly more in quantity than the output of 1972 but sharply higher in total value, was shipped to destinations in about 20 States, Canada, and Mexico. The United States consumes many thousands of tons of feldspar, aplite, and nepheline syenite annually as raw materials for making container glass, and increasing demand for feldspathic materials in Georgia is a foreseeable consequence of the installation of a new glass container factory near Macon in Bibb County.[6]

Gypsum.—There was no production of crude gypsum in Georgia, but three firms, each operating one plant (The Flintkote Co. and National Gypsum Co., both in Chatham County, and Georgia-Pacific Corp. in Glynn County) calcined gypsum shipped from other States. The processed material, slightly less in quantity and 5% less in total value than the output in 1972,

[5] Jeffers, P. E. New Plant Adds 200,000 Brick Per Day. Brick & Clay Record, v. 163, No. 5, November 1973, pp. 18–21.
[6] Macon News. First Plant in Robins Industrial Park. July 10 1973, p. 10A.

was used in plaster and wallboard, as a cement retarder, as a filler, and for agricultural purposes. A new firm, Universal Gypsum of Georgia, Inc., was formed to build and operate two new plants, one to recover gypsum from waste acid sludge discarded by American Cyanamid Co.'s titanium dioxide pigment factory at Savannah, Chatham County, and the other to fabricate it into wallboard. The new complex, scheduled for completion in 1974, will thus be of benefit to Georgia's building industry while at the same time assisting in the solution of a troublesome disposal problem.[7]

Kyanite-Mullite.—C–E Minerals, a division of Combustion Engineering, Inc., operated an open pit mine and a flotation plant at Graves Mountain, Lincoln County, to extract kyanite contained in a deposit of quartz-kyanite schist. Most of the product was calcined for use as a component in special-purpose refractories. Both the quantity and the total value of the 1973 kyanite output were substantially greater than the corresponding figures for 1972 and established new records for the State. Further attesting to the prosperity of Georgia's kyanite industry was the announcement in August 1973 that C–E Minerals was launching an immediate 30,000-ton-per-year expansion of its Graves Mountain kyanite mining and processing facilities. In addition to the refractory materials of the mullite type that were derived from kyanite, synthetic mullite was produced by two firms: Electric-furnace fused material by Babcock & Wilcox Co. at Augusta, Richmond County; and high-temperature sintered material by Mulcoa, a subsidiary of C–E Minerals, at Andersonville, Sumter County. Production of synthetic mullite in both categories, measured either by tonnage or by total value, was notably higher than in 1972.

Lime.—No quicklime or hydrated lime was produced in Georgia, but the State's 1973 consumption of these materials from outside sources totaled 160,300 tons, 43% more than the comparable figure for 1972. Under slightly different economic conditions, an abundant supply of these products could be provided by substantial deposits of high-grade limestone that are known to exist within the State's borders.

Mica.—Scrap and flake mica was produced in 1973 by Franklin Mineral Products Co., Inc. from the Hartwell mine in Hart County, and additional production from the Brady mine in Cherokee County was reported by Thompson-Weinman & Co. The combined tonnage from these operations was substantially more than in 1972, but the total value increased only slightly. The two firms each operated one dry-grinding mill (in Hart County and Bartow County, respectively) to process the mined material for use in wallboard joint cement. No production of byproduct mica from feldspar operations was reported in 1973.

Perlite.—Armstrong Cork Co., treating raw material mined in the western United States, produced expanded perlite in one plant in Bibb County, chiefly for use in acoustic ceiling tile. W. R. Grace & Co. reported minor sales from stock of previously processed perlite for use as plaster and concrete aggregate. The quantity of expanded perlite sold or used by Georgia producers in 1973 was moderately less in tonnage than in 1972 but substantially higher in total value.

Sand and Gravel.—Georgia's 1973 production of sand and gravel from 40 pits distributed among 28 counties amounted to 5 million tons with a total value of $6.8 million, both figures notably greater than in 1972. It has been observed that finding a good source of sand, especially one near a large city, is likely to be more profitable than that of a gold mine. Late in 1973 it was announced that Georgia Marble Co. had discovered an extensive deposit of high-grade sand near Junction City, Talbot County, conveniently near the industrial centers of Atlanta, Columbus, and Macon. High-purity silica sand is one of the essential ingredients for glassmaking, and a ready market for the Talbot County sand was doubly assured by the construction, launched in mid-1973, of the new Midland Glass Co. glass container factory in the Warner Robbins industrial park south of Macon, Bibb County.[8]

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[7] Marshall, A. New Industry Planned for Pollution Abatement: Wallboard Plant Construction To Cost $16 Million. Savannah Morning News, Aug. 28, 1973, p. 1–D.

[8] Reference cited in footnote 6.

Table 8.—Georgia: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Bibb	4	W	W	4	395	W
Cook	1	280	W	1	244	W
Decatur	--	--	--	1	50	31
Fulton	1	2	4	1	20	45
Lee	1	152	W	1	141	147
McDuffie	--	--	--	1	30	25
Richmond	1	W	W	4	519	W
Warren	1	60	90	--	--	--
Undistributed [1]	r 18	3,323	4,637	27	3,578	6,534
Total [2]	27	3,816	4,729	40	4,976	6,781

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes Sumter County in 1972; Chatham, Crawford, De Kalb, Dougherty, Effingham, Evans, Greene, Long, Montgomery, Muscogee, Pike, Talbot, Thomas and Ware Counties in 1972 and 1973; and Bacon, Baldwin, Bartow, Coffee, Elbert, Upson, and Wheeler Counties in 1973.
[2] Data may not add to totals shown because of independent rounding.

Table 9.—Georgia: Sand and gravel sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Sand:				
Building	3,062	2,942	3,497	3,501
Fill	23	23	333	182
Paving	W	W	306	543
Other uses [1]	463	1,377	338	1,186
Total [2]	3,547	4,342	4,474	5,413
Gravel:				
Fill	W	W	25	99
Paving	--	--	365	1,044
Railroad ballast	60	90	--	--
Miscellaneous	8	17	39	78
Other uses [3]	202	281	72	146
Total [2]	270	387	502	1,368
Total sand and gravel	[2] 3,816	4,729	4,976	6,781

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes foundry sand (1972); blast, engine, filtration, glass, molding, and other sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes building and other gravel.

Stone.—Stone in one or more of several classifications was produced in Georgia in 1973 by 57 private firms and by the highway departments of 2 counties. Approximately 100 quarries were operated in 43 counties, 40 of which lie in the northern half of the State. The total tonnage produced was 10% more than in 1972, and the corresponding total value, almost $100 million, was 18% higher.

Continuing in 1973, the last few years' unprecedented demand for crushed stone aggregate has led to the opening of 15 new quarries in Georgia since 1970, which together with coinciding expansion of existing operations, has swelled the industry's productive capacity by more than 100%. Producers now have the capability of supplying at least five kinds of crushed stone for a diversity of uses and in a wide range of sizes at the rate of 50 million tons per year.

Crushed granite, ahead of the State's other classifications of stone by a factor of four or more in regard to both quantity and value of output, was produced by Davidson Mineral Properties, Inc.; Dixie Lime & Stone Co.; Vulcan Materials Co.; Georgia Marble Co.; Martin-Marietta Corp. (jointly accounting for just over three-quarters of the total tonnage); and 12 other companies with smaller outputs. Granite for crushing was taken from 38 quarries in 29 coun-

ties—De Kalb, Douglas, Fulton, Gwinnett, Jones (making up half of the total), and 24 others. Compared with 1972 figures, the 1973 output of this material was 11% greater in volume and 20% higher in total value.

Dimension granite totaling almost a quarter of a million tons and valued at $6.9 million (4% and 3% greater, respectively, than the comparable 1972 figures) was quarried at 36 locations in 5 counties (De Kalb, Elbert, Hancock, Madison, and Oglethorpe). The largest producers of this type of stone, which was used predominantly for monuments, were Bennie & Harvey Quarries, Inc.; Coggins Granite Industries, Inc.; Davidson Granite Co., Inc.; Georgia Marble Co.; and Middle Georgia Quarries Co. The individual outputs of 23 other producers ranged from a few hundred to several thousand tons with total values that approached an upper limit of about $0.2 million.

Table 10.—Georgia: Crushed granite sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972			1973		
		Value			Value	
	Quantity	Total	Average per ton	Quantity	Total	Average per ton
Bituminous aggregate	6,131	10,712	1.75	6,592	12,887	1.95
Concrete aggregate	8,854	14,972	1.69	8,918	16,311	1.83
Dense graded roadbase stone	5,698	9,681	1.70	5,896	11,260	1.91
Macadam aggregate	W	W	W	736	1,400	1.90
Surface treatment aggregate	1,353	2,397	1.77	1,604	3,170	1.98
Unspecified construction aggregate and roadstone	4,190	7,027	1.68	6,417	12,203	1.90
Railroad ballast	2,183	3,486	1.60	2,131	3,556	1.67
Riprap and jetty stone	592	1,094	1.85	535	1,033	1.93
Other uses[1]	668	1,150	1.72	67	106	1.58
Total[2]	29,668	50,520	1.70	32,896	61,925	1.88

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes poultry grit and manufactured fine aggregate (1973).
[2] Data may not add to totals shown because of independent rounding.

Table 11.—Georgia: Dimension granite sold or used by producers, by county

County	1972				1973			
	Number of quarries	Thousand cubic feet	Short tons (equivalent)	Value (thousands)	Number of quarries	Thousand cubic feet	Short tons (equivalent)	Value (thousands)
De Kalb	3	356	29,359	W	3	344	34,438	W
Elbert	11	611	57,797	$2,859	12	572	55,809	$2,555
Oglethorpe	13	527	57,992	1,075	18	680	67,148	1,368
Undistributed[1]	3	882	88,801	2,726	3	871	87,073	2,961
Total	30	2,376	233,949	6,660	36	[2]2,468	244,468	6,884

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes Hancock and Madison Counties.
[2] Data may not add to totals shown because of independent rounding.

Table 12.—Georgia: Dimension granite sold or used by producers, by use
(Thousand cubic feet and thousand dollars)

Use	1972			1973		
	Quantity	Value		Quantity	Value	
		Total	Average per cubic foot		Total	Average per cubic foot
Rough:						
Architectural	149	267	1.79	198	452	2.28
Construction	W	W	W	151	125	.83
Monumental	1,766	5,206	2.94	1,828	4,919	2.69
Dressed:						
Sawed stone	W	W	W	W	W	W
Curbing	W	W	W	W	W	W
Other uses [1]	461	1,187	2.57	291	1,389	4.77
Total	2,376	6,660	2.80	2,468	[2] 6,884	2.79

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] 1972 data include other rough stone, cut stone, and dressed construction stone. 1973 data also include dressed monumental stone.
[2] Data may not add to totals shown because of independent rounding.

Crushed limestone and dolomite, 9% more in quantity and 41% higher in total value than in 1972, was produced in 1973 from 19 quarries located in 12 counties, 5 of which taken together (Bartow, Early, Floyd, Houston, and Whitfield) furnished nearly three-quarters of the total tonnage. Dalton Rock Products Co.; Florida Rock Industries, Inc.; LBI Quarries, Inc.; Marquette Cement Manufacturing Co.; and Medusa Cement Co. jointly produced two-thirds of the total output. Seven other firms, as well as the Fannin County and Floyd County highway departments, contributed smaller tonnages.

Table 13.—Georgia: Crushed limestone [1] sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	563	862	492	886
Concrete aggregate	744	1,322	998	2,420
Dense graded roadbase stone	599	875	822	1,389
Macadam aggregate	297	W	W	W
Surface treatment aggregate	396	590	343	720
Unspecified construction aggregate and roadstone	1,135	2,290	985	1,768
Agricultural limestone	W	W	382	942
Cement	W	W	W	W
Terrazzo	50	750	198	3,209
Manufactured fine aggregate (stone sand)	--	--	66	W
Other uses [2]	2,346	4,163	2,374	4,006
Total [3]	6,130	10,853	6,659	15,340

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Limestone used generally to include dolomite.
[2] Includes riprap and jetty stone, railroad ballast, and a small amount of fill.
[3] Data may not add to totals shown because of independent rounding.

Crushed marble was produced from two quarries operated by Georgia Marble Co., one in Gilmer County and one in Pickens County. The quantity and value of this material were not notably different from those recorded in 1972. Production of dimension marble was confined to the Tate quarry in Pickens County, also operated by Georgia Marble Co. The 1973 output of this high-unit-value stone was at the lowest level in a number of years. Crushed and broken marble was used for filler, whiting, and exposed terrazzo; dimension marble was used mostly for monuments and in smaller quantities for house stone veneer, rough blocks, and flagging.

Crushed sandstone was produced by The Feldspar Corp. from one quarry in Jasper

County and by Marquette Cement Manufacturing Co. from one quarry in Polk County for use as building material and in cement making. Dimension sandstone was quarried at separate locations in Pickens County by North Georgia Stone Co. and Buchanan Flagstone Co. and used as flagging, irregular-shaped stone, and rubble.

Crushed quartzite for use as aggregate and exposed terrazzo was produced by Stone Products Corp. from one quarry in Fannin County and by Buchanan Flagstone Co. from one quarry in Pickens County. Buchanan Flagstone Co. also produced dimension quartzite from its Pickens County quarry for use as irregular-shaped stone and flagging.

Crushed slate, produced from one quarry in Bartow County by GAF Corp. and from one quarry in Polk County by Georgia Lightweight Aggregate Co., was either expanded for lightweight aggregate, sized for use as roofing granules, or ground to a fine powder for filler purposes.

Strontium.—Chemical Products Corp. processed imported celestite ore at a plant in Bartow County to obtain refined strontium compounds for consumption in electronic components and special-purpose glass formulations.

Talc.—Southern Talc Co. mined talcose material classified as soapstone at three underground operations near Chatsworth, Murray County. The 1973 output tonnage was 17% below that of 1972, and the reported total value was markedly lower. The producing firm also operated a grinding mill in which the mined material was processed to serve as a filler for rubber and asphalt products and in the manufacture of roofing and insecticides.

METALS

Bauxite.—American Cyanamid Co. and C–E Minerals, Inc., produced bauxite in 1973 from a number of open pit operations in Sumter County. The year's production, markedly higher than in 1972, was consumed principally in such nonmetallic applications as aluminum chemicals, high-alumina refractory grog, and firebrick.

Gold.—There has been no commercial production of gold in Georgia for many years, but soaring gold prices worldwide have reawakened interest in the State's lode and placer deposits, some of which yielded important quantities of gold a century and more ago. Deposits in the Dahlonega area, 60 miles north of Atlanta in Lumpkin County, were the focus of the Nation's first big gold rush and were so rich that a branch of the U.S. Mint was established there in 1838 to stamp the newly mined metal into golden eagles. Some of those mines were never completely worked out, and a few are still in operation on a small-scale pan-for-fee basis as tourist attractions.

The implication of most of the newspaper articles on this subject was that, unless the price of gold rises still higher and a number of critical economic and environmental obstacles can be overcome, even a modest revival of gold mining in Georgia seems unlikely, although it cannot entirely be ruled out.[9]

Iron Ore.—Two firms, Luverne Mining Co. and Lumpkin Mining Co., each operating an open pit facility in adjoining Stewart and Quitman Counties, respectively, produced limonite ore, which was shipped to Alabama to be smelted along with ores from other sources. Total output of this type of ore, losing ground for the third year in succession, was substantially less than in 1972. Other iron oxide minerals, ochre and umber for use as coloring agents for paints, mortars, structural clay products, and concrete or in chemical manufacturing, were produced by New Riverside Ochre Co. from open pit mines in Bartow County. Output of ochre and umber was moderately greater in quantity and value in 1973 than in each of the preceding years.

Rare-Earth Minerals.—Monazite concentrate (chiefly rare-earth phosphates and silicates) was one of the coproducts recovered by Humphreys Mining Co. in treating titaniferous sand dredged from ancient river terraces in Charlton County. Output of this concentrate, used as a source of thorium and associated rare-earth metals, was moderately less in quantity and total value than in 1972.

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[9] Bailey, S. Yen for Gold and Dahlonega. Atlanta Constitution, May 17, 1973, p. 19–A.
Columbus Ledger. There's Still Gold in Them Thar Hills. July 4, 1973, p. 26.
Hopkins, S. Georgia Has Vast Potential, Interest in Mining. Atlanta Constitution, May 28, 1973, p. A–B (interview with S. M. Pickering, Jr.).
Macon News. Gold Rush in Georgia? Sept. 13, 1973, p. P–1A.
Salter, S. Georgia Gold To Pay Off Again. Atlanta Constitution, Mar. 29, 1973, p. 8–A.
Wells, F. Georgia's Gold Worth Most in the Ground. Atlanta Constitution, Mar. 15, 1973, p. 8–C.

Titanium.—Ilmenite concentrate (essentially ferrous titanate) was the most important product (with respect to both quantity and value) that was obtained by Humphreys Mining Co. from a deposit of mineral-bearing sand in Charlton County. The year's output of ilmenite, moderately less than that of 1972, was used as a raw material in the manufacture of pigments and ceramics.

Zirconium.—Zircon concentrate (zirconium silicate) was second in tonnage and value among the three salable fractions separated by Humphreys Mining Co. from the mineralized sand of Charlton County. The zircon produced in 1973, most of which was used in refractories, molding sand, and ceramics, was slightly less than the quantity recovered in 1972.

MINERAL FUELS

Coal.—Expectations for a revival of coal mining in Georgia (last recorded in 1964) were not realized. A firm operating briefly in Chattooga County announced abandonment of the enterprise reportedly because the seam being worked on proved too thin for profitable exploitation under present conditions.

Peat.—Partially decomposed vegetable matter, accumulated in limestone sinks and classified as humus peat, was processed by Shep Peat Co. in Miller County. The 1973 output was down sharply in both quantity and value from that of 1972 when there were two producers. The material was dried and shredded for non-fuel use, either as a soil conditioner or as root packing material for plant nurseries.

Table 14.—Principal producers

Commodity and company	Address	Type of activity	County
Barite, primary:			
New Riverside Ochre Co	Box 387 Cartersville, Ga. 30120	Open pit mine	Bartow.
Paga Mining Co., Div. Thompson-Weinman & Co.	Box 130 Cartersville, Ga. 30120	Open pit mine and grinding mill.	Do.
Bauxite:			
American Cyanamid Co	Berdan Ave. Wayne, N.J. 07470	Open pit mine and drying plant.	Sumter.
C-E Minerals Inc., Div. Combustion Engineering Inc.	901 East Eighth Ave. King of Prussia Industrial Park King of Prussia, Pa. 19406	Open pit mine	Do.
Cement, portland:			
Marquette Cement Manufacturing Co.	20 North Wacker Dr. Chicago, Ill. 60606	Plant	Polk.
Martin-Marietta Cement (Southern Div.) Sub. of Martin-Marietta Corp.	18th Floor, Daniel Bldg. Birmingham, Ala. 35233	---- do	Fulton.
Medusa Cement Co. Medusa Corp.	Box 5668 Cleveland, Ohio 44101	---- do	Houston.
Clays:			
Fuller's earth:			
Engelhard Minerals & Chemicals Corp.	Menlo Park Edison, N.J. 08817	Open pit mine	Decatur.
Georgia-Tennessee Mining & Chemicals Co.	3379 Peachtree Rd. Atlanta, Ga. 30326	---- do	Jefferson.
Milwhite Co., Inc	Box 15038 Houston, Tex. 77020	---- do	Decatur.
Oil-Dri Corp of Georgia	Box 200–A Ochlocknee, Ga. 31773	---- do	Thomas.
Thor Mining Co	Berkeley Springs W. Va. 25411	---- do	Do.
Waverly mineral Products Co.	Box 106 Meigs, Ga. 31765	---- do	Do.
Kaolin:			
American Industrial Clay Co.	433 North Broad St. Elizabeth, N.J. 07207	Open pit mines	Warren and Washington.
Engelhard Minerals & Chemicals Corp.	Menlo Park Edison, N.J. 08817	---- do	Washington and Wilkinson.
Freeport Kaolin Co	733 Third Ave. New York, N.Y. 10017	Open pit mine	Twiggs.
Georgia Kaolin Co	433 North Broad St. Elizabeth, N.J. 07207	---- do	Do.
J. M. Huber Corp	Thornall St. Edison, N.J. 08817	Open pit mines	Twiggs and Warren.
Thiele Kaolin Co	Box 1056 Sandersville, Ga. 31082	---- do	Warren and Washington.

Table 14.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clays—Continued			
Common clay and shale:			
Bickerstaff Clay Products Co.	P.O. Box 1178 Columbus, Ga. 31902	Open pit mine	Floyd and Muscogee.
Burns Brick Co	Box 4787 Macon, Ga. 31208	do	Bibb.
Chattahoochee Brick Co	3195 Brick Plant Rd., N.W. Atlanta, Ga. 30318	Open pit mines	Floyd, Fulton, Polk.
Cherokee Brick & Tile Co	Box 4567 Macon, Ga. 31208	Open pit mine	Bibb.
Georgia-Carolina Brick & Tile Co.	RFD 1, Box 10 Augusta, Ga. 30906	do	Richmond.
Griffin Pipe Products Co. Operating Unit AMSTED Industries Inc.	Drawer 548 Milledgeville, Ga. 31061	Open pit mines	Floyd and Hancock.
Martin-Marietta Corp. Southern Div.	18th Floor, Daniel Bldg. Birmingham, Ala. 35233	Open pit mine	Fulton.
Merry Companies Inc	Box 1957 Augusta, Ga. 30903	do	Richmond.
Feldspar:			
The Feldspar Corp	P.O. Box 99 Spruce Pine, N.C. 28777	Open pit mine and flotation plant.	Jasper.
Gypsum:			
The Flintkote Co	400 Westchester Ave. White Plains, N.Y. 10604	Calcination plant.	Chatham.
Georgia-Pacific Corp. Gypsum Div.	Box 311 Portland, Oreg. 97207	do	Glynn.
National Gypsum Co	327 Delaware Ave. Buffalo, N.Y. 14202	do	Chatham.
Iron ore:			
Lumpkin Mining Co	Box 234 Greenville, Ala. 36037	Mine and plant	Quitman.
Luverne Mining Co	Box 409 Luverne, Ala. 36104	do	Stewart.
Iron oxide pigment materials:			
New Riverside Ochre Co	Box 387 Cartersville, Ga. 30120	do	Bartow.
Kyanite:			
Aluminum Silicates, Div. C-E Minerals, Inc., Div. Combustion Engineering, Inc.	433 South Gulph Rd. King of Prussia, Pa. 19406	Open pit mine and flotation plant.	Lincoln.
Mica:			
Franklin Mineral Products Co. Inc.	P.O. Box O 635 Main St. Wilmington, Mass. 01887	Open pit mine and grinding mill.	Hart.
Thompson-Weinman & Co	Box 130 Cartersville, Ga. 30120	do	Cherokee.
Peat:			
Shep Peat Co	Box 307 Colquitt, Ga. 31737	Open pit mine	Miller.
Perlite, expanded:			
Armstrong Cork Co	1010 Concord St. Lancaster, Pa. 17604	Plant	Bibb.
W. R. Grace & Co	62 Whittemore Ave. Cambridge, Mass. 02140	do	Gwinnett.
Rare-earth minerals:			
Humphreys Mining Co., Div. Humphreys Engineering Co.	Box 8 Folkston, Ga. 31537	Dredge and plant.	Charlton.
Sand and gravel:			
Atlanta Sand & Supply Co	695 Forsyth Bldg. Atlanta, Ga. 30303	Open pit mine	Crawford.
Colwell Construction Co	P.O. Box 6 Blairsville, Ga. 30512	do	Upson.
Cornell-Young Co	Box 96, 4496 Mead Rd. Macon, Ga. 31206	do	Bibb.
Dawes Silica Mining Co	Box 470, Ochlocknee Rd. Thomasville, Ga. 31792	Open pit mines	Dougherty, Effingham, Long, Thomas.
Drakes Eye Mining Co	P.O. Box 236 Lithonia, Ga. 30058	do	De Kalb.
Stone:			
Granite, crushed:			
Davidson Mineral Properties Inc.	Box 458, Rogers Lake Rd. Lithonia, Ga. 30058	Quarries and mills.	De Kalb and Fulton.
Dixie Lime & Stone Co	Box 910 Ocala, Fla. 32670	do	Clayton and Fayette.
Georgia Marble Co. Div. Jim Walter Corp.	3460 Cumberland Pkwy. NW Atlanta, Ga. 30303	do	De Kalb and Douglas.

Table 14.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Granite, crushed—Continued			
Martin-Marietta Cement (Southern Div.) Sub. of Martin-Marietta Corp.	Box 2479, 414 Fayetteville Raleigh, N.C. 27602	Quarries and mills.	Jones and Richmond.
Vulcan Materials Co. Southeastern Div.	Box 7324–A, 1 Office Park Birmingham, Ala. 35223	---- do ------	Cobb, Douglas, Fulton, Gwinnett, Muscogee.
Coggins Granite Industries, Inc.	Box 250, Railroad St. Elberton, Ga. 30635	Quarries ------	Elbert and Madison.
Davidson Granite Co., Div. Davidson Mineral Properties, Inc.	Box 458, Rogers Lake Rd. Lithonia, Ga. 30058	Quarry --------	De Kalb.
Georgia Marble Co., Div. Jim Walter Corp.	3460 Cumberland Pkwy. NW Atlanta, Ga. 30303	---- do ------	Madison.
Limestone, crushed:			
Dalton Rock Products Co --	Box 1608 Dalton, Ga. 30720	Quarry and mill	Whitfield.
Dixie Lime & Stone Co --	Route 1, P.O. Box 998 Bridgeboro, Ga. 31744	Quarries ------	Clayton, Fayette, Mitchell, Monroe.
LBI Quarries, Inc --------	Box 1067, 401 East 1st Ave. Rome, Ga. 31061	Quarry and mill	Floyd.
Martin-Marietta Cement (Southern Div.) Sub. of Martin-Marietta Corp.	P.O. Box 650 Adairsville, Ga. 30103	Quarry --------	Bartow.
Vulcan Materials Co. Southeastern Div.	P.O. Box 7324–A, 1 Office Park Birmingham, Ala. 35223	---- do ------	Gwinnett.
Marble, crushed:			
Georgia Marble Co., Div. Jim Walter Corp.	3460 Cumberland Pkwy. NW Atlanta, Ga. 30303	Quarry and mill	Gilmer and Pickens.
Marble, dimension:			
Georgia Marble Co., Div. Jim Walter Corp.	---- do ----------	Quarry and finishing plant.	Do.
Sandstone, crushed:			
The Feldspar Corp ------	P.O. Box 99 Spruce Pine, N.C. 28777	Open pit mine and mill.	Jasper.
Marquette Cement Manufacturing Co.	20 North Wacker Dr. Chicago, Ill. 60606	Quarry and mill.	Polk.
Sandstone, dimension:			
North Georgia Stone Co --	Whitestone, Ga. 30186	Quarry --------	Pickens.
Slate, crushed:			
GAF Corp., Industrial Products Div.	140 West 51st St. New York, N.Y. 10020	Quarry and mill	Bartow.
Georgia Lightweight Aggregate Co.	Box 188 Rockmart, Ga. 30125	Mine and mill -	Polk.
Talc (soapstone):			
Southern Talc Co ----------	Box F Chatsworth, Ga. 30705	Underground mines and grinding mill.	Murray.
Titanium concentrate:			
Humphreys Mining Co., Div. Humphreys Engineering Co.	Box 8 Folkston, Ga. 31537	Dredge and plant.	Charlton.
Zircon concentrate:			
Humphreys Mining Co., Div. Humphreys Engineering Co.	---- do ----------	---- do ------	Do.

The Mineral Industry of Hawaii

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U. S. Department of the Interior, and the Hawaii Department of Land and Natural Resources for the collection of mineral data.

By Avery H. Reed [1]

The mineral industry of Hawaii operated at record levels in 1973 as the construction boom of the sixties was resumed. Output of construction materials, especially stone and cement, set new annual records.

Environmental problems continued to concern any future expansion of the mineral economy of Hawaii. Land has become almost too valuable for mining. New antipollution restrictions limit expansion.

Total value of mineral production expanded 25% to $35 million, 19% above the previous 1969 record. The leading producing county was Honolulu. Leading mineral producing companies were Kaiser Cement & Gypsum Corp. which operated a cement plant and a limestone quarry; Hawaiian Cement Corp. with a cement plant and a limestone quarry; and Pacific Concrete and Rock Co. Ltd. with five stone quarries.

[1] Supervisory physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Mineral production in Hawaii [1]

Mineral	1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Masonry thousand short tons	13	$384	16	$537
Portland do	402	10,732	453	13,213
Gem stones	NA	57	NA	W
Lime thousand short tons	7	266	6	238
Pumice do	379	762	354	611
Sand and gravel do	609	1,893	753	2,012
Stone do	[2] 5,005	[2] 13,494	7,180	18,466
Value of items that cannot be disclosed: Clays, salt, stone (dimension) (1972), and values indicated by symbol W	XX	486	XX	70
Total	XX	28,074	XX	35,147
Total 1967 constant dollars	XX	23,164	XX	[p] 25,805

[p] Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed". XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes dimension stone; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Hawaii, by county

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Hawaii	$2,032	$3,673	Stone, pumice.
Honolulu	22,721	27,690	Stone, cement, lime, clays, salt.
Kauai	741	908	Stone, sand and gravel, pumice.
Maui	2,579	2,881	Sand and gravel, stone, lime, pumice, gem stones.
Total [1]	28,074	35,147	

[1] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Hawaii business activity

		1972	1973 p	Change, percent
Total nonagricultural employment	thousands	309.5	316.3	+2.2
Manufacturing	do	24.8	24.4	−1.6
Contract construction	do	23.1	25.1	+8.7
All other industries [1]	do	261.6	266.8	+2.0
Personal income:				
Total	millions	$4,020	$4,391	+9.2
Per capital		$5,031	$5,309	+5.5
Construction activity:				
Number of private and public residential units authorized		16,063	18,350	+14.2
Value of nonresidential construction	millions	$97.6	$107.2	+9.8
Farm marketing reciepts	do	$243.2	$273.2	+12.3
Mineral production value	do	$28.1	$35.1	+24.9

p Preliminary.
[1] Includes transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; services, and government.

Sources: Survey of Current Business, Construction Review, Employment and Earnings, Farm Income Situation, and U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Kaiser Cement & Gypsum Corp. operated a cement plant near Nanakuli, and Hawaiian Cement Corp. operated a cement plant at Barbers Point, both on Oahu, in Honolulu County. Shipments of portland cement increased 13% to 453,000 tons, a new annual record. Shipments of masonry cement were a record 15,640 tons, 22% above the 1972 record.

Of the portland cement consumed, 80% was for ready-mix concrete; 13% for concrete products; 4% for building materials; and 3% for other uses.

Raw materials used in portland cement included 592,800 tons of limestone and 84,620 tons of basalt which were quarried on Oahu; 51,130 tons of silica sand; and 20,300 tons of gypsum from Mexico. The two plants consumed 360,000 barrels of fuel oil and purchased 56 million kilowatt-hours of electric energy.

Clays.—Pacific Clay Corp. mined common clay at Waimanals, Oahu, in Honolulu County, for use in making face brick.

Gem Stones.—The value of retail sales of coral jewelry was estimated at more than $3 million. Coral is present in waters around Hawaii in gold, pink, bamboo, and black colors. Some coral was recovered by scuba divers.

Lime.—GasprO Ltd. and Hawaiian Commercial & Sugar Co. Ltd. produced lime in Honolulu and Maui Counties for sugar refining and finishing lime. Output decreased 2% and was 33% below the 1966 record. Total lime consumption was 7,223 tons.

Pumice and Volcanic Cinder.—Fifteen operators produced 354,100 tons of pumice and volcanic cinder at 15 mines for concrete, roads, landscaping, and fill. Output decreased 7% below the 1972 record. Leading counties were Hawaii and Maui. Leading producers were Volcanite Ltd., Laupahoehoe Sugar Co., and Hilo Coast Processing Co. Among the States, Hawaii ranked fourth in production of pumice.

Salt.—Tanaka Hawaiian Salt recovered a small quantity of solar salt near Honolulu.

Sand and Gravel.—Twelve operators mined sand and gravel at 12 mines in Maui and Kauai Counties for concrete and roads, fill, and other uses. Output increased 24% to 752,700 tons but was 10% below the 1971 record. Leading producers were HC&D, Ltd., Louis K. Rego Trucking Co., and Maui Concrete & Aggregates, Inc.

Stone.—Seven operators crushed traprock at 20 quarries for concrete and roads, fill, and other uses. Output expanded 38% to 4,966,000 tons, 5% above the 1970 record. Leading counties were Honolulu and Hawaii. Leading producers were Lone Star Industries, Pacific Concrete & Rock Co. Ltd., and HC&D, Ltd.

Eight operators crushed limestone at eight quarries for cement, concrete and roads, agriculture, and other uses. Output increased 42% to 1,746,000 tons and set a new annual record. The leading county was Honolulu. Leading producers were Pa-

cific Concrete & Rock Co. Ltd., Hawaiian Cement Corp., Herbert Tanaka, and Kaiser Cement & Gypsum Corp.

Four operators crushed miscellaneous stone at five quarries for concrete and roads and for other uses. Output increased and was 31% above the 1971 record. The leading county was Hawaii. The leading producer was Yamada Sons, Inc.

Six producers quarried dimension miscellaneous stone and traprock for construction use. The leading producer was Joe's Moss Rock, Inc.

Total stone production was 7,180,000 tons valued at $18,466,000, a new record.

Vermiculite.—Vermiculite of Hawaii, Inc. exfoliated vermiculite imported from Montana at a plant on Oahu.

MINERAL FUELS

Hawaiian energy is mainly derived from petroleum products. There are two oil refineries on Oahu, owned by Standard Oil Co. of California and by Hawaiian Independent Refinery, Inc. Conoco-Dillingham plans to build another refinery at Barbers Point. A fourth refinery is planned for North Kohala, on the Island of Hawaii.

Hawaiian Independent planned to increase its plant capacity to 125,000 barrels per day.

Table 4.–Principal producers

Commodity and company	Address	Type of activity	Island
Cement:			
Hawaiian Cement Corp	1600 Kapiolani Blvd., Suite 1200 Honolulu, Hawaii 96814	Dry process portland cement plant.	Oahu.
Kaiser Cement & Gypsum Corp	Permanente Rd. Permanente, Calif. 95014	Wet process portland cement plant.	Do.
Clays: Pacific Clay Corp	547 Halekauwila St. Honolulu, Hawaii 96813	Open pit mine	Do.
Lime:			
GasprO, Ltd	P. O. Box 2454 Honolulu, Hawaii 96804	Rotary kiln and continuous hydrator.	Do.
Hawaiian Commercial & Sugar Co. Ltd.	Puunene, Hawaii 96784	----do	Maui.
Pumice and volcanic cinder:			
Fong Construction Co., Ltd	237 Dairy Rd. Kahului, Hawaii 96732	Open pit mine	Do.
HC&D, Ltd	P. O. Box 190 Honolulu, Hawaii 96810	----do	Molokai.
James Kuwana	P. O. Box 406 Pahoa, Hawaii 96778	----do	Hawaii.
Hilo Coast Processing Co	Pepeekeo, Hawaii 96783	----do	Do.
Laupahoehoe Sugar Co	Papaaloa, Hawaii 96780	----do	Do.
Volcanite, Ltd	8282 Fort St. Honolulu, Hawaii 96813	----do	Do.
Salt: Tanaka Hawaiian Salt	968 D Akepo Lane Honolulu, Hawaii 96817	Solar evaporation	Oahu.
Sand and gravel:			
Concrete Industries, Inc	P. O. Box 86 Puunene, Hawaii 96784	Open pit mine	Maui.
HC&D, Ltd	P. O. Box 190 Honolulu, Hawaii 96810	----do	Molokai.
Kekaha Sugar Co., Ltd	Kekaha, Hawaii 96752	----do	Kauai.
Maui Concrete & Aggregates, Inc	8 Central Ave. Wailuku, Hawaii 96793	----do	Maui.
Louis K. Rego Trucking Co	Lihue, Hawaii 96766	----do	Kauai.
Stone:			
Concrete Industries, Inc	P. O. Box 86 Puunene, Hawaii 96784	Open quarry	Maui.
James W. Glover, Ltd	P. O. Box 275 Hilo, Hawaii 96720	----do	Hawaii.
Grove Farm Co., Inc	Puhi Rural Station Puhi, Hawaii 96766	----do	Kauai.
Hawaiian Bitumuls & Paving Co., Ltd.	P. O. Box 2240 Honolulu, Hawaii 96804	----do	Oahu.
Hawaiian Cement Corp	1600 Kapiolani Blvd., Suite 1200 Honolulu, Hawaii 96814	----do	Do.
HC&D, Ltd	P. O. Box 190 Honolulu Hawaii 96810	----do	Do.
Kaiser Cement & Gypsum Corp	Permanente Rd. Permanente, Calif. 95014	----do	Do.
Lone Star Industries, Pacific Region.	400 Alabama St. San Francisco, Calif. 94110	----do	Do.
Pacific Concrete & Rock Co., Ltd	2344 Pahounui Dr. Honolulu, Hawaii 96819	----do	Molokai, and Oahu.
Vermiculite (exfoliated):			
Vermiculite of Hawaii, Inc	842-A Mapunapuna St. Honolulu, Hawaii 96819	Exfoliating plant	Oahu.

The Mineral Industry of Idaho

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Idaho Bureau of Mines and Geology for collecting information on all minerals except fuels.

By William C. Butterman [1]

The value of Idaho's mineral production increased 28% in 1973 to $136 million. Twenty-two mineral commodities were produced, of which 9 were metallic and 13 were nonmetallic or industrial minerals. No fossil fuels were produced. Silver was the most valuable commodity, yielding 26% of the State's mineral revenues. Lead, zinc, sand and gravel, and stone accounted for another 42% and, of the commodities for which the value cannot be disclosed, phosphate rock and vanadium were especially important.

Much of the increase in mineral revenue was attributed to higher prices in 1973. The production of silver fell 4%, but its value roes 45%. The quantities of lead and zinc produced rose 1% and 19%, respectively, and the production of copper increased 23%; however, the value of the three increased by 9%, 39%, and 43%, respectively. The production of sand and gravel increased 9%, but its value remained about the same as in 1972; the production of stone decreased 4% and its value increased 15%.

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in Idaho [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Antimony ore and concentrate short tons, antimony content	345	$303	322	$406
Clays thousand short tons	57	415	42	227
Copper (recoverable content of ores, etc.) short tons	2,942	3,013	3,625	4,314
Gem stones	NA	105	NA	110
Gold (recoverable content of ores, etc.) troy ounces	2,884	169	2,696	264
Gypsum thousand short tons	--	--	W	W
Lead (recoverable content of ores, etc.) short tons	61,407	18,459	61,744	20,116
Mercury 76-pound flasks	161	35	--	--
Pumice thousand short tons	W	W	80	110
Sand and gravel do	7,696	10,294	8,393	10,246
Silver (recoverable content of ores, etc.) thousand troy ounces	14,251	24,012	13,620	34,840
Stone thousand short tons	3,094	7,042	2,972	8,096
Zinc (recoverable content of ores, etc.) short tons	38,647	13,720	46,107	19,052
Value of items that cannot be disclosed: Cement, garnet, iron ore, lime, perlite, phosphate rock, tungsten, vanadium, and values indicated by symbol W	XX	28,639	XX	38,300
Total	XX	106,206	XX	136,081
Total 1967 constant dollars	XX	87,631	XX	p 99,911

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Idaho, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973, in order of value
Ada	$1,080	$1,293	Sand and gravel.
Adams	303	1,286	Copper, silver, sand and gravel.
Bannock	4,588	W	Cement, stone, sand and gravel.
Bear Lake	W	62	Sand and gravel.
Benewah	W	547	Garnet, sand and gravel, clays.
Bingham	W	W	Phosphate rock, sand and gravel.
Blaine	W	W	Sand and gravel, lead, silver, zinc, gold.
Bonner	W	273	Sand and gravel.
Bonneville	1,722	1,371	Lime, sand and gravel, stone, pumice.
Boundary	W	W	Stone, sand and gravel.
Butte	--	W	Sand and gravel, silver, lead, zinc.
Camas	W	40	Sand and gravel, silver, copper, gold, lead, zinc.
Canyon	W	W	Sand and gravel, lime.
Caribou	16,997	25,243	Phosphate rock, vanadium, stone, sand and gravel, pumice.
Cassia	90	415	Sand and gravel, stone, clays.
Clark	92	93	Stone, iron ore, sand and gravel, lead, clays.
Clearwater	W	W	Stone, sand and gravel.
Custer	775	1,231	Zinc, silver, lead, copper, gold.
Elmore	W	W	Stone, sand and gravel, clays.
Franklin	W	W	Stone, sand and gravel.
Fremont	W	W	Sand and gravel, stone.
Gem	W	315	Sand and gravel.
Gooding	--	W	Do.
Idaho	W	W	Sand and gravel, stone.
Jefferson	336	--	
Kootenai	W	1,432	Sand and gravel, stone, silver, gold.
Latah	1,713	W	Clays, stone.
Lemhi	80	102	Gypsum, copper, sand and gravel, gold, silver.
Lewis	155	W	Stone.
Lincoln	W	W	Sand and gravel.
Madison	W	207	Do.
Minidoka	W	W	Lime, sand and gravel, clays.
Nez Perce	776	W	Stone, sand and gravel.
Oneida	235	W	Pumice, perlite.
Owyhee	W	3	Sand and gravel.
Payette	W	140	Do.
Power	W	30	Sand and gravel, stone.
Shoshone	59,232	76,763	Silver, lead, zinc, copper, antimony, stone, gold.
Teton	W	286	Sand and gravel.
Twin Falls	W	W	Sand and gravel, lime.
Valley	--	W	Tungsten.
Washington	252	378	Stone, gypsum, sand and gravel, iron ore.
Undistributed [2]	17,775	24,570	
Total [3]	106,206	136,081	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Boise and Jerome Counties are not listed because no production was reported.

[2] Includes values of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Idaho business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total labor force ---thousands--	322.9	339.0	+5.0
Unemployment ---do---	19.9	19.1	−4.0
Employment (nonagricultural):			
Construction ---do---	12.8	13.9	+8.6
Mining ---do---	3.1	2.9	−6.5
Manufacturing ---do---	43.8	47.2	+7.8
Government ---do---	53.7	55.6	+3.5
All other ---do---	118.8	125.6	+5.7
Personal income:			
Total ---millions--	$2,858	$3,329	+16.5
Per capita	$3,780	$4,323	+14.4
Construction activity:			
New housing units authorized	6,946	5,822	−16.2
Nonresidential building permits issued ---thousands--	$42.6	$62.8	+47.4
State highway commission:			
Value of contracts awarded ---millions--	e $45.0	$40.1	−10.9
Cement shipments to and within Idaho thousand short tons--	415	430	+3.6
Farm marketing receipts ---millions--	$888.8	$1,148.3	+29.2
Mineral production value ---do---	$106.2	$136.1	+28.2

e Estimated. p Preliminary. NA Not available.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and the U.S. Bureau of Mines.

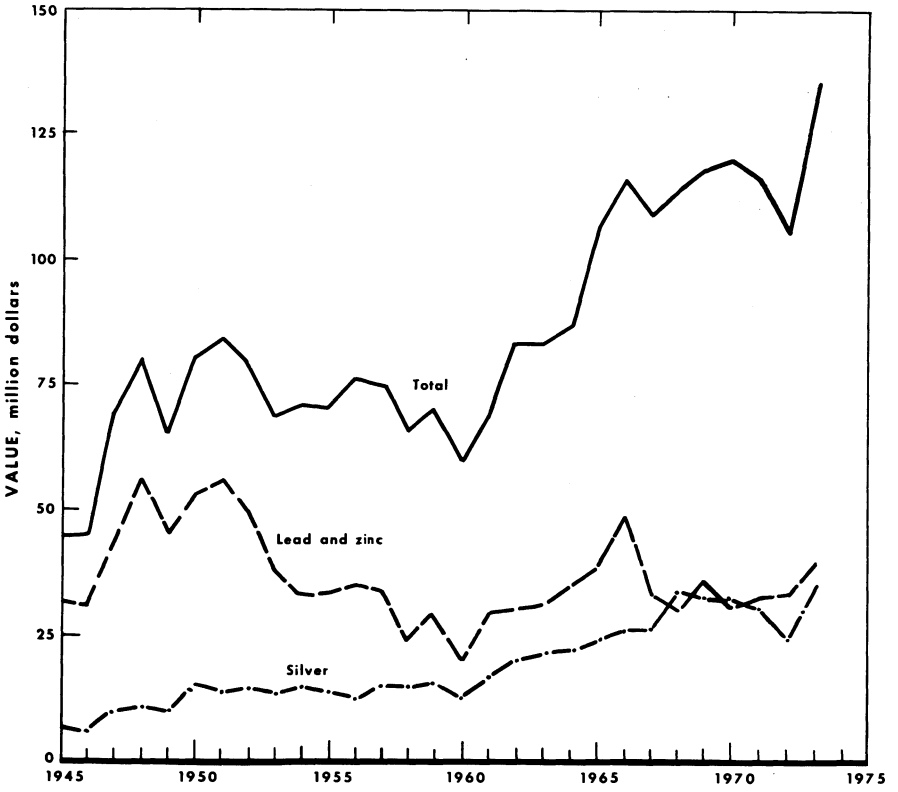

Figure 1.—Value of silver, lead, and zinc, and total value of mineral production in Idaho.

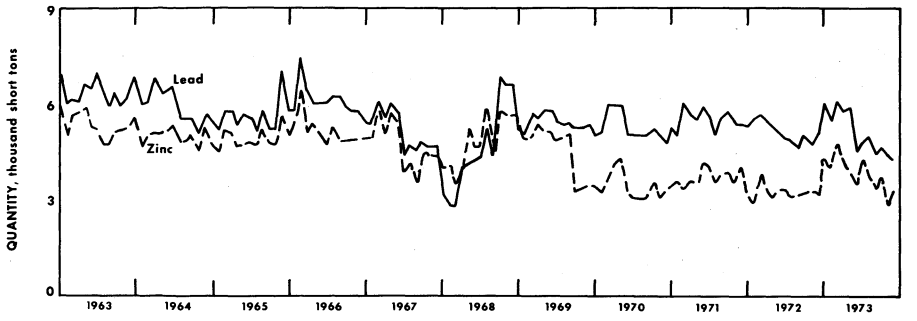

Figure 2.—Mine production of lead and zinc in Idaho, by months, in terms of recoverable metals.

The Sunshine mine resumed operation on July 16 after being closed for more than 4 months by a strike. The Sunshine Mining Co. continued with plans for a new silver-copper refinery to be located at Kellogg. The Bunker Hill Co. began construction at its Kellogg lead-zinc smelter of a new facility for extracting copper from smelter byproducts. The company proceeded also with construction of a liquid waste treatment plant that will serve its mine and other facilities at Kellogg. Silver King Mines, Inc., expanded the known reserves at its Copper Cliff mine in Adams County to more than 2 million tons of copper-silver ore, and planned to switch to an open pit operation. Cyprus Mines Corp. continued to explore its Thompson Creek molybdenum prospect in central Idaho, which contains about 100 million tons of ore assaying about 0.15% molybdenum. The Idaho Mining Co., a subsidiary of Hanna Mining Co., studied the feasibility of reopening its cobalt mine at Cobalt, Idaho.

Of six wildcat wells drilled in search of oil or gas, two were deep tests in Payette and Elmore Counties; all were dry holes.

Interest in geothermal energy mounted in Idaho in 1973. About 30% of the State appears to have geothermal resource potential, and 25 favorable sites were identified in a report released by the Idaho Department of Water Administration. Regulations governing the leasing of State-owned lands for geothermal exploration and development were expected to be ready in early 1974. At least two companies filed for or acquired leases for geothermal drilling.

Environmental quality continued to receive attention in 1973. Construction of the Bureau of Mines pilot plant at Bunker Hill's Kellogg lead smelter, to evaluate the citrate process for removing SO_2 from stack gases, began in the second quarter of the year. The U.S. Geological Survey and the Federal Bureau of Mines began a 3-year study of mineral resources in the Boulder-Pioneer Mountains, which was under consideration for classification as a wilderness area. The establishment of a National Park within the Sawtooth National Recreation Area (NRA) was being considered, as was legislation for the creation of a Hells Canyon NRA.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—Production of antimony ore and concentrate fell for the second year to 322 tons of contained antimony. The metal was recovered at Sunshine Mining Co.'s electrolytic antimony plant at Big Creek, near Wallace, Shoshone County.

Cadmium.—A significant part of the United States supply of newly mined cadmium in 1973 was produced in Idaho as a byproduct of zinc smelting.

Copper.—The production of copper rose 23% to 3,625 tons, valued at $4.3 million. Silver King Mines, Inc., made plans to expand production at its Copper Cliff mine, in the Seven Devils district, Adams County, from 300 tons per day to 800 tons per day. Hanna Mining Co. decided to drop its option on the Iron Creek copper-cobalt

property of Pom Corp.

Gold.—Gold production dropped 7% to 2,696 troy ounces, but soaring prices increased the value of the gold produced by 56% to $264,000. The Lucky Friday mine in Shoshone County was by far the largest producer, yielding nearly half of the State's output.

Iron Ore.—Shipments of iron ore decreased 10% in 1973. The ore was produced at two localities: The Birch Creek mine of E. J. Wilson and Sons in Clark County, and the Iron Mountain mine of C & W Sand & Gravel Co. in Washington County.

Table 4.—Idaho: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing [1]		Material sold or treated [2] (short tons)	Gold		Silver	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
Total:							
1971	26	--	1,646,661	3,596	$148,336	19,139,575	$29,589,785
1972	19	2	1,394,135	2,884	169,003	14,250,725	24,012,469
1973:							
Adams	1	--	84,396	--	--	36,564	93,531
Camas	1	--	29	2	196	620	1,586
Clark	1	--	9	--	--	--	--
Custer	4	--	98,545	137	13,400	125,846	321,914
Kootenai	1	--	330	29	2,836	4,829	12,353
Lemhi	4	--	750	49	4,792	908	2,323
Shoshone	14	--	1,473,926	2,477	242,273	13,449,859	34,404,743
Undistributed [3]	3	--	228	2	196	1,198	3,065
Total	29	--	1,658,213	2,696	263,693	13,619,824	34,839,515

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Total:							
1971	3,776	$3,926,728	66,610	$18,384,444	45,078	$14,515,036	$66,564,329
1972	2,942	3,012,572	61,407	18,459,024	38,647	13,719,649	59,372,717
1973:							
Adams	968	1,151,780	--	--	--	--	1,245,311
Camas	(4)	39	1	410	1	488	2,719
Clark	--	--	5	1,751	--	--	1,751
Custer	136	162,300	871	283,898	1,088	449,606	1,231,118
Kootenai	--	--	--	--	--	--	15,189
Lemhi	15	18,244	--	--	--	--	25,359
Shoshone	2,505	2,981,319	60,860	19,828,253	45,016	18,600,582	76,057,170
Undistributed [3]	--	--	6	1,818	2	870	5,949
Total [5]	3,625	4,313,682	61,744	20,116,130	46,107	19,051,546	78,584,566

[1] Operations at old mill or miscellaneous cleanups not counted as producing mines.
[2] Does not include gravel washed.
[3] Includes Blaine and Butte Counties combined to avoid disclosing individual company confidential data.
[4] Less than ½ unit.
[5] Data may not add to totals shown because of independent rounding.

Table 5.—Idaho: Mine production of gold, silver, copper, lead, and zinc in 1973, by class of ore or other source material, in terms of recoverable metal

Source	Number of mines	Material sold or treated (thousand short tons)	Gold (troy ounces)	Silver (thousand troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Gold-silver	1	(1)	41	(1)	(1)	--	--
Silver	8	436	673	7,937	1,978	1,012	768
Copper	5	93	105	39	1,104	--	--
Lead	7	245	1,365	3,365	251	26,084	2,045
Lead-zinc	6	874	509	2,278	290	34,639	42,871
Zinc	2	9	3	(1)	(1)	9	423
Total [2]	29	1,658	2,696	13,620	3,625	61,744	46,107

[1] Less than ½ unit.
[2] Data may not add to totals shown because of independent rounding.

Table 6.—Idaho: Mine production of gold, silver, copper, lead, and zinc in 1973, by type of material processed and method of recovery, in terms of recoverable metal

Type of material processed and method of recovery	Gold (troy ounces)	Silver (thousand troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Smelting of concentrates from ore	2,614	13,611	3,610	61,688	46,060
Direct smelting of ore	82	9	15	56	47
Total	2,696	13,620	3,625	61,744	46,107

Lead.—Production of lead increased only 1% to 61,744 tons, but value increased 9% to over $20 million. Of the 21 mines in six counties, four remained among the 25 top lead-producing mines in the Nation; these were the Bunker Hill, Lucky Friday, Star Morning, and Dayrock mines, all in Shoshone County.

Silver.—Silver production decreased 4% in 1973 to 13.6 million troy ounces owing to a 4-month strike at the Sunshine mine, but its value rose 45% to nearly $35 million. More than 85% of the State's silver production was accounted for by four mines: The Galena mine yielded 4.2 million ounces; the Sunshine mine, 3.1 million ounces; the Lucky Friday mine, 2.7 million ounces; and the Bunker Hill mine, 1.6 million ounces. By mid-January, the Sunshine mine was operating at about 40% of the level of production sustained before the fire in May 1972, and the company's management planned to be at full production at the end of March; however, on March 12, the mine was shut down by a strike that lasted 4 months. Ore reserves at the Coeur project in Shoshone County, of which the American Smelting and refining Company (Asarco) is the operator, were estimated at 758,000 tons, assaying nearly 24 ounces of silver per ton as of January 1, 1973.

Tungsten.—Small amounts of tungsten concentrates were shipped from the Quartz Creek mine, Yellow Pine district, Valley County, and concentrates were being stockpiled at the Golden Gate mill, also in the Yellow Pine district.

Vanadium.—Production of vanadium decreased 1% in 1973, and value declined 5%. The element was recovered as the pentoxide from byproduct ferrophosphorous slag produced in Caribou County by the Kerr-McGee Corp. The slag was processed at its phosphate fertilizer plant in Soda Springs, Caribou County. Some of the slag was shipped to Union Carbide Corp. at Hot Springs, Ark.

Zinc.—The production of zinc rose 19% in 1973 to 46,107 tons, and the value rose 39% to over $19 million. The Bunker Hill and Star-morning mines accounted for most of the State's production.

NONMETALS

Cement.—The production and value of portland cement rose 19% in 1973. The production of masonry cement remained unchanged, but the value fell 24%. Both

types of cement were manufactured by Idaho Portland Cement, Division of Oregon Portland Cement Co., Inkom, Bannock County.

Clays.—The production of clays of all types declined 26% in 1973, to 42,088 tons and value decreased 45% to $227,000. Fire clay was produced by A. P. Green Refractories Co. in Latah County, kaolin by J. R. Simplot Co. in Latah County, and bentonite by E. J. Wilson & Sons in Clark County.

Fluorspar.—No fluorspar was mined in Idaho in 1973, but exploration and development continued West of Challis in Custer County at the Ozark Mahoning Co. claims on Garden Creek, and at the NL Industries, Inc., claims on Bay Horse Creek.

Garnet.—Production of abrasive-grade garnet rose 43% in 1973; value rose 44%. The garnet was produced by two companies, Emerald Creek Garnet Milling Co. and Idaho Garnet Abrasive Co., from deposits near Fernwood, Benewah County.

Gem Stones.—The value of gem stone materials collected in Idaho in 1973 was estimated at $110,000, up 5% from the value in 1972. Collection continued to be centered around the Emerald Creek deposit near Fernwood, Benewah County, where star garnets (almandite) are found, and at the precious opal digging site northeast of Spencer, Clark County.

Gypsum.—Gypsum was mined in Lemhi County by E. J. Wilson and Sons, and in Washington County by Consumers Co-op Association.

Lime.—The Utah-Idaho Sugar Co. in Bonneville County, and the Amalgamated Sugar Co. in Canyon, Minidoka, and Twin Falls Counties, produced lime for beet-sugar processing and water purification. Output rose 4% in 1973.

Perlite.—Production of perlite rose 35%, and its value increased 87% in 1973. The crude perlite was produced at the open pit operation of Oneida Perlite Corp. near Malad City, Oneida County.

Phosphate Rock.—Phosphate rock production increased 16% in 1973, and its value rose 61%. The phosphate rock was produced at five mines in Bingham County and Caribou County. In Bingham County, it was produced at the Gay mine of J. R. Simplot Co.; in Caribou County, it was produced at the Conda mine of J. R. Simplot Co., the Henry mine operated by Monsanto Co., the Wooley Valley mine operated by Stauffer Chemical Co., and the Dry Valley mine operated by Agricultural Products Corp.

Pumice.—Production of pumice in Idaho in 1973 amounted to 80,204 short tons, valued at $110,000. The pumice was quarried at four locations in Bonneville, Caribou and Oneida Counties. It was used in road construction (including maintenance and ice control) as an additive and aggregate in concrete, and as an abrasive.

Sand and Gravel.—The output of sand and gravel increased 9% to 8.4 million tons, but value remained about the same as in 1972, at $10.2 million. Production was reported in 35 of the 44 counties in the State. Canyon County was the leading producer, followed by Kootenai and Ada Counties.

Stone.—Production of stone decreased 4% in 1973 to 3.0 million tons, and value rose 15% to $8.1 million. Sixty-seven quarries in 19 counties were active. Nez Perce County led the State in stone production. Only about 8,000 tons went into dimension stone, so virtually all of the stone was produced as crushed and broken stone. A high proportion was used as construction material. The main type produced was trap rock (56%), followed by quartzite, limestone, granite, and much smaller amounts of marble and sandstone.

Table 7.—Idaho: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	6	55	31	123
Building	554	1,064	852	1,431
Fill	W	W	125	112
Filtration	--	--	1	3
Glass	80	740	46	184
Paving	182	164	55	98
Other uses [1]	288	263	54	76
Total [2]	1,111	2,286	1,164	2,027
Gravel:				
Building	643	1,262	1,250	1,965
Fill	658	483	329	285
Paving	1,329	1,788	2,535	3,364
Miscellaneous	W	W	141	166
Other uses	83	78	75	76
Total [2]	2,714	3,610	4,330	5,855
Government-and-contractor operations:				
Sand:				
Building	1	2	18	7
Fill	25	16	20	14
Paving	373	761	36	71
Other uses	1	1	12	19
Total	400	780	86	111
Gravel:				
Building	160	107	144	86
Fill	322	95	510	162
Paving	2,817	3,276	2,109	1,949
Other uses	172	140	49	55
Total [2]	3,471	3,618	2,813	2,252
Total sand and gravel [2]	7,696	10,294	8,393	10,246

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes other industrial sands.
[2] Data may not add to totals shown because of independent rounding.

Table 8.—Principal producers

Commodity and company	Address	Type of activity	County
METALS			
Antimony: Sunshine Mining Co	P.O. Box 1080 Kellogg, Idaho 83837	Mine and plant	Shoshone.
Copper:			
American Smelting and Refining Co.	Wallace, Idaho 83873	Mine and mill	Do.
Sunshine Mining Co	Kellogg, Idaho 83837	----do	Do.
Gold: Hecla Mining Co	Wallace, Idaho 83873	----do	Do.
Lead:			
Bunker Hill Co	Kellogg, Idaho 83837	Mine, mill, smelter.	Do.
Hecla Mining Co	----do	----do	Do.
Silver:			
American Smelting and Refining Co.	Wallace, Idaho 83873	Mine and mill	Do.
Bunker Hill Co	Kellogg, Idaho 83837	----do	Do.
Day Mines, Inc	Wallace, Idaho 83873	----do	Do.
Hecla Mining Co	----do	----do	Do.
Sunshine Mining Co	Kellogg, Idaho 83837	----do	Do.
Tungsten: Salmon River Scheelite Corp.	Clayton, Idaho 83227	Mine and plant	Valley.
Vanadium: Kerr-McGee Corp.[1]	P.O. Box 478 Soda Springs, Idaho 83276	Plant	Caribou.
Zinc: Bunker Hill Co	Kellogg, Idaho 83837	Mine, mill, smelter.	Shoshone.

See footnote at end of table.

Table 8.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
NONMETALS			
Cement: Idaho Portland Cement Co., division of Oregon Portland Cement Co.	111 S.E. Madison St. Portland, Ore. 97214	Plant	Bannock.
Clays:			
Burley Brick & Sand Co	P.O. Box 497 Burley, Idaho 83318	Pit and plant	Cassia.
A. P. Green Refractories Co	3504 9th St. Troy, Idaho 83871	do	Latah.
Pullman Brick Co., Inc	7901 Warm Springs Ave. Boise, Idaho 83706	do	Ada and Elmore.
J. R. Simplot Co	P.O. Box 647 Bovill, Idaho 83806	do	Latah.
Garnet:			
Emerald Creek Garnet Milling Co.	Box 91 Fernwood, Idaho 83830	Mine and plant	Benewah.
Idaho Garnet Abrasive Co	P.O. Box 1080 Kellogg, Idaho 83837	do	Do.
Peat: Idaho Peat Industries Inc	Downey, Idaho 83234	Bog	Bannock.
Perlite (crude and expanded):			
Oneida Perlite Corp	P.O. Box 162 Malad City, Idaho 83252	Pit and plant	Oneida.
Phosphate Rock:			
Agricultural Products Corp	Box 37 Conda, Idaho 83230	Mine and plant	Caribou.
Monsanto Co	800 North Lindbergs & Olive St. Rd. St. Louis, Mo. 63104	do	Do.
J. R. Simplot Co	Box 912 Pocatello, Idaho 83201	Mine	Bingham.
	Conda, Idaho 83230	Mine and plant	Caribou.
Stauffer Chemical Co	636 California St. San Francisco, Calif. 94119	Mine	Do.
Pumice:			
Hess Pumice Products	P.O. Box 209, Malad City, Idaho 83252	Mine and plant	Oneida.
Producer's Pumice	6001 Fairview Ave. Boise, Idaho 83704	Mine	Bonneville.
Sand and gravel:			
Idaho Concrete Pipe Co., Inc	222 Caldwell Blvd. Nampa, Idaho 83651	Stationary plant	Canyon.
Materne Bros	Box O Rosewood Station Spokane, Wash. 99208	do	Kootenai.
Quinn-Robbins Co	703 American Blvd. Boise, Idaho 83706	do	Ada.
Ready-to-Pour-Concrete Co	P.O. Box 1221 Idaho Falls, Idaho 83401	5 stationary and 3 dredge plants.	Ada, Bonneville, Bingham, Twin Falls.
Seubert Excavators Inc	P.O. Box 57 Cottonwood, Idaho 83522	2 portable plants.	Latah and Idaho.
Stone:			
Bannock Paving Co	Box 4002 Alemeda Branch Pocatello, Idaho 83201	Quarry and plant.	Bannock and Oneida.
Bristol Northwest Silica Co	10818 Northwest St. Helens Rd. Portland, Oregon 97321	do	Washington.
DeAtley Corp	Box 648 Lewiston, Idaho 83501	do	Idaho and Lewis.
Idaho Portland Cement Co	222 Caldwell Blvd. Nampa, Idaho 83651	Pit and plant	Bannock.
Monsanto Quartzite	P.O. Box 816 Soda Springs, Idaho 83276	do	Caribou.

[1] Recovered from byproduct ferrophosphorus.

The Mineral Industry of Illinois

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Illinois State Geological Survey, under a memorandum of understanding for collecting information on all minerals except mineral fuels.

By Grace N. Broderick [1]

The value of mineral production in Illinois in 1973 was $825.6 million, a 7.3% increase above the record high of $769.7 million set in 1972. Illinois ranked 10th among the States in value of mineral production. Mineral fuels continued to account for the major part of the total mineral value, nonmetals comprised 30.5%, and metals accounted for the remainder. Illinois ranked first nationally in the production of fluorspar, tripoli, and iron oxide pigments, second in output of stone and peat, and fourth in output of sand and gravel and coal. Coal remained the leading commodity in mineral value, accounting for $413.3 million, or 50.1% of the State total. Output of bituminous coal in 1973 was 61.6 million tons, a de-

[1]Physical scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Mineral production in Illinois [1]

Mineral		1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Cement:					
Portland	thousand short tons	1,571	$33,124	1,572	$36,064
Masonry	do	80	2,483	88	2,901
Clays [2]	do	1,716	3,314	1,758	3,613
Coal (bituminous)	do	65,523	402,481	61,572	413,309
Fluorspar	short tons	132,405	9,961	160,305	11,871
Gem stones		NA	2	NA	2
Lead (recoverable content of ores, etc.)	short tons	1,335	401	541	176
Natural gas	million cubic feet	1,194	334	1,638	573
Peat	thousand short tons	74	935	72	1,037
Petroleum (crude)	thousand 42-gallon barrels	34,874	121,013	30,669	132,490
Sand and gravel	thousand short tons	39,929	61,696	43,649	62,029
Stone	do	[3] 56,260	[3] 94,225	66,653	114,068
Zinc (recoverable content of ores, etc.)	short tons	11,378	4,039	5,250	2,169
Value of items that cannot be disclosed: Clays (fuller's earth), lime, natural gas liquids, silver, dimension stone–1972, and tripoli		XX	35,729	XX	45,306
Total		XX	769,737	XX	825,608
Total 1967 constant dollars		XX	635,110	XX	[p] 606,161

[p] Preliminary. NA Not available. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers.)
[2] Excludes fuller's earth; included with "Value of items that cannot be disclosed."
[3] Excludes dimension stone; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Illinois, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adams	$3,056	$3,334	Stone, lime, sand and gravel, petroleum.
Alexander	W	W	Tripoli, sand and gravel.
Bond	W	W	Sand and gravel, petroleum, clays.
Boone	626	650	Stone, sand and gravel.
Brown	26	33	Sand and gravel, clays, petroleum.
Bureau	432	581	Sand and gravel, stone.
Calhoun	W	W	Stone, sand and gravel.
Carroll	W	W	Do.
Champaign	737	701	Sand and gravel.
Christian	W	W	Coal, petroleum, stone.
Clark [2]	W	W	Stone, petroleum, sand and gravel.
Clay	W	W	Petroleum, stone.
Clinton	W	W	Petroleum, stone, sand and gravel.
Coles	2,353	W	Stone, petroleum, natural gas, sand and gravel.
Cook	42,800	53,423	Stone, lime, sand and gravel, clays, peat.
Crawford	6,407	6,081	Petroleum, sand and gravel.
Cumberland [2]	W	110	Sand and gravel, stone.
De Kalb	W	W	Do.
De Witt	W	W	Petroleum, sand and gravel.
Douglas	27,353	37,303	Natural gas liquids, coal, stone, petroleum.
Du Page	3,558	W	Sand and gravel, stone.
Edgar	390	484	Petroleum.
Edwards	1,898	1,961	Do.
Effingham	1,054	1,114	Do.
Fayette	13,643	14,785	Petroleum, stone, sand and gravel, clays.
Ford	W	628	Sand and gravel.
Franklin	48,078	45,987	Coal, petroleum.
Fulton	W	W	Coal, sand and gravel.
Gallatin	19,011	W	Coal, petroleum, sand and gravel, natural gas.
Greene	W	W	Stone.
Grundy	W	W	Sand and gravel, clays.
Hamilton	4,028	4,055	Petroleum.
Hancock	805	1,085	Stone.
Hardin	15,346	16,956	Fluorspar, stone, zinc, lead, silver, sand and gravel.
Henderson	522	W	Stone.
Henry	W	W	Do.
Iroquois	W	W	Stone, sand and gravel.
Jackson	W	W	Stone, coal, sand and gravel.
Jasper	2,332	2,840	Petroleum, sand and gravel.
Jefferson	62,485	68,619	Coal, petroleum.
Jersey	190	219	Stone.
Jo Daviess	3,075	2,214	Sand and gravel, zinc, stone, lead, silver.
Johnson	W	W	Stone, coal.
Kane	6,373	10,042	Sand and gravel, stone, peat.
Kankakee	6,924	5,138	Coal, stone, clays, sand and gravel.
Kendall	W	692	Stone, sand and gravel.
Knox	W	W	Coal, stone, clays.
Lake	W	W	Sand and gravel, peat, stone.
La Salle	W	W	Cement, sand and gravel, clays, stone.
Lawrence	W	16,674	Petroleum, sand and gravel.
Lee	W	W	Cement, stone, sand and gravel.
Livingston	W	W	Stone, clays, sand and gravel.
Logan	W	W	Sand and gravel, stone.
McDonough	813	1,054	Stone, petroleum, clays.
McHenry	W	10,073	Sand and gravel.
McLean	W	746	Do.
Macon	W	934	Sand and gravel, petroleum.
Macoupin	W	W	Coal, stone.
Madison	W	3,102	Stone, sand and gravel, petroleum.
Marion	W	W	Petroleum, stone.
Marshall	W	59	Sand and gravel.
Mason	W	41	Do.
Massac	W	W	Cement, stone, sand and gravel.
Menard	W	W	Stone.
Mercer	W	W	Stone, coal.
Monroe	W	W	Stone.
Montgomery	12,556	W	Coal, stone, petroleum.
Moultrie	W	W	Sand and gravel, petroleum.

See footnotes at end of table.

Table 2.—Value of mineral production in Illinois, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Ogle	W	W	Sand and gravel, stone.
Peoria	$16,124	$14,319	Coal, sand and gravel, stone.
Perry	54,502	56,412	Coal, petroleum.
Pike	W	W	Stone, sand and gravel.
Pope	W	3	Sand and gravel.
Pulaski	W	W	Clays, stone, sand and gravel.
Putnam	W	11	Sand and gravel.
Randolph	W	W	Coal, stone, sand and gravel, petroleum.
Richland	3,815	4,605	Petroleum.
Rock Island	W	2,955	Stone, sand and gravel.
St. Clair	41,961	43,256	Coal, stone, petroleum, sand and gravel.
Saline	19,406	21,547	Coal, petroleum, natural gas.
Sangamon	W	2,604	Sand and gravel, stone.
Schuyler	W	W	Do.
Scott	W	W	Stone, clays, sand and gravel.
Shelby	W	W	Stone, sand and gravel, petroleum.
Stark	W	W	Coal, sand and gravel.
Stephenson	532	845	Stone, sand and gravel.
Tazewell	W	W	Sand and gravel, clays.
Union	W	W	Stone, sand and gravel.
Vermilion	2,058	W	Stone, sand and gravel, clays.
Wabash	W	W	Petroleum, coal, sand and gravel.
Warren	W	W	Stone.
Washington	W	W	Petroleum, stone.
Wayne	12,403	13,862	Petroleum.
White	16,522	16,260	Petroleum, sand and gravel.
Whiteside	2,340	W	Stone, peat, sand and gravel.
Will	10,813	14,146	Stone, sand and gravel.
Williamson	30,030	29,092	Coal, petroleum, natural gas, stone.
Winnebago	3,575	2,953	Stone, sand and gravel.
Woodford	1,173	2,026	Sand and gravel.
Undistributed [3]	267,610	288,998	
Total [4]	769,737	825,608	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Cass, Morgan, and Piatt Counties are not listed because no production was reported. Value of petroleum is based on an average price per barrel for the State.

[2] Value of petroleum production in Cumberland County is included with Clark County because actual source of production cannot be identified.

[3] Includes some sand and gravel, stone, and petroleum that cannot be assigned to specific counties, gem stones, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Illinois business activity

	1972	1973 [p]	Change, percent
Labor force and employment, annual average:			
Total labor force ---- thousands	4,859.0	4,903.3	+.9
Unemployment ---- do	246.0	202.0	−17.9
Employment (nonagricultural):			
Manufacturing ---- do	1,269.5	1,321.1	+4.1
Construction ---- do	180.3	184.4	+2.3
Mining ---- do	23.4	23.1	−1.3
Transportation and public utilities ---- do	280.3	279.9	−.1
Wholesale and retail trade ---- do	940.4	944.9	+.5
Finance, insurance, and real estate ---- do	239.0	244.0	+2.1
Government ---- do	654.8	654.7	--
Personal income:			
Total ---- millions	$57,829	$64,639	+11.8
Per capita	$5,140	$5,753	+11.9
Construction activity:			
Value of authorized nonresidential private construction ---- millions	$936.8	$941.6	+.5
Number of private and public residential permits issued	79,370	65,874	−17.0
Portland cement shipments to and within Illinois ---- thousand short tons	3,606	4,149	+15.1
Mineral production value ---- millions	$769.7	$825.6	+7.3

[p] Preliminary.

Source: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

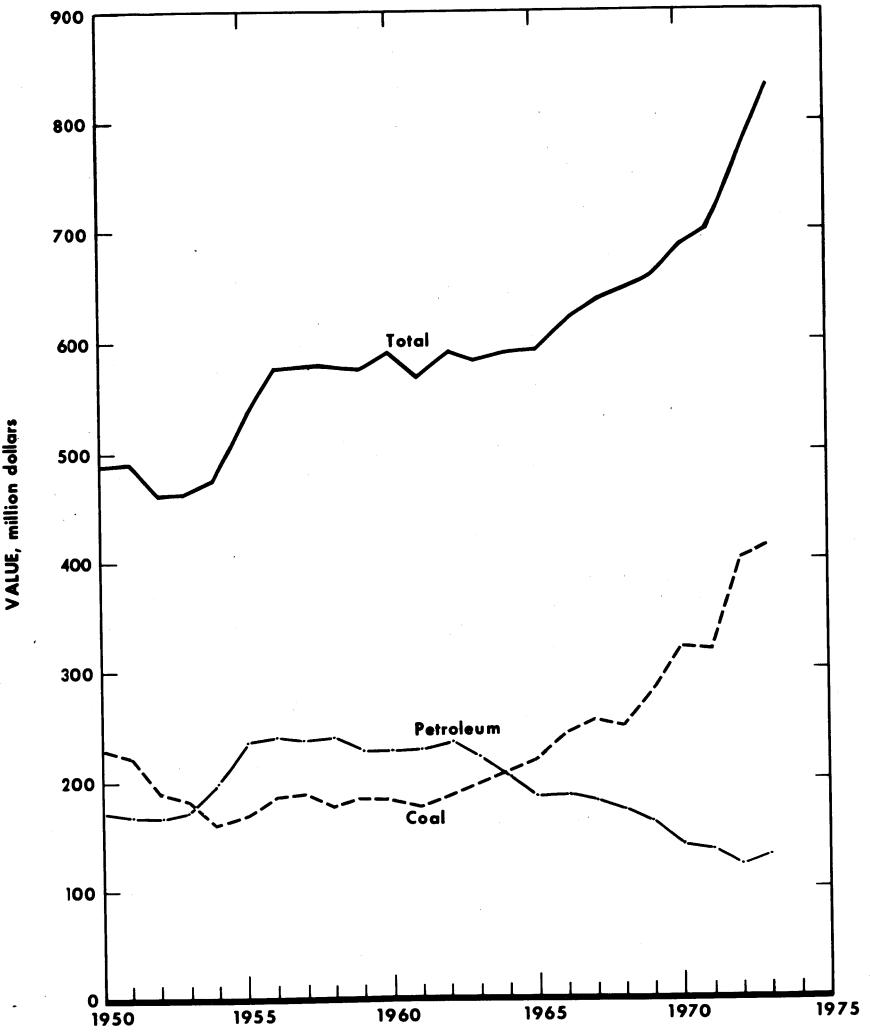

Figure 1.—Value of coal, petroleum, and total value of mineral production in Illinois.

crease of 6.0% in quantity from that of 1972; however, total value of coal production increased 2.7%. Production of crude petroleum was 30.7 million barrels, 4.2 million barrels less than that of 1972; in value, it accounted for $132.5 million or 16.0% of the total mineral output of the State. Marketed production of natural gas increased 37.2% in quantity and 71.6% in value. A number of synthetic natural gas plants were either under construction or in the planning stages. Production of liquefied petroleum gases increased only slightly, but value rose 35.6%; natural gasoline production decreased 6.6%, whereas value remained about the same. Production of peat, as measured by sales, decreased in quantity but increased in value.

Among the nonmetallic mineral com-

modities, stone ranked first in value, followed by sand and gravel and cement. Combined output of sand and gravel and stone accounted for 21.3% of the State's total mineral value in 1973. Illinois supplied 64.5% of the total domestic output of fluorspar. Other nonmetallic minerals produced in Illinois were clays, gem stones, lime, and tripoli.

Production of 541 short tons of lead and 5,250 short tons of zinc represented decreases in terms of recoverable metal of 59.5% and 53.9%, respectively, from the 1972 figures. Value of lead production decreased 56.1%, and value of zinc production decreased 46.3%. The Bautsch mine, owned by Eagle-Picher Industries, Inc., located in northern Illinois near Galena (Jo Daviess County), closed in May; this was the last all-lead-zinc mine operating in the State. Small amounts of silver were recovered in smelter operations.

Plans to test a flue-gas scrubbing system on a coal-fired boiler unit at Southern Illinois University (SIU) were announced by Governor Daniel Walker. The test was proposed as an alternative to a State Legislature proposal disqualifying the State Pollution Control Board from regulating coal use for power generation. The scrubber test will determine the feasibility of continued burning of the State's high-sulfur coal. The scrubber installation cost of about $45,000 will be paid for by the Illinois Institute for Environmental Quality; SIU will pay all but $5,000 of the estimated $26,000 annual operating cost.

A $16 million transfer port to be built on the Ohio river about 3 miles from Metropolis, Ill., has been planned. The facility will permit the transshipment of low-sulfur western coal from rail to barge for delivery to powerplants (mainly in Indiana and Ohio).

The Kaskaskia Lock and Dam, near Roots, was completed after 5 years of construction and a number of setbacks. The new facility is a key segment in the multimillion-dollar canalization system on the Kaskaskia River. The system is designed to provide water access along 55 miles of the river to coal-rich areas of southern Illinois. The project required a total of 175,000 cubic yards of concrete, 16 million pounds of reinforcing steel, 560,000 sacks of cement, and 88,540 cubic feet of fly ash.

U.S. Industrial Chemicals Co., a division of National Distillers and Chemical Corp., has under construction a new sulfuric acid plant in Tuscola. The plant was expected to be in production by mid-1975.

Installation of a $2.5 million Wellman Power Gas sulfur dioxide recovery plant was completed in December 1972 at the Allied Chemical Corporation plant, on the south side of Chicago. It is the Nation's second unit and is specially designed to reduce sulfur dioxide emissions from sulfuric acid manufacturing plants. Allied Chemical produces sulfuric acid used primarily in the petroleum refining industry.

Legislation and Government Programs.—House Bill 128, a mineral sales tax bill, was passed by the Legislature and approved by the Governor. The bill provides for redistributing the 1% retail sales tax (on all minerals mined and sold in Illinois) to the counties where the minerals are mined, instead of the counties where they are sold or the order placed.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Illinois continued to rank fourth in the Nation in the production of bituminous coal. The State's output of 61.6 million tons, valued at $413 million, represented a decrease in tonnage of 6.0% but an increase in value of 2.7%. Bituminous coal production accounted for 50% of the State's total mineral value in 1973. The average value per ton (f.o.b. mine) for Illinois coal continued to rise; in 1973 the average value per ton was $6.71, compared with $6.14 per ton in 1972.

The utility market continued to be the largest consuming sector for Illinois coal, and its share of the market has been growing steadily since 1957. Until coal gasification and liquefaction plants are developed, the Illinois coal industry will continue to depend heavily on its ability to remain competitive in the utility fuel market.

Coal production in Illinois in 1973 (excluding mines producing less than 1,000 short tons annually) was reported from 55 mines, 4 less than were operating in 1972. Major producing counties were, in order of decreasing tonnage, Perry, Jefferson, St. Clair, Franklin, Randolph, Christian, Williamson, Fulton, Macoupin, and Saline. Underground mine production accounted for 52.9% of the coal produced in the State in 1973, compared with 48.4% in 1972.

Northern Illinois Gas Company and the State of Illinois agreed to support jointly the building of a coal gasification and liquefaction plant in central or southern Illinois. It is hoped that 50% of the $250 million cost will be provided by the Federal Office of Coal Research. When completed, the plant would be capable of processing 10,000 tons per day of high-sulfur Illinois coal to produce 80 to 90 million cubic feet of pipeline-quality gas and 10,000 barrels per day of "environmentally acceptable" crude oil. The demonstration plant, as presently planned, would be operational by 1980.

Commonwealth Edison Co. and the Electric Power Research Institute plan to build a demonstration coal gasification plant near Pekin. The $18-million plant, scheduled to be in operation by the end of 1975, will use the Lurgi process. It will convert about 65 tons per hour of high-sulfur Illinois coal to 5 million cubic feet per hour of clean, low-Btu (150-200) gas for use as a boiler fuel in a 75-megawatt generating unit at Edison's Powerton station at Pekin.

Three new mines that started production in 1973 were Consolidation Coal Co.'s Burning Star No. 4 strip mine near Jamestown which produces from both the Harrisburg (No. 5) and the Herrin (No. 6) coals; AMAX Coal Co.'s Wabash mine at Keensburg which produces Harrisburg (No. 5) coal; and Zeigler Coal Co.'s No. 5 mine near Murdock which produces from the Herrin (No. 6) coal. Zeigler Coal Co. became a subsidiary of Houston Natural Gas Corp. late in 1973.

Consolidation Coal Co. began preliminary construction of a new strip mine near Elkville. The mine, when readied for operation, will be the company's fourth strip mine in southern Illinois.

Two small strip coal mines began operation near Marion in Williamson County. Houston Coal Co.'s mine #3 opened at Crab Orchard, east of Marion, on June 18, 1973; Cold Water Coal Co. opened its mine west of Marion in July.

The Forsyth-Energy Company's strip mine, located two miles east of Energy in Williamson County, was closed permanently on February 5, 1973. It opened in 1947 and had produced 9,983,959 tons of coal. The mine operated for the last time in November 1972 and employed 55 men.

The State's northernmost underground coal mine, the Hazel Dell mine near New Windsor in Mercer County, was closed on May 1, 1973, due to collapse of the air shaft. All machinery was recovered by May 18, 1973. The mine opened on January 15, 1958, and had produced 456,714 tons of coal since its startup.

Additional mines closed were the No. 3 mine of Tab Mining Co., Inc. in Jackson County, which closed in January; E. & L Coal Co.'s mine in Pope County, which also closed in January; and the No. 1 mine of Deaton Coal Co. in Johnson County, which closed in July.

A Bureau of Mines report[2] estimated the demonstrated coal reserve base of Illinois on January 1, 1974, to be 65,665 million short tons. Of this total, 53,442 million tons is potentially minable by underground methods, and 12,223 million tons is potentially minable by surface methods. A report published by the Illinois State Geological Survey gives more detailed data on coal in the State.[3]

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[2] U.S. Bureau of Mines. Demonstrated Coal Reserve Base of the United States on January 1, 1974. Mineral Industry Survey, June 1974, 6 pp.

[3] Hopkins, M.E. and J.A. Simon, Coal Resources of Illinois. Ill. State Geol. Survey, Ill. Min. Note 53, 1974, 24 pp.

Table 4.—Illinois: Bituminous coal production in 1973, by type of mine and county
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines			Production (thousand short tons)			Value (thousands)
	Underground	Strip	Total	Underground	Strip	Total[1]	
Christian	1	--	1	4,147	--	4,147	W
Douglas	2	--	2	1,620	--	1,620	W
Franklin	3	--	3	6,482	--	6,482	$43,480
Fulton	--	3	3	--	3,136	3,136	21,434
Gallatin	2	1	3	1,557	310	1,867	15,156
Jackson	--	2	2	--	77	77	W
Jefferson	3	1	4	6,626	664	7,289	64,836
Johnson	--	1	1	--	5	5	W
Kankakee	--	1	1	--	414	414	W
Knox	--	1	1	--	1,016	1,016	W
Macoupin	1	--	1	2,695	--	2,695	W
Mercer	1	1	2	12	6	18	W
Montgomery	1	--	1	1,888	--	1,888	W
Peoria	--	3	3	--	1,758	1,758	11,889
Perry	--	5	5	--	11,212	11,212	56,346
Randolph	2	2	4	2,014	2,833	4,847	30,052
St. Clair	1	2	3	2,354	4,297	6,651	37,102
Saline	2	4	6	1,391	1,098	2,488	20,358
Stark	--	1	1	--	379	379	W
Wabash	1	--	1	38	--	38	W
Williamson	3	4	7	1,747	1,799	3,546	28,183
Undistributed	--	--	--	--	--	--	84,476
Total[1]	23	32	55	32,570	29,002	61,572	413,309

W Withheld to avoid disclosing individual company confidential data.
[1] Data may not add to totals shown because of independent rounding.

Coke.—Production of coke in 1973 was 1,941,000 tons, a decrease of 6.9% from the 2,085,000 tons produced in 1972. The Granite City Steel Div. of National Steel Corp. produced coke in Madison County. Three other companies produced coke in Cook County: Interlake Steel Corp. (a subsidiary of Interlake, Inc.), the Wisconsin Steel Div. of International Harvester Co., and Republic Steel Corp. Most of the coke was used by the producing companies in their own blast furnaces. Illinois coke plants carbonized 3,108,000 tons of coal. Illinois provided 37.4% of the 3,071,000 tons of coal received by its coke-oven plants. The remainder was received from other States, as follows: Kentucky 35.3%, West Virginia 19.3%, Arkansas 4.9%, Pennsylvania 1.7%, and Virginia 1.4%.

About 223,000 tons of coke breeze was recovered at the producing plants, an increase of 19.9% over the 186,000 tons recovered in 1972. Other byproducts of coke-oven operations in the State included coke-oven gas, ammonia, tar, and crude light oil.

Natural Gas.—Marketed production of natural gas in 1973 was 1,638 million cubic feet valued at $573,000, a 37.2% increase over the 1,194 million cubic feet (valued at $334,000) produced in 1972. About 85% of the gas was from the Mattoon field in Coles County; the remainder was from fields in Gallatin, Saline, and Williamson Counties.

According to estimates of the American Gas Association (AGA) proved natural gas reserves in Illinois on December 31, 1973, were 380,525 million cubic feet, compared with 545,361 million cubic feet on December 31, 1972.

A 235-acre site in Jackson Township was officially dedicated as the location of the new synthetic natural gas (SNG) plant being constructed by Peoples Gas Light and Coke Co. The site is about 5 miles south of Joliet. The plant, which is expected to have a capacity of 160 million cubic feet per day and cost $60 million, is expected to go on stream in the fall of 1975. The plant will purify and reform naphtha. Peoples Gas Light and Coke Co. has long-term contracts with Amoco Production Co. and Union Oil Co. of California for supply of feedstocks for the facility.

Natural Gas Liquids.—The quantity of natural gas liquids produced at U.S. Industrial Chemicals Co.'s natural gas processing plant in Douglas County increased

slightly over that of 1972; value increased 33.3%.

Peat.—Illinois produced 71,552 short tons of peat in 1973, 2.9% more than the 69,523 short tons produced in 1972. Production was reported by six companies from Cook, Kane, Lake, and Whiteside Counties.

Sales totaled 71,551 short tons, a decrease of 3.3% from 1972 sales. Humus, moss, and reed-sedge peat were sold in bulk and packaged forms. Packaged forms accounted for 90% of all sales. The majority of the peat was used for general soil improvement; a small amount was used for potting soils.

Illinois continued to rank second only to Michigan in output of peat in the United States, accounting for 11% of the Nation's total.

Petroleum.—Petroleum production in Illinois continued its downward trend for the 11th consecutive year. Output decreased 12.1% from 34.9 million barrels in 1972 to 30.7 million barrels in 1973. The value of crude petroleum provided 16% of the total State mineral output value.

According to the American Petroleum Institute (API), proved reserves of crude oil in Illinois totaled 152,343,000 barrels on December 31, 1973, compared with 174,883,000 barrels on December 31, 1972, a decrease of 12.9%.

Petroleum and Natural Gas Exploration and Development.—Total number of well completions in Illinois decreased from 602 wells in 1972 to 556 wells in 1973. Of the 556 wells drilled, 240 were completed as oil wells, 13 as gas wells, and 303 as dry holes for an overall success ratio of 45.5%. Of the exploratory wells, 11.7% were completed as oil and gas producers.

New fields discovered in 1973 were the Brubaker and Bannister fields in Marion County and the Nashville field in Washington County. The latter field, a Silurian producer, has estimated reserves of more than 1 million barrels and was the first field in the million-barrel class discovered in Illinois since 1963.[4]

Petroleum Refineries.—Performance at Mobil Oil Corp.'s new refinery near Joliet in Will County, which came into full operation in early 1973, exceeded expectations. The facility processed 175,000 barrels per day and on occasion operated at even higher levels. It was an important source of gasoline, heating oil, diesel fuels, and liquefied petroleum gas.

To expand production of gasoline and light fuel oil at its Robinson refinery in Crawford County, Marathon Oil Co. reactivated two units that had been closed in 1970 after a plant modernization program. A 75,000-barrel-per-day crude oil distillation unit and a 14,000-barrel-per-day catalytic reformer were put back into service.

Clark Oil & Refining Corp. was expanding the capacity of its Hartford (Wood River) refinery in Madison County by 45,000 barrels per day to 80,000 barrels per day. Completion of the expansion was scheduled for late 1974.

Texaco, Inc., was expanding capacities at its Lawrenceville and Lockport refineries in Lawrence and Will Counties, respectively.

[4] Van Den Berg, J., G.L. Carpenter, E. Nosow, and A. T. Statler. Developments in East-Central States in 1973. AAPG Bull. v. 58, No. 8, August 1974, pp. 1565–1574.

Table 5.—Illinois: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Adams	--	--	--	--	--	2	2	1,302
Bond	--	2	5	--	--	--	7	9,229
Brown	1	--	--	1	--	2	4	3,080
Champaign	--	--	--	--	--	1	1	289
Christian	2	--	4	--	--	2	8	15,180
Clark	--	--	3	1	--	6	10	16,915
Clay	24	--	14	1	--	17	56	165,906
Clinton	2	--	2	--	--	7	11	18,110
Coles	--	3	2	--	--	--	5	13,921
Crawford	5	1	1	--	--	--	7	7,584
Douglas	1	--	2	--	--	--	3	6,017
Edgar	4	2	1	1	1	2	11	4,925
Edwards	9	1	5	1	--	3	19	56,919
Effingham	1	--	4	--	--	2	7	17,617
Fayette	3	--	--	--	--	2	5	7,449
Franklin	1	--	1	--	--	5	7	23,424
Gallatin	4	1	3	2	--	2	12	29,323
Hamilton	1	--	--	--	--	1	2	6,805
Hancock	--	--	--	--	--	2	2	1,342
Jasper	10	--	2	2	--	6	20	54,380
Jefferson	1	--	4	--	--	2	7	17,914
Lawrence	38	--	3	--	--	3	44	73,534
McDonough	--	--	2	--	--	--	2	1,026
McLean	--	--	--	--	--	2	2	1,736
Macon	--	--	--	--	--	2	2	4,809
Macoupin	--	--	--	--	--	3	3	1,628
Madison	1	--	1	--	--	3	5	8,575
Marion	6	--	6	4	--	14	30	94,304
Montgomery	--	--	--	--	--	1	1	2,000
Perry	--	--	--	--	--	1	1	1,336
Pike	--	--	--	--	--	1	1	1,010
Randolph	--	--	--	--	--	4	4	8,999
Richland	13	--	10	2	--	5	30	90,569
St. Clair	--	--	--	--	--	7	7	11,358
Saline	1	2	3	1	--	5	12	30,907
Sangamon	10	--	15	--	--	7	32	54,937
Schuyler	--	--	1	--	--	--	1	523
Shelby	1	--	--	--	--	3	4	7,373
Vermilion	--	--	--	--	--	1	1	1,212
Wabash	10	--	6	1	--	1	18	42,201
Washington	25	--	4	2	--	22	53	137,141
Wayne	30	--	12	1	--	3	46	153,752
White	13	--	8	2	--	1	24	65,334
Williamson	1	--	6	--	--	20	27	78,198
Total	218	12	130	22	1	173	556	1,350,093

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

NONMETALS

Barite.—Minerva Oil Co. added a barite flotation unit to its principal mill near Cave in Rock (Hardin County) in order to recover barite associated with the fluorspar at its No. 1 mine.

Pfizer, Inc. Minerals Pigments & Metals Div. continued to, produce ground barite at its East St. Louis plant in St. Clair County.

Cement.—Portland and masonry cements were produced by three companies in 1973. These were the Marquette Cement Manufacturing Co. at its Oglesby plant, LaSalle County; the Medusa Cement Co., a division of Medusa Corp., at its Dixon plant, Lee County; and the Missouri Portland Cement Co. at its Joppa plant, Massac County. Portland cement shipments increased slightly in quantity and 8.9% in value; masonry cement shipments increased 10% in quantity and 16.8% in value.

Portland cement shipped included type I and II (general use and moderate heat), type III (high-early-strength), white, and waterproof. Raw materials used in making portland cement included limestone, sandstone, clay and shale, sand, gypsum, and iron-bearing materials. Disposition of portland cement by type of customer was as follows: ready-mix concrete companies (68%), concrete product manufacturers (7%); building material dealers (12%), and contractors and other users (13%).

Missouri Portland Cement Co. had underway an expansion program that was expected to more than double the plant capacity at Joppa. The new kiln is de-

signed with modern heat-recuperating devices to produce the rated annual output of 750,000 tons with minimum fuel usage. Initial production of this unit was expected to begin in 1975. A 7,500-horsepower finish grinding mill, one of the largest mills in the United States, was to be installed in the new facility. The new kiln, finish mill, and raw mill were expected to be fully automated.

Table 6.—Illinois: Portland cement salient statistics
(Short tons)

	1972	1973
Number of active plants	3	3
Production	1,540,281	1,530,833
Shipments from mills:		
Quantity	1,571,188	1,571,813
Value	$33,124,461	$36,064,129
Stocks at mills, Dec. 31	180,135	108,690

Table 7.—Illinois: Masonry cement salient statistics
(Short tons)

	1972	1973
Number of active plants	3	3
Production	76,004	84,575
Shipments from mills:		
Quantity	79,661	88,318
Value	$2,483,457	$2,900,675
Stocks at mills, Dec. 31	9,173	5,430

The Illinois Cement Co., a subsidiary of Centex Corp., was scheduled to complete installation of equipment at its new LaSalle plant in 1974; capacity of the plant was expected to be 376,000 tons.

Marquette Cement Manufacturing Co. completed an extensive modernization program at its Oglesby plant; capacity of the plant is 771,000 tons.

Clays.—Total production of fire clay and common clay and shale increased 2.4% in quantity and 9.0% in value in 1973. Production of fuller's earth remained about the same in quantity but decreased 3.4% in value.

Production of clay and shale was reported from 14 counties. Fire clay was produced in Grundy and Scott Counties.

In October 1973, the Illinois State Geological Survey canvassed clay products manufacturers in Illinois to determine the extent and types of fuels problems they were experiencing. A summary of the findings was published by that agency.[5]

Fluorspar.—Shipments of finished fluorspar totaled 160,305 tons valued at $11.9 million, an increase of 21.1% in quantity and 19.2% in value compared with that of 1972. The State continued to be the Nation's leading producer of fluorspar, supplying 64.5% of the output.

Minerva Oil Co. and Ozark-Mahoning Co., with operations in Hardin County, continued to be the dominant producers.

Minerva Oil Co. resumed sinking a shaft at its Spivey development with a depth of 650 feet targeted for yearend. The company added a barite flotation annex to its principal mill near Cave in Rock and planned to begin saving much of the barite associated with many of the deeper fluorspar ore reserves at its No. 1 mine.

Ozark-Mahoning Co. began hoisting all ore from its Davis mine complex through a new, fully automated shaft at its heavy-media plant. The company's new Knight mine began producing ore from development drifting and from the second- and third-level stopes.

In December 1973, it was announced that Pennwalt Corp. and Ozark-Mahoning Co. had merged; the latter will be in charge of all Pennwalt's domestic fluorspar operations.

Gem Stones.—Small quantities of gem materials and mineral specimens continued to be collected in 1973. Estimated total value of the materials in 1973 remained about the same as the 1972 estimate.

Gypsum.—National Gypsum Co. calcined gypsum at its Waukegan plant in Lake County. Output increased 16%, establishing a new annual record.

The Illinois State Geological Survey released a report on byproduct gypsum as a resource in the State.[6]

Lime.—Illinois ranked sixth in the Nation in lime production. Output in the State increased 13.4% compared with that of 1972, and surpassed the 1969 record high by 8.5%. Producing companies were Marblehead Lime Co., with four plants in Adams and Cook Counties, and

[5] Major, R.L. The energy crisis and its potential impact on the Illinois clay products industry. Ill. State Geol. Survey, Ill. Min. Note 55, 1974, 15 pp.
[6] Ehringer, H.P., III, B.F. Bohor, and G.C. Finger. By-Product Gypsum in Illinois—A New Resource? Ill. State Geol. Survey, Ill. Min. Note 50, 1973, 16 pp.

Vulcan Materials Co., with a plant in Cook County. The lime was used in steel furnaces, refractories, water purification, and for other purposes. Total lime consumption in Illinois was 1,202,000 tons; Illinois lime was also shipped to Indiana, other States, and Canada.

Perlite.—Crude perlite mined outside the State was expanded by five companies with plants in Cook, DeKalb, Lake, and Will Counties. Sales of the expanded product increased 3.0% in quantity but decreased 2.2% in value. The principal use was for roof insulation, which accounted for 73.3% of the total. Other uses included concrete aggregate, filter aid, low-temperature insulation, plaster aggregate, and horticultural aggregates. Illinois continued to lead the country in production of expanded perlite and also in the quantity used and sold by producers.

Sand and Gravel.—Production of sand and gravel in 1973 was 43.6 million tons valued at $62.0 million. Counties from which over 1 million tons was produced were Cook, DuPage, Grundy, Kane, Lake, LaSalle, McHenry, Sangamon, Will and Woodford.

Of the total sand and gravel produced, 49.4% was used as paving material, 33.5% as building material, and the remainder as industrial sands, railroad ballast, and fill. The average value of the total sand and gravel produced was $1.42 per ton, compared with $1.55 per ton in 1972. The State continued to rank fourth in the Nation in quantity and fourth in value of sand and gravel produced.

Table 8.—Illinois: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	134	W	W	W
Building	6,585	7,753	6,960	8,829
Fill	2,541	2,312	2,764	2,746
Glass	2,367	7,330	904	2,450
Molding	1,362	5,668	710	2,537
Paving	7,819	8,998	9,769	12,641
Other uses [1]	1,310	6,222	835	1,421
Total [2]	22,117	38,284	21,944	30,623
Gravel:				
Building	6,632	8,574	7,675	10,596
Fill	1,528	1,504	1,526	1,658
Paving	8,590	12,175	11,320	17,701
Miscellaneous	312	371	428	609
Other uses [3]	352	419	276	372
Total [2]	17,416	23,044	21,227	30,936
Government-and-contractor operations:				
Sand:				
Building	(4)	(4)	--	--
Fill	36	2	1	1
Paving	42	44	12	18
Other uses	--	--	1	1
Total [2]	78	46	14	19
Gravel:				
Building	3	2	--	--
Fill	18	35	2	2
Paving	298	286	463	449
Other uses	(4)	(4)	--	--
Total [2]	318	323	465	451
Total sand and gravel [2]	39,929	61,696	43,649	62,029

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes abrasives (1972), chemicals (1972), enamel (1972), engine (1972), foundry, grinding and polishing (1973), oil (hydrafrac), and other sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast.
[4] Less than ½ unit.

Table 9.—Illinois: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Boone	4	W	W	4	147	W
Brown	1	12	12	1	13	13
Bureau	10	417	432	8	400	575
Calhoun	--	--	--	1	4	2
Champaign	9	673	722	8	656	701
Clark	4	359	457	4	366	480
Clinton	5	153	133	5	196	207
Coles	4	239	W	2	153	177
Cook	4	911	W	6	1,475	2,050
Crawford	3	347	294	3	490	329
Cumberland	2	W	W	1	65	102
De Kalb	5	1,086	W	5	534	676
Du Page	5	549	671	4	W	W
Ford	6	W	W	7	497	628
Gallatin	2	260	259	2	W	W
Hardin	--	--	--	1	3	3
Henderson	1	(1)	(1)	--	--	--
Jackson	1	50	57	1	W	W
Jasper	--	--	--	1	13	18
Kane	10	3,203	4,001	11	5,415	7,517
Kankakee	2	16	W	2	W	W
Lake	6	849	1,080	7	1,483	W
La Salle	14	4,898	17,634	13	2,119	4,613
Lawrence	4	458	467	4	316	415
Logan	5	438	511	5	486	661
McHenry	16	W	W	15	7,744	10,073
McLean	17	W	W	5	573	746
Macon	4	W	W	4	W	912
Madison	3	341	382	2	W	W
Marshall	4	W	W	1	39	59
Mason	2	W	W	1	27	41
Moultrie	1	13	W	1	13	W
Pope	1	2	(1)	1	4	3
Pulaski	--	--	--	1	5	3
Putnam	1	W	W	1	8	11
Rock Island	5	W	785	4	W	W
St. Clair	1	W	181	1	W	W
Sangamon	4	880	1,150	4	1,092	1,702
Stephenson	1	71	133	1	93	156
Union	1	16	12	2	20	15
Vermilion	7	304	215	6	325	231
Wabash	3	170	W	3	151	147
White	5	1,106	993	4	475	624
Whiteside	2	W	W	2	230	325
Will	12	3,272	4,588	10	3,313	5,128
Winnebago	9	1,414	1,454	8	893	953
Woodford	5	702	1,173	5	1,057	2,026
Undistributed [2]	r 60	16,721	23,902	56	12,756	19,710
Total [3]	271	39,929	61,696	244	43,649	62,029

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Includes Adams, Alexander, Bond, Carroll, DeWitt, Fayette, Fulton, Grundy, Henry (1972), Iroquois, Jo Daviess, Kendall, Lee, Livingston, McDonough (1972), Massac, Ogle, Peoria, Pike, Randolph, Schuyler, Scott, Shelby, Stark and Tazewell Counties, and some sand and gravel that cannot be assigned to specific counties.

[3] Data may not add to totals shown because of independent rounding.

Stone.—Illinois, with a production of 66.7 million tons, continued to rank second only to Pennsylvania in total tonnage of stone produced in the United States.

Major producing counties, each with production of over 1 million short tons, were Clark, Cook, DuPage, Hardin, Johnson, Kane, LaSalle, Lee, Livingston, Montgomery, Randolph, Rock Island, St. Clair, Union, Vermilion, Will, and Winnebago.

Dimension stone, which represented only a small part of the total stone production in the State, was produced in Kane County.

Trucks transported 89% of the crushed and broken stone; the remainder was shipped by railroad and water.

Calcium Carbonate Co., engaged primarily in the underground quarrying and processing of finely ground high-calcium limestone in the Quincy area, was acquired by the J. M. Huber Corp., a major producer of kaolin.

Table 10.—Illinois: Limestone and dolomite sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension total	W	W	3	61
Crushed and broken:				
Bituminous aggregate	5,190	9,427	5,580	10,394
Concrete aggregate	10,142	17,284	11,647	20,492
Dense graded roadbase stone	17,193	28,584	20,393	34,436
Macadam aggregate	1,497	2,605	2,322	4,077
Surface treatment aggregate	5,615	9,426	6,946	12,442
Unspecified construction aggregate and roadstone	4,026	6,664	5,840	9,088
Agricultural purposes [1]	4,024	6,790	4,533	7,732
Cement manufacture [2]	2,506	3,001	3,002	3,932
Flux stone	779	1,315	963	1,775
Mineral fillers, extenders, whiting [3]	W	W	502	2,007
Railroad ballast	454	691	489	788
Riprap and jetty stone	629	1,069	951	1,633
Other uses [4]	4,205	7,368	3,484	5,210
Total [5]	56,260	94,225	66,650	114,007
Grand total [5]	W	W	66,653	114,068

W Withheld to avoid disclosing individual company confidential data.
[1] Includes agricultural limestone, poultry grit, and mineral food.
[2] Data for 1973 include stone used in lime manufacture.
[3] Includes asphalt filler, whiting or whiting substitute, and other fillers or extenders.
[4] Includes stone for building products (1973), chemicals (1973), chemical stone, disinfectant and animal sanitation (1973), fill, lime manufacture (1972), stone sand, mine dusting, roofing aggregates, chips, and granules, waste material, and uses not specified.
[5] Data may not add to totals shown because of independent rounding.

Table 11.—Illinois: Crushed stone sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972		1973	
	Quantity	Value	Quantity	Value
Adams	W	W	957	W
Bureau	--	--	3	6
Carroll	494	669	334	420
Champaign	2	15	--	--
Christian	694	1,077	434	664
Coles	489	948	742	1,492
Cumberland	W	W	4	8
Ford	6	11	--	--
Greene	307	W	402	W
Hancock	495	805	646	1,085
Hardin	2,352	3,287	2,543	3,546
Henderson	311	522	W	W
Iroquois	18	29	W	W
Jackson	318	W	366	W
Jersey	107	190	118	219
Jo Daviess	280	298	382	389
Kane	1,265	2,288	1,339	2,525
Lake	1	2	1	1
Lee	1,677	2,391	1,758	2,427
Livingston	1,931	3,182	2,231	3,899
Macon	79	259	--	--
Massac	W	674	W	403
Montgomery	W	W	1,383	2,416
Moultrie	5	10	--	--
Ogle	746	1,191	741	1,192
Pike	535	898	559	961
Randolph	1,456	2,246	1,470	2,537
St. Clair	2,436	3,957	3,259	5,932
Sangamon	W	W	10	19
Scott	W	776	215	426
Stephenson	306	399	495	689

See footnotes at end of table.

Table 11.—Illinois: Crushed stone sold or used by producers, by county—Continued
(Thousand short tons and thousand dollars)

County	1972		1973	
	Quantity	Value	Quantity	Value
Whiteside	W	W	781	1,219
Will	3,783	6,225	5,410	9,018
Williamson	--	--	14	20
Winnebago	1,314	2,121	1,102	2,000
Undistributed [1]	34,850	59,755	38,954	70,555
Total [2]	56,260	94,225	66,653	114,068

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes stone produced in the following counties: Boone, Calhoun, Clark, Clay, Clinton, Cook, De Kalb, Douglas, Du Page, Fayette, Henry, Johnson, Kankakee, Kendall, Knox, La Salle, Lawrence (1972), Logan, McDonough, McHenry (1972), Macoupin, Madison, Marion, Menard, Mercer, Monroe, Peoria, Pulaski, Rock Island, Schuyler, Shelby, Union, Vermilion, Warren and Washington Counties, and production for which no county breakdown is available (1972).
[2] Data may not add to totals shown because of independent rounding.

Sulfur (Recovered Elemental).—Sulfur was recovered by The Anlin Co. of Illinois, a subsidiary of Alaska Interstate Co., at its Hartford refinery in Madison County; by Union Oil Co. of California, Union 76 Div., in Cook County; by Marathon Oil Co. at its Robinson refinery in Crawford County; and by Mobil Oil Corp. at its new refinery near Joliet in Will County. The statistics on quantity and value of sulfur recovered from these sources were not included in the mineral production statistics in table 1 because the recovered sulfur is considered a secondary product. Nationally, Illinois ranked fifth in quantity and sixth in value of recovered sulfur.

Tripoli (Amorphous Silica).—Crude material was recovered from underground mines in Alexander County by Illinois Minerals Co. near Elco and by Tammsco, Inc., near Tamms. The production of crude material increased 23.8% in quantity and 20.0% in value. Output of prepared material increased 21.7% in quantity and 30.8% in value. Prepared material was used for abrasives, filler, and other purposes. Of the few States that produce tripoli in the United States, Illinois continued to rank first in production and second in value.

Vermiculite.—Crude vermiculite mined outside the State was processed by the W. R. Grace & Co., Construction Products Div., at its plant in Cook County; Mica Pellets, Inc., at its plant in DeKalb County; and International Vermiculite Co. at its plant in Macoupin County. Uses were for insulation, aggregate in plaster and concrete, horticulture, and other purposes.

METALS

Iron Oxide Pigments.—Three plants, operating in Adams, Kane, and St. Clair Counties, produced finished (natural and manufactured) iron oxide pigments in 1973. In August 1972, Pfizer, Inc., completed expansion of its East St. Louis plant, enabling Illinois to overtake Pennsylvania as the leading producer of finished iron oxide pigments. Total output for the State (as indicated by sales) increased in quantity and value.

Lead and Zinc.—In terms of recoverable metal, production of 541 short tons of lead and 5,250 short tons of zinc represented decreases of 59.5% and 53.9%, respectively. In terms of total value, lead production decreased 56.1% and zinc production declined 46.3%.

Average weighted yearly prices used to calculate values of lead and zinc in table 1 were 16.29 cents and 20.66 cents per pound, respectively. In 1972, these averages were 15.03 cents per pound for lead and 17.75 cents per pound for zinc.

The Bautsch mine, owned by Eagle-Picher Industries, Inc., located in northern Illinois near Galena, Jo Daviess County, closed in May because of depleted ore reserves. This was the last all-lead-zinc mine operating in the State. However, in southern Illinois (Hardin County), the Minerva Oil Co. and Ozark-Mahoning Co. continued to recover lead and zinc as byproducts of fluorspar operations.

The Sauget electrolytic zinc plant, purchased by American Metal Climax, Inc. (AMAX), in 1972, began initial production in May after extensive rehabilitation.

A total of 25,000 tons of refined zinc was produced in 1973, and output for 1974 was estimated at 70,000 tons. Full capacity of 84,000 tons per year was expected in 1975; an annual production of 1.35 million pounds of cadmium and 150,000 tons of sulfuric acid was also expected at that time. Completion of preleach facilities was expected in late 1974; these facilities would permit the processing of high-magnesium-bearing zinc concentrates.

Table 12.—Illinois: Mine production (recoverable) of lead and zinc

	1971	1972	1973
Mines producing: Lode[1]	4	2	1
Material sold or treated (ore):			
Fluorspar thousand short tons	320	346	358
Zinc do	230	211	67
Production (recoverable):			
Quantity:			
Lead short tons	1,238	1,335	541
Zinc do	12,706	11,378	5,250
Value:			
Lead thousands	$342	$401	$176
Zinc do	4,091	4,039	2,169
Total do	4,433	4,440	2,345

[1] Fluorspar operations producing byproduct lead and zinc not included in mine count.

Pig Iron and Steel.—About 7.9 million tons of pig iron, valued at $585 million, was shipped from Illinois blast furnaces or consumed by the producing companies in 1973, compared with 7.2 million tons, valued at $543 million, shipped or consumed in 1972. Pig iron was produced by five companies operating blast furnaces in Granite City and South Chicago.

According to the American Iron and Steel Institute, Illinois produced 13.4 million short tons of steel in 1973, compared with 12.2 million short tons in 1972.

National Steel Corp.'s Granite City Steel Div. has nearly completed its environmental improvement program agreed to with the State of Illinois. Late in 1973, a high-energy Venturi scrubber went into operation to control emissions from its main sinter-plant exhaust. Earlier, a baghouse air cleaner had been installed to clean the sinter-breaker exhaust. An advanced air quality control system for coal charging at the division's coke ovens was to begin operation in the first part of 1974. The program was expected to reduce Granite City Steel's particulate emission levels by 90%.

In one of the more significant programs undertaken in the United States to recycle municipal solid waste, Granite City Steel contracted to buy iron and steel scrap from St. Louis municipal refuse collections. The material, consisting primarily of scrap steel cans, was to be extracted magnetically and recycled in the plant's blast furnaces. This demonstrates a new market for ferrous scrap, which is normally charged into steelmaking furnaces.

Republic Steel Corp. planned to construct a new oxygen steelmaking facility at its plant in South Chicago. Completion of the facility was scheduled for 1977 and would increase raw steel production by about 13,000 tons per month.

Silver.—Small amounts of silver were recovered in smelter operations by Minerva Oil Co. and Ozark-Mahoning Co. in Hardin County and by Eagle-Picher Industries, Inc., in Jo Daviess County.

Other Metals.—Lindsay Rare Earths Division of Kerr-McGee Chemical Corp., West Chicago, Ill., one of two domestic processors of monazite, ceased production at the end of 1973 because the operation could not be economically improved to meet pollution standards for waste water.

Smelter production of cadmium in Illinois in 1973 increased 400% in quantity and 664% in value.

Table 13.—Principal producers

Commodity and company	Address	Type of activity	County
Barite: Pfizer, Inc., Minerals, Pigments & Metals Div.	2001 Lynch Ave. East St. Louis, Ill. 62201	Grinding plant	St. Clair.
Cement:			
Marquette Cement Manufacturing Co.	20 North Wacker Dr. Chicago, Ill. 60606	Portland and masonry, dry process.	LaSalle.
Medusa Cement Co., a division of Medusa Corp.	Box 5668 Cleveland, Ohio 44101	---- do	Lee.
Missouri Portland Cement Co.	7751 Carondelet Ave. St. Louis, Mo. 63105	---- do	Massac.
Clays and shale:			
American Brick Co	6558 West Fullerton Ave. Chicago, Ill. 60635	Pit and plant	Cook.
Streator Brick Systems, Inc	West End of Ninth St. Streator, Ill. 61364	Pits	LaSalle and Livingston.
Illinois Brick Co., a division of Old Fort Industries, Inc.	228 North LaSalle St. Chicago, Ill. 60450	Pit and plant	Cook.
A.P. Green Refractories Co., a division of U.S. Gypsum Co.	Box 64 Morris, Ill. 60450	---- do	Grundy.
Marblehead Lime Co., Subsidiary of General Dynamics Corp.	300 West Washington St. Chicago, Ill. 60606	---- do	LaSalle.
Marquette Cement Mfg. Co	20 North Wacker Dr. Chicago, Ill. 60606	Pit	Do.
Richards Brick Co	234 Springer Ave. Edwardsville, Ill. 62025	Pit	Bond.
Southern Clay Co., Inc., Subsidiary of Lowe's, Inc.	North Edward St. Cassopolis, Mich. 49031	Pit and plant	Pulaski.
Western Brick Co., a division of Illinois Brick Co.	Box 591 Danville, Ill. 61832	---- do	Vermilion.
Coal, bituminous:			
Amax Coal Company, a division of American Metal Climax, Inc.:	105 South Meridian St. Indianapolis, Ind. 46225		
Sun Spot	----------	Strip mine, cleaning plant.	Fulton.
Leahy	----------	---- do	Perry.
Delta	----------	---- do	Williamson.
Wabash	----------	Underground mine	Wabash.
Consolidation Coal Company, Midwestern Div.:	P.O. Box 218 Pinckneyville, Ill. 62274		
Hillsboro	----------	---- do	Montgomery.
Norris	----------	Strip mine, cleaning plant.	Fulton.
Burning Star No. 2	----------	---- do	Perry.
Burning Star No. 3	----------	---- do	Randolph.
Burning Star No. 4	----------	Strip mine	Perry.
Eads Coal Co	Box 1473 St. Louis, Mo. 63178	---- do	Jefferson.
Freeman Coal Mining Corp.:	300 West Washington Ave. Chicago, Ill. 60606		
Orient No. 3	----------	Underground mine, cleaning plant.	Jefferson.
Orient No. 6	----------	---- do	Do.
Orient No. 4	----------	---- do	Williamson.
Inland Steel Co.: Inland	30 West Monroe St. Chicago, Ill. 60603	---- do	Jefferson.
Midland Coal Co., a division of American Smelting and Refining Co.:	P.O. Box 8 Trivoli, Ill. 61569		
Allendale	----------	Strip mine, cleaning plant.	Stark.
Mecco	----------	---- do	Knox.
Edwards	----------	---- do	Peoria.
Elm No. 1	----------	---- do	Do.
Elm No. 2	----------	---- do	Fulton.
Monterey Coal Co	205 Oakland Ave. Carlinville, Ill. 62626	Underground mine, cleaning plant.	Macoupin.
Old Ben Coal Co.:	10 South Riverside Plaza Chicago, Ill. 60606		
Old Ben No. 21	----------	---- do	Franklin.
Old Ben No. 24	----------	Underground mine	Do.
Old Ben No. 26	----------	Underground mine, cleaning plant.	Do.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Coal, bituminous—Continued			
Peabody Coal Co.:	301 North Memorial Dr. St. Louis, Mo. 63102		
No. 10		Underground mine, cleaning plant.	Christian.
Eagle		Strip and underground mines, cleaning plant.	Gallatin.
Northern Illinois		Strip mine, cleaning plant.	Kankakee.
Baldwin No. 1		Underground mine, cleaning plant.	Randolph.
River King		Strip and underground mines, cleaning plant.	St. Clair.
Will Scarlet		Strip mine, cleaning plant.	Williamson.
Sahara Coal Co., Inc.:	59 East Van Buren St. Chicago, Ill. 60605		
No. 6		Strip mine, cleaning plant.	Saline.
No. 20		Underground mine	Do.
No. 21		---- do	Do.
Southwestern Illinois Coal Corp.:	Box 14743 St. Louis, Mo. 63178		
Captain		Strip mine, cleaning plant.	Perry.
Streamline		---- do	Randolph.
United Electric Coal Co.:	300 West Washington Ave. Chicago, Ill. 60606		
Buckheart No. 17		Strip mine, cleaning plant.	Fulton.
Banner No. 27		---- do	Peoria.
Fidelity No. 11		---- do	Perry.
Zeigler Coal Co.:	208 South LaSalle St. Chicago, Ill. 60604		
Murdock		Underground mine, cleaning plant.	Douglas.
Spartan No. 2		---- do	Randolph.
Zeigler No. 4		---- do	Williamson.
Zeigler No. 5		Underground mine	Douglas.
Coke:			
Granite City Steel Div., National Steel Corp.	Box 367 Granite City, Ill. 62041	Coke ovens	Madison.
Interlake, Inc	310 South Michigan Ave. Chicago, Ill. 60604	---- do	Cook.
International Harvester Co., Wisconsin Steel Div.	401 North Michigan Ave. Chicago, Ill. 60611	---- do	Do.
Republic Steel Corp	Box 6778 Cleveland, Ohio 44101	---- do	Do.
Fluorspar:			
Minerva Company, mining division of Minerva Oil Co.:	Eldorado, Ill. 62930		
Crystal Group		Underground mines, mill.	Hardin.
Minerva No. 1		Underground mine, mill.	Do.
Ozark-Mahoning Co	Box 57 Rosiclare, Ill. 62982	Underground mines, mill.	Do.
Iron and Steel:			
Interlake, Inc	310 South Michigan Ave. Chicago, Ill. 60604	Iron furnaces	Cook.
International Harvester Co., Wisconsin Steel Div.	401 North Michigan Ave. Chicago, Ill. 60611	Iron and steel furnaces	Do.
National Steel Corp., Granite City Steel Div.	Box 365 Granite City, Ill. 62040	---- do	Madison.
Republic Steel Corp	Box 6778 Cleveland, Ohio 44101	Iron furnace and steel furnace.	Cook.
United States Steel Corp	3426 East 89th St. Chicago, Ill. 60617	Iron and steel furnaces	Do.
Iron oxide pigments, finished:			
Pfizer, Inc., Minerals, Pigments & Metals Div.	2001 Lynch Ave. East St. Louis, Ill. 62201	Plant	St. Clair.
Prince Manufacturing Co	Bowmanstown, Pa. 18030	---- do	Adams.
George B. Smith Chemical Works.	Maple Park, Ill. 60151	---- do	Kane.
Lead and zinc:			
Eagle-Picher Industries, Inc	Box 406 Galena, Ill. 61036	Underground mine, mill.	Jo Daviess.
Minerva Company, mining division of Minerva Oil Co.: Minerva No. 1.	Eldorado, Ill. 62930	---- do	Hardin.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Lead and zinc—Continued			
Ozark-Mahoning Co	Box 57 Rosiclare, Ill. 62982	Underground mines, mill.	Hardin.
Lime:			
Marblehead Lime Co.:	300 West Washington St. Chicago, Ill. 60606		
Marblehead Limekiln		Quicklime and hydrated lime, 3 shaft kilns.	Adams.
Quincy Limekiln		Quicklime, 1 calcimatic kiln.	Do.
South Chicago Limekiln		Quicklime and hydrated lime, 4 rotary kilns.	Cook.
Thornton Limekiln		do	Do.
Vulcan Materials Co	Box 6 Countryside, Ill. 60525	Quicklime, 3 rotary kilns.	Do.
Natural gas liquids:			
U.S. Industrial Chemicals Co., a division of National Distillers & Chemical Corp.	99 Park Ave. New York, N.Y. 10016	Plant	Douglas.
Peat:			
Anderson Peat Co	Morrison, Ill. 61270	Bog, processing plant	Whiteside.
Markman Peat Co	Route 3 Morrison, Ill. 61270	do	Do.
Expanded perlite:			
Filter Products Corp	124 North Buesching Rd. Lake Zurich, Ill. 60047	Processing plant	Lake.
Johns-Manville Perlite Corp., Building Products Div.	Box 5108 Denver, Colo. 80217	do	Will.
Mica Pellets, Inc	1120 Oak St. De Kalb, Ill. 60115	do	De Kalb.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Lake.
Silbrico Corp	6300 River Rd. La Grange, Ill. 60525	do	Cook.
Petroleum refineries:			
Amoco Oil Co	200 East Randolph Chicago, Ill. 60601	Refinery	Madison.
Clark Oil & Refining Corp	8530 West National Ave. Milwaukee, Wis. 53227	do	Cook, Madison.
Marathon Oil Co	539 South Main Findlay, Ohio 45840	do	Crawford.
Mobil Oil Corp	Box 874 Joliet, Ill. 60434	do	Will.
Shell Oil Co	One Shell Plaza Houston, Tex. 77002	do	Madison.
Texaco, Inc	135 East 42d St. New York, N.Y. 10017	do	Lawrence, Will.
Union Oil Co. of California	Box 239 Lemont, Ill. 60439	do	Cook.
Sand and gravel:			
Elmhurst-Chicago Stone Co	400 West First St. Elmhurst, Ill. 61026	Pits, portable and stationary plants.	DuPage. Kane, Will.
General Dynamics Corp	4226 South Lawndale Ave. Lyons, Ill. 60534	Pits, dredges, portable and stationary plants.	Cook, DuPage, Grundy, Kane, McHenry, Will.
McHenry Sand & Gravel Co., Inc.	920 North Front St. McHenry, Ill. 60050	Pits, stationary plants	McHenry.
Martin Marietta Aggregates	Box 789 Cedar Rapids, Iowa 52406	Pits, portable and stationary plants.	Ogle, Peoria, Tazewell, Woodford.
Meyer Aggregate	Box 56, Route 2 Algonquin, Ill. 60102	Pits, portable and stationary plants.	Kendall, McHenry.
Moline Consumers Co	313 16th St. Moline, Ill. 61265	Pits, dredges, portable and stationary plants.	LaSalle, Pike, Rock Island.
Ottawa Silica Co	Box 577 Ottawa, Ill. 61350	Pit, portable and stationary plants.	LaSalle.
Road Materials Corp., E. M. Melahn Construction Co., Inc.	Box 205, Route 63 East Dundee, Ill. 60118	Pits, stationary plants	Kane, McHenry.
Vulcan Materials Co	Box 391 LaGrange, Ill. 60525	Pits, portable and stationary plants.	Kane, Lake, McHenry.
Wedron Silica Co., Del Monte Properties Co.	400 West Higgins Rd. Park Ridge, Ill. 60068	Pit, stationary plant	LaSalle.
Smelters and Refineries:			
AMAX Zinc Company, Inc	Box 347 East St. Louis, Ill. 62202	Zinc primary plant	St. Clair.
American Smelting & Refining Co.	120 Broadway New York, N.Y. 10005	Zinc secondary plant	Montgomery.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Smelters and Refineries—Continued			
N.L. Industries, Inc	111 Broadway New York, N.Y. 10006	Lead secondary plants	Cook, Madison.
The Richardson Graphics Co	1800 South 54th Ave. Chicago, Ill. 60650	Lead secondary plant	Cook.
Stone:			
Columbia Quarry Co	Box 1000 Dupo, Ill. 62239	Quarries, stationary plants.	Johnson, Massac, Pulaski, St. Clair.
		Underground mine, stationary plant.	Monroe.
Elmhurst-Chicago Stone Co	400 West First St. Elmhurst, Ill. 61026	Quarry, stationary plant.	DuPage.
General Dynamics Corp	4226 South Lawndale Ave. Lyons, Ill. 60534	Underground mine, stationary plant.	Adams.
		Quarries, stationary plants.	Cook, Vermilion, Will.
Industrial Chemicals Div., Allied Chemicals Corp.	Box 70 Morristown, N.J. 07960	---- do	Randolph.
Marquette Cement Manufacturing Co.	20 North Wacker Dr. Chicago, Ill. 60606	Quarry, stationary plant.	LaSalle.
Medusa Cement Co	Box 5668 Cleveland, Ohio 44101	Quarries, stationary plants.	Clark, Henderson, Kankakee, Lee.
Mississippi Lime Co	7 Alby St, Box 247 Alton, Ill. 62002	Underground mine, stationary plant.	Madison.
Moline Consumers Co	313 16th St. Moline, Ill. 61255	Quarries, portable and stationary plants.	Adams, Henry, Pike, Rock Island, Schuyler, Warren.
Rein, Schultz & Dahl, Inc	6217 Nesbitt Rd. Madison, Wis. 53711	Quarries, portable plants.	Carrol, Stephenson, Winnebago.
Vulcan Materials Co	Box 391 LaGrange, Ill. 60525	Quarries, stationary plants.	Cook, Will.
Sulfur, recovered:			
The Anlin Company of Illinois.	Box 6554 Houston, Tex. 77005	Byproduct sulfur recovery.	Madison.
Marathon Oil Co	Robinson, Ill. 62454	---- do	Crawford.
Mobil Oil Corp	Box 874 Joliet, Ill. 60434	---- do	Will.
Union Oil Co. of California	Box 239, Lemont, Ill. 60439	---- do	Cook.
Tripoli, amorphous silica:			
Illinois Minerals Co	218 Tenth St. Cairo, Ill. 62914	Underground mine	Alexander.
Tammsco, Inc	Box J, Tamms, Ill. 62988	---- do	Do.
Vermiculite, exfoliated:			
International Vermiculite Co	First and Mound Sts. Girard, Ill. 62640	Processing plant	Macoupin.
Mica Pellets, Inc	1120 Oak St. De Kalb, Ill. 60115	---- do	De Kalb.
W. R. Grace & Co., Construction Products Div.	62 Whittemore Ave. Cambridge, Mass. 02140	---- do	Cook.

The Mineral Industry of Indiana

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior and the Geological Survey, Indiana Department of Natural Resources, for collecting information on all minerals except fuels.

By Robert A. Clifton [1]

The value of Indiana's mineral products in 1973 was at an alltime high ($351,405,000). However, whether this trend reflects more than inflation is debatable. The volume of five commodities was higher; that of six was lower; and that of one was the same as in 1972. Coal, petroleum, and natural gas declined in volume; petroleum and natural gas declined also in value so that mineral fuels accounted for about half the mineral value. Total value of mineral products increased 9% over that of 1972.

Mineral production value was led by coal, with 44% of the total. Stone had 17%, sand and gravel 10%, and petroleum 6% of the value. The remainder was divided among abrasives, cement, fire clay, gypsum, lime, natural gas, and peat.

Legislation and Government Programs.—The 1973 Indiana Legislative Session passed a few bills that directly affected the minerals industry, but some that did affect the industry were as follows:

1. House Bill 1272, P.L. 242, which deletes the 25-year age requirement for mine shot firer, electrician, foreman, and fireboss and the 21-year age requirement for an underground mine worker.

2. Senate Bill 266, P.L. 117, granted an indefinite exemption from phosphorus limits for dishwasher, industrial and institutional speciality detergents, but restated the zero phosphorous limit for household laundry detergents.

3. House Bill 1001, P.L. 118, prohibited the interstate flow of sewage sludge or waste water into Indiana for land treatment.

4. Senate Bill 10, P.L. 132, allowed the Department of Natural Resources to acquire abandoned and unreclaimed mined areas for reclamation purposes.

5. Senate Bill 186, P.L. 129, regulated permits for mineral extraction from State-owned lands and deleted oil, gas, and other petroleum deposits from permit control.

The Indiana Geological Survey began a long-range drilling program to test the coalbeds in southwestern Indiana that lie from 300 to 1,400 feet beneath the surface, hoping to find low-sulfur coal.

[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Mineral production in Indiana [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays ---------- thousand short tons	[2] 1,419	[2] $2,465	1,436	$2,568
Coal (bituminous) ---------- do ----	25,949	144,688	25,253	153,136
Natural gas ---------- million cubic feet --	355	55	276	38
Peat ---------- thousand short tons --	45	478	51	475
Petroleum (crude) thousand 42-gallon barrels --	6,130	20,964	5,312	20,823
Sand and gravel ------ thousand short tons --	27,978	33,290	27,731	35,015
Stone ---------- do --	27,511	50,919	[3] 32,288	[3] 57,652
Value of items that cannot be disclosed: Abrasives (whetstone), cement, fire clay, gypsum, lime, and values indicated by symbol W ----------	XX	69,749	XX	81,698
Total ----------	XX	322,608	XX	351,405
Total 1967 constant dollars ----------	XX	266,184	XX	[p] 258,002

[p] Preliminary.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes fire clay; included with "Value of items that cannot be disclosed."
[3] Excludes sandstone; included with "Value of items that cannot be disclosed."

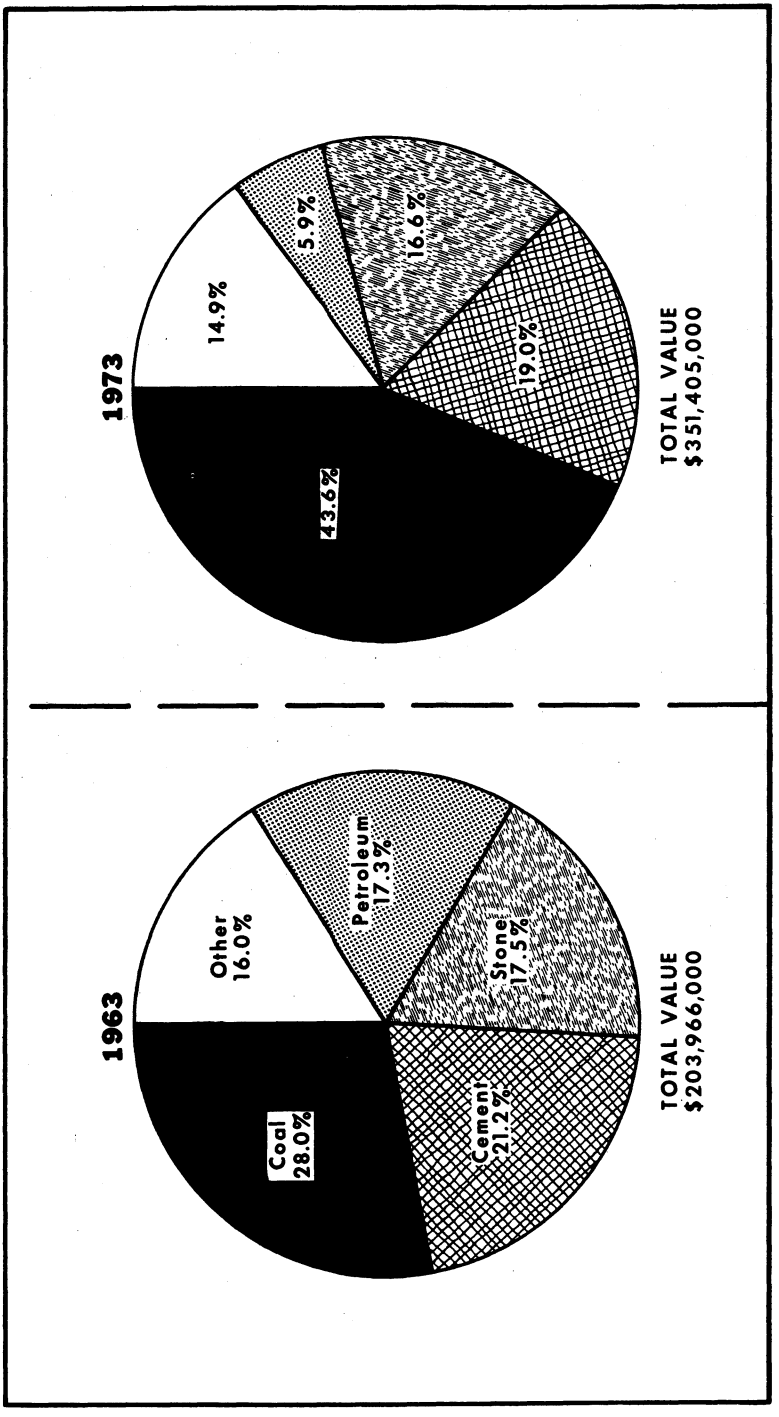

Figure 1.—Total value of mineral production in Indiana.

Table 2.—Value of mineral production in Indiana, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adams	$675	$875	Stone, sand and gravel.
Allen	3,922	5,533	Stone, sand and gravel, peat.
Bartholomew	W	W	Stone, sand and gravel.
Blackford	W	W	Stone, clays.
Boone	W	W	Sand and gravel.
Carroll	W	W	Stone, sand and gravel.
Cass	W	W	Cement, stone, clays, sand and gravel.
Clark	W	W	Cement, stone, sand and gravel, clays.
Clay	W	--	Coal, clays.
Clinton	13	--	
Crawford	W	W	Stone, sand and gravel.
Daviess	W	102	Sand and gravel.
Dearborn	W	W	Do.
Decatur	W	W	Stone.
De Kalb	W	469	Sand and gravel.
Delaware	1,531	W	Stone, sand and gravel, peat.
Dubois	W	W	Clays.
Elkhart	W	W	Sand and gravel, stone.
Fayette	W	W	Sand and gravel.
Fountain	W	W	Sand and gravel, coal, clays.
Franklin	W	W	Stone, sand and gravel, clays.
Fulton	W	W	Sand and gravel, peat.
Gibson	W	W	Coal, sand and gravel.
Grant	819	929	Stone, sand and gravel, peat.
Greene	15,578	7,162	Coal, sand and gravel, clays.
Hamilton	W	5,774	Stone, sand and gravel.
Hancock	83	W	Sand and gravel, stone.
Harrison	1,832	1,260	Stone, sand and gravel.
Hendricks	W	W	Sand and gravel.
Henry	W	W	Do.
Howard	W	W	Stone, sand and gravel.
Huntington	1,457	W	Stone, sand and gravel, clays.
Jackson	W	W	Sand and gravel, clays.
Jasper	W	W	Stone, sand and gravel.
Jay	W	W	Do.
Jefferson	4	13	Sand and gravel.
Jennings	W	W	Stone, sand and gravel.
Johnson	W	W	Sand and gravel, stone.
Knox	501	576	Sand and gravel.
Kosciusko	509	W	Stone, sand and gravel.
Lagrange	280	W	Sand and gravel, stone.
Lake	W	24,741	Cement, lime, sand and gravel, stone, clays.
La Porte	1,155	W	Sand and gravel, stone.
Lawrence	16,289	W	Cement, stone, clays.
Madison	4,560	W	Stone, sand and gravel.
Marion	W	5,001	Sand and gravel, stone.
Marshall	W	536	Sand and gravel, stone, peat.
Martin	W	W	Gypsum, clays.
Miami	W	W	Sand and gravel, stone.
Monroe	7,103	W	Stone.
Montgomery	81	W	Sand and gravel, clays.
Morgan	W	W	Clays, sand and gravel, stone.
Newton	W	W	Stone.
Noble	389	319	Sand and gravel.
Orange	W	W	Stone, abrasives.
Owen	984	W	Stone, sand and gravel.
Parke	414	552	Clays, sand and gravel, coal.
Perry	W	W	Stone.
Pike	W	W	Coal, stone.
Porter	W	W	Clays.
Posey	W	W	Sand and gravel.
Pulaski	W	W	Stone, clays.
Putnam	W	W	Cement, stone, sand and gravel.
Randolph	W	W	Stone, sand and gravel.
Ripley	W	W	Stone.
Rush	W	W	Stone, sand and gravel.
St. Joseph	934	W	Sand and gravel, stone.
Scott	W	W	Stone.
Shelby	W	W	Stone, sand and gravel.
Spencer	941	2,826	Coal, stone.
Starke	49	14	Sand and gravel.
Steuben	W	W	Sand and gravel, stone.
Sullivan	21,960	27,778	Coal, sand and gravel, stone.
Switzerland	W	W	Sand and gravel, stone.

See footnotes at end of table.

Table 2.—Value of mineral production in Indiana, by county [1]—Continued
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Tippecanoe	$1,113	W	Sand and gravel.
Union	4	$4	Do.
Vanderburgh	--	35	Stone.
Vermillion	11,075	15,706	Coal, sand and gravel, clays.
Vigo	1,563	1,447	Sand and gravel, coal, stone.
Wabash	W	W	Stone, sand and gravel.
Warren	W	W	Sand and gravel, peat.
Warrick	46,751	51,204	Coal, stone.
Washington	W	W	Stone, sand and gravel.
Wayne	W	W	Sand and gravel, stone.
Wells	W	W	Stone, peat.
White	W	800	Stone.
Whitley	W	W	Sand and gravel.
Undistributed [2]	180,039	197,748	
Total [3]	322,608	351,405	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Benton, Brown, Floyd, Ohio, and Tipton.

[2] Includes petroleum, natural gas, mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Indiana business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ---- thousands	2,282	2,326	+1.9
Unemployment ---- do	103	98	−4.9
Employment:			
Manufacturing ---- do	709.4	755.7	+6.5
Construction ---- do	82.2	88.6	+7.8
Mining ---- do	6.9	6.9	—
Transportation and public utilities ---- do	102.5	104.0	+1.5
Wholesale and retail trade ---- do	392.8	417.1	+6.2
Finance, insurance, and real estate ---- do	81.8	85.4	+4.4
Services ---- do	245.0	257.8	+5.2
Government ---- do	301.4	303.5	+.7
Personal income:			
Total ---- millions	$23,101	$26,091	+12.9
Per capita	$4,366	$4,908	+12.4
Construction activity:			
Building permits:			
Value of authorized nonresidential construction millions	$276.3	$350.2	+26.7
Number of private and public residential units authorized	40,161	38,330	−4.6
State highway commission contracts awarded millions	[e] $150.0	$146.1	−2.6
Portland cement shipments to and within Indiana thousand short tons	1,793	1,830	+2.1
Farm marketing receipts ---- millions	$1,861.3	$3,095.6	+66.3
Mineral production value ---- do	$322.6	$351.4	+8.9

[e] Estimate. [p] Preliminary.

Source: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

The Governor formed a new Division of Reclamation within the Department of Natural Resources to enforce the laws on strip mine reclamation. Financed by permit fees, the new division will handle duties formerly performed under the Division of Forestry.

The Indiana Geological Survey published "Coal Resources of Indiana," Bulletin 42–1 and Miscellaneous Map No. 18 showing oil, gas and pipelines in 1973.

Employment and Injuries.—Indiana's coal miners' safety record was among the better records of the 25 coal-producing States. The 5.7 million man-hours worked in coal mining ranked Indiana ninth in the number of man-hours worked. The disabling injury frequency was 18.9 per million man-hours and the frequency rate from all injuries in coal mines was 69.09 per million man-hours.

Environmental.—The Indiana Natural Resources Commission revoked its first strip mining permit since the enabling legislation was passed in 1967. The Virginia-Kentucky Corp. not only lost its permit but was fined $2,000 and forced to forfeit its reclamation bond for allegedly mining 4 acres without a permit and not filing proper maps and reports.

The Environmental Protection Agency (EPA) was active on two fronts in the State. Indiana was granted $487,688 (90% of total project costs) to demonstrate reclamation techniques on 80 acres of former strip coal mine land in the Greene-Sullivan State Forest. EPA also cited three petroleum refineries and two coal-burning electric powerplants for violation of sulfur-dioxide emission standards.

The Council on Economic Priorities pronounced United States Steel Corp.'s Gary Works one of the two worst polluters of all major steel producers in the country.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasives.—Sandstone whetstones quarried in Orange County by the Hindostan Whetstone Co. had the same volume of production as 1972 but increased nearly 32% in value over that year.

Cement.—Portland cement shipments, which accounted for 86% of Indiana's output, increased significantly over those of 1972. There was an accompanying increase in masonry cement volume. The average mill value of the portland was $19.89 per ton in Indiana, less than the national average.

United States Steel started producing calcium aluminate cement at its Universal Atlas Cement plant at Buffington by a new patented "shock sintering" process.

Four companies operated two wet-process and three dry-process plants with a combined annual capacity of 2.8 million tons. This figure includes the additional capacity gained by Louisville Cement Co. in its Speed, Clark County, plant when its new large dry-process kiln went onstream early in 1973. This company operated another plant at Logansport, Cass County. Lone Star Industries, Inc., produced cement at its Greencastle plant in Putnam County, and Lehigh Portland Cement Co. operated its Mitchell plant in Lawrence County. In addition to producing portland cement, Universal Atlas Cement Division of United States Steel Corp. manufactured calcium aluminate cement.

Type I (general construction use) and Type II (moderately low heat and moderate degree of resistance to sulfate attack) comprised 93% of the portland cement shipped; 6% was Type III (high-early-strength); and the remainder was expansive and portland blast furnace slag cement.

Disposition of portland cement shipped by Indiana manufacturers was as follows: 67% went to ready-mix concrete producers; 8% to highway contractors; 15% to concrete product manufacturers for concrete block and pipe, precast prestressed concrete, and other concrete products; 8% to building material dealers; and the remainder to other contractors and for miscellaneous uses. Apparent consumption of portland cement in Indiana during 1973 was 1,830,000 tons, an increase of 2%. Masonry cement was manufactured at four of the five plants; Lehigh did not produce masonry cement. Shipments increased in quantity and in value. The average mill value of masonry cement decreased $1.36 per ton, to $22.97. Consumption of masonry cement in Indiana was 125,000 tons, an increase of 9%.

Clays.—Common clay and shale production in 1973 was at 98% of the 1972 volume and 97% of the 1972 value. Twenty-nine companies operated 35 mines in 19 counties. A small quantity of the fire clay was produced in Dubois County. Six companies produced most of the State's clay and shale: Hydraulic-Press Brick Co. in Morgan County; Log Cabin Coal Co. in Clay County; Louisville Cement Co. in Cass and Clarke Counties; S.L. Turner Coal and Clay Co. in Parke County; General Shale Products Corp. in Morgan County; and American Brick Co. in Lake County.

Table 4.—Indiana: Clays sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Year	Fire clay		Common clay and shale		Total [1]	
	Quantity	Value	Quantity	Value	Quantity	Value
1969	166	314	1,317	1,950	1,483	2,264
1970	75	202	1,259	1,936	1,335	2,139
1971	[2] 1	[2] 5	1,324	2,303	1,325	2,308
1972	W	W	1,419	2,462	[3] 1,419	[3] 2,465
1973	[2] 43	[2] 174	1,393	2,394	1,436	2,568

W Withheld to avoid disclosing individual company confidential data.
[1] Data may not add to totals shown because of independent rounding.
[2] Includes a small quantity of kaolin.
[3] Excludes fire clay; includes a small quantity of ball clay.

Gypsum.—United States Gypsum Co. and National Gypsum Co. mined gypsum in Martin County. Output declined 17%. United States Gypsum Co. and National Gypsum Co. calcined gypsum in Lake and Martin Counties. Output increased 4%. Among the States, Indiana ranked fifth in output of calcined gypsum.

Lime.—Marblehead Lime Co. produced lime in Lake County for steel furnaces and other chemical uses. Output increased 45% for a new annual record. The lime was used in Indiana, Illinois, and other States. Total lime consumption in Indiana was 1,730,000 tons.

Perlite.—Crude perlite mined in New Mexico was expanded at six plants: United States Gypsum Co. at gypsum plants in Lake and Martin Counties; National Gypsum Co. at its gypsum plant in Martin County; Grefco, Inc., near Crawfordsville, Montgomery County; Airlite Processing Corp. near Scottsburg, Scott County; and Chemrock Corp. near Lafayette, Tippecanoe County. Expanded perlite production increased slightly in quantity and 6% in value. The principal uses for perlite expanded in Indiana were for plaster aggregate and as a filter aid. Smaller quantities were used for concrete aggregate and insulation.

Sand and Gravel.—Production of sand and gravel decreased 1% in quantity and increased 5% in value. Sand and gravel was produced in 66 counties at 189 locations. There was a slight increase both in the quantity and value of commercial operations, 1% and 6%, respectively, but there were major decreases in government-and-contractor operations. Government-and-contractor operations produced at 54% of the volume and 73% of the value of 1972. American Aggregates Corp., Irving Materials, Inc., and Martin Marietta Aggregates were the largest producers.

Table 5.—Indiana: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	4,673	5,144	4,682	5,613
Fill	984	780	1,144	996
Paving	6,064	6,853	6,852	7,779
Other uses [1]	541	1,806	395	736
Total [2]	12,263	14,584	13,073	15,124
Gravel:				
Building	4,621	5,935	4,575	6,541
Fill	1,110	956	1,196	1,056
Paving	8,127	10,289	7,519	10,799
Miscellaneous	470	519	366	422
Other uses [3]	60	64	284	381
Total [2]	14,390	17,764	13,940	19,199
Government-and-contractor operations:				
Sand:				
Fill	6	6	--	--
Paving	133	130	28	60
Other uses	7	7	59	101
Total [2]	147	143	86	161
Gravel:				
Building	126	117	1	1
Fill	68	15	3	2
Paving	964	662	597	513
Other uses	21	5	31	15
Total [2]	1,179	800	632	531
Total sand and gravel [2]	27,978	33,290	27,731	35,015

[1] Includes railroad ballast (1973), glass (1972), and molding sand.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast and other gravel.

Table 6.—Indiana: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Allen	6	936	1,000	6	797	887
Bartholomew	1	263	252	2	W	W
Cass	2	164	167	2	108	103
Clinton	1	13	13	--	--	--
Daviess	1	W	W	1	W	102
De Kalb	3	W	W	4	411	469
Delaware	4	W	W	5	882	882
Elkhart	14	630	646	8	377	511
Fountain	3	397	503	1	W	W
Franklin	1	60	9	1	61	9
Fulton	2	211	249	4	W	W
Gibson	1	27	31	1	27	33
Hamilton	5	W	W	5	W	2,730
Hancock	3	84	83	2	W	W
Harrison	3	350	W	2	W	W
Huntington	3	W	W	3	239	308
Jay	1	W	45	1	47	62
Jefferson	1	4	4	1	13	13
Jennings	--	--	--	1	1	1
Knox	5	578	501	4	538	576
Kosciusko	5	694	509	3	W	W

See footnotes at end of table.

Table 6.—Indiana: Sand and gravel sold or used by producers, by county—Continued
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Lagrange	5	281	248	2	W	W
Lake	3	344	388	2	W	W
La Porte	4	760	1,134	4	1,232	1,509
Madison	10	W	W	7	733	947
Marshall	2	W	W	4	439	523
Montgomery	5	76	48	4	48	W
Morgan	4	704	792	6	389	519
Noble	7	416	389	6	282	319
Perry	1	11	11	--	--	--
Randolph	2	103	68	3	W	W
Ripley	1	(1)	(1)	--	--	--
Rush	3	49	40	3	48	56
St. Joseph	6	1,055	932	4	1,231	1,641
Shelby	5	558	698	5	405	512
Starke	1	13	13	1	18	14
Steuben	4	184	W	4	215	W
Sullivan	4	W	W	4	296	540
Switzerland	1	1,164	W	1	1,240	W
Tippecanoe	5	1,035	1,110	4	W	W
Union	1	12	4	1	11	4
Warren	3	625	W	3	W	W
Washington	--	--	--	1	2	1
Wells	1	29	23	--	--	--
Undistributed [2]	r 67	16,150	23,380	63	17,647	21,744
Total [3]	210	27,978	33,290	189	27,731	35,015

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Less than ½ unit.
[2] Includes Adams, Boone, Carroll, Clark, Crawford (1973), Dearborn, Fayette Grant, Greene, Hendricks, Henry, Howard, Jackson, Jasper, Johnson, Marion, Miami, Owen, Parke, Posey, Putnam, Vermillion, Vigo, Wabash, Wayne and Whitley Counties, and some sand and gravel that cannot be assigned to specific counties.
[3] Data may not add to totals shown because of independent rounding.

Stone.—Output of stone, comprising mostly crushed limestone and dolomite, increased 18% in quantity and 25% in value. Stone was mined in 58 counties. Ralph Rogers & Co., Mulzer Crushed Stone Co., and Grance Stone Co. were the largest producers of crushed limestone and dolomite. Ten companies mined 41,241 tons of marl from quarries in Elkart, Lagrange, La Porte, Marshall, St. Joseph, and Steuben Counties.

Dimension stone, while less than 1% of the stone tonnage produced, had 12% of the value in 1973. Production was at 84% of the 1972 quantity and 72% of that year's value. Victor Oolitic Stone Co. and Indiana Limestone Co. were the State's largest producers. The static dimension limestone producers are hoping that Congress will fund two new buildings in downtown Washington which would need Indiana limestone exteriors to match existing buildings. One-half million cubic feet of stone worth $6 to $8 million would be used.

Table 7.—Indiana: Limestone and dolomite sold or used by producers, by use
(Thousand short tons and thousand dollars unless otherwise specified)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension:				
Rough architectural ____ thousand cubic feet	2,187	3,820	1,729	2,785
Irregular shaped stone	W	W	1	27
Rubble	--	--	13	134
Flagging ____ thousand cubic feet	85	67	36	20
Cut stone ____ do	377	3,474	225	1,948
House stone veneer ____ do	523	990	366	708
Sawed stone ____ do	W	W	[1] 398	[1] 1,205
Total ____ thousand short tons	257	9,532	217	6,828

See footnotes at end of table.

Table 7.—Indiana: Limestone and dolomite sold or used by producers, by use—Continued

(Thousand short tons and thousand dollars unless otherwise specified)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Crushed and broken:				
Bituminous aggregate	2,029	3,251	2,281	3,942
Concrete aggregate	3,721	5,814	3,994	6,489
Dense graded roadbase stone	8,186	12,655	8,725	13,770
Macadam aggregate	2,038	3,050	2,589	4,050
Surface treatment aggregate	943	1,612	2,240	3,632
Unspecified aggregate and roadstone	3,828	5,972	5,729	9,687
Agricultural purposes [2]	1,527	2,828	1,842	3,265
Cement manufacture	3,308	3,250	3,419	3,638
Railroad ballast	463	670	402	601
Riprap and jetty stone	160	290	259	602
Other uses [3]	778	1,280	551	1,099
Total [4]	26,980	40,672	32,030	50,774
Grand total [4]	27,238	50,204	32,246	57,603

W Withheld to avoid disclosing individual company confidential data; included with "Total."
[1] Includes small amount of dressed flagging.
[2] Includes agricultural limestone, agricultural marl and other soil conditioners, and poultry grit and mineral food.
[3] Includes stone used for manufactured fine aggregates, flux stone, mine dusting, asphalt and other fillers (1973), fill glass (1973), and uses not specified.
[4] Data may not add to totals shown because of independent rounding.

Table 8.—Indiana: Limestone and dolomite sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972		1973		Type of stone produced in 1973
	Quantity	Value	Quantity	Value	
Adams	W	W	W	W	Crushed.
Allen	W	W	2,469	4,618	Do.
Bartholomew	W	W	W	W	Do.
Blackford	W	W	158	270	Do.
Carroll	W	W	W	W	Do.
Cass	W	W	1,167	1,460	Do.
Clark	2,414	3,046	2,616	3,543	Do.
Crawford	W	W	W	W	Do.
Decatur	W	W	W	W	Do.
Delaware	W	W	707	1,155	Do.
Fayette	2	4	--	--	
Franklin	W	W	W	W	Dimension.
Grant	W	W	W	W	Crushed.
Hamilton	1,460	2,481	1,765	3,044	Do.
Hancock	--	--	1	1	Do.
Harrison	W	W	W	W	Do.
Howard	W	W	W	W	Do.
Huntington	W	W	W	W	Do.
Jasper	W	W	W	621	Do.
Jay	W	W	W	W	Do.
Jennings	W	W	W	W	Do.
Johnson	--	--	1	2	Do.
Lake	--	--	W	W	Do.
La Porte	--	--	W	W	Do.
Lawrence	2,270	6,962	2,479	5,945	Dimension and crushed.
Madison	W	W	W	W	Crushed.
Marion	W	W	W	W	Do.
Marshall	--	--	2	5	Do.
Miami	W	W	W	W	Do.
Monroe	W	r 7,097	W	W	Dimension and crushed.
Morgan	W	W	W	W	Crushed.
Newton	W	W	W	W	Do.
Orange	692	999	746	1,146	Do.
Owen	W	W	W	W	Do.
Perry	W	W	W	W	Do.
Pike	W	W	--	--	
Pulaski	W	W	W	W	Do.
Putnam	2,861	4,094	3,292	4,764	Dimension and crushed.
Randolph	W	W	W	W	Crushed.

See footnotes at end of table.

Table 8.—Indiana: Limestone and dolomite sold or used by producers, by county—Continued
(Thousand short tons and thousand dollars)

County	1972 Quantity	1972 Value	1973 Quantity	1973 Value	Type of stone produced in 1973
Ripley	W	W	W	W	Crushed.
Rush	W	W	W	W	Dimension and crushed.
Scott	W	W	W	W	Crushed.
Shelby	W	W	W	W	Do.
Spencer	--	--	17	43	Do.
Sullivan	1	30	15	44	Do.
Switzerland	63	115	75	W	Do.
Vanderburgh	--	--	13	35	Do.
Vigo	W	W	W	W	Do.
Wabash	W	W	W	W	Do.
Warrick	14	44	57	141	Do.
Washington	W	W	W	W	Do.
Wayne	180	297	214	372	Do.
Wells	W	W	W	W	Do.
White	W	W	592	800	Do.
Total	27,238	50,204	32,246	57,603	

r Revised. W Withheld to avoid disclosing individual company confidential data; included in "Total."

Table 9.—Indiana: Calcareous marl production

Year	Number of producers	Short tons	Value
1969	12	31,671	$30,190
1970	12	23,208	23,436
1971	12	29,074	26,095
1972	9	26,137	24,171
1973	10	41,241	48,981

Sulfur.—American Oil Co. and Atlantic Richfield Co. recovered sulfur from their refineries in Lake County. Sales increased 20% in volume and 97% in value.

MINERAL FUELS

Coal (Bituminous).—Indiana's coal production in 1973 was just 97% of the tonnage produced in 1972, although there was a 6% rise in value. The value of an average ton of coal rose $0.48 cents to $6.06. The State's largest coal producers were Peabody Coal Co., Amax Coal Co., and Enos Coal Corp.

The State's last large underground coal mine was closed by the Old Ben Corp. Their King's Station mine, which reached peak production in 1972 of 950,000 tons, was the victim of a "squeeze." Subsidence of the overburden resulted in the closing of the east side openings of the mine when the roofs and floors met in the "squeeze." Although the squeeze was both unanticipated and rapid, there were no injuries and the company was able to effect an orderly withdrawal of equipment.

Amax Coal Co., a subsidiary of American Metal Climax, Inc., is engaged in a major expansion program which is designed to triple present production to a total of 50 million tons per year by 1977.

Old Ben Coal Corp. announced plans to open the Alfred field in southern Indiana by mid-1975.

Table 10.—Indiana: Bituminous coal production by type of mine and county, 1973
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines: Underground	Strip	Total	Production (thousand short tons): Underground	Strip	Total	Value (thousands)
Clay	--	6	6	--	1,293	1,293	$8,155
Fountain	--	1	1	--	39	39	W
Gibson	1	1	2	614	16	630	W
Greene	--	5	5	--	1,059	1,059	6,609
Parke	--	1	1	--	2	2	W
Pike	1	8	9	92	5,697	5,789	36,872
Spencer	--	3	3	--	542	542	2,783
Sullivan	--	3	3	--	4,252	4,252	27,194
Vermillion	--	1	1	--	3,044	3,044	15,088
Vigo	1	--	1	82	--	82	W
Warrick	--	7	7	--	8,520	8,520	51,063
Undistributed	--	--	--	--	--	--	5,372
Total[1]	3	36	39	789	24,465	25,253	153,136

W Withheld to avoid disclosing individual company confidential data.
[1] Data may not add to totals shown because of independent rounding.

Petroleum and Natural Gas.—Although oil production was reported from 199 fields in 1973 as compared with 192 fields in 1972, total production amounted to 5,312,000 barrels, a decline of 817,000 barrels or 13%. An estimated 2,648,000 barrels, or 5% of the total, were credited to secondary recovery methods. The amount of oil produced by this method declined 14% from the previous year, whereas primary oil production declined 12%.

Fewer wells and less total footage were drilled in 1973 than in 1972, but drilling activity was more widely dispersed through the State in 1973 than in 1972. Drilling was distributed through only 24 counties in 1972, whereas in 1973 drilling took place in 33 counties, 16 of which had no drilling in the previous year. Within the region of the old Trenton oil and gasfield, 10 wells were drilled in seven counties in which no drilling occurred in 1972—Adams, Blackford, Decatur, Hancock, Jay, Jennings, and Wells. The search in that region is for Knox erosional remnants, which appear to offer possibilities for production at the unconformity between the Lower Ordovcian and the Middle Ordovician strata.

By far the greater part of the drilling during the year took place in a belt of known and suspected reef occurrences trending northward and northwestward from Perry and Spencer Counties on the Ohio River through Vermillion and Fountain Counties, with greatest activity in Daviess and Greene Counties. The 78 exploratory wells drilled in Daviess, Greene, and Knox Counties accounted for more than half of the exploratory holes in the State. Three new-field discoveries were on structures induced by Silurian reefs.

Of the 249 wells drilled for oil and gas, 143 were exploratory wells (an increase of 11 over the previous year) and 106 were for development purposes (a decrease of 50). Other drilling included 68 service wells and 31 in connection with gas shortage projects, for a total of 348.

Exploratory drilling resulted in 12 oil wells, 4 gas wells, and 127 dry holes. Two new oilfields, two new gasfields, and one new gas pool were completed in Devonian carbonate rocks; five new oilfields, one new gasfield, and five new oil pools were completed in Mississippian limestone and sandstone reservoirs.

Three wells drilled to Middle Ordovician limestones in Lawrence and Washington Counties along the Mt. Carmel Fault encountered shows of oil but no commercial production.

The discovery well of the Westphalia South Field in Knox County was completed in the Ste. Genevieve Limestone at a depth of 997 feet. Initial daily production was 348 barrels.

Natural gas produced during the year amounted to 276.4 million cubic feet, a decline of 22%. Proved oil reserves at the end of 1973 were 26,622,000 barrels, and because no natural gas liquid reserves were credited to Indiana in 1973, the total liquid hydrocarbon reserve was also 26,622,000 barrels.[2]

[2] American Gas Association, American Petroleum Institute, and Canadian Petroleum Association. Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas in the United States and Canada and United States Productive Capacity (as of December 31, 1973). V. 28, June 1974.

Table 11.—Indiana: Crude petroleum production in 1973, by major field

Name of field	Year discovered	Area, acres	Location, county	Number of wells		Production (barrels)
				Producing	Completed	
Black River Consolidated	1950	700	Posey	NA	--	111,527
Coe South	1961	440	Pike	NA	--	141,181
Elnora Central	1972	230	Daviess	23	8	279,807
Griffin Consolidated	1938	7,490	Gibson, Posey	NA	8	833,896
Heusler Consolidated	1938	2,230	Posey, Vanderburgh	NA	1	210,267
Mt. Carmel Consolidated	1941	2,260	Gibson, Knox	NA	4	121,352
Mt. Vernon Consolidated	1941	2,380	Posey	NA	1	252,878
Plummer	1969	1,180	Greene	NA	9	375,920
Springfield Consolidated	1943	2,640	Posey	NA	--	284,915
Union-Bowman Consolidated (new)	1941	15,740	Gibson, Knox, Pike	NA	2	219,445
Welborn Consolidated	1941	1,830	Posey	NA	--	177,005
Wheatonville Consolidated (new)	1949	2,100	Gibson	NA	--	151,520
Undistributed	XX	XX		NA	41	2,152,383
Total	XX	XX		NA	[1] 74	5,312,096

NA Not available. XX Not applicable.
[1] Includes workovers without newly drilled footage.

Source: Petroleum Section, Indiana Geological Survey.

Table 12.—Indiana: Oil and gas wells drilled in 1973 [1]

County	Proved field wells			Exploratory wells			Total	Footage
	Oil	Gas	Dry	Oil	Gas	Dry		
Adams	--	--	--	--	--	1	1	1,870
Allen	--	--	1	--	--	--	1	1,687
Blackford	--	--	--	--	--	1	1	2,395
Clay	3	--	2	3	--	4	12	14,201
Daviess	11	--	3	2	3	42	61	68,483
Decatur	--	2	--	--	--	--	2	1,781
Dubois	--	--	--	--	1	8	9	10,699
Gibson	13	--	2	--	--	3	18	29,528
Greene	10	--	2	--	--	20	32	38,465
Hancock	--	--	--	--	--	1	1	1,500
Huntington	1	--	1	--	--	--	2	2,020
Jasper	--	--	--	--	--	3	3	2,883
Jay	--	--	--	--	--	2	2	3,525
Jennings	--	1	--	--	--	--	1	946
Knox	4	1	3	1	--	10	19	30,973
Lawrence	--	--	--	--	--	2	2	5,002
Madison	--	--	--	--	--	1	1	1,433
Marion	--	--	--	--	--	1	1	1,520
Martin	--	--	--	--	--	4	4	4,971
Miami	1	--	--	--	--	--	1	862
Montgomery	--	--	--	--	--	1	1	570
Orange	--	--	--	--	--	1	1	2,308
Owen	--	--	--	--	--	2	2	2,225
Pike	8	--	--	--	--	4	12	14,512
Posey	4	--	12	1	--	3	20	44,117
Spencer	4	1	8	4	--	5	22	21,319
Sullivan	--	--	--	--	--	3	3	4,040
Vanderburgh	3	--	5	--	--	--	8	15,281
Vermillion	--	--	--	--	--	1	1	2,577
Vigo	--	--	--	--	--	1	1	1,398
Warrick	--	--	--	1	--	--	1	1,771
Washington	--	--	--	--	--	1	1	1,784
Wells	--	--	--	--	--	2	2	3,372
Total	[2][3] 62	[3] 5	[3][4] 39	12	4	[3] 127	249	340,018

[1] Does not include service wells (water input, saltwater disposal, water supply, or gas input wells). Also does not include wells drilled in connection with gas storage operations.
[2] Includes oil wells completed in secondary recovery projects.
[3] Includes workovers without newly drilled footage.
[4] Includes dry holes completed in secondary recovery projects.

METALS

Aluminum.—The Aluminum Co. of America's (Alcoa) Warrick smelter in Evansville produced aluminum ingot that exceeded 1972's output by 10% in volume and 5% in value.

Pig Iron and Steel.—Indiana's four steel mills increased their pig iron production 12%, to 17.1 million tons. The value increased 7%, to $1.3 billion. Inland Steel Co., United States Steel Corp., and Youngstown Sheet and Tube Co. produced pig and steel in Lake County while the Bethlehem Steel Corp. production was in Porter County.

The American Iron and Steel Institute ranked Indiana third among the steel producing States with 23.6 million tons in 1973, an 11% increase over 1972 production.

Inland Steel Company's Indiana Harbor Works capacity has been ranked as the country's third largest mill, but this plant poured more metal than any other in the Nation in 1971 and 1972. In May this plant became one of the few in the world to pour 200 million tons over the years.

Other Metals.—Antimonial lead, bismuth, gold, lead, silver, and tellurium were recovered by United States Smelting Lead Refinery, Inc., a subsidiary of United States Smelting, Refining, and Mining Co. at its electrolytic refinery in Lake County.

Table 13.—Principal producers [1]

Commodity and company	Address	Type of activity	County
Abrasive Stone: Hindostan Whetstone Co.	Box 501 Bedford, Ind. 47421	Quarry; stationary plant.	Orange.
Cement:			
Lehigh Portland Cement Co	Young Bldg. 718 Hamilton St. Allentown, Pa. 18105	Portland, dry process.	Lawrence.
Lone Star Cement Corp	2511 East 46th St. Suite K Indianapolis, Ind. 46205	Portland and masonry, wet process.	Putnam.
Louisville Cement Co	501 South 2nd St. Louisville, Ky. 40202	Portland and masonry, wet and dry process.	Cass, Clark.
Universal Atlas Cement Div., United States Steel Corp.	600 Grant St. U.S. Steel Bldg. Pittsburgh, Pa. 15230	Portland and masonry, dry process.	Lake.
Clays and shale:			
Adams Clay Products Co	Box 32 Martinsville, Ind. 46151	Pits and plant	Morgan.
American Brick Co	6558 West Fullerton Ave. Chicago, Ill. 60635	Pit and plant	Lake.
Arketex Ceramic Corp	Box 347 Brazil, Ind. 47834	Pit and plants	Vermillion.
Bloomfield Shale, Inc	P.O. Box 272 Bloomfield, Ind. 47424	Pit and plant	Greene.
Bloomington Crushed Stone, Inc.	P.O. Box 849 Bloomington, Ind. 47401	Pit	Lawrence.
Colonial Brick Corp	Box 365 Cayuga, Ind. 47928	Pits and plants	Vermillion.
Comet Coal and Clay Co	P.O. Box 11 Linton, Ind. 47441	Pit	Greene.
General Shale Corp	P.O. Box 96 Mooresville, Ind. 46158	Pit and plant	Morgan.
Hydraulic-Press Brick Co	705 Olive St. St. Louis, Mo. 63101	do	Do.
Indiana Clay Sales Inc	Box 112 Carbon, Ind. 47837	Pits	Clay.
Log Cabin Coal Co	304 South Depot St. Brazil, Ind. 47834	Pits	Do.
Logan Clay Products Co	Brazil, Ind. 47834	Pit and plant	Clay, Montgomery.
Louisville Cement Co	501 South 2nd St. Louisville, Ky. 40202	Pits	Cass, Clark.
Medora Brick Co	Medora, Ind. 47260	Pits	Jackson.
Mineral Resources, Inc	Pierre LaClede Center 7701 Forsyth Blvd. St. Louis, Mo. 63105	Pit	Martin.
S. L. Turner Coal and Clay Co., Inc.	Box 337 Carbon, Ind. 47837	Pit	Parke.
Coal (bituminous):			
AMAX Coal Co., Div. of American Metal Climax, Inc.:	430 Big Four Bldg. Indianapolis, Ind. 46225		
Chinook		Strip mine; cleaning plant.	Clay.
Ayrcoe		Strip mine	Pike.
Minnehaha		Strip mine; cleaning plant.	Sullivan.
Wright		Strip mine	Warrick.
Chapman Coal Co	P.O. Box 55 Petersburg, Ind. 47567	do	Pike.
Enos Coal Corp., Old Ben Coal Corp.:	10 South Riverside Plaza Chicago, Ill. 60606		
Enos		Strip mine; cleaning plant.	Do.
Blackfoot No. 5		do	Do.
Kings Station Coal Corp	10 South Riverside Plaza Chicago, Ill. 60606	Underground mine; cleaning plant.	Gibson.
Mountain Pleasant Mining	Route 25, Box 19 Terre Haute, Ind. 48701	do	Vigo.
Mulzer Crushed Stone Co	Box 248 Tell City, Ind. 47586	Strip mine	Spencer.
Parke Coal Co	Box 236 Petersburg, Ind. 47567	do	Pike.

See footnote at end of table.

Table 13.—Principal producers [1]—Continued

Commodity and company	Address	Type of activity	County
Coal (bituminous)—Continued			
Peabody Coal Co.:	301 North Memorial Dr. St. Louis, Mo. 63102		
Hawthorn	----------	Strip mine; cleaning plant.	Greene.
Latta	----------	Strip mine; coal cleaned at Miller plant.	Do.
Universal	----------	Strip mine	Vermillion.
Miller Preparation Plant	----------	Cleaning plant	Greene.
Dugger	----------	Strip mine; coal cleaned at Miller plant.	Sullivan.
Lynnville	----------	Strip mine; cleaning plant.	Warrick.
Squaw Creek	----------	---- do	Do.
R & H Mining, Inc	Route 1 Jasper, Ind. 47546	Underground mine	Pike.
Three States Coal Co	P.O. Box 694 Grandview, Ind. 47615	Strip mine	Spencer.
Walker & Sons Coal Co	Chrisney, Ind. 47611	---- do	Do.
Coke:			
Citizens Gas & Coke Utility	2020 North Meridian Indianapolis, Ind. 46209	Coke ovens	Marion.
Indiana Gas & Chemical Corp	1341 Hulman St. Terre Haute, Ind. 47802	---- do	Vigo.
Inland Steel Co	3210 Watling St. East Chicago, Ind. 46312	---- do	Lake.
United States Steel Corp	Gary, Ind. 46400	---- do	Do.
The Youngstown Sheet & Tube Co.	Box 900 Youngstown, Ohio 44501	---- do	Do.
Gypsum:			
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	Underground mine; calcining plant.	Martin.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	Underground mine; 2 calcining plants.	Lake, Martin.
Iron and Steel:			
Bethlehem Steel Corp., Burns Harbor Plant.	701 East 3rd St. Bethlehem, Pa. 18016	Iron blast furnace and basic oxygen steel furnace.	Porter.
Inland Steel Co	3210 Watling St. East Chicago, Ind. 46312	Iron blast furnaces and open-hearth steel furnaces.	Lake.
United States Steel Corp., Gary Steel Works.	Gary, Ind. 46400	---- do	Do.
The Youngstown Sheet & Tube Co.	Box 900 Youngstown, Ohio 44501	---- do	Do.
Lime: Marblehead Lime Co	300 West Washington St. Chicago, Ill. 60606	Quicklime, 3 rotary kilns.	Do.
Peat:			
Herb Felger Peat Moss and Black Dirt.	9912 Valentine Rd. Fort Wayne, Ind. 46808	Bog, processing plant.	Allen.
Millburn Peat Co., Inc	Box 297 Otterbein, Ind. 47970	---- do	Warren.
Organic Products Co	225 South Nichols Ave., Apt. 8 Muncie, Ind. 47303	---- do	Delaware.
Expanded perlite:			
Airlite Processing Corp	P.O. Scottsburg Vienna, Ind. 47170	Processing plant	Scott.
Chemrock Corp	End of Osage St. Nashville, Tenn. 37208	---- do	Tippecanoe.
Grefco, Inc	2111 Enco Drive Oakbrook, Ill. 60521	---- do	Montgomery.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	---- do	Martin.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	---- do	Lake, Martin.

See footnote at end of table.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Petroleum Refineries:			
Amoco Oil Co	2400 New York Ave. Box 710 Whiting, Ind. 46394	Processing plant	Lake.
Atlantic Richfield Co	3500 Indianapolis Blvd. East Chicago, Ind. 46312	----	Do.
Cities Service Oil Co	4900 Cline Ave. Box 718 East Chciago, Ind. 46312	----	Do.
Mobil Oil Corp	3821 Indianapolis Blvd. East Chicago, Ind. 46312	----	Do.
Rock Island Refining Corp	P.O. Box 68007 Indianapolis, Ind. 46228	----	Marion.
Roofing granules: H. B. Reed & Co., Inc.	8149 Kennedy Ave. Highland, Ind. 46322	2 plants; produced from slag.	Lake.
Sand and gravel:			
American Aggregates Corp	Garst Ave. at Ave. B Greenville, Ohio 45331	Pits; stationary plants.	Hamilton, Marion, Wayne.
Deutchman-Coweles Sand and Gravel Co.	Box 188 Kewanna, Ind. 46939	Pit; stationary plant.	Fulton.
Gospert Gravel Co. Inc	P.O. Box 849 Bloomfield, Ind. 47401	---- do	Green.
Hanna Sand and Gravel Co., Inc.	Hanna, Ind. 46340	---- do	La Porte.
Hilltop Concrete Corp	Box 11056 Cincinnati, Ohio 45211	---- do	Switzerland.
Interstate Sand & Gravel Co., Inc.	Box 38 Covington, Ind. 47932	---- do	Warren.
Irving Brothers Gravel Co., Inc.	R.R. 3 Marion, Ind. 46952	Stationary plants	Delaware and Grant.
Irving Materials, Inc., No. 2	Box 369 Greenfield, Ind. 46140	Pits; portable and stationary plants.	Hamilton, Henry.
Martin Marrietta Aggregates Div., Martin Marietta Corp.	4096 First Ave., N.E. Cedar Rapids, Iowa 52406	---- do	Hamilton, Marion, Shelby, Vermillion, Vigo.
Neal Gravel Co., Inc., Interstate Sand & Gravel Co., Inc.	Box 38 Covington, Ind. 47932	Pit; stationary plant.	Fountain.
Spray Sand & Gravel, Inc	Route 4 Seymour, Ind.	Pits; dredges; stationary plants.	Jackson.
Western Indiana Aggregates, Inc., Medusa Portland Cement Co.:	500 North 6th Street Lafayette, Ind. 47901		
Anderson Gravel Division	----	Pits; stationary plant.	Madison.
Eagle Materials, Inc	----	Dredge; stationary plant.	Lake.
Hanna Sand & Gravel Co., Inc.	----	---- do	La Porte.
Lafayette No. 1 Gravel Division.	----	Pit; stationary plant.	Tippecanoe.
Lafayette Portable Gravel Division.	----	Pit; portable plant.	Do.
Leesburg Gravel Division	----	Pit; stationary plant.	Kosciusko.
Montezuma Gravel Division	----	---- do	Parke.
South Bend Gravel Division.	----	---- do	St. Joseph.
Nonferrous Smelters and Refineries:			
Aluminum Company of America.	Newburgh, Ind. 47630	Aluminum smelter	Warrick.
American Smelting & Refining Co.	2230 Indianapolis Blvd. Whiting, Ind. 46394	Lead secondary plant.	Lake.
NL Industries	Beech Grove, Ind. 46107	---- do	Marion.
United States Smelting Lead Refinery, Inc.	5300 Kennedy Ave. East Chicago, Ind. 46312	Lead primary and secondary plant.	Lake.

See footnote at end of table.

Table 13.—Principal producers [1]—Continued

Commodity and company	Address	Type of activity	County
Stone:			
Crushed and broken:			
American Aggregates Corp	Garst Ave. at Avenue B Greenville, Ohio 45331	Quarries; stationary plants.	Hamliton, Owen.
T. J. Atkins & Co	P.O. Box 529 Jeffersonville, Ind. 47265	Quarry	Clark.
Berry Materials Corp	Box 450 North Vernon, Ind. 47265	Quarries	Jennings, Ripley.
Bloomington Crushed Stone Co., Inc., Ralph Rogers & Co., Inc.	Box 849 Bloomington, Ind. 47401	Quarries; stationary plants.	Lawrence, Monroe.
Cave Quarries, Inc	R.R. 3 Paoli, Ind. 47454	Quarries	Orange, Shelby.
France Stone Co	Box 1928 Toledo, Ohio 43603	do	Allen, Cass, Putnam.
Gorman Construction, Inc	P.O. Box 96 Russellville, Ind. 46175	Quarry	Putnam.
Irving Bros. Gravel Co., Inc.:	Rt. 3 Marion, Ind. 46952		
Erie Stone, Inc		Quarries; stationary plant.	Hamilton, Huntington, Wells.
Irving Bros. Stone & Gravel.		Quarry; stationary plant.	Delaware.
Pipe Creek Stone Co		do	Grant.
Lehigh Portland Cement Co.	Young Bldg. 718 Hamilton St. Allentown, Pa. 18105	do	Lawrence.
Lone Star Cement Corp	2511 East 46th St. Suite K Indianapolis, Ind. 46205	do	Putnam.
Louisville Cement Co	501 South 2nd St. Louisville, Ky. 40202	Quarries; stationary plants.	Cass, Clark.
Martin-Marietta Aggregates Central Division.	Box 789 Cedar Rapids, Iowa 52406	Quarry	Clark.
Meshberger Brothers Stone Corp.	P.O. Box 38 Linngrove, Ind. 46769	Quarries and plants.	Adams, Bartholomew.
Midwest Aggregates Corp., Old Fort Industries, Inc.	2013 South Anthony Blvd. Fort Wayne, Ind. 46805	Quarry; stationary plant.	Allen, Blackford, Delaware.
Mitchell Crushed Stone Co., Inc., Ralph Rogers & Co., Inc.	Box 849 Bloomington, Ind. 47401	do	Lawrence.
Mulzer Crushed Stone Co	Box 248 Tell City, Ind. 47586	Quarries; underground mine; stationary plants.	Crawford, Perry.
Muncie Stone and Lime Co.	Box 2525 Muncie, Ind. 47302	Quarry	Delaware.
New Point Stone Co	R.R. No. 1 Batesville, Ind. 47006	Quarries	Decatur, Ripley.
Newton County Stone Co., Inc., Ralph Rogers & Co., Inc.	Box 147 Kentland, Ind. 47951	Quarry; stationary plant.	Newton.
Scott County Stone Co., Inc.	P.O. Box 130 Scottsburg, Ind. 47170	Quarry	Scott.
Sellersburg Stone Co., Inc	1019 East Utica St. Sellersburg, Ind. 47172	do	Clark.
Stony Creek Stone Co., Inc.	R.R. 4, Box 133A Noblesville, Ind. 46060	do	Hamilton.
Western Indiana Aggregates, Inc., Medusa Portland Cement Co., Francesville Stone Division.	500 North 6th St. Lafayette, Ind. 47901	Quarry; stationary plant.	Lawrence, Monroe.
Yeoman Stone Co	P.O. Box 2 Kokomo, Ind. 46901	Quarry	Howard.
Dimension Stone:			
Bloomington Limestone Corp.	Box 250 Bloomington, Ind. 47401	Quarry; stationary plant.	Monroe.
Eliott Stone Co		Quarry	Do.
Evans Quarries Inc	Box 144 Bedford, Ind. 47421	do	Lawrence.
Four R Quarries Inc	Box 229 Fairland, Ind. 46126	do	Monroe.

See footnote at end of table.

Table 13.—Principal producers [1]—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Dimension stone—Continued			
Independent Limestone Co	Route 5, Box 395 Bloomington, Ind. 47401	Quarry; stationary plant.	Monroe.
Indiana Limestone Co., Inc.	405 North 1st St. Bedford, Ind. 46421	Quarries; stationary plant.	Lawrence, Monroe.
Indiana Sandstone Co., Inc.	Box 501 Bedford, Ind. 47421	Quarry; finishing plant.	Lawrence.
Piedmont Stone Co., Inc	P.O. Box 188 Bloomington, Ind. 47401	Quarry	Do.
Reed Quarries, Inc	Box 64 Bloomington, Ind. 47401	Quarry; stationary plant.	Monroe.
Victor Oolitic Stone Co	Box 668 Bloomington, Ind. 47401	do	Lawrence, Monroe.
Woolery Stone Co., Inc	Box 40 Bloomington, Ind. 47401	do	Monroe.
Sulfur (recovered):			
AMOCO Oil Co	910 South Michigan Ave. Chicago, Ill. 60680	Mathieson-Fluor process.	Lake.
Atlantic Richfield Co	3500 Indianapolis Blvd. East Chicago, Ind. 46312	Claus process	Do.

[1] Data regarding producers of natural gas and petroleum not available.

The Mineral Industry of Iowa

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Iowa for collecting information on all minerals except fuels.

By Brinton C. Brown [1]

Iowa continued to rank 31st in the Nation in value of mineral production, which attained another alltime high of $159 million in 1973, surpassing the 1972 record by 18%. Despite decreases in production and value of coal, the spectacular rise in the State's mineral production value was achieved by a combination of increased output of nonmetallic minerals except clays, and substantially higher prices.

Nonmetallic minerals dominated the State's total mineral production value, accounting for 98%; mineral fuels, mostly coal, comprised the remainder. Iowa's mineral production value was distributed as follows: Portland cement, 38%; stone, 36%; sand and gravel, 16%; gypsum, 4%; coal, 2%; masonry cement and clays, 1% each; and lime, peat, and gemstones, the remaining 2%. Petroleum has not been produced in the State since 1963. During 1973, 301 drilling permits were issued—10 for gas injection/withdrawal wells and 291 wells to obtain geologic information related to underground gas storage.

[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Mineral production in Iowa [1]

Mineral	1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Masonry ---thousand short tons--	66	$1,916	68	$2,351
Portland ---do---	2,458	49,635	2,688	59,574
Clays ---do---	1,047	2,643	967	2,028
Coal (bituminous) ---do---	851	4,138	601	3,279
Gem stones	NA	1	NA	W
Gypsum ---thousand short tons--	1,380	5,714	1,470	6,324
Sand and gravel ---do---	17,107	20,140	19,950	25,541
Stone ---do---	27,457	48,642	31,541	56,918
Value of items that cannot be disclosed:				
Other nonmetals and values indicated by symbol W	XX	1,667	XX	2,785
Total	XX	134,496	XX	158,800
Total 1967 constant dollars	XX	110,973	XX	p 116,591

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Iowa, by county[1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adair	W	W	Stone.
Adams	W	W	Do.
Allamakee	$294	$328	Stone, sand and gravel.
Appanoose	W	W	Stone, clays.
Audubon	W	W	Sand and gravel.
Benton	W	W	Stone, sand and gravel.
Black Hawk	W	W	Do.
Boone	W	W	Sand and gravel, clays.
Bremer	W	386	Stone, sand and gravel.
Buchanan	W	W	Do.
Buena Vista	120	153	Sand and gravel.
Butler	530	W	Stone, sand and gravel.
Calhoun	W	--	
Carroll	W	W	Sand and gravel.
Cass	W	W	Stone.
Cedar	W	W	Stone, sand and gravel.
Cerro Gordo	29,727	33,165	Cement, stone, clays, sand and gravel.
Cherokee	606	558	Sand and gravel.
Chickasaw	W	W	Sand and gravel, stone.
Clarke	W	W	Stone.
Clay	W	191	Sand and gravel.
Clayton	1,098	1,475	Sand and gravel, stone.
Clinton	W	W	Stone, sand and gravel.
Crawford	W	W	Sand and gravel.
Dallas	W	W	Sand and gravel, clays, stone.
Davis	W	W	Stone.
Decatur	W	W	Do.
Delaware	W	W	Stone, sand and gravel.
Des Moines	W	3,363	Gypsum, stone, sand and gravel.
Dickinson	177	241	Sand and gravel.
Dubuque	W	W	Stone, sand and gravel.
Emmet	W	15	Sand and gravel.
Fayette	963	W	Stone, sand and gravel.
Floyd	W	W	Stone, sand and gravel, clays.
Franklin	W	W	Do.
Fremont	W	W	Stone, sand and gravel.
Greene	W	W	Sand and gravel.
Grundy	W	W	Stone, sand and gravel.
Guthrie	W	W	Sand and gravel.
Hamilton	W	W	Stone, sand and gravel.
Hancock	869	W	Sand and gravel, stone.
Hardin	W	W	Stone, sand and gravel.
Harrison	809	926	Do.
Henry	W	W	Do.
Howard	249	227	Do.
Humboldt	1,281	W	Do.
Iowa	W	W	Sand and gravel.
Jackson	W	477	Stone, sand and gravel.
Jasper	W	W	Sand and gravel, stone.
Jefferson	278	W	Stone.
Johnson	1,853	W	Stone, sand and gravel.
Jones	W	2,502	Do.
Keokuk	W	W	Stone, clays.
Kossuth	263	215	Sand and gravel.
Lee	626	778	Stone, sand and gravel.
Linn	3,453	W	Do.
Louisa	W	W	Stone.
Lucas	542	W	Coal.
Lyon	82	350	Sand and gravel.
Madison	W	W	Stone, clays.
Mahaska	2,331	1,499	Coal, stone, sand and gravel.
Marion	W	1,511	Stone, sand and gravel, coal.
Marshall	W	W	Stone, sand and gravel.
Mills	W	W	Stone.
Mitchell	W	836	Stone, sand and gravel.
Monona	245	166	Sand and gravel.
Monroe	1,250	W	Coal, stone.
Montgomery	W	W	Stone, sand and gravel.
Muscatine	W	W	Do.
O'Brien	W	236	Sand and gravel.
Osceola	W	W	Do.
Page	W	W	Stone, sand and gravel.
Palo Alto	W	W	Sand and gravel.
Plymouth	423	733	Do.
Pocahontas	W	W	Stone, sand and gravel.
Polk	17,658	21,247	Cement, sand and gravel, clays.

See footnotes at end of table.

Table 2.—Value of mineral production in Iowa, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Pottawattamie	W	W	Stone, sand and gravel.
Poweshiek	W	W	Stone.
Ringgold	--	W	Do.
Sac	$744	W	Sand and gravel.
Scott	15,696	$19,578	Cement, stone, lime, clays.
Shelby	W	W	Sand and gravel.
Sioux	974	1,246	Do.
Story	W	1,300	Sand and gravel, stone, clays.
Tama	W	W	Sand and gravel.
Taylor	W	W	Stone.
Union	W	W	Do.
Van Buren	W	W	Stone, sand and gravel.
Wapello	345	W	Coal, sand and gravel, clays, stone.
Warren	W	W	Sand and gravel, clays.
Washington	W	W	Stone.
Wayne	W	288	Do.
Webster	5,106	6,132	Gypsum, stone, sand and gravel, clays.
Winnebago	W	W	Peat, sand and gravel.
Winneshiek	935	1,069	Stone, sand and gravel.
Woodbury	163	190	Sand and gravel, clays.
Worth	1,640	W	Stone, peat, sand and gravel.
Wright	W	W	Sand and gravel.
Undistributed [2]	43,162	57,420	
Total [3]	134,496	158,800	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Ida County is not listed because no production was reported.

[2] Includes some sand and gravel and stone that cannot be assigned to specific counties, gem stones, and value indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Iowa business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ---thousands--	1,255.5	1,294.0	+3.1
Unemployment ---do---	45.1	37.0	−18.0
Employment:			
Manufacturing ---do---	223.4	240.5	+7.7
Construction ---do---	42.1	44.9	+6.7
Mining ---do---	3.0	2.9	−3.3
Transportation and public utilities ---do---	53.2	54.9	+3.2
Finance, insurance, and real estate ---do---	44.0	45.6	+3.6
Wholesale and retail trade ---do---	225.1	237.9	+5.7
Services ---do---	161.2	165.8	+2.9
Government ---do---	180.2	183.4	+1.8
Personal income:			
Total ---millions--	$12,396	$14,139	+14.1
Per capita	$4,300	$4,869	+13.2
Construction activity:			
Value of nonresidential construction ---millions--	$150.1	$210.7	+40.4
New housing units authorized	13,633	13,710	+.6
State highway commission contracts awarded ---millions--	[e] $157.6	$118.5	−24.8
Portland cement shipments to and within Iowa thousand short tons--	1,601	1,744	+8.9
Mineral production value ---millions--	$134.5	$158.8	+18.1

[e] Estimate. [p] Preliminary.

Source: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

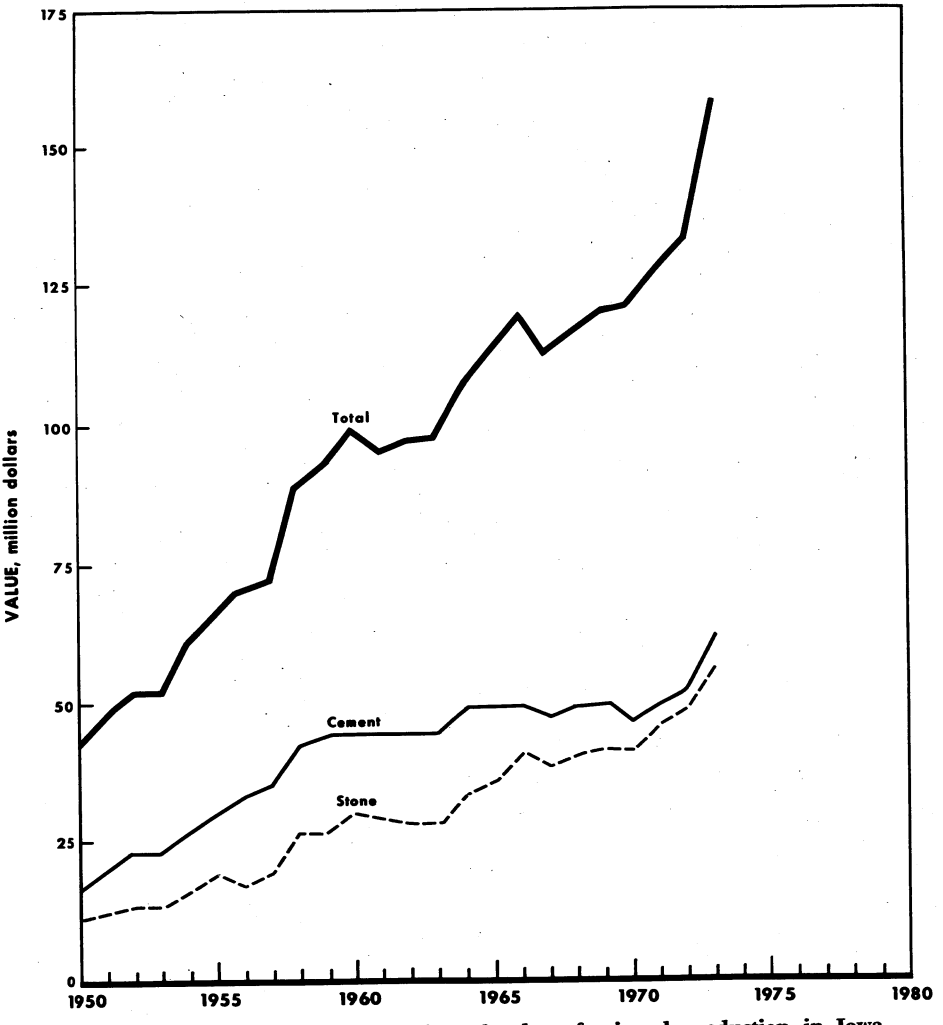

Figure 1.—Value of cement, stone, and total value of mineral production in Iowa.

The impact of the energy crisis on Iowa was the most important phenomenon in the State in 1973. Few Iowans were untouched by the energy shortages during the year. Fuel oil supplies dwindled in the early months, and the year ended with fuel oil and gasoline shortages. The State Employment Service reported that the energy crisis was the cause of a significant number of work stoppages and was taking its toll of jobs and wages. Natural gas users with interruptible service contracts were warned to switch to other fuels. This led to a run on alternative fuels—propane and fuel oil. Farmers faced a critical shortage of propane needed to dry grain; the price of the fuel had escalated 26 to 30 cents a gallon. Some brick factories closed and others curtailed production because of the fuel oil shortage. According to the Iowa Power and Light Co., residents of Des Moines and southwest Iowa cut their use of electricity 5% and natural gas 7% by voluntary conservation.

In 1973, only 2.2% of Iowa's energy consumption came from resources within the State. The largest energy source for Iowans was petroleum, comprising 41%, followed by natural gas (37%), and coal (18%). Iowans made little use of coal, the only

fossil fuel found in the State. Less than 10% of the coal burned in the State came from Iowa mines. However, the State Legislature funded a $243,000 research project in 1973 to find ways to mine and burn Iowa high-sulfur coal in an acceptable manner. In October, Iowa Power and Light Co. received its first shipment of Wyoming low-sulfur coal by unit train. The Wyoming coal will be mixed with Iowa coal to produce a fuel with acceptable sulfur content. Iowa Public Service Co. has been using Wyoming coal for this purpose for the past 1½ years.

Atomic energy development in the State has been seriously hindered by environmentalists. Evidence of the continuing harassment was a complaint filed with the Iowa Commerce Commission charging that the Duane Arnold Energy Center, Iowa's first nuclear powerplant nearing completion near Palo in Linn County, does not constitute a "reasonable" service under Iowa law. The first truckload of nuclear fuel arrived for the 550-megawatt electric-power-generating plant; it was scheduled to be in operation in January 1974.

A group of Iowa investors formed the Blazer Corp. to search for and exploit Iowa's coal resources. The company proposes to undertake a 3-year drilling program at an estimated cost of $2 million to identify a suitable coalfield in southern Iowa that will yield a minimum of 500,000 tons of coal a year for at least 20 years.

Legislation and Government Programs.—House File 779, passed by the first session of the 65th Iowa General Assembly, was signed into law on July 12, 1973 by the Governor. The law abolished the Department of Mines and Minerals, updated the 5-year-old Surface Mining Control Law, and placed the administration and enforcement of both surface and underground mining rehabilitation under the Department of Soil Conservation. Provisions of the law (1) give the Department of Soil Conservation the authority to cooperate with the U.S. Department of the Interior in the administration and enforcement of the Federal Coal Mine Health and Safety Act of 1969 and the Federal Metal and Nonmetallic Mine Safety Act of 1966, (2) limit the required rehabilitation of mined land to a maximum slope of 4:1 (instead of 3:1) to permit farm machinery to operate safely, (3) require rehabilitated land to be seeded for some type of vegetation to prevent erosion, and (4) transfer the responsibility for mapping underground mines to the Iowa Geological Survey.

An attempt to double the $500 a-day penalty for air pollution was rejected by the Iowa Legislature after some legislators contended the Legislature already had an antibusiness image and shouldn't make it worse. The Iowa Legislature adjourned its 1973 session without taking up a State land-use bill. Proposed bills introduced in 1973 would have created a State land-use policy commission to provide for the orderly development of land and related natural resources in Iowa and to provide for greater uniformity of local land-development plans.

During the year, the Iowa Air Quality Commission issued its first emergency order and shut down a kiln of Lehigh Portland Cement Co. in Mason City for emitting excessive dust. A faulty electrostatic precipitator awaiting repairs was blamed for the dust situation. The company initiated a program to install additional pollution control equipment on all its kilns.

The Iowa Geological Survey issued the following publications in 1973: (1) Report of Preliminary Interpretation of Aeromagnetic Survey of Southern Iowa; (2) Flood Inundation Mapping in Southwestern Iowa; a Preliminary Report, Analysis of ERTS–1 Imagery; (3) Public Information Circular No. 6: Flood Inundation Mapping and Remote Sensing in Iowa; (4) Mississippian Aquifer of Iowa: Miscellaneous Map Series 3; and (5) Bedrock Topography of Southeast Iowa (2 sheets).

The Federal Bureau of Mines, in cooperation with the Iowa Geological Survey, published its Report of Investigations 7830, "Preparation Characteristics and Desulfurization Potential of Iowa Coals." The report describes the preparation characteristics of 10 coal samples collected from significant coal-producing mines in Lucas, Mahaska, Marion, Monroe, and Wapello Counties, with special emphasis on physical desulfurization. All of the coals tested were high in sulfur content, but could meet the current Federal SO_2-emission standards by utilizing a combination of physical desulfurization prior to combus-

tion and SO_2-removal processes after combustion. Iowa State University published a booklet on Iowa's Coal Mining Heritage, which includes supplementary material on the Last Pony mine (New Gladstone mine).

Employment and Injuries.—Although no fatalities occurred in the coal mines during the year, there were seven disabling injuries and one nondisabling injury reported for the 228,480 man-hours worked. There were no fatalities in the nonmetallic mineral industry (compared with three fatalities in 1972), but there were 21 lost-time accidents. Average employment in the nonmetallic minerals industry ranged from 2,300 in January to 3,700 in August.

Martin Marietta Aggregates' Pond portable stone operation was the winner of the National Crushed Stone Association's 48th Annual Safety Contest group V competition, for plants operating 30,000 man-hours or less. Certificates were also awarded the following companies that had an injury-free year in 1973, by group classification: Group II (50,000 to 100,000 man-hours), Atalissa plant operated by Wendling Quarries, Inc.; group IV (30,000 to 50,000 man-hours), four plants operated by Martin Marietta Aggregates—Cedar Rapids quarry, Earlham quarry, Boyd portable stone, and Job portable stone; group V, B. L. Anderson, Inc., plant II, and four plants (in addition to Pond) operated by Martin Marietta Aggregates—Volk portable stone, Short portable stone, Mercer stripping crew, and Day stripping crew.

In its 1973 Safety Contest, the National Sand and Gravel Association awarded Certificates of Achievement in Safety to the following Iowa participants operating during the period without lost-time accidents: Class B competition (550,000 to 1,499,999 tons), Martin Marietta Aggregates' West Des Moines sand plant; class C (225,000 to 549,999 tons), Martin Marietta Aggregates' Cedar Rapids sand plant; class D (170,000 to 224,999 tons), two Martin Marietta Aggregates sand plants—Marshalltown and Waterloo; class E (60,000 to 169,999 tons), Van Dusseldorp Sand and Gravel, Inc.'s, Reasnor pit, and two Martin Marietta Aggregates' plants—Eddyville sand plant and portable plant No. 41; and class F (less than 60,000 tons), Pella Sand and Gravel Co., a division of Van Dusseldorp Sand and Gravel, Inc., and Martin Marietta Aggregates' portable plant No. 42. Five plants owned by Martin Marietta Aggregates received special certificates for 5 or more consecutive accident-free years: Waterloo (20 years), Marshalltown (16 years), Cedar Rapids (14 years), portable No. 42 (13 years), and portable No. 41 (11 years).

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Portland cement shipments increased 9% in quantity and 20% in value. Iowa continued to rank 9th in the Nation in value of cement production, but dropped to 10th in quantity produced. The average mill value for all types of portland cement increased $1.97 a ton (to $22.16) in Iowa, compared with an average increase of $1.57 a ton (to $21.88) in the United States, including Puerto Rico.

Five companies operated a total of 19 kilns at two dry-process and three wet-process plants; their combined annual capacity was 2,689,000 tons. Northwestern States Portland Cement Co. and Lehigh Portland Cement Co. operated dry-process plants near Mason City in Cerro Gordo County. Martin Marietta Cement produced cement at a plant along the Mississippi River west of Davenport in Scott County. Penn-Dixie Cement Corp. manufactured cement at West Des Moines in Polk County. Also in Polk County, Marquette Cement Manufacturing Co. operated a plant near Des Moines.

About 96% of the portland cement shipped was type I (general construction use) and type II (moderately low heat and moderate degree of resistance to sulfate attack); the remainder comprised type III (high-early-strength) and expansive cements. Shipments were 95% in bulk and 5% in bags. About 81% of the cement was transported by truck to the customer, with the remainder shipped by rail. Most of the cement hauled from plants to distribution terminals was by rail; a small quantity was transported by barge.

Disposition of portland cement shipped by Iowa manufacturers was as follows: Ready-mix concrete producers, 65%; con-

crete product manufacturers (for concrete block, concrete pipes, precast prestressed concrete, and other concrete products), 16%; highway contractors, 9%; building material dealers, 7%; and other contractors, government agencies, and miscellaneous uses, 3%. Apparent consumption of portland cement in Iowa during 1973 was 1,744,000 tons, an increase of 9%. Despite shipments of more than 900,000 tons of cement produced in Iowa to customers in nearby States, some Iowa customers received cement produced in other States.

Masonry cement shipments increased 3% in quantity and 23% in value. The average mill value of masonry cement increased $5.54 a ton to $34.57. This was $5.14 a ton higher than the average value for masonry cement in the United States. Consumption of masonry cement in Iowa was 27,000 tons, an increase of 8%. About 61% of the masonry cement manufactured in Iowa was shipped to customers outside the State.

Clays.—Production of common clay and shale decreased 8% in quantity and 23% in value. Although 14 companies operated 20 open-cut clay and shale mines in 15 counties, 5 companies produced 76% of the clay and shale from 10 pits. The largest producers were, in descending order, Can-Tex Industries, the brick and tile division of Harsco Corp.; Northwestern States Portland Cement Co.; Carter-Waters Corp. (for lightweight aggregate); and Martin Marietta Cement. The largest production came from Cerro Gordo County. Dallas and Appanoose Counties followed, each with production exceeding 100,000 tons.

The total clay and shale production was used as follows: 43% in manufacturing portland cement, 29% for making building brick, 9% for drain tile, and the remainder for lightweight aggregate, sewer pipe, and structural tile.

In August, Kalo Brick and Tile Co. terminated manufacturing operations in Webster County.

During the year, operators stripped 32 acres of land for clay production and rehabilitated 29 acres of land for other use.

Gem Stones.—Rockhounds and amateur collectors collected small quantities of gem stones and mineral specimens.

Gypsum.—Output of crude gypsum increased 7% in quantity and 11% in value, establishing a new annual record. Iowa ranked fourth in the Nation in quantity of gypsum produced and third in value of production.

United States Gypsum Co. operated the sixth largest open pit gypsum mine in the United States at Fort Dodge in Webster County. The company was expanding its production capacity for high-strength gypsum cement at the plant adjacent to the mine. The plant ranked fourth in the Nation in output of calcined gypsum.

The company also operated an underground mine near Sperry in Des Moines County. The first fertilizer-type granular gypsum unit in the country was built during the year at United States Gypsum Co.'s Sperry calcining plant. The unit was the result of an innovation in gypsum technology by the company in late 1973 whereby gypsum was successfully granulated into particles of controlled size. This development permits the use of granular gypsum as a carrier of other ingredients such as herbicides, insecticides, and micronutrients.

National Gypsum Co., Georgia-Pacific Corp., and the Celotex Corp., a division of Jim Walter Corp., each produced gypsum from open pit mines near Fort Dodge, and calcined gypsum at plants adjacent to their mines.

Output of calcined gypsum increased 7% to a record high of 975,000 tons. A combined total of 22 kettles, 4 hydrocal-digestors, and 6 board machines were in operation at the 5 calcining plants. The major use for calcined gypsum was in manufacturing wallboard, lath, and sheathing for the building industry. Smaller quantities were used for building plasters and prepared finishes. Some calcined gypsum was sold for industrial uses in manufacturing plate glass, terracotta items, dental and orthopedic plasters, industrial molding, art and casting plasters, and other nonbuilding uses. Uncalcined gypsum was sold for portland cement retarder, filler material, and agricultural use.

During the year, 66 acres of land was stripped for gypsum removal and 47 acres of land was rehabilitated for other uses.

Lime.—Quicklime and hydrated lime output increased 70% in quantity and 73% in value, only 2% below the 1969 record high production. Linwood Stone Products Co., a subsidiary of McCarthy Improvement Co., was the State's sole producer of quicklime and hydrated lime for commercial

sale. The firm processed limestone from an underground mine near Buffalo in Scott County. American Crystal Sugar Co. ceased operating its lime plant near Mason City in Cerro Gordo County.

Lime produced in the State was used as follows: 34% for water purification, 32% for flux in steel manufacturing in open-hearth furnaces and electric arc furnaces, 21% for soil stabilization, 8% for sewage treatment and neutralization of waste acids, and 5% for miscellaneous uses.

Total lime consumption in Iowa was 86,180 tons, which included lime manufactured in other States. Customers in the State consumed 29% of Iowa's lime production. About 44% of the State's lime was shipped to Illinois, 15% to Wisconsin, and 12% to Minnesota, Nebraska, Michigan, and Kansas.

Perlite.—Crude perlite mined in New Mexico was expanded by National Gypsum Co., United States Gypsum Co., and Georgia-Pacific Corp. in facilities at three gypsum plants near Fort Dodge in Webster County. Expanded perlite production decreased 31% in quantity and 26% in value. The principal use was as aggregate in the manufacture of building plaster.

Sand and Gravel.—Production of sand and gravel increased 17% in quantity and 27% in value. About 18.7 million tons of sand and gravel was produced by 124 commercial operators at 264 locations; nearly 1.3 million tons was produced by 33 county and municipal highway departments at 36 locations. Sand and gravel producers operated 127 stationary plants, 106 portable plants, and 25 dredges in 80 counties.

Only 1 commercial operation produced between 700,000 and 800,000 tons; 10 operations produced between 300,000 and 500,000 tons; 41 produced between 100,000 and 300,000 tons; 109 between 25,000 and 100,000 tons; and 103 produced less than 25,000 tons. Nearly 37% of the sand and gravel was produced at 162 plants with less than 100,000 tons annual production each. Largest production was in Polk County with 1,850,000 tons. Five companies produced 41% of Iowa's sand and gravel at 107 locations: Maudlin Construction Co., Hallett Construction Co., Martin Marietta Aggregrates, G. A. Finley Inc., and Welp & McCarten, Inc.

Iowa's sand and gravel was used as follows: 53% for paving roads, 25% for construction, 10% for fill, and the remainder for railroad ballast and miscellaneous uses. A small quantity of ground and unground sand was used for industrial purposes, such as molding, sand blasting, and filtration.

During the year, sand-and-gravel operators stripped 393 acres of land for mining operations and rehabilitated 298 acres for other uses.

Table 4.—Iowa: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Allamakee	3	5	5	4	95	109
Black Hawk	7	430	547	7	491	633
Boone	9	427	W	10	727	W
Buena Vista	5	219	120	5	187	153
Cerro Gordo	6	445	431	5	319	504
Cherokee	8	583	606	10	502	558
Chickasaw	2	59	91	3	76	122
Clay	3	W	W	4	210	191
Clinton	4	147	179	4	148	188
Dallas	5	460	459	6	788	1,145
Davis	1	1	1	--	--	--
Des Moines	2	307	259	1	W	W
Dickinson	2	W	177	6	239	241
Emmet	2	W	W	2	22	15
Fayette	8	120	164	10	140	213
Franklin	6	268	243	5	W	W
Grundy	1	13	15	1	23	37
Hamilton	4	34	20	5	W	W
Hancock	10	W	W	10	709	W
Hardin	10	318	332	14	575	473
Henry	2	91	111	1	W	W
Howard	2	W	34	2	12	10
Humboldt	4	69	64	3	107	101
Jackson	3	W	W	3	55	76
Johnson	2	273	W	2	319	W
Jones	4	50	60	4	52	69
Kossuth	5	367	263	6	393	215
Lee	2	282	199	2	W	W
Linn	4	498	695	3	586	W
Lyon	5	122	82	6	463	350
Marion	5	119	159	4	W	W
Marshall	4	332	W	5	376	434
Mills	1	W	32	--	--	--
Monona	2	133	245	1	82	166
Monroe	1	7	11	--	--	--
Muscatine	6	508	651	6	505	643
O'Brien	3	64	W	5	262	236
Osceola	2	W	W	4	281	W
Plymouth	3	420	423	6	564	733
Polk	9	1,577	2,282	10	1,850	2,610
Sac	7	576	744	5	509	W
Sioux	7	749	974	7	925	1,246
Story	9	954	1,203	7	W	W
Union	1	32	120	--	--	--
Webster	10	176	W	13	443	429
Winneshiek	2	W	W	3	113	152
Woodbury	4	W	W	3	106	142
Worth	5	212	W	6	144	115
Wright	3	178	W	5	W	W
Undistributed [1]	r 63	5,483	8,136	66	6,556	13,231
Total [2]	278	17,107	20,140	300	19,950	25,541

r Revised. W Withheld to avoid disclosing individual company confidential data; included in "Undistributed."

[1] Includes Audubon, Benton, Bremer, Buchanan, Butler, Calhoun (1972), Carroll, Cedar, Clayton, Crawford, Delaware, Dubuque, Floyd, Fremont, Greene, Guthrie, Harrison, Iowa, Jasper, Mahaska, Mitchell, Montgomery, Page, Palo Alto, Pocahontas (1973), Pottawattamie, Shelby, Tama, Van Buren, Wapello, Warren, and Winnebago Counties, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 5.—Iowa: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,023	3,704	3,227	4,320
Fill	1,231	967	1,598	1,231
Paving	2,787	3,675	3,414	4,366
Other uses [1]	1,001	1,585	1,409	2,311
Total [2]	8,043	9,930	9,647	12,227
Gravel:				
Building	1,164	2,148	1,503	2,901
Fill	187	186	331	366
Paving	5,111	5,418	6,211	7,528
Railroad ballast	W	W	31	W
Miscellaneous	107	167	114	160
Other uses	1,161	1,214	823	1,191
Total [2]	7,729	9,133	9,014	12,145
Government-and-contractor operations:				
Sand:				
Building	(3)	(3)	1	1
Fill	--	--	(3)	(3)
Paving	225	262	177	215
Other uses	3	3	7	9
Total [2]	228	266	185	226
Gravel:				
Building	--	--	315	158
Fill	--	--	2	1
Paving	1,103	809	663	559
Other uses	4	1	125	225
Total [2]	1,107	811	1,105	942
Total sand and gravel [2]	17,107	20,140	19,950	25,541

W Withheld to avoid disclosing individual company confidential data; included in "Other uses."
[1] Includes railroad ballast, blast, foundry, and other ground and unground sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Less than ½ unit.

Stone.—Stone output, comprising mostly crushed limestone and dolomite, increased 15% in quantity and 17% in value. The average price for crushed and broken stone was $1.79 a ton, an increase of 3 cents a ton. Stone was quarried by 70 companies and 5 municipal highway departments at 327 quarries in 68 counties. More than 1.8 million tons was quarried from six underground mines in Scott, Poweshiek, Louisa, Hamilton, Van Buren, and Jones Counties. Nine companies quarried 50% of the stone output at 118 locations. The largest producers in Iowa were in descending order, Martin Marietta Aggregates, Kaser Construction Co., Schildberg Construction Co., Inc., Alpha Crushed Stone Inc., Welp & McCarten, Inc., B. L. Anderson, Inc., River Products Co., and Medusa Aggregates Co. (formerly Raid Quarries). The output at 2 quarries exceeded 900,000 tons each; 7 quarries each produced between 600,000 and 900,000 tons; 28 produced between 200,000 and 500,000 tons; 58 produced between 100,000 and 200,000 tons; 125 produced between 25,000 and 100,000 tons; and 107 produced less than 25,000 tons. Three companies produced a small quantity of dimension limestone at four quarries in Jones, Dubuque, and Jackson Counties. Crushed stone production exceeded 1 million tons in Cerro Gordo, Jones, Linn, Madison, Marshall, and Scott Counties. Producers operated 48 stationary crushers and 226 portable crushers.

Principal uses of Iowa's limestone output were 58% for roadbase and paving materials, 12% for manufacturing portland cement, 12% for concrete aggregate, 6% for agricultural purposes, and 12% for manufacturing lime, riprap and jetty stone, construction fill, railroad ballast, rough and dressed dimension stone, and miscellaneous chemical and industrial uses.

Operators stripped 355 acres of land to quarry stone and rehabilitated 311 acres of mined land for other uses.

Table 6.—Limestone and dolomite sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973			
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	Type of stone produced in 1973
Allamakee	12	r 197	289	13	209	219	Crushed and broken.
Benton	1	16	25	2	45	72	Do.
Buchanan	12	285	419	13	382	614	Do.
Butler	5	W	W	7	360	525	Do.
Cerro Gordo	6	2,065	2,651	5	W	W	Do.
Des Moines	5	785	W	4	W	W	Do.
Dubuque	12	705	1,132	10	560	853	Dimension and crushed and broken.
Fayette	15	587	799	14	W	W	Crushed and broken.
Floyd	6	212	278	3	W	284	Do.
Franklin	5	62	93	4	164	260	Do.
Fremont	2	268	W	2	181	328	Do.
Howard	10	151	215	9	W	217	Do.
Humboldt	5	W	1,217	4	W	W	Do.
Jackson	7	W	313	7	W	401	Dimension and crushed and broken.
Jasper	1	131	W	1	141	W	Crushed and broken.
Jefferson	2	149	278	2	W	W	Do.
Jones	6	W	W	30	W	2,433	Dimension and crushed and broken.
Keokuk	3	369	W	3	439	W	Crushed and broken.
Lee	3	259	427	3	W	W	Do.
Linn	32	1,843	2,758	8	1,125	2,004	Do.
Madison	9	2,223	4,292	9	2,496	4,987	Do.
Mahaska	3	W	W	3	292	W	Do.
Mills	2	117	W	3	228	W	Do.
Mitchell	7	352	553	8	W	W	Do.
Monroe	--	--	--	1	174	W	Do.
Montgomery	2	239	W	2	378	W	Do.
Scott	7	2,140	3,332	7	2,159	3,812	Do.
Wayne	1	W	W	1	144	288	Do.
Winneshiek	14	507	W	16	565	917	Do.
Undistributed [1]	125	13,769	29,529	131	21,416	38,570	Do.
Total [2]	320	27,432	48,600	325	31,459	56,785	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Adair, Adams, Appanoose, Black Hawk, Bremer, Cass, Cedar, Chickasaw, Clarke, Clayton, Clinton, Dallas, Davis, Decatur, Delaware, Grundy, Hamilton, Hancock, Hardin, Harrison, Henry, Johnson, Louisa, Marion, Marshall, Muscatine, Page, Pocahontas, Pottawattamie, Poweshiek, Ringgold (1973), Story, Taylor, Union, Van Buren, Wapello, Washington, Webster and Worth Counties, and production for which no county breakdown is available.

[2] Data may not add to totals shown because of independent rounding.

Table 7.—Limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousand dollars unless otherwise specified)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension:				
Rough stone:				
Irregular shaped stone	1	$14	1	$33
Rubble	1	21	4	55
Flagging	W	W	W	W
Dressed stone:				
Cut stone, thousand cubic feet	2	13	1	5
Sawed stone, do.	W	W	W	W
House stone veneer, do.	18	58	19	70
Construction	4	92	5	124
Flagging	(1)	2	--	--
Other uses [2]	2	54	2	61
Total, thousand short tons	10	254	13	348
Crushed and broken:				
Bituminous aggregate	1,908	3,558	2,075	3,929
Concrete aggregate	3,232	6,953	3,797	8,205
Dense graded roadbase stone	6,408	11,029	4,972	8,882
Macadam aggregate	W	W	131	239
Surface treatment aggregate	7,167	12,494	5,438	9,516
Unspecified construction aggregate and roadstone	1,111	1,778	7,500	12,779
Agricultural purposes [3]	1,876	4,649	2,005	4,991
Cement manufacture	3,799	4,715	3,890	4,767
Riprap and jetty stone	157	265	277	451
Other [4]	1,765	2,904	1,360	2,680
Total [5]	27,422	48,346	31,445	56,437

W Withheld to avoid disclosing individual company confidential data.
[1] Less than ½ unit.
[2] Includes rough block, uses not specified, and any use with symbol W.
[3] Includes agricultural limestone, poultry grit, and mineral food.
[4] Includes crushed and broken stone for fill, flux stone, filter stone (1973), lime manufacture, mineral fillers, extenders, whiting, refractory stone, roofing aggregates, chips and granules, railroad ballast, terrazzo, uses not specified, and figures where symbol W appears in crushed and broken stone.
[5] Data may not add to totals shown because of independent rounding.

MINERAL FUELS

Coal (Bituminous).—Production of coal declined 29% in quantity and 21% in value. The average price of coal mined in Iowa increased 59 cents a ton to $5.46. The average price of strip mine coal rose 63 cents a ton to $5.54, and the price of underground coal increased 60 cents a ton to $5.40.

Nearly 60% of the coal was produced at two underground mines in Lucas and Monroe Counties. Ten strip mines, operated by eight companies in Mahaska, Marion, and Wapello Counties, accounted for 40% of the coal output. Lovilia Coal Co.'s underground mine in Monroe County was the largest producer in the State in September. Lost Creek Coal Co. abandoned its mine in Mahaska County.

The thickness of overburden at the strip mines ranged from 45 to 60 feet; strip mine coal seams ranged from 36 to 58 inches thick. Both underground operations mined the 60-inch-thick Cherokee seam.

All underground coal was mined with mechanical cutting and loading machines and was hauled in mine cars by locomotives. Strip mine excavating equipment included 7 diesel-powered shovels with bucket capacities less than 6 cubic yards, 13 diesel-powered draglines (3 with capacities of between 6 and 15 cubic yards and 10 with capacities of less than 6 cubic yards), 9 front-end loaders, and 4 scrapers.

About 70% of Iowa's coal production was shipped by truck; the remainder by rail. No coal was hauled by unit trains. Electric utilities received 94% of Iowa's coal shipments and consumed 78% of the total coal used in the State. Iowa coal consumption was 6,889,000 tons. Of this total, 10% came from mines in the State, 56% was from Illinois, 21% from Wyoming, 9% from western Kentucky, and the remainder from West Virginia, Kansas, Missouri, Indiana, and Colorado.

During the year, operators stripped 33 acres of land for coal removal and rehabilitated 14 acres of mined land for other uses.

Table 8.—Iowa: Bituminous coal production in 1973, by type of mine and county
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines			Production (thousand short tons)			Value (thousands)
	Underground	Strip	Total	Underground	Strip	Total	
Lucas	1	--	1	107	--	107	W
Mahaska	--	4	4	--	135	135	$724
Marion	--	4	4	--	64	64	353
Monroe	1	--	1	249	--	249	W
Wapello	--	2	2	--	46	46	280
Undistributed [1]	--	--	--	--	--	--	1,922
Total	2	10	12	356	245	601	3,279

W Withheld to avoid disclosing individual company confidential data, included with "Undistributed."
[1] Includes values indicated by symbol W.

Peat.—Sales of peat increased 25% in quantity and 54% in value. Eli Colby Co. mined peat moss near Lake Mills in Winnebago County, and Colby Pioneer Peat Co. mined reed-sedge near Joice in Worth County. Both companies processed the material in plants at Hanlontown. About 60% of the material was sold in bulk; the remainder was sold in packaged form. Approximately 92% of the peat was sold for soil improvement, and the remainder was sold for packing flowers, plants, and shrubs, and as an ingredient for potting soils.

METALS

Ferroalloys.—Kemco Div. of Foote Mineral Co. produced ferrosilicon and silvery pig iron in electric arc furnaces at Keokuk. Production was severely curtailed by two transformer failures, which caused the largest furnace to be shut down for 4 months. The entire plant was then closed for 3 weeks by Mississippi River floods. Despite strong sales demand, the company decided to shut down the two oldest and obsolete furnaces in the fourth quarter of the year. Federal price regulations limited the company's ability to increase the price of ferroalloy products.

Molybdenum.—AMAX announced that construction of a new molybdenum-conversion plant at Fort Madison was to begin in 1974. The facility, scheduled for operation in 1975, was expected to be comparable with, but substantially larger than, AMAX's high-purity molybdate plant recently completed in Rotterdam, the Netherlands. A new molybdenum-concentrate roasting plant, equipped with a sulfuric acid plant for environmental protection, was also planned for the Fort Madison facility.

Table 9.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Lehigh Portland Cement Co.	Young Bldg., 718 Hamilton St. Allentown, Pa. 18105	Portland and masonry, dry process.	Cerro Gordo.
Marquette Cement Manufacturing Co.	20 North Wacker Dr. Chicago, Ill. 60606	Portland and masonry, wet process.	Polk.
Martin Marietta Cement, div. of Martin Marietta Corp.	Box 4288 Davenport, Iowa 52808	----do----------	Scott.
Northwestern States Portland Cement Co.	12 Second St., NE. Mason City, Iowa 50401	Portland and masonry, dry process.	Cerro Gordo.
Penn-Dixie Cement Corp.	Box 152 Nazareth, Pa. 18064	Portland, wet process.	Polk.
Clays and shale:			
Ballou Brick Co ------	Sergeant Bluff, Iowa 51054	Pit and plant -----	Woodbury.
Can-Tex Industries, brick and tile division of Harsco Corp.	Box 556, Ottumwa, Iowa 52501	6 pits and plants -	Cerro Gordo, Dallas, Keokuk, Mahaska, Polk, Wapello.
Carter-Waters Corp ----	2440 Pennway Kansas City, Mo. 64100	----do----------	Appanoose.
W. S. Dickey Clay Manufacturing Co.	P.O. Box 6 Pittsburg, Kans. 66762	Pit and plant -----	Webster.
Lehigh Portland Cement Co.	Young Bldg., 718 Hamilton St. Allentown, Pa. 18105	Pit ----------	Cerro Gordo.
Martin Marietta Cement, a division of Martin Marietta Corp.	Box 4288 Davenport, Iowa 52808	Pit ----------	Scott.
Marquette Cement Manufacturing Co.	20 North Wacker Dr. Chicago, Ill. 60606	Pit ----------	Madison.
Northwestern States Portland Cement Co.	12 Second St., NE. Mason City, Iowa 50401	Pit ----------	Cerro Gordo.
Rockford Brick & Tile Co.	Rockford, Iowa 50468 ----	Pit and plant -----	Floyd.
Sheffield Brick & Tile Co.	Sheffield, Iowa 50475 ----	----do----------	Franklin.
United Brick & Tile Co. of Iowa.	209 Benson Bldg. Sioux City, Iowa 51102	----do----------	Dallas.
Coal (bituminous):			
Big Ben Coal Co ------	Route 3, Chariton, Iowa 50049.	Underground mine -	Lucas.
Lovilia Coal Co --------	Route 2, Melrose, Iowa 52569	----do----------	Monroe.
Star Coal Co ----------	802 Lincoln St. Pella, Iowa 50219	4 strip mines -----	Mahaska.
Ferroalloys: Foote Mineral Co.	320 Concert St. Keokuk, Iowa 52632	Electric furnace --	Lee.
Gypsum:			
The Celotex Corp -----	1500 North Dale Mabry Tampa, Fla. 33607	Open pit mine, calcining and board plants.	Webster.
Georgia-Pacific Corp --	900 Southwest Fifth Ave. Portland, Oreg. 97204	----do----------	Do.
National Gypsum Co --	325 Delaware Ave. Buffalo, N.Y. 14202	----do----------	Do.
United States Gypsum Co.	101 South Wacker Dr. Chicago, Ill. 60606	----do----------	Do.
		Underground mine, calcining and board plant.	Des Moines.
Lime:			
Linwood Stone Products Co.	Route 2, Davenport, Iowa 52804	Quicklime and hydrated lime, 3 rotary kilns.	Scott.
Peat:			
Eli Colby Co ---------	Box 248 Lake Mills, Iowa 50450	Bog ----------	Winnebago.
		Processing plant --	Worth.
Colby Pioneer Peat Co -	Box 8, Hanlontown, Iowa 50444	Bog, processing plant.	Do.
Expanded perlite:			
Georgia-Pacific Corp --	900 Southwest Fifth Ave. Portland, Oreg. 97204	Processing plant --	Webster.
National Gypsum Co ---	325 Delaware Ave. Buffalo, N.Y. 14202	----do----------	Do.
United States Gypsum Co.	101 South Wacker Dr. Chicago, Ill. 60606	----do----------	Do.

Table 9.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel:			
Concrete Materials Div., Martin Marietta Corp.	4096 First Ave., NE. Cedar Rapids, Iowa 52401	Pits, underground mine; portable and stationary plants.	Black Hawk, Clayton, Linn, Mahaska, Marshall, Polk, Wapello, Worth.
L. G. Everist, Inc	302 Paulton Bldg. Sioux Falls, S. D. 57102	Pit, stationary plant.	Sioux.
G. A. Finley, Inc	Harlan, Iowa 51537	Pits, portable and stationary plants.	Audubon, Crawford, Dallas, Pottawattamie, Sac, Shelby.
Hallett Construction Co.	Box 13, Boone, Iowa 50036	----do----	Boone, Cherokee, Decatur, Franklin, Fremont, Iowa, Marshall, Osceola, Page, Polk, Sac, Story, Winnebago.
Maudlin Construction Co.	Box 134 Webster City, Iowa 50595	----do----	Various.
Medusa Aggregates div. of Medusa Corp.	P.O. Box 5668 Cleveland, Ohio 44101	----do----	Des Moines, Henry, Lee.
Peters Construction Co	5225 East University Des Moines, Iowa 50317	----do----	Monona and Polk.
Sankey Sand and Gravel Inc.	Britt, Iowa 50423	Pit, portable plant	Hancock.
Van Dusseldorp Sand and Gravel Inc.	Box 156 Colfax, Iowa 50054	2 pits and plant	Jasper and Marion.
Welp & McCarten, Inc	522 South 22d St. Fort Dodge, Iowa 50501	Pits, portable plants.	Cerro Gordo, Hancock, Howard, Webster.
Stone: Limestone and dolomite:			
Alpha Crushed Stone Inc.	Box 267, Marion, Iowa 52302	Quarries, stationary plants.	Clinton.
B. L. Anderson, Inc	327 Guaranty Bldg. Cedar Rapids, Iowa 52400	Quarries, portable plant.	Linn and Jones.
Gendler Stone Products Co.	1075 Polk Blvd. Des Moines, Iowa 50311	----do----	Dallas, Madison, Page, Taylor.
Kaser Construction Co	3111 Ingersol Des Moines, Iowa 50312	----do----	Des Moines, Fremont, Jasper, Keokuk, Mahaska, Marion, Mills, Montgomery, Poweshiek, Washington.
Linwood Stone Products Co.	Rural Route 2 Davenport, Iowa 52804	Quarry	Scott.
Martin Marietta Aggregates.	Box 189 Cedar Rapids, Iowa 52406	Quarries, portable and stationary plants.	Black Hawk, Bremer, Johnson, Hancock, Linn, Madison, Marshall, Tama, Worth.
Medusa Aggregates, div. of Medusa Corp.	P.O. Box 5668 Cleveland, Ohio 44101	----do----	Des Moines, Jefferson, Lee, Van Buren.
Northwestern States Portland Cement Co.	12 Second St., NE. Mason City, Iowa 50401	Quarry, stationary plant.	Cerro Gordo.
The River Products Co	220 Savings & Loan Bldg. Iowa City, Iowa 52240	Quarries, underground mines; portable and stationary plants.	Johnson, Louisa, Washington.
E. I. Sargent Quarries Inc.	2525 West Euclid St. Des Moines, Iowa 50310	Quarries, portable plants.	Clarke, Decatur, Madison.
Schildberg Construction Co., Inc.	Box 358 Greenfield, Iowa 50849	----do----	Adair, Adams, Cass, Madison, Union, Pottawattamie.
Welp & McCarten, Inc	522 South 22d St. Fort Dodge, Iowa 50501	Quarries, portable and stationary plants.	Black Hawk, Howard, Humboldt, Webster, Worth.

The Mineral Industry of Kansas

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the State Geological Survey of Kansas for collecting information on all minerals except fuels.

By William G. Carrico [1] and David A. Grisafe [2]

Kansas mineral production by value reached an alltime high of $646.3 million in 1973, a significant increase of 10.6% above the 1972 value of $584.6 million. Although the increase was largely attributed to higher prices, increased production occurred in all commodity groups with the exception of coal, crude helium, LP gases, petroleum, clays, and pumice. Petroleum continued to be the major commodity of value, contributing 43.6% to the total mineral production value compared with 44.4% in 1972. Other significant mineral commodities produced in Kansas, listed in order of decreasing value, included natural gas, natural gas liquids, cement (portland and masonry), stone, helium (crude and refined), and salt (rock and evaporated). Approximately three-quarters of the total 1973 mineral value was derived from petroleum, natural gas, and natural gas liquids.

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Table 1.—Mineral production in Kansas [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Cement:				
Masonry ---- thousand short tons	59	$1,452	73	$2,068
Portland ---- do	1,889	35,432	2,026	42,172
Clays ---- do	1,170	1,457	1,169	1,490
Coal (bituminous) ---- do	1,227	7,835	1,086	7,979
Helium:				
Crude ---- million cubic feet	r 2,278	r 27,336	1,539	18,468
High purity ---- do	[2] 384	8,064	[2] 416	8,736
Lime ---- thousand short tons	9	172	10	199
Natural gas ---- million cubic feet	889,268	127,859	893,118	138,521
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels	5,505	13,170	5,993	17,685
LP gases ---- do	25,099	43,170	24,463	53,819
Petroleum (crude) ---- do	73,744	259,578	66,227	281,465
Salt [3] ---- thousand short tons	1,369	20,562	1,397	23,460
Sand and gravel ---- do	11,591	10,920	13,261	12,663
Stone [4] ---- do	14,547	23,849	18,334	33,601
Value of items that cannot be disclosed:				
Gypsum, salt (brine), pumice, and stone (dimension) ----	XX	3,741	XX	3,973
Total ----	XX	r 584,597	XX	646,299
Total 1967 constant dollars ----	XX	429,198	XX	p 474,513

r Revised. p Preliminary. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Helium measured at 14.7 pounds per square inch absolute at 70° F.
[3] Excludes salt in brine; included with "Value of items that cannot be disclosed."
[4] Excludes dimension stone; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Kansas, by county [1 2]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Allen	$8,623	$10,967	Cement, stone, clays, natural gas.
Anderson	148	W	Stone.
Atchison	W	W	Do.
Barber	6,832	7,029	Natural gas, petroleum, gypsum, natural gas liquids, sand and gravel.
Barton	14,100	14,582	Petroleum, sand and gravel, clays, natural gas.
Bourbon	W	W	Stone.
Butler	W	W	Petroleum, stone.
Chase	114	171	Stone, petroleum, sand and gravel.
Chautauqua	W	W	Stone, natural gas.
Cherokee	W	W	Coal, stone, clays.
Cheyenne	W	169	Sand and gravel.
Clark	833	W	Natural gas, petroleum, sand and gravel.
Clay	W	W	Sand and gravel, stone.
Cloud	W	W	Sand and gravel, clays, stone.
Coffey	W	824	Stone.
Comanche	514	631	Natural gas, petroleum, sand and gravel.
Cowley	7,316	8,738	Petroleum, stone, sand and gravel, natural gas.
Crawford	W	3,642	Coal, stone, clays.
Decatur	W	2,567	Petroleum, sand and gravel.
Dickinson	W	369	Stone, sand and gravel, petroleum.
Doniphan	749	W	Stone.
Douglas	W	W	Sand and gravel, stone.
Edwards	W	1,827	Petroleum, natural gas, sand and gravel.
Elk	1,019	W	Stone, natural gas, sand and gravel.
Ellis	22,207	24,067	Petroleum, sand and gravel, stone.
Ellsworth	26,126	34,775	Natural gas liquids, petroleum, salt, clays, natural gas, sand and gravel.
Finney	W	W	Petroleum, natural gas liquids, sand and gravel.
Ford	500	W	Natural gas liquids, sand and gravel, petroleum, natural gas.
Franklin	W	W	Stone, clays.
Geary	W	W	Stone, sand and gravel.
Gove	1,414	2,009	Petroleum, sand and gravel.
Graham	12,388	13,239	Do.
Grant	14,140	W	Natural gas liquids, petroleum, sand and gravel.
Gray	W	W	Sand and gravel.
Greeley	W	3	Do.
Greenwood	W	W	Petroleum, stone.
Hamilton	984	W	Natural gas, sand and gravel, petroleum.
Harper	2,366	2,512	Natural gas liquids, petroleum, natural gas, sand and gravel.
Harvey	W	1,658	Petroleum, sand and gravel, natural gas liquids.
Haskell	14,894	13,251	Petroleum, helium, natural gas, sand and gravel.
Hodgeman	W	5,563	Petroleum, sand and gravel.
Jackson	71	66	Stone, sand and gravel.
Jefferson	W	575	Stone.
Jewell	W	W	Stone, sand and gravel.
Johnson	4,017	W	Do.
Kearny	634	805	Natural gas liquids, petroleum, sand and gravel, natural gas.
Kingman	11,371	12,459	Petroleum, natural gas, natural gas liquids, sand and gravel, stone.
Kiowa	3,912	4,061	Petroleum, natural gas, sand and gravel.
Labette	523	1,185	Stone.
Lane	W	955	Petroleum, sand and gravel.
Leavenworth	W	W	Stone, sand and gravel.
Lincoln	W	W	Do.
Linn	W	W	Stone.
Logan	W	274	Petroleum, sand and gravel.
Lyon	823	884	Petroleum.
McPherson	6,278	6,810	Petroleum, natural gas, clays, sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Kansas, by county [1] [2]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Marion	$2,126	$2,322	Petroleum, stone, natural gas, sand and gravel.
Marshall	1,325	1,480	Gypsum, sand and gravel, stone.
Meade	3,925	4,524	Natural gas, petroleum, sand and gravel.
Miami	W	596	Stone.
Mitchell	W	2	Sand and gravel.
Montgomery	6,567	8,562	Cement, stone, clays.
Morris	1,084	1,201	Petroleum, stone, sand and gravel.
Morton	21,018	22,939	Petroleum, natural gas, helium, natural gas liquids.
Nemaha	131	92	Sand and gravel, stone.
Neosho	W	13,263	Cement, stone, sand and gravel, clays.
Ness	10,423	12,377	Petroleum, sand and gravel.
Norton	W	1,263	Petroleum, sand and gravel, pumice.
Osage	--	W	Stone.
Osborne	141	165	Petroleum, sand and gravel.
Ottawa	1	3	Sand and gravel.
Pawnee	3,417	3,631	Petroleum, natural gas, sand and gravel.
Phillips	6,600	7,425	Petroleum, sand and gravel, stone.
Pottawatomie	W	218	Stone, petroleum.
Pratt	3,175	3,264	Petroleum, natural gas, sand and gravel.
Rawlins	2,083	2,056	Petroleum.
Reno	17,946	19,806	Salt, petroleum, sand and gravel, natural gas.
Republic	86	104	Sand and gravel.
Rice	24,779	21,828	Petroleum, salt, stone, sand and gravel, natural gas.
Riley	W	W	Stone, petroleum, sand and gravel.
Rooks	W	W	Petroleum, sand and gravel.
Rush	6,446	6,514	Petroleum, helium, natural gas, sand and gravel.
Russell	21,040	22,762	Petroleum, sand and gravel, natural gas.
Saline	W	W	Petroleum, sand and gravel.
Scott	3,854	7,737	Natural gas liquids, helium, petroleum, sand and gravel, natural gas.
Sedgwick	8,256	9,241	Petroleum, natural gas liquids, sand and gravel, salt.
Seward	r 27,384	30,828	Helium, natural gas liquids, petroleum, natural gas, sand and gravel.
Shawnee	W	W	Stone, sand and gravel.
Sheridan	W	1,702	Petroleum, sand and gravel.
Sherman	W	W	Lime, sand and gravel, petroleum, stone.
Smith	W	--	
Stafford	11,122	11,834	Petroleum, natural gas, sand and gravel.
Stanton	92	W	Petroleum, natural gas.
Stevens	2,912	W	Petroleum, natural gas, sand and gravel.
Sumner	5,701	W	Do.
Thomas	W	167	Sand and gravel, petroleum.
Trego	W	3,003	Petroleum, sand and gravel.
Wabaunsee	1,599	1,729	Petroleum.
Wallace	--	W	Stone, sand and gravel.
Washington	W	W	Sand and gravel, stone.
Wichita	W	W	Sand and gravel.
Wilson	W	8,357	Cement, stone, clays, natural gas.
Woodson	W	W	Stone.
Wyandotte	W	W	Cement, stone, sand and gravel.
Undistributed [3]	228,468	238,631	
Total [4]	r 584,597	646,299	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Brown County is not listed because no production was reported.

[2] Value of petroleum is based on an average price per barrel for the State.

[3] Includes some sand and gravel, stone, petroleum, natural gas, and natural gas liquids (1972) that cannot be assigned to specific counties, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Kansas business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total civilian labor force ---------- thousands --	962.4	1,002.1	+4.1
Unemployment ---------- do ----	38.1	31.6	—17.1
Employment:			
Nonagricultural:			
Construction ---------- do ----	33.7	34.0	+.9
Mining ---------- do ----	9.7	9.5	—2.1
Manufacturing ---------- do ----	143.1	158.5	+10.8
Services ---------- do ----	109.8	116.1	+5.7
Finance, insurance, and real estate - do ----	32.1	33.5	+4.4
Wholesale and retail trade ---------- do ----	170.4	178.5	+4.8
Transportation and public utilities - do ----	52.0	53.7	+3.3
Government ---------- do ----	162.8	169.0	+3.8
Personal income:			
Total ---------- millions --	$10,058.0	$11,525.0	+14.6
Per capita ----------	$4,455.0	$5,057.0	+13.5
Construction activity:			
Building permits, total private nonresidential millions --	$141.4	$141.9	+.4
Cement shipments to and within Kansas thousand short tons --	1,072.0	1,146.0	+6.9
Farm marketing receipts ---------- millions --	$3,224.1	$4,522.4	+40.3
Mineral production value ---------- do ----	$584.6	$646.3	+10.6

p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

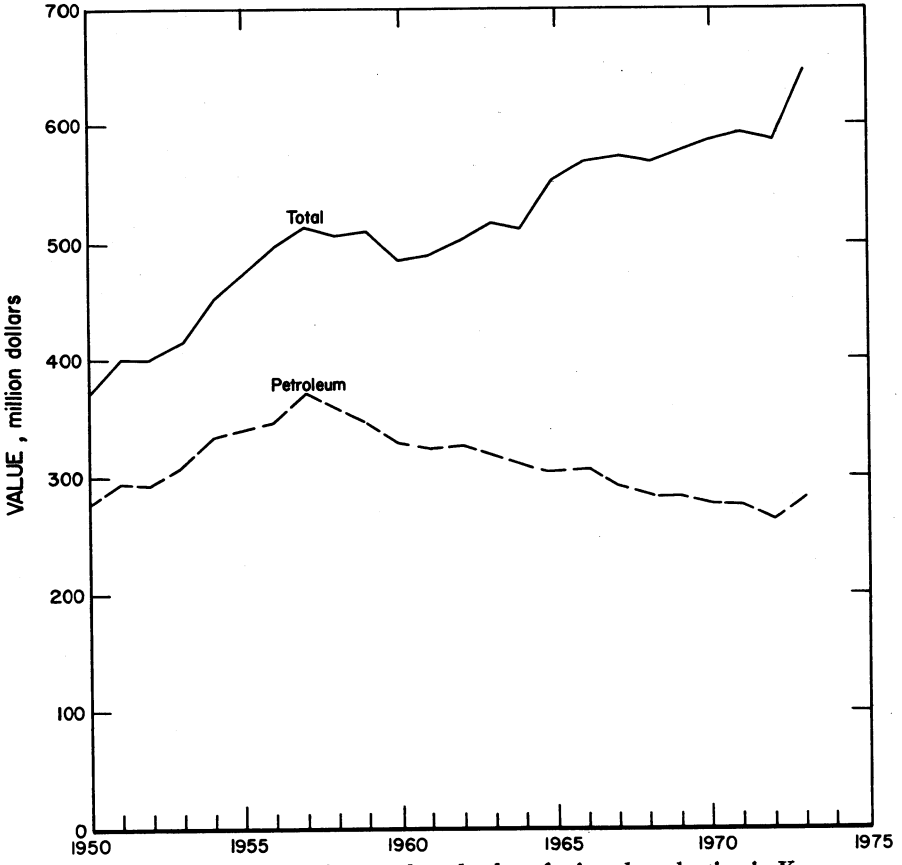

Figure 1.—Value of petroleum and total value of mineral production in Kansas.

Trends and Developments.—Despite a sharp decrease in crude petroleum production (down 10% from that of 1972), the value (1972 and 1973) remained relatively stable owing to price increases. An acute shortage of well casing seriously hindered drilling programs in 1973. Production of natural gas and natural gas liquids increased slightly, but price increases caused their value to increase over 14% relative to 1972 values.

Crude helium, derived from natural gas, showed a large decrease as a result of the termination of government purchase contracts. This development is particularly significant because three of the five plants producing crude helium in the United States are located in Kansas.

Coal production decreased during 1973, and with the yearend announcement that Pittsburg & Midway Coal Co. would close their mine No. 19 next April 1974, coal production is expected to decline sharply in 1974.

Cement continued to be in strong demand and 1973 production of both portland and masonry cement set alltime highs with plants running close to full capacity. Other construction-oriented products such as sand and gravel, limestone, clay, and shale also continued to be in high demand.

With the advent of the energy crunch during 1973, the Kansas Geological Survey began a study of the geology of the tar sands located in extreme southeastern Kansas with the ultimate goal of developing economical methods of mining and extracting oil from such deposits. The Survey also continued its study of Kansas coal reserves.

For the first time in Kansas, some commercial users of natural gas faced restrictions on supplies during the summer months in order to conserve gas for winter usage. The gas was stored in exhausted fields and later used for residential heating during the winter.

Assembly of the $34 million limestone scrubber unit (for removing sulfur dioxide produced by the combustion of sulfur-containing coals) at the coal-fired, electric-generating LaCygne powerplant was completed during 1973 and testing was begun. Testing continued throughout 1973 of a different type of limestone scrubber system at the 430-megawatt powerplant at Lawrence. Because of environmental restrictions on the SO_2 content and the fact that midwestern coals usually contain a relatively high sulfur content, considerable interest lies in the test results of these different scrubber systems.

Kansas Power and Light Co. announced plans for construction of the 2,800-megawatt Pottawatomie County plant, a coal-fired, electric-generating plant near St. Mary's. The plant, using low-sulfur Wyoming coal, will be one of the largest coal-fired complexes in the world and will consist of four coal-fired, steam-generating units, each having a 700-megawatt capacity.

Kansas Gas and Electric Co. and Kansas City Power and Light Co. announced the planned construction of the Wolf Creek nuclear-fueled, electric-generating plant near Burlington. Tentatively scheduled for completion in 1981, the 1,200-megawatt plant will cost an estimated $500 million. Cooling water will be acquired from the John Redmond Reservoir.

Employment.—Total employment in the mining and crude petroleum industries continued to decline in 1973. The Employment Security Division of the Kansas Department of Labor reported a total employment in these industries of 9,500 persons during 1973 compared with 9,700 during 1972. Employment in the crude petroleum industry dropped from 8,200 (1972) to 7,800 (1973) persons.

Statistics supplied by the Workmen's Compensation Commission showed a total of 541 injuries in the mining (76) and petroleum (465) industries during 1973, down from the 592 injuries in 1972. Thirteen fatalities occurred during 1973, six during the month of August, whereas only one fatality occurred during 1972.

Highway improvement contracts approved for 1973 totaled $113,070,000, an alltime high in Kansas highway history. The total exceeded 1972 by $26,476,000 and the previous high year of 1971 by $11,629,000. Major highway improvements included the opening of a 38.7-mile segment of I–35 between Ottawa and the Lyon County line. In addition, a 9.3-mile section of U.S.-675 freeway was completed from the U.S.-56 junction in Osage County north to the four-lane pavement in Shawnee County. Highway maintenance resurfacing projects were let on 1,383 miles of highway during 1973. Bridge repair contracts were approved for 26 bridges. County secondary road contracts totaled $10,912,000.

The Kansas Highway Commission has undertaken materials investigations to write

new specifications for aggregates to be used in road maintenance. If successful, the aggregate (used with asphalt emulsions) will reduce the use of petroleum for asphalt.

Legislation and Government Programs.—As a result of the energy shortage, the Kansas Fuel Allocation Office (operating under the Kansas Depatment of Economic Development) was established to monitor the usage and demand for fuels including fuel oil, gasoline, kerosine, and other liquid distillates of crude oil. The overall goal of the new office includes equitable distribution of fuel to eliminate the development of critical shortages. Governor Docking charged the Kansas Geological Survey with the collection of data for the new office.

The Kansas Institute for Mineral Resource Research, funded by the Ozarks Regional Commission, completed its research on the feasibility of new mining methods to recover shallow seams of coal with minimal environmental impact. The Institute, comprised of personnel from the Kansas Geological Survey and the School of Engineering at the University of Kansas, will issue a report during 1974 recommending possible alternatives to the present strip-mining technique in order to reduce environmental hazards.

Studies on the feasibility of reclaiming strip-mined land and using such land for agricultural and recreational purposes continued throughout 1973. Funded by the Ozarks Regional Commission, the project is nearing completion.

Plans were announced in 1973 for a joint program between the Kansas Geological Survey and the U.S. Geological Survey involving a 5-year study of the irrigation waters of western Kansas. Actual sampling and analysis will begin next year. The two agencies continued their cooperative investigations of the surface water and ground water resources of Kansas and the Top-Kan Project, a geologic study of the Topeka-Kansas City corridor. The latter includes mineral resources, water quality and quantity, general soil and geological mapping, and environmental considerations, all for planning the future development of this corridor.

The Bureau of Mines developed SolFrac heavy-oil-recovery process, combining chemical-explosives fracturing and an aromatic solvent, recovered viscous immobile oil from a 5-spot pattern of shallow wells (300 to 350 feet) in the Bartlesville Sandstone Formation in Labette County. The research is directed toward studying the factors involved by which heavy oil can be efficiently and economically recovered from a consolidated sandstone petroleum reservoir by the use of suitable solvents and supporting techniques.[3] The five-well arrangement experienced a four-fold increase in volume of void space and oil in place. Solvent was injected into the four outside wells and production came from the center well. Operating procedures were changed to vary the soak time and the rate of injection. Evaluation of the production data indicated a greater loss of solvent to the formation at the higher rates of injection. Cummulative fluid produced in 1973 was approximately 1,000 barrels or 0.35 pore volume. Crude oil production was 68 barrels, or 6.68% of the oil in place.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Carbon Black.—The Columbian Carbon Co., a subsidiary of Cities Service Oil Co. and only producer of carbon black, continued production at its Hickok plant in Grant County. Carbon black production decreased in volume by 6.0% and value decreased 5.9%.

Natural gas used in manufacturing carbon black was processed in a furnace-type plant. Rubber compounding, inks, and paints were the major uses of carbon black.

Coal.—For the first time in 11 years, Big Brutus, a 6,000-ton electric power shovel with a 90-cubic-yard dipper, emerged on the plain above the pits of the Pittsburg & Midway Coal Mining Co. P and M mine No. 19. The machine will now be disassembled for shipment to another state. P and M, the largest coal mining company in Kansas, cited high costs for extracting coal in Kansas, new reclamation regulations, and dwindling reserves as some of the reasons for closing down mine No. 19. Reportedly, the average selling price for coal in the last 6 months of 1973 was $6.82 per ton. During that same period, cost of mining a ton of coal rose to $9.06. New recla-

[3] Heath, L. J., F. S. Johnson, and J. S. Miller. Solvents and Explosives To Recover Heavy Oil, Bartlett, Kans. BuMines TPR 60, 1972, 11 pp.

mation requirements may add another $2.00 to the per ton cost of mining. Mining coal in this area requires removal of approximately 35 cubic yards of overburden to recover 1 ton of coal. During the year, the Bureau of Mines analyzed delivered samples of coal from the No. 19 mine.[4] Approximately 553 tons of coal was sampled. The percent of volatile matter was 37.4; fixed carbon, 51.2; and ash, 11.4. The sample had a sulfur content of 3.5% and a calorific value of 12,690 British thermal units (Btu) per pound.

Helium.—A total of 416 million cubic feet of high-purity helium valued at about $8,736,000 was produced at plants located in Morton, Scott, and Rush Counties in 1973. The helium produced at the Scott City plant was piped to the Cities Service Helex, Inc., plant at Ulysses in Grant County for purification. Crude helium production was 1,539 million cubic feet, valued at $18,468,000. Crude helium was produced in Haskell, and Seward, Counties. The average price for high-purity helium sold during the year was $21 per thousand cubic feet; private industry plant prices averaged $12 per thousand cubic feet.

Natural Gas.—Marketed natural gas totaled 893,118 million cubic feet in 1973, Compared with 889,268 million in 1972. Natural gas value rose to $138,521,000 from $127,859,000, in 1972. Average wellhead value increased from 14.4 cents per thousand cubic feet to 15.5 cents per thousand cubic feet.

The American Gas Association (AGA) reported that natural gas reserves totaled 11,722 billion cubic feet at yearend, a decrease of 217 billion cubic feet from the previous year. According to AGA, revisions and extensions totaled 635 billion cubic feet, and new field discoveries, 31 billion cubic feet. The ultimate recovery (the sum of cumulative production and the remaining recoverable reserves) of natural gas as estimated to December 31, 1973, was 32,504 billion cubic feet. Associated dissolved natural gas accounted for 10.2% and nonassociated natural gas, 89.8% of the total ultimate recovery.

Effective December 31, 1973, Kansas underground natural gas reservoir capacity reported by AGA was 116,333 million cubic feet in 17 reservoirs. Gas in storage on December 31, 1973, was 107,097 million cubic feet, an increase of 18.4% above the previous year's storage. Much of the natural gas used last winter for home heating was obtained from this storage.

Natural Gas Liquids.—The production of natural gas liquids, including ethane, in 1973 was 30,456,000 barrels, a 148,000-barrel decline from the 1972 level. Liquefied petroleum gases output declined 1,385,000 barrels. This was partially offset by a gain in natural gasoline and cycle products output of 488,000 barrels and again in ethane of 749,000 barrels.

Total value rose to $71,504,000, an increase from $56,304,000 the previous year. The average price per barrel in 1973 for liquefied petroleum gas and ethane was $2.20; for natural gasoline and cycle products, $2.95; and for plant condensate, $3.97.

Proved reserves of natural gas liquids at yearend 1973, as estimated by the AGA, totaled 387,298,000 barrels, a decrease of 5,784,000 barrels compared with 393,082,000 barrels at yearend 1972. The total was comprised of 378,555,000 barrels of nonassociated reserves and 8,743,000 barrels of associated dissolved reserves. Revisions and extensions added 23,779,000 barrels to reserves whereas new fields added 1,039,000 barrels.

Petroleum.—The 1973 production of crude oil (including lease condensate) was 66,227,000 barrels; 7,517,000 barrels below 1972 output. Although total output declined, Kansas ranked eighth in petroleum production in the Nation. The value of petroleum production attained $281,465,000. The average unit value increased from $3.52 to $4.25 per barrel in 1973.

Petroleum production by county is shown in table 5. The five leading counties and their production in thousand barrels were Ellis, 5,611; Russell, 5,341; Rooks, 3,507; Rice, 3,452; and Barton, 3,348. Combined production from these counties represented 32% of the State output.

Bemis-Shutts and Hall-Gurney were the two leading producing fields, representing 6.4% of the State's output. As shown in table 6, the 1972 leading field, Hall-Gurney, ranked second in 1973.

The estimated proved crude oil reserves as of December 31, 1973, were 401,089,000 barrels according to the American Petroleum Institute, a decrease of 52,305,000

[4] Janus, J. B. and B. S. Shirley, Analyses of Tipple and Delivered Samples of Coal, Collected During Fiscal Year 1973. BuMines RI 7848, 1973, 15 pp.

barrels and a 11.5% decline. New fields and pools added 2,464,000 barrels of reserves compared with 4,654,000 barrels in 1972. Revisions and extensions added 11,819,000 barrels compared with 21,189,000 barrels in 1972.

Table 4.—Kansas: Crude oil production, indicated demand, and stocks in 1973, by month
(Thousand 42-gallon barrels)

Month	Production	Indicated demand	End-of-month stocks originating within Kansas
January	5,677	6,048	5,233
February	5,416	4,068	6,581
March	5,605	6,228	5,958
April	5,669	5,482	6,145
May	5,925	4,852	7,218
June	5,628	5,929	6,917
July	5,557	4,693	7,781
August	5,672	6,557	6,896
September	5,212	5,365	6,743
October	5,664	5,471	6,936
November	5,269	5,844	6,361
December	4,933	5,133	6,161
1973 total	66,227	65,670	XX
1972 total	73,744	75,906	XX

XX Not applicable.

Table 5.—Kansas: Crude oil production, by county
(Thousand 42-gallon barrels)

County	Production	County	Production
Barber	514	Norton	288
Barton	3,348	Osborne	31
Butler	2,594	Pawnee	688
Chase	2	Phillips	1,715
Clark	52	Pottawatomie	17
Comanche	29	Pratt	714
Cowley	1,850	Rawlins	484
Decatur	603	Reno	833
Dickinson	6	Rice	3,452
Edwards	208	Riley	76
Ellis	5,611	Rooks	3,507
Ellsworth	1,213	Rush	744
Finney	1,074	Russell	5,341
Ford	15	Saline	198
Gove	467	Scott	120
Graham	3,112	Sedgwick	780
Grant	85	Seward	677
Greenwood	1,646	Sheridan	395
Hamilton	2	Sherman	8
Harper	212	Stafford	2,729
Harvey	375	Stanton	17
Haskell	1,494	Stevens	431
Hodgeman	1,297	Sumner	1,342
Kearny	78	Thomas	7
Kingman	2,242	Trego	678
Kiowa	740	Wabaunsee	407
Lane	218	Miscellaneous eastern Kansas stripper counties	[e] 2,830
Logan	62		
Lyon	208	Total	66,227
McPherson	1,548		
Marion	387		
Meade	455		
Morris	264		
Morton	2,817		
Ness	2,890		

[e] Estimated.

Source: State of Kansas Corporation Commission.

Table 6.—Kansas: Crude petroleum production, by field [1]
(Thousand 42-gallon barrels)

Field [2]	1972	1973	Cumulative to Dec. 31, 1973
Bemis-Shutts	2,260	2,149	216,475
Chase-Silica	1,510	1,272	249,244
El Dorado	1,475	1,204	278,847
Hall-Gurney	2,335	2,071	125,423
Kraft-Prusa	1,065	917	116,958
Trapp	1,775	1,466	205,691
Other fields [3]	63,324	57,148	NA
Total [3]	73,744	66,227	NA

NA Not available.
[1] Fields with annual production in excess of 1 million barrels.
[2] Breakdown for individual fields from the Oil and Gas Journal Annual Forecast and Review.
[3] Bureau of Mines figures.

Drilling Activities.—During 1973, industry drilled a total of 2,053 oil and gas wells, 345 wells fewer than the previous year, a 14.4% decrease. Total development and exploratory drilling footage decreased from 7,905,299 feet in 1972, to 6,772,966 feet, a 14.3% decrease.

A total 1,314 wells were drilled as development attempts compared with 1,634 in 1972, representing a 19.6% decrease. Total footage drilled for development wells in 1973 was 4,084,677, compared with a 1972 footage of 4,978,575 representing a decrease of 893,898 feet. Approximately 38% of the development oil wells and 26% of the gas wells were completed as successful producers; dry wells were the remaining 36%.

Exploratory wells drilled totaled 739 in 1973 and were 3% less than in 1972. Decreases were experienced in the total number of exploratory oil and dry wells drilled. Exploratory gas wells showed a 53.8% increase.

Cowley, Hodgeman, and Ness Counties accounted for 13% of total wells drilled in Kansas. These counties combined with Stanton, Ellis, and Graham represented 23% of all well completions in 1973. Footage drilled in these counties totaled 1,736,226 feet, averaging 3,726 feet per well.

According to Petroleum Information, stripper wells (those producing 10 barrels of oil or less per day) accounted for about 69% of the State's annual production or approximately 45,697,000 barrels in 1973 and represent 97% of all Kansas oil wells. The total number of wells plugged in the State during 1973 was 2,500, a drop from the 1972 total of 2,821. The 1973 total includes 998 dry holes, 1,173 depleted oil wells, 59 depleted gas wells, and 270 miscellaneous service wells.

Table 7.—Kansas: Oil and gas well drilling completions, by county

County	Proved field wells			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Allen	15	4	8	--	--	--	27	21,960
Anderson	7	--	7	--	--	10	24	29,251
Atchison	--	--	--	--	--	4	4	6,185
Barber	--	6	11	1	2	15	35	151,570
Barton	14	--	19	3	--	8	44	147,124
Bourbon	2	--	2	--	--	2	6	4,902
Butler	9	--	13	--	--	10	32	88,910
Chase	1	--	--	--	--	2	3	7,269
Chautauqua	24	6	13	1	--	3	47	65,330
Cherokee	--	--	--	--	--	6	6	4,301
Cheyenne	--	--	1	--	--	--	1	4,765
Clark	1	--	5	--	--	7	13	66,322
Coffey	18	--	7	5	--	13	43	84,228
Comanche	--	1	1	--	--	4	6	30,964
Cowley	54	1	22	2	--	16	95	280,807
Crawford	1	--	--	--	--	1	2	1,004
Decatur	8	--	7	3	--	12	30	109,058
Edwards	--	5	3	--	--	1	9	40,064
Elk	17	1	14	1	2	12	47	101,047

Table 7.—Kansas: Oil and gas well drilling completions, by county—Continued

County	Proved field wells			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Ellis	22	--	21	5	--	20	68	241,452
Ellsworth	7	6	5	--	3	15	36	95,829
Finney	5	--	2	1	--	2	10	49,648
Ford	--	2	5	--	--	8	15	74,000
Franklin	5	--	4	--	1	8	18	19,526
Gove	8	--	10	7	--	20	45	193,680
Graham	23	--	12	7	--	23	65	250,589
Grant	--	49	--	--	--	--	49	140,525
Greeley	--	13	9	--	3	2	27	78,606
Greenwood	21	--	13	--	--	11	45	95,086
Hamilton	--	15	--	--	--	7	22	63,292
Harper	9	4	15	3	8	11	50	226,721
Harvey	2	2	3	--	--	3	10	33,120
Haskell	1	1	--	--	--	2	4	19,450
Hodgeman	18	--	16	3	--	35	72	326,224
Johnson	1	4	1	--	1	3	10	5,538
Kearny	--	31	2	--	--	5	38	116,467
Kingman	3	8	13	--	1	12	37	144,874
Kiowa	3	11	12	1	1	13	41	192,527
Labette	4	2	6	--	--	10	22	17,338
Lane	4	--	6	6	--	15	31	138,767
Leavenworth	--	--	1	--	--	--	1	1,439
Lincoln	--	1	--	--	--	--	1	1,416
Linn	--	--	--	--	--	3	3	1,689
Logan	--	--	2	2	--	4	8	37,117
Lyon	7	--	2	1	--	7	17	41,011
McPherson	3	2	4	2	1	6	18	56,634
Marion	4	--	--	1	--	3	8	19,560
Meade	7	3	6	--	2	9	27	156,907
Miami	2	2	2	--	--	--	6	2,846
Mitchell	--	--	--	--	--	1	1	4,320
Montgomery	13	1	4	1	--	2	21	21,797
Morris	6	--	4	1	--	2	13	37,947
Morton	1	13	5	1	1	4	25	98,972
Neosho	7	2	5	--	--	--	14	11,214
Ness	31	--	30	17	--	28	106	472,392
Norton	--	--	2	2	--	1	5	18,391
Osage	--	--	--	--	--	1	1	2,144
Osborne	--	--	--	1	--	2	3	10,846
Pawnee	3	9	3	1	1	11	28	108,953
Phillips	3	--	--	--	--	1	4	14,102
Pottawatomie	--	--	1	--	--	--	1	3,680
Pratt	7	5	2	--	1	4	19	80,600
Rawlins	3	--	5	4	--	16	28	119,376
Reno	2	--	6	--	1	5	14	43,664
Rice	7	3	6	--	2	7	25	72,281
Rooks	12	--	10	3	--	15	40	135,374
Rush	3	1	12	1	1	12	30	111,370
Russell	26	--	15	2	--	11	54	170,294
Saline	--	--	2	--	--	--	2	7,130
Scott	1	5	2	1	3	2	14	49,302
Sedgwick	--	--	2	--	--	5	7	23,570
Seward	2	7	6	--	2	9	26	139,846
Sheridan	9	--	8	2	--	19	38	152,355
Stafford	6	1	10	1	2	4	24	93,953
Stanton	1	57	2	--	--	--	60	164,762
Stevens	--	51	3	--	--	3	57	187,960
Sumner	6	9	11	1	1	21	49	167,193
Thomas	--	--	--	--	--	2	2	8,981
Trego	--	--	3	4	--	8	15	61,516
Wabunsee	--	--	--	--	--	6	6	19,543
Wichita	--	--	--	--	--	9	9	26,296
Wilson	1	--	3	--	--	2	6	6,458
Woodson	14	--	9	--	--	5	28	39,445
Total	494	344	476	98	40	601	2,053	6,772,966

Source: American Petroleum Institute.

Refineries.—Crude oil processed at refineries was 136,242,000 barrels in 1973, compared with 133,329,000 barrels in 1972. Intrastate receipts totaled 62,669,000 barrels; 61,786,000 barrels was transported via pipeline, and 883,000 barrels, by rail tank car and truck. Interstate receipts totaled 64,908,000 barrels. Nearly all was received by pipeline: From Oklahoma 21,642,000 barrels; Wyoming 19,535,000 barrels;

Texas 15,646,000 barrels; and 8,085,000 barrels from other States. Receipts from Canada totaled 8,955,000 barrels. Opening stocks totaled 1,397,000 barrels. Closing stocks totaled 1,600,000 barrels resulting in a positive stock change of 203,000 barrels. Refinery fuel use and losses of 87,000 barrels accounted for the remainder. Based on total January 1, 1974, capacity, refineries operated at 90.5% of capacity in 1973. Shipments of domestic crude oil from Kansas to other States totaled 10,884,000 barrels, some 2,394,000 barrels less than in 1972.

APCO Oil Corp. initiated construction to expand its Arkansas City, Kans., refinery. Addition of a new crude and vacuum unit will increase crude processing capacity from 25,000 to 40,000 barrels per day. A 10,000-barrel-per-day reforming unit is also planned.

Texhoma Pipeline Co. was constructing a 24- to 36-inch oil pipeline to Oklahoma from one or more points on the Louisiana and Texas gulf coast. The 600-mile line will have a daily capacity of 200,000 to 400,000 barrels and will connect with existing lines in Cushing, Okla., to supply Oklahoma and Kansas refineries. Completion is scheduled for late in 1974.

Consumption of fuels by Kansas refineries was reported as follows:

Fuel	Quantity	Btu equivalent[1] (billion Btu)
Distillate fuel oil ---- thousand barrels	1	6
Residual fuel oil ---- do	731	4,596
Liquefied petroleum gas ---- do	249	999
Natural gas ---- million cubic feet	33,840	34,889
Refinery gas ---- do	30,732	30,425
Petroleum coke ---- thousand short tons	469	14,126
Purchased electricity ---- million kilowatt-hours	671	2,290
Total Btu equivalent	XX	87,331

XX Not applicable.
[1] Conversion factors: Distillate, 5,825,000 Btu per barrel; residual, 6,287,000 Btu per barrel; LPG, 4,011,000 Btu per barrel; natural gas, 1,031 Btu per cubic foot; refinery gas 990 Btu per cubic foot; petroleum coke, 30,120 Btu per short ton; purchased electricity, 3,412 Btu per kilowatt-hour.

Kansas' 11 operating refineries had a total throughput of 144,978,000 barrels in 1972, and 149,011,000 barrels in 1973, yielding the following finished petroleum products, in thousand barrels:

	1972	1973
Motor gasoline	84,309	85,877
Aviation gasoline	345	346
Jet fuel	3,993	4,241
Liquefied refinery gas and ethane	4,600	4,594
Kerosine	335	444
Distillate fuel oil	35,311	36,788
Residual fuel oil	3,389	3,044
Petrochemical feedstocks	1,664	1,605
Special naphtha	131	108
Lubricating oil	1,506	1,482
Petroleum wax	36	35
Petroleum coke	3,845	4,972
Asphalt and road oil	7,095	7,251
Still gas	4,253	4,263
Miscellaneous products	245	233
Processing gain	—6,079	—6,272

Percent of refinery yields of the major petroleum products from crude and unfinished oil reruns were as follows:

	1972	1973
Gasoline, total[1]	54.9	54.0
Kerosine	.3	.3
Jet fuel, total	3.0	3.1
Distillate fuel oil	26.4	26.9
Residual fuel oil	2.5	2.2
All other products	12.9	13.5

[1] Based on total gasoline output minus input of natural gas liquids.

Table 8.—Kansas: Capacity of petroleum refineries: January 1, 1974
(Barrels per calendar day)

Company	Location	Crude oil distillation—cracking, reforming, coking, and alkylation						Other products
					Charge	Gasoline output		
		Operating	Shutdown	Type of process [1]	Operating and shutdown	Operating	Shutdown	
American Petrofina Co. of Texas.	El Dorado	25,000	--	CC	11,500	6,500	--	Asphalt.
				CR	4,000	3,500	--	
				A	2,500	2,000	--	
APCO Oil Corp	Arkansas City	26,009	--	CC	9,200	5,900	--	Do.
				CR	6,350	5,600	--	
				H	3,000	3,000	--	
				A	3,750	2,300	--	
CRA, Inc	Coffeyville	41,500	--	CC	13,500	7,100	--	Asphalt, coke, lubricants, wax.
				CR	8,600	7,700	--	
				C	8,500	1,300	--	
				A	6,100	3,400	--	
Do	Phillipsburg	20,500	--	CC	7,000	4,800	--	Asphalt.
				CR	4,000	3,600	--	
				A	2,500	1,400	--	
Derby Refining Co.	Wichita	37,982	--	CC	10,176	5,700	--	Coke.
				CR	4,800	4,176	--	
				C	3,800	985	--	
				A	4,032	2,782	--	
Mid-America Refining Company, Inc.	Chanute	3,000	--	--	--	--	--	Asphalt.
Mobil Oil Corp	Augusta	50,000	--	CC	19,900	10,500	--	Do.
				CR	20,000	8,200	8,200	
				TC	3,900	1,050	--	
				A	3,500	3,500	--	
National Cooperative Refinery Association.	McPherson	54,150	--	CC	19,000	10,150	--	Coke.
				CR	7,000	5,800	--	
				C	14,000	1,700	--	
				A	8,100	6,500	--	
Northern American Petroleum Corp.	Shallow Water	--	5,000	CC	2,250	--	1,600	Asphalt.
				A	1,200	--	700	
Phillips Petroleum Co.	Kansas City	85,000	--	CC	32,000	16,000	--	Asphalt, lubricants.
				CR	16,000	15,000	--	
				A	8,200	7,500	--	
Skelly Oil Co	El Dorado	73,664	--	CC	29,301	17,704	--	Asphalt, coke.
				CR	20,380	16,536	--	
				C	11,160	2,443	--	
				A	10,284	6,505	--	

[1] CC=catalytic cracking, CR=catalytic reforming, H=hydrocracking, C=coking, TC=thermal cracking, A=alkylation.

NONMETALS

Total value of nonmetals produced in 1973 was $119,626,000 compared with $97,585,000 in the previous year, a 22.6% increase. Portland cement was the major contributor to the total value with 35.3%, stone 28.1%, salt 19.6%, and sand and gravel 10.6%. The combined value of the aforementioned commodities equalled 93.6% of the total value of 1973 nonmetallic mineral production.

Cement.—The cement industry enjoyed another good year as production of portland cement passed the 2-million-ton mark. Masonry cement production was up sharply. Both products were in high demand throughout the year. The production of cement in Kansas required large quantities of natural gas. Because of the shortage of natural gas and fuel oil, the industry may install facilities for burning more coal.

Table 9.—Kansas: Portland cement salient statistics
(Thousand short tons)

	1972	1973
Number of active plants	5	5
Production	1,986	2,036
Shipments from mills:		
Quantity	1,889	2,026
Value thousands	$35,432	$42,172
Stocks at mills, Dec. 31	232	163

Table 10.—Kansas: Masonry cement salient statistics
(Thousand short tons)

	1972	1973
Number of active plants	5	5
Production	54	70
Shipments from mills:		
Quantity	59	73
Value thousands	$1,452	$2,068
Stocks at mills, Dec. 31	22	19

Clays.—Production of clay and shale during 1973 was reported at 1,169,000 short tons with a value of $1,490,000. Volume in 1972 was 1,170,000 short tons, and value was $1,457,000. Of the total 1973 output, about 35% or 409,000 short tons was consumed in the manufacture of brick; 34% or 398,000 short tons was consumed in cement manufacture; and the remaining 31% was consumed in the manufacture of lightweight aggregates, flue linings, structural and drain tiles, and sewer pipes.

Gypsum.—Two gypsum mines were in operation in 1973. The National Gypsum Co. has a mine near Sun City, in Barber County, and the Bestwall Division of the Georgia-Pacific Corp. mine is located in Marshall County. Kansas was the ninth largest producer and ranked tenth in value. Quantity increased 3.9% and value increased 4.0% over that of 1972.

Perlite.—Lite Weight Products, Inc., located in Wyandotte County, produced and sold expanded perlite. Major uses in 1973 were horticultural aggregates 37%, fertilizers 31%, and masonry and cavity fill insulation 22%. Plaster aggregate, concrete aggregate, filter aids, and low-temperature insulation uses consumed the other 10%.

Pumice.—Production of pumice declined by 99% in 1973 due to the inactivity of the San Ore Construction Co., Inc. BASF Wyandotte Corp. was the only producer. Chinchilla dusting powder was the major use, which was 86%; cleaning and scouring powder use was 14%.

Salt.—Production of salt, excluding brine, increased 2% in volume and 14% in value. Salt was produced in Ellsworth, Reno, Rice, and Sedgwick Counties by seven firms.

A salt vein in Reno County—40 miles wide, 100 miles long, and 325 feet thick—is estimated to have enough rock salt to supply the Nation for the next 250,000 years. In the 650 foot deep mine, where the temperature never varies from 68° F and where the humidity is always in the low 50's, underground storage areas and vaults have been built in the mined out sections. Depositors from 50 States and 32 foreign countries have stored documents, microfilms, old movies, and coin and book collections in this underground warehouse. A seed company keeps sacks of hybrid seed corn stored for fear of blight. During reconstruction of the Wichita Art Museum, valuable oil paintings were stored here to prevent deterioration. Protection and resistance to fire, flood, theft, and nuclear explosion is what makes this combination salt mine and underground storage center unique.

Table 11.—Kansas: Evaporated and rock salt sold or used by producers
(Thousand short tons and thousand dollars)

Year	Evaporated salt		Rock salt	
	Quantity	Value	Quantity	Value
1969	623	13,810	648	3,280
1970	670	15,178	560	3,028
1971	676	15,847	564	2,865
1972	723	17,207	646	3,355
1973	782	19,913	615	3,547

Sand and Gravel.—Production during 1973 increased 14.4% in volume and 16.0% in value from the 1972 levels. There were 158 sand and gravel operations in 77 counties in the State. Of the total volume, about 43% or 5,702,000 tons was used for paving purposes, and 30% or 3,952,000 tons was used in building construction.

Leading counties in sand and gravel production were those counties in which large cities are located. Based on total volume produced, Douglas, Sedgwick, and Wyandotte Counties produced more than 38% of the State's sand and gravel.

One of the largest sand plants placed in operation was that of Superior Sand Co. at Wichita, Kans. This plant is controlled by automation with a centrally located push-button panel for the entire plant. The plant has a capacity to produce nearly 600 tons per hour of sand products, three sizes of concrete sand, plus fill and mason sand.

Table 12.—Kansas: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,888	4,158	3,407	3,710
Fill	1,254	907	2,252	1,458
Paving	2,652	2,781	2,629	2,784
Other uses [1]	128	167	714	631
Total [2]	7,923	8,013	9,004	8,583
Gravel:				
Building	163	275	469	659
Fill	169	124	212	183
Paving	816	866	1,099	1,114
Miscellaneous	166	269	284	388
Other uses [3]	29	41	6	10
Total [2]	1,342	1,575	2,070	2,355
Government-and-contract operations:				
Sand:				
Fill	16	4	1	(4)
Paving	797	435	885	677
Other uses	--	--	103	109
Total	813	439	989	786
Gravel:				
Building	67	43	75	63
Fill	23	16	28	22
Paving	1,200	715	1,088	839
Other uses	223	120	6	14
Total [2]	1,513	894	1,197	939
Total sand and gravel [2]	11,591	10,920	13,261	12,663

[1] Includes railroad ballast (1972), abrasives (1972), and other industrial sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast (1972).
[4] Less than ½ unit.

Table 13.—Kansas: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Barber	3	W	19	2	W	W
Barton	3	277	311	3	250	212
Chase	1	W	W	1	8	8
Cheyenne	2	W	W	3	W	169
Clark	1	22	11	1	42	25
Clay	2	W	104	1	90	100
Comanche	1	31	4	1	42	31
Cowley	6	335	279	5	318	268

See footnotes at end of table.

Table 13.—Kansas: Sand and gravel sold or used by producers, by county—Continued
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Decatur	2	W	W	1	9	3
Dickinson	1	121	204	1	W	111
Douglas	2	472	W	2	645	695
Edwards	1	32	20	2	W	W
Elk	1	W	W	1	10	4
Ellis	3	176	196	3	151	169
Gove	2	38	5	1	37	27
Graham	1	21	11	1	24	13
Grant	2	W	W	1	20	15
Greeley	1	W	W	1	8	3
Hamilton	1	W	W	1	27	27
Harvey	--	--	--	1	95	W
Haskell	2	80	33	1	53	20
Hodgeman	1	W	W	1	95	50
Jackson	1	W	8	1	8	3
Jewell	1	11	4	1	7	4
Johnson	1	518	W	2	W	W
Kearny	1	W	16	2	W	W
Lane	1	W	W	1	37	27
Leavenworth	1	13	26	1	14	19
Lincoln	--	--	--	1	105	78
Logan	1	W	W	2	11	9
McPherson	1	10	4	1	30	23
Meade	1	21	15	1	38	28
Mitchell	1	W	W	1	5	2
Morris	1	26	35	1	6	3
Nemaha	1	72	68	1	83	81
Neosho	1	89	W	1	W	W
Ness	1	W	W	1	129	95
Norton	1	25	26	2	32	29
Osborne	1	31	31	1	44	32
Ottawa	1	4	1	1	4	3
Pawnee	3	W	W	3	127	W
Phillips	2	39	41	2	91	74
Rawlins	1	W	3	--	--	--
Reno	7	435	342	8	616	450
Republic	1	98	86	1	113	104
Rush	1	39	22	1	30	28
Russell	1	W	38	2	77	59
Saline	1	297	W	2	262	W
Scott	1	31	23	1	36	28
Sedgwick	9	1,626	1,251	12	2,770	1,814
Seward	2	W	W	3	114	W
Shawnee	5	611	551	6	577	572
Sheridan	1	W	W	2	30	22
Sherman	3	65	99	3	62	96
Smith	1	22	6	--	--	--
Stevens	--	--	--	1	21	8
Thomas	2	W	W	4	134	136
Trego	3	W	W	4	128	122
Wallace	--	--	--	1	21	25
Wyandotte	10	2,279	2,724	6	1,679	2,110
Undistributed [1]	r 42	3,625	4,306	39	3,901	4,629
Total [2]	152	11,591	10,920	158	13,261	12,663

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes Cloud, Ellsworth, Finney, Ford, Geary, Gray, Harper, Kingman, Kiowa, Marion (1973), Marshall, Pottawatomie (1972), Pratt, Rice, Riley, Rooks, Stafford, Sumner, Washington, and Wichita Counties and some sand and gravel that cannot be assigned to specific counties.
[2] Data may not add to totals shown because of independent rounding.

Stone.—Stone sold or used in 1973 totaled 18,334,000 short tons and was valued at $33,601,000, a 26.0% increase from 1972 in quantity and a 40.9% increase in value. Of the total stone output, some 96.3% was crushed limestone. The five leading producing counties in descending order were Johnson, Wyandotte, Neosho, Elk, and Wilson, which accounted for 37.5% of the State's stone production and 38.9% of the value.

Approximately 15,776,000 short tons was shipped by truck and about 2,558,000 short tons by railroad, waterway, conveyor belt, and unspecified methods.

The principal end uses for stone were for raw material in preparing cement, concrete aggregate, and dense graded road base stone.

Table 14.—Kansas: Crushed and broken stone sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	1,613	3,051	2,509	5,178
Concrete aggregate	2,536	4,989	3,198	7,236
Dense graded road base stone	2,646	4,375	3,198	5,782
Macadam aggregate	W	W	315	473
Surface treatment aggregate	2,257	3,635	2,543	4,494
Unspecified construction aggregate and roadstone	830	1,593	1,606	3,048
Agricultural limestone	621	1,051	540	805
Cement manufacture	2,799	3,392	3,349	5,017
Railroad ballast	W	W	101	225
Riprap and jetty stone	921	1,233	726	880
Other uses [1]	325	531	247	462
Total [2]	14,547	23,849	18,334	33,601

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes stone used in the lime manufacture, ferrosilicon (1973), whiting, and uses not specified.
[2] Data may not add to totals shown because of independent rounding.

Table 15.—Kansas: Stone sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Kind of stone	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone total [1]	W	W	W	W
Crushed and broken:				
Limestone	13,962	22,886	17,658	32,254
Undistributed [2]	585	963	676	1,347
Total crushed	14,547	23,849	18,334	33,601

W Withheld to avoid disclosing individual company confidential data.
[1] Data include limestone and sandstone (1972).
[2] Includes sandstone, quartzite, and other stone.

Sulfur.—Sulfur was recovered from sour natural gas in Butler, Montgomery, and Wyandotte Counties. Wyandotte County was the largest producer with 85.4% of the total. Sales by volume decreased 3.7% and value declined 2.4% in 1973.

Skelly Oil Co. constructed a sulfur recovery unit at its oil refinery in El Dorado, Butler County. The unit, initially designed to recover about 16 tons per day and ultimately recover 50 tons per day, came onstream late in 1973.

Table 16.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Ash Grove Cement Co	1000 Tenmain Center Kansas City, Mo. 64105	Plant and quarry	Neosho.
General Portland Cement Co	2800 Republic Bank Tower Dallas, Tex. 75201	do	Wilson.
Lone Star Cement Corp	2511 East 46th St., Suite "K" Indianapolis, Ind. 46205	do	Wyandotte.
The Monarch Cement Co	Humboldt, Kans. 66748	do	Allen.
Universal Atlas Cement, Div. of U.S. Steel Corp.	600 Grant Street U.S. Steel Bldg. Pittsburgh, Pa. 15230	do	Montgomery.
Clays:			
Acme Brick Co	Box 425 Fort Worth, Tex. 76101	Mine and plant	Cherokee and Ellsworth.
Ash Grove Cement Co	1000 Tenmain Center Kansas City, Mo. 64105	do	Neosho.
Buildex Inc	Box 62299 Pittsburg, Kans. 66762	do	Franklin and Ellsworth.
Cloud Ceramics	Box 417 Concordia, Kans. 66901	do	Cloud.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clays—Continued			
W. S. Dickey Clay Manufacturing Co.	1818 Commerce Tower Kansas City, Mo. 64105	Mine and plant	Cherokee and Crawford.
Excelsior Clay Products, Inc	342 North Waco Wichita, Kans. 67202	---- do -------	Wilson.
General Portland Cement Co	Box 479 Fredonia, Kans. 66736	---- do -------	Do.
Humboldt Shale Mining Co	Box 185 Humboldt, Kans. 66748	Mine ----------	Allen.
Kansas Brick & Tile Co., Inc	Box 126 Hoisington, Kans. 67544	Mine and plant	Barton.
The Monarch Cement Co	Humboldt, Kans. 66748	---- do -------	Allen.
Universal Atlas Cement, Div. of U.S. Steel Corp.	Box 2969 Pittsburgh, Pa. 15230	---- do -------	Montgomery.
Wilkinsons, Inc	Rt. 1 Weir, Kans. 66781	Mine ----------	Cherokee.
Coal:			
Clemens Coal Co	Box 62299 Pittsburg, Kans. 66762	Strip mine ----	Crawford.
Pittsburg & Midway Coal Mining Co.	Tenmain Center Kansas City, Mo. 64105	---- do -------	Cherokee.
Wilkinsons, Inc	Rt. 1 Weir, Kans. 66781	---- do -------	Do.
Gypsum:			
Georgia-Pacific Corp. Bestwall Div.	900 Southwest 5th Portland, Oreg. 97204	Quarry and plant.	Marshall.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	---- do -------	Barber.
Lime: The Great Western Sugar Co.	Box 5308 Denver, Colo. 80217	Plant ----------	Sherman.
Pumice: BASF Wyandotte Corp	1609 Biddle Ave. Wyandotte, Mich. 48192	Mine and plant.	Norton.
Salt:			
American Salt Corp	3142 Broadway Kansas City, Mo. 64111	Wells and underground.	Rice.
Carey Salt Co	1800 Carey Blvd. Hutchinson, Kans. 67501	---- do -------	Reno.
Independent Salt Co	Box 36 Kanopolis, Kans. 67454	Underground --	Ellsworth.
Morton Salt Co	110 North Wacker Drive Chicago, Ill. 60606	Wells ----------	Reno.
Vulcan Materials Co., Chemicals Div.	Box 545 Wichita, Kans. 67201	Brine wells --	Sedgwick.
Sand and gravel:			
Associate Materials and Supply Co., Inc.	6015 No. Broadway Box 4064 N. Wichita, Kans. 67204	Stationary pits	Sedgwick and Sumner.
Builders Sand Co	78th and Holiday Drive Kansas City, Kans. 66106	3 stationary -- 2 dredge ------	Wyandotte.
Dolese Brothers Co	Box 1841 Wichita, Kans. 67212	Stationary pit	Sedgwick.
Holliday Sand & Gravel Co	6811 West 63d Street Overland Park, Kans. 66202	Stationary and portable.	Wyandotte, Johnson, Douglas.
Miles Sand, Inc	4857 North Meridian Wichita, Kans. 67204	Dredge ---------	Sedgwick.
Salina Sand Co., Inc	Mentor, Kans. 67465 ---	Stationary ----	Saline.
Siebert Sand Co., Inc	Box 10 Wess City, Kans. 67560	---- do -------	Phillips, Thomas, Trego, Wallace.
Smith Sand Co	1206 E. Fulton Garder City, Kans. 67846	---- do -------	Finney.
Stewart Sand & Materials Co	4049 Penn. Ave. Kansas City, Mo. 64111	3 stationary ---	Wyandotte.
Superior Sand Co., Inc	6500 West 21st, Route 7 Wichita, Kans. 67212	Dredge ---------	Sedgwick.
Wichita Big River Sand Co	990 North Westlink Wichita, Kans. 67212	Stationary ----	Do.
Stone:			
Ash Grove Cement Co	1000 Tenmain Center Kansas City, Mo. 64105	Quarry ---------	Johnson and Neosho.
Hallett Construction Co	Box 13 Crosby, Minn. 56441	Quarries ------	Chase, Clay, Dickenson, McPherson, Marion, Rice.
Holland Quarries	9131 Noland Rd. Lenexa, Kans. 66215	---- do -------	Johnson.
Ideal Cement Co	420 Ideal Cement Bldg. Denver, Colo. 80202	---- do -------	Jewell.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of Activity	County
Stone—Continued			
Martin-Marietta Aggregates Central Div.	P.O. Box 789 Cedar Rapids, Iowa 52406	Quarries	Various.
Midwest Minerals, Inc	Box 7 Girard, Kans. 66743	do	Do.
The Monarch Cement Co	Humbolt, Kans. 66748	Quarry	Allen.
Reno Construction Co	Box 4278 Overland Park, Kans. 66204	do	Johnson.
Thompson Strauss Quarries	7000 Holliday Drive Kansas City, Kans. 66106	do	Wyandotte.
J. A. Tobin Construction Co	P.O. Box 3270 Kansas City, Kans. 66103	do	Do.
Helium:			
Alamo Chemical Co., Gardner Cryogenics, Inc.	Elkhart, Kans. 67950	Plant	Morton.
Cities Services Cryogenics, Inc.	Scott City, Kans. 67871	do	Scott.
Cities Service Helex, Inc	Ulysses, Kans. 67880	do	Grant.
Kansas Refined Helium Co	Otis, Kans. 67565	do	Rush.
National Helium Corp	Liberal, Kans. 67901	do	Seward.
Natural gas purchasers:			
Cities Service Gas Co	Oklahoma City, Okla. 73100		Various.
Kansas-Nebraska Natural Gas Co.	Hastings, Nebr. 68901		Do.
Northern Natural Gas Co	Omaha, Nebr. 68100		Do.
Panhandle Eastern Pipeline Co.	Houston, Tex. 77000		Do.

The Mineral Industry of Kentucky

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Kentucky for collecting information on all mineral production from mines, quarries, and wells.

By L. H. Frey[1] and Preston McGrain [2]

The value of mineral production in Kentucky increased to $1,165 million; this was a 19.2% increase over that of 1972. Coal production accounted for 85% of the value. Kentucky ranked first in the United States in the production of bituminous coal with 22% of the national total. One hundred twenty-eight million tons of bituminous coal valued at $987 million were mined.

Legislation and Government Programs.—The U.S. Geological Survey with the cooperation of the Kentucky Geological Survey continued to map the areal geology of the State on 7.5-minute quadrangle maps. A total of 464 maps have been published.

The Kentucky Geological Survey published six reports on geology and mineral resources.[3] The U.S. Geological Survey published two reports on geology and mineral resources in Kentucky.[4]

[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.

[2] Assistant State geologist, Kentucky Geological Survey, Lexington, Ky.

[3] Dever, G. R. Jr., and Preston McGrain. Compositional Variations in High-Calcium Limestone Deposits in Western Kentucky. Kentucky Geol. Survey, ser. 10, Reprint 30, 1973, 9 pp.

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[4] Finch, W. I., R. C. Whitemore, Jr., and J. D. Sims. Stratigraphy, Morphology, and Paleoecology of a Fossil Peccary Herd From Western Kentucky. U.S. Geol. Survey, Prof. Paper 790, 1973, 25 pp.

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Table 1.—Mineral production in Kentucky [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays [2] thousand short tons	920	$1,406	1,083	$1,961
Coal (bituminous) do	121,187	824,691	127,645	986,654
Natural gas million cubic feet	63,648	15,976	62,396	21,839
Petroleum (crude) thousand 42-gallon barrels	9,702	32,599	8,687	34,515
Sand and gravel thousand short tons	8,485	11,967	10,331	14,627
Stone [3] do	34,279	59,690	38,205	70,912
Zinc (recoverable content of ores, etc.) short tons	1,780	632	273	113
Value of items that cannot be disclosed: Cement, clay (ball), fluorspar, lime, natural gas liquids, and stone (quartzite)	XX	29,949	XX	34,141
Total	XX	976,910	XX	1,164,762
Total 1967 constant dollars	XX	806,048	XX	p 855,168

p Preliminary. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes ball clay; included with "Value of items that cannot be disclosed."

[3] Excludes quartzite; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Kentucky, by county [1 2]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adair	W	W	Stone, petroleum.
Allen	W	$525	Do.
Anderson	W	W	Stone.
Ballard	W	4	Sand and gravel.
Barren	W	W	Stone, petroleum.
Bath	$365	--	
Bell	24,304	29,706	Coal, petroleum.
Boone	W	W	Sand and gravel, stone.
Bourbon	--	W	Stone.
Boyd	1,429	1,179	Coal, clays, petroleum.
Boyle	W	W	Stone.
Breathitt	39,885	47,702	Coal, petroleum.
Breckinridge	W	W	Stone, sand and gravel, petroleum.
Bullitt	W	W	Stone, clays.
Butler	1,564	W	Coal, stone, petroleum.
Caldwell	W	W	Stone.
Calloway	W	98	Sand and gravel.
Campbell	W	W	Stone.
Carlisle	W	W	Clays, sand and gravel.
Carter	3,023	3,409	Stone, coal, clays.
Casey	W	W	Stone, petroleum.
Christian	3,858	5,011	Stone, coal, petroleum.
Clay	2,778	3,899	Coal, petroleum.
Clinton	W	W	Stone, petroleum.
Crittenden	W	W	Stone, fluorspar.
Cumberland	W	W	Stone, petroleum.
Daviess	8,975	9,597	Coal, petroleum, sand and gravel.
Edmonson	W	W	Coal, stone, petroleum.
Elliott	W	1,585	Coal, petroleum.
Estill	W	W	Petroleum, stone.
Fayette	W	W	Stone.
Fleming	W	W	Do.
Floyd	31,743	39,209	Coal, natural gas liquids, petroleum.
Franklin	W	W	Stone, sand and gravel.
Fulton	W	W	Sand and gravel.
Gallatin	W	W	Do.
Garrard	W	420	Stone.
Graves	W	3,030	Clays, sand and gravel.
Grayson	W	W	Stone.
Green	W	W	Stone, petroleum.
Greenup	373	W	Stone, clays, petroleum.
Hancock	656	586	Clays, petroleum.
Hardin	1,312	1,997	Stone.
Harlan	95,188	124,054	Coal, stone.
Harrison	W	W	Stone.
Hart	W	W	Stone, sand and gravel, petroleum.
Henderson	6,394	W	Petroleum, coal, sand and gravel.
Henry	W	W	Stone.
Hickman	7	1	Sand and gravel.
Hopkins	67,297	66,788	Coal, petroleum, clays.
Jackson	W	W	Stone, coal.
Jefferson	15,320	21,009	Cement, stone, sand and gravel, clays.
Jessamine	--	W	Stone.
Johnson	12,344	6,579	Coal, petroleum.
Knott	25,919	36,044	Do.
Knox	4,755	6,582	Do.
Laurel	3,285	W	Coal, stone, petroleum.
Lawrence	2,425	2,584	Coal, petroleum.
Lee	W	W	Petroleum, stone, coal.
Leslie	14,051	19,851	Coal, petroleum.
Letcher	W	W	Coal, stone, petroleum.
Lewis	W	W	Clays.
Livingston	12,550	14,170	Stone, sand and gravel, zinc.
Logan	W	W	Stone, petroleum.
McCracken	W	W	Sand and gravel.
McCreary	8,057	8,006	Coal, petroleum.
McLean	6,706	9,482	Do.
Madison	W	W	Stone.
Magoffin	2,988	6,453	Coal, petroleum.
Marion	W	W	Stone, petroleum.
Marshall	(3)	(3)	Sand and gravel.
Martin	17,989	41,032	Coal, sand and gravel, petroleum.
Mason	W	W	Sand and gravel.
Meade	W	W	Natural gas liquids, stone.
Menifee	W	W	Stone.
Mercer	W	12	Do.
Metcalfe	W	W	Stone, petroleum.
Monroe	W	W	Do.
Montgomery	W	W	Stone.

See footnotes at end of table.

Table 2.—Value of mineral production in Kentucky, by county [1] [2]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Morgan	W	W	Coal, stone, clays, petroleum.
Muhlenberg	$126,452	$134,486	Coal, stone, petroleum.
Nelson	W	W	Stone.
Nicholas	940	423	Do.
Ohio	36,117	46,368	Coal, stone, petroleum.
Oldham	W	W	Stone, sand and gravel.
Owsley	W	1,570	Coal, petroleum.
Pendleton	W	W	Lime, stone.
Perry	37,396	48,494	Coal, petroleum.
Pike	W	W	Coal, stone, petroleum.
Powell	W	W	Stone, clays, petroleum.
Pulaski	5,143	W	Coal, stone, petroleum.
Rockcastle	W	W	Stone, coal.
Rowman	W	W	Stone, clays.
Russell	19	22	Sand and gravel, petroleum.
Scott	W	W	Stone.
Simpson	W	W	Stone, petroleum.
Taylor	W	W	Stone.
Todd	W	W	Stone, petroleum.
Trigg	W	390	Stone.
Trimble	W	W	Sand and gravel.
Union	32,188	51,391	Coal, petroleum, sand and gravel.
Warren	W	1,665	Stone, petroleum.
Washington	W	W	Stone.
Wayne	W	W	Coal, stone, petroleum.
Webster	12,582	13,625	Coal, petroleum.
Whitley	W	W	Coal, clays, petroleum.
Wolfe	570	W	Petroleum, stone.
Undistributed [4]	309,966	355,730	
Total [5]	976,910	1,164,762	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Bracken, Carroll, Clark, Grant, Kenton, Larue, Lincoln, Lyon, Owen, Robertson, Shelby, Spencer, and Woodford.

[2] Values for petroleum are based on an average price per barrel for the State.

[3] Less than ½ unit.

[4] Includes natural gas, some sand and gravel that cannot be assigned to specific counties, and values indicated by symbol W.

[5] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Kentucky business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total nonagricultural employment ----- thousands --	987.6	1,039.3	+5.2
Mining ----- do ----	31.4	31.6	+0.1
Contract construction ----- do ----	55.4	56.8	+2.5
Service ----- do ----	147.2	155.3	+5.5
Government ----- do ----	189.4	197.3	+4.1
Manufacturing ----- do ----	265.6	286.5	+7.8
Personal income:			
Total ----- millions --	$11,905.0	$13,259.0	+11.4
Per capita -----	$3,609.0	$3,967.0	+9.9
Construction activity:			
Housing units—private and public:			
Number -----	25,359.0	13,383.0	−47.2
Value of nonresidential construction -- millions --	$125.1	$147.5	+17.9
Cement shipments to and within Kentucky:			
Portland ----- thousand short tons --	1,125.0	1,150.0	+2.2
Masonry ----- do ----	104.0	114.0	+9.6
Farm marketing receipts ----- millions --	$1,114.9	$1,374.7	+23.3
Mineral production value ----- do ----	$976.9	$1,164.8	+19.2

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; and U.S. Bureau of Mines.

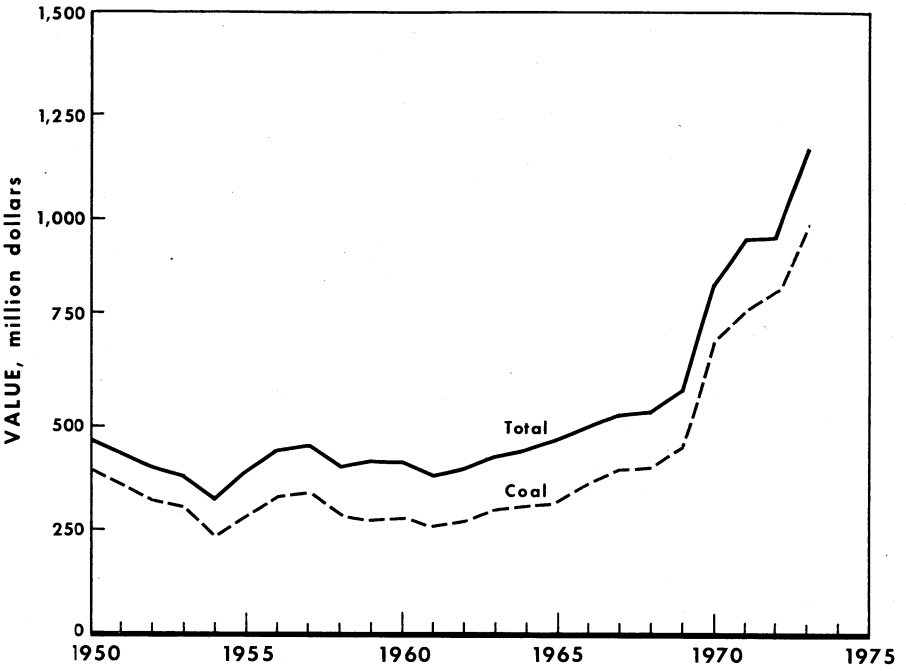

Figure 1.—Value of coal and total value of mineral production in Kentucky.

The State Legislature enacted new legislation that will affect the coal mining industry in the State. Legislation now requires that a strip mine operator must obtain written consent of the surface owner before mining permits are issued and that the minimum for a land reclamation bond be increased. Also there has been legislative activity concerning the regulation of weights of trucks on public roads; however, final action has not been taken on the subject.

The University of Kentucky Research Foundation received a 3-year contract from the Federal Bureau of Mines to measure ground movement and rock movement. The National Science Foundation and Ashland Oil Co. awarded funds to the university for a coal gasification study. Pikeville College received a federal grant to study coal miners' acceptance and attitudes toward mining equipment modifications. The Appalachian Regional Commission undertook a comprehensive study on water quality and quantity. The State's Division of Reclamation and the Appalachian Regional Commission started a cooperative investigation of surface coal mining reclamation problems. The Kentucky State Legislature passed a law to provide $50 million for coal-conversion research by 1979.

Trends and Developments.—Kentucky has shown a greater increase (5.3%) in coal production than have surrounding States in Appalachia. Pennsylvania's production increased 0.6%, and West Virginia's production decreased 6.7%. Factors relating to this trend were: (1) The average number of days worked increased in Kentucky (206 to 214) and West Virginia (209 to 218) and decreased in Pennsylvania (245 to 240); (2) the average number of men working per day increased in Kentucky (27,616 to 27,975) and Pennsylvania (24,211 to 25,373) and decreased in West Virginia (47,000 to 44,765); and (3) the average tons per man per day increased in Kentucky (21.26 to 21.29) and decreased in Pennsylvania (12.82 to 12.52) and West Virginia (12.55 to 11.83).

The United Mine Workers of America has been actively campaigning in East Kentucky to unionize the mines. They have signed three mines to union contracts, and more are expected to follow them.

A manpower shortage is developing in parts of Kentucky, principally among municipal workers who are going to the mines for higher pay.

Oglebay Norton Co. is planning a rail-to-water coal transfer terminal in Wilders; the cost is to be $6 million. Designed to transfer 8 million tons per year, the facility will be one of the largest terminals on the inland waterways in the country. Plans are also being developed for a $7 million coal transfer terminal to be located at Ghent. The Kentucky Utilities Co. plans to install a second 511,000-kilowatt coal-fired generating unit at its Ghent station. Completion of the unit is scheduled for January 1977.

The Texas Gas Transmission Corp. has agreed in principle with Kentucky to develop a large coal-gasification plant in the western part of the State. This plant should produce 80 million cubic feet of synthetic natural gas per day. Planned for the eastern part of the State at Catlettsburgh is an $80 million coal liquefaction plant.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Production of coal increased 5.3%, from 121 million tons in 1972, to 128 million tons. In 1969, coal production was 109 million tons. Over the last 5-year period, production has increased by 17%.

Coal is found in two separate areas; the eastern coalfield of the Appalachian region and the western coalfield of the Interior province. The contrasting topography of mountains in eastern Kentucky and the flat-to-undulating country in western Kentucky has resulted in a difference in mining and transportation of coal from these fields. The average surface mine in east Kentucky averages 59,000 tons per year at an average f.o.b. value of $7.05 per ton; in west Kentucky, the average surface mine produces 570,000 tons per year at an average f.o.b. value of $5.53 per ton. The average f.o.b. value of coal mined underground in east Kentucky is $10.63 per ton, and in west Kentucky, $6.49 per ton.

The demonstrated coal reserve base in east Kentucky on January 1, 1974, was 12,917 million tons. This can be broken down by potential mining methods as (1) underground, 9,467 million tons and (2) surface, 3,450 million tons.[5]

"As-received" samples of east Kentucky coal during 1973 averaged 12,552 Btu per pound and 0.9% sulfur by weight.

The demonstrated coal reserve base in west Kentucky for January 1, 1974, was 12,624 million tons. This can be broken down by potential mining methods as (1) underground, 8,720 million tons and (2) surface, 3,904 million tons.[6]

"As-received" samples of west Kentucky coal during 1973 averaged 12,129 Btu per pound and 3.0% sulfur by weight.

In east Kentucky, 30,359,108 tons of raw coal were cleaned, which yielded 22,263,855 tons of clean coal; in west Kentucky, 26,005,128 tons of raw coal were cleaned yielding 20,005,461 tons of clean coal.

[5] Demonstrated Coal Reserve Base of the United States on January 1, 1974. Mineral Industry Survey, June 1974, 6 pp.

[6] Demonstrated Coal Reserve Base of the United States on January 1, 1974. Mineral Industry Survey, June 1974. 6 pp.

Table 4.—Kentucky: Bituminous coal production, by type of mine and county, 1973
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total [1]	
Eastern:									
Bell	21	16	10	47	645	2,641	441	3,728	$29,706
Boyd	--	4	2	6	--	152	17	169	1,115
Breathitt	--	36	31	67	--	4,585	1,769	6,354	47,655
Carter	--	4	--	4	--	71	--	71	526
Clay	5	6	5	16	145	175	208	528	3,876
Elliott	--	3	1	4	--	175	2	177	1,473
Floyd	103	23	28	154	2,393	1,219	792	4,404	31,884
Harlan	67	27	32	126	8,965	727	628	10,319	123,204
Jackson	--	1	--	1	--	2	--	2	W
Johnson	3	19	17	39	148	448	272	868	5,935
Knott	48	17	23	88	3,078	491	403	3,972	36,011
Knox	3	28	17	48	16	647	204	867	6,571
Laurel	--	13	9	22	--	230	76	306	2,349
Lawrence	--	5	3	8	--	222	94	317	2,067
Lee	1	--	--	1	20	--	--	20	W
Leslie	14	16	19	49	1,480	609	313	2,403	19,835
Letcher	59	23	28	110	3,132	1,004	638	4,774	40,682
McCreary	4	3	1	8	887	138	8	1,033	8,005
Magoffin	--	11	7	18	--	675	114	789	5,839
Martin	12	15	7	34	2,674	3,176	304	6,154	40,730
Morgan	--	2	1	3	--	127	6	133	1,026
Owsley	--	5	3	8	--	151	72	224	1,566
Perry	28	25	29	82	2,540	2,198	1,035	5,774	47,788
Pike	210	63	83	356	14,169	2,821	2,099	19,090	198,860
Pulaski	2	1	--	3	66	314	--	381	W
Rockcastle	--	1	1	2	--	6	3	10	W
Wayne	--	2	2	4	--	47	23	70	492
Whitley	4	30	20	54	194	618	219	1,031	8,143
Undistributed	--	--	--	--	--	--	--	--	2,943
Total [1]	584	399	379	1,362	40,553	23,671	9,742	73,966	668,282
Western:									
Butler	1	6	--	7	6	78	--	83	497
Christian	--	1	--	1	--	171	--	171	W
Daviess	--	1	--	1	--	977	--	977	W
Edmonson	--	1	--	1	--	96	--	96	W
Henderson	1	--	--	1	600	--	--	600	W
Hopkins	9	13	--	22	5,780	4,266	--	10,046	64,561
McLean	--	5	--	5	--	1,312	--	1,312	7,572
Muhlenberg	5	15	--	20	5,223	19,104	--	24,327	132,904
Ohio	3	12	--	15	2,192	5,302	--	7,493	43,720
Union	6	--	--	6	7,093	--	--	7,093	46,232
Webster	1	1	--	2	1,450	31	--	1,481	11,219
Undistributed	--	--	--	--	--	--	--	--	11,668
Total [1]	26	55	--	81	22,342	31,337	--	53,679	318,372
Grand total	610	454	379	1,443	62,895	55,008	9,742	127,645	986,654

W Withheld to avoid disclosing individual company confidential data.
[1] Data may not add to totals shown because of independent rounding.

Natural Gas.—Marketable production of natural gas continued to decrease from 63,648 million cubic feet in 1972 to 62,396 million cubic feet in 1973, a 2% decline. Since 1969, production has decreased 23% from 81,304 million cubic feet. The number of gas wells producing at yearend was reported to be 7,224. Proven reserves of natural gas were reported to be 864,921 million cubic feet.[7] A new drilling depth record for Kentucky was achieved by Signal Oil and Gas No. 1 Elkhorn Coal Corp., in Johnson County at 14,566 feet. The average well drilled in Kentucky in 1973 was 1,587 feet.

[7] Source: American Gas Association.

Table 5.—Kentucky: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Adair	12	--	10	2	--	6	30	36,000
Allen	4	--	5	--	--	--	9	2,792
Barren	1	--	2	--	1	3	7	3,267
Breathitt	--	9	5	--	--	1	15	27,084
Breckinridge	--	--	2	--	--	--	2	725
Butler	7	--	1	1	--	1	10	3,984
Caldwell	--	--	--	--	--	1	1	1,965
Carter	--	--	--	--	1	2	3	14,749
Casey	--	--	2	--	--	2	4	2,670
Christian	2	1	5	--	1	1	10	9,153
Clay	--	8	7	--	--	4	19	25,795
Clinton	2	--	--	1	--	2	5	7,702
Cumberland	3	--	6	4	--	15	28	22,026
Daviess	17	6	16	1	1	6	47	63,052
Edmonson	--	--	1	--	--	--	1	1,057
Elliott	--	--	--	--	1	1	2	6,607
Estill	1	--	--	--	--	4	5	4,053
Fleming	--	--	--	--	--	1	1	400
Floyd	--	3	3	--	--	1	7	19,287
Grayson	--	--	--	--	2	--	2	3,010
Green	6	--	1	--	--	--	7	3,688
Hancock	2	--	6	--	--	1	9	5,852
Hardin	--	1	--	--	--	5	6	4,671
Hart	3	--	1	--	--	3	7	6,941
Henderson	6	--	10	--	--	2	18	37,451
Hopkins	5	1	13	4	2	12	37	88,211
Johnson	1	2	3	--	--	3	9	43,608
Knott	--	5	3	--	1	--	9	24,000
Knox	2	6	4	--	--	1	13	19,728
Lawrence	1	10	1	--	--	--	12	23,968
Lee	8	--	--	--	--	1	9	10,884
Leslie	--	16	2	--	--	--	18	50,811
Letcher	2	9	--	--	1	--	12	39,415
Logan	2	--	2	--	--	1	5	2,870
McCreary	--	--	--	--	--	1	1	576
McLean	3	--	7	3	--	3	16	30,609
Magoffin	--	2	--	--	--	--	2	2,600
Marion	8	--	1	--	--	--	9	1,619
Martin	--	16	1	--	--	--	17	26,640
Meade	--	5	--	--	--	--	5	2,740
Metcalfe	1	--	8	--	--	14	23	14,161
Monroe	6	--	10	--	--	5	21	13,443
Morgan	--	--	--	--	--	1	1	4,584
Muhlenberg	1	1	7	--	1	3	13	16,333
Ohio	3	1	9	--	--	1	14	13,366
Perry	--	12	5	--	1	--	18	47,957
Pike	2	16	6	--	1	--	25	88,920
Powell	11	--	--	--	--	--	11	12,851
Pulaski	--	--	--	--	--	1	1	388
Russell	4	--	5	1	--	4	14	14,511
Simpson	1	--	1	--	--	3	5	4,207
Union	2	--	3	--	--	3	8	14,868
Warren	1	--	--	--	--	2	3	2,705
Wayne	--	--	2	--	--	4	6	4,531
Webster	5	--	7	--	--	1	13	26,468
Whitley	--	11	3	1	2	4	21	33,808
Wolfe	5	--	--	--	--	--	5	6,106
State total	140	141	186	18	16	130	631	1,001,467

[1] Development wells as defined by American Petroleum Institute.
Source: American Petroleum Institute.

Petroleum.—Crude oil production continued to decrease from 9.7 million barrels in 1972 to 8.7 million barrels, a 10.5% decrease. Since 1969, production has decreased 32.8% from 12.9 million barrels. Proven reserves of oil were reported to be 40 million barrels.[8]

[8] Source: American Petroleum Institute.

Table 6.—Kentucky: Crude oil production, by county
(Thousand 42-gallon barrels and thousand dollars)

County	1972	1973
Adair	326	220
Allen	36	39
Barren	11	9
Bath	1	—
Bell	(1)	(1)
Boyd	3	3
Breathitt	13	12
Breckinridge	18	13
Butler	60	48
Casey	7	5
Christian	152	143
Clay	9	6
Clinton	27	24
Cumberland	27	22
Daviess	720	647
Edmonson	(1)	1
Elliott	28	28
Estill	161	140
Floyd	24	14
Green	45	32
Greenup	1	1
Hancock	64	70
Hart	13	9
Henderson	1,191	1,044
Hopkins	707	560
Johnson	166	162
Knott	7	8
Knox	3	3
Laurel	2	2
Lawrence	148	130
Lee	1,700	1,560
Leslie	2	4
Letcher	190	347
Logan	1	(1)
McCreary	1	(1)
McLean	559	481
Magoffin	193	155
Marion	(1)	(1)
Martin	9	9
Metcalfe	26	13
Monroe	16	8
Morgan	1	(1)
Muhlenberg	253	194
Ohio	276	225
Owsley	1	1
Perry	191	178
Pike	32	29
Powell	22	18
Pulaski	1	(1)
Russell	1	1
Simpson	10	9
Todd	1	1
Union	1,369	1,292
Warren	22	22
Wayne	9	5
Webster	719	606
Whitley	7	6
Wolfe	120	128
Total	9,702	8,687
Value	32,599	34,515

[1] Less than 500 barrels.

Sources: Quantity—Kentucky Geological Survey; Value—U.S. Bureau of Mines.

NONMETALS

Cement.—In Jefferson County, Kosmos Cement, subsidiary of the Flintkote Co., operated the State's only cement plant. Most of the cement shipped was used in ready-mix concrete products and other masonry building materials. Raw materials used in making portland cement included limestone, clay, gypsum, and iron-bearing materials. Production and value data are withheld to protect company confidential data.

Clays.—Two companies mined ball clay at five operations. This clay was mined, processed, and packaged or shipped in bulk to manufacturers of pottery ware, floor and wall tile, for use as paper fillers, refractory ware, and firebrick.

Twenty-three companies produced 1,083,000 tons of fire clay or common clay valued at $1,961,000 from 34 operations.

Fluorspar.—Minerva Oil Co. mined ore at the Keystone Mine in Crittenden County. The Calvert City Chemical Co. operated a modernized flotation plant in Mexico, Ky. Production had not started at the ore deposit being developed by Cerro Corp. and its partners. Production and value data are withheld to protect confidential company data.

Graphite.—Graphite was manufactured in Fulton County for use in electrodes.

Lime.—Jones & Laughlin Steel Corp. signed an agreement, in principle, to become a partner with Black River Mining Co. to construct new facilities for burning limestone at Carntown.

The Calcium Products Corp. plans to build a plant at Irvington to produce pelletized agricultural limestone.

Mullite.—Synthetic mullite was produced by Charles Taylor and Son, Co., in Greenup County. Production and value data are withheld to protect confidential company data.

Perlite.—Crude perlite mined in the Western States was expanded at plants in Boone, Kenton and Campbell Counties for use in roof insulation board, plaster aggregates, soil conditioning, and concrete plaster.

Table 7.—Kentucky: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Ballard	1	W	W	1	7	4
Boone	3	1,289	1,454	3	1,380	1,570
Calloway	2	W	W	2	22	98
Carlisle	1	W	W	1	11	6
Franklin	1	W	W	--	--	--
Gallatin	1	W	W	1	250	W
Greenup	1	W	1	--	--	--
Hart	1	86	129	2	W	131
Hickman	1	7	7	1	2	1
Jefferson	2	W	W	4	2,083	3,581
Livingston	2	W	W	1	1,832	3,216
Marshall	1	W	W	1	7	3
Martin	1	113	190	1	44	265
Russell	1	12	16	1	W	17
Union	2	W	W	1	24	26
Undistributed [1]	r 18	6,979	10,170	20	4,669	5,710
Total [2]	39	8,485	11,967	40	10,331	14,627

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Breckinridge, Campbell (1972), Daviess, Fulton, Graves, Henderson, McCracken, Mason, Oldham, and Trimble Counties and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 8.—Kentucky: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	W	W	11	54
Building	3,222	4,912	4,527	6,701
Fill	704	661	407	358
Foundry	W	W	5	35
Paving	2,129	2,954	2,898	3,916
Other uses [1]	187	254	141	265
Total [2]	6,241	8,781	7,988	11,328
Gravel:				
Building	963	1,599	934	1,312
Fill	174	123	100	123
Paving	944	1,351	1,123	1,562
Miscellaneous	(3)	65	49	75
Other uses	--	--	9	(4)
Total [2]	2,080	3,138	2,214	3,072
Government-and-contractor operations:				
Sand: Paving	24	24	20	81
Total	24	24	20	81
Gravel: Paving	139	24	108	146
Total	139	24	108	146
Total sand and gravel [2]	8,485	11,967	10,331	14,627

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes other industrial sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Included with fill data to avoid disclosing individual company confidential data.
[4] Included with miscellaneous gravel to avoid disclosing individual company confidential data.

Stone.—Seventy-six companies operated 114 quarries to produce 38,205,000 tons of stone valued at $70,912,000 (excludes quartzite). See tables 9 and 10.

Table 9.—Kentucky: Crushed limestone sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value
Allen	1	W	W	1	223	372
Bath	1	281	W	--	--	--
Bourbon	--	--	--	1	191	W
Carter	4	586	944	4	1,337	2,515
Edmonson	2	W	W	1	99	151
Garrard	1	76	W	1	178	420
Hardin	5	834	1,312	5	1,183	1,997
Harlan	1	178	312	1	486	850
Hart	1	100	W	1	163	W
Jefferson	5	1,823	3,230	5	2,819	4,910
Marion	2	W	W	1	118	W
Mercer	2	W	W	1	6	12
Metcalfe	1	W	W	2	117	W
Morgan	3	313	551	3	436	804
Nicholas	1	895	940	1	W	423
Oldham	4	947	1,435	3	1,102	1,891
Powell	2	W	W	1	W	90
Pulaski	3	1,295	2,198	4	1,355	2,537
Trigg	1	201	W	1	W	390
Warren	4	W	W	4	926	1,576
Wolfe	1	93	167	1	W	W
Undistributed [1]	73	26,657	48,602	72	27,468	51,976
Total [2]	118	34,279	59,690	114	38,205	70,912

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes Adair, Anderson, Barren, Boone, Boyle, Breckinridge, Bullitt, Butler, Caldwell, Campbell, Casey, Christian, Clinton, Crittenden, Cumberland, Estill, Fayette, Fleming, Franklin, Grayson, Green, Greenup, Harrison, Henry, Jackson, Jessamine (1973), Laurel, Lee, Letcher, Livingston, Logan, Madison, Meade, Menifee, Monroe, Montgomery, Muhlenberg, Nelson, Ohio, Pendleton, Pike, Rockcastle, Rowan, Scott, Simpson, Taylor, Todd, Washington, and Wayne Counties.
[2] Data may not add to totals shown because of independent rounding.

Table 10.—Kentucky: Crushed limestone sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	3,580	6,358	4,004	7,410
Concrete aggregate	6,496	10,758	4,633	8,040
Dense graded roadbase stone	8,926	15,003	12,498	22,891
Macadam aggregate	866	1,642	964	1,695
Surface treatment aggregate	1,649	2,905	1,726	2,975
Unspecified construction aggregate and roadstone	6,456	11,242	5,002	9,283
Agricultural limestone	2,318	3,963	1,868	3,652
Fill	289	336	W	W
Railroad ballast	332	638	415	797
Riprap and jetty stone	1,611	3,518	2,332	5,218
Other uses [1]	1,756	3,327	4,763	8,951
Total	34,279	59,690	38,205	70,912

W Withheld to avoid disclosing individual company data; included with "Other uses."
[1] Includes stone used in cement and lime manufacture, building products, mine dusting, ferrosilicon (1972), filter (1972), flux stone (1973), acid neutralization (1973), drain fields (1973), manufactured fine aggregate (1973), and uses not specified.

Vermiculite.—Crude vermiculite mined in other States was exfoliated at a plant in Campbell County. The product was used in loose fill insulation, in lightweight concrete, and as a plaster aggregate. Production and value data are withheld to protect confidential company data.

METALS

Zinc.—The American Smelting and Refining Co. has proposed construction of a new zinc smelter at Stephensport. Completion could be as early as 1976. Plant capacity would be about 500 tons per day, with significant byproduct recovery of cadmium and sulfuric acid.

During the last 2 years, the United States has lost roughly 50% of its zinc smelting capacity. Reversing this trend, the new plant would be one of the largest electrolytic zinc refineries in the world.

Table 11.—Principal producers

Commodity and company	Address	Type of activity	County
Aluminum, primary:			
Anaconda Aluminum Co	P.O. Box 1654 Louisville, Ky. 40201	Smelter	Henderson.
National-Southwire Aluminum Co.	P.O. Box M Hawesville, Ky. 42348	do	Hancock.
Cement, masonry and portland:			
Kosmos Cement, Division of the Flintkote Co.	Dixie Highway Kosmosdale, Ky. 40272	Plant	Jefferson.
Clays:			
Ball:			
Kentucky-Tennessee Clay Co.	Box 77 Mayfield, Ky. 42066	3 open pit mines and plant.	Graves.
Old Hickory Clay Co	Box 271 Paducah, Ky. 42351	2 open pit mines	Do.
Fire:			
Ford Burchett Clay Co	Olive Hill, Ky. 41164	Open pit mine	Carter.
Burge & Fultz Clay Co	Route 2 Olive Hill, Ky. 41164	do	Do.
General Refractories Co	1520 Locust St. Philadelphia, Pa. 19102	4 open pit mines and plant.	Carter and Rowan.
M. A. McCoy & Son	Oak Hill, Ohio 45656	2 open pit mines	Greenup.
Miscellaneous:			
Harsco Corp., Can-Tex Industries Div.	4th & Washington St. Cannelton, Ind. 47520	do	Hancock.
Kosmos Cement, Division of the Flintkote Co.	Dixie Highway Kosmosdale, Ky. 40272	Open pit mine	Jefferson.
Owensboro Brick & Tile Co.	Ewing Road Owensboro, Ky. 42302	do	Hancock.
H. B. Sipple Brick Co	Box 35 Stanton, Ky. 40380	Mine	Powell.
Solite Corp	Box 27211 Richmond, Va. 23261	Open pit and plant	Bullitt.
Coal:			
Amax Coal Co	150 S. Meridan St. Indianapolis, Ind. 46225	1 strip mine	Muhlenberg.
Beth-Elkhorn Corp	701 E. Third St. Bethlehem, Pa. 18016	3 underground mines.	Letcher and Pike.
Gibraltar Coal Co	150 S. Meridan St. Indianapolis, Ind. 46225		Muhlenberg.
Island Creek Co	Wheelwright, Ky. 41669	3 underground mines.	Hopkins.
		5 underground mines.	Floyd.
Do	444 S. Main St. Madisonville, Ky. 42431	8 underground mines.	Hopkins, Muhlenberg, Union.
Do	Holden, W. Va. 25625	3 underground mines.	Pike.
Peabody Coal Co	301 N. Memorial Dr. St. Louis, Mo 63102	2 underground and 6 strip mines.	Muhlenberg, Ohio, Union.
Pittsburg and Midway Coal Mining Co.	10 Main Center Kansas City, Mo. 64105	2 underground and 2 strip mines.	Hopkins and Muhlenberg.
United States Steel Corp	525 William Penn Place Pittsburgh, Pa. 15230	3 underground and 1 auger mine.	Harlan.
Coke: Semet-Solvay Div. of Allied Chemical Corp.	40 Rector St. New York, N.Y. 10006	Plant	Boyd.
Ferroalloys: Airco Alloys and Carbide.	Box 217 Calvert City, Ky. 42029	do	Marshall.
Fluorspar: Calvert City Chemical Co.	Box 305 Calvert City, Ky. 42029	Underground mine and mill.	Crittenden and Livingston.
Graphite, artificial:			
Carborundum Co	Hickman, Ky. 42050	Plant	Fulton.
Iron, pig:			
Armco Steel Corp	Middletown, Ohio 45042	do	Boyd.
Interlake Inc	9th & Lowell Streets Newport, Ky. 41071	do	Campbell.
Lime:			
Black River Mining	Route 1 Butler, Ky. 41006	Limekiln	Pendleton.
Natural Gas: Producers:			
Inland Gas Co	340 17th Street Ashland, Ky. 41101	Natural gas wells	Various.
Kentucky-West Virginia Gas Co.	Second National Bank Bldg. Ashland, Ky. 41101	do	Do.
Wiser Oil	Box 192 Sistersville, W. Va. 26175	do	Do.
Texas Gas Transmission Co	Owensboro, Ky. 42301	do	Do.
Columbia Gas Transmission	Charleston, W. Va. 25325	do	Do.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Perlite, expanded:			
Grefco, Inc	Box 35 Florence, Ky. 41042	Plant	Kenton.
W. R. Grace & Co	62 Whittemore Ave. Cambridge, Mass. 02140	do	Campbell.
Petroleum:			
Producers:			
Ashland Oil and Refining Co.	1409 Winchester Ave. Ashland, Ky. 41101	Crude oil wells	Various.
Har-Ken Oil Co	Box 616 Owensboro, Ky. 42301	do	Do.
Humble Oil & Refining Co	2010 W. Ohio St. Evansville, Ind. 47712	do	Do.
Sun Oil Co	Box 5026, Lawnsdale Evansville, Ind. 47715	do	Do.
Refineries:			
Ashland Oil and Refining Co.	1409 Winchester Ave. Ashland, Ky. 41101	Refinery	Boyd.
Kentucky Oil and Refining Co.	Box 325 Betsy Layne, Ky. 41605	do	Floyd.
Louisville Refining Co	1300 S. Western Parkway Louisville, Ky. 40212	do	Jefferson.
Somerset Refinery, Inc	520 Monticello St. Somerset, Ky. 42501	do	Pulaski.
Sand and Gravel:			
Evansville Materials, Inc	624 N.W. Riverside Dr. Evansville, Ind. 47708	Dredge	Henderson.
Ingram Materials, Inc	Box 1049 302 Harding Road Nashville, Tenn.	do	Livingston.
Martin Marietta Aggregates	P.O. Box 120 Mercersburg, Pa. 17236	do	Boone, Jefferson, Oldham.
Nugent Sand Co	Box 6072 Louisville, Ky. 40206	do	Jefferson.
E. T. Slider Inc	P.O. Box 6041 Louisville, Ky. 40206	Pit	Do.
Stone: Limestone, crushed:			
Kentucky Stone Co., Subsidiary of Koppers Co.	400 Sherburn Lane Louisville, Ky. 40207	5 underground mines, 7 quarries and plants.	Various.
Marble Cliff Quarries Co	Route 1 Butler, Ky. 41006	Mill	Pendleton.
Martin Marietta Corp., Apple Stone Div.	4096 First Ave., N.E. Cedar Rapids, Iowa 52406	5 quarries and plants.	Boone and Jefferson.
Reed Crushed Stone Co., Inc	Box 35 Gilbertsville, Ky. 42044	1 quarry and plant.	Livingston.
Three Rivers Rock Co	Box 218 Smithland, Ky. 42081	do	Do.
Vulcan Materials Co	Box 7 Knoxville, Tenn. 37901	3 quarries and plants.	Fayette and Jefferson.
Vermiculite exfoliated:			
W. R. Grace & Co	62 Whittemore Ave. Cambridge, Mass. 02140	Plant	Campbell.

The Mineral Industry of Louisiana

By William B. Harper,[1] Eugene R. Anderson,[2] and Leo W. Hough [3]

The mineral industry of Louisiana in 1973 recovered from a 1972 decline with an overall increase in value of $408 million, or 7.5%. Part of the increase was attributable to higher prices for petroleum; production of crude in 1973 was 60.3 million barrels below that of 1972, but its value increased $126 million, or nearly 4%. Natural gas production was higher in 1973 in terms of both volume and value, and the same pattern held for liquefied petroleum gases. All other mineral production was down except for stone, which improved over 1972 production by 1.6 million short tons. Louisiana has maintained its second place rank in overall U.S. mineral production and ranked second in the production of petroleum, natural gas, and natural gas liquids. These three commodities, for which the value aggregated $5.6 billion, accounted for 96% of Louisiana's total mineral production value as indicated in table 1.

[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.
[2] Petroleum engineer, Division of Fossil Fuels—Mineral Supply.
[3] State Geologist, Louisiana Geological Survey, Baton Rouge, La.

Table 1.—Mineral production in Louisiana [1]

Mineral	1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays ____ thousand short tons __	1,000	$1,454	979	$1,329
Lime ____ do ____	908	19,614	897	16,801
Natural gas ____ million cubic feet __	7,972,678	1,626,426	8,242,423	1,846,303
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels __	52,842	167,768	47,906	167,037
LP gases ____ do ____	98,233	185,660	102,701	253,671
Petroleum (crude) ____ do ____	891,827	3,201,659	831,524	3,327,702
Salt ____ thousand short tons __	13,514	67,464	13,152	66,211
Sand and gravel ____ do ____	18,920	26,996	13,748	21,165
Stone [2] ____ do ____	9,190	14,836	10,802	21,309
Sulfur (Frasch) ____ thousand long tons __	3,765	W	3,329	W
Value of items that cannot be disclosed:				
Cement, gypsum, stone (miscellaneous), and values indicated by symbol W ____	XX	99,666	XX	98,082
Total ____	XX	5,411,543	XX	5,819,610
Total 1967 constant dollars ____	XX	4,465,064	XX	p 4,272,758

p Preliminary. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Shell only; all others included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Louisiana, by parish [1]

Parish	1972	1973	Minerals produced in 1973 in order of value
Acadia	$114,412	$123,828	Natural gas liquids, natural gas, petroleum.
Allen	6,480	6,299	Petroleum, natural gas, natural gas liquids, sand and gravel.
Ascension	46,370	57,893	Natural gas liquids, petroleum, salt, natural gas.
Assumption	30,284	33,245	Natural gas, petroleum, natural gas liquids.
Avoyelles	4,112	3,374	Petroleum, natural gas, natural gas liquids.
Beauregard	7,937	8,101	Petroleum, sand and gravel, natural gas, natural gas liquids.
Bienville	W	W	Natural gas, petroleum, clays.
Bossier	19,061	21,360	Natural gas, petroleum, natural gas liquids.
Caddo	23,628	24,186	Petroleum, natural gas, natural gas liquids, clays.
Calcasieu	62,587	68,070	Petroleum, natural gas liquids, natural gas, lime, salt.
Caldwell	3,345	2,626	Natural gas, petroleum.
Cameron	311,335	385,437	Natural gas, petroleum, natural gas liquids, salt, stone.
Catahoula	10,943	8,313	Petroleum, sand and gravel, natural gas.
Claiborne	24,988	25,751	Petroleum, natural gas, natural gas liquids.
Concordia	21,521	16,379	Do.
De Soto	8,332	9,972	Natural gas, petroleum.
East Baton Rouge	23,736	18,706	Cement, lime, petroleum, sand and gravel, natural gas, clays.
East Carroll	W	W	Sand and gravel, natural gas.
East Feliciana	W	W	Sand and gravel.
Evangeline	10,817	14,828	Petroleum, natural gas, natural gas liquids, sand and gravel.
Franklin	2,219	2,278	Petroleum, natural gas.
Grant	3,779	3,617	Petroleum, sand and gravel, natural gas.
Iberia	311,490	329,511	Petroleum, natural gas, salt, natural gas liquids.
Iberville	61,775	59,521	Petroleum, salt, natural gas, natural gas liquids.
Jackson	1,203	1,261	Natural gas, petroleum.
Jefferson	371,150	387,934	Petroleum, natural gas, sulfur, natural gas liquids, salt.
Jefferson Davis	47,966	47,680	Natural gas, petroleum, natural gas liquids, sand and gravel.
Lafayette	16,337	16,637	Natural gas, petroleum, natural gas liquids, sand and gravel.
Lafourche	426,523	439,940	Petroleum, natural gas, sulfur, natural gas liquids.
La Salle	23,199	22,774	Petroleum, natural gas, sand and gravel.
Lincoln	19,822	12,932	Natural gas liquids, natural gas, petroleum, clays.
Livingston	W	W	Sand and gravel.
Madison	528	467	Do.
Morehouse	9,414	10,448	Natural gas, petroleum.
Natchitoches	34,231	41,557	Petroleum, natural gas, natural gas liquids, clays.
Orleans	21,477	24,771	Cement, stone, lime, petroleum, natural gas, sand and gravel.
Ouachita	7,054	7,273	Natural gas, sand and gravel, petroleum, natural gas liquids.
Plaquemines	1,226,430	1,250,134	Petroleum, natural gas, sulfur, natural gas liquids, salt.
Pointe Coupee	24,339	22,306	Petroleum, natural gas, natural gas liquids, clays.
Rapides	7,432	6,817	Petroleum, sand and gravel, natural gas.
Red River	174	220	Natural gas, sand and gravel, petroleum.
Richland	24,597	29,953	Petroleum, natural gas liquids, natural gas.
Sabine	821	717	Petroleum, natural gas.
St. Bernard	55,322	63,840	Natural gas liquids, petroleum, natural gas, clays.
St. Charles	86,672	94,853	Petroleum, natural gas liquids, natural gas.
St. Helena	W	W	Sand and gravel, clays.
St. James	10,582	13,360	Petroleum, natural gas, natural gas liquids.
St. John the Baptist	7,130	7,149	Petroleum, natural gas.
St. Landry	37,324	43,311	Natural gas, petroleum, natural gas liquids.
St. Martin	79,961	69,312	Petroleum, natural gas, salt, natural gas liquids, clays.
St. Mary	524,946	633,573	Petroleum, natural gas, natural gas liquids, stone, salt, lime.
St. Tammany	W	W	Stone, sand and gravel, clays.
Tangipahoa	W	W	Sand and gravel, petroleum, clays.
Tensas	3,646	3,350	Petroleum, natural gas, natural gas liquids.
Terrebonne	852,821	901,082	Petroleum, natural gas, natural gas liquids, sulfur, salt.
Union	842	839	Natural gas, petroleum, sand and gravel.
Vermilion	312,724	364,674	Natural gas, petroleum, natural gas liquids, sand and gravel.
Vernon	507	W	Sand and gravel.

Table 2.—Value of mineral production in Louisiana, by parish [1]—Continued

Parish	1972	1973	Minerals produced in 1973 in order of value
Washington	$1,943	W	Sand and gravel.
Webster	28,764	$31,885	Natural gas, natural gas liquids, petroleum, sand and gravel.
West Baton Rouge	W	6,426	Petroleum, clays, natural gas.
West Carroll	W	--	
West Feliciana	W	W	Sand and gravel.
Winn	W	3,705	Petroleum, stone, gypsum, natural gas.
Undistributed [2]	36,506	35,134	
Total [3]	5,411,543	5,819,610	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Values for petroleum are based on an average price per barrel for the state.

[2] Includes some petroleum and sand and gravel that cannot be assigned to specific counties and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Louisiana business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ---- thousands			
Unemployment ---- do	1,390.0	1,423.0	+2.4
Employment:	84.9	85.7	+0.9
Contract construction ---- do	85.6	80.2	−6.3
Mining ---- do	52.6	52.5	−.2
Manufacturing ---- do	180.4	182.7	+1.3
Total all industries [1] ---- do	1,136.5	1,161.2	+2.2
Personal income:			
Total ---- millions	$13,179	$14,397	+9.2
Per capita	$3,543	$3,825	+8.0
Construction activity:			
Total private nonresidential buildings ---- millions	$240.5	$324.1	+34.8
Highway construction contracts awarded ---- do	[e] $167.5	$197.3	+17.8
Cement shipments to and within Louisiana thousand short tons	2,431.0	2.411.0	−.8
Farm marketing receipts ---- millions	$768.0	$1,224.9	+59.5
Mineral production value ---- do	$5,411.5	$5,819.6	+7.5

[e] Estimate. [p] Preliminary.

[1] Transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; services; and government included.

Sources: Employment and Earnings; Survey of Current Business; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

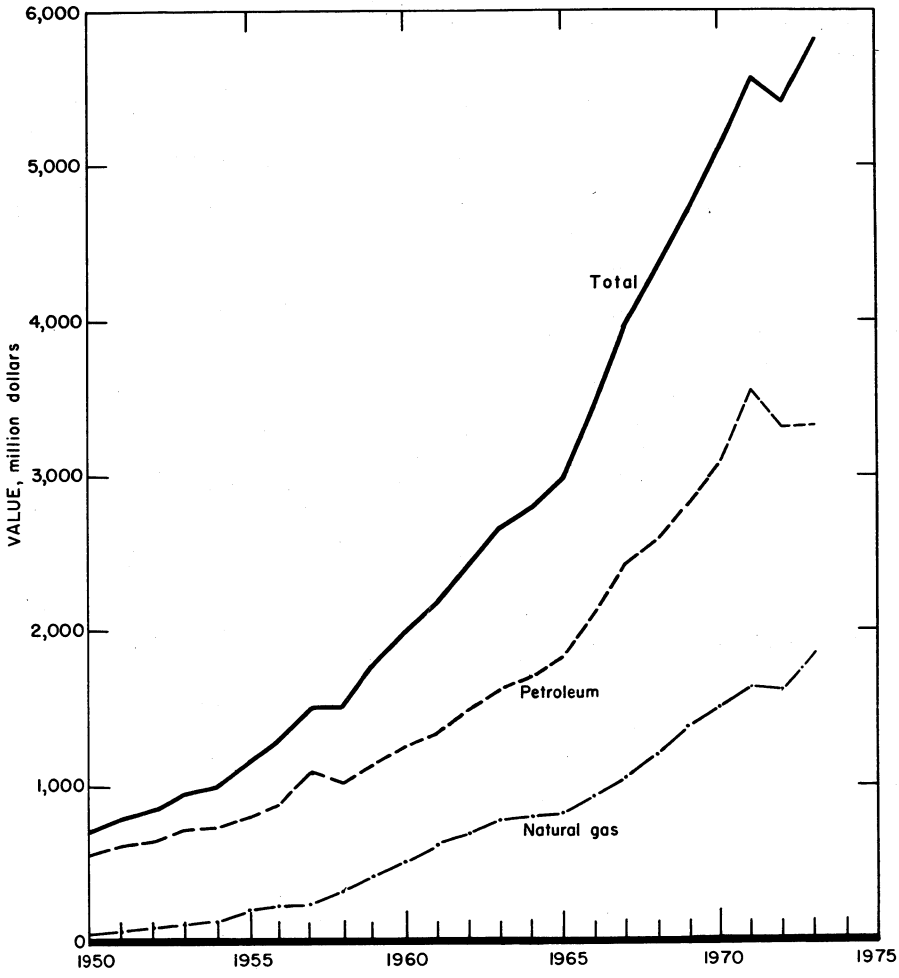

Figure 1.—Value of petroleum, natural gas, and total value of mineral production in Louisiana.

Economic and industrial activity felt the impact of uncertainties about feedstock and fuel supplies, environmental constraints, and high money rates. As a result, capital investment in new projects dropped precipitously, from nearly $1.9 billion in 1972 to $561.2 million in 1973. It should be recognized, however, that the growth trend of about $500 million annually over the past decade was distorted in 1972 by announced expenditures relating to three nuclear power facilities aggregating $1.1 billion. Nuclear plants require huge amounts of capital. Five such plants will be built eventually in Louisiana. None have been started; however, two are scheduled for commercial operation by 1979 and three others by 1981, 1982, and 1984.

The Louisiana Department of Commerce and Industry reported that capital expenditures for chemical plants and petroleum refining facilities approximated $342.5 million, or 61% of all industrial investment in the State in 1973, electric power facilities $98 million, and metal-related operations $51 million. In the ag-

gregate, these three segments accounted for nearly 88% of total capital expansion plans announced by industry in 1973. Most of the investment in petroleum refining was geared to cope with processing increasing amounts of high-sulfur crude oils.

Trends and Developments.—Curtailed deliveries of natural gas to industrial users and utilities and to pipelines spurred efforts to alleviate the shortage problem. The Federal Power Commission (FPC) authorized Texas Eastern Transmission Corp. to build a $23.19 million pipeline of 8- to 20-inch diameter for some 57 miles, from the Vermilion, East Cameron, and West Cameron areas of offshore Louisiana waters, to existing Texas Eastern lines. Texas Eastern estimated natural gas reserves that will be drained by the system to total 237.5 billion cubic feet. The gas will flow at 93 million cubic feet per day for more than six years and the line is expected to be completed in May 1975. Texas Eastern had to curtail deliveries at rates of up to 18.5% in 1973 and curtailments reached 500 million cubic feet per day.

Capline, the world's largest crude pipeline, was expanded by 38% to bring capacity to 743,000 barrels per day by the installation of new pumping facilities. The 634-mile, 40-inch-diameter line, owned by seven companies, stretches from St. James, La., to Patoka, Ill. Line additions and new storage and tanker unloading facilities were scheduled for completion in 1974.

Copolymer Rubber & Chemical Corp. announced that it will convert its steam-producing boilers from natural gas fuel to fuel oil because of the gas shortage. The projected cost for conversion of its Baton Rouge and Addis synthetic rubber plants is $4.0 million. The company estimates that using fuel oil will triple costs, compared with natural gas costs. The plants will still require natural gas for about 20% of energy needs. The fuel oil will be low sulfur and will meet all Federal and State environmental standards. The Ethyl Corp. announced that a plant energy committee had been set up to reduce energy usage at its Baton Rouge plant, by utilizing devices to measure leaks on steam lines and valves, water lines; and to minimize heat loss through stacks, etc.

United Gas Pipeline Co. (UGPL), a subsidiary of Pennzoil Co. began a $6.3 million contruction project in north Louisiana. The project included injection withdrawal wells and pipelines that will facilitate quicker withdrawal of stored natural gas for delivery. UGPL is constructing 31 miles of 24-inch pipeline at a cost of about $4.6 million from a point near Clarence, La., to a tie-in with the company's Bistineau storage reservoir about 30 miles east of Shreveport near Ringgold in Bienville Parish.

Michigan Wisconsin Pipe Line Co., a subsidiary of American Natural Gas Co., announced agreement with Cities Service Oil Co., Getty Oil Co., and Skelly Oil Co. to advance payments of $80 million for the exploration, development, and production of natural gas reserves in the Gulf of Mexico. In exchange for a first call on gas discovered, Michigan Wisconsin made the advance payment with a guaranteed payback in either gas or cash.

The FPC affirmed an initial decision by FPC Administrative Law Judge Jair S. Kaplan that conditionally granted amended applications by Sea Robin Pipeline Co. to construct additional pipeline and compressor facilities in offshore Louisiana, at an estimated cost of $25.1 million, in order to expand maximum delivery capacity from 800 million cubic feet daily to about 1.26 billion cubic feet daily. Sea Robin will increase contract demand deliveries to United Gas Pipe Line Co. and Southern Natural Gas Co., its two joint owners, from 400 million cubic feet daily each to 458.5 million cubic feet daily each. In addition, Sea Robin may deliver and sell to United and Southern such quantities of gas as may be available in excess of their respective contract demands—up to a maximum of 540 million cubic feet daily each.

Intrastate gas sales offer another solution, in part, to industry's fuel and feedstock problems. Union Carbide Corp. reportedly has contracted for a supply of Louisiana gas at an initial price of $1 per million Btu for its Louisiana chemical operation. Still another effort to augment existing domestic supplies of fuels are the proposed deepwater ports. The Louisiana Offshore Oil Port Inc. (Loop), an organization of oil companies, was formed to establish such a port in the proximity of Grand Isle. Loop wants to start with three single-point mooring (SPM) buoys and three pipelines to shore. The SPM's would be located in 105 to 115 feet of water

and sized for the forces generated by very large crude carriers (in excess of 500,000 deadweight tons). Governor Edwin Edwards told a special Senate Subcommittee in Washington that Louisiana would prefer that the Fedaral Government give the States control over construction and licensing of proposed offshore superports. He said that this would allow States that oppose such development to veto such plans while allowing States that want superports to build them. Superports have been opposed by some east coast States. Subsequently, both the House of Representatives and the Senate passed Deepwater Port legislation and the Deepwater Port Act was signed into law (P.L. 93–627) early in 1975.

Legislative and Government Programs.—The marketing and distribution of natural gas produced in areas under State jurisdiction is a prime mineral industry issue in Louisiana. The State legislature created an Energy Commission in December 1973 and empowered it to set minimum prices on new intrastate natural gas contracts and reallocate 10% of the existing in-State industrial natural gas during times of emergency. This power to reallocate extends to 100% of new gas reserves discovered in the State. The State legislature also enacted an increase in the severance tax on natural gas from 3.3 cents to 7 cents per 1,000 cubic feet and an increase in the severance tax on crude oil from 25 cents per barrel to 12.5% of the value of the oil at the wellhead. Also related to minerals and energy was the repeal of an electric generating tax and a power use tax, repeal of a lubricating oil tax, and an exemption from the State sales tax for fuel oil and coal used by industry.

In a further move to retain more gas for in-State use, the Governor's Natural Gas Commission voted to recommend that legislation be introduced to permit private royalty owners to write into their oil and gas leases the stipulation that the entire production be made available to the State. A recommendation was also made for legislation to permit private land owners to take royalty payments in oil and gas rather than cash, and be able to sell it to the State.

Environment.—The Louisiana Air Control Commission, the Capital Region Planning Commission, and the Atchafalaya Basin Commission, along with other State agencies and commissions responsible for environmental protection, are making notable gains toward controlling overall pollution in Louisiana. These gains were made possible through a combined cooperative effort on the part of industry and State government. Typical of this effort was the comprehensive study of the ecology surrounding the proposed deep water superport off Grand Isle. This study will be made by the Louisiana State University under a $400,000 contract with the Loop. According to Jack R. Van Lopik, Director of the LSU Center for Wetlands Resources, the study is to include two onshore and one offshore sites.

A new clean air plan was implemented in 1972 by the Louisiana Air Control Commission. It is estimated that this plan, in compliance with stipulations set forth by the Environmental Protection Agency (EPA), will cost Louisiana industry more than $250 million in the next 5 years. The Air Control and Occupational Health Division of the State Health Department reported that air quality in most areas of Louisiana exceeds Federal standards. There are some problem areas, namely the industrial corridor along the Mississippi River between Baton Rouge and New Orleans, and the Lake Charles area.

A U.S. Supreme Court decision handed down on June 11, 1973, had the effect of enforcing a national policy that barred significant deterioration of already clean air. In Louisiana, however, there is, the possibility of a required switch to fuel oil or coal in industry, if major gas supplies are curtailed for reallocation outside the State. Such a switch, if ordered by the Federal Power Commission (FPC), would require, according to Louisiana Attorney General William Gusee, at least 5 years to complete and during the interim period would subject that State to intolerable air pollution levels. Also, the possibility of total electrical blackouts due to lack of adequate gas supply is a threat to all industry in Louisiana. Because of such possibilities some industry has already postponed plans for new plant construction.

With adequate natural gas supply in doubt, two utility companies in Louisiana have already contracted for low-sulfur coal from Wyoming for three generators to be in operation by 1977 and 1978. Gulf

States Utilities Co. plans to transport 50 million tons of coal into the Lake Charles area to power two 540,000-kilowatt generators. The first unit is scheduled to go into operation in 1977, and the second in 1978. The Central Louisiana Electric Co. signed a 30-year agreement with Kerr-McGee Corp. for Wyoming coal at the rate of 1,750,000 tons per year for use at a generator to be in operation by late 1978.

Kaiser Aluminum & Chemical Corp. announced an anti-air-pollution program which the company says will completely eliminate gaseous emissions from its stacks by mid-1976. The program calls for a $33 million bond sale to finance pollution control.

The Texaco refinery expansion project at Donaldsonville will include a sulfur recovery unit and other modern environmental protection equipment. This equipment will include smokeless flares, floating roof tankage, and other air quality protection equipment according to Texaco. Water quality will be protected through minimum usage air cooler and water cooling towers. Water will be treated before being returned to the Mississippi River.

In a joint environmental protection plan, 36 oil companies have spent more than $1.2 million on equipment they hope will never be used. These firms joined forces to form Clean Gulf Associates, a New Orleans-based organization devoted to the containment and cleanup of oil spills in gulf offshore waters. Georgia-Pacific Corp. has completed a water pollution control project at its Port Hudson operation. The automated equipment is designed to clarify 24 million gallons per day.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The value of mineral fuel production for Louisiana totaled $5,595 million in 1973, an 8% increase over 1972. Fuels represented 96% of the total value of mineral production in Louisiana.

Leasing Activity.[4]—Onshore lease activity resumed in April following a moratorium imposed by Governor Edwards in January. Basis for the moratorium on leasing was the drastic curtailment and reallocation of natural gas produced in Louisiana as imposed by the F.P.C. Faced with the possibility of natural-gas-dependent industrial plants being forced to close and the possible loss of potential new industry due to an unpredictable natural gas supply, Governor Edwards felt legislative controls on a State level were necessary. State lease sales were resumed on a monthly basis with a stipulation that the operator make a diligent effort to market all gas production intrastate. Such intrastate gas would not be under FPC jurisdiction.

Onshore lease activity declined 15% from 1972, with 721,700 acres leased. The downdip Miocene trend from Cameron Parish to Plaquemines Parish created the most activity in the onshore leasing as operators assembled blocks delineated by recent seismic interpretation. Leasing activity in the Cretaceous trend shifted westward into Allen, Beauregard, and Vernon Parishes. Oligocene trend activity was confined to small blocks around the older fields.

Amoco Production Co., Chevron Oil, Placid Oil, and Union Texas Petroleum Div. of Allied Chemical Corp. were the most active companies in onshore leasing activity. The majority of leasing activity was confined to Terrebonne, Vernon, Lafourche, Cameron, Beauregard, Vermilion, St. Landry, Assumption, Calcasieu, and St. Mary Parishes.

In the June 1973 Federal offshore lease sale, five tracts were offered in western Louisiana waters. The Bureau of Land Management (BLM) accepted the high bids on four of these tracts and rejected one. The Amoco group's bid of $6.1 million for West Cameron Block 528 was the highest bid ever rejected. Pennzoil Offshore Gas Operators, Inc. (POGO) et al. won three blocks and Clark Oil Co. won one.

In June, the industry nominated for consideration five deep water tracts within the 200- to 600-meter depths on new leasing maps prepared by the BLM. Five new areas were portioned off as far out as the 2,000-meter depth. These areas add approximately 25,000 square miles to the Louisiana Gulf Coast District. By 1979,

[4] Stevens, Edgar M. and Robert L. Callahan. "Developments in Louisiana Gulf Coast in 1973," Amer. Assoc. Pet. Geol. Bulletin, v. 58, No. 8, August 1974, pp. 1621–1629.

the Department of the Interior intends to triple acreage to be leased on the Outer Continental Shelf offshore Louisiana.

Geophysical Activity.[5]—Onshore geophysical exploration was down by 28% in 1973. There were 517 crew-weeks in 1973, down 197 crew-weeks from 1972. The upper and middle Miocene trends in Terrebonne and Lafourche Parishes received the most concentrated seismic activity, accounting for approximately 25% of the State's total. Operators continued to test the Cretaceous trend in hopes of locating additional Cretaceous reef production in the western section. Five tests, with depths ranging to 22,473 feet in the Lower Cretaceous beds, were drilled. Although data from these wells are confidential, bottom-hole temperatures exceeded 400°F in some holes. New data were acquired in the Miocene and Oligocene trends where tenuous closures and stratigraphic traps are believed to exist around known producing pay zones.

Offshore evaluation of the acreage acquired in the December 1972 Federal lease sale and reconnaissance of deep water tracts nominated in June 1973 accounted for most of the 345 offshore seismic crew-weeks. Continued activity in seismic exploration can be expected in anticipation of the extensive offshore leasing proposed by the Department of the Interior.

Exploration and Development Drilling.—The Louisiana Department of Conservation compiles data on well completions covering north Louisiana and south Louisiana onshore, and offshore areas under Louisiana jurisdiction. In 1973, the Department reported 2,076 wells completed, 1,954 of which were onshore. In addition to the data published by the State, the American Petroleum Institute (API) (the historical data used in Minerals Yearbook) reports well completions both within and beyond State jurisdiction, including wells on the Outer Continental Shelf. According to the API there were 2,904 wells drilled in Louisiana, including 888 offshore wells. Total onshore footage drilled was 15.7 million feet, and average depth was 7,801 feet. Offshore footage drilled totaled 8.6 million feet with an average depth of 9,665 feet.

In the 26 parishes of north Louisiana, a total of 821 wells were drilled, 27% less than the 1,125 wells drilled in 1972. Exploration drilling totaled 144 wells, 18% less than the 175 exploratory wells drilled in 1972. Of the exploratory wells drilled, only five (3%) were completed successfully. Development drilling totaled 677 wells, of which 233 were completed as oil wells and 265 as gas wells for a success ratio of 74%. Development drilling was predominant in Caddo, La Salle, Morehouse, Ouachita, and Union Parishes.

Onshore in the 39 parishes of southern Louisiana, a total of 1,195 wells were drilled. There were 360 exploratory wells drilled, of which 21 were completed as oil wells and 48 as gas wells. Some 291 dry holes were drilled. The success ratio was 19%. The 835 developmental wells included 321 completed as oil wells, 241 completed as gas wells, and 273 dry holes, for a 67% success ratio.

Offshore, development drilling accounted for a total of 680 wells, up 88 wells (15%) compared with 1972. (Table 4.) Of the offshore development wells, 282 were completed as oil wells, and 224 as gas wells; 174 were plugged as dry holes. The success ratio was 74% offshore. Exploratory drilling accounted for 208 wells, basically unchanged from the 206 wells drilled in 1972. Of these exploratory wells, only 2 were completed as gas wells while 206 were dry wells, a success ratio of 1%.

For the State, there were 2,192 developmental wells, down 137 wells from the 2,329 wells drilled in 1972. A total of 712 exploratory wells were drilled in 1973, down 24 from the 736 wells drilled in 1972. Of the 2,904 wells drilled in 1973, 858 were completed as oil wells, 784 completed as gas wells, and 1,262 classified as gas wells, and 1,262 classified as dry holes. The State success ratio was 57%, unchanged from 1972.

Important new field discoveries included a northern Lafourche parish discovery identified as South Bayou Boeuf. The discovery well has a potential of 192 barrels per day of 38° gravity oil and 109,000 cubic feet per day of natural gas. This discovery has been confirmed by two additional wells; one of the confirmation wells was dually completed and is reported to be in a new fault block. A potential discovery in Vermilion Parish was completed in a 130-foot section of Oligocene sand with perforations between 12,896 and 12,916 feet. The initial potential test pro-

[5] Work cited in footnote 4.

duced 135 barrels per day of condensate and 10.6 million cubic feet per day of natural gas. Upper Miocene production was discovered in Lafourche Parish at Bay Lizette. This State lease completion was perforated between 14,495 and 14,526 feet with a potential natural gas flow of 5.6 million cubic feet per day. Additional major onshore discoveries and field extensions were reported in Assumption (2), Cameron (4), St. Mary (5), Terrebonne (8), and Vermilion (5) Parishes.

Offshore, there were only two confirmed discoveries. Offshore activity, however, has increased appreciably as a direct result of the largest and most expensive offshore lease sale in the U.S. history. This activity has disclosed a number of potential new field discoveries and major extension of existing fields as several new multiple well platforms are being developed. The confidential nature of offshore drilling activity precludes any definitive information from being released.

Table 4.—Louisiana: Oil and gas well drilling completions, by parish, 1973

Parish	Development Wells			Exploratory			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Acadia	7	12	22	1	4	14	60	628,134
Allen	2	1	2	--	--	2	7	65,227
Ascension	3	1	4	--	--	1	9	88,591
Assumption	1	1	4	--	4	10	20	264,858
Avoyelles	--	--	3	--	--	1	4	42,577
Beauregard	3	2	7	--	--	7	19	178,588
Bienville	--	20	7	--	1	2	30	273,117
Bossier	30	8	12	--	--	7	57	151,322
Caddo	118	14	15	--	1	9	157	357,572
Calcasieu	15	11	16	2	2	15	61	506,281
Caldwell	--	6	13	--	--	22	41	117,649
Cameron	15	11	11	2	3	41	83	800,667
Catahoula	6	--	15	--	--	14	35	174,908
Claiborne	10	1	3	--	--	6	20	182,159
Concordia	6	--	21	--	--	20	47	297,427
De Soto	--	17	13	--	--	6	36	179,491
East Baton Rouge	--	--	2	--	--	2	4	42,450
Evangeline	--	1	2	1	--	10	14	159,306
Franklin	2	--	2	--	--	2	6	22,787
Grant	1	--	--	--	--	--	1	1,872
Iberia	9	8	8	3	2	14	44	474,995
Iberville	11	2	9	--	1	11	34	328,911
Jackson	--	--	--	--	--	3	3	18,549
Jefferson	13	10	18	--	--	3	44	491,468
Jefferson Davis	4	9	15	1	2	21	52	510,600
Lafayette	--	1	2	--	1	5	9	118,670
Lafourche	31	21	23	3	1	11	90	988,609
La Salle	27	5	29	1	1	11	74	297,533
Lincoln	--	1	--	--	--	1	2	19,577
Livingston	--	--	--	--	--	1	1	8,512
Madison	--	--	--	--	--	1	1	3,950
Morehouse	--	67	7	--	--	1	75	177,603
Natchitoches	--	--	--	--	--	6	6	44,104
Orleans	--	--	--	--	--	2	2	20,036
Ouachita	--	75	2	--	--	1	78	218,741
Plaquemines	62	17	29	1	3	8	120	1,053,373
Pointe Coupee	2	2	2	1	--	--	7	84,072
Rapides	1	--	2	--	--	3	6	61,491
Red River	6	1	3	--	--	3	13	45,396
Richland	--	9	14	--	--	1	24	71,022
Sabine	--	2	9	--	1	3	15	76,589
St. Bernard	--	2	--	--	--	6	8	82,303
St. Charles	15	10	6	--	1	4	36	391,388
St. James	--	2	4	--	1	6	13	142,729
St. John the Baptist	--	--	--	--	1	4	5	55,644
St. Landry	6	10	18	--	2	7	43	392,461
St. Martin	10	3	9	2	1	19	44	463,031
St. Mary	43	26	11	1	3	13	97	976,910
Tensas	3	1	1	--	--	1	6	53,498
Terrebonne	57	60	35	2	7	25	186	2,162,198
Union	1	31	3	--	--	4	39	145,896
Vermilion	11	18	8	1	8	20	66	885,493
Vernon	--	--	--	--	1	3	4	49,245
Webster	1	7	7	--	--	--	15	121,477
West Baton Rouge	--	--	1	--	--	2	3	30,327
West Carroll	--	--	--	--	--	1	1	3,066
Winn	22	--	3	--	--	14	39	123,089
Offshore[1]	282	224	174	--	2	206	888	8,582,328
Total	836	730	626	22	54	636	2,904	24,309,867

[1] Data does not include multiple completions reported as gas wells for offshore.

Source: American Petroleum Institute.

Carbon Black.—Production was 1,208 million pounds, a 12% increase over 1972 output. Louisiana continued to rank second after Texas and accounted for 34.5% of the total national production. Part of the 1973 increase was accounted for by modernization of Cabot Corp.'s Ville Platte facility and expansion of its Franklin installation.

Louisiana leads the nation in the production of carbon black from natural gas. Natural gas use totaled 21,278 million cubic feet, down 2,285 million cubic feet from 1972. Liquid hydrocarbon usage was 187 million gallons, up 9 million gallons from 1972. This reflects a gradual increase in oil furnace black production over gas furnace blacks. Total value of production was $96.8 million, or 8.01 cents per pound.

At yearend 1973, the nine operating plants in the State had a total capacity of 3,851,837 pounds per day. Louisiana accounted for 32% of the country's daily production. The three plants in St. Mary Parish accounted for most of the State's production. Other plants are located in Avoyelles, Calcasieu, Evangeline, Ouachita (2 plants) and West Baton Rouge Parishes.

Table 5.—Louisiana: Carbon black production and value
(Million pounds and million dollars)

Year	Quantity	Value
1969	1,046	70.8
1970	982	70.6
1971	1,079	78.2
1972	1,078	78.8
1973	1,208	96.8

Natural Gas.—Marketed natural gas production in Louisiana increased in 1973 to 8.24 trillion cubic feet, 3.4% over the 7.97 trillion cubic feet of marketed gas produced in 1972. The average wellhead values of Louisiana gas increased 9.8% from 20.4 cents per 1,000 cubic feet to 22.4 cents.The total value of marketed natural gas produced rose 13.5% to $1.8 billion.

Although the State still ranks second in natural gas production, Louisiana is steadily narrowing the gap with Texas, the leader, in 1968 that gap was some 1 trillion cubic feet, but at yearend 1973 it was down to 271 billion cubic feet.

Development of gas production potential was revitalized in 1973 after a marked decline in the mid-1960's. This change is particularly evident in well completions offshore; after slumping to 133 in 1972. Offshore gas well completions rose 74% to 231, in 1973. The following table provides a brief time series on gas well completions in Louisiana as reported by API.[6]

Year [1]	North	South	Offshore	Total
1968	143	210	184	537
1969	123	230	190	543
1970	157	232	150	539
1971	237	200	184	621
1972	451	234	133	818
1973	269	284	231	784

[1] These data include multiple completions reported as gas wells, therefore figures will not agree with table 4.

New gas discoveries did not keep ahead of withdrawals from the 10,551 gas and condensate wells producing at the end of 1973. As a result gas reserves continued to decline. The American Gas Association (AGA) reported that reserves of natural gas aggregated 69,151.6 million cubic feet at the end of 1973, 7.8% below the preceding year. Downward revisions of previous estimates, plus the fact that additions to reserves from new fields and new reservoirs were not large enough to offset production withdrawals, resulted in a net reduction in proved reserves of 5.8 trillion cubic feet. New field discoveries totaled 549.7 billion cubic feet, and new reservoir discoveries in old fields amounted to about 1.2 trillion cubic feet. Most Louisiana reserves are offshore.

Comparison of the proved reserves, as of December 31, 1972 and 1973, are shown in table 6. Productive capacity for natural gas in Louisiana in millions of cubic feet per day as follows:

Production Capacity [1]		
Non-associated gas	Associated dissolved gas	Total gas
23,072	3,258	26,330

[1] During the heating season (90 days) immediately following December 31, 1973.
Source: American Gas Association.

[6] American Petroleum Institute. Annual Review of Drilling Statistics for the United States. V. 2–7, No. 4, 1974.

Table 6.—Louisiana: Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

Commodity	Proved reserves, Dec. 31, 1972	Changes in proved reserves due to net revisions, extensions, and discoveries in 1973	Proved reserves, Dec. 31, 1973 (production deducted)	Changes from 1972 (percent)
Crude oil ____ thousand barrels __	5,028,478	451,652	4,576,826	—9.0
Natural gas liquids ____ do ____	2,135,837	143,300	1,992,537	—6.7
Natural gas ___ million cubic feet __	74,971,334	5,819,721	69,151,613	—7.8

Source: American Gas Association, American Petroleum Institute, and the Canadian Petroleum Association. Reserves of Crude Oil, Natural Gas Liquids and Natural Gas in the United States and Canada and United States Productive Capacity as of December 31, 1973. V. 28, June 1974.

Table 7.—Louisiana: Natural gas data
(Million cubic feet)

Year	Withdrawals			Disposition			
	From gas wells	From oil wells	Total	Marketed production [1]	Value at wells (thousands)	Repressuring	Vented and wasted [2]
1969 ____	6,305,897	1,255,130	7,561,027	7,227,826	1,387,743	174,349	158,852
1970 ____	6,811,334	1,264,823	8,076,157	7,788,276	1,503,137	133,792	154,089
1971 ____	7,011,666	1,306,885	8,318,551	8,081,907	1,632,545	133,080	103,564
1972 ____	6,924,204	1,235,559	8,159,763	7,972,678	1,626,426	123,418	63,667
1973 ____	7,347,732	1,143,462	8,491,194	8,242,423	1,846,303	146,680	102,091

[1] Marketed production plus quantities used in repressuring, vented, and wasted.
[2] Partly estimated. Includes direct waste on producing properties and residue blown to the air.

Table 8.—Louisiana: Marketed production, interstate shipments, and total consumption of natural gas in selected producing States [1]
(Billion cubic feet)

State	Marketed production	Interstate movements			Change in underground storage	Transmission loss and unaccounted for	Consumption
		Receipts	Deliveries	Net receipts (+) or deliveries (—)			
Louisiana ____	8,242	1,257	7,163	—5,906	85	35	2,217
Oklahoma ____	1,771	1,268	2,333	—1,065	22	10	673
Texas ____	8,514	551	3,942	—3,391	1	34	5,088
Total ____	18,527	3,076	13,438	—10,362	108	79	7,978

[1] Data may not add to totals shown because of independent rounding.

Nearly 2,217 billion cubic feet of natural gas was used for all purposes in Louisiana in 1973, a 3.7% increase over the 2,138 billion cubic feet used in 1972. Gas delivered to consumers (table 8) was 2.9% higher because increased industrial consumption more than offset the reduction in natural gas used by electric utilities. Consumption of gas in the State in 1973 was equal to 26.9% of production. Most (81.8%) of the 22.6 trillion cubic feet of natural gas produced in the United States in 1973 came from three south-central States, of the three States, Louisiana accounted for 44% of the production. Interstate deliveries of natural gas exceeded in-State use by a wide margin, and authorizations by the FPC to extend natural gas pipelines to transport Louisiana gas to interstate markets suggests a further widening of the spread between production and consumption within the State.

Table 9.—Louisiana: Quantity and value of natural gas delivered to consumers and other consumption of natural gas

	Number of consumers (thousands)		Quantity (million cubic feet)		Value (thousand dollars)	
	1972	1973	1972	1973	1972	1973
Residential	359	893	82,847	93,072	75,805	90,559
Commercial	72	68	34,014	28,730	20,306	19,450
Industrial [1]	XX	XX	1,016,536	1,085,216	331,391	410,212
Electric utilities	XX	XX	382,369	355,023	104,769	104,377
Other consumers	XX	XX	32,317	30,788	10,341	10,947
Total delivered to consumers	XX	XX	1,548,083	1,592,829	542,612	635,545
Extraction loss:						
Natural gas processing	XX	XX	197,967	206,833	59,588	73,219
Lease and plant fuel	XX	XX	312,145	336,832	65,550	78,819
Pipeline fuel	XX	XX	79,534	80,198	18,293	19,568
Total natural gas consumption	XX	XX	2,137,729	2,216,692	686,043	807,151
Marketed natural gas production			7,972,678	8,242,423	1,626,426	1,846,303
In-State use as percent of production			26.8	26.9	XX	XX

XX Not applicable.
[1] Includes refinery fuel use of 113,322 million cubic feet and 21,278 million cubic feet for carbon black production in 1973, and refinery fuel use of 103,578 million cubic feet and 23,563 million cubic feet for carbon black production in 1972.

Natural Gas Liquids.—Louisiana continued to rank second after Texas in natural gas liquids production, which in 1973 amounted to 150.6 million barrels. Of the total, liquefied petroleum gases (including ethane) output increased 4.6% to 102.7 million barrels, while natural gasoline and cycle products declined 9% to 47.9 million barrels. Average value per barrel of liquefied petroleum gases (including ethane) was $2.47; of natural gasoline and cycle products, $3.49 a barrel.

According to an Oil and Gas Journal survey[7] there were 124 natural gas processing plants in Louisiana at yearend 1973 with a total capacity of nearly 24,000 million cubic feet per day. Natural gas throughput at these plants totaled 19,600 million cubic feet, representing a plant capacity utilization of 82%. Utilization was down from 86% in 1971 attributed to the processing of a leaner gas and in part to leaving some of the ethane and propane in the gas to raise the Btu content.

The AGA and API estimated that natural gas liquids reserves at yearend 1973 totaled 1,993 billion barrels. This was 6.7% less than in 1972, and represented the fifth consecutive year of decline. Nearly 84% of these reserves were in nonassociated gasfields. Louisiana accounted for 31% of the Nation's total natural gas liquids reserves.

Consumption of the liquefied petroleum gases and ethane segment of natural gas liquids rose 1% in 1973, as shown below, in thousands of barrels:

Sector	1972	1973	Percent change
Residential and commercial	3,562	3,223	−9.5
Internal combustion engine fuel	1,021	933	−8.6
Industrial sales [1]	3,875	4,261	+10.0
Miscellaneous uses	212	354	+7.0
Total	8,670	8,771	1.2

[1] Includes refinery fuel.

Liquefied petroleum gases (LPG) sales for industrial uses increased in 1973 to 4,261,000 barrels, or 10%; propane accounted for 93% of these volumes.

Lower-than-normal inventories at midyear 1973 and the strong possibility that residential and commercial consumers would not have adequate propane supplies triggered the enactment of a mandatory propane allocation program which became effective nationwide October 3, 1973. A mild winter and consumer resistance to sharply higher prices helped to alleviate the tight LPG supply situation.

Petroleum.—Crude oil production continued to decline for the second straight year. Production of 831.5 million barrels (2,278,148 barrels per day) in 1973 represented a 6.8% decline from 1972 pro-

[7] Oil and Gas Journal. Survey of Gas Processing Plants. V. 72, No. 27, Jul. 8, 1974, pp. 98–114.

duction. Nationwide Louisiana ranked second in crude production, accounting for 24.7% of the U.S. total.

The majority of oil-producing wells continued to operate at their maximum efficiency rate. As a result, Louisiana no longer possesses a reserve producing capacity. At yearend the average daily crude production was declining at the rate of 18,360 barrels per day.

According to the API, reserves of crude oil at yearend totaled 4,577 million barrels, down 451 million barrels from that of 1972. Additions to reserves based on reevaluation of known reservoirs, extensions of known fields, and discovery of new fields and reservoirs amounted to 452 million barrels.

According to a Bureau of Mines survey, there were 21 refineries operating in Louisiana with a total operating capacity of 1,697,450 barrels per day at yearend 1973, an increase of 143,950 barrels per day over 1972. The only new refinery added was the 15,000-barrel-per-day unit of Continental Oil Co. at Egan. Additions to refining capacity at 12 separate refineries accounted for the notable increase in Louisiana for 1973. The largest increase in refining capacity, 28,000 barrels per day, was reported by Cities Service Oil Co. at its Lake Charles complex. Exxon Co., U.S.A., added 25,000 barrels per day at Baton Rouge, Murphy Oil Corp. added 22,500 barrels per day at Meraux, and Good Hope Refineries, Inc., added about 21,000 barrels per day at Good Hope. Other additions ranged from 200 to 10,500 barrels per day. There were no reports of reduction in operating capacity at any of the other eight reporting refineries.

With an average crude production of 2.3 million barrels per day, the Louisiana refining capacity could process only 74.5% (1.7 million barrels per day) of this total, leaving a theoretical crude balance of 0.6 million barrels per day for transshipment to other areas for processing. At yearend, the Conservation Commission reported almost all wells were being produced at the maximum efficient rate (MER). Wells in Federal offshore waters have been producing at the MER since 1971. Monthly allowable hearings are being held on a bimonthly basis.

Table 10.—Louisiana: Crude oil production indicated demand, and stocks in 1973, by month
(Thousand 42-gallon barrels)

Month	Production	Indicated demand	End of month stocks originating within State
January	72,929	74,879	28,481
February	65,640	66,704	27,417
March	72,679	70,831	29,265
April	69,856	68,454	30,667
May	70,953	69,784	31,836
June	68,774	70,082	30,528
July	71,614	72,006	30,136
August	70,393	69,432	31,097
September	63,767	65,129	29,735
October	69,680	70,489	28,926
November	67,068	66,198	29,796
December	68,171	69,912	28,055
Total:			
1973	831,524	833,900	XX
1972	891,827	894,424	XX

XX Not applicable.

Table 11.—Louisiana: Number of producing oil wells and average production per well per day

Year	Approximate number of producing wells, Dec. 31	Average production per well per day [1] (barrels)
1969	29,393	r 77.6
1970	r 27,934	r 86.7
1971	r 28,829	r 93.6
1972	e 27,762	89.3
1973	e 28,869	80.5

e Estimated. r Revised.
[1] Based on the average number of wells during the year.

Table 12.—Louisiana: Production of crude petroleum, by district and selected fields
(Thousand 42-gallon barrels)

District and field [1]	1972	1973
Gulf coast onshore: [2]		
Avery Island	3,880	1,839
Bay de Chene	6,551	6,590
Bay Ste. Elaine	7,247	6,254
Bayou Salle	3,697	2,816
Black Bay West	9,113	8,036
Caillou Island	29,683	25,613
Cote Blanch Bay West	13,908	10,288
Cote Blanche Island	8,015	5,482
Delta Farms	1,281	997
Garden Island Bay	12,993	10,384
Golden Meadow	2,306	2,027
Grand Bay	6,661	5,755
Hackberry East	1,995	1,647
Hackberry West	3,349	3,100
Iowa	852	1,244
Jennings	256	261
Lafitte	9,333	8,211
Lake Barre	6,625	5,420
Lake Pelto	4,502	4,069
Lake Salvador	4,118	2,432
Lake Washington	9,333	6,965

See footnotes at end of table.

Table 12.—Louisiana: Production of crude petroleum, by district and selected fields—Continued
(Thousand 42-gallon barrels)

District and field [1]	1972	1973
Gulf coast onshore: [2]—Continued		
Leeville	4,246	3,156
Paradis	1,720	4,277
Quarantine Bay	4,538	3,946
Romere Pass	3,074	2,727
Venice	5,380	9,456
Vinton	2,782	5,078
Weeks Island	11,053	3,478
West Bay	9,040	8,363
Other fields	214,108	194,974
Total	401,639	354,885
Gulf coast offshore: [2]		
Bay Marchand Block 2	29,390	32,561
Eugene Island Block 126	5,527	4,663
Eugene Island Block 175	6,954	9,873
Eugene Island Block 276	7,613	6,322
Grand Island Block 16	19,690	18,936
Grand Island Block 43	23,095	20,732
Grand Island Block 47	4,172	4,684
Main Pass Block 35	3,148	2,456
Main Pass Block 41	17,678	14,808
Main Pass Block 69	11,566	10,924
Main Pass Block 306	7,576	6,652
Ship Shoal Block 204	5,300	5,369
Ship Shoal Block 207	8,638	6,964
Ship Shoal Block 208	14,420	11,262
South Marsh Island Block 73	5,453	5,353
South Pass Block 24	18,227	16,740
South Pass Block 27	17,312	13,366
South Pass Block 62	10,248	8,666
South Pass Block 65	11,931	12,088
West Delta Block 30	25,144	24,626
West Delta Block 58	8,674	8,176
West Delta Block 73	16,250	9,348
Other fields	167,909	182,306
Total	445,915	436,875
Northern:		
Caddo-Pine Island	3,448	3,076
Delhi	5,848	6,290
Haynesville	2,196	1,788
Homer	(3)	(3)
Lake St. John	(3)	(3)
Rodessa	552	329
Other fields	32,229	28,281
Total	44,273	39,764
Grand total	891,827	831,524

[1] Breakdown for individual fields from the Oil and Gas Journal.
[2] Some fields include onshore and offshore production.
[3] Included in "Other fields."

Petrochemicals.—Anticipated expansion of the Louisiana petrochemical industry in 1973 did not materialize as expected. Industrialists were moving with extreme caution owing to the uncertainty of feedstocks, especially benzene, ethylene, and naphtha, and the lack of a stable natural gas supply. This apprehension was brought about by the energy crisis, a switch to the production of nonleaded gasoline, and a fear of further curtailment by the FPC of natural gas as an industrial fuel and a petroleum feedstock.

Despite the apprehension on the part of industry over an unstable natural gas supply, there were a number of major plant expansions; several new plants were either under construction or proposed, and other long-range plans were announced. There were some cutbacks in petrochemical production such as the 25% reduction at Union Carbide's Taft, La., complex. This cutback resulted from the curtailment of propane feedstocks and affected the total output of ethylene, propylene, butadiene, and aromatics. Exxon Chemical Co., U.S.A., announced the closing by the end of 1974 of its ethanol and ethyl ether plant at Baton Rouge. Increasingly stringent pollution regulations were listed as the main contributing factor leading to the planned shutdown of this phase of production.

Shell Chemical Co. officially announced the awarding of a contract to The M. W. Kellogg Company for the construction of a 1-billion-pound-per-year ethylene plant. The plant to be built at Shell's Norco, Louisiana refinery, is scheduled for a 1975 completion. The plant will be designed to use a varied feedstock supply and will produce smaller amounts of propylene in addition to the ethylene. The increased demand for polyolefins may firm up plans by other companies for similar ethylene-propylene units.

Exxon Chemical Co., U.S.A., at Baton Rouge, completed construction and placed onstream its new ethylene-propylene purification facility. In July the plant was producing at an annual rate of 300 million pounds of butadiene and 180 million pounds of propylene. A 50-million-pound-per-year low-density-polyetheylene plant was scheduled for completion in 1974 expanding the total capacity to approximately 400 million pounds per year.

Continental Oil Co. announced the opening, by May of 1974, of the first tanker terminal for ethylene in the United States. This ethylene will be processed at the Conoco Chemicals Div. manufacturing complex at Lake Charles.

Union Carbide is planning a major expansion of its ethylene oxide capacity at Taft. This expansion, along with two other out-of-State expansions, will add approximately 260 million pounds per year to

its overall production capacity at the three plants. The unit is anticipated to be onstream by 1975.

Although Hercules Inc. is having problems securing adequate feedstocks, it is planning major expansion of its total industry propylene facilities. Major cutbacks were due to propylene feedstocks being drastically curtailed by its supplier. Unable to secure adequate natural gas, Cities Service was forced to burn some propane from its nearby olefins plant, thus reducing the firms output of propylene, which is the feedstock for Hercules.

The first full-scale polybutylene production facility in the United States was being built by Witco Chemical Corp. at Taft. The 50-million-pound-per-year plant, being built by the Badger Co. Inc., was scheduled for completion by yearend 1974. Polybutylene, a specialty plastic, will be used initially as a utility piping and industrial plastic. Long-range plans will include the use of polybutylene as an industrial packaging material. Feedstocks appear to be adequate with butadiene and C_4 refinery stream as the principal feedstock source as well as byproduct C_4 from new ethylene plants using heavy feedstocks.

Copolymer Rubber & Chemical Corp. is planning a 50-million-pound-per-year expansion at its Baton Rouge facility which will boost styrene-butadiene dry rubber capacity to approximately 420 million pounds per year.

Hercules Inc., announced plans to build a 40-million-pound-per-year hydrocarbon resin plant and a hydrogenation facility adjacent to an existing resin plant at Baton Rouge. Completion is scheduled for mid-1975.

Shell Chemical Co. went onstream late in 1973 with its 700-million-pound-per-year vinyl chloride monomer plant at Norco. The ethylene feedstock comes from its olefins plant nearby with chlorine requirements being supplied from existing chlorine plants along the Mississippi waterway. Goodyear Tire & Rubber will double polyvinyl chloride capacity to 200 million pounds per year, at its Plaquemine facility. The unit was expected to be onstream by early 1974.

BASF Wyandotte Corp. has awarded a contract for the expansion of its toluene di-isocyanate facility at Geismar. This expansion will bring the plant's total capacity to 100 million pounds per year.

As a result of a major expansion, Conoco Chemicals Division expanded its Lake Charles Alfol alcohol plant from a 1972 production capacity of 150 million pounds per year to 200 million pounds per year of C_6–C_{18} alcohol.

Chembond Corp's formaldehyde plant is now onstream at Winnfield, La. This formax process plant has an estimated capacity of 70 million pounds per year. This 37% formaldehyde will be used at Chembond's resin and adhesives facilities at Winnfield and Andalusia, Ala.

The world's largest double-contact sulfuric acid plant is under construction in Donaldsonville. The two 1,800-ton-per-day units are a part of an Agrico Chemical Co. expansion at its Faustina complex in Donaldsonville.

The Georgia-Pacific Corp. chlorine-caustic soda addition at Plaquemine is now under construction. When complete, the facility will have the capacity to produce 1,200 tons of chlorine per day. Part of the chlorine production will be used in Georgia-Pacific's polyvinyl chloride plant now under construction at Plaquemine.

According to the Louisiana Department of Commerce and Industry, the petrochemical, chemical and refining industry accounted for $200.6 million or 54%, of the $369.4 million of investment funds qualifying for industrial tax exemption in 1973. This is a significant figure considering the uncertainty of feedstocks and fuel supplies resulting from the 1972–73 energy crisis.

NONMETALS

Value of nonmetals production declined by $5 million in 1973 to $225 million and comprised 3.9% of the State's total mineral value. Except for a 4% increase in 1972, the State has been experiencing a steady decline in mineral production value since the record $289 million high set in 1968. Of the eight nonmetalic minerals produced, seven were down in value. Only stone showed an increase over 1972.

Barite.—Crude barite is not mined in Louisiana; however, one plant in Calcasieu Parish, one in St. Martin Parish, and three in Orleans Parish crushed and ground barite ore. Ore mined domestically and

abroad was shipped to Louisiana for processing. The quantity of ore processed in 1973 was up slightly, 1.73% while unit value increased by 15.72%. Virtually all the barite processed in Louisiana is used as a weight additive in oil and gas well drilling muds.

Cement.—Shipments of portland cement and masonry cement from three plants operating in Louisiana, decreased, for the first time in 2 years, by 12%. Portland cement accounted for about 99% of total production. About 86% of the portland cement shipped was type I and II (general use and moderate heat); the remainder was type III (high early strength) and oil well cement. Portland cement was consumed by ready-mix concrete companies (45%), highway contractors (15%), concrete product manufacturers (10%), building material dealers (10%), and other contractors and miscellaneous customers (20%). Raw materials used in making portland cement include limestone, shells, clay, sand, gypsum, and iron-bearing materials. All plants used natural gas to fire their kilns.

The producing companies were Ideal Cement Co., Lone Star Cement Corp., and Louisiana Cement Co., Div. of OKC Corp. The latter company's new kiln and grinding mills were scheduled to be in production in 1974.

Clays.—Output of common clay and undifferentiated clay and shale decreased 2% to 979,000 tons. Average unit value was down to $1.36 from the 1972 average of $1.45 per short ton. Eleven companies operated 13 pits in 12 parishes. Principal producing parishes in descending order of production were West Baton Rouge, Pointe Coupee, and St. Bernard. Clay output was consumed in the manufacture of cement, heavy brick, and lightweight aggregate.

Table 13.—Louisiana: Clays sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value
1969	1,078	2,943
1970	1,080	1,575
1971	1,073	1,606
1972	1,000	1,454
1973	979	1,329

Gypsum.—Crude gypsum was mined at Winnfield mine in Winn Parish by Winn Rock, Inc. Output was used as a retarder in portland cement. Unit price was up by 7% from that of 1972. Gypsum was calcined by National Gypsum Co. at its Jefferson Parish plant and by United States Gypsum Co. at its Orleans Parish plant. Output, which decreased by 17% in 1973, was used principally at chemical plants. Unit value was 20% less than in 1972.

Lime.—Production decreased 1% in 1973 to nearly 900,000 short tons, 12% below the 1970 record high. The unit value decreased 13% to $18.73 per ton. Allied Chemical Corp., Olin Corp., S. I. Lime Co., and U.S. Gypsum Co. produced lime in Calcasieu, East Baton Rouge, Orleans, and St. Mary Parishes. Lime consumption in Louisiana which totaled 918,000 tons, was used principally at chemical plants, aluminum smelters, and water purification facilities.

Perlite.—Athough not mined in Louisiana, perlite is expanded at two plants—Zonolite Division of W.R. Grace & Co. in Orleans Parish and Filter-Media Co. of Louisiana, Inc., in St. John the Baptist Parish. The latter is a principal producer of filter materials. Expanded perlite showed a very slight increase in production for 1973, with a unit value increase of 25%. Principal uses were for filter aids, low-temperature insulation, and horticulture aggregates.

Salt.—Salt sold or used in Louisiana amounted to 13,152,000 short tons in 1973, ranking the State first and accounting for 30% of the U.S. total.

Salt sold or used decreased 2.7% and was valued at $66.2 million in 1973. The average unit value was $5.03 per ton, a 1% increase from 1972. Whereas rock salt sold or used decreased 11.9% during the year, brine salt and evaporated salt increased 5.0% and 6.0%, respectively, as shown in table 14. The drop in rock salt can be attributed in part to the unexpected closing of the Cargill, Inc., Belle Isle salt mine after its number 2 shaft caved in. The Belle Isle mine is the second largest producer in North America. Average unit values in dollars per short ton were: evaporated salt, $35.00; rock salt, $5.56; and brine salt, $3.51. Thirteen companies mined salt at 16 operations in 10 parishes. Of these, 10 operations produced brine, 3 produced both evaporated and rock salt, 2 produced rock salt only, and 1 produced evaporated salt only. Iberia Parish accounted for 74.1% of the evaporated salt and 31.7% of the total salt sold or used.

Table 14.—Louisiana: Salt sold or used by producers
(Thousand short tons and thousand dollars)

Year	Evaporated salt		Rock salt		Brine		Total [1]	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1969	277	7,598	5,237	29,160	6,921	24,344	12,435	61,102
1970	270	7,888	5,581	32,459	7,733	24,507	13,584	64,854
1971	275	9,399	5,794	32,976	7,283	25,574	13,352	67,950
1972	269	8,840	6,142	34,032	7,104	24,592	13,514	67,464
1973	285	9,976	5,411	30,065	7,456	26,170	13,152	66,211

[1]Data may not add to totals shown because of independent rounding.

Sand and Gravel.—Production in 1973 totaled 13.7 million short tons, a sharp 27.3% decline from the 1972 production. Average unit value increased to $1.54 per short ton. A total of 44 companies with 61 operations produced in 26 of the State's 64 parishes. Leading parishes in descending rank of production were St. Helena, East Baton Rouge, Rapides, and Washington. These four parishes produced 47% of the State's output of sand and gravel. Commercial operations accounted for 99% of sand and gravel production. Sand production of 5,975,000 short tons was 31% less than 1972 production. While production was down appreciably, average unit value increased to $1.43, a 6.7% increase over 1972. Principal uses of sand produced were building 49% and paving 36%. The remaining 15% was used as blast sand, glass sand, engine sand, and fill sand.

Gravel production of 7.8 million short tons was 25% less than in 1972. Average unit value was $1.62, up $0.12 from 1972. Principal uses for gravel were building 56% and paving 37%.

Table 15.—Louisiana: Sand and gravel sold or used by producers
(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total [1]	
	Quantity	Value	Quantity	Value	Quantity	Value
1969	17,715	21,278	416	616	18,131	21,895
1970	17,746	21,527	410	836	18,155	22,363
1971	18,823	23,861	405	631	19,228	24,492
1972	18,538	26,255	383	740	18,920	26,996
1973	13,676	21,127	72	37	13,748	21,165

[1] Data may not add to totals shown because of independent rounding.

Table 16.—Louisiana: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	120	720	125	750
Building	5,319	6,756	2,918	3,986
Fill	408	261	490	366
Paving	2,254	2,612	2,172	2,756
Other uses [1]	142	476	211	686
Total [2]	8,244	10,825	5,915	8,543
Gravel:				
Building	6,312	9,776	4,381	7,772
Fill	W	W	76	W
Paving	3,576	5,207	2,843	4,112
Other uses [3]	406	449	462	700
Total [2]	10,294	15,431	7,761	12,585

See footnotes at end of table.

Table 16.—Louisiana: Sand and gravel sold or used by producers, by class of operation and use—Continued
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Government-and-contractor operations:				
Sand:				
Fill	22	57	37	11
Paving	201	371	--	--
Other uses	138	256	22	17
Total [2]	361	684	60	28
Gravel:				
Fill	22	57	--	--
Paving				
Other uses	--	--	12	9
Total	22	57	12	9
Total sand and gravel [2]	18,920	26,996	13,748	21,165

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes glass (1973) and molding sand.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast (1972), fill (1972), and miscellaneous gravel.

Stone.—Production was principally crushed and broken clam and oyster shells. Output totaled 10,802,000 short tons in 1973, a 17.5% increase over that of 1972. The value increased by $0.36 to $1.97 per ton. Most of the production was used as concrete and bituminous aggregate for highway construction and for the manufacture of cement, quicklime, and hydrated lime. Shell is produced in St. Mary, St. Tammany, Orleans, and Cameron Parishes. The first two accounted for 85% of the State total. Some quarried stone is produced in Winn Parish.

Sulfur.—For the second year Louisiana fell below Texas in the production of Frasch sulfur in 1973 after 6 years as the leading producer. In 1973, the State's four plants produced 3,311,000 long tons, down 6.3%. The share of total U.S. Frasch sulfur mined in Louisiana fell to 43.5% in 1973, compared with 48.5% in 1972.

During the year, the production of recovered sulfur increased about 45%, reflecting the increased additions of sulfur recovery equipment throughout the State.

The natural gas shortage is the prime reason for the lower Frasch sulfur production in Louisiana. There were six Frasch sulfur production plants in operation in 1972, but only four plants operated in 1973. The Frasch sulfur plants operating in the United States burn approximately 43 billion cubic feet of natural gas per year and thus are especially vulnerable to natural gas curtailment.

One of the world's largest double absorption sulfuric acid plants is being built by Freeport Chemical Co. at Uncle Sam. This plant is designed to produce 1,600 tons of sulfuric acid per day.

Table 17.—Louisiana: Sulfur produced and shipped from Frasch mines
(Thousand long tons and thousand dollars)

Year	Production	Shipments	
		Quantity	Value [1]
1969	3,857	3,924	106,261
1970	3,636	3,660	90,488
1971	3,616	3,646	W
1972	3,534	3,765	W
1973	3,311	3,329	W

W Withheld to avoid disclosing individual company confidential data.
[1] F.o.b. mine or plant.

METALS

Aluminum.—Bauxite received from out-of-State sources was processed into alumina at the Gramercy and Baton Rouge plants of Kaiser Aluminum & Chemical Corp. (Kaiser) and at the Burnside plant of Ormet Corp. Only the Chalmette plant of Kaiser produced primary aluminum. Alumina production was down 1% from that of 1972, while primary aluminum production increased 13%. During 1973, Louisiana dropped from fourth to fifth in total aluminum in the Nation.

The aluminum companies continued their environmental programs to clean up both air and water pollution. The 1974–75

deadlines as established by the EPA will be met barring unforeseen delays.

Nickel.—American Metal Climax, Inc. (Amax), continued renovations of the Port Nickel refinery at Braithwaite. The plant, 20 miles downriver from New Orleans, will use a sulfuric acid leach process in processing nickel-copper matte from Bamangwato Concessions, Ltd., Botswana. The renovated plant is expected to have a capacity of 80 million pounds of nickel per year. In addition to nickel, the plant will also yield cobalt and copper as well as ammonium sulfate as a byproduct.

Table 18.—Principal producers

Commodity and company	Address	Type of activity	Parish
Aluminum:			
Kaiser Aluminum & Chemical Corp.	P.O. Box 1600 Chalmette, La. 70043	Reduction plant	St. Bernard.
Consolidated Aluminum Corp	P.O. Box LL Lake Charles, La. 70601	do	Calcasieu.
Barite:			
Dresser Minerals Division, Dresser Industries, Inc.	P.O. Box 6504 Houston, Tex. 77005	Grinding plant	Orleans and Calcasieu.
Milchem, Inc	P.O. Box 22111 Houston, Tex. 77027	do	Orleans.
NL Industries Inc.; Baroid Div	P.O. Box 1675 Houston, Tex. 77001	do	Do.
Carbon black:			
Ashland Chemical Co	P.O. Box 1503 Houston, Tex. 77005	Furnace plant	St. Mary.
Cabot Corp	125 High St. Boston, Mass. 02110	do	St. Mary and Evangeline.
Columbian Carbon Co	380 Madison Ave. New York, N.Y. 10017	do	Ouachita, Avoyelles, St. Mary.
Continental Carbon Co	P.O. Box 22085 Houston, Tex. 77027	do	Calcasieu.
Sid Richardson Carbon & Gasoline Co.	1200 Ft. Worth National Bank Bldg. Fort Worth, Tex. 76102	do	West Baton Rouge.
Thermatomic Carbon Co., Inc	245 Park Ave. New York, N.Y. 10017	do	Ouachita.
Cement:			
Ideal Cement Co., Div. Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Plant	East Baton Rouge.
Lone Star Industries, Inc	P.O. Box 47327 Dallas, Tex. 75247	do	Orleans.
Louisiana Cement Co., Div. OKC Corp.	14900 Intracoastal Dr. New Orleans, La. 70129	do	Do.
Clays:			
Acme Brick Co	P.O. Box 425 Ft. Worth, Tex. 76101	Mine and plant	East Baton Rouge.
Athens Caddo Brick Co	P.O. Box 70 Athens, Tex. 75751	do	Caddo.
Big River Industries, Inc	P.O. Box 66377 Baton Rouge, La. 70806	do	Pointe Coupee.
Dixie Brick, Inc	P.O. Box 969 Natchitoches, La. 71457	do	Bienville and Natchitoches.
Hammond Baton Rouge Brick Co.	P.O. Box 329 Hammond, La. 70401	do	Tangipahoa.
Ideal Cement Co., Div. Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	do	West Baton Rouge.
Kentwood Brick & Tile Manufacturing Co., Inc.	Drawer F Kentwood, La. 70444	do	St. Helena.
Louisiana Cement Co., Div. OKC Corp.	14900 Intracoastal Dr. New Orleans, La. 71029	do	St. Bernard.
Gypsum:			
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	Calcining plant	Jefferson.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	Calcining plant	Orleans.
Winn Rock, Inc	P.O. Box 790 Winnfield, La. 71483	Quarry and plant	Winn.
Lime:			
Allied Chemical Corp	P.O. Box 70 Morristown, N.J. 07960	do	East Baton Rouge.
Olin Corp	P.O. Box 2896 Lake Charles, La. 70601	do	Calcasieu.

Table 18.—Principal producers—Continued

Commodity and company	Address	Type of activity	Parish
Lime—Continued			
Pelican State Lime, Division of Radcliff Materials, Inc.	P.O. Box 1637 Morgan City, La. 70380	Quarry and plant	St. Mary.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	---- do	Orleans.
Natural gas and petroleum [1]			
Salt:			
Allied Chemical Corp., Industrial Chemicals Div.	P.O. Box 70 Morristown, N.J. 07960	Brine wells	Iberville.
Cargill, Inc	Cargill Bldg. Minneapolis, Minn. 55402	Underground mine	St. Mary.
Diamond Crystal Salt Co., Jefferson Island Div.	916 Riverside Ave. St. Clair, Mich. 48079	---- do	Iberia.
The Dow Chemical Co	Midland, Mich. 48640	Brine wells	Iberville.
International Salt Co., Avery Mine & Refinery.	Clarks Summit, Pa. 18411	Underground mine	Iberia.
Morton Salt Co	110 North Wacker Dr. Chicago, Ill. 60606	---- do	Do.
PPG Industries, Inc., Industrial Chemical Div.	P.O. Box 1000 Lake Charles, La. 70604	---- do	Calcasieu.
Sand and gravel:			
Braswell Sand & Gravel Co., Inc.	P.O. Box 798 Minden, La. 71055	Stationary	Webster.
Gifford-Hill & Co., Inc	P.O. Box 47127 Dallas, Tex. 75247	Stationary and dredge.	Jefferson Davis Webster, Tangipahoa.
Dixie Sand and Gravel Co	P.O. Box 847 Baton Rouge, La.70821	Stationary	Washington.
Louisiana Sand and Gravel Co	P.O. Box 963 Baton Rouge, La 70800	2 portable and 4 dredge.	East Baton Rouge.
Louisiana Industries Inc	P.O. Box 188 Pollock, La. 71467	Dredge and plant Pit and plant	Grant. Do.
Do	P.O. 5472 Alexandria, La. 71301	Stationary	Ouachita.
Mid-State Materials	P.O. Box 7177 Alexandria, La. 71301	2 Stationary 2 dredge	Rapidies. Do.
Rapides Sand and Gravel Co	P.O. Box 847 Baton Rouge, La. 70821	Stationary ---- do	Ouachita. East Baton Rouge.
Red Stick Gravel Co	P.O. 847 Baton Rouge, La. 70821	---- do	Do.
Standard Gravel Co., Inc	Rt. 4, Box 17 Franklinton, La. 70438	---- do	Washington.
Trinity Concrete Products Co	P.O. Box 47524 Dallas, Tex 75247	Stationary and dredge.	Beauregard.
Shell:			
Ayers Materials Co., Inc	P.O. Box 382 Harvey, La. 70058	Dredge	St. Tammany.
W.T. Burton Industries, Inc	P.O. Box 100 Sulphur, La. 70663	---- do	Cameron.
Ideal Cement Co., Div. Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	---- do	St. Mary.
Lake Charles Dredging & Towing Co.	Lafayette, La. 70501	---- do	Do.
Louisiana Materials Co	P.O. Box 8214 New Orleans, La. 70122	---- do	St. Tammany.
OKC Corp. Jahacke Service Inc	3819 France Rd. New Orleans, La. 70122	---- do	Orleans.
Radcliff Materials, Inc	P.O. Drawer 946 Mobile, Ala. 36601	---- do	Do.
Stone: Winn Rock, Inc	P.O. Box 790 Winnfield, La. 71483	Quarry and plant	Winn.
Sulfur, native:			
Freeport Minerals Co	161 East 42d St. New York, New York 10017	Frasch process	Jefferson, Plaquemines, Terrebonne.
Texas Gulf, Inc	200 Park Ave. New York, New York 10017	---- do	Lafourche.
Sulfur, recovered:			
Cities Service Oil Co	P.O. Box 300 Tulsa, Okla. 74102	Refinery	Calcasieu.
Exxon Co. U.S.A	P.O. Box 551 Baton Rouge, La. 70821	Stationary	East Baton Rouge.
Vermiculite: W. R. Grace & Co., Zonolite Div.	62 Whittemore Ave. Cambridge, Mass. 02140	Exfoliating plant	Orleans.

[1] Most major companies and many smaller companies operate in Louisiana. Commercial directories contain listings of operators.

The Mineral Industry of Maine

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Maine, for collecting information on all minerals except fuels.

By Frank B. Fulkerson [1]

The value of mineral production in Maine in 1973 was $33.5 million, a record high and an advance of 46% over that of 1972. Increased mine output of zinc was the chief reason for the big gain in State mineral-production value. Increases in value were also recorded for cement and sand and gravel. Other mineral commodities produced in Maine included clays, copper, gem stones, lead, peat, silver, and stone.

In the exploration for metallic mineral deposits, several major companies were active. International Paper Co. and Kerramerican, Inc., began a joint venture to explore copper mining prospects on the former's property at Square Lake in Aroostook County. Hanna Mining Co. and Knox Mining Corp. continued an exploration project at a nickel-copper deposit near Union in Knox County. Callahan Mining Corp., the New Jersey Zinc Co., and Superior Oil Co. in a joint venture conducted exploration for metallic mineral deposits in several counties of the State.

[1] Industry economist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Mineral production in Maine [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays ---thousand short tons--	40	$57	41	$74
Copper ---short tons--	1,220	1,249	1,107	1,317
Lead ---do---	85	26	204	66
Peat ---thousand short tons--	2	99	5	177
Sand and gravel ---do---	11,818	7,535	13,583	10,304
Silver (recoverable content of ores, etc.) thousand troy ounces--	16	27	W	W
Stone ---thousand short tons--	1,078	2,996	1,212	3,329
Zinc (recoverable content of ores, etc.)---short tons--	5,820	2,066	19,640	8,115
Value of items that cannot be disclosed: Other nonmetals and values indicated by symbol W ---	XX	8,867	XX	10,111
Total ---	XX	22,922	XX	33,493
Total 1967 constant dollars ---	XX	18,913	XX	p 24,591

p Preliminary. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Maine, by county

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Androscoggin	$830	W	Sand and gravel, clays.
Aroostook	W	$848	Sand and gravel.
Cumberland	2,498	2,922	Sand and gravel, stone, clays.
Franklin	311	219	Sand and gravel.
Hancock	3,939	10,491	Zinc, copper, sand and gravel, stone, peat, lead, silver, clays.
Kennebec	W	W	Sand and gravel, stone.
Knox	W	W	Cement, stone, sand and gravel.
Lincoln	94	285	Sand and gravel.
Oxford	W	88	Do.
Penobscot	1,406	1,414	Do.
Piscataquis	W	W	Stone, sand and gravel.
Sagadahoc	W	W	Sand and gravel.
Somerset	W	W	Do.
Waldo	W	W	Do.
Washington	141	W	Sand and gravel, peat.
York	W	934	Sand and gravel, stone.
Undistributed [1]	13,701	16,291	
Total [2]	22,922	33,493	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes gem stones, some sand and gravel and stone that cannot be assigned to specific counties, and values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Maine business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total labor force—thousands	418.7	423.8	+1.2
Unemployment—do	29.1	25.2	−13.4
Employment:			
Mining—do	(1)	(1)	
Construction—do	18.6	19.5	+4.8
Manufacturing—do	102.7	104.2	+1.5
Services—do	51.7	54.0	+4.4
Government—do	69.7	69.9	+.3
Other [2]—do	101.3	105.1	+3.8
Personal income:			
Total—millions	$3,714	$4,054	+9.2
Per capita	$3,610	$3,944	+9.3
Portland cement shipments to and within Maine—thousand short tons	257	278	+8.2
Mineral production value—thousands	$22,922	$33,493	+46.1

p Preliminary.

[1] Combined with services.

[2] Includes transportation and public utilities; wholesale and retail trade; and finance, insurance, and real estate.

Sources: Survey of Current Business; Employment and Earnings; Area Trends in Employment and Unemployment; and the U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Martin Marietta Cement Co., increased production of both portland and masonry cement at its Thomaston plant. Cement rock, the principal raw material, was quarried locally. Purchased sand, gypsum, and iron-bearing materials were also used as raw materials. Bulk and bagged cement was shipped by rail and truck to consumers in Maine, New Hampshire, and Massachusetts. The company storage and distribution terminal at Wilmington, Mass., was supplied from Thomaston.

Clays.—Production of clay for brick manufacture was about the same as in 1972. Output was reported from two pits in Cumberland and two in Androscoggin County. Besides brick sales in Maine, manufacturers shipped brick to Massachusetts.

A small tonnage of stoneware clay was mined in Hancock County and used in making pottery.

Gem Stones.—Plumbago Mining Co. produced tourmaline from a deposit discovered in 1972 on Newry Mountain near Rumford in Oxford County. Rockhounds collected specimens of tourmaline, lepidolite, quartz, feldspar, apatite, garnet, and chrysoberyl at the site of old mines, quarries, and dumps, chiefly in Oxford County.

Peat.—Sales of peat increased over those in 1972. Bogs were operated by Acadia Peat Corp., Penobscot, International Peat Moss Co., Inc., Jonesport, and Eric Kelley Peat Moss Co., Centerville. The peat was harvested, dried, packaged, and sold for use by homeowners and landscape contractors in soil conditioning. The State Land Use Regulation Commission disapproved an application by Northeast Peat Moss, Inc., to mine peat in the Great Heath in Washington County. The decision stated that the operation would adversely affect the environment of the heath, the largest in Maine, and silt from the peat mining would hurt valuable fisheries.

Perlite.—Chemrock Corp. expanded crude perlite from New Mexico at its Rockland rotary-kiln plant. The expanded product was sold for use as a filter aid.

Sand and Gravel.—Production increased 15%, while value increased 37%. Average value per ton was 76 cents, compared with 64 cents in 1972. A total of 87 commercial and 23 Government-and-contractor operations were active. Aroostook, Cumberland, Kennebec, Penobscot, and Sagadohoc Counties each produced more than 1 million tons of sand and gravel. Most of the output was used for highway construction. The State Highway Commission produced paving sand and gravel in all counties by contract work and by the Commission's own crews.

At the end of 1973, highway construction was in progress on 12.8 miles of the interstate system in a $33.9 million program. Large projects under construction or scheduled included Scarborough-Portland, Route I-295, Cumberland County; Topsham-Bowdoinham and Richmond-Gardiner, Route I-95, Sagadohoc and Kennebec Counties; and Penobscot, Route I-95, Penobscot County. From 1956 through 1973, about 281 miles of the interstate system in Maine was completed.

Stone.—Cumberland and Knox Counties supplied most of the crushed stone output. Crushed granite, quartzite, and traprock were produced at quarries in Cumberland County for use as concrete aggregate. Limestone for cement manufacture, agricultural lime, aggregates, poultry feed, paper mill stone, and other uses was quarried and crushed in Knox County.

Rockland-Rockport Lime Co., which operates its own quarries and also uses stone from the Martin Marietta Cement Co., quarry in Thomaston, phased out its grinding plant on Rockland's waterfront and built a new dustless plant further inland. The new plant features wet grinding.

The John Swenson Granite Co., Inc., produced dimension stone for architectural use from the Franklin quarry, Hancock County, and the Green and Tatnic Black quarries, York County. The Tatnic Black quarry was active only in August. The Green quarry also was the source of riprap. Perini Corp. produced dimension stone for construction work in Hancock County.

In September, Portland-Monson Slate Co. suspended the underground quarrying of dimension slate at Monson in Piscataquis County. Production was to be resumed as soon as a new shaft was completed. The company produces black slate for floor tile and other uses. The slate is sawed and split to size at Monson and then shipped to New York State to grind for smoothness and desired thickness.

METALS

Kerramerican, Inc., and Black Hawk Corp., a joint venture, completed their first full year of production at their underground zinc-copper mine and a 1,000-ton-per-day flotation mill near Blue Hill, Hancock County. Kerramerican, the operator, used a trackless mining method. Broken ore was loaded into diesel trucks and brought to the surface for milling. In 1973, about 230,200 tons of ore averaging 10.69% zinc and 0.63% copper were milled. Concentrates from the flotation mill were trucked to Bucksport, a distance of 20 miles, for loading into railroad cars. Zinc concentrate was shipped for smelting to National Zinc Co., Bartlesville, Okla., and copper concentrate was shipped to Gaspé Copper Mines, Ltd., Gaspé, Quebec. The concentrates also contained minor values in lead and silver. Milling continued through 1973 on a 5-day-per-week basis, as it was not possible to develop enough ore faces in the mine for

Table 4.—Maine: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	439	573	518	629
Engine	3	5	W	5
Fill	319	141	630	214
Paving	830	782	1,054	1,035
Other uses [1]	148	99	175	112
Total [2]	1,738	1,600	2,378	1,995
Gravel:				
Building	659	975	717	925
Fill	290	149	294	137
Paving	1,058	1,289	959	1,178
Miscellaneous	289	332	223	226
Other uses [3]	91	50	213	233
Total [2]	2,388	2,795	2,406	2,699
Government-and-contractor operations:				
Sand:				
Building	--	--	5	5
Fill	10	2	3	1
Paving	1,442	558	171	156
Other uses	33	8	39	23
Total [2]	1,486	569	218	185
Gravel:				
Building	--	--	10	5
Fill	30	7	3	1
Paving	6,176	2,565	8,280	4,863
Other uses	--	--	289	556
Total [2]	6,206	2,572	8,582	5,425
Total sand and gravel [2]	11,818	7,535	13,583	10,304

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes other industrial sand.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast and other gravel.

a greater production rate. Employment was 106, about 72 of whom comprised underground and surface shift workers.

According to the annual report of Black Hawk Mining Co., Ltd., parent company of Black Hawk Corp., the main zinc zone, where mining was concentrated in 1973, was difficult to mine because of the average dip of 30 degrees and the pinching and swelling on dip and strike of the deposit. Production from the main zinc zone was scheduled to continue in 1974 at about the 1973 rate. Development was begun of copper ore reserves in the Mammoth zone, and increased production of copper concentrate was expected in 1974. Minable ore reserves at the end of 1973 were estimated to be 742,000 tons grading 1.70% copper and 5.68% zinc. A decrease in the tonnage and grade of reserves compared with 1972 was the result of eliminating from estimates of two fringe areas and one other area of the main zinc zone, application of an ore extraction factor, and allowance for ore mined in 1973.

Surface diamond drilling continued primarily in an area 2,000 feet south of the shaft. A number of holes intersected ore grade mineralization, but enough drilling had not been done by the end of the year to make an ore reserve estimate.

Callahan Mining Co. continued a unique reclamation project at Harborside, Hancock County, site of its former zinc-copper mining operation. After the mine closed in 1972, the Callahan company formed Maine Sea Foods for the purpose of carrying out an aquaculture project in the 320-foot-deep open pit. The pit was allowed to fill with salt water from the tides in Goose Cove, which were held back by a dam during the mining operation. The new operation includes the raising of coho salmon and oysters for Eastern seafood markets. A 5-year program was prepared, and a profit was expected by the end of 1975.

MINERAL FUELS

Maine does not produce crude petroleum or natural gas, but large tonnages of petrol-

eum and petroleum products are handled at Portland, which ranks as the third largest oil port on the east coast, after Philadelphia and New York. Much of the traffic is crude oil from South America and the Middle East that is unloaded from tankers at Portland for shipment to Canada through the Portland-Montreal pipeline system. Shipments of refined products from the gulf coast also are received at Portland for storage and distribution.

The Maine Supreme Court upheld the State Coastal Conveyance Law. Enacted in 1970, the law imposes a ½-cent-per-barrel transfer fee on terminal operators to finance a coastal protection fund. The fund is to be used to make initial payments in cleaning up oil spills and to compensate persons damaged in cases where liability cannot be determined. The law applies in waters up to 12 miles off the coast.

The State Board of Environmental Protection held hearings and studied the plan of the Pittston Co. to construct a $350 million oil refinery at Eastport in Washington County.

Table 5.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Martin Marietta Cement Co., Division of Martin Marietta Corp.[1]	277 Park Ave. New York, N.Y. 10017	Plant	Knox.
Clays:			
Dennis Brick Co., Inc	Mt. B Washington St. Auburn, Maine 04210	Pit	Androscoggin.
Lachance Bros. Brick Co	Gorham, Maine 04038	Pit	Cumberland.
Morin Brick Co	Danville, Maine 04223	Pit	Androscoggin.
Royal River Brick Co., Inc	Box 191, Gray, Maine 04039	Pit	Cumberland.
Peat:			
Acadia Peat Corp	Penobscot, Maine 04476	Bog	Hancock.
International Peat Moss Co., Inc.	430 Trapelo Rd. Belmont, Mass. 02178	Bog	Washington.
Perlite (expanded):			
Chemrock Corp	End of Osage Street Nashville, Tenn. 37208	Plant	Knox.
Sand and gravel:			
Blue Rock Industries	58 Main Street Westbrook, Maine 04092	Pit	Androscoggin and Cumberland.
Cianbro Corp	P.O. Box D Pittsfield, Maine 04967	Pit and mill	Penobscot and Somerset.
Harry C. Crooker & Sons, Inc.	Brunswick, Maine 04011	Pit [2]	Cumberland.
D. J. Gurney Inc	Rt. 1 River Road Waterville, Maine 04901	Pit	Somerset.
Lane Constr. Co	965 E. Main St. Meriden, Conn. 06450	Pit, mine, and mill.	Penobscot and Waldo.
Lewiston Crushed Stone Co., Inc.	South Ave. Lewiston, Maine 04240	Pit [2]	Androscoggin.
Harold C. MacQuinn, Inc	Hulls Cove, Maine 04409	Pit	Hancock.
Leroy S. Prout Sand & Gravel.	Scarborough, Maine 04074	Pit	Cumberland.
Maynard W. Robinson & Sons.	R.F.D. No. 2 Cumberland Center, Maine 04021	Pit	Do.
Frank Rossi & Sons, Inc	National Bank Bldg. Gardiner, Maine 04345	Pit	Various.
Warren Bros. Company	Fairfield, Maine 04937	Pit	Kennebec.
Stone:			
Granite, dimension:			
Perini Corp., Marine Div	62 Condor St. E. Boston, Mass. 02128	Quarry	Hancock.
The John Swenson Granite Co., Inc.	North State St. Concord, N.H. 03300	Quarries	York and Hancock.
Granite, crushed:			
Cook Concrete Co	150 Causeway St. Boston, Mass. 02114	Quarry	Cumberland.
Limestone, crushed:			
Blue Rock Industries	58 Main St. Cumberland Mills, Maine 04092	do	Kennebec.
Lime Products Corp	P.O. Box 357 Union, Maine 04862	do	Knox.
Martin Marietta Cement Co., Div. of Martin Marietta Corp.	P.O. Box 5618 Two Hamhill Rd. Baltimore, Md. 21210	do	Do.
Miscellaneous, crushed:			
Blue Rock Industries	58 Main St. Cumberland Mills, Maine 04092	do	Cumberland.
Slate, dimension:			
Portland-Monson Slate Co.	Monson, Maine 04464	Underground	Piscataquis.
Zinc:			
Kerramerican, Inc	Blue Hill, Maine 04614	do	Hancock.

[1] Portland and masonry.
[2] Two pits.

The Mineral Industry of Maryland

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Maryland Geological Survey for collecting information on all minerals in the State.

By Charles L. Klingman [1]

The value of mineral production in Maryland was 14% greater in 1973 than that of 1972. Total 1973 mineral value was $131.9 million, but the increase was due essentially to increased selling price rather than to increased tonnage. Individual unit price increases ranged from 4% to 50% and the overall average unit increase for the major tonnage minerals was 16%.

Stone was again the most valuable commodity produced in the State. In spite of a 4% drop in production to 18,585,000 tons, the industry contributed 35% of Maryland's mineral wealth in 1973. The total value of stone produced was $46,732,000, 11% above the value in 1972.

Sand and gravel contributed 22% of the State's mineral wealth in 1973. Production increased 2% to 12,845,000 tons, and the value increased 12% to $29,625,000.

Portland and masonry cement contributed significantly to the economy of Maryland in 1973, but the actual figures must remain concealed to avoid the disclosure of individual company confidential data. There were modest increases in both tonnage and value of both kinds of cement in 1973.

Bituminous coal production displayed a 9% increase, but clay showed a 19% decrease in production in 1973 compared with 1972. All other mineral production in Maryland was too small to affect the State total greatly.

Baltimore County had the highest mineral production value in the State in 1973. It was followed in order by Carroll, Frederick, and Prince Georges Counties.

[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Mineral production in Maryland [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays [2] thousand short tons	1,104	$2,121	897	$1,973
Coal (bituminous) do	1,640	8,961	1,789	13,644
Gem stones	NA	8	NA	8
Natural gas million cubic feet	244	51	298	69
Peat thousand short tons	3	29	2	29
Sand and gravel do	12,594	26,557	12,845	29,625
Stone do	19,431	41,973	18,585	46,732
Value of items that cannot be disclosed: Cement, ball clay, lime, and talc	XX	35,801	XX	39,827
Total	XX	115,501	XX	131,907
Total 1967 constant dollars	XX	95,300	XX	p 96,846

p Preliminary. NA Not available. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes ball clay; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Maryland, by county[1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Allegany	$3,885	$4,440	Coal, stone, sand and gravel.
Anne Arundel	2,846	2,836	Sand and gravel.
Baltimore[2]	21,550	26,528	Stone, sand and gravel, clays.
Calvert	5	19	Sand and gravel.
Caroline	W	W	Do.
Carroll	W	21,991	Cement, stone, sand and gravel, clays.
Cecil	6,332	7,277	Stone, sand and gravel.
Charles	W	W	Sand and gravel.
Dorchester	189	290	Do.
Frederick	15,057	17,973	Cement, stone, clays, lime, sand and gravel.
Garrett	6,660	11,554	Coal, stone, peat.
Harford	1,471	993	Sand and gravel, stone, clays, talc.
Howard	1,206	W	Stone.
Kent	16	W	Clays.
Montgomery	W	W	Stone.
Prince Georges	13,061	13,621	Sand and gravel, clays, stone.
St. Marys	W	W	Sand and gravel.
Somerset	W	--	
Washington	14,819	W	Cement, stone, clays.
Wicomico	W	W	Sand and gravel.
Worcester	13	27	Do.
Undistributed[3]	28,393	24,357	
Total[4]	115,501	131,907	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Queen Annes and Talbot Counties are not listed because no production was reported.

[2] Includes Baltimore City.

[3] Includes some sand and gravel and stone for 1972, which cannot be assigned to specific counties, gem stones, natural gas, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Maryland business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total labor force ---thousands--	1,711	1,734	+1.3
Unemployment ---do---	81	60	−25.9
Employment:[1]			
Manufacturing ---do---	248.5	255.5	+2.8
Transportation and public utilities ---do---	78.6	80.0	+1.8
Trade ---do---	331.3	347.3	+4.8
Finance, insurance, and real estate ---do---	74.4	77.8	+4.6
Mining ---do---	1.8	1.5	−16.7
Contract construction ---do---	97.9	107.0	+9.3
Services ---do---	259.3	272.6	+5.1
Government ---do---	265.6	273.1	+2.8
Payroll—average weekly earnings: Manufacturing	$157.58	$170.91	+8.5
Personal income:			
Total ---millions--	$19,803	$21,697	+9.6
Per capita	$4,882	$5,331	+9.2
Construction activity:			
Cement shipments to and within Maryland, thousand short tons--	1,550	1,654	+6.7
Mineral production value ---thousands--	$115,501	131,907	+14.2

p Preliminary.

[1] Excludes Federal employment in the Maryland sector of the Washington Standard Metropolitan Statistical Area.

Sources: Survey of Current Business; Employment and Earnings; Area Trends in Employment and Unemployment; U.S. Bureau of Mines.

Employment and Injuries.—Data on employment and injuries in Maryland in 1973 were available only for the coal mining industry.[2] With employment and production higher in 1973 than in 1972, the accident statistics were much better than those of previous years as shown by the following tabulation:

	1970	1971	1972	1973
Man-hours exposure, thousand hours	446	806	520	541
Coal produced, thousand tons	1,467	1,592	1,638	1,754
Fatal accidents	1	0	0	0
Nonfatal accidents	4	6	5	3
Accidents per million man-hours	11.21	7.44	9.61	5.7
Accidents per million tons	3.39	3.77	3.05	1.14

[2] Maryland Bureau of Mines. Fifty-first Annual Report, Calendar Year 1973, pp. 15–16.

Legislation and Government Programs.—The State of Maryland stopped all strip mining of coal on State-owned lands as of July 1, 1973. The Buffalo Coal Co., Inc., and the Georges Creek Coal and Land Co. had been strip mining in the Savage River State Forest and were affected by the ruling. They filed lawsuits in August to obtain payment for the unmined coal which they had under lease. No legal decision had been reached by the end of 1973.

Energy Generation.—Two additional nuclear powerplants were planned by the Potomac Electric Power Co. at Douglas Point, Md., each with an output of 1,100 megawatts. Startup dates were scheduled for 1980 and 1981. Present plans for the two nuclear powerplants of Baltimore Gas and Electric Co., at Calvert Cliffs, Md., specify startup by the end of 1974. The total capacity of the Calvert Cliffs plants will be 1,690 megawatts.

A Maryland powerplant, using coal or oil for fuel, was projected by the Delmarva Power & Light Co. to be in operation by the summer of 1978. The 400-megawatt unit was said to be required because of delays in finishing the nuclear powerplants.

An experimental solar heating unit was constructed at an elementary school in Timonium, Md. If successful, it could be a model for many future fuel-saving heating systems.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Consumption of portland cement for Maryland in 1973 was 1,525,000 tons, a 6% increase over that of 1972; consumption of masonry cement was 129,000 tons, 9% greater than that of 1972. A portion of the cement consumed in Maryland, however, came from other States. Portland cement production for the State increased 6%, and the average value increased 10% in 1973 as compared to the 1972 figures. Masonry cement production also increased 6% and its value rose 29% in 1973 over that of 1972.

Approximately 13% of the State's 1973 limestone production went into the making of cement. Other raw materials consisted of clay, shale, gypsum, and iron-bearing materials. The cement-manufacturing plants used large quantities of fuel oil, coal, and electric power to convert these materials into cement.

By far the largest portion of the cement production, over 71%, went to the ready-mix concrete companies, and this percentage increased 1% during 1973. Over 20% of the Maryland cement production went to manufacture concrete products such as concrete blocks, flagstones, and preformed building beams. The combined portion that went to highway construction, contractors, and Government agencies was about 6% of the total, up 1% from 1972.

Portland cement was produced by three plants in Maryland, one of which also produced masonry cement. Another plant produced masonry cement exclusively.

Clays.—Production of clays of all types, except ball clay, decreased 19% in tonnage. There were 8 companies operating 11 pits in 7 counties during the year. About 39% of the clay production went into the manufacture of face brick. The remaining 61% of the clay went into the manufacture of ceramic tile, common brick, lightweight aggregates, firebrick, cement, and pottery.

Frederick County produced over half the clay of the entire State. Other major clay-producing counties are listed below in the order of their clay production: Prince Georges, Carroll, Washington, and Baltimore.

Gem Stones.—Production of semiprecious stones was limited to small quantities collected by dealers and amateur collectors. The total value of such stones was estimated at $8,000 in 1973.

Gypsum.—United States Gypsum Co. and National Gypsum Co. calcined gypsum at Baltimore. Output declined 14% in 1973 compared with that of 1972.

Lime.—S. W. Barrick & Sons, Inc., produced lime in Frederick County for agriculture in 1973. The lime was consumed in Maryland, Virginia, Delaware, and Pennsylvania. Total consumption of lime in Maryland was 483,100 tons.

Peat.—Only one company produced peat in Maryland in 1973. Production was down somewhat, but the unit price increased enough that the total value was about the same in both 1972 and 1973. The peat ob-

tained was humus and reed sedge and was sold for soil improvement in bulk and in packaged form.

Perlite.—Relatively small amounts of raw perlite from the Western United States were processed in 1973 at two plants in Prince Georges County and one plant in Baltimore County. The 1973 production was less than the 1972 output. The average mill value of the perlite was slightly higher than the 1972 value.

About 80% of the perlite production went into concrete and plaster aggregate. The remaining 20% was divided among horticultural uses, low-temperature insulation, and other uses.

Sand and Gravel.—Production of sand and gravel was 2% more in 1973 than that of 1972, and a general increase in unit value caused the total value of sand and gravel to be 12% higher than that of 1972. The average price of sand increased 9% and that of gravel increased 10%.

The five top-ranking counties in the order of production of sand and gravel were: Prince Georges, Baltimore, Charles, Anne Arundel, and Cecil. Forty-four companies operated a total of 56 sand and gravel pits in Maryland during 1973.

In 1973, the portion of sand and gravel going into the building trades increased from 71% to 73% of the total, and that going into paving decreased from 19% to 9%. The sand and gravel going into fill operations increased from 4% to 9%. Over 98% of the sand and gravel produced was transported by truck, and less than 2% by rail.

Table 4.—Maryland: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	5,231	10,510	5,791	12,702
Fill	133	W	410	808
Paving	1,343	2,907	735	1,753
Other uses [1]	1	159	124	246
Total [2]	6,708	13,577	7,061	15,510
Gravel:				
Building	3,706	8,715	3,595	9,474
Fill	428	514	695	1,305
Paving	919	1,918	384	594
Other uses [3]	665	1,794	1,008	2,668
Total [2]	5,718	12,941	5,683	14,041
Government-and-contractor operations:				
Sand: Paving	11	2	9	7
Gravel: Paving	157	38	92	66
Total sand and gravel [2]	12,594	26,557	12,845	29,625

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes ground (1973), and other sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes miscellaneous and other gravel.

Stone.—Stone production in Maryland had a 4% decrease in tonnage, to 18,585,000 short tons in 1973. The total value of the stone produced was $46,732,000, 11% greater than that in 1972. Stone was the most valuable mineral product of the State, contributing 35% of the State's mineral wealth. Baltimore County produced not only the greatest tonnage of stone in the State, but also had the highest unit value of all the major stone producing counties. Baltimore was followed by Frederick, Montgomery, Washington, and Cecil Counties in order of their stone production. Statewide there were 45 stone quarries in 11 counties. Five of the quarries produced only dimension stone, 36 produced only crushed and broken stone, and 4 produced both.

Sixty-nine percent of all stone in Maryland went to aggregates, 13% went to cement manufacture, nearly 12% went to roadbase stone, and the remaining 6% was utilized in miscellaneous applications such as lime manufacture and riprap stone.

Only 1 ton of dimension stone was produced for each 743 tons of crushed and

broken stone, but its average unit value was over seven times that of average crushed and broken stone.

Ninety-three percent of the stone was shipped by truck, 3% by railroad, and 4% by waterways. Sixty percent of the 1973 stone production was produced at six large quarries with production rates of over 900,000 tons per year each. Another 17 quarries, with production rates between 100,000 and 800,000 tons per year, contributed 38% of the stone production. The 22 smaller quarries, with production rates less than 100,000 tons per year, added only 2% to the State's tonnage.

Talc.—With production declining for a number of years the one talc producer in Harford County, finally shut down about the end of 1973 and may not reopen.

Vermiculite (Exfoliated).—The Construction Products Division of the W. R. Grace & Co. processed raw vermiculite into the exfoliated product at Muirkirk, Md., in 1973. The finished material was utilized 31% as loose-fill insulation, 28% as aggregate for concrete and plaster, 24% in horticulture, and 17% in flameproofing.

MINERAL FUELS

Coal (Bituminous).—Production of bituminous coal in 1973 increased to 1,789,000 tons, about 9% greater than that of 1972. The unit value of the coal also increased about 40% to bring the total evaluation of Maryland's coal output up to $13,644,000. Allegany County had 16 strip mines and 3 auger mines for a total of 19 mines in the County. Garrett County had 2 underground mines, 30 strip mines, and 5 auger mines for a county total of 37 mines.

The 46 strip mines of the State produced 92% of the coal, underground mines produced 4%, and the remaining 4% came from auger mines. In 1973, strip mining and auger mining increased, but deep mining decreased as compared with 1972 figures.

A most important consideration in strip mining of coal is reclamation of the land. In 1973, 91% of the acreage that was strip mined in Maryland was backfilled and 48% of it was replanted. A land reclamation committee was formed to review all plans and procedures for backfilling, grading, and replanting strip-mined land. Durthe year, it approved 12 new permits and 37 amended permits. It also limited the number of acres of strip-mined land that could be left open before reclamation was started. Bonds to assure compliance with reclamation plans were increased, and any mining company that forfeited a bond was not allowed to mine coal again in the State.

There were no fatalities in coal mines in 1973, and there were only three lost-time accidents out of 541,210 man-hours of exposure. This gives a frequency rate of 5.7 accidents per million man-hours. There were 585,000 tons of coal mined in 1973 per injury, compared with 329,000 tons per injury in 1972.[3]

Coke and Coal Chemicals.—Bethlehem Steel Corp. produced coke for its internal use at Sparrows Point, Md. Byproducts recovered from the distillation of coal included oven coke gas, ammonia, crude light oil, benzene, toluene, xylene, oven coke tar, and other minor components in addition to the primary product, coke.

Natural Gas and Petroleum.—There was a 22% increase in the volume of natural gas produced in Maryland in 1973, compared with that of 1972. The unit value of the gas also increased about 11%, thus increasing the total value of the gas about 35% in one year.

There were two petroleum refineries near Baltimore, but none of the feedstock originated in Maryland.

Crown Central Petroleum Corp. of Baltimore, Md., announced its plans to build a $350 million hydrocarbon fuel complex in Anne Arundel County. The plant was projected to process 200,000 barrels of crude oil per day into synthetic natural gas in addition to liquid petroleum derivatives.

The mid-Atlantic area off the coast of Maryland was considered a high-priority site for oil and gas exploration by four major oil companies. Leases were being sought from the Federal Government to allow offshore drilling. Onshore exploration was also considered by the Spartan Engineering Co. between Taylor's Island and Golden Hill.

Environmental organizations apparently withdrew their opposition to construction of a $100 million liquefied natural gas terminal at Cove Point, Md. El Paso Natural Gas Co. planned to bring 2 billion cubic feet of Algerian gas through this port over a 25-year period.

[3] Work cited in footnote 2.

METALS

Aluminum.—No aluminum ores are mined in Maryland, but there was a significant production of aluminum metal from two facilities in the State. The plants were the Eastalco Aluminum Co. (Howmet Corp.) in Frederick County, and the Tomke Aluminum Co. in Baltimore County. In September 1973, it was announced[4] that 50% of the Eastalco plant would be purchased by Amax Aluminum Co. and that its production would be doubled by 1975, with the installation of a new potline whose capacity would be an additional 87,000 tons of metal per year. Amax Aluminum Co. is a joint venture between American Metal Climax, Inc., and Mitsui & Co. of Japan.

Aluminum production in Maryland in 1973 was about equal to that of 1972, but there was a 10% increase in the unit value of the metal in 1973.

Copper.—Two copper refineries produced metal in Maryland using ore obtained from outside the State. They were American Smelting & Refining Co. in Baltimore and Kennecott Refining Corp. at Hawkins Point, Anne Arundel County.

Iron and Steel.—Bethlehem Steel Corp. of Sparrows Point produced pig iron, raw steel, and semifabricated steel products mostly from imported ore during the year.

Lead.—Lead, lead alloys, and other alloys and products were produced at three plants in Baltimore. The plants utilized primary metals and scrap as raw materials.

[4] Wall Street Journal. Amax Aluminum Plans To Buy 50% of Howmet Plant. V. 182, No. 46, Sept. 5, 1973, p. 5.

Table 5.—Maryland: Coal (bituminous) production in 1973 by type of mine and county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total	
Allegany	--	16	3	19	--	501	10	511	$3,450
Garrett	2	30	5	37	66	1,142	69	1,277	10,195
Total	2	46	8	56	66	1,643	79	[1] 1,789	[1] 13,644

[1] Data may not add to totals shown because of independent rounding.

Table 6.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Portland:			
Alpha Portland Cement Co	15 South 3d St. Easton, Pa. 18042	Plant	Frederick.
Lehigh Portland Cement Co	718 Hamilton St. Allentown, Pa. 18101	----do----	Carroll.
Portland and masonry:			
Marquette Cement Mfg. Co.	First American Center Nashville, Tenn. 37238	----do----	Washington.
Masonry: M. J. Grove Lime Co., Division of the Flintkote Co.	Frederick, Md. 21701	----do----	Frederick.
Clays:			
Baltimore Brick Co	501 St. Paul Pl. Baltimore, Md. 21202	Pit	Baltimore and Frederick.
Capitol Clay Products Inc	6600 Sheriff Rd., N.E. Washington, D.C. 20027	Pit	Prince Georges.
Cyprus Industrial Minerals Co.	555 South Flower St. Los Angeles, Calif. 90071	Pit	Baltimore.
Victor Cushwa & Sons, Inc	201 West Potomac St. Williamsport, Md. 21795	Pit	Washington.
Lehigh Portland Cement Co	718 Hamilton St. Allentown, Pa. 18101	2 pits	Carroll and Frederick.
Maryland Clay Products, Inc., Borden Brick & Tile Co. Div.	7100 Muirkirk Rd. Beltsville, Md. 20705	----do----	Prince Georges.
Coal:			
Buffalo Coal Co., Inc	P.O. Box 275 Bayard, W. Va. 26707	3 strip; 1 auger.	Allegany and Garrett.
Grafton Coal Co	P.O. Box 75 Mt. Storm, W. Va. 26539	Strip	Garrett.

Table 6.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Coal—Continued			
Moran Coal Co., Inc	Drawer E Westernport, Md. 21562	5 strip	Allegany.
Shallmar Coal Co., Inc	Bayard, W. Va. 26707	1 strip; 1 auger.	Garrett.
TG&C Coal Co., Inc	Midlothian, Md. 21543	Strip	Allegany.
Winner Bros. Coal Co., Inc	300 Consol Rd. Frostburg, Md. 21532	2 strip	Do.
Gypsum (calcined):			
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	Plant	Baltimore.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	----do----	Do.
Finished iron oxide pigments (natural and manufactured):			
Minerals Pigments Corp	7011 Muirkirk Road Beltsville, Md. 20705	----do----	Prince Georges.
Lime: S. W. Barrick & Sons, Inc	Woodsboro, Md. 21798	----do----	Frederick.
Peat: Garrett County Processing & Packaging Corp.	R.F.D. No. 1 Accident, Md. 21520	Bog	Garrett.
Perlite (expanded): Atlantic Perlite Co.	7950 New Hampshire Ave. Suite 6 Langley Park, Md. 20787	Plant	Prince Georges.
Petroleum refineries:			
Amoco Oil Co	910 South Michigan Ave. Chicago, Ill. 60680	Refinery	Baltimore.
Chevron Asphalt Co	Baltimore, Md. 21200	----do----	Do.
Sand and gravel:			
Annapolis Sand & Gravel Co., Inc.	P.O. Box 322 Waldorf, Md. 20601	Pit	Anne Arundel.
Buffalo Sand and Gravel, Inc	2001 Kenilworth Ave., N.E. Washington, D.C. 20019	Plant	Charles.
Campbell Sand and Gravel, Inc.	4911 Calvert Rd. College Park, Md. 20740	Pit	Prince Georges.
Charles County Sand & Gravel Co., Inc.	P.O. Box 322 Waldorf, Md. 20601	Pit	Charles.
Contee Sand & Gravel Co., Inc.	P.O. Box 460 Laurel, Md. 20810	Pit	Prince Georges.
Lone Star Industries, Inc	P.O. Box 277 Upper Marlboro, Md. 20870	Pit	Do.
Nottingham Properties Inc	102 W. Pennsylvania Ave. Towson, Md. 21204	Plant	Baltimore.
Silver Hill Sand & Gravel Co	4714 St. Barnabas Rd., S.E. Washington, D.C. 20031	Pit	Prince Georges.
A. H. Smith Co	Branchville, Md. 20721	Pit	Do.
York Building Products Co., Inc	Loucks Mill Rd. York, Pa. 17400	3 pits	Cecil.
Smelters:			
American Smelting & Refining Co.	120 Broadway New York, N.Y. 10005	Refinery	Baltimore.
Kennecott Copper Corp	161 East 42d St. New York, N.Y. 10017	----do----	Anne Arundel.
Stone:			
Arundel Corp	501 St. Paul Pl. Baltimore, Md. 21202	Quarry	Baltimore, Harford, Howard.
M. J. Grove Lime Co., Division of the Flintkote Co.	Frederick, Md. 21701	----do----	Frederick.
Lehigh Portland Cement Co	718 Hamilton St. Allentown, Pa. 18101	----do----	Carroll.
Marquette Cement Mfg. Co	First American Center Nashville, Tenn. 37238	----do----	Washington.
Martin-Marietta Aggregates Northeast Division.	66 Long Clove Rd. Congers, N.Y. 10920	----do----	Do.
Maryland Materials, Inc	P.O. Box W North East, Md. 21901	----do----	Cecil.
Rockville Crushed Stone, Inc	P.O. Box 407 Rockville, Md. 20850	----do----	Montgomery.
D. M. Stoltzfus & Sons, Inc	Talmage, Pa. 17580	----do----	Cecil and Harford.
Talc and soapstone:			
Harford Talc Co	P.O. Box 527 Bel Air, Md. 21014	----do----	Harford.
Vermiculite (exfoliated): W. R. Grace & Co., Construction Products Div.	62 Whittemore Ave. Cambridge, Mass. 02140	Plant	Prince Georges.

The Mineral Industry of Massachusetts

By Robert A. Clifton [1]

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Department of Public Works of the Commonwealth of Massachusetts for collecting information on all minerals except fuels.

The dollar value of Massachusetts' mineral production in 1973 rose 14% above that of 1972 to $59.7 million. Sand and gravel and stone again dominated mineral production, accounting for 93% of the value. These commodities together had a 2% increase in quantity and a 13% increase in value.

Massachusetts continued to be a strong leader among the States that are doing something about the solid waste disposal problem created by municipal refuse. In addition to the Lowell plant of the Raytheon Co., which will use Bureau of Mines technology in its "incinerator residue" plant, two other refuse plants were in the building or operating stage, and plans for two plants using waste materials as primary raw material were announced.

Half of the 1,200 tons per day of refuse from Brockton and Whitman, to be processed at the East Bridgewater plant of Combustion Engineering Associates, Inc., is expected to be recycled as shredded "ECO-FUEL." An estimated 75 tons per day of ferrous scrap will be recovered. Nonferrous metals and glass will remain part of the "clean fill" residue until markets are found. The city of Brockton signed a 20-year pact starting July 1 to haul its trash to the East Bridgewater facility. The Mayor hopes to convert his towering trash dump into a ski slope.

In August, ground-breaking ceremonies took place for the $28 million incinerator-steam generator plant at Saugus, which is a joint venture of M. DeMatteo Construction Co. and Wheelabrator-Frye Inc. The plant, capable of utilizing 2,400 tons of refuse per day, will produce marketable steam. The 16 to 18 municipalities using the new facility will pay $1 per ton for the privilege.

Owens-Illinois Corp. announced the immediate construction of a glass container plant in Mansfield. Not only will the plant hire 250 people and produce 230 million bottles and jars annually, but it should provide a market for recycled glass.

[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Mineral production in Massachusetts [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays ---------- thousand short tons --	219	$416	217	$404
Gem stones ----------	NA	5	NA	5
Peat ---------- thousand short tons --	W	W	2	78
Sand and gravel ---------- do ----	18,883	25,655	18,743	26,910
Stone ---------- do ----	7,990	23,500	8,580	28,738
Value of items that cannot be disclosed:				
Nonmetals and values indicated by symbol W	XX	2,852	XX	3,547
Total ----------	XX	52,428	XX	59,682
Total 1967 constant dollars ----------	XX	43,258	XX	[p] 43,819

[p] Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed". XX Not applicable.
[1] Production as measured by mine shipments, sales or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Massachusetts, by county
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Barnstable	W	$1,218	Sand and gravel.
Berkshire	$8,946	10,419	Stone, lime, sand and gravel.
Bristol	4,513	5,421	Sand and gravel, stone.
Dukes	W	62	Sand and gravel.
Essex	4,519	4,646	Stone, sand and gravel.
Franklin	1,688	W	Sand and gravel, stone.
Hampden	3,645	3,816	Stone, sand and gravel.
Hampshire	488	W	Sand and gravel, stone.
Middlesex	15,114	16,147	Stone, sand and gravel.
Nantucket	W	--	
Norfolk	6,073	7,352	Stone, sand and gravel, clays.
Plymouth	W	834	Sand and gravel, clays, stone.
Suffolk	W	637	Stone, sand and gravel.
Worcester	4,750	5,732	Sand and gravel, stone, peat.
Undistributed [1]	2,693	3,398	
Total [2]	52,428	59,682	

W Withheld to avoid disclosing company confidential data; included with "Undistributed."
[1] Includes gem stones, some sand and gravel which cannot be assigned to specific counties, and values indicated by symbol W.
[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Massachusetts business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ---- thousands	2,489	2,565	+3.1
Unemployment ---- do	160	171	+6.9
Employment (Nonagricultural):			
Manufacturing ---- do	599.6	618.7	+3.2
Construction ---- do	106.1	108.8	+2.5
Transportation and public utilities ---- do	121.5	122.7	+1.0
Wholesale and retail trade ---- do	510.3	522.2	+2.3
Finance, insurance, real estate ---- do	132.1	134.3	+1.7
Services [1] ---- do	477.5	490.6	+2.7
Government ---- do	337.1	342.7	+1.7
Personal income:			
Total ---- millions	$28,096	$30,444	+8.4
Per capita	$4,855	$5,233	+7.8
Construction activity:			
Cement shipments to and within Massachusetts thousand short tons	1,460	1,511	+3.5
Highway construction contracts awarded ---- millions	[e] $50.5	$95.0	+88.1
Mineral production value ---- thousands	$52,428	$59,682	+13.8

[e] Estimate. [p] Preliminary.
[1] Includes mining.

Sources: Survey of Current Business; Employment and Earnings; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Common clay and shale production remained practically static in Massachusetts in 1973; volume was 99% of the 1972 level and value was 97%. Shale for lightweight aggregate, produced at the Norfolk County mine of the Masslite Division of Plainville Corp. gave that county the highest valued single mine production of clay or shale.

Plymouth County's Stiles & Hart Brick Co. and K–F Brick Co., Inc., had a combined clay for brick production that exceeded the production and value in Norfolk County.

Gypsum.—United States Gypsum Co. calcined gypsum at Boston in Suffolk County. Output increased 11%, establishing a new annual record.

Graphite.—Synthetic graphite production decreased in Massachusetts to the point that only 31% of the 1972 tonnage and 64% of the 1972's value were realized.

Lime.—Pfizer Inc. and Lee Lime Corp. produced lime in Berkshire County for paper and pulp, calcium carbide, mason's

lime, and other uses. Output increased 23%, but was 22% below the 1969 record. Total consumption of lime in Massachusetts was 65,920 tons or 96% of the 1972 level.

Perlite (Expanded).—Crude perlite mined outside the State was expanded at two plants in Suffolk County that sold the product mainly for lightweight aggregate, low-temperature insulation, masonry and cavity fill insulation, and horticultural aggregate.

Sand and Gravel.—Total sand and gravel production in 1973 was just 99% of the 1972 production level, but 5% above the 1972 value. The $26.9 million of sand and gravel produced accounted for 45% of the total mineral value in the State, making it the second leading mineral commodity produced. Gravel accounted for 59% of the 18.7 million tons of sand and gravel output. Ninety-three percent of the total tonnage was mined at commercial operations; Government-and-contractor operations produced the balance.

Commercial sand and gravel was produced in all counties in the State except Suffolk, in which production was all noncommercial. Building and paving markets consumed the major portion of the production. Small quantities of sand were used for fill, molding, blast, and filtration. Besides building and paving, gravel was used for railroad ballast and fill.

Table 4.—Massachusetts: Sand and gravel sold or used by producers by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,877	5,813	3,589	5,209
Fill	809	485	613	460
Paving	2,181	2,756	2,091	2,451
Railroad ballast	9	14	--	--
Other uses [1]	790	1,752	1,055	1,946
Total [2]	7,667	10,818	7,349	10,064
Gravel:				
Building	3,795	7,301	4,310	8,067
Fill	1,511	975	1,500	917
Paving	2,337	3,148	2,456	3,566
Railroad ballast	12	31	W	W
Miscellaneous	698	773	1,221	911
Other uses	547	737	615	745
Total [2]	8,901	12,964	10,102	14,207
Government-and-contractor operations:				
Sand:				
Building	--	--	3	6
Fill	179	38	25	13
Paving	677	406	245	504
Other uses	48	49	21	29
Total [2]	904	493	294	551
Gravel:				
Building	75	188	77	195
Fill	2	2	30	19
Paving	1,334	1,189	890	1,870
Other uses	1	2	2	3
Total [2]	1,411	1,380	998	2,088
Total sand and gravel [2]	18,883	25,655	18,743	26,910

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes blast, engine (1973), filtration (1972), grinding and polishing (1972), molding (1973), and other ground and unground sands.
[2] Data may not add to totals shown because of independent rounding.

Stone.—The stone industry's production increased 7% in 1973 and value increased 22%. Dimension stone increased 17% over 1972 production tonnage and increased 41% in value. Production of crushed and broken stone increased 7% over 1972 tonnage and had an 18% increase in overall value. The $28.7 million received made stone the top valued mineral in the State and contributed 48% of the State's total mineral value.

Stone, produced at 42 quarries in 11 of the 14 counties, included basalt, granite, limestone, dolomite, sandstone, and miscellaneous stone. Basalt was the most important stone in both quantity and value. Crushed and broken stone accounted for 99% of the total stone output in 1973.

John S. Lane & Son, Inc., Ashland Oil & Refining Co., and Simeone Stone Corp. were the leading producers in the State in quantity of stone, but the H. E. Fletcher Co., 22d in quantity and Pfizer, Inc., 7th in quantity, led in value.

Crushed basalt was produced in nine counties. Middlesex County led in both quantity and value. The value of crushed basalt accounted for 45% of the total value of stone. The crushed stone was used mainly for construction aggregate; other uses were riprap, railroad ballast, and filter stone.

Granite, sold as crushed and dimension stone, was quarried in five counties. Norfolk County led in value and quantity of granite produced. Granite was the second most important stone produced in the State. The chief use for cut granite was for curbing; other uses were rubble, irregular-shaped stone, paving blocks, cut stone, and house stone veneer. Crushed granite was used mainly for construction aggregate; smaller quantities were used for roadbase stone and railroad ballast.

Limestone was quarried in Berkshire County. The chief uses of crushed limestone, in descending order, were lime, construction aggregate, asphalt fill, whiting, poultry grit, agricultural limestone, other filter, and flux stone.

Crushed miscellaneous stone was quarried in Bristol, Hampden, Norfolk, and Worcester Counties.

Table 5.—Massachusetts: Stone sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone, total	63	4,016	74	5,674
Crushed and broken stone:				
Bituminous aggregate	2,773	5,796	3,541	8,067
Concrete aggregate	749	1,808	500	1,199
Dense graded roadbase stone	1,576	3,382	738	1,615
Macadam aggregate	142	263	118	275
Surface treatment aggregate	93	205	97	277
Unspecified construction aggregate and roadstone	1,290	2,343	2,026	4,679
Agricultural purposes [1]	181	984	172	995
Railroad ballast	W	246	232	413
Riprap and jetty stone	83	147	107	215
Other [2]	1,040	4,311	976	5,331
Crushed total [3]	7,927	19,485	8,506	23,064
Grand total [3]	7,990	23,501	8,580	28,738

W Withheld to avoid disclosing individual company confidential data; included with "Other."
[1] Includes agriculture limestone and poultry grit and mineral food.
[2] Data includes stone used in lime manufacture, roofing aggregate, filter stone, asphalt filler, whiting, flux stone, stone sand, mine dusting (1972), drain fields (1973), and other uses not specified.
[3] Data may not add to totals shown because of independent rounding.

Vermiculite.—The quantity and value of the vermiculite processed in Massachusetts during 1973 increased 25% and 29%, respectively, over those of 1972. W. R. Grace & Co. in Hampshire County exfoliated vermiculite mined outside the State. The material was used mainly as insulation; other uses, in order of production, were concrete aggregate, soil conditioning, and plaster.

MINERAL FUELS

Peat.—Reed-sedge peat was mined by Sterling Peat Co. in Worcester County. There was no increase in tonnage, but value was doubled that of 1972. The peat was used mainly by nurserymen, landscapers, and greenhouse owners.

METALS

Iron and Steel Scrap.—A 150,000-ton-per-year "mini mill" for steel was being built at Waltham to use junk automobiles and low-grade scrap. An automated method will make the steel inexpensive enough to compete with foreign products. Urban Reclamation Technologies, Inc., is building the plant and using methods developed by them and Koppers Co., Inc.

Table 6.—Principal producers

Commodity and company	Address	Type of activity	County
Clays:			
Susquehanna Corp., K-F Brick Co., Inc.	River St. Middleboro, Mass. 02346	Pit	Plymouth.
Plainville Corp., Masslite Div	Box 1747, Cross St. Plainville, Mass. 02762	Pit	Norfolk.
Stiles & Hart Brick Co	Box J Bridgewater, Mass. 02324	Pit	Plymouth.
Gypsum, calcined:			
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	Plant	Suffolk.
Lime:			
Lee Lime Corp	Marble St., Lee, Mass. 01238	do	Berkshire.
Pfizer, Inc	260 Columbia St. Adams, Mass. 01220	do	Do.
Peat: Sterling Peat Co	Sterling Junction, Mass. 01565	Bog	Worcester.
Perlite, expanded:			
U.S. Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	Plant	Suffolk.
Whittemore Products, Inc	35 Harrison St. Roslindale, Mass. 02131	do	Do.
Roofing Granules: Bird & Son, Inc	East Walpole, Mass. 02032	do	Norfolk.
Sand and gravel:			
J. J. Cronin Co	P.O. Box 176 North Reading, Mass. 01864	Pit	Middlesex.
Glenview Sand and Gravel Corp	152 Steadman St. Chelmsford, Mass. 01824	Pit	Do.
Hyannis Sand and Gravel Co	Box 96 Hyannis, Mass. 02601	Mine and mill	Barnstable.
J. L. Construction Co	5 Cypruss Dr. Burlington, Mass. 01803	do	Middlesex.
Marshfield Sand and Gravel Inc	Clay Pit Rd. Marshfield, Mass. 02050	Plant	Norfolk.
Merrimack Materials, Inc	Yemma Rd. Groveland, Mass. 01830	Pit	Essex.
New England Sand and Gravel Co., Inc.	Box 50, Framingham, Mass. 01701	Pit	Middlesex.
San-Vel Contracting Co	Route 2, Ayer Rd. Littleton, Mass. 01460	Pit	Do.
A. A. Will Sand & Gravel Corp	Turnpike St. Canton, Mass. 02021	Pit	Norfolk.
Worcester Sand & Gravel Co	182 Holden St. Shrewsbury, Mass. 01545	Pit	Worcester.
Stone:			
Essex Bituminous Concrete Corp	Russell St., West Peabody, Mass. 01960	Quarry	Essex.
H. E. Fletcher Co	West Chelmsford, Mass. 01863	do	Middlesex and Worcester.
John S. Lane & Son, Inc	P.O. Box 125 Westfield, Mass. 01085	do	Hampden and Hampshire.
Lee Lime Corp	Marble St. Lee, Mass. 01238	do[1]	Berkshire.
Lynn Sand & Stone Co	30 Danvers Rd. Swampscott, Mass. 01907	do	Essex.
Old Colony Crushed Stone Co	P.O. Box 230 Quincy, Mass. 02169	do	Norfolk.
Pfizer, Inc	260 Columbia St. Adams, Mass. 01220	do	Berkshire.
Simeone Stone Corp	P.O. Box 218 Wrentham, Mass. 02093	do	Norfolk.

Table 6.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Trimount Bituminous Products Co.	1840 Parkway St. Everett, Mass. 02149	Quarry	Essex.
Warren Bros. Co., Division of Ashland Oil & Refining Co.	430 Howard St. Brockton, Mass. 02402	do	Bristol.
Vermiculite, exfoliated:			
W. R. Grace & Co., Zonolite Div	62 Whittemore Ave. Cambridge, Mass. 02140	Plant	Hampshire.

[1] 2 quarries; 1 dolomite, 1 limestone.

The Mineral Industry of Michigan

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey Division of the Michigan Department of Natural Resources, under a memorandum of understanding for collecting information on all minerals except coal and liquid fuels.

By Grace N. Broderick [1]

The value of mineral production in Michigan in 1973, $789.0 million, showed a 13.6% increase over the record $694.8 million set in 1972. Nonmetals accounted for $437.9 million, 55.5% of the total; metals were valued at $268.3 million, 34.0% of the total; and fuels were valued at $82.8 million, 10.5% of the total. Iron ore continued to be the leading commodity in terms of mineral value, followed by cement, copper, and sand and gravel.

[1] Physical Scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Mineral production in Michigan [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Cement:				
Portland ---- thousand short tons	5,901	$111,410	6,242	$123,442
Masonry ---- do	250	5,959	247	6,185
Clays ---- do	2,514	3,715	2,151	3,304
Copper (recoverable content of ores, etc.) short tons	67,260	68,874	72,221	85,943
Gem stones	NA	8	NA	8
Gypsum ---- thousand short tons	1,650	7,267	1,882	8,538
Iron ore (usable) ---- thousand long tons, gross weight	12,692	177,461	12,389	180,194
Lime ---- thousand short tons	1,509	22,753	1,545	26,055
Magnesium compounds ---- short tons, MgO equivalent	377,675	31,484	455,501	41,790
Natural gas ---- million cubic feet	34,221	10,506	44,579	17,495
Natural gas liquids:				
Natural gasoline thousand 42-gallon barrels	395	1,097	372	1,189
LP gases ---- do	833	2,274	691	2,529
Peat ---- thousand short tons	219	2,190	232	2,172
Petroleum (crude) thousand 42-gallon barrels	12,990	41,556	14,614	59,413
Salt ---- thousand short tons	4,358	50,761	4,818	53,732
Sand and gravel ---- do	59,467	65,445	62,407	73,972
Silver (recoverable content of ores, etc.) thousand troy ounces	785	1,323	850	2,175
Stone ---- thousand short tons	39,754	50,317	45,886	60,494
Value of items that cannot be disclosed:				
Bromine, calcium-magnesium chloride, and iodine	XX	40,367	XX	40,392
Total	XX	694,767	XX	789,022
Total 1967 constant dollars	XX	573,252	XX	[p] 579,300

[p] Preliminary. NA Not available. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Michigan, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Alcona	$49	$139	Sand and gravel.
Alger	52	W	Do.
Allegan	999	1,293	Sand and gravel, petroleum, stone, natural gas, peat.
Alpena	49,296	50,072	Cement, stone, clays, sand and gravel.
Antrim	W	W	Clays, sand and gravel, petroleum.
Arenac	1,195	W	Petroleum, stone, sand and gravel.
Baraga	W	W	Sand and gravel.
Barry	W	W	Sand and gravel, petroleum, stone.
Bay	11,796	12,840	Cement, sand and gravel, petroleum, lime.
Benzie	W	20	Sand and gravel.
Berrien	3,088	W	Sand and gravel, stone.
Branch	W	W	Sand and gravel.
Calhoun	5,546	5,705	Petroleum, sand and gravel, stone.
Cass	W	W	Sand and gravel, stone.
Charlevoix	W	W	Cement, stone, sand and gravel.
Cheboygan	W	W	Stone, sand and gravel.
Chippewa	W	W	Do.
Clare	1,390	1,596	Petroleum, sand and gravel, natural gas.
Clinton	616	W	Sand and gravel, clays.
Crawford	W	W	Petroleum, natural gas, sand and gravel.
Delta	W	W	Sand and gravel, stone.
Dickenson	31,998	31,469	Iron ore, sand and gravel, stone.
Eaton	735	1,322	Stone, sand and gravel, natural gas, petroleum, clays, peat.
Emmet	12,299	12,991	Cement, stone, clays, sand and gravel.
Genesee	700	1,101	Sand and gravel, petroleum.
Gladwin	875	1,095	Petroleum.
Gogebic	26	W	Sand and gravel.
Grand Traverse	620	2,651	Natural gas, petroleum, sand and gravel.
Gratiot	6,596	8,537	Magnesium compounds, calcium chloride, salt, bromine, sand and gravel, petroleum, natural gas.
Hillsdale	10,085	10,754	Petroleum, natural gas liquids, natural gas, sand and gravel.
Houghton	296	W	Sand and gravel, stone.
Huron	1,202	W	Stone, sand and gravel, lime, petroleum.
Ingham	5,548	8,925	Petroleum, natural gas, sand and gravel, natural gas liquids, peat.
Ionia	W	W	Sand and gravel.
Iosco	6,775	W	Gypsum.
Iron	W	W	Iron ore, sand and gravel.
Isabella	649	W	Sand and gravel, petroleum.
Jackson	3,239	4,348	Petroleum, natural gas, sand and gravel, stone.
Kalamazoo	W	W	Sand and gravel, stone.
Kalkaska	W	10,496	Petroleum, natural gas, sand and gravel.
Kent	5,497	5,880	Sand and gravel, gypsum, petroleum, stone, peat, natural gas.
Keweenaw	2	134	Sand and gravel.
Lake	483	436	Petroleum, sand and gravel.
Lapeer	1,812	2,172	Peat, sand and gravel, calcium chloride, petroleum, natural gas.
Leelanau	W	W	Sand and gravel.
Lenawee	1,335	382	Sand and gravel, clays.
Livingston	W	4,260	Sand and gravel.
Luce	W	95	Do.
Mackinac	W	W	Stone, sand and gravel.
Macomb	W	W	Sand and gravel, natural gas, petroleum.
Manistee	29,258	35,883	Magnesium compounds, salt, sand and gravel, petroleum.
Marquette	142,951	W	Iron ore, sand and gravel, stone.
Mason	30,251	36,508	Magnesium compounds, calcium chloride, lime, bromine, sand and gravel, petroleum.
Mecosta	393	W	Sand and gravel, petroleum, peat, natural gas.

See footnotes at end of table.

Table 2.—Value of mineral production in Michigan, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Menominee	W	$213	Sand and gravel.
Midland	$30,937	28,893	Bromine, calcium chloride, magnesium compounds, salt, iodine, petroleum.
Missaukee	2,167	3,023	Petroleum, natural gas, sand and gravel.
Monroe	24,352	26,542	Cement, stone, clays, sand and gravel, peat, petroleum.
Montcalm	568	622	Petroleum, sand and gravel.
Montmorency	27	59	Sand and gravel.
Muskegon	2,646	W	Sand and gravel, salt, petroleum.
Newaygo	[2] 132	W	Sand and gravel, petroleum.
Oakland	W	14,898	Sand and gravel, peat, stone, petroleum.
Oceana	385	458	Sand and gravel, petroleum.
Ogemaw	2,275	3,330	Petroleum, sand and gravel, natural gas.
Ontonagon	70,444	88,410	Copper, silver, sand and gravel, stone.
Osceola	2,616	2,640	Petroleum, natural gas liquids, sand and gravel, stone.
Oscoda	10	16	Sand and gravel, petroleum.
Otsego	W	11,853	Petroleum, natural gas, sand and gravel.
Ottawa	4,379	4,752	Sand and gravel, petroleum, clays, natural gas, stone.
Presque Isle	21,528	25,736	Stone, sand and gravel.
Roscommon	1,255	1,372	Petroleum, natural gas, sand and gravel.
Saginaw	766	W	Sand and gravel, clays, lime, petroleum, stone.
St. Clair	26,669	23,854	Salt, petroleum, natural gas, natural gas liquids, cement, stone, sand and gravel.
St. Joseph	269	W	Sand and gravel, peat, stone.
Sanilac	1,546	W	Peat, sand and gravel, lime.
Schoolcraft	W	W	Stone, sand and gravel.
Shiawassee	764	W	Sand and gravel, peat, clays, petroleum.
Tuscola	W	W	Sand and gravel, lime, petroleum.
Van Buren	158	122	Sand and gravel, petroleum.
Washtenaw	W	2,112	Do.
Wayne	61,212	68,638	Cement, lime, salt, stone, sand and gravel, clays, petroleum.
Wexford	W	W	Sand and gravel, natural gas, petroleum.
Undistributed [3]	72,008	230,376	
Total [4]	694,767	789,022	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Value of petroleum is based on an average price per barrel for the State.

[2] Excludes value of natural gas.

[3] Includes values for gem stones, some sand and gravel and stone (1973) that cannot be assigned to specific counties, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Michigan business activity

		1972	1973 p	Change, percent
Employment and labor force, annual average:				
Total labor force	thousands	3,728.0	3,801.0	+2.0
Unemployment	do	260.0	221.0	−15.0
Employment:				
Manufacturing	do	1,085.6	1,163.6	+7.2
Contract construction	do	126.0	127.3	+1.0
Mining	do	12.1	12.5	+3.3
Transportation and public utilities	do	148.4	153.0	+3.1
Wholesale and retail trade	do	628.6	647.1	+2.9
Finance, insurance, and real estate	do	124.4	126.6	+1.8
Services	do	465.7	491.0	+5.4
Government	do	526.0	533.7	+1.5
Personal income:				
Total	millions	$44,325	$49,190	+11.0
Per capita		$4,881	$5,439	+11.4
Construction activity:				
Valuation of nonresidential construction	millions	$596.5	$674.0	+13.0
Number of private and public residential units authorized		76,597	70,397	−8.1
State highway department: Contracts awarded	millions	e $248.8	$225.7	−9.3
Portland cement shipments to and within Michigan	thousand short tons	3,231	3,249	+.6
Farm marketing receipts	millions	$1,104.6	$1,539.1	+39.3
Mineral production value	do	$694.8r	$789.0	+13.6

e Estimate. p Preliminary.
Sources: Survey of Current Business, Employment and Earnings, Farm Income Situation, Construction Review, Area Trends in Employment and Unemployment, Roads and Streets, and the U.S. Bureau of Mines.

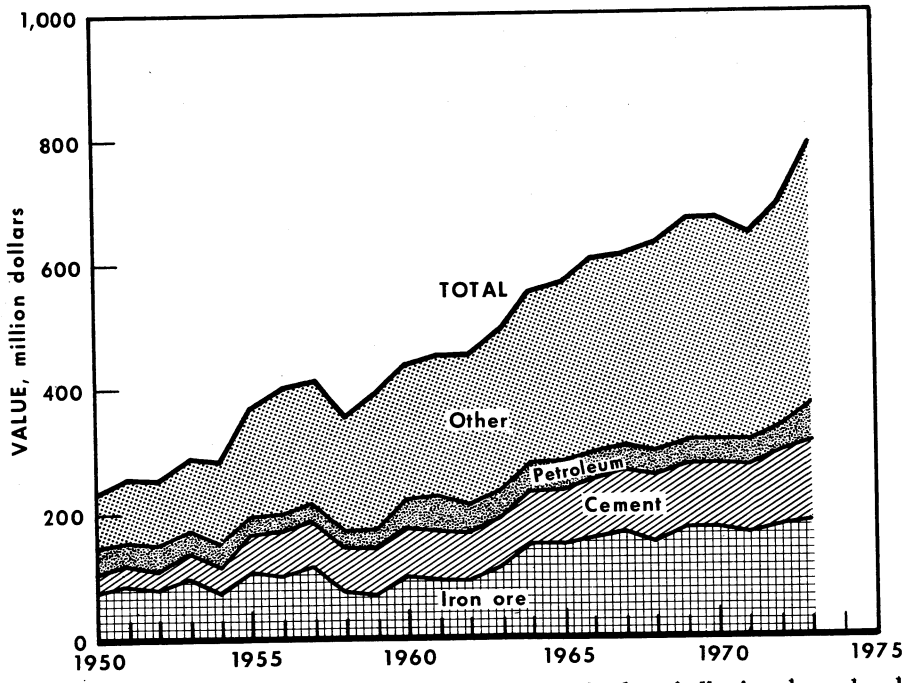

Figure 1.—Value of iron ore, petroleum, cement, and total value of all minerals produced in Michigan.

The major part of the total Michigan mineral value continued to be contributed by nonmetallic mineral commodities. Cement ranked first in value among the nonmetals, followed by sand and gravel, stone, salt, and magnesium compounds. Nationally, Michigan ranked first in production and value of calcium-magnesium chloride and gypsum. It ranked second to Arkansas in value of bromine production, and second to Louisiana in value of salt production. It was the only domestic producer of iodine. Other nonmetallic minerals produced were clays, lime, and gem stones.

Metallic minerals represented 34% of the total value of mineral production in 1973. Iron ore shipments decreased from 12.7 million long tons valued at $177.5 million in 1972 to 12.4 million long tons valued at $180.2 million in 1973. Production of copper, in terms of recoverable metal, increased 7.4% over that of 1972. A small amount of silver was recovered from copper ore.

Mineral fuels (natural gas, natural gas liquids, peat, and petroleum) provided 10.5% of the total mineral output value. Oil production was valued at $59.4 million, an increase of 43% over that of 1972. Value of marketed natural gas production was $17.5 million, an increase of 66.5%. Output of natural gas liquids declined for the fourth successive year. Production of peat increased in quantity but declined in value in 1973, and Michigan continued to be the largest producer of peat in the Nation. Peat was sold principally for soil improvement; none was sold as a fuel.

In May, Consumers Power Co. received authorization from the Atomic Energy Commission to operate the Palisades nuclear power plant near South Haven at its full 700,000-kilowatt capacity. However, it operated only intermittently and closed down for repairs in August. This plant, which began generating electricity in late 1971, is the second nuclear power plant operated by Consumers Power Co. and has 10 times the generating capability of its Big Rock Point plant, which began operation in 1962. The company's third and largest nuclear plant is under construction on a 1,000-acre site south of The Dow Chemical Co. industrial complex at Midland. The plant, scheduled to begin operation in 1979, will be capable of generating 1.3 million kilowatts of electricity for the Consumers Power system and will also process steam for industrial use by Dow Chemical.

Work was progressing on two additional generating units at Consumer Power Co.'s Dan E. Karn plant near Essexville. Each of the units will be oil-fired and will have a capacity of 660,000 kilowatts. The first of the units is to begin operation in late 1974, and the second toward the end of 1975.

A coal-fired electric power generating unit will be added to the Port Sheldon (Campbell) plant of Consumers Power Co. The 800,000-kilowatt unit is scheduled for startup late in 1977. It will increase the generating capacity of the Port Sheldon plant to 1,450,000 kilowatts, which will make it the second largest plant in the Consumers Power system.

Detroit Edison Co. has four major conventional power plants planned or under construction. These are a coal-fired plant near Monroe, two coal-fired plants at Belle River in St. Clair County, and an oil-burning plant at the Greenwood complex about 15 miles northwest of Port Huron. It has under construction the Enrico Fermi No. 2 nuclear plant near Monroe and plans to build a sister reactor plant, Fermi No. 3, adjacent to it. The original Fermi plant, a pioneering "breeder" reactor, is being dismantled. Detroit Edison Co. also plans to construct two nuclear plants at its Greenwood complex, with completion of the first unit scheduled for the late 1970's and the second unit for the early 1980's.

Under construction on the shores of Lake Michigan south of Benton Harbor near Bridgman in Berrien County is Indiana & Michigan Electric Co.'s Donald C. Cook nuclear plant. The 2.2-million-kilowatt plant will serve three southwestern Michigan counties, but most of its power will go to Indiana and Kentucky.

At its new Portage station, north of the village of South Range, Upper Peninsula Power Co. has a new oil-fueled, gas turbine generating facility. The package-type 22,600-kilowatt unit is the first of its size in Upper Michigan.

A unique electric generating plant, the Ludington pumped storage hydroelectric plant, jointly owned by Consumers Power

Co. and Detroit Edison Co., was completed in October with the installation of the facility's sixth reversible pump-turbine unit. The plant, said to be the largest of its kind in the world, pumps water from Lake Michigan to a huge storage reservoir at night and on weekends when demand for electricity is low and releases it to flow through the generators during periods of peak electrical demand. The storage pond, which holds more than 27 billion gallons of water, covers 842 acres and has a shoreline more than 6 miles long. When the plant is generating electricity, up to 17.5 billion gallons of water may be transferred between the storage pond and the lake, moving at a maximum rate of more than 33 million gallons per minute. The plant was built at a cost of more than $340 million. It was designated the Outstanding Civil Engineering Achievement of 1973 by the American Society of Civil Engineers.

Burlington Northern, Inc., added three more unit trains to its coal-hauling service, which involves transporting low-sulfur coal from Montana and Wyoming to electric power plants in Michigan, Indiana, and West Virginia. One of the new operations linked a recently opened coal mine at Decker, Mont., with the Detroit Edison Co. generating plants at St. Clair, Mich. The unit trains haul the coal some 1,000 miles to Superior, Wis., where it is transferred to ships for the 720-mile run to Michigan. By 1976, volume is expected to reach 5 million tons yearly.

According to the district office of the Army Corps of Engineers, cargoes passing through the Soo Locks at Sault Ste. Marie during a record 314-day shipping season totaled 97 million tons, which included 65.2 million tons of iron ore. The season opened April 1, 1972, and closed on February 8, 1973.

The higher-than-normal water levels of Lake Michigan allowed Inland Lime and Stone Co. to set a new record for the most limestone to be loaded on a boat at its Port Inland harbor. On June 22 the steamer *Detroit Edison* loaded 21,795 tons of stone, nearly a thousand tons more than the previous record.

Legislation and Government Programs.—Michigan's Oil and Gas Conservation Law, Public Act 61 of 1939, was again amended by the legislature. One of the amendments was a provision to levy and collect a fee not in excess of 1% based on the gross cash market value of all oil and gas produced in the State. Another repealed Act 326, Public Acts of 1937, which governed the drilling of natural dry gas wells. The Director of the Department of Natural Resources was designated as the Supervisor of Wells, and the Advisory Board was increased from six to eight members, two of whom were to be chosen from the public. The amended act became effective in July.

New legislation was introduced under the title of the Michigan Energy Resources Act. This act contains essentially the same language as Act 61 but is more comprehensive. It would in effect replace Act 61 and repeal Act 9, now administered by the Public Service Commission. The proposed legislation seeks to clarify ambiguities in responsibility that have grown up through 70 years of piecemeal energy legislation, to provide a continuous information inventory on available energy supplies with an annual Energy Resources Report to the legislature and to the people, and to research new sources of energy and better uses of existing energy. It would give the Department of Natural Resources full and unambiguous authority over oil and gas exploration, drilling, and production, and over the safety aspects of natural gas storage. The Public Service Commission would be responsible for monitoring the supply and distribution of Michigan's energy resources.

A bill to amend Act 326, Public Acts of 1913, was introduced for the purpose of removing from the authority of the Department of Natural Resources the right to permit oil and gas exploration and development on the bottomlands of the Great Lakes. If enacted, the Department of Natural Resources Commission's policy of prohibiting leases on State-owned bottomlands of the Great Lakes would become law.

A land use proposal bill was introduced to regulate the use and development of certain lands, to create a State land use commission, to prescribe its powers and duties, to provide for regional and local planning commissions, to prescribe their powers and duties, to provide for a State land use plan, to provide for a State clearinghouse relative to land planning and development, to create certain councils and adjudicatory boards, to prescribe

duties of the Department of Natural Resources and other State agencies, and to prescribe penalties.

Another bill that was introduced proposes the establishment of a Michigan Solid Waste Authority.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasives, Manufactured.—Metallic abrasive producers in 1973 were Abrasive Materials, Inc., at its Hillsdale plant, Hillsdale County; Cleveland Metal Abrasive Co. at its Howell plant, Livingston County; and Ervin Industries, Inc., at its Adrian plant, Lenawee County. The State ranked second to Ohio in the manufacture of metallic abrasives.

Bromine.—Output of elemental bromine decreased 3.8% in quantity and 1.9% in value in 1973. Three companies sold or used elemental bromine. These were The Dow Chemical Co. at its Ludington and Midland plants in Mason and Midland Counties, respectively, Morton Chemical Co. in Manistee County, and Michigan Chemical Corp. in Gratiot County. Michigan ranked second to Arkansas in output and value of elemental bromine. Bromine compounds sold or used by producers in Michigan included ethylene dibromide, hydrobromic acid, ethyl bromide, methyl bromide, ammonium bromide, sodium bromide, potassium bromide, and other bromine compounds.

Calcium-Magnesium Chloride.—Three companies recovered calcium-magnesium chloride from brine: The Dow Chemical Co. at Ludington, Mason County, and Midland, Midland County; Michigan Chemical Corp. at St. Louis, Gratiot County; and Wilkinson Chemical Corp. at Mayville, Lapeer County. Output increased 2.8% in quantity and 4.8% in value.

Cement.—Portland cement shipments increased 5.8%, and value of shipments increased 10.8%. Counties that shipped portland cement were Alpena, Bay, Charlevoix, Emmet, Monroe, St. Clair, and Wayne. Average mill value of portland cement increased to $19.78 per ton from $18.88 per ton in 1972. Yearend stocks of portland cement at mills were 570,366 tons, compared with 763,454 tons in 1972. Ninety-three percent of the portland cement shipped was Type I and II (general use and moderate heat); the remainder was Type III (high-early strength), white, slag-pozzolan, block, expansive, and Type V (high-sulfate-resistance). Consumption of portland cement in Michigan totaled 3,198,000 tons. It was consumed by ready-mix concrete companies (67%), concrete product manufacturers (15%), building material dealers (6%), and contractors and other users (12%).

Masonry cement shipments decreased 1.4%, but value rose 3.8%. Masonry cement was produced in Alpena, Bay, Emmet, and Wayne Counties. Average mill value of masonry cement was $25.04 per ton, compared with $23.82 per ton in 1972. Yearend stocks of masonry cement at mills were 67,490 tons, compared with 61,709 tons in 1972. Masonry cement consumed in the State totaled 179,000 tons.

Early in 1973, Martin Marietta Cement, Great Lakes Division began taking out its four old kilns, which did not lend themselves to modernization and pollution control requirements. The fifth and largest kiln continued in operation. Two new wet process kilns and related facilities were being planned.

A Federal Trade Commission (FTC) complaint charged that the 1971 purchase by St. Lawrence Cement Co. of BASF Wyandotte's cement operations illegally restrained competition in the Detroit area. As a result of an ensuing FTC order, the St. Lawrence Cement Co. sold its assets in Wyandotte Cement Inc. in Wyandotte, Mich.

At the Wyandotte cement plant, a dust abatement facility said to be the first of its kind in the United States was installed to capture the air pollutants generated during the unloading of basic cement-making materials from lake freighters at the plant's Detroit River dock.[2] The dockside dust collector sucks in dust as the materials move by conveyor from ship to shore. The motor-driven vacuum can draw 22,100 cubic feet per minute. Dacron bags collect the dust.

Huron Cement Division of National Gypsum Co. is building two new kilns to

[2] Michigan Manufacturer & Financial Record. V. 131, No. 5, May 1973, p. 15.

replace 12 smaller kilns, some of which were built as long ago as 1923. When the present program is completed in 1975, the Alpena plant will include five nonpolluting, high-capacity kilns, and 22 older kilns will have been replaced since 1966.

Two company name changes that should be noted follow: The America Cement Corp. became Amcord, Inc., and Penn-Dixie Cement Corp. became Penn-Dixie Industries, Inc.

Table 4.—Michigan: Portland cement salient statistics
(short tons)

	1972	1973
Number of active plants	9	9
Production	6,180,940	6,006,643
Shipments from mills:		
Quantity	5,901,390	6,242,386
Value	$111,409,545	$123,442,328
Stocks at mills, Dec. 31	763,454	570,366

Clays.—Miscellaneous clays and shale were mined at 11 pits in 11 counties. Output of clay and shale decreased 14.4% in quantity and 11.1% in value from that of 1972. Eighty-six percent of the clay or shale was used in cement manufacture in 1973, compared with 81% used for this purpose in 1972. The use of plastic drainage tubing has lessened the use of clay for drain tile. Principal producing counties were Alpena, Antrim, Emmet, Monroe, Ottawa, Saginaw, and Wayne.

Peerless Cement Co., Div. of Amcord, Inc., closed its Smith Creek clay mine in St. Clair County at the end of 1972. In Wayne County, Clippert Brick Co. ceased making brick, and Light Weight Aggregate Corp. discontinued its clay operation. The Ludington clay pit in Mason County was mined in 1971 and 1972 by Walsh-Canonie Co. The clay was used to line the water reservoir constructed for the Ludington hydroelectric generating plant of Consumers Power Co. and Detroit Edison Co. which was completed in 1973.

Gem Stones.—Estimated total value of gem stones gathered in the State was about the same as in 1972. Stones usually found in the State include agate, amethyst, garnets, Petoskey stone, datolite, thompsonite, and rose quartz.

Gypsum.—United States Gypsum Co., National Gypsum Co., Georgia-Pacific Corp., Michigan Gypsum Co., and Grand Rapids Gypsum Co. mined gypsum in Iosco and Kent Counties. Output increased 14% to 1,882,000 tons, a new annual record for Michigan. Among the States, Michigan ranked first in the production of gypsum. United States Gypsum Co., National Gypsum Co., Georgia-Pacific Corp., and Grand Rapids Gypsum Co. calcined gypsum in Iosco, Kent, and Wayne Counties. Output increased 11% to 596,000 tons, a new annual record.

Iodine.—The Dow Chemical Co., the sole domestic producer, continued to recover crude iodine from natural well brines at Midland. Production decreased nearly 20% in quantity and value from the 1972 figures.

Lime.—Six companies produced lime at nine plants in seven counties. Leading counties were Wayne and Mason. Leading companies were BASF Wyandotte Corp., Marblehead Lime Co., Detroit Lime Co., and The Dow Chemical Co. Output increased 2.4% to 1,545,000 tons, but value was 13% below the 1967 record. The lime was used for alkalies, steel (BOF), petrochemicals, and other uses. Most of the lime was consumed in Michigan, but some was shipped to Ohio and Indiana. Total consumption of lime in the State was 1,945,000 tons. Nationally, Michigan ranked fifth in quantity and fourth in value of lime produced. In 1972, the Wyandotte plant of BASF Wyandotte Corp. was sixth in the United States in order of total lime output.

Magnesium Compounds.—Michigan continued as the Nation's largest producer of magnesium compounds, accounting for over 53% of the U.S. total. Production increased 20.6% in quantity and 32.7% in value over the 1972 figures. Output came from Gratiot, Manistee, Mason, and Midland Counties.

A new plant to produce periclase, a magnesium oxide refractory material, is being built at Manistee for Martin Marietta Corp. The plant, scheduled to be completed in 1975, will have a capacity of 150 tons per day. Plans include a multiple-hearth calcining furnace, briquetting presses, and a high-temperature shaft kiln.

Perlite.—Crude perlite, mined in Western States, was expanded by National Gypsum Co. at its National City plant, Iosco County; by Harborlite Corp. at its Vicksburg plant, Kalamazoo County; and by United States Gypsum Co. at its De-

troit plant, Wayne County. The expanded perlite was used for filter aid and plaster aggregate.

Salt.—Salt was produced from one rock salt mine in Wayne County, the only underground salt mine in the State, and from natural and artificial brines at plants in Gratiot, Manistee, Midland, Muskegon, St. Clair, and Wayne Counties. Output was 10.6% more than in 1972 and value 5.9% more. Nationally, Michigan ranked fourth in output and second in value of salt sold or used.

Sand and Gravel.—Michigan ranked second only to California in production of sand and gravel in the United States. Tonnage increased 4.9% and was valued at $74 million, an increase of 13% over the 1972 value. Of the State's 83 counties, all but Gladwin, Iosco, and Midland Counties reported sand and gravel production. In each of 11 counties, output exceeded 1 million tons. These counties provided 53% of the State production. Five of these counties make up the metropolitan Detroit area (Livingston, Macomb, Oakland, Washtenaw, and Wayne Counties) and produced 21.8 million tons.

Permanent magnet separators installed by J. P. Burroughs & Son, Inc., at its Salem and Holly plants in Oakland County have increased magnetite recovery. Old electromagnetic drums were replaced by permanent-magnet wet-drum separators built by Eriez Magnetics. These 30-inch-diameter separators are used to recover magnetite for use in heavy-media sink-float separation. Each drum has a capacity of 400 gallons per minute.[3]

American Aggregates Corp. plans to build a new gravel plant at Milford. The company also plans to build a new plant at Oxford; the present plant at this location was built in the 1920's. The new Oxford plant will enable the company to transport all of the excavated materials from the pit area to the plant by conveyor.

[3] Pit & Quarry. V. 65, No. 10, April 1973, pp. 106–107.

Table 5.—Michigan: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	7,862	7,571	8,381	8,315
Glass	W	W	122	359
Engine	28	73	297	720
Fill	2,610	1,634	2,501	1,344
Molding	2,909	6,694	2,889	7,401
Paving	8,772	8,960	7,517	8,093
Other uses [1]	2,363	4,534	2,194	2,996
Total [2]	24,544	29,465	23,900	29,229
Gravel:				
Building	7,344	11,037	8,478	13,571
Fill	288	283	453	383
Paving	17,942	19,204	19,035	21,930
Miscellaneous	1,716	1,464	4,317	3,964
Other uses [3]	2,849	2,191	426	868
Total [2]	30,139	34,181	32,709	40,716
Government-and-contractor operations:				
Sand:				
Building	4	1	61	45
Fill	849	92	803	437
Paving	700	213	994	712
Other uses	109	69	150	107
Total [2]	1,662	375	2,008	1,301
Gravel:				
Building	127	90	--	--
Fill	420	26	672	364
Paving	2,508	1,290	2,923	2,207
Other uses	68	18	196	154
Total [2]	3,122	1,424	3,791	2,725
Total sand and gravel [2]	59,467	65,445	62,407	73,972

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes abrasives (1972), blast, enamel (1972), foundry, glass (1972), fire or furnace, grinding and polishing (1972), pottery, and other sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroads ballast and other gravel.

Table 6.—Michigan: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Alcona	2	86	49	3	149	139
Alger	1	99	52	2	W	W
Allegan	5	902	542	7	735	785
Alpena	4	W	W	4	226	313
Antrim	2	84	158	2	W	W
Barry	5	387	485	5	417	520
Benzie	1	W	W	1	13	20
Berrien	12	1,483	W	6	1,680	W
Branch	3	249	W	3	360	W
Cass	7	322	238	4	407	417
Charlevoix	4	39	21	4	66	46
Cheboygan	4	91	32	2	W	W
Clare	3	W	W	3	183	113
Clinton	11	499	596	14	1,067	1,019
Crawford	1	48	28	4	W	W
Dickinson	3	W	186	5	306	230
Eaton	8	281	293	5	W	448
Emmet	3	225	148	3	87	108
Genesee	6	553	552	6	785	916
Gogebic	2	77	26	3	W	W
Grand Traverse	4	W	111	4	206	W
Gratiot	3	238	231	3	447	349
Houghton	3	W	W	3	277	299
Huron	6	301	191	8	363	266
Ingham	10	626	W	13	758	626
Ionia	3	294	W	4	W	W
Iron	2	153	159	1	46	97
Isabella	3	309	188	4	W	W
Jackson	4	350	262	4	385	509
Kalamazoo	6	836	1,244	7	983	1,436
Kalkaska	1	22	14	2	W	W
Kent	20	2,761	4,101	14	2,877	4,388
Keweenaw	1	17	2	1	81	134
Lake	2	49	44	1	23	27
Lapeer	9	879	558	7	536	440
Lenawee	7	1,099	1,328	4	385	367
Livingston	6	2,798	W	7	3,515	4,260
Luce	1	W	W	1	157	95
Mackinac	7	188	72	5	W	W
Macomb	11	3,017	2,964	10	2,808	2,765
Manistee	4	399	W	4	W	W
Marquette	8	1,031	817	9	1,079	1,286
Mecosta	2	W	189	2	W	376
Menominee	5	127	114	11	223	213
Montcalm	8	430	226	9	424	263
Montmorency	1	69	27	1	59	59
Newaygo	6	185	92	4	W	W
Oakland	25	12,439	14,198	23	11,754	14,838
Oceana	4	257	221	4	259	294
Ogemaw	3	488	W	5	957	1,471
Osceola	1	W	W	3	362	W
Oscoda	1	7	5	1	12	11
Ostego	3	74	49	2	W	W
Ottawa	12	3,229	3,852	13	3,236	4,089
Roscommon	5	W	W	3	W	57
Saginaw	3	367	W	4	W	W
St. Joseph	3	W	W	1	213	284
Sanilac	5	W	W	7	650	527
Schoolcraft	1	62	3	1	43	39
Shiawassee	9	520	514	10	1,341	1,594
Tuscola	9	795	1,004	9	752	1,060
Van Buren	4	216	138	3	140	97
Washtenaw	8	1,816	2,285	8	1,777	2,099
Wayne	8	3,000	5,023	5	1,957	2,179
Wexford	2	W	W	3	80	81
Undistributed [1]	r 59	14,598	21,813	62	16,763	21,921
Total [2]	395	59,467	65,445	396	62,407	73,972

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Arenac, Baraga, Bay, Calhoun, Chippewa, Delta, Hillsdale, Iosco (1972), Leelanau, Mason, Midland (1972), Missaukee, Monroe (1973), Muskegon, Ontonagon, Presque Isle, St. Clair, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Stone.—Michigan, with production of 45.9 million tons, ranked eighth in the Nation in output of stone. Production (principally crushed limestone and dolomite) increased 15.4% over that of 1972. The principal producing counties were Alpena, Chippewa, Mackinac, Monroe, Presque Isle, and Wayne.

Limestone operations are in many areas of the State, but the greatest concentrations of facilities are in southeast Michigan, around Saginaw Bay, on the shore of the northeast tip of the Lower Peninsula, and along the south shore of the Upper Peninsula. Among the leading producers are United States Steel Limestone Operations, United States Steel Corp.; Presque Isle Corp.; Inland Lime & Stone Co., division of Inland Steel Co.; National Gypsum Co., Huron Cement Division; and Bethlehem Mines Corp., Bethlehem Steel Corp. In 1973, these five companies accounted for 80% of the State's total stone production.

A large proportion of the material was shipped by boat from company-operated ports on Lakes Huron and Michigan to steel mills, cement and lime plants, and other consumers. In table 8, the distribution of crushed and broken stone shipments by type of use is shown.

Small quantities of dimension stone have been produced in recent years for building purposes. Output in 1973 was 10,839 short tons valued at $164,912.

Michigan remained the leading producer of marl with production reported from seven counties. It was sold for agricultural purposes. Cass, Calhoun, and Kalamazoo Counties provided the bulk of the material.

The France Stone Co.'s plant at Monroe, its largest operation, was being expanded in a $110,000 project. The plant will be able to produce concrete and asphalt sand. All small products will be washed, and regular stone production will be increased.

Table 7.—Michigan: Stone sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Kind of stone	1972		1973	
	Quantity	Value	Quantity	Value
Dimension [1]	4	66	11	165
Crushed and broken:				
Limestone	31,301	35,360	36,573	42,515
Dolomite	7,499	12,104	8,448	14,393
Marl	79	81	73	79
Traprock	W	W	21	34
Other [2]	870	2,707	760	3,308
Total [3]	39,750	50,251	45,875	60,329
Grand total [3]	39,754	50,317	45,886	60,494

W Withheld to avoid disclosing individual company confidential data; included with "Other."
[1] Includes limestone, dolomite, and sandstone.
[2] Includes granite, sandstone, marble (1972), and other stone.
[3] Data may not add to totals shown because of independent rounding.

Table 8.—Michigan: Crushed and broken stone sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	W	1,213	1,225	1,636
Concrete aggregate	3,241	4,022	4,546	5,547
Dense graded roasbase stone	687	1,065	1,434	2,095
Surface treatment aggregate	W	181	353	596
Unspecified construction aggregate and roadstone	1,555	2,034	1,198	1,706
Agricultural purposes [1]	556	651	733	1,080
Cement manufacture	7,184	6,428	8,178	6,633
Flux stone	11,446	15,944	13,241	19,021
Lime manufacture	9,604	10,926	10,555	13,257
Railroad ballast	W	W	246	385
Riprap and jetty stone	353	629	411	612
Terrazzo	4	109	W	W
Other uses [2]	5,121	7,051	3,755	7,761
Total [3]	39,750	50,251	45,875	60,329

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes data for agricultural limestone, agricultural marl, and other soil conditioners, and poultry grit and mineral food (1973).
[2] Includes data for macadam aggregate, manufactured fine aggregate, chemical stone, fill, paper manufacture, and use not specified. In 1972 data include poultry grit and mineral food.
[3] Data may not add to totals shown because of independent rounding.

Sulfur (Recovered).—Byproduct sulfur was recovered from crude petroleum by TOTAL Leonard, Inc. (Alma) and by Marathon Oil Co. (Detroit); a small amount was produced and shipped by Mobil Oil Corp. (Woodhaven) before operations were discontinued at this facility. Shipments decreased 22.4% in quantity and 28.3% in value.

Vermiculite.—Crude vermiculite, mined outside the State, was exfoliated at a plant in the Detroit area. It was sold for use in loose fill insulation, concrete aggregate, plaster aggregate, fireproofing, horticulture, and other uses.

METALS

Aluminum.—Martin Marietta Aluminum Inc. continued to operate its aluminum fabricating plant at Adrian, Mich. This plant, designed and built in World War II, has produced hard-alloy products for aircraft, military, and other governmental requirements. The company plans to close the facility because of factors that include a shortage of available primary metal and a dwindling demand for the military products that are the plant's specialty.

Copper.—Production of copper, in terms of recoverable metal, was 7.4% more than in 1972, and its value was 24.8% higher. The White Pine mine of White Pine Copper Co., Michigan's only productive copper mine, produced 8,935,480 tons of ore for an average production rate of 25,029 tons of ore per day, according to the 1973 Annual Report of The Copper Range Co., of which the White Pine Copper Co. is a subsidiary. This production exceeded the previous record high of 1969 by 735,564 tons. Refined copper production was 157,011,226 pounds, which exceeded the 1969 record by 301,532 pounds. Shipments of refined copper were 164,205,690 pounds, more than 8 million pounds greater than the 1969 record. The mill (concentrator) operated without interruption throughout the year and established a new record by treating 8,884,136 tons of ore, for an average of 24,886 tons of ore per day, and exceeding the previous record established in 1972 by 633,785 tons, or 1,840 tons per day. The mill recovered 86.22% of the copper contained in concentrates, which represented an improvement in recovery of 0.45% over that of 1972.

Table 9.—Michigan: Mine production (recoverable) of silver and copper

	1971	1972	1973
Mines producing: Lode	1	2	1
Material sold or treated:			
Copper ore, thousand short tons	6,891	8,250	8,884
Copper tailings, do	--	40	--
Production (recoverable):			
Quantity:			
Silver, troy ounces	670,052	785,100	850,273
Copper, short tons	56,005	67,260	72,221
Value:			
Silver, thousands	$1,036	$1,323	$2,175
Copper, do	58,245	68,874	85,943
Total, do	59,281	70,197	88,118

Of the 16 States that produced copper in 1973, Michigan ranked sixth, following Arizona, Utah, New Mexico, Montana, and Nevada; its production was 4.2% of the Nation's total.

Results of a Bureau of Mines study of fracturing and associated damage occurring in the vicinity of blastholes from five shots fired in the shale pillars in the White Pine mine were published.[4]

Homestake Copper Co., in conjunction with Michigan Technological University's Institute of Mineral Research and the Bureau of Mines, is investigating the development of new mining techniques and processing procedures. Investigations on in situ leaching procedures and on electronic sorting equipment are among those underway. The company's options to conduct exploration and research on Michigan copper properties owned by Universal Oil Products Co. were extended for another 3 years. More than 52 million gallons of

[4] Siskind, D. E., R. C. Steckley, and J. J. Olson. Fracturing in the Zone Around a Blasthole, White Pine, Mich. BuMines RI 7753, 1973, 20 pp.

water were pumped from the Centennial No. 6 mine, near Calumet, and a shaft that is to be sunk to the 45th level was started on November 20.

The Department of Natural Resources leased about 26 square miles (16,941 acres) of State Forest land in Dickinson, Gogebic, and Iron Counties in the southwestern Upper Peninsula to three mining companies interested in searching for copper. The three mining companies (Cleveland Cliffs Iron Co., International Minerals & Chemical Co., and I & L Hardwood Uranium Co.) paid $6,250 for the exploratory leases. They are required to restore to natural conditions any lands that their exploratory activity disturbs, and in the event copper deposits are discovered, the leases stipulate that no mining will be allowed until the companies prove that their operations will not have a substantial adverse effect on the environment. Exploration for new copper formations on State land started in 1965, when the Department of Natural Resources leased 4,941 acres in the southwestern Upper Peninsula, followed by leasing 240 acres, 1,000 acres, and 2,287 acres from 1966 through 1970.

A $49,000 grant to support research on the in situ leaching of native copper and copper sulfide ores of the Upper Peninsula was received by Michigan Technological University's Institute of Mineral Research from the National Science Foundation and the Quincy Mining Co.

Iron Ore.—Iron ore shipments in 1973 were 12.4 million long tons, a slight decrease from the 12.7 million long tons shipped in 1972. The average weighted mine value for Michigan usable iron ore shipments in 1973 was $14.54 compared with $13.98 in 1972.

Production, measured as shipments, came from the Mather and Sherwood underground mines and from the Empire, Groveland, and Republic open pit mines.

According to the Geological Survey Division of the Michigan Department of Natural Resources,[5] shipments of iron ore on the Marquette range totaled 9,940,525 tons. The Pioneer pellet plant at Eagle Mills shipped 1,670,646 tons, of which 1,577,611 tons was pellets produced from Mather ore; the Empire mine shipped 3,688,854 tons; the Mather mine shipped 666,180 tons; and the Republic-Humboldt shipped 3,914,845 tons. On the Menominee range the Groveland mine shipped 1,969,354 tons and the Sherwood mine shipped 404,277 tons.

The Cleveland-Cliffs Iron Co. continued construction of the Tilden project and expansion of the Empire facility; these projects will increase the company's pellet-making capacity by 5.8 million tons per year.

A $2.6 million oil storage terminal and truck loading station will be built at Rapid River by Cleveland-Cliffs to serve mining operations (principally the new Tilden mine) managed by the company in nearby Marquette County. The terminal will receive oil by pipeline from Alberta, Canada, and move it by truck to mine properties; it will be operated by Cliffs Fuel Service Co., a subsidiary.

For the first time in its history The Cleveland-Cliffs Iron Co. hired women as general laborers, who worked at cleanup, hosing, shoveling, general maintenance, and filling in on other jobs. Some worked as assistants to male welders and repairmen, and two are pellet cooler attendants.

[5] Hardenberg, H. J., and R. C. Reed. 1973 General Statistics Covering Production of Michigan Iron Mines. Department of Natural Resources Geological Survey Division, 1973, table 1.

Table 10.—Usable iron ore [1] produced (direct-shipping and all forms of concentrates), by range
(Thousand long tons)

Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total		
				Gross weight		Iron content (percent)
				Ore [2]	Iron content	
1854–1968	369,686	287,163	249,625	906,475	NA	NA
1969	10,048	3,369	--	13,417	8,183	60.99
1970	10,363	2,394	--	12,757	7,950	62.31
1971	9,495	2,424	--	11,919	7,384	61.95
1972	9,131	2,533	--	11,664	7,332	65.94
1973	9,036	2,404	--	11,440	7,210	63.02
Total [2]	417,759	300,289	[3] 249,625	967,672	NA	NA

NA Not available.
[1] Exclusive, after 1905, of iron ore containing 5% or more manganese.
[2] Data may not add to totals shown because of independent rounding.
[3] Distribution by range partly estimated before 1906.

Table 11.—Michigan: Iron ore shipped from mines
(Thousand long tons)

Year	Direct-shipping ore [1]	Total concentrates and agglomerates	Total usable ore [2]	Proportion of beneficiated ore to total usable ore (percent)
1969	1,972	12,086	14,058	86.0
1970	1,512	11,588	13,100	88.5
1971	1,439	10,393	11,833	87.8
1972	727	11,965	12,692	94.3
1973	463	11,927	12,389	96.3

[1] Includes crushed, screened, and sized ore not further treated.
[2] Data may not add to totals shown because of independent rounding.

Iron Oxide Pigments.—Iron oxide pigments were produced in Marquette County by the Cleveland-Cliffs Iron Co. Shipments increased substantially in quantity and value over those of 1972.

Pig Iron and Steel.—Pig iron and steel were manufactured in the Detroit area. Pig iron shipments and value increased 15.5% and 22.7%, respectively, compared with those of 1972. According to the American Iron and Steel Institute, Michigan produced 10,945,000 short tons of steel in 1973, compared with 9,380,000 short tons in 1972.

The Steel Division of Ford Motor Co. is substantially increasing its steelmaking capacity with a major expansion and modernization program at its Rouge manufacturing complex in Dearborn. The new hot strip mill, scheduled for operation by mid-1974, is the largest facility in Ford's operation. Slabs of steel will be heated at the new mill and then rolled into coiled strips from which automotive parts will be stamped. Construction was started on a new electric furnace shop, additional soaking pits and annealing furnaces, and new processing and shipping facilities. The program, when completed, will increase Ford's steelmaking capacity by about 750,000 tons annually.

Cannon Muskegon Corp. installed three new 8,500-pound electric furnaces, one vacuum and two air-melt, to increase productive capacity at its specialty alloys melter at Muskegon. The company produces nickel, cobalt, stainless, and tool steel alloys in various ingot forms.

Jones & Laughlin Steel Corp. announced it would close the alloy bar production facility at its Warren plant by yearend. Steel melting capacity made available by this closing will be used for producing stainless products, which comprise the bulk of the Warren plant's output.

Saginaw Casting Division (formerly known as Valley Grey Iron Foundry) of Wilson Engineering, Saginaw, completed new electric melting facilities. This improvement, along with a recent plant expansion from 18,000 to 26,000 square feet,

has more than tripled Saginaw Casting's production capacity in the past year.

Hoskins Manufacturing Co., Detroit, manufacturer of metal alloys for the automotive industry, purchased a 20-acre site near Hamburg, for a new $4.5 million melt shop and hot-rolling mill facility. The melt shop and hot-rolling processes located in part of Hoskin's Detroit plant will be relocated to the Hamburg facility.

Upper Peninsula Industries, Inc., a subsidiary of Zalk-Joseph Steel Co. of Duluth, established a new steel-fabricating plant in the Iron River area. The company will be located in the 12,500-square-foot former Cannon mine engine house.

Silver.—Silver was recovered from copper ore mined at the White Pine mine in Ontonagon County. Concentrates from a silver-recovery circuit in the White Pine mill were shipped to an outside smelter for silver recovery. Output of silver in 1973 was 8.3% more than in 1972, while value was 64.4% more than in 1972.

MINERAL FUELS

Coke.—Three companies operated oven-coke plants in Michigan in 1973. Total production of 3,871,000 short tons represented an increase of 5.3% over the 3,677,000 short tons produced in 1972. The majority of the coke was consumed by blast furnaces. Michigan ranked fifth among the States in coke production and fourth in coke consumption.

Natural Gas.—Marketed production of natural gas increased substantially, from 34,221 million cubic feet in 1972 to 44,579 million cubic feet in 1973, the largest volume ever produced in a single year in Michigan. Value was $17,495,000, a 66.5% increase over that of 1972. To meet its needs, however, Michigan relies heavily on imports which, according to compilations by the Gas Section, Public Utilities Division, Michigan Department of Commerce, increased slightly from 906,684,020,000 cubic feet in 1972 to 907,122,475,000 cubic feet in 1973.

Proved recoverable reserves of natural gas in Michigan as of December 31, 1973, according to the American Gas Association, Inc. (AGA), totaled 1,548,508 million cubic feet, compared with 1,296,815 million cubic feet on December 31, 1972.

Consumers Power Co. started production at its synthetic-natural-gas (SNG) plant at Marysville. The plant has an output of more than 100 million cubic feet of natural gas daily, which will be doubled when a second unit comes on stream in 1974. The plant is reported to be the largest gas-reforming facility in the world and the first large one of its kind to go into service in the Western Hemisphere. Feedstock for the plant comes from Alberta, Canada. Some liquids probably will be brought over to Marysville from northern Michigan wells, including strip-off from the gas-processing plants of Consumers Power Co. and Shell Oil Co. that are under construction at Kalkaska.

In South Chester Township, Otsego County, Michigan Hydrocarbons, Inc., has under construction a gas-processing plant with a rated capacity of about 15 million cubic feet of gas per day.

Mobil Oil Corp. opened its Aurelius plant in Ingham County in 1972; it also has a second gas-processing plant planned for Eaton Rapids.

Two natural-gas-processing plants that have shut down are Michigan Consolidated Gas Co.'s Willow Station plant, Washtenaw County, which closed at the end of 1972, and Consumers Power Co.'s St. Clair plant, St. Clair County, which closed as of July 1, 1973.

The Federal Power Commission (FPC) in April approved a settlement involving delivery of up to 3 million cubic feet of natural gas daily to be sold to the city of Manistique on Michigan's Upper Peninsula. In 1967, when the FPC authorized Great Lakes Gas Transmission Co. to build facilities to transport Canadian gas, it also provided for the delivery of 57 million cubic feet of gas daily to Michigan Consolidated Gas Co., of which 3 million cubic feet per day were allocated for resale to Manistique. None of the allocated gas, however, had been delivered to the city. The settlement provides for the residential and commercial customers of Manistique to start receiving natural gas service.

A $1.2 million damage suit was filed by the State of Michigan against Amoco Production Co. and Cactus Drilling Corp. The companies were charged with negligence in connection with the drilling of Amoco's 1–22–E State-Whitewater wildcat in Grand Traverse County. A series of craters and gas blowholes developed near the drill site last April, and about 80 families were evacuated from the town of

Williamsburg and nearby areas. As a result of the incident, the Department of Natural Resources issued a Special Order requiring an intermediate casing string in wells drilled for oil and gas in the State.

Natural Gas Liquids.—Production of natural gas liquids decreased 13.4% from that of 1972, to 1,063,000 barrels. Of the total production, 372,000 barrels was natural gasoline and 691,000 barrels was liquefied petroleum (LP) gas. LP gases averaged $3.66 per barrel, compared with $2.73 in 1972, and natural gasoline averaged $3.20 per barrel, compared with $2.78 in 1972.

According to the AGA, proved reserves of natural gas liquids totaled 25,046,000 barrels at yearend 1973, compared with 19,026,000 barrels at yearend 1972.

Peat.—Michigan continued to lead the Nation in peat production, accounting for 37.2% of the U.S. total. Production, which increased from 208,691 short tons in 1972 to 236,340 short tons in 1973, was obtained from 11 counties. Lapeer and Sanilac Counties continued to be the leading producing counties. Production also came from Allegan, Eaton, Ingham, Kent, Mecosta, Monroe, Oakland, St. Joseph, and Shiawassee Counties.

Sales totaled 232,330 short tons in 1973, compared with 219,251 short tons in 1972. Reed-sedge peat accounted for 79.6% of the total sales, moss peat for 5.7%, and humus peat for 14.6%. Over 87% of the sales was in packaged form. Of the total output, 96.5% was used for general soil improvement, with the remainder being used as an ingredient for potting soils, mushroom beds, packing flowers, etc.

Petroleum.—Crude oil production in Michigan increased for the third consecutive year. Output in 1973 was 14.6 million barrels, or 12.5% above the 1972 level, and was valued at $59.4 million. This production, however, was far short of the State's needs, and imports in 1973 amounted to 39,775,383 barrels, of which 22,826,153 million barrels came from Canada. In 1972, imports were 47,481,425 barrels.

Reserves of crude oil, according to the American Petroleum Institute (API), were 72,444,000 barrels on December 31, 1973, compared with 62,002,000 barrels on December 31, 1972.

Petroleum and Natural Gas Exploration and Development.—Total number of well completions in Michigan, according to the API, decreased from 309 wells in 1972 to 278 wells in 1973. Of the 278 wells drilled, 73 were completed as oil wells, 41 as gas wells, and 164 as dry holes. Overall success record was 41%; 39% of the exploratory wells were completed as oil and gas producers. The total footage drilled in new wells was 1,468,962 feet, of which 515,651 feet was in development completions and 953,311 feet was in exploratory completions.

Kalkaska, Otsego, Grand Traverse, and Manistee Counties in the northern part of Michigan's Lower Peninsula led the State in exploratory activity with a total of 84 exploratory well completions, of which 44 were successful (25 oil and 19 gas) for a success record of 52%. Kalkaska County had 29 exploratory completions with 16 discoveries (7 oil and 9 gas). Otsego County was second with 23 exploratory completions resulting in 10 oil wells and 13 dry holes; Grand Traverse County had 19 exploratory completions with 9 successes (2 oil and 7 gas); and Manistee County had 9 discoveries (6 oil and 3 gas) in 13 attempts.

Ingham, Calhoun, and Eaton Counties were active in exploration in the southern part of the Lower Peninsula. A total of 35 exploratory wells were completed in these 3 counties; 9 were completed as oil wells, 3 as gas wells, and 23 as dry holes for an overall success record of 34%.

Although interest in the Niagaran reef continued to dominate the State's activity, a completion in Hillsdale County (United Petroleum Co. and Earl Majeske's #1 May in NW¼ SW¼ NW¼ sec 14T, 6S, R2W, Adams Township), southeast of the famed Albion-Scipio trend, may renew interest in the Trenton Ordovician rocks in southern Michigan. The Albion-Scipio trend is the State's first and only 100-million-barrel oilfield.

Table 12.—Michigan: Oil and gas well drilling completions, by county, in 1973

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Allegan	--	--	1	--	--	--	1	1,161
Alpena	--	--	1	--	1	--	2	7,775
Antrim	--	--	--	--	--	1	1	6,860
Barry	--	--	--	--	--	1	1	3,410
Bay	--	--	--	--	--	2	2	7,704
Calhoun	--	2	6	2	2	7	19	66,421
Charlevoix	--	--	--	--	--	2	2	10,048
Chippewa	--	--	--	--	--	1	1	1,305
Clare	1	--	--	--	--	2	3	13,340
Crawford	--	--	--	2	2	1	5	36,836
Eaton	2	1	1	1	1	4	10	40,583
Gladwin	--	--	2	--	--	--	2	7,808
Grand Traverse	1	1	6	2	7	10	27	171,940
Hillsdale	2	--	1	--	--	5	8	32,162
Huron	--	--	--	--	--	1	1	9,038
Ingham	6	--	11	6	--	12	35	148,117
Jackson	--	--	--	--	--	3	3	11,765
Kalkaska	10	3	10	7	9	13	52	356,358
Livingston	--	1	5	--	--	--	6	25,195
Macomb	--	--	--	--	--	4	4	14,184
Manistee	1	--	--	6	3	4	14	75,585
Mason	2	--	--	1	2	4	9	44,537
Mecosta	--	--	--	--	--	3	3	10,901
Montcalm	--	--	1	--	--	4	5	17,529
Montmorency	--	--	--	--	--	1	1	5,375
Muskegon	--	--	1	--	--	--	1	1,710
Oceana	--	--	1	--	--	1	2	6,552
Osceola	--	--	--	--	--	1	1	4,135
Otsego	9	1	8	10	--	13	41	251,872
Presque Isle	--	--	--	--	--	3	3	13,248
St. Clair	1	--	1	--	--	2	4	9,863
Sanilac	--	--	--	--	--	1	1	7,554
Tuscola	--	--	--	1	1	--	2	15,689
Van Buren	--	--	1	--	--	--	1	1,196
Wexford	--	1	--	--	3	1	5	31,206
Total	35	10	57	38	31	107	278	1,468,962

[1] Development wells as defined by American Petroleum Institute.
Source: American Petroleum Institute.

Major oil companies, who hold the largest blocks of acreage under lease, were again the most successful in finding oil and gas. In the northern area, Shell Oil Co. continued to lead the way, followed by Amoco Production Co., a Standard affiliate; in the southern area, Mobil Oil Corp. continued to be the leader. Michigan-based independents, long the mainstay and backbone of the State's oil and gas industry, also found new fields in the northern and southern regions.

A new portable, self-propelled drilling rig was acquired by Wagner Drilling Co. for drilling in Michigan's oilfields. The new unit, manufactured by Ideco, Oilfield Products Division of Dresser Industries, Inc., is reported to be the first of its kind in Michigan. The 80,000-pound rig is capable of drilling to about 6,500 feet with 4½-inch drillpipe and to depths of about 8,000 feet with 3½-inch drillpipe. It is 59 feet, 6 inches long when ready for the road, and is capable of road speeds up to 45 miles per hour.

Petroleum Refineries.—Michigan had six active refineries in 1973. The plants are scattered across the Lower Peninsula in Bay, Gratiot, Kalamazoo, Montcalm, Ogemaw, and Wayne Counties. They have a total capacity of 142,000 barrels of crude oil per day, with an actual current throughput of about 132,000 barrels daily.[6] They all produce gasoline motor fuel, home heating oils, and residual industrial fuels; several also manufacture asphalt, jet fuels, solvents, and petrochemical industry feedstocks.

The Marathon Oil Co. refinery in Detroit, rated at 62,000 barrels per day, is the largest of the group. TOTAL Leonard, Inc.'s, refinery in Alma, rated at 43,000 barrels daily, is the next largest. Marathon Oil Co. uses crude from Michigan and also from Wyoming and Louisiana. TOTAL Leonard, Inc., uses about 50% Michigan production and imports the remainder from Canada. The Dow Chemical

[6] Oil and Gas News. Michigan Plants Run 132,000 Barrels Daily. V. 80, No. 5, Feb. 1, 1974, pp. 10, 14.

Co. Bay Refining Div. in Bay City, rated at 17,000 barrels daily, uses some crude oil from Michigan, but its main source of supply is Canada.

The smaller refineries are Crystal Refining Co.'s operation in Carson City, Lakeside Refining Co.'s operation in Kalamazoo, and Osceola Refining Co.'s plant in West Branch. The latter company has been purchased by United Refining Co. of Warren, Pa., and plans are to increase its current capacity of about 9,500 barrels of crude per day to about 19,000 barrels daily when installation of new equipment is complete.

Pipeline Construction.—Shell Pipe Line Corp., at yearend, was about half finished with construction of its 85-mile crude oil pipeline system to transport oil from the Kalkaska area to the existing Lewiston facility of the Lakehead Pipeline Co. in Crawford County; the line connects with refineries in West Branch, Alma, and Marysville, near Port Huron.

Michigan Consolidated Gas Co., a Detroit-based utility, has under construction a pipeline that is to run from their South Kalkaska regulator station to their Woolfolk station near Big Rapids; existing lines will move the gas from there to Detroit. The company also has planned a 20-inch pipeline that is to run 10.7 miles from the Fowlerville field to their Austin storage field, where it will tie in with existing 24- and 30-inch pipelines that connect the storage field with Detroit.

Construction was started on a 44-mile pipeline by Michigan-Ohio Pipeline Corp., a subsidiary of TOTAL Leonard, Inc. The 8-inch pipeline will run from TOTAL Leonard's refinery in Alma to its terminal in Bay City. It will carry petroleum products except liquefied petroleum gases.

Construction was completed on Consumers Power Co.'s 18.5-mile line connecting their Kalkaska processing plant with their Muskegon River line; the line will be put in use upon completion of the Kalkaska plant. Capacity of the 12-inch line is reported to be 117 million cubic feet per day without compression and 150 million cubic feet per day under full compression. In constructing this pipeline, a technique used in other parts of the country but never before used in Michigan was applied in running a section of gas pipeline under the North Branch of the Manistee River. Key to the new technique is a specially designed plow, designed to run as much as 6 feet underground, that simply pulls the pipe along behind as it breaks a subterranean passageway.[7]

[7] Oil and Gas News. Consumers Pipeline Tests New Method. V. 79, No. 26, June 24, 1973, pp. 14, 19–20.

Table 13.—Principal producers [1]

Commodity and company	Address	Type of activity	County
Abrasives, metallic:			
Abrasive Materials, Inc	Box 291 Hillsdale, Mich. 49242	Plant	Hillsdale.
Cleveland Metal Abrasive Co	887 East 67th St. Cleveland, Ohio 44103	do	Livingston.
Ervin Industries, Inc	Box 1168 Ann Arbor, Mich. 48106	do	Lenawee.
Cement:			
Dundee Cement Co	Box 122 Dundee, Mich. 48131	Portland, wet process.	Monroe.
Martin Marietta Cement, Great Lakes Div.	Box 8 Bay City, Mich. 48706	Portland and masonry, wet process.	Bay.
Medusa Cement Co., Div. Medusa Corp.	Box 5668 Cleveland, Ohio 44101	Portland, wet process.	Charlevoix.
National Gypsum Co., Huron Cement Div.	17515 West 9 Mile Rd. Honeywell Center Southfield, Mich. 48075	Portland and masonry, dry process.	Alpena.
Peerless Cement Co., div. of Amcord, Inc.:			
Detroit plant	2000 The Executive Plaza Detroit, Mich. 48226	Portland and masonry, wet process.	Wayne.
Penn-Dixie Industries, Inc	Box 307 Petoskey, Mich. 49770	do	Emmet.
Wyandotte Cement Inc	3505 Biddle Ave. Wyandotte, Mich. 48192	do	Wayne.

See footnote at end of table.

Table 13.—Principal producers [1]—Continued

Commodity and company	Address	Type of activity	County
Clays and shale:			
Construction Aggregates Corp	13600 104th Ave. Grand Haven, Mich. 49417	Pit and plant	Ottawa.
Dundee Cement Co	Box 122 Dundee, Mich. 48131	Pit	Monroe.
Martin Marietta Cement, Great Lakes Div.	Box 8 Bay City, Mich. 48706	Pit	Saginaw.
Medusa Cement Co., Div. Medusa Corp.	Box 5668 Cleveland, Ohio 44101	Pit	Antrim.
National Gypsum Co., Huron Cement Div.	17515 West 9 Mile Rd. Honeywell Center Southfield, Mich. 48075	Pit	Alpena.
Peerless Cement Co., div. of Amcord Inc.	2000 The Executive Plaza Detroit, Mich. 48226	Pit	Wayne.
Penn-Dixie Industries, Inc	Box 307 Petoskey, Mich. 49770	Pit	Emmet.
Coke:			
Semet-Solvay Div., Allied Chemical Corp.	Box 70 Morristown, N.J. 07960	Coke ovens	Wayne.
Ford Motor Co	The American Rd. Dearborn, Mich. 48121	do	Do.
National Steel Corp., Great Lakes Steel Div.	2800 Grant Bldg. Pittsburgh, Pa. 15219	do	Do.
Copper:			
White Pine Copper Co., subsidiary of Copper Range Co.	Box 427 White Pine, Mich. 49971	Mine and mill	Ontonagon.
Gypsum:			
Georgia-Pacific Corp., Gypsum Div.	900 SW 5th Ave. Portland, Oreg. 97204	Underground mine and calcining and board plant.	Kent.
Grand Rapids Gypsum Co	Box 1674 Grand Rapids, Mich. 49501	do	Do.
Michigan Gypsum Co	2840 Bay Rd. Saginaw, Mich. 48601	Open pit mine	Iosco.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	Open pit mine and calcining and board plant.	Do.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	Open pit mine Calcining and board plant.	Do. Wayne.
Iron ore:			
Cleveland-Cliffs Iron Co	1460 Union Commerce Bldg. Cleveland, Ohio 44115		
Empire		Open pit mine, concentrator, and agglomerator.	Marquette.
Mather		Underground mine. Ore treated at the ore improvement plant and Pioneer pellet plant.	Do.
Ore improvement plant		Processes Mather ore.	Do.
Pioneer pellet plant		Pelletizes ore from the Mather mine.	Do.
Republic		Open pit mine, concentrator, and agglomerator. Part of the concentrates pelletized at the Humboldt plant.	Do.
Hanna Mining Co: Groveland	100 Erieview Plaza Cleveland, Ohio 44114	Open pit mine, concentrator, and agglomerator.	Dickinson.
Inland Steel Co.: Sherwood	30 West Monroe St. Chicago, Ill. 60603	Underground mine	Iron.
Iron and steel:			
Ford Motor Co	The American Rd. Dearborn, Mich. 48121	Iron blast furnaces and open-hearth steel furnaces.	Wayne.
McLouth Steel Corp	300 South Livernois Ave. Detroit, Mich. 48217	do	Do.
National Steel Corp., Great Lakes Steel Div.	2800 Grant Bldg. Pittsburgh, Pa. 15219	do	Do.

See footnote at end of table.

Table 13.—Principal producers [1]—Continued

Commodity and company	Address	Type of activity	County
Iron oxide pigments, crude: Cleveland-Cliffs Iron Co.	1460 Union Commerce Bldg. Cleveland, Ohio 44115	Mine	Marquette.
Lime:			
Detroit Lime Co., Subsidiary of Edward C. Levy Co.	8800 Dix Ave. Detroit, Mich. 48209	Quicklime, shaft and rotary kilns.	Do.
The Dow Chemical Co	2020 Dow Center Midland, Mich. 48640	Quicklime, 3 rotary kilns, continuous hydrator.	Mason.
Marblehead Lime Co., Div. General Dynamics Corp.	300 West Washington St. Chicago, Ill. 60606	Quicklime, 2 rotary kilns.	Wayne.
BASF Wyandotte Corp	1609 Biddle Ave. Wyandotte, Mich. 48192	Quicklime, 9 shaft kilns.	Do.
Natural gas processors:			
Consumers Power Co	212 West Michigan Jackson, Mich. 49201	Plant	St. Clair.
The Dow Chemical Co	2020 Dow Center Midland, Mich. 48640	do	Crawford.
Marathon Oil Co	539 South Main St. Findlay, Ohio 45840	do	Hillsdale.
Michigan Wisconsin Pipe Line Co.	1 Woodward Ave. Detroit, Mich. 48226	do	Osceola.
Mobil Oil Corp	P.O. Box 258 Mason, Mich. 48854	do	Ingham.
Peat:			
Anderson Peat Co	332 Graham Rd. Imlay City, Mich. 48444	Bog, processing plant.	Lapeer.
Fletcher & Rickard	54001 Grand River Rd. New Hudson, Mich. 48165	do	Oakland.
Huber Peat Co., Bay Houston Towing Co.	P.O. Box 312 Sandusky, Mich. 48471	do	Sanilac.
Michigan Peat, Bay Houston Towing Co.	P.O. Box 3006 Houston, Tex. 77001	Bogs, processing plant.	Do.
Scenic Lakes, Inc	Box 926 East Lansing, Mich. 48823	Bog, processing plant.	Shiawassee.
Expanded perlite:			
Harborlite Corp	P.O. Box 458 Escondido, Calif. 92025	Processing plant	Kalamazoo.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Iosco.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	do	Wayne.
Petroleum refineries:			
Bay Refining Div., The Dow Chemical Co.	4868 Wilder Rd. Bay City, Mich. 48709		Bay.
Crystal Refining Co	901 North Williams Carson City, Mich. 48811		Montcalm.
Lakeside Refining Co	2705 East Cork Kalamazoo, Mich. 49001		Kalamazoo.
Marathon Oil Co	1300 South Fort St. Detroit, Mich. 48217		Wayne.
Osceola Refining Co	Box 178 Reed City, Mich. 49677		Ogemaw.
TOTAL Leonard, Inc., Alma Division.	East Superior St. Alma, Mich. 48801		Gratiot.
Salt and salines:			
Diamond Crystal Salt Co	916 South Riverside St. Clair, Mich. 48079	Brine wells and processing plant: Salt.	St. Clair.
The Dow Chemical Co.:			
Ludington plant	Midland, Mich. 48640	Brine wells and processing plant: Bromine, calcium-magnesium compounds, magnesium compounds.	Mason.
Midland plant		Brine wells and processing plant: Bromine, calcium-magnesium compounds, iodine, magnesium compounds, salt.	Midland.
Harbison-Walker Refractories Co.	2 Gateway Center Pittsburg, Pa. 15222	Processing plant: Magnesium compounds.	Mason.

See footnote at end of table.

Table 13.—Principal producers [1]—Continued

Commodity and company	Address	Type of activity	County
Salt and salines—Continued			
Hardy Salt Co	P.O. Drawer 449 St. Louis, Mo. 61366	Processing plant: Salt.	Manistee.
Hooker Chemical Corp	Box 295 Montague, Mich. 49437	Brine wells and processing plant: Salt.	Muskegon.
International Salt Co., Inc	Clarks Summit, Pa. 18411	Underground salt mine.	Wayne.
Martin Marietta Chemicals, Refractories Div.	Executive Plaza II Hunt Valley, Md. 21030	Brine wells and processing plant: Magnesium compounds.	Manistee.
Michigan Chemical Corp.:	351 East Ohio St. Chicago, Ill. 60611		
St. Louis Plant	----------	Brine wells and processing plant: Bromine, calcium magnesium compounds, magnesium compounds, salt.	Gratiot.
Morton Chemical Co., div. Morton-Norwich Products, Inc.	110 North Wacker Dr. Chicago, Ill. 60606	Brine wells and processing plant: Bromine, magnesium compounds.	Manistee.
Morton Salt Co., div. of Morton-Norwich Products, Inc.:	---- do ----------		
Manistee plant	----------	Brine wells and processing plant: Salt.	Do.
Port Huron plant	----------	---- do ----------	St. Clair.
Pennwalt Corp	3 Penn Center Philadelphia, Pa. 19102	---- do ----------	Wayne.
Wilkinson Chemical Corp	Mayville, Mich. 48744	Brine wells and processing plant: Calcium-magnesium compounds.	Lapeer.
BASF Wyandotte Corp	1609 Biddle Ave. Wyandotte, Mich. 48744	Brine wells and processing plant: Salt.	Wayne.
Sand and gravel:			
American Aggregates Corp	Drawer 160 Greenville, Ohio 45331	Pits and stationary plants.	Kalamazoo, Livingston, Macomb, Oakland.
Construction Aggregates Corp	120 South LaSalle St. Chicago, Ill. 60603	---- do ----------	Ottawa.
Grand Rapids Gravel Co	2700 28th St., SW. Grand Rapids, Mich. 49509	---- do ----------	Kent.
Holloway Sand & Gravel Co	29250 Wixom Rd. Box 247 Wixom, Mich. 48096	Pits and portable plants.	Genesee, Oakland, Ogemaw, Otsego.
Holly Sand & Gravel Div., J. P. Burroughs & Son, Inc., Aggregate Div.	Box 1468 Saginaw, Mich. 48605	Pit and stationary plant.	Oakland.
McCormick Sand Corp	P.O. Box 506 Muskegon, Mich.	Stationary plant	Ottawa.
Mickelson Corp	435 Granger Rd. Oxford, Mich. 48051	Pit, dredges, portable plant.	Do.
Moleworth Contracting Co	321 Park Ave. Yale, Mich. 48097	Pits and portable plants.	Lapeer, Macomb, St. Clair, Sanilac.
Natural Aggregates Corp	65545 Mound Rd. Romeo, Mich. 48065	Pits, dredge, portable and stationary plants.	Livingston, Macomb.
New Hudson Sand & Gravel, Inc.	Box 174 New Hudson, Mich. 48165	Pits and stationary plants.	Oakland.
Sargent Sand Co	2840 Bay Rd. Saginaw, Mich. 48604	---- do ----------	Bay, Mason, Saginaw, Tuscola.
Spartan Aggregates	P.O. Box 25 Holt, Mich. 48842	---- do ----------	Clinton, Ingham, Oakland.
Standard Sand Co	P.O. Box 290 Grand Haven, Mich. 49417	Stationary plant	Ottawa.

See footnote at end of table.

Table 13.—Principal producers [1]—Continued

Commodity and company	Address	Type of activity	County
Silver:			
White Pine Copper Co. subsidiary of Copper Range Co.	Box 427 White Pine, Mich. 49971	Byproduct silver	Ontonagon.
Smelters:			
White Pine Copper Co., subsidiary of Copper Range Co.	---- do ----	Primary copper smelter.	Do.
Stone:			
Granite:			
Caspian Construction Co	100 West Caspian Caspian, Mich. 49915	Quarries and portable plant.	Dickinson.
George Hocking Construction Co.	Box 488 South Range, Mich. 49963	---- do ----	Houghton, Ontonagon.
Limestone and dolomite:			
Bethlehem Mines Corp., Bethlehem Steel Corp.	701 East Third St. Bethlehem, Pa. 18016	Quarry and stationary plant.	Chippewa.
Cheney Limestone Co	Box 6 Bellevue, Mich. 49021	---- do ----	Eaton.
Dundee Cement Co	Box 122 Dundee, Mich. 48131	---- do ----	Monroe.
The France Stone Co	1800 Toledo Trust Bldg. Toledo, Ohio 43603	---- do ----	Do.
Inland Lime & Stone Co., div. of Inland Steel Co.	Gulliver, Mich. 49840	Quarries and stationary plants.	Mackinac, Schoolcraft.
Medusa Cement Co., div. Medusa Corp.	Box 5668 Cleveland, Ohio 44101	Quarry and stationary plant.	Charlevoix.
Michigan Foundation Quarry Co., Inc.	110 West Jefferson Ave. Trenton, Mich. 48183	---- do ----	Wayne.
The Michigan Stone Co	Ottawa Lake, Mich. 49267	Quarries and stationary plants.	Monroe.
National Gypsum Co., Huron Cement Div.	17515 West 9 Mile Rd. Honeywell Center Southfield, Mich. 49840	---- do ----	Alpena.
Penn-Dixie Industries, Inc	Box 307 Petoskey, Mich. 49770	Quarry and stationary plant.	Emmet.
Presque Isle Corp	Box 426 Alpena, Mich. 49707	---- do ----	Presque Isle.
United States Steel Limestone Operations, United States Steel Corp.	Rogers City, Mich. 49779	Quarries and stationary plants.	Mackinac, Presque Isle.
Wallace Stone Co., div. of J. P. Burroughs & Son, Inc., Aggregate Div.	Box 1468 Saginaw, Mich. 48605	Quarry and stationary plant.	Huron.
Marl:			
Case Brothers	Route 2, Box 136 Union City, Mich. 49094	Pit	Calhoun.
Hayward Dry Marl	Route 2 Vicksburg, Mich. 49097	Pit	Kalamazoo.
Poehlman & Son	Route 2 Cassopolis, Mich. 49031	Pit	Cass.
Sandstone:			
Ottawa Silica Co	33620 Streicher Rd. Rockwood, Mich. 48173	Pit and stationary plant.	Wayne.
Napoleon Stone Quarry	331 Austin Rd. Napoleon, Mich. 49261	Quarry and finishing plant.	Jackson.
Jude Stone Quarry	338 Austin Rd. Napoleon, Mich. 49261	---- do ----	Do.
Sulfur, recovered elemental:			
TOTAL Leonard Inc., Alma Div.	East Superior St. Alma, Mich. 48801	Byproduct sulfur recovery.	Gratiot.
Marathon Oil Co	1300 South Fort St. Detroit, Mich. 48217	---- do ----	Wayne.
Exfoliated vermiculite:			
Construction Products Div., W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	Processing plant	Do.

[1] A number of oil and gas producing companies operate in Michigan and they are listed in several commercial directories.

The Mineral Industry of Minnesota

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Minnesota Geological Survey for collecting information on all minerals except fuels.

By Cynthia T. Collins [1]

Mineral output in Minnesota in 1973 reached an alltime high value of $853 million, a 29% increase over that of 1972. Iron ore, the State's principal mineral commodity, accounted for 92% of total output value in 1973. Sand and gravel represented 5% of the total value and stone represented 2%.

Iron ore produced in Minnesota accounted for 68.5% of total U.S. iron ore production. Output consisted of 41.6 million tons of pellets and 18.4 tons of natural ore and concentrates. Most of the ore was produced in St. Louis and Itasca Counties. St. Louis County accounted for 81% of the total State mineral production value.

Employment in the mineral industry of Minnesota totaled 14,200 as of December 1973, with 13,000 employed in the iron mining industry, according to statistics published by the Minnesota Department of Employment Services. This was an increase of 10% over employment in 1972.

The Omnibus Tax bill became law on May 24, 1973. The bill provides for a 25-cent-per-acre tax on mineral property when the mineral interests are owned separately and apart from surface ownership of the property. There had been no tax on separate mineral rights in the past.

To encourage building of new taconite plants and the expansion of existing plants, the State Executive Council voted a 25-year extension on State taconite leases. The extension will begin in 1991 when the current 50-year leases are scheduled to expire.

In 1972, consumption of energy in the State of Minnesota totaled 1,171 trillion Btu.[2] Of this total, 48.1% was attributable to petroleum products, 16.5% to coal, 31.4% to natural gas, and 4.0% to nuclear and hydroelectric sources. Mineral fuels consumed in the production of this quantity of energy included 8.2 million short tons of coal, 103.7 million barrels of petroleum products, and 356.3 billion cubic feet of natural gas. Nuclear and hydroelectric sources contributed 4.4 billion kilowatt-hours of electricity. Minnesota, with a population of 3.9 million, ranked 28th in the Nation in terms of per capita consumption of energy, although it ranked 19th in population.

In 1972 a total of 20.2 billion kilowatt-hours of electricity was generated by 164 powerplants in Minnesota. Of the total output, 78% was produced from fossil fuels, 4% from hydroelectric plants, and 18% from nuclear powerplants.[3] Two nuclear powerplants were operated by Northern States Power Company in 1973, and a third, under construction, was expected to begin production late in 1974. The two operating plants were the Monticello nuclear generating plant, which is a boiling-water reactor (BWR) with a 545-megawatt capacity; and the Prairie Island nuclear generating plant unit 1 at Red

[1] Statistical assistant, Division of Ferrous Metals—Mineral Supply.
[2] Crump, L. H., and C. L. Readling. Fuel and and Energy Data: United States by States and Regions, 1972. BuMines IC 8647, 1974, 82 pp.
[3] Work cited in footnote 2.

Wing, which is a pressurized-water reactor (PWR) with a 530-megawatt capacity.

A shortage of diesel fuel in the spring of 1973 caused a cutback in production at the Butler taconite plant at Nashwauk, resulting in the temporary layoff of 28 employees. The shortage was due to a program that allocated fuel on the basis of the amount used during a base period in 1972. During the base period, the Butler plant had been closed by a strike, which created an artificially low consumption figure.

Table 1.—Mineral production in Minnesota [1]

Mineral	1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays [2] thousand short tons	167	$251	156	$233
Gem stones	NA	14	NA	14
Iron ore (usable) thousand long tons, gross weight	50,595	601,869	62,614	782,197
Manganiferous ore short tons	119,324	W	170,971	W
Sand and gravel thousand short tons	36,792	33,454	37,935	39,438
Stone do	5,757	16,318	7,581	20,411
Value of items that cannot be disclosed: Abrasive stone, cement, clays (kaolin), lime, peat, and values indicated by symbol W	XX	7,763	XX	10,492
Total	XX	659,669	XX	852,785
Total 1967 constant dollars	XX	544,292	XX	p 626,115

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Minnesota, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Aitkin	$109	W	Sand and gravel.
Anoka	W	W	Do.
Becker	117	W	Do.
Beltrami	W	$210	Do.
Benton	114	39	Do.
Big Stone	W	488	Stone, sand and gravel.
Blue Earth	1,397	W	Do.
Brown	W	W	Sand and gravel, clays.
Carlton	W	W	Sand and gravel, peat.
Carver	W	W	Sand and gravel, stone.
Cass	190	177	Sand and gravel.
Chippewa	W	295	Do.
Chisago	W	263	Do.
Clay	W	W	Sand and gravel, lime.
Clearwater	W	123	Sand and gravel.
Cook	W	W	Do.
Cottonwood	W	W	Do.
Crow Wing	1,494	W	Manganiferous ore, iron ore, sand and gravel.
Dakota	W	W	Sand and gravel, stone.
Dodge	W	W	Stone, sand and gravel.
Douglas	62	59	Sand and gravel.
Faribault	120	W	Do.
Fillmore	606	678	Stone, sand and gravel.
Freeborn	391	W	Sand and gravel.
Goodhue	W	700	Stone, sand and gravel.
Grant	W	W	Sand and gravel.
Hennepin	4,447	W	Sand and gravel, clays, stone.
Houston	W	355	Stone, sand and gravel.
Hubbard	--	W	Sand and gravel.
Isanti	29	--	
Itasca	75,527	90,092	Iron ore, sand and gravel, peat.
Jackson	W	W	Sand and gravel.
Kanabec	75	W	Do.
Kandiyohi	274	W	Sand and gravel, stone.
Kittson	W	W	Sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Minnesota, by county [1]—Continued
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Koochiching	$116	$62	Sand and gravel.
Lac qui Parle	414	W	Stone, sand and gravel.
Lake	80	67	Sand and gravel.
Lake of the Woods	W	62	Do.
Le Sueur	W	W	Sand and gravel, stone.
Lincoln	90	W	Sand and gravel.
Lyon	W	W	Do.
McLeod	27	24	Do.
Marshall	212	343	Do.
Martin	300	53	Do.
Meeker	W	W	Do.
Mille Lacs	W	W	Stone, sand and gravel.
Morrison	W	W	Sand and gravel.
Mower	W	745	Stone, sand and gravel.
Murray	7	17	Sand and gravel.
Nicollet	W	W	Sand and gravel, stone.
Nobles	W	W	Sand and gravel.
Norman	96	W	Do.
Olmsted	W	W	Stone, sand and gravel.
Otter Tail	W	146	Sand and gravel.
Pennington	122	W	Do.
Pine	17	340	Do.
Pipestone	W	W	Do.
Polk	W	W	Lime, sand and gravel.
Pope	W	37	Sand and gravel.
Ramsey	W	W	Sand and gravel, clays.
Red Lake	W	7	Sand and gravel.
Redwood	87	216	Sand and gravel, stone, clays.
Renville	W	W	Stone, sand and gravel.
Rice	W	W	Sand and gravel, stone.
Rock	640	797	Sand and gravel, abrasives, stone.
Roseau	59	87	Sand and gravel.
St. Louis	534,260	703,100	Iron ore, cement, sand and gravel, stone, peat.
Scott	W	2,374	Stone, sand and gravel.
Sherburne	931	1,506	Sand and gravel, stone.
Stearns	W	W	Stone, sand and gravel.
Steele	W	W	Sand and gravel, stone.
Stevens	W	W	Sand and gravel.
Swift	W	W	Do.
Todd	W	266	Do.
Traverse	W	140	Do.
Wabasha	W	298	Sand and gravel, stone.
Wadena	W	W	Sand and gravel.
Waseca	W	34	Do.
Washington	W	W	Sand and gravel stone.
Watonwan	8	W	Sand and gravel.
Wilkin	W	W	Do.
Winona	W	1,501	Stone, sand and gravel.
Wright	W	W	Sand and gravel, stone.
Yellow Medicine	424	W	Stone, sand and gravel.
Undistributed [2]	36,832	47,092	
Total [3]	659,669	852,785	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Mahnomen and Sibley Counties are not listed because no production was reported.

[2] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

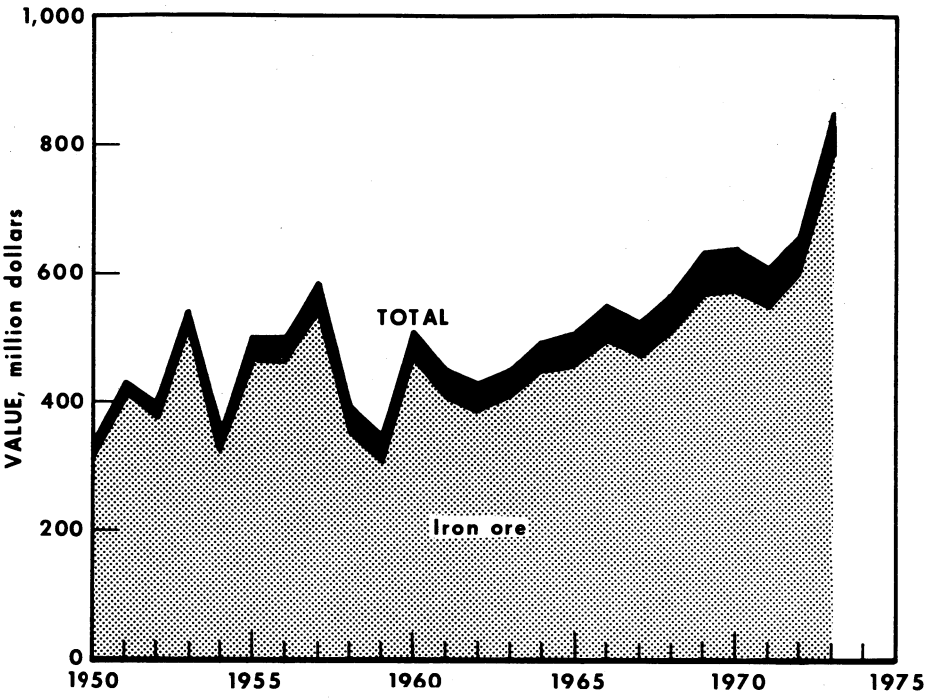

Figure 1.—Value of iron ore shipments and total value of mineral production in Minnesota.

Table 3.—Indicators of Minnesota business activity.

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total labor force ---------- thousands --	1,723	1,776	+3.1
Unemployment ---------- do ----	74	79	+6.8
Employment:			
Manufacturing ---------- do ----	310.8	331.0	+6.5
Construction ---------- do ----	62.1	67.4	+8.5
Mining ---------- do ----	13.2	14.1	+6.8
Transportation and public utilities ---------- do ----	86.8	90.7	+4.5
Wholesale and retail trade ---------- do ----	332.1	352.1	+6.0
Finance, insurance, real estate ---------- do ----	66.7	71.4	+7.0
Services ---------- do ----	240.8	254.8	+5.8
Government ---------- do ----	246.1	255.2	+3.7
Personal income:			
Total ---------- millions --	$16,746	$19,175	+14.5
Per capita ----------	$4,298	$4,921	+14.5
Construction activity:			
Value of authorized nonresidential construction millions --	$281.6	$408.3	+45.0
Number of private and public residential units authorized	37,338	21,427	−42.6
State highway commission contracts available millions --	e $125.0	$127.7	+2.2
Portland cement shipments to and within Minnesota ---------- thousand short tons --	1,602	1,762	+10.0
Farm marketing receipts ---------- millions --	$2,660.0	$4,218.2	+58.6
Mineral production value ---------- do ----	$659.7	$852.8	+29.3
International trade:			
Value of exports through Minnesota ---------- do ----	$499.9	$1,174.3	+134.9
Value of imports through Minnesota ---------- do ----	$900.6	$1,158.3	+28.6

e Estimate. p Preliminary.

Source: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; Highlights of U.S. Export and Import Trade; and U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

METALS

Copper-Nickel.—On November 29, 1973, the Minnesota Department of Natural Resources (DNR) held its sixth sale of copper-nickel exploration and mining leases. From 127 noncompetitive and 8 competitive bids, 5 companies were awarded leases on 135 mining units in Beltrami, Koochiching, Lake of the Woods, Marshall, and St. Louis Counties; the leases comprised 31,209 acres in the Greenstone Formation and 30,687 acres in the Duluth Gabbro Complex. Companies receiving the leases were Exxon Co. U.S.A., Amoco Minerals Co., Ridge Mining Co., The Superior Oil Co., and American Shield Corp.

The Federal Bureau of Mines Twin Cities Metallurgy Research Center continued metallurgical studies on copper-nickel ores found in the Duluth Complex. International Nickel Co. (INCO) was reportedly reconsidering the economic feasibility of developing its copper-nickel reserves in the complex near Ely.

Iron Ore.—Iron ore production in Minnesota in 1973 was 60 million long tons, the highest since 1957. It accounted for 68.5% of total U.S. production, compared with 65% in 1972, when production was 49 million tons. The increase of 9.1 million tons was due mainly to the first full year of operation of expanded facilities at the Minntac plant of United States Steel Corp., and record high shipments by Erie Mining Co. The average iron content of the ore produced was 60.5%, compared with 60.2% in 1972. Shipments of iron ore pellets in 1973 totaled 43.6 million tons, the largest since shipments of pellets began in 1956.

With the high level of demand from consuming plants, production of natural ores and concentrates increased to 18.4 million tons, 27% more than that of 1972. This was in contrast to the declining trend in production of natural ores. Several idle properties were reactivated in 1973.

In mid-1973, Pickands Mather & Co. (PM) and Bethlehem Steel Corp. announced plans to build a taconite plant near Hibbing. The plant will have a production capacity of 5.4 million tons per year of pellets and was scheduled to be completed by late 1976. Site preparation had begun by yearend. The mine and plant will be located just northeast of the Hull-Rust open pit. The project will be operated by the Hibbing Taconite Co., jointly owned by PM and Bethlehem, and will be the seventh major taconite project in the State.

Inland Steel Co. was considering construction of a taconite plant near Virginia in St. Louis County, but no decision was announced by yearend. The proposed plant would have a production capacity of 2.3 million tons per year of pellets.

In other developments, the Mahoning natural ore mine at Hibbing was closed by PM in midyear owing to exhaustion of ore reserves. The mine had produced about 128 million tons of ore since production began in 1895. Near Hibbing, The Hanna Mining Co. began stripping operations at the new Whitney natural ore mine. Ore production from the Whitney was scheduled to begin in 1974, to replace production from the Pierce mine, which was expected to be depleted by then. The Whitney ore body is a continuation of the Pierce deposit; the ore will be processed at the Pierce concentrator.

Trial of the suit filed against Reserve Mining Co. by the U.S. Department of Justice began August 1, 1973, at U.S. District Court in Minneapolis. The suit alleges pollution of Lake Superior by taconite tailings discharged from the company's plant at Silver Bay. Testimony was still being presented at yearend, and the trial was continued into 1974.

Erie Mining Co. completed installation of new emission-control equipment at its Taconite Harbor powerplant to assure compliance with the more stringent State laws on pollution control. Cost of the new equipment was reported to be $3 million. Other companies are in the process of making similar modifications to their plants to meet the new requirements.

Published prices for Lake Superior iron ores, delivered-rail-of-vessel at lower lake ports, were 5% to 6% higher in 1973 than during most of 1972. The published price of Mesabi non-Bessemer ore (basis 51.5% Fe natural) was $11.71 per long ton. The price of iron ore pellets was 29.4 cents per long-ton unit of iron, although in October The Hanna Mining Co. increased the price of pellets delivered to Lake Erie ports to 30.019 cents.

Owing to favorable weather conditions, the Great Lakes ore-shipping season began at Duluth on March 29, 1973, and iron ore shipping was underway at all Minnesota ports by April 6. The closing date of February 5, 1974, made the 1973 season the longest on record. The late closing date was made possible by the effectiveness of icebreaking, air bubbling, and other support systems for extending the navigation season on the Great Lakes.

Developments relating to the shipping of iron ore from Minnesota ports in 1973 included the completion of the 1,000-foot-long, integrated tug-barge unit, "Presque Isle," owned by United States Steel Corp. and operated by Litton Industries. The 152-foot, pusher-type tug fits into the notched stern of the 975-foot barge, which has a beam of 105 feet. With a maximum cargo capacity of 59,000 long tons of iron ore pellets, or 52,000 short tons of coal, the unit will carry pellets from Two Harbors to consuming plants of United States Steel in the Chicago-Gary area. PM and American Shipbuilding Co. (Amship) announced a contract to build two 1,000-foot self-unloading bulk freighters; the first is expected to be delivered in July 1976. The 105-foot-beam vessels will have a cargo capacity of 59,000 long tons of iron ore pellets, and unloading rates of up to 10,000 tons per hour.

Research at the Bureau of Mines Twin Cities Metallurgy Research Center in 1973 continued on beneficiation of nonmagnetic taconite, using reduction roasting-magnetic separation-flotation techniques. Research on the use of superconducting magnets in the separation of weakly magnetic taconite was being carried on at both the University of Minnesota and the University of Wisconsin. Some reduction in the mineral research program at the University of Minnesota Mineral Resources Research Center, was necessitated by a cut in appropriations by the State legislature.

Iron and Steel.—On October 1, 1973, United States Steel Corp. permanently closed its Duluth finishing mill and announced plans to convert the plant site into an industrial park. The corporation's coke-making facilities are to remain in operation. North Star Steel Co., now Minnesota's only steel mill, continued to produce steel from scrap in its two electric furnaces in St. Paul.

Manganiferous Ore.—Approximately 171,000 short tons of manganiferous ore was shipped in 1973, a 43% increase over shipments in 1972; there was no production. All shipments were made by The Hanna Mining Co. and Pittsburgh Pacific Co. from properties on the Cuyuna Range.

Table 4.—Minnesota: Iron ore [1] data, in 1973, by county and range
(Thousand long tons)

County and range	Crude ore [2]	Usable ore			
	Production	Stocks Jan. 1	Production	Iron content of production	Shipments	Stocks Dec. 31
County:						
Crow Wing	--	W	--	--	W	W
Itasca	24,181	404	8,712	5,136	8,822	295
St. Louis [3]	131,004	5,274	51,309	31,195	53,793	2,791
Total [4]	155,185	5,679	60,021	36,331	62,614	3,085
Range:						
Cuyuna	--	W	--	--	W	W
Mesabi [5]	155,185	5,679	60,021	36,331	62,614	3,085
Total	155,185	5,679	60,021	36,331	62,614	3,085

W Withheld to avoid disclosing individual company confidential data; included with Itasca County.
[1] Exclusive of ore containing 5% or manganese.
[2] Entire production from open pit mines.
[3] Includes Lake County.
[4] Data may not add to totals shown because of independent rounding.
[5] Includes small quantities from Cuyuna Range in Crow Wing County.

Table 5.—Minnesota: Usable iron ore [1] produced (direct-shipping and all forms of concentrate), by range

(Thousand long tons)

Year	Cuyuna	Mesabi	Vermilion	Spring Valley District	Total [2]
1884–1968	70,336	2,665,177	103,527	8,150	2,847,189
1969	--	55,275	--	--	55,275
1970	--	56,073	--	--	56,073
1971	--	51,283	--	--	51,283
1972	--	48,998	--	--	48,998
1973	--	60,021	--	--	60,021
Total	70,336	2,936,827	103,527	8,150	3,118,840

[1] Exclusive, after 1905, of iron ore containing 5% or more manganese.
[2] Data may not add to totals shown because of independent rounding.

Table 6.—Minnesota: Production of usable iron ore

(Thousand long tons)

	Natural ore			Taconite	Total usable ore [1]	Iron content (percent)
	Direct shipping ore	Concentrates	Total	Pellets		
1969	5,461	16,433	21,894	33,381	55,275	58.90
1970	3,892	16,836	20,728	35,345	56,073	58.76
1971	3,335	14,178	17,513	33,771	51,283	59.89
1972	W	W	14,452	34,546	48,998	60.20
1973	W	W	18,420	41,601	60,021	60.53

W Withheld to avoid disclosing company confidential data; included in "Total."
[1] Data may not add to totals shown because of independent rounding.

Table 7.—Minnesota: Shipments of iron ore [1] from mines

(Thousand long tons)

Year	Natural ore			Taconite	Total usable ore [3]	Proportion of taconite pellets to total usable ore (percent)
	Direct shipping ore [2]	Concentrates	Total	Pellets		
1969	5,461	17,802	23,263	33,693	56,957	59.16
1970	3,892	16,965	20,857	33,935	54,791	61.93
1971	3,335	13,100	16,435	32,619	49,054	66.50
1972	W	W	15,229	35,366	50,595	69.90
1973	W	W	19,013	43,601	62,614	69.63

W Withheld to avoid disclosing individual company confidential data, included in "Total."
[1] Exclusive of ore containing 5% or more manganese.
[2] Includes crushed, screened, and sized ore not further treated.
[3] Data may not add to totals shown because of independent rounding.

Table 8.—Dates of first and final cargoes of iron ore at Minnesota and Wisconsin upper Great Lakes

Port and dock	1972		1973	
	First	Final	First	Final
Duluth, Minn.: DM&IR	Apr. 13	Dec. 22	Mar. 29	Dec. 31
Silver Bay, Minn.: Reserve	Apr. 19	Dec. 29	Apr. 1	Jan. 13 [2]
Superior, Wis.: Burlington Northern	Apr. 24	Jan. 1 [1]	Apr. 1	Jan. 9 [2]
Taconite Harbor, Minn.: Erie	Apr. 21	Jan. 1 [1]	Apr. 6	Jan. 4 [2]
Two Harbors, Minn.: DM&IR	Apr. 16	Feb. 7 [1]	Apr. 1	Feb. 5 [2]

[1] 1973.
[2] 1974.

Source: Skillings' Mining Review.

Table 9.—Minnesota: Shipments of usable [1] manganiferous iron ore and ferruginous manganese ore from mines in the Cuyuna Range

Year	Manganiferous iron ore (5% to 10% Mn, natural)			Ferruginous manganese ore (10% to 35% Mn, natural)			Total shipments (long tons)
	Shipments (long tons)	Contents (natural)		Shipments (long tons)	Contents (natural)		
		Fe (Percent)	Mn (percent)		Fe (percent)	Mn (percent)	
1969	50	40.37	7.44	340,567	29.73	14.29	340,617
1970	--	--	--	286,996	29.96	13.97	286,996
1971	--	--	--	151,547	28.16	13.56	151,547
1972	--	--	--	106,539	27.09	12.64	106,539
1973	--	--	--	152,653	27.69	12.59	152,653

[1] Direct-shipping and beneficiated ore.

NONMETALS

Abrasive Stone.—Grinding pebbles and tube-mill liners were produced from quartzite quarried by the Jasper Stone Co. in Rock County. Production in 1973 increased from that of 1972 by about 2%, but total value increased 5%.

Cement.—United States Steel Corp. announced plans in August to continue operation of its Universal Atlas Cement Div. at Duluth. To comply with Minnesota Pollution Control Agency (MPCA) standards, which require 99% efficiency in dust-control equipment, the company announced that a bag-type collector will be installed on the shorter of the two stacks at the plant. Required efficiency had already been achieved for the taller stack by the earlier installation of an electrostatic precipitator. The plant continued to be the only cement producer in the State.

Clays.—Production of common clay and shale decreased 7% from 167,000 short tons, valued at $251,000, in 1972 to 156,000 short tons, valued at $233,000, in 1973. All of the clay was used in the production of lightweight aggregate and face brick.

Gem Stones.—Agates and similar semiprecious stones gathered by amateur collectors accounted for all State gem stone production.

Lime.—Production of lime in Minnesota decreased 14% in 1973, but value increased 5% compared with that of 1972. With the closing in 1972 of the Cutler-Magner Co. plant at Duluth, the State's only remaining producer was American Crystal Sugar Co. All lime produced from three plants in Clay and Polk Counties was used by the company in refining sugar. Consumption of lime in Minnesota from all U.S. sources was 146,400 short tons in 1973.

Perlite.—Minnesota's only expanded perlite producer, the Zonolite Div. of W. R. Grace and Co., produced expanded perlite at the Minneapolis plant from material mined outside the State. It was used primarily for horticultural purposes, but also for plaster and concrete aggregate, textured granules, and miscellaneous purposes.

Sand and Gravel.—The quantity of sand and gravel produced in Minnesota in 1973 was 37.9 million short tons valued at $39.4 million. Compared with 1972 figures, production increased 3% and value increased approximately 18%. Sand and gravel accounted for 5% of the value of all mineral commodities produced in the State, and ranked second only to iron ore. Average value was $1.04 per ton, compared with $0.91 per ton in 1972.

Table 10.—Minnesota: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972 Quantity	1972 Value	1973 Quantity	1973 Value
Commercial operations:				
Sand:				
Building	5,814	5,512	5,675	6,084
Fill	1,053	714	1,343	827
Paving	2,746	2,435	4,060	3,362
Railroad ballast	33	29	W	W
Other uses [1]	825	1,659	918	2,350
Total [2]	10,471	10,349	11,995	12,624
Gravel:				
Building	4,697	7,290	4,526	8,106
Fill	1,941	574	1,135	625
Paving	12,166	10,483	14,799	13,936
Railroad ballast	110	105	94	103
Miscellaneous	775	921	754	726
Other uses	291	251	159	197
Total [2]	19,980	19,624	21,468	23,693
Government-and-contractor operations:				
Sand:				
Building	3	1	2	2
Fill	369	137	46	33
Paving	311	270	316	211
Other uses	139	94	14	10
Total [2]	822	502	378	256
Gravel:				
Building	36	18	2	2
Fill	387	161	463	330
Paving	4,883	2,707	3,442	2,330
Other uses	213	94	186	204
Total [2]	5,519	2,980	4,094	2,865
Total sand and gravel [2]	36,792	33,454	37,935	39,438

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes engine (1972), filler (1972), foundry, glass, molding (1972), oil (hydrafrac, 1972), and other sands.

[2] Data may not add to totals shown because of independent rounding.

Table 11.—Minnesota: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972 Number of mines	1972 Quantity	1972 Value	1973 Number of mines	1973 Quantity	1973 Value
Aitkin	4	117	109	3	W	W
Becker	4	180	117	4	W	W
Beltrami	2	W	W	3	249	210
Benton	3	211	114	2	57	39
Blue Earth	3	380	388	6	564	555
Brown	4	292	W	4	226	103
Carlton	7	438	272	8	275	221
Carver	4	639	484	2	W	W
Cass	8	155	190	6	155	177
Chippewa	3	W	W	10	322	295
Chisago	4	W	W	6	355	263
Clay	11	1,309	1,889	11	870	1,112
Clearwater	3	W	W	4	145	123
Cook	1	9	W	2	15	W
Crow Wing	14	386	360	11	406	460
Dakota	14	3,141	3,143	15	3,479	3,569
Dodge	1	5	6	1	17	13
Douglas	2	122	62	2	148	59
Faribault	1	115	120	2	W	W
Fillmore	3	118	152	2	55	53
Freeborn	3	448	391	5	W	W
Goodhue	7	209	232	6	190	203
Hennepin	19	5,100	4,273	24	5,035	5,021

See footnotes at end of table.

Table 11.—Minnesota: Sand and gravel sold or used by producers, by county—Continued
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Houston	2	W	W	2	W	25
Hubbard	--	--	--	3	180	W
Isanti	1	50	29	--	--	--
Itasca	11	847	885	6	535	593
Kanabec	4	119	75	2	W	W
Kandiyohi	4	304	274	3	W	W
Koochiching	3	W	116	1	82	62
Lake	3	95	80	3	79	67
Lake of the Woods	2	W	W	2	86	62
Le Sueur	6	876	W	5	929	2,442
Lyon	3	104	90	3	W	W
McLeod	1	47	27	2	32	24
Marshall	4	209	212	5	396	343
Martin	4	319	300	2	87	53
Mille Lacs	2	W	165	3	166	141
Morrison	2	466	W	1	W	W
Mower	4	412	259	3	W	W
Murray	1	49	7	1	23	17
Nobles	4	252	W	2	W	W
Norman	1	130	96	2	W	W
Olmsted	5	382	372	4	400	416
Otter Tail	8	W	W	7	168	146
Pennington	4	239	122	3	W	W
Pine	3	W	17	3	339	340
Polk	7	813	771	7	626	588
Pope	1	W	W	1	24	37
Red Lake	2	W	W	1	7	7
Redwood	3	W	14	3	W	W
Renville	6	316	287	10	570	480
Rice	4	280	W	2	W	W
Rock	2	W	48	3	W	W
Roseau	6	114	59	3	128	87
St. Louis	27	1,722	1,402	34	3,610	3,493
Scott	4	279	W	4	610	607
Sherburne	6	735	931	6	1,261	1,504
Stearns	4	303	56	7	441	262
Steele	7	348	537	3	W	W
Swift	3	62	W	1	W	W
Todd	3	287	W	3	356	266
Traverse	1	W	W	1	140	140
Waseca	1	W	W	1	69	34
Washington	16	2,559	3,040	16	2,928	3,600
Watonwan	1	54	8	2	W	W
Wright	8	592	610	12	1,351	1,354
Yellow Medicine	5	135	124	4	56	85
Undistributed [1]	r 51	9,918	10,145	45	9,692	9,688
Total [2]	375	36,792	33,454	376	37,935	39,438

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Anoka, Big Stone, Cottonwood, Grant, Jackson, Kittson, Lac qui Parle, Lincoln, Meeker, Nicollet, Pipestone, Ramsey, Stevens, Wabasha, Wadena, Wilkin, and Winona Counties (1973), and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Stone.—Value of all stone produced in Minnesota in 1973 was $20.4 million, up 25% from that of 1972. Stone ranked third in value of State mineral production, accounting for 2% of total value.

Limestone and dolomite accounted for 85% of total stone output, and 53% of total stone value. Principal production was as crushed rock. However, the 0.2% produced as dimension stone was 6% of the total limestone and dolomite value.

Most of the granite quarried in Minnesota was for use as crushed rock and dimension stone. The Granite City Granite Co. at St. Cloud was closed at the end of the year due to consolidation with three other granite producers, Delano Granite, Inc., the Braham Monument Co., and Green-Olsen Memorials of Duluth. All four were bought by Rembrandt Enterprises of Minneapolis, but only the latter three will continue operations. The 50-year-old Delano plant was scheduled to be remodeled.

Table 12.—Minnesota: Limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousand dollars unless otherwise specified)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension:				
Rough architectural [1] ____ thousand cubic feet	24	79	12	50
Cut stone ____ do	43	777	59	775
House stone veneer [2] ____ do	98	430	107	403
Total (thousand short tons) [3]	13	1,285	15	1,228
Crushed and broken:				
Bituminous aggregate	224	284	404	559
Concrete aggregate	262	420	731	1,197
Dense graded roadbase stone	2,819	4,102	2,982	4,252
Macadam aggregate	237	324	W	W
Surface treatment aggregate	636	866	608	905
Unspecified construction aggregate and roadstone	82	114	663	1,071
Agricultural limestone	231	454	223	416
Riprap and jetty stone	40	49	44	62
Other [4]	293	578	663	1,123
Total [3]	4,825	7,190	6,318	9,585
Grand Total [3]	4,838	8,475	6,333	10,813

W Withheld to avoid disclosing individual company confidential data; included in "Other."
[1] Data include irregular shaped stone, rubble, and rough flagging (1973).
[2] Data include sawed stone, dressed flagging, and monumental (1972).
[3] Data may not add to total shown because of independent rounding.
[4] Data include stone used for railroad ballast and uses not specified. 1973 data include filter stone, asphalt filler, bedding material, and other uses in minor quantities.

Table 13.—Minnesota: Granite sold or used by producers, by use

(Thousand short tons and thousand dollars unless otherwise specified)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension:				
Rough architectural ____ thousand cubic feet	W	W	W	W
Rough monumental ____ do	W	W	258	472
Flagging ____ do	--	--	8	46
Dressed architectural ____ do	196	W	W	W
Dressed monumental ____ do	W	W	W	W
Total (thousand short tons)	22	W	W	W
Crushed and broken:				
Aggregate and roadstone [1]	W	W	363	W
Poultry grit	7	W	W	W
Railroad ballast	195	300	W	W
Riprap and jetty stone	W	W	W	W
Filter stone	--	--	4	6
Other [2]	--	--	553	1,665
Total	W	W	920	1,671
Grand total	W	W	W	W

W Withheld to avoid disclosing individual company confidential data.
[1] Includes stone used for concrete aggregate, bituminous aggregate, surface treatment aggregate (1972), dense graded roadbase stone (1973), and unspecified construction aggregate and road stone (1973).
[2] Includes items indicated by symbol W in 1973.

Table 14.—Minnesota: Stone sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973			Kind of stone produced in 1973 [1]
	Number of quaries	Quantity	Value	Number of quaries	Quantity	Value	
Big Stone	1	(2)	W	2	W	W	Granite.
Blue Earth	3	W	1,009	4	W	W	Limestone.
Carver	--	--	--	1	61	91	Do.
Dakota	1	W	W	1	W	W	Do.
Dodge	3	W	W	3	W	W	Do.
Fillmore	6	280	454	10	345	625	Do.
Goodhue	4	W	W	15	374	496	Do.
Hennepin	1	31	W	2	1	2	Do.
Houston	12	W	W	14	253	330	Do.
Kandiyohi	--	--	--	2	3	5	Do.
Lac qui Parle	3	W	W	3	2	289	Granite.
Le Sueur	3	29	727	2	W	W	Dolomite.
Mille Lacs	1	1	W	1	W	W	Granite.
Mower	2	W	W	5	W	W	Limestone.
Nicollet	1	W	W	1	W	W	Quartzite.
Olmsted	12	W	W	11	W	W	Limestone.
Redwood	2	W	W	2	W	W	Granite.
Renville	1	1	W	1	W	W	Do.
Rice	1	W	W	2	W	W	Limestone.
Rock	1	W	W	1	W	W	Quartzite.
St. Louis	7	115	327	6	153	358	Traprock.
Scott	4	770	1,393	5	1,019	1,767	Limestone.
Sherburne	--	--	--	1	1	2	Granite.
Stearns	8	W	W	10	W	W	Do.
Steele	1	W	W	1	125	181	Limestone.
Wabasha	2	W	W	2	W	W	Do.
Wadena	1	W	W	--	--	--	
Washington	3	W	W	3	W	W	Limestone.
Winona	5	W	W	9	366	907	Do.
Wright	1	W	W	1	W	W	Other stone.
Yellow Medicine	1	195	300	2	W	W	Granite.
Undistributed	--	r 4,335	12,108	--	4,878	15,359	
Total [3]	91	5,757	16,318	123	7,581	20,411	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] "Limestone" used generally to include dolomite.
[2] Less than ½ unit.
[3] Data may not add to totals shown because of independent rounding.

Sulfur.—Byproduct sulfur continued to be recovered from petroleum refining operations by the Koch Refining Co. (formerly the Great Northern Oil Co.) of Pine Bend, Dakota County, and the Northwestern Refining Co. at St. Paul Park, Washington County.

Vermiculite.—Production of exfoliated vermiculite in 1973 increased 11%. The expanded material was produced by three Twin Cities companies from vermiculite shipped from outside the State. It was sold for use as concrete and plaster aggregate, insulation, packing material, fireproofing, and for horticultural purposes.

MINERAL FUELS

Gasoline.—A total of 36.8 million barrels of gasoline (excluding naphtha) was produced in 1973 by Minnesota's three refineries. The crude oil was received principally from Canada. Small amounts of crude oil were received from Montana and North Dakota, but none was produced in Minnesota. Despite a 6-month-long strike at the State's largest refinery, Koch Refining Co., gasoline production in Minnesota in 1973 was 9% greater than in 1972 and 24% greater than in 1971. The three refineries, operated by Continental Oil Co., Koch Refining Co., and Northwestern Refining Co., have a combined daily output capacity of 176,700 barrels.

The American Petroleum Institute reported consumption of 51.3 million barrels of gasoline in the State in 1973, a slight increase over consumption in 1972.

Peat.—Production of peat by three companies in Minnesota in 1973 increased 25% over that in 1972. It consisted principally of moss and reed-sedge peat used in general soil improvement and in potting soils. Most was sold in packaged form, but minor quantities were sold in bulk. Minnesota contains 50% of the known peat deposits in the Nation, yet contributes only a small fraction of total U.S. production.

Table 15.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Universal Atlas Cement Division, United States Steel Corp.	Chatham Center, Box 2969 Pittsburgh, Pa. 15230	Portland and masonry, wet process.	St. Louis.
Clays and shale:			
North Central Lightweight Aggregate Co. Inc.	4901 West Medicine Lake Dr. Minneapolis, Minn. 55427	Pit and plant ----	Hennepin.
Ochs Brick & Tile Co -----	Springfield, Minn. 56087	Pits and plant ----	Brown, Redwood.
Twin City Brick Co -------	790 Joy Ave. St. Paul, Minn. 55118	Pit and plant ----	Ramsey.
Coke:			
American Steel & Wire Division, United States Steel Corp.	Morgan Park Duluth, Minn. 55800	Coke ovens -------	St. Louis.
Koppers Co., Inc ----------	1000 Hamline Ave., North St. Paul, Minn. 55104	---- do ----------	Ramsey.
Iron ore:			
Cleveland-Cliffs Iron Co.:	1460 Union Commerce Bldg. Cleveland, Ohio 44115		
Canisteo and Hill-Trumbull.	----------	Mines and concentrator.	Itasca.
The Hanna Mining Co.:	100 Erieview Plaza Cleveland, Ohio 44114		
Butler Taconite Project	----------	Mine, concentrator, agglomerator.	Do.
National Steel Pellet Project.	----------	---- do ----------	Itasca, St. Louis.
Pierce Group ---------	----------	Mine and concentrator.	St. Louis.
Jones & Laughlin Steel Corp., Northwest Ore Division:	Virginia, Minn. 55792		
Delaware, Hill Annex, Lind-Greenway.	----------	Mines and concentrators.	Itasca.
McKinley ----------	----------	Mine and concentrator.	St. Louis.
Oglebay Norton Co.:	Hanna Bldg. Cleveland, Ohio 44115		
Thunderbird mine ----	----------	Mine ----------	Do.
Fairlane plant -------	----------	Concentrator and agglomerator.	Do.
Pickands Mather & Co.:	1100 Superior Ave. Cleveland, Ohio 44114		
Erie Commercial ------	----------	Mine, concentrator, agglomerator.	Do.
Mahoning ----------	----------	Mine and concentrator.	Do.
Pittsburgh Pacific Co.:	2521 First Ave. Hibbing, Minn. 55746		
Higgins Leonard-Burt, Monroe-Tener, Wyoming Annex and others.	----------	Mines ----------	Do.
Coons Pacific, Julia, Monroe plants.	----------	Concentrators ----	Do.
Reserve Mining Co.:	Silver Bay, Minn. 55614		
Peter Mitchell -------	----------	Mine and primary crushing.	Do.
E. W. Davis Works ---	----------	Concentrator and aglomerator.	Lake.
Rhude & Fryberger, Inc.:	Box 66 Hibbing, Minn. 55746		
Gross Nelson and Hull-Rust group.	----------	Mines and concentrator.	St. Louis.
United States Steel Corp., Minnesota Ore Operations:	Box 417 Mountain Iron Minn. 55768		
Minntac ----------	----------	Mine, concentrator, agglomerator.	Do.
Plummer group ------	----------	Mine and concentrator.	Itasca.
Rouchleau group ------	----------	Mine ----------	St. Louis.
Sherman Group -------	----------	Mine and concentrator.	Do.
Stephens mine --------	----------	---- do ----------	Do.
Iron and steel:			
North Star Steel Co ------	1400 Red Rock Rd., St. Paul, Minn. 55519.	Electric steel furnace.	Ramsey.

Table 15.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Secondary lead smelters:			
Gopher Smelting & Refining Co.	33855 S. Highway 49 St. Paul, Minn. 55111	Processing plant	Dakota.
NL Industries, Inc	3645 Hampshire Ave., South Minneapolis, Minn. 55426	do	Hennepin.
Lime:			
American Crystal Sugar Co	Boston Bldg. Denver, Colo. 80201	Quicklime, shaft kilns.	Clay, Polk.
Manganiferous ore:			
The Hanna Mining Co.:	100 Erieview Plaza Cleveland, Ohio 44114		
Lauretta		Stockpile shipments	Crow Wing.
Pittsburgh Pacific Co.:	2521 First Ave. Hibbing, Minn. 55746		
Louise and Mangan No. 1		do	Do.
Peat:			
Power-O-Peat Co	Gilbert, Minn. 55741	Peat bog	St. Louis.
Red Wing Peat Corp	Box 3006 Houston, Tex. 77001	do	Carlton.
Expanded perlite:			
W. R. Grace & Co	62 Whittemore Ave. Cambridge, Mass. 01109	Processing plant	Hennepin.
Sand and gravel:			
Alexander Construction Co., Inc.	4641 Hiawatha Ave. Minneapolis, Minn. 55403	Pits and portable plants.	Dakota, Hennepin, Washington.
Anderson Aggregates, Inc	100 North Seventh St. Minneapolis, Minn. 55403	Pit, stationary and portable plant.	Hennepin.
Barton Contracting Co	10300 89th Ave., North Osseo, Minn. 55369	Pits and stationary plants.	Carlton, Chisago, Dakota, Hennepin, Sherburne, Washington.
Cemstone Products Co	1520 East Minnehaha Ave. St. Paul, Minn. 55106	Portable plant	Washington.
Duininck Bros. & Gilchrist	Olivia, Minn. 56277	Pits and portable plants.	Big Stone, Carlton, Clearwater, Kandiyohi, Kittson, Marshall, Polk, Redwood, Renville, Roseau.
Fisher Sand & Aggregates	Rosemount, Minn. 55068	Stationary plant	Dakota.
Hallet Construction Co	Box 519 Detroit Lakes, Minn. 56501	Pits	Becker, Chippewa, Nicollet, Rock.
C. McCrossan, Inc	Box 322, Osseo, Minn. 55369	Stationary plant	Hennepin.
Northwestern Gravel Co	P.O. Box 1248 Burnsville, Minn. 55378	Pit	Dakota.
J. L. Shiely Co	1101 North Snelling Ave. St. Paul, Minn. 55108	Pit and stationary plant.	Washington.
Ulland Brothers, Inc	Box 98 Austin, Minn. 55912	Pits and portable plants.	Freeborn, Mower, Olmsted, Steele.
Do	Box 340 Cloquet, Minn. 55720	do	Carlton, Cook, Lake, St. Louis.
Stone:			
Granite:			
Cold Spring Granite Co	Cold Spring, Minn. 56320	Quarries	Big Stone, Lac qui Parle, Mille Lacs, Renville.
Do		Quarries and stationary plants.	Stearns.
Delano Granite, Inc	Delano, Minn. 55328	Quarries	Lac qui Parle, Stearns.
Do		Stationary plant	Wright, Yellow Medicine.
The Green Co	Granite Falls, Minn. 56241	Quarry and stationary plant.	
Shiely-Petters Crushed Stone Co., Inc.	Box 69, St. Cloud, Minn. 56301	do	Stearns.
Limestone and dolomite:			
Bryan Rock Products, Inc.	Box 215 Shakopee, Minn. 55379	Quarries; stationary and portable plant.	Scott, Washington.
Hector Construction Co., Inc.	Box 410 Caledonia, Minn. 55921	Quarries and portable plants.	Houston, Winona.

Table 15.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued.			
Limestone and dolomite—Continued			
Kielmeyer Construction Co.	Nerstrand, Minn. 55053	5 quarries	Goodhue, Rice.
Edward Kraemer & Sons, Inc.	Plain, Wis. 53577	Quarry and stationary plant.	Dakota.
Lundin Construction	1905 Third Ave. Mankato, Minn. 56001	Quarry	Blue Earth.
Mankato Ag Lime & Rock Co.	Route 3, Mankato, Minn. 56001	Quarry and stationary plant.	Do.
Osmundson Brothers	Adams, Minn. 55909	Quarries and portable plant.	Mower.
Quarve & Anderson Co	Route 3, Box 27, Rochester, Minn. 55901	Quarries and portable plants.	Dodge, Olmsted, Wabasha, Winona.
River Warren Aggregates, Inc.	Lakeville, Minn. 55074	do	Scott.
J. L. Shiely Co	1101 North Snelling Ave. St. Paul, Minn. 55108	do	Scott, Washington.
Marl:			
Richard Nanik Marl Pit	Star Route Staples, Minn. 56479	Pit	Wadena.
Quartzite:			
Jasper Stone Co	Box 206 Sioux City, Iowa 51102	Quarry and stationary plant.	Rock.
New Ulm Quartzite Quarries, Inc.	New Ulm, Minn. 56073	do	Nicollet.
Traprock (basalt):			
Arrowhead Blacktop Co.	14th Ave. West & Waterfront Duluth, Minn. 55802	Pit	St. Louis.
Sulfur (recovered):			
Koch Refining Co	Box 3596 St. Paul, Minn. 55101	Elemental sulfur recovered as a byproduct of oil refining.	Dakota.
Exfoliated vermiculite:			
MacArthur Co	936 Raymond Ave. St. Paul, Minn. 55114	Processing plant	Ramsey.
The B. F. Nelson Manufacturing Co.	401 Main St., NE. Minneapolis, Minn. 55413	do	Hennepin.
Zonolite Div., W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 01109	do	Do.

The Mineral Industry of Mississippi

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Mississippi Geological, Economic, and Topographical Survey for collecting information on all minerals except fuels.

By C. L. Readling [1] and Alvin R. Bicker, Jr.[2]

Value of mineral production in Mississippi reached $281.7 million in 1973, the highest value ever attained, and was 10.3% greater than the revised 1972 mineral production value of $255.3 million. Petroleum (crude) and natural gas constituted 84% of the total value. Although production for both petroleum and natural gas was lower than in 1972, average unit value of petroleum increased 21% and natural gas was up 5% in average unit value. Value of all other mineral production, excluding petroleum and natural gas, increased $5 million and was 12.5% higher than in 1972.

Securing adequate fuel to generate power posed a major problem for the two utility companies in the State. Curtailment of natural gas by all major suppliers, coupled with scarcity and high cost of fuel oil used as a substitute fuel, caused the average cost of fuel used by the Mississippi Power and Light Co. (MP&L) for power generation to increase more than 55% over the 1972 level. The Mississippi Power Co. reported that the average cost of all fuel burned for power generation increased almost 35% in 1973. Increases in fuel prices, after a short lag, are substantially recovered by the utility companies through a fuel adjustment clause in their rate schedules.

Construction continued on the MP&L 750,000-kilowatt Gerald Andrus steam electric station near Greenville. At yearend it was approximately 65% complete and was slated to go on-line in late 1974. This station is the first in the MP&L system designed to use residual fuel oil as the principal fuel and represents an investment of approximately $117 million.

[1] Mineral specialist, Division of Interfuels Studies.
[2] Economic geologist, Mississippi Geological, Economic, and Topographical Survey, Jackson, Miss.

Table 1.—Mineral production in Mississippi [1]

Mineral	1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays ---- thousand short tons --	1,919	$7,837	2,075	$9,082
Natural gas ---- million cubic feet --	103,989	r 22,670	99,706	22,846
Petroleum (crude) thousand 42-gallon barrels --	61,100	192,465	56,102	213,747
Sand and gravel -- thousand short tons --	13,419	16,133	14,251	17,383
Stone ---- do ----	1,135	1,199	[2] 760	[2] 809
Value of items that cannot be disclosed: Cement, lime, magnesium compounds, natural gas liquids, and limestone --	XX	14,970	XX	17,871
Total ----	XX	r 255,274	XX	281,738
Total 1967 constant dollars ----	XX	210,627	XX	p 206,852

p Preliminary. r Revised. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes limestone; included with "Value of items that cannot be disclosed."

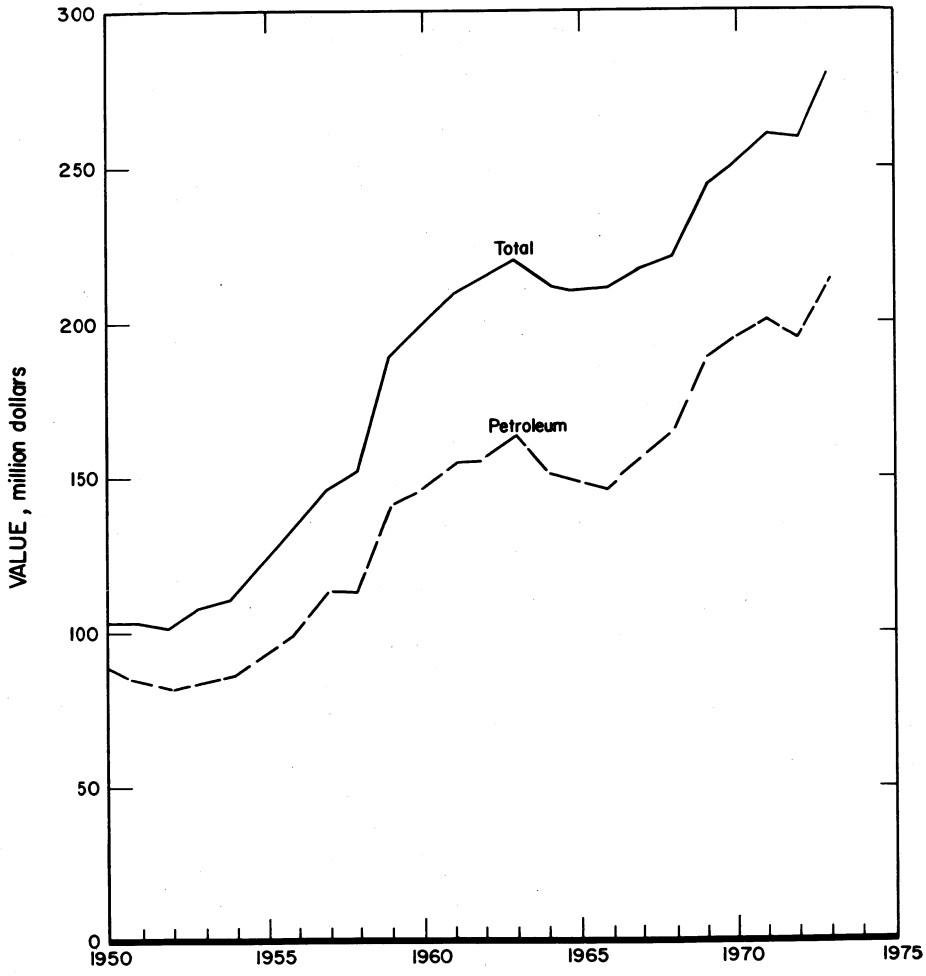

Figure 1.—Value of petroleum and total value of mineral production in Mississippi.

Table 2.—Value of mineral production in Mississippi, by county [1 2]
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adams	r $20,136	$18,616	Petroleum, sand and gravel, natural gas, natural gas liquids.
Alcorn	W	W	Clays.
Amite	r 4,700	W	Petroleum, natural gas.
Bolivar	W	--	
Calhoun	--	W	Natural gas.
Carroll	2,003	W	Sand and gravel, clays.
Chickasaw	--	W	Natural gas.
Clarke	r 38,624	48,426	Petroleum, natural gas, natural gas liquids.
Clay	r 671	484	Sand and gravel, natural gas, stone.
Copiah	3,014	W	Sand and gravel, natural gas, petroleum.
Covington	r 458	W	Natural gas, petroleum.
De Soto	W	950	Sand and gravel.
Forrest	r 2,513	2,434	Sand and gravel, natural gas, petroleum, clays.
Franklin	r 7,562	7,024	Petroleum, natural gas.

[1] See footnotes at end of table.

Table 2.—Value of mineral production in Mississippi, by county [1] [2]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Greene	$333	$556	Petroleum, natural gas.
Grenada	--	418	Sand and gravel.
Hancock	r 228	227	Natural gas, petroleum.
Hinds	r 1,672	2,115	Petroleum, clays, natural gas.
Holmes	W	W	Sand and gravel, petroleum.
Humphreys	57	12	Petroleum.
Itawamba	r 607	752	Clays, natural gas, sand and gravel.
Jackson	W	42,669	Petroleum, natural gas, natural gas liquids.
Jasper	r 34,224	W	Magnesium compounds, lime.
Jefferson	r 870	W	Petroleum, natural gas.
Jefferson Davis	r 4,062	3,373	Natural gas, petroleum, natural gas liquids.
Jones	r 9,925	9,696	Petroleum, natural gas, clays.
Kemper	43	W	Clays.
Lamar	r 28,645	30,310	Petroleum, natural gas.
Lauderdale	W	W	Clays.
Lawrence	--	W	Sand and gravel.
Lee	W	W	Clays.
Leflore	r 38	W	Sand and gravel, petroleum, natural gas.
Lincoln	r 4,608	4,855	Petroleum, clays, natural gas.
Lowndes	W	W	Sand and gravel, clays.
Madison	r 1,480	W	Petroleum, natural gas.
Marion	r 5,814	5,533	Natural gas, petroleum, sand and gravel.
Marshall	348	343	Clays.
Monroe	r 3,276	3,863	Clays, sand and gravel, natural gas, petroleum.
Noxubee	W	W	Clays, stone, sand and gravel.
Oktibbeha	r 11	W	Natural gas.
Panola	W	W	Clays, sand and gravel.
Pearl River	r 508	W	Natural gas, petroleum.
Perry	W	W	Sand and gravel, petroleum, natural gas.
Pike	r 2,025	1,792	Petroleum, sand and gravel, natural gas, natural gas liquids.
Prentiss	W	W	Clays.
Quitman	--	W	Do.
Rankin	r 7,045	9,130	Cement, natural gas, petroleum, stone.
Scott	r 230	W	Petroleum, natural gas.
Simpson	r 1,637	W	Do.
Smith	r 10,145	10,100	Petroleum, natural gas, natural gas liquids, clays.
Stone	W	W	Sand and gravel.
Sunflower	23	22	Clays.
Tippah	W	W	Do.
Tishomingo	W	W	Sand and gravel, stone.
Walthall	r 8,484	W	Natural gas, petroleum.
Warren	5,730	5,759	Cement, sand and gravel, stone.
Washington	W	300	Sand and gravel.
Wayne	r 14,058	15,969	Petroleum, natural gas, stone.
Wilkinson	r 5,136	W	Petroleum, natural gas.
Winston	59	W	Clays.
Yalobusha	432	465	Sand and gravel.
Yazoo	r 11,379	13,383	Petroleum, sand and gravel, natural gas.
Undistributed [3]	12,459	42,160	
Total [4]	r 255,274	281,738	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties were not listed because no production was reported: Attala, Benton, Choctaw, Claiborne, Coahoma, George, Harrison, Issaquena, Lafayette, Leake, Montgomery, Neshoba, Newton, Pontotoc, Sharkey, Tallahatchie, Tate, Tunica, Union, and Webster.

[2] Value of petroleum is based on an average price per barrel for the State.

[3] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Mississippi business activity

		1972	1973 p	Change, percent
Employment and labor force, annual average:				
Total work force	thousands	863.6	903.6	+4.6
Unemployment	do	33.7	32.9	−2.4
Employment (nonagricultural):				
Construction	do	36.1	41.8	+15.8
Mining	do	6.1	6.1	--
All manufacturing	do	207.2	217.8	+5.1
Other industries [1]	do	388.6	410.6	+5.7
Personal income:				
Total	millions	$7,099	$7,864	+10.8
Per capita		$3,137	$3,448	+9.9
Construction activity:				
Building permits, total private nonresidential	millions	$106.1	$91.7	−13.6
Cement shipments to and within Mississippi	thousand short tons	1,001	1,045	+4.3
Mineral production value	millions	$255.3	$281.7	+10.3

p Preliminary.
[1] Includes transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; services; and government.

Sources: Survey of Current Business; Construction Review; Employment and Earnings; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

Progress was made on application for a construction permit from the Atomic Energy Commission to build the $1.2 billion Grand Gulf nuclear station near Port Gibson. Present plans call for two units, each with a capability of 1,250,000 kilowatts. The first unit is scheduled to begin operating in 1979.

The impact of fuel shortages during 1973 on the Mississippi Power Co. and its customers was minimized by the fact that 65% of the company's generating capacity was from coal-fired units. The largest of these, a 500,000-kilowatt unit at Plant Jack Watson located between Biloxi and Gulfport, was completed and placed in service in mid-1973. Construction continued on a new fossil-fired generating plant on the Pascagoula River in Jackson County. The first unit of 500,000 kilowatts is planned for completion in early 1976, with a second unit of the same size to be completed in the spring of 1978. For environmental reasons, the plant was designed to use low-sulfur residual oil. With the current uncertainty of reliable supplies of oil, the Mississippi Power Co. was considering installation of facilities that would permit the use of coal as an alternate fuel for the first two units.

The first sale of Federal leases off Mississippi, Alabama, and Florida was held by the Department of the Interior on December 20 in New Orleans, La. Interior rejected bids on 2 of the 89 tracts receiving offers out of the 147 put up in the sale.

The 87 bids accepted totaled $1,491,065,230 for rights to drill on 485,396 acres off the coast of Mississippi, Alabama, and Florida.

Flooding by the Mississippi River and its tributaries during April hampered oil and gas production in south Mississippi, mainly in Adams and Wilkinson Counties. The flooding affected 138 wells with a combined production of almost 7,000 barrels per day. Divers had to be used to shut in some wells. It was the greatest flood south of Cairo, Ill., since 1937, and created higher flow lines than had been expected by coming in several crests rather than in one crest. As a result of the flood, 800 miles of main-line Mississippi levees are being raised.

Overall oil- and gas-drilling operations declined 16.1% in 1973. Drilling activity in the Eocene Wilcox trend was curtailed by the flood and contributed to the decline, though the trend was the most active in the State.

Exploratory well-drilling completions were down 12.3%, and development drilling activity was down 21%. Drilling in the Eocene Wilcox trend of southwestern Mississippi decreased 33.5% in 1973 as compared with 1972 activity. McNeal field in Jasper County, a new Jurassic oilfield, had four completions at yearend, and further development was being conducted. Lake Como (Jurassic) in Jasper County

developed five oil wells, and five oil wells were completed in the Eocene Wilcox discovery, Bisland Bayou field, in Adams County.

The Standard Oil Co. announced plans to install two isomax desulfurization units, a 25,000-barrel-per-day rheniformer, two 85-ton-per-day sulfur recovery units, and new tank and wharf facilities at its refinery in Pascagoula. Originally designed to process low-sulfur crude oil from Louisiana, the refinery is being modified to enable processing in excess of 100,000 barrels daily of high-sulfur foreign crude oil and still meet environmental standards.

The Mississippi Geological, Economic, and Topographical Survey published another bulletin [3] in its series of comprehensive investigations of the mineral resources of individual counties. Also published was a bulletin [4] of geologic names.

Employment.—The number of wage-and-salary workers in petroleum production, refining, and related industries decreased 1.7% according to the Mississippi Employment Security Commission. Employment in the mining industry has averaged 6,100 since 1971 and constituted 0.9% of the total nonagricultural labor force.

Table 4.—Mississippi: Wage-and-salary workers in petroleum production, refining, and related industries

Year	Crude petroleum and natural gas production	Petroleum refining [1]	Pipeline transportation (except natural gas)	Gas utilities	Retail filling stations	Chemicals manufactured as byproducts of petroleum or used in refining of petroleum [2]
1969	5,515	864	158	2,141	5,084	417
1970	5,900	1,000	175	2,153	5,238	424
1971	5,738	1,059	181	2,187	5,115	411
1972	5,764	1,038	182	2,225	5,429	397
1973	5,131	1,006	177	2,236	5,766	459

[1] Employment in petroleum refineries and petrochemicals manufactured in petroleum refineries.
[2] Employment in petrochemical manufacturing facilities located outside petroleum refineries.

Source: Mississippi Employment Security Commission.

Legislation and Government Programs.—In response to the Arab oil embargo in October, the Bureau of Mines Liaison Officer was detailed to be the Federal Allocation Officer for middle distillate fuel allocation in the State effective November 1.

The Legislative Audit Committee terminated the participation of the State in the Federal Occupational Safety and Health Act (OSHA) program after investigation revealed that the State had no law authorizing such participation.

The OSHA Act, which had been in effect since April 1972, authorized States to assume responsibility for enforcing the Federal regulations after submitting an acceptable plan. The Mississippi plan had been submitted to the U.S. Department of Labor. All inspections for citations were being conducted by Federal inspectors until legislation was approved to give the Mississippi Health Department authority to enter an agreement with Federal officials.

Transportation.—The Tennessee Gas Pipeline Co. completed 64 miles of 36-inch gas pipeline in Mississippi and Alabama and 72 miles of 36-inch gas pipeline in Mississippi and Tennessee.

The Mississippi Fuels Co. constructed a 186-mile gas pipeline from southeastern Mississippi to the MP&L Rex Brown steam electric generating plant in Jackson.

According to the American Gas Association (AGA), there were 16,781 miles of utility gas mains in Mississippi at the end of 1973. During the year 516 miles of utility gas mains were installed, of which 273 miles were distribution lines and 243 miles were transmission lines. At the end of 1972 there were 16,402 miles of utility gas mains in the State. Allowing for old

[3] Luper, E. E., and others. Smith County Geology and Mineral Resources. Miss. Geol., Econ., and Topographical Survey Bull. 116, 1973, 189 pp.
[4] Cildress, S. C. Mississippi Geologic Names. Miss. Geol., Econ., and Topographical Survey Bull. 118, 1973, 172 pp.

pipe replaced or retired from use, there was a net gain of 379 miles of utility gas mains for the year.

There were 3,058 miles of crude-oil and refined-products pipelines in the State as of January 1, 1971, according to the latest Bureau of Mines crude-oil and product pipelines triennial report.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The combined value of crude petroleum and natural gas production increased by $21.5 million and was 10% higher than the comparable 1972 value. The combined value of $236.6 million was 84% of the State's total mineral production value, compared with 84.3% in 1972.

Mississippi ranked 9th in order of crude oil production, 12th in natural gas production, and 19th in natural gas liquids production. Leading counties, in order of mineral fuels value, were the same as in 1972: Clarke, Jasper, Lamar, Adams, Wayne, Yazoo, and Smith.

According to the Mississippi State Oil and Gas Board, there were 7 new gasfields and 11 new oilfields discovered during the year, encompassing production from 5 geologic intervals. Four oil discoveries were productive from Tertiary (Eocene) age sediments, and four oil discoveries and one gas discovery were productive from formations of Jurassic age. Four gas discoveries and one oil discovery produced from the Mississippian pool (Paleozoic era). Two oil discoveries and one gas discovery produced from Lower Cretaceous formations, and one gas discovery was productive from formations of Upper Cretaceous age.

Tertiary oil discoveries were Bisland Bayou (Armstrong reservoir) in Adams County, Silver Creek (Parker) in Wilkinson County, Ogden Bayou (Sparta) in Adams County, and North Corbin Branch (Parker) in Franklin County. Jurassic discoveries were McNeal (Lower Cotton Valley reservoir), Hale (Upper Smackover), Boyce (Smackover), Waldrup (Cotton Valley), and Thornton (Smackover—gas discovery).

All of the Paleozoic discoveries were in Monroe County. South Splunge produced oil from a Carter sandstone. Two gasfield discoveries were dually completed: Four Mile Creek (Carter A and Carter B) and McKinley Creek (Pennsylvanian and Mississippian). The remaining two Paleozoic gasfield discoveries were Splunge (Carter) and Strong (Sanders).

Upper Cretaceous discoveries were all productive from the Lower Tuscaloosa Formation. The Cobb Branch and East McElveen discoveries are located in Amite County, and Hurricane Creek field (gas) was discovered in Marion County.

According to the Mississippi Oil and Gas Board, as of December 31, 1973, there were 435 oil pools and 79 gas pools producing in 430 fields in the State. Producible wells totaled 3,090—357 fewer than on December 31, 1972.

The Mississippi Geological, Economic, and Topographical Survey was cooperating with the Bureau of Mines in a survey of lignite deposits in the northeastern part of the State. Core samples were being analysed and evaluated at the Bureau of Mines Energy Research Center in Pittsburgh, Pa.

Table 5.—Mississippi: Oil and gas well drilling completions, by county

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Adams	9	--	17	4	--	30	60	372,232
Amite	2	--	4	2	--	7	15	174,394
Clarke	4	--	6	1	--	11	22	291,944
Clay	--	--	1	--	--	1	2	8,701
Copiah	--	1	2	--	--	--	3	55,214
Franklin	1	--	4	--	--	14	19	121,965
Greene	--	--	1	--	--	1	2	25,096
Hinds	--	--	--	--	--	1	1	12,507

See footnote at end of table.

Table 5.—Mississippi: Oil and gas well drilling completions, by county—Continued

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Holmes	--	--	--	--	1	--	1	12,077
Issaquena	--	--	--	--	--	1	1	21,061
Itawamba	--	1	1	--	--	--	2	3,220
Jasper	17	--	9	2	--	11	39	560,647
Jefferson	--	--	1	--	--	7	8	55,127
Jefferson Davis	--	2	1	--	--	--	3	28,112
Jones	2	--	1	--	--	3	6	91,141
Lamar	2	--	2	--	--	2	6	57,990
Lincoln	3	--	8	--	1	8	20	232,379
Lowndes	--	--	--	--	--	1	1	5,612
Madison	--	--	--	--	--	1	1	4,510
Marion	--	--	2	--	1	1	4	48,012
Monroe	1	2	4	--	8	10	25	92,239
Oktibbeha	--	--	--	--	--	2	2	32,394
Pearl River	--	--	--	--	--	1	1	9,527
Perry	--	--	--	--	--	4	4	53,543
Pike	--	--	1	--	--	3	4	44,106
Pontotoc	--	--	--	--	--	1	1	4,010
Prentiss	--	--	--	--	--	2	2	5,322
Rankin	1	6	--	--	1	3	11	103,544
Scott	--	--	--	--	--	5	5	78,894
Simpson	--	--	--	--	2	--	2	28,574
Smith	1	--	--	--	--	3	4	66,666
Stone	--	--	--	--	--	1	1	7,660
Tishomingo	--	--	--	--	--	1	1	3,505
Walthall	1	1	--	1	1	6	10	124,278
Warren	--	--	--	--	--	1	1	16,515
Wayne	8	--	1	1	--	8	18	224,643
Wilkinson	3	--	4	1	--	27	35	271,570
Yazoo	2	--	3	1	--	1	7	66,802
Total	57	13	73	13	15	179	350	3,415,733

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 6.—Mississippi: Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

Commodity	Proved reserves Dec. 31, 1972	Changes in proved reserves due to extensions and discoveries in 1973	Proved reserves Dec. 31, 1973 (production deducted)	Changes from 1972 (percent)
Crude oil thousand barrels	312,458	32,102	291,049	−6.9
Natural gas liquids thousand barrels	14,620	969	14,090	−3.6
Natural gas million cubic feet	1,104,336	182,087	1,178,218	+6.7

Source: American Petroleum Institute and American Gas Association.

Natural Gas.—Marketed natural gas production was 99.7 billion cubic feet, a decline of 4.1% from the 104 billion cubic feet marketed in 1972. This marked the ninth consecutive year that marketed natural gas volume has declined in the State. Wellhead value in 1973 averaged 22.9 cents per thousand cubic feet (Mcf), up 5% from 21.8 cents per Mcf in 1972. Mississippi ranked 12th in the Nation in marketed production of natural gas.

Seven of 36 gas-producing counties supplied 80.4% of the natural gas produced in the State. In descending order of production they were Walthall, Marion, Jefferson Davis, Rankin, Smith, Jasper, and Clarke. Four additional counties reported natural gas production in 1973—Calhoun, Chickasaw, Copiah, and Perry.

Natural gas reserves in Mississippi increased in 1973, reversing the downward trend begun in 1961. According to the

AGA, estimated gas reserves were 1,178.2 billion cubic feet as of December 31, 1973, a 6.7% increase compared with the 1,104.3 billion cubic feet at yearend 1972.

The reserve-to-production ratio increased from 10.6:1 in 1972 to 11.8:1 in 1973. In 1961 the ratio was 16.4:1.

Seven new gasfields were discovered during the year, according to the Mississippi State Oil and Gas Board. Four of these were in Monroe County: Four Mile Creek (dual completion—productive from Mississippian Carter A and Carter B gas pools), Strong (Mississippian-Sanders), McKinley Creek (dual completion—flowing from Mississippian-Lewis and Pennsylvanian-Nevins gas pools), and Splunge (Mississippian-Carter). The other new gasfield discoveries were Thornton (Smackover) in Holmes County, Oak Grove (Rodessa) in Simpson County, and Hurricane Creek (Lower Tuscaloosa) in Marion County.

Underground storage of gas was at four operations: Amory Field in Monroe County, Jackson Dome in Rankin and Hinds Counties, Eminence Dome in Covington County, and Muldon Field, Monroe County. According to the AGA, the 69 storage wells of the 4 pools held 78,442 million cubic feet of gas on December 31, 1973. Ultimate storage capacity was 109,517 million cubic feet.

Natural Gas Liquids.—Reserves of natural gas liquids as of December 31, 1973, decreased 530,000 barrels, or 3.6%, from yearend 1972, according to the AGA. Mississippi contained 0.2% of the Nation's natural gas liquids reserves.

According to the Oil and Gas Journal annual survey of natural gas plants,[5] 9 plants in Mississippi as of December 31, 1973, had a total capacity of 241.9 MMcfd, a decrease of 21.1% from the capacity of 306.7 MMcfd at yearend 1972. This capacity was slightly more than 0.3% of the U.S. total. The survey indicated that the Mississippi plants operated at an average of 48.3% of capacity in 1973.

The Sun Oil Co. Mercer gas processing plant in Adams County was closed April through June due to flooding of the Mississippi River.

Four companies conducted underground natural gas liquids operations in the Petal salt dome, Forrest County. According to the 1973 LPG storage survey of the Natural Gas Processors Association (NGPA), storage capacity in the dome was 6.75 million barrels of propane and 177,000 barrels of butane-propane mix.

Petroleum.—Mississippi ranked ninth in crude petroleum production and accounted for 1.7% of U.S. output in 1973. State production of 56.1 million barrels of crude petroleum was valued at $213.7 million, an average unit value of $3.81 per barrel and an increase of 21% over the average $3.15 per barrel in 1972. Seven counties produced more than 2 million barrels of crude petroleum, accounting for 80.8% of the total State production. These counties, in descending order of production, were Clarke, Jasper, Lamar, Adams, Wayne, Yazoo, and Jones. Salt water produced in association with crude petroleum production was 201.9 million barrels, an average of 3.6 barrels of water for each barrel of petroleum.

The 350 wells drilled for oil and gas in Mississippi represented 1.3% of the total wells drilled in the United States. Drilling activity declined 16.1%. Rig, pipe, and tubing shortages throughout the year, plus extensive flooding of the Mississippi River, were important factors in the overall drilling decline.

[5] Oil and Gas Journal. 1974 Survey of Gas Processing Plants. V. 72, No. 28, July 8, 1974, p. 80.

Table 7.—Mississippi: Crude oil production, indicated demand, and stocks in 1973, by month
(Thousand 42-gallon barrels)

Month	Production	Indicated demand [1]	End of month stocks originating in Mississippi
January	5,024	4,173	4,674
February	4,314	4,498	4,490
March	4,848	5,098	4,240
April	4,633	4,584	4,289
May	4,751	5,068	3,972
June	4,571	4,993	3,550
July	4,768	5,058	3,260
August	4,787	3,998	4,049
September	4,606	5,082	3,573
October	4,669	4,798	3,444
November	4,520	4,379	3,585
December	4,611	4,865	3,331
Total:			
1973	56,102	56,594	XX
1972	61,100	61,405	XX

XX Not applicable.
[1] Calculated from monthly production and changes in stocks.

Table 8.—Mississippi: Crude petroleum production by field
(Thousand 42-gallon barrels)

Field	1972	1973	Cumulative through Dec. 31, 1973
Baxterville	8,870	7,768	159,507
Bay Springs	2,110	1,772	24,615
Brookhaven	1,094	794	67,744
Bryan	1,027	753	22,204
Davis	1,517	1,582	5,214
East Eucutta	1,130	1,199	37,752
East Heidelberg	3,678	3,761	74,008
West Heidelberg	1,450	1,563	35,148
Lake Como	656	1,196	1,864
West Nancy	1,729	1,541	6,428
Pachuta Creek	3,123	4,581	20,587
Quitman Field	1,232	918	13,202
Quitman Bayou	1,396	1,340	12,783
Soso	1,092	1,002	52,207
Tinsley	3,114	3,054	193,413
Other fields	27,882	23,278	722,381
Total	61,100	56,102	1,449,057

Source: Mississippi State Oil and Gas Board.

According to American Petroleum Institute (API) drilling statistics, proved field well drilling activities dcereased 21% and exploratory drilling decreased 12.3% from 1972 activities. There were 70 successes—57 oil and 13 gas producers—from 143 proved field wells drilled. There were 13 successful oil and 15 successful gas ventures from a total of 207 exploratory wells drilled, a success ratio of 13.5%. Exploratory drilling accounted for 59.1% of all drilling activity in the State.

Exploratory and development oil and gas well drilling totaled 3,415,733 feet. Average depth per well drilled in Mississippi was 9,759 feet, compared with a national average of 5,129 feet. A Getty Oil Co. well in Jones County set a new depth record for Mississippi at over 24,000 feet and reportedly could go to 24,500 feet to test the Jurassic Smackover Formation.

According to the Mississippi State Oil and Gas Board monthly bulletin data, 44% of exploratory wells were drilled to the Wilcox Formation (Tertiary age), 21% to Cretaceous age formations, 11% to the Jurassic age trend, and 7% to formations of Paleozoic age. Of the proved field well completions, 28% were drilled to the Wilcox Formation, 31% to Cretaceous age formations, 26% to the Jurassic trend, and

7% to the Paleozoic trend. As of December 31, 1973, approximately 2,901 oil wells were producing an average of 50.4 barrels of crude oil per well per day in Mississippi.

According to API estimates, proved crude oil reserves as of December 31, 1973, were 291 million barrels, 21.5 million barrels less than at yearend 1972. The crude oil reserves to production ratio was 5.2:1 compared with the nationwide average of 10.5:1.

Crude-oil-refining capacity of the five refineries in the State was 328,000 barrels per calendar day, as of January 1, 1973. Capacity was 324,200 barrels per day on the same date in 1972.

Petrochemicals.—The Mississippi Chemical Corp. announced a planned $43 million expansion over the next 2 years of its fertilizer manufacturing facilities in Pascagoula and Yazoo City. Almost a fourth of the cost will be for environmental controls. The Pascagoula project includes a 1,500-ton-per-day sulfuric acid plant and a 1,000-ton-per-day mixed-fertilizers manufacturing unit.

NONMETALS

The combined value of nonmetals and natural gas liquids production was $45.1 million and represented 16% of the value of mineral production. This value of nonmetals including natural gas liquids production was an increase of 12.5% over the comparable 1972 value.

Cement.—Portland and masonry cements were produced at two plants using the wet process. Raw materials used in making cement were limestone, marl, oyster shells, and gypsum. Shipments of portland cement in 1973 were 4.4% less than in 1972, while shipments of masonry cement were up 12.5% for the same period. Average unit value for masonry cement increased 47% from $21.03 per ton in 1972 to $31 in 1973. Portland cement average unit value increased from $21.44 per ton to $22.97.

Consumption of portland and masonry cement in the State totaled 968,000 tons and 77,000 tons, respectively. Most of the cement (74.3%) was shipped to ready-mix concrete companies.

Construction continued on the Texas Industries, Inc., $15 million cement plant near Columbus. The new plant was scheduled to go on-stream in January 1974.

Clays.—Clays sold and used in Mississippi totaled almost 2.1 million tons in 1973, an 8.1% increase over the 1972 figure. However, total value of clay and shale increased 15.9% for the same period and contributed 3.2% of the State's mineral production value. Ball clay and fuller's earth output was up 15.3%. Common clay output was up 8.4% and accounted for 78.2% of total clay output. Bentonite output increased 3%.

Clays were mined from 32 pits in 21 counties. Leading counties, in descending order of output, were Hinds, Noxubee, Marshall, and Monroe. Production from these four counties comprised 64.4% of the State total. Common clay used for brick, lightweight aggregates, flue lining, drain tile, and sewer pipe was mined in 15 counties. Bentonite was mined in three counties. Ball clay was mined in Panola and Quitman Counties, and fuller's earth was mined, in Tippah County.

Astro Brick and Block Co. announced plans to construct a new plant at Hattiesburg to cost about $1 million. The plant will have five kilns with expected production of 10,000 to 11,000 bricks per hour. In June, Delta Macon Brick and Tile Co. placed a new kiln in operation, and Tri-State Brick and Tile Co. began operation of a new plant expected to increase production by 60%.

Table 9.—Mississippi: Clays sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Year	Bentonite		Ball clay, fire clay, and fuller's earth		Common clay		Total [1]	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1969	299	3,525	305	3,999	1,099	1,136	1,703	8,660
1970	262	3,124	318	3,930	974	1,008	1,553	8,062
1971	281	3,396	[2] 137	[2] 2,966	1,860	2,139	2,278	8,501
1972	278	3,388	[2] 144	[2] 2,943	1,497	1,506	1,919	7,837
1973	286	3,607	[2] 166	[2] 3,390	1,623	2,085	2,075	9,082

[1] Data may not add to totals shown because of independent rounding.
[2] Ball clay and fuller's earth.

Lime.—Corchem, Inc., produced quicklime at Pascagoula in Jackson County. Output expanded 47% and was 10% above the 1970 record. Total lime consumption in Mississippi was 169,400 tons. Raw material for lime production was dolomite quarried in Alabama and shipped into the State.

Magnesium Compounds.—Production of magnesium compounds used in the manufacture of refractory bricks increased 25.3% over that of 1972 and was 13.4% higher than production in 1970. Average unit value increased 14.3% in 1973.

Perlite.—Johns Manville Perlite Corp. continued to produce expanded perlite in Adams County near Natchez. Production decreased 7.2% in 1973 compared with the 1972 output, but was 14.7% greater than in 1971. Average unit value increased 4.9% per ton compared with the 1972 figure. All perlite production was used for roof insulation board.

Sand and Gravel.—Production was reported by 33 companies (including operations by the U.S. Army Corps of Engineers and by 1 county) operating in 24 counties. Output was 14.25 million tons, 6.2% greater than in 1972. The leading producing counties, in descending order of output, were Copiah, Monroe, Lowndes, Forrest, and Yazoo. These five counties produced 8.35 million tons, or 58.6% of the State output. The average unit value for sand and gravel was $1.22 per ton, compared with $1.20 per ton in 1972.

Sand output totaled 4,505,000 tons. Paving operations accounted for 52% of the sand used, and building construction consumed 46.1%. Fill, railroad ballast, and miscellaneous uses accounted for the remaining 1.9% of sand use. Paving operations consumed 58.3% of the 9,747,000 tons of gravel used; building, 33.5%; and fill, railroad ballast, and miscellaneous uses, 8.2%. The average unit value for gravel increased 3.2% to $1.29 per ton.

Table 10.—Mississippi: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	2,627	2,989	2,019	2,157
Fill	78	72	35	23
Paving	2,003	2,137	2,313	2,391
Railroad ballast	W	19	W	W
Other uses [1]	98	138	50	101
Total [2]	4,806	5,355	4,416	4,672
Gravel:				
Building	2,831	3,724	3,195	4,423
Fill	(3)	(3)	566	316
Paving	5,373	6,588	5,662	7,438
Railroad ballast	2	(3)	W	W
Miscellaneous	284	199	186	156
Other uses	--	--	45	52
Total [2]	8,489	10,512	9,654	12,385
Government-and-contractor operations:				
Sand:				
Building	56	86	59	97
Paving	--	--	29	15
Total [2]	56	86	89	111
Gravel:				
Building	68	180	73	204
Paving	--	--	19	11
Total [2]	68	180	93	214
Total sand and gravel [2]	13,419	16,133	14,251	17,383

W Withheld to avoid disclosing individual company confidential data; included in "Other uses."
[1] Includes molding.
[2] Data may not add to totals shown because of independent rounding.
[3] Included with miscellaneous gravel.

Stone.—Output was reported by six companies from seven quarry operations. Crushed and broken limestone was produced in Rankin, Tishomingo, Warren, and Wayne Counties. Marl was quarried in Clay, Noxubee, and Warren Counties.

Shell stone for use as poultry grit was produced in Warren County. Total output declined compared with that of 1972. Average unit value (per ton) for marl was $1.07; shell, $1.05; and limestone, $1.07. Cement manufacturing consumed 77.2% of stone output, and agricultural uses accounted for 13.7%.

Sulfur.—Recovery of sulfur from refinery and natural gases was reported in Clarke, Jackson, Lamar, and Rankin Counties. Sales of recovered sulfur in 1973 increased almost sevenfold. The Shell Oil Co. plant in Thomasville accounted for more than 87% of the sulfur recovered. Standard Oil Co. of Kentucky began adding desulfurization equipment to its Pascagoula refinery at yearend 1970. Sulfur recovery began at this plant in 1972. Average unit value increased 6.1% from comparable 1972 figures.

Table 11.—Principal producers

Commodity and company	Address	Type of activity or producing fields	County
Cement:			
Marquette Cement Mfg. Co.	20 North Wacker Dr. Chicago, Ill. 60606	Plant	Rankin.
Valley Cement Ind. Inc	Box 22491 Jackson, Miss. 39205	do	Warren.
Clays:			
Atlas Brick Co	P. O. Box 67 Shuqualak, Miss. 39361	3 mines	Noxubee.
Delta-Macon Brick & Tile Co. Inc.	RFD 3, Box 2 Macon, Miss. 39341	Mine and plant	Do.
Filtrol Corp	3250 East Washington Blvd. Los Angeles, Calif. 90023	do	Itawamba and Smith.
Holly Springs Brick & Tile Co. Inc.	Box 310 Holly Springs, Miss. 38635	do	Marshall.
International Minerals & Chemical Corp.	Administration Center Old Orchard Rd. Skokie, Ill. 60076	Mine	Monroe.
Jackson Ready Mix Concrete, Div. of Delta Industries Inc.	P.O. Box 1292 Jackson, Miss. 39205	do	Hinds.
Tri-State Brick & Tile Co., Inc.	Box 9787 Jackson, Miss. 39206	Mine and plant	Do.
Lime: Corchem, Inc	Box 1707 Pascagoula, Miss. 39567	Plant	Jackson.
Magnesium compounds: Corhart Refractories Co.	1600 West Lee St. Louisville, Ky. 40210	do	Do.
Sand and gravel:			
American Sand & Gravel Co.	Box 272 Hattiesburg, Miss. 39401	Stationary	Forrest.
Blaine Gravel Co	Box 268 Crystal Spring, Miss. 39059	do	Copiah.
Contractors Gravel Co	P.O. Box 2069 Columbus, Miss. 39701	Portable	Monroe.
J. J. Ferguson Sand & Gravel	Box 318 Greenwood, Miss. 38930	Stationary	Carroll.
Green Bros. Gravel Co., Inc.	Route 4, Box 17 Franklinton, La. 70438	do	Copiah.
Memphis Stone & Gravel Co.	Box 6246 Memphis, Tenn. 38111	do	De Sota.
Petermann Gravel Corp	P.O. Box 161 Yazoo City, Miss. 39194	do	Yazoo.
Riverside Gravel Co	Box 207 Lexington, Miss. 39095	do	Pike.
W. J. Runyon & Son, Inc.	3312 Oak St. Vicksburg, Miss. 39180	do	Warren.
West Point Gravel Co	P.O. Box 304 West Point, Miss. 39773	do	Clay and Monroe.
Traxler Gravel Co., Div. of Delta Ind., Inc.	Box 1292 Jackson, Miss. 39205	Stationary and dredge	Copiah.
Stone:			
Marquette Cement Mfg. Co.	20 North Wacker Dr. Chicago, Ill. 60606	Quarry	Rankin.
Valley Cement Ind., Inc	Box 22491 Jackson, Miss. 39205	do	Warren.
State Department of Agriculture and Commerce.	West Point, Miss. 39773	do	Clay.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity or producing fields	County
Oil and gas:			
Atlantic Richfield Co	Box 2819 Dallas, Tex. 75221	East Heidelberg	Jasper.
Amoco Production Co	Box 591 Tulsa, Okla. 74102	Clear Springs	Franklin.
		Collins	Covington.
		Dollar Lake	Leflore.
		Dry Bayou	Franklin.
		North Freewoods	Do.
		Knoxville	Do.
		North Knoxville	Do.
		Quitman Bayou	Adams.
		Stringer	Jasper.
		Zeigler Creek	Franklin.
Chevron Oil Co., Western Div.	Box 599 Denver, Colo. 80201	Brookhaven	Lincoln.
		South Center Ridge	Smith.
		Cranfield	Adams and Franklin.
		Hub	Marion.
		Hub East	Do.
		Knoxo	Walthall.
		East Mallalieu	Lincoln.
		West Mallalieu	Do.
		Mize	Smith.
		Pisgah	Rankin.
		Puckett	Rankin and Smith.
		Raleigh	Simpson.
		Reedy Creek	Jones.
Cities Service Oil Co	Box 12026 Jackson, Miss. 39211	Hazlit Creek	Wilkinson.
		North Mud Creek	Do.
Continental Oil Co	Box 2197 Houston, Tex. 77001	Davis	Clarke.
Exxon Co. U.S.A	Box 2180 Houston, Tex. 77001	Baxterville	Marion and Lamar.
		Bryan	Jones and Jasper.
		East Fairview	Adams.
		Gillsburg	Amite.
		Gwinville	Jefferson Davis.
		Hub	Marion.
		Hub East	Do.
		Knoxo	Walthall.
		Pistol Ridge	Pearl River.
		Sandy Hook	Marion.
		East Yellow Creek	Wayne.
Getty Oil Co	Box 1404 Houston, Tex. 77001	East Nancy	Do.
		West Nancy	Do.
Gulf Oil Corp	Box 1166 Pittsburgh, Pa. 15230	Baxterville	Lamar and Marion.
		Bolton	Hinds.
		Gwinville	Jefferson Davis.
		Heidelberg	Jasper.
		East Heidelberg	Do.
		West Heidelberg	Do.
		Pistol Ridge	Forest and Pearl River.
		Soso	Jasper, Jones, Smith.
		East Yellow Creek	Wayne.
Meason Operating Co	Natchez, Miss. 39120	North Carthage Point	Adams.
		Clear Springs	Franklin.
		Courtland	Adams.
		Dexter	Walthall.
Pennzoil Producing Co	900 Southwest Tower Houston, Tex. 77002	Tinsley	Yazoo.
Placid Oil Co	1401 Elm St. Dallas, Tex. 75202	Nancy	Clarke.
Shell Oil Co	Shell Building 921 Common New Orleans, La. 70112	Pachuta Creek	Do.
		Goodwater	Do.
		Bay Springs	Jasper.
		Tallahala Creek	Smith.
		East Tallahala Creek	Do.
Skelly Oil Co	Box 1650 Tulsa, Okla. 74101	Bay Springs	Jasper.
		Goodwater	Clarke.
Sun Oil Co	1608 Walnut Philadelphia, Pa. 19103	Baxterville	Lamar.
		Diamond	Wayne.
		West Eucutta	Do.
		East Franklin	Franklin.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity or producing fields	County
Oil and gas—Continued			
Sun Oil Co	1608 Walnut Philadelphia, Pa. 19103	East Heidelberg	Jasper.
		Kokomo	Walthall
		Mantua	Adams.
		McComb	Pike.
		Mercer	Adams.
		Pistol Ridge	Forrest and Pearl River.
		Sandy Hook	Marion.
		Smithdale	Amite.
		Tom Branch	Franklin.
		West Yellow Creek	Wayne.
Texaco, Inc	Box 60252 New Orleans, La. 70150	Baxterville	Lamar.
		Pachuta Creek	Clarke.
Petroleum refineries:			
Amerada Hess Corp., Hess Oil & Chemical Div.	One Hess Plaza Woodbridge, N.J. 07095	Purvis refinery	Calhoun.
Southland Oil Co	P.O. Box 328 Yazoo City, Miss. 39194	Sandersville refinery	Jones.
		Lumberton refinery	Lamar.
		Crupp refinery	Yazoo.
Standard Oil Co	P.O. Box 328 Yazoo City, Miss. 39194	Pascagoula refinery	Jackson.

The Mineral Industry of Missouri

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Division of Geological Survey and Water Resources of Missouri, for collecting information on all minerals.

By J. Patrick Ryan [1] and James A. Martin [2]

Total value of Missouri's mineral output increased in 1973 for the 12th consecutive year and, with a 13% gain over 1972, exceeded the half-billion-dollar mark and recorded a new high. Significant increases in value were recorded for most mineral commodities. Lead production was just under the record tonnage of 1972, but higher market prices brought total value to a record $159 million. Output of 82,000 tons of zinc made Missouri the Nation's principal zinc producer, up from third place in 1972. Silver output reached a new high, making Missouri the sixth largest producer in the Nation. Cement also set a new tonnage record, and coal output was the highest in many years.

In addition to record highs in mineral production, highlights of mineral-related developments in 1973 also included an orderly cleanup and shaft-sealing operation in the Old Lead Belt after shutting down the last mine in the district, opening of the new Brushy Creek mine of St. Joe Minerals Corp. (St. Joe), and achievement of full operation at the Midway mine of Pittsburgh and Midway Coal Co. in Bates County. Other notable events affecting the State's mineral industry included fuel shortages in the winter of 1972–73, announcement of plans for Missouri's first nuclear generating plant, accelerated efforts to solve a wide variety of environmental problems, and a commercial-scale "power-from-waste" project. At yearend 1973 a severe energy crisis was having deep effects and far-reaching implications for the State's mineral producing, processing, transporting, and consuming industries.

Trends and Developments.—The most pronounced trend in Missouri's minerals industry in the past several years has been the rapid growth, expansion, and diversification of producing, processing, fabricating, and consuming activities.

The No. 1 headframe at the old Bonne Terre mine of St. Joe Minerals Corp. was toppled on November 16, 1973, as dismantling of surface structures continued to erase all signs of mining and milling in the Old Lead Belt where St. Joe had its beginning in 1864.

Development of the Brushy Creek mine by St. Joe in the New Lead Belt began in 1972, and the mine was officially opened in May 1973. The production shaft was 1,450 feet deep, and the concentrating plant with lead, zinc, and copper circuits was designed to process 5,000 tons of ore per day. The Brushy Creek mine-mill complex was designed to produce the equivalent of 50,000 tons of lead per year.

St. Joe estimates its proven lead ore reserves at 50 million tons, enough for 15 years at current production levels, and its probable ore reserves at another 100 million tons, or 30 years of production.

St. Joe, the largest miner of lead in the United States, has four operating mine-mill units in the New Lead Belt in southeast Missouri: Fletcher, Viburnum, Indian

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Creek, and the newest one at Brushy Creek. These deposits are among the most productive in the world, and the New Lead Belt accounts for about 80% of U.S. production. In 1973, St. Joe's lead concentrate output was lower than in the previous year due to the phasing-in of the new facility at Brushy Creek, but output was expected to resume its upward trend. Zinc-in-concentrate production also was increasing.

Mine operations in the New Lead Belt have been accompanied by a substantial increase in productivity, largely due to the higher grades of ore, averaging 4%—8%, compared with the 2%–3% ore mined in the last days of the Old Lead Belt. Trackless mining and automated mills added flexibility and efficiency.

The mills at Fletcher and Brushy Creek incorporate computer-controlled processes to reduce the ore to concentrates. The entire plant can be operated by a few employees. At a mine like Brushy Creek, these factors can mean a savings of 4 cents per pound of lead over Old Lead Belt operating cost, according to company estimates.

As an integrated producer, St. Joe mines, smelts, and refines all its lead concentrates. The company's lead smelter at Herculaneum, Mo., is the Nation's largest, with a capacity of 230,000 tons of lead annually. Herculaneum's capacity was not fully used in 1973 because of a planned shutdown to install new environmental control equipment. Capacity is expected to be enhanced in 1974 because the smelter will operate on a full-time basis and with increased efficiency.

Despite the 3-week shutdown to connect the $5 million baghouse and related facilities, smelter production of 215,000 tons of lead exceeded the 1972 production of 207,877 tons. The new facility, financed through tax-free bonds at an interest rate of 5¾%, will enable the plant to operate near capacity in 1974 and still remain in compliance with existing regulations for stack emissions.

The Missouri mine-mill-smelter complex, owned jointly by AMAX, and Homestake Mining Co., benefited from increased production through favorable ore grades and higher prices. About 1.6 million tons of ore was mined and milled in 1973, an increase of 10% over 1972. Production of lead concentrate was up 19% to 225,000 tons, and zinc concentrate increased 42% to 116,500 tons. The smelter produced 135,000 tons of refined lead in 1973, representing 18% of domestic primary metal production. Of the total refined lead output, 38,400 tons was for the account of AMAX, an equal quantity was for Homestake, and the remainder was refined on toll for other producers.

Table 1.—Mineral production in Missouri [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Barite ---------- thousand short tons --	213	$3,637	196	$3,395
Cement:				
Masonry ---------- do ----	80	1,859	84	2,400
Portland ---------- do ----	4,277	80,898	4,582	99,858
Clays ---------- do ----	[2] 2,571	[2] 9,096	2,551	11,626
Coal (bituminous) ---------- do ----	4,551	23,667	4,658	24,999
Copper (recoverable content of ores, etc.) short tons --	11,509	11,785	10,273	12,224
Iron ore (usable) thousand long tons, gross weight --	2,695	W	2,630	W
Lead (recoverable content of ores, etc.) short tons --	489,397	147,113	487,143	158,711
Lime ---------- thousand short tons --	W	W	1,626	23,534
Natural gas ---------- million cubic feet --	9	2	33	8
Petroleum (crude) - thousand 42-gallon barrels --	60	W	60	W
Phosphate rock ---------- thousand short tons --	--	--	42	W
Sand and gravel ---------- do ----	10,082	14,806	10,879	16,950
Silver (recoverable content of ores, etc.) thousand troy ounces --	1,972	3,322	2,058	5,264
Stone ---------- thousand short tons --	42,473	[3] 63,219	49,304	79,921
Zinc (recoverable content of ores, etc.) short tons --	61,923	21,983	82,350	34,027
Value of items that cannot be disclosed: Asphalt (native), clays (bentonite and kaolin) (1972), stone (dimension) (1972), and values indicated by symbol W ----------	XX	70,430	XX	39,717
Total ----------	XX	451,817	XX	512,634
Total 1967 constant dollars ----------	XX	372,794	XX	[p] 376,376

[p] Preliminary. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed". XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers.

[2] Excludes certain clays; included with "Value of items that cannot be disclosed."

[3] Excludes value of certain stone; included with "Value of items that cannot be disclosed."

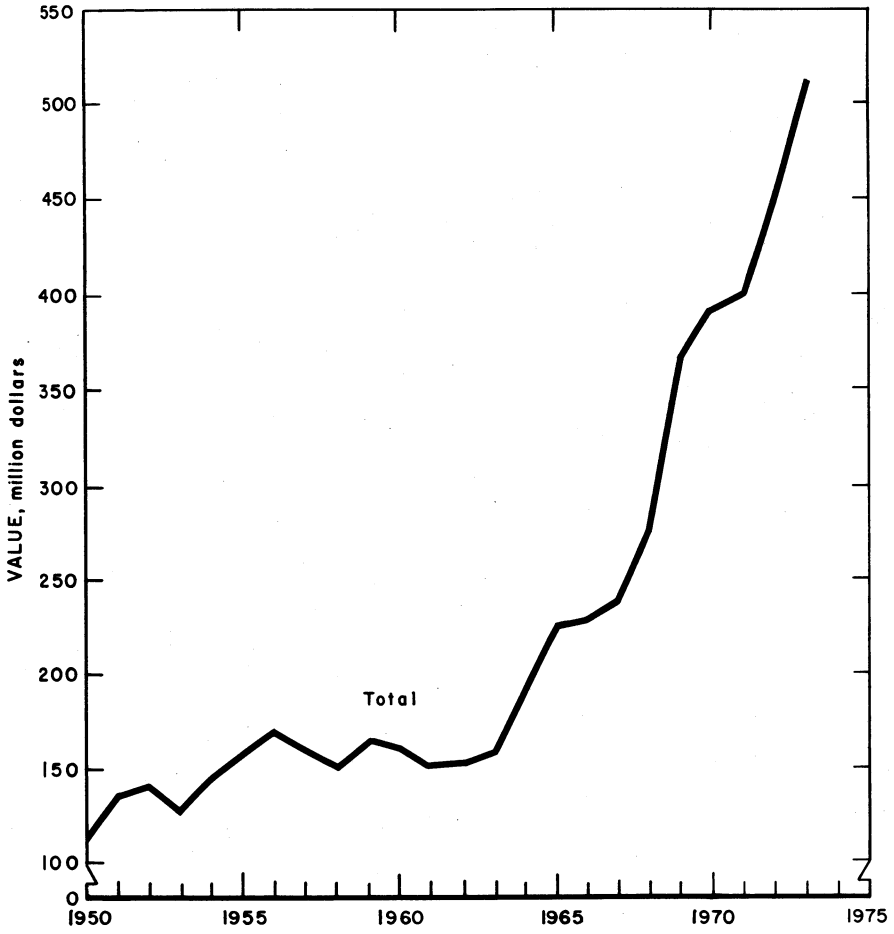

Figure 1.—Total value of mineral production in Missouri

Table 2.—Value of mineral production in Missouri, by county [1 2]
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adair	W	W	Stone.
Andrew	--	W	Do.
Atchison	W	$29	Petroleum.
Audrain	$1,635	1,682	Clays.
Barry	W	W	Stone.
Barton	W	W	Coal, stone, native asphalt.
Bates	W	W	Coal, stone.
Benton	W	W	Stone.
Boone	4,150	2,087	Stone, sand and gravel, clays.
Buchanan	W	W	Sand and gravel, stone.
Butler	W	W	Sand and gravel, stone, clays.
Caldwell	W	514	Stone.
Callaway	2,071	W	Clays, stone, sand and gravel.
Camden	--	W	Stone, sand and gravel.
Cape Girardeau	W	W	Cement, stone, clays, sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Missouri, by county [1 2]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Cass	W	W	Stone, petroleum.
Cedar	W	W	Stone.
Chariton	W	W	Stone, sand and gravel.
Christian	W	$993	Stone.
Clark	W	W	Stone, sand and gravel.
Clay	W	W	Do.
Clinton	$396	604	Stone.
Cole	W	W	Sand and gravel, stone.
Cooper	W	W	Stone, sand and gravel.
Crawford	W	4,620	Lead, copper, zinc, silver.
Dade	W	122	Stone.
Dallas	W	W	Do.
Daviess	W	W	Stone, sand and gravel.
De Kalb	132	130	Stone.
Douglas	W	W	Sand and gravel.
Franklin	W	W	Stone, sand and gravel, clays.
Gasconade	W	W	Clays, stone, sand and gravel.
Gentry	W	W	Stone, sand and gravel.
Greene	W	W	Stone, lime.
Grundy	W	W	Stone, sand and gravel.
Harrison	W	W	Do.
Henry	W	W	Coal, stone.
Hickory	W	W	Stone.
Holt	W	W	Do.
Howard	W	702	Stone, coal, sand and gravel.
Howell	W	W	Stone, sand and gravel.
Iron	110,512	135,480	Lead, zinc, iron ore, copper, silver, stone.
Jackson	15,735	20,949	Cement, stone, sand and gravel, clays, petroleum.
Jasper	W	W	Stone, sand and gravel.
Jefferson	W	W	Cement, stone, sand and gravel, clays.
Johnson	304	302	Stone.
Knox	W	W	Do.
Laclede	W	W	Stone, sand and gravel.
Lafayette	W	W	Do.
Lawrence	W	W	Stone.
Lewis	W	W	Sand and gravel, stone.
Lincoln	W	W	Stone, sand and gravel, clays.
Livingston	993	W	Stone, clays, sand and gravel.
Macon	W	4,918	Coal.
Maries	--	W	Clays, sand and gravel.
Marion	W	W	Stone, lime.
Mercer	239	W	Stone.
Miller	W	W	Stone, sand and gravel.
Moniteau	102	128	Stone.
Monroe	270	W	Stone, clays.
Montgomery	1,129	W	Clays, stone, sand and gravel.
Newton	446	226	Stone.
Nodaway	W	W	Stone, sand and gravel.
Oregon	9	W	Stone.
Osage	W	W	Sand and gravel, clays, stone.
Ozark	14	15	Stone.
Pemiscot	W	200	Sand and gravel.
Perry	W	W	Sand and gravel, stone.
Pettis	W	W	Stone.
Phelps	W	W	Stone, clays.
Pike	W	28,479	Cement, stone, clays.
Platte	W	800	Stone, clays, sand and gravel.
Polk	W	256	Stone.
Pulaski	W	W	Sand and gravel, stone.
Putnam	W	W	Coal.
Ralls	W	W	Cement, stone, clays.
Randolph	W	3,549	Coal, stone.
Ray	1,788	1,793	Stone.
Reynolds	55,644	62,176	Lead, zinc, copper, silver, sand and gravel.
St. Charles	2,301	W	Stone, sand and gravel, clays.
St. Clair	--	W	Stone.
St. Francois	12,162	W	Lime, stone.
St. Louis	28,855	39,128	Cement, stone, sand gravel, clays, petroleum.
Ste. Genevieve	28,410	24,194	Lime, stone, sand and gravel.
Saline	W	1,223	Stone.
Scotland	W	W	Do.
Scott	W	W	Stone, clays.
Shannon	W	W	Stone.
Shelby	W	W	Do.
Stoddard	W	703	Sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Missouri, by county [1 2]—Continued
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Stone	W	W	Stone.
Sullivan	W	W	Do.
Taney	W	W	Stone, sand and gravel.
Texas	W	$225	Stone.
Vernon	$286	W	Coal, stone, native asphalt, petroleum, sand and gravel.
Warren	W	W	Clays, stone.
Washington	49,651	51,704	Iron ore, lead, barite, zinc, copper, silver, phosphate rock, sand and gravel.
Wayne	243	373	Stone.
Webster	--	W	Do.
Worth	--	W	Do.
Wright	W	W	Do.
Undistributed [3]	134,355	124,329	
Total [4]	451,817	512,634	

W Withheld to avoid disclosing individual company confidental data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Dent, Dunklin, Linn, McDonald, Madison, Mississippi, Morgan, New Madrid, Ripley, and Schuyler.

[2] Value of petroleum is based on an average price per barrel for the State.

[3] Includes values of sand and gravel and stone that cannot be assigned to specific counties, natural gas (1973), and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Missouri business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ---- thousands	2,003.0	1,999.9	−0.2
Unemployment ---- do	84.0	73.0	−13.1
Employment (nonagricultural):			
Construction ---- do	72.0	75.3	+4.6
Mining ---- do	8.3	8.0	−3.6
Manufacturing ---- do	438.3	454.5	+3.7
Personal income:			
Total ---- millions	$20,403	$22,227	+8.9
Per capita	$4,293	$4,672	+8.8
Construction activity:			
Building permits, total private nonresidential - millions	$346.0	$399.3	+15.4
Cement shipments to and within Missouri thousand short tons	1,839	1,919	+4.4
Mineral production value ---- millions	$451.8	$512.6	+13.5

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; U.S. Bureau of Mines.

Because of the natural gas shortage in the 1972–73 winter, the metallurgical industry of the State, particularly the iron ore pelletizing operations and the three major lead smelters, were making plans to switch to auxiliary or alternate and higher cost propane facilities and propane-burning equipment. In some instances the natural gas shortage resulted in temporary shutdowns at metallurgical operations.

The Mining Industry Council of Missouri (MICOM) issued an informative booklet entitled "Missouri Mining and YOU" containing facts about the State's mining industry. Questions about mining in Missouri will be answered by the staff at 210 Monroe St., Box 275, Jefferson City, Mo. 65101.

Labor, Employment, and Safety.—According to the Division of Employment Security, Missouri Department of Labor and Industrial Relations, the mining industry employed 7,977 workers in 1973. The slight decrease from the previous year and the small but steady decrease over the past few years were generally considered to be mostly due to slowly increasing productivity. Employment in metal mining was 3,072 persons, compared with 3,363 in 1972. Employment in coal mining increased slightly to 1,078 from 1,051 in 1972. Employment in the nonmetals segment remained steady at 3,648, compared with 3,643 in 1972. At 12,200 employ-

ment in the cement, structural clay products, and other stone and clay products industry was almost exactly the same as the previous year. Employment in the primary metal industries (iron and steel foundries, nonferrous foundries, and other primary metal plants) was up slightly from 14,400 in 1972 to 15,500 in 1973, reflecting the strong efforts to maintain full production of the many products in critically short supply.

The mining and metallurgical industry of Missouri was largely free of strikes and work stoppages during the year, but a few did occur and some production was lost. Most of the lead-producing companies were struck at some time during the year. Striking United Steel workers at the Cominco American, Inc., lead-zinc mine near Bixby ratified a contract that called for a 75-cent-across-the-board hourly wage increase in increments over the next 2 years and vacation and insurance benefits. Union spokesmen said the benefits would eventually include a 3-week vacation for miners who had been with the company for 5 years, and substantial insurance benefits.

A 12-day work stoppage in April at the Amax Lead Co. of Missouri, preceding ratification of a new labor contract in the second quarter of 1973, did not significantly affect production. Some 500 members of Local 7447 of the United Steelworkers of America settled for a new 26-month contract calling for a 30-cent-an-hour pay increase and another 20-cent-across-the-board increase in April 1974. Premium pay and vacation time were also increased. Subsequently an agreement was made to end a strike by nearly 180 members of Local 944 who walked off the job at Ozark Lead Co.'s Sweetwater mine on March 1.

In 1972, for the second consecutive year, Ozark Lead Co. placed first in the Nation in national safety competition by attaining the best safety performance of all underground metal mining operations. The company received the "Sentinels of Safety" trophy which had not been awarded to an underground metal mine for 2 consecutive years since 1928. Ozark Lead Co., with 276,224 man-hours and zero frequency of lost-time injuries, also won top honors awarded by the Southeast Missouri Mine Safety Association. St. Joe Minerals Corp.'s Viburnum No. 27 mine, with 98,200 man-hours and zero frequency, also was honored. Amax Lead Co. of Missouri was awarded the "Roving Trophy" for the mine making the most improvement during the year.

Perfect safety records—operating an entire year without a disabling work injury—were achieved by 11 of the 17 Missouri firms participating in the National Limestone Institute Safety Competition. The competition is conducted annually by the Federal Bureau of Mines under the sponsorship of the National Limestone Institute.

The Division of Mine Inspection issued its 86th (1973) Annual Report, showing six fatal accidents in Missouri during 1973. Two of these fatilities were in underground lead-zinc mines, and four were in underground iron mines. This annual report contains, in addition to accident statistics, data on employment, mineral production by individual companies, wage rates, and technical information not readily available elsewhere.

Environment.—State involvement in air pollution control began in 1965, with the passage of the Missouri Air Conservation Law. The law set up the Missouri Air Conservation Commission (MACC) as the official State agency for "prevention, abatement and control of air pollution by all practical and economically feasible methods."

The commission is made up of seven members, appointed by the Governor. No more than four can belong to the same political party. Commission members serve without pay, and are selected so that three represent agriculture, industry, and labor, respectively, while the remaining four represent the general public. The commission controls air pollution in three ways: First, it monitors the air to compare Missouri's air quality with State and Federal standards for the major pollutants; second, it adopts regulations to control emissions from the sources of air pollution; and third, it enforces those regulations.

Because the most severe air pollution problems occur in the larger cities, the commission grants "certificates of authority" to local governments that wish to maintain their own control programs, if those governments have sufficient finances and personnel. The local agencies must adopt and enforce regulations that are at least as strict as State regulations, and a

certificate of authority may be withdrawn at any time if a local agency fails to maintain an adequate program. Local agencies exist in Kansas City, Independence, St. Louis, St. Louis County, and Springfield-Green County.

The staff of the MACC Air Quality Section is responsible for air quality monitoring and for collection and analysis of samples. It maintains a network of about 70 sampling stations located throughout the State. These stations measure such things as particulates, sulfation, sulfur dioxide, fluorides, ozone, nitrogen oxides, photochemical oxidants, and trace metals.

Besides the stations operated by the MACC, many additional stations are maintained by local agencies in major metropolitan areas. Data collected from all stations are submitted to the U.S. Enviromental Protection Agency (EPA) for its National Aerometric Data Bank.

During 1973, the Air Quality staff refined its sampling network by eliminating many sampling sites in areas that were found to be relatively pollution-free. Altogether, 35 monitoring stations were removed. Three new suspended particulate sampling stations were established, while six special stations were operated for a period of 3 months each. The special sampling was done to determine the existence and severity of a problem in a given area.

A continuous-reading sulfur dioxide sampler was set up in Herculaneum, completing a network of such instruments to monitor emissions from the State's three lead smelters.

Although many fixed sampling stations were eliminated in 1973, the agency began an extensive program of mobile sampling. With mobile sampling, the areas of maximum ground level concentration of a pollutant can be found. To provide even greater flexibility, a pair of special sampling trailers was acquired. Each was equipped to continuously monitor six different pollutants: sulfur dioxide, carbon monoxide, reactive hydrocarbons, photochemical oxidants, nitrogen oxides, and suspended particulates.

Publication of semiannual Air Quality Reports was discontinued in 1973, because the small number of requests for them made publication of regular reports uneconomical. However, air sampling data are still available to anyone who requests them.

Regulations to control the sources of air pollution are adopted by the commission, and the staff is responsible for enforcement. During 1973, separate sets of regulations were in effect for the St. Louis, Kansas City, Springfield-Greene County, and rural Missouri regions. An attempt was made to consolidate the regulations into one set for the entire State, but by yearend, no formal action on consolidation had been taken.

To obtain a variance, a firm must submit a compliance schedule describing the actions it will take to comply with clean air requirements. In 1973, the EPA announced it was lifting its requirement for nitrogen oxide control in St. Louis and 44 other cities. EPA said the decision was based on measurements obtained with a new testing technique, which showed nitrogen oxide levels to be considerably lower than originally estimated.

In August the Attorney General of Missouri issued the opinion that Missouri authorities do not have the power, under State law, to regulate complex sources of air pollution. Complex sources include shopping centers, sports complexes, convention centers, and other developments which may cause air quality standards to be violated by attracting large volumes of automobile traffic. The opinion was requested by the MACC, after a Federal court in Washington, D.C. ruled that complex sources must be controlled in order to prevent degradation of existing air quality.

Toward the end of 1973, the Nation's worsening energy crisis made it apparent that some Missouri industries were going to have difficulty obtaining enough clean fuels, such as natural gas, to continue meeting air quality standards for sulfur oxides and particulates. Rather than relax the standards or amend the regulation, however, the commission decided to handle fuel-related problems through the variance system.

A total of 14 Missouri firms were given variances allowing them to temporarily exceed clean air standards by burning dirtier fules while adequate clean fuels were not available. Of the 14 firms, only 9 actually used their variances.

A significant fact is that most of the variances used were for particulate emissions, rather than for sulfur dioxide. Particulates are generally less hazardous and easier to control. For most firms, burning low-sulfur fuel is still the only reliable and economical way to reduce sulfur dioxide emissions, while there are many good particulate-removal devices available. Only one firm had to use its sulfur dioxide variance, while three did not. The other 10 fuel-related variances involved only particulates. Missouri's largest electric powerplants were already operating on sulfur dioxide variances previously granted by the commission, and were not among the 14 firms that needed the special fuel-related variances.

Missouri's mined-land reclamation laws passed in 1970 provided that all surface mining in the State can be done only under permit issued by the Missouri Mined Land Reclamation Commission. During 1973 the commission issued permits for the following types of mining and acreages (1972 acreage in parentheses): Coal, 1,966 acres (1,187); barite, 209 acres (164); limestone, 389 acres (752); sand and gravel, 56 acres (196); and clays, 165 acres (215). The only source of revenue for the commission was from permit fees and acreage fees paid by the surface-mining industries in Missouri. A fee of $50 is paid annually for a permit to operate a surface mine, and an acreage fee of $17.50 is paid for each acre permitted. All revenue collected by the commission is deposited into the Mined Land Reclamation and Conservation Fund of the State Treasury. A total of $59,247 was collected in 1973, compared with $55,562 in 1972.

Eleven "cooperators" have been chosen by the Kaysinger Basin Regional Planning Committee to receive cost-share assistance under "Project Reuse", a special reclamation demonstration program. Funds from the Ozarks Regional Commission will be given to the cooperators to work on strip-mined land in the following west-central Missouri counties: Barton, Bates, Henry, St. Clair, and Vernon. The purpose of the demonstration program is to show that land strip mined before enactment of Missouri's reclamation law can be successfully reclaimed for productive use.

The State officially accepted the title deed to a 1,028-acre former strip mine property north of Columbia, which will become Missouri's newest State park. Donated to the State by Peabody Coal Co. of St. Louis, the land will be developed as a national demonstration project for outdoor recreation. In donating the acreage, the company enabled the State to receive $102,000 in Federal matching funds, equal to the value of the land, from the Bureau of Outdoor Recreation land and water conservation fund.

The Secretary of Agriculture announced that a new "land purchase unit" had been chosen in Missouri, in the triangle formed by Columbia, Jefferson City, and Fulton. This opened the way for the Forest Service to purchase the land when funds become available. The area was chosen in part because it contains about 2,000 acres of unreclaimed strip-mined land that has been a source of acid drainage. Pollution abatement was one of the high-priority considerations in selecting the purchase unit.

Planting and stabilization projects were featured at a meeting of the Mineral Waste Stabilization Liaison Committee at Bonne Terre on May 8. Papers presented covered projects in several States including a lead tailings pond in Missouri. St. Joe Minerals Corp., which hosted the session, conducted a tour of the latter facility where a stand of rye now covers most of the pond surface.

A grant of $31,351 from the American Smelting and Refining Company (ASARCO) to the University of Missouri—Rolla was to be used for an in-depth study of the environmental impact of a lead smelter on its immediate surroundings. The study was being made at the company smelter at Glover.

In recent years when air quality standards for SO_2 were adopted by Federal, State, and local air pollution control agencies, ASARCO responded by developing a "closed loop" system to meet the standards. Local and regional weather data and computers are used to predict conditions unfavorable to SO_2 dispersion so that curtailment can be ordered in advance of any SO_2 accumulation. Successful applications of closed-loop or intermittent control systems have been demonstrated at ASARCO's El Paso, Tacoma, and Glover smelters.

Exploration, Geologic Studies, and Mapping.—The Missouri Geological Survey published a report describing Missouri's physical characteristics from a geological

perspective and interpretation.[3] One section of the report deals with bedrock geology, surficial materials, topography and relief, mineral resources, and water resources; another section is concerned with engineering geology and geologic constraints on impoundments, liquid waste disposal, and solid waste disposal.

A paper on "First Look Analysis of Geologic Ground Patterns on ERTS–1 Imagery of Missouri" was presented at the Symposium on Significant Results Obtained from ERTS–1, March 5–8, 1973, in New Carrollton, Md. The Missouri Geological Survey was receiving this information on Missouri, which was one of only 16 States to have an ERTS project. In addition to known structural elements, a number of heretofore unknown circular and linear patterns are apparent on the ERTS imagery.

In recognition of the mineral potential of Missouri's Precambrian rocks, an intensive study was begun in 1968 by the Missouri Geological Survey on the mineral-rich Precambrian rocks exposed at the surface in the St. Francois Mountains of southeast Missouri and buried beneath the surface in other parts of the State. The third phase with emphasis on conceptual analysis was begun in 1973. Several petrologic, geochemical, geochronologic, and structural investigations of Missouri's buried and exposed basement rocks were in progress at yearend. A number of areal mapping projects are also underway with more detailed maps being made in southeast Missouri where drill-hole density is greater.

The Missouri Survey and the University of Missouri—Rolla (UMR) began a cooperative project to put existing aeromagnetic map data on punched cards so that computerized interpretations can be made. The program should improve the mapping and understanding of Precambrian geology and the structural features of the subsurface, already under study.

Rock core from the Old Lead Belt and other areas was donated by St. Joe Minerals, Corp., to the Missouri Geological Survey for scientific study. Some of the core will be used for stratigraphic and paleontological studies and for studies of mineralization provinces and related research. Many of the drill holes penetrated the Precambrian and will provide a first-hand glimpse of "basement rock" that has not been available for study before.

Table 4.—Missouri: Exploratory drilling
(Linear feet)

Year	Churn	Rotary	Diamond
1969	73,874	21,442	167,179
1970	38,080	23,556	248,009
1971	26,548	29,188	223,110
1972	28,025	19,957	194,273
1973	38,000	--	191,000

A new base map of Missouri was made available on a scale of 1:500,000 (1 inch = approximately 8 miles), edited and published by the U.S. Geological Survey and the Missouri Geological Survey. The map comes in two versions, one without contour lines and one with contours. These maps are available from the Missouri Geological Survey, Box 250, Rolla, Mo. 65401.

At the end of 1973, about 99.6% of the State had been covered by topographic maps. Only 63.6% of the area was covered by 7½-minute quadrangles. During 1973, however, the Missouri Geological Survey made available 67 new or revised 7½-minute topographic quadrangle maps and one new geologic quadrangle map. An index of available maps may be obtained free from the Missouri Geological Survey.

REVIEW BY MINERAL COMMODITIES

NONMETALS

In 1973, nonmetals accounted for about 46% of total value of mineral production, compared with 45% in 1972.

Barite.—Output of barite was down from that of 1972. Most of Missouri's barite produced by 15 active operations was sent to grinding plants where it was prepared for use in drilling fluids. Increased drilling for petroleum as a result of the energy crisis was expected to boost exploration and production of barite in the State.

Cement.—Seven cement plants operated by six companies at near-capacity levels produced an alltime record of 4.5 million tons of cement in 1973, making Missouri one of the Nation's leading cement pro-

[3] Stout, L.N., and D. Hoffman. An Introduction to Missouri's Geologic Environment. Missouri Geol. Survey Educational Series No. 3, 1973, 44 pp.

ducers. The increased production of cement reflected the high rate of growth in the construction industry throughout the Mississippi Valley.

Table 5.—Missouri: Portland cement salient statistics
(Short tons)

	1972	1973
Number of active plants	7	7
Production	4,328,860	4,358,852
Shipments from mills:		
Quantity	4,277,339	4,581,685
Value	80,897,790	99,858,393
Stocks at mills, Dec. 31	r 417,918	267,335

r Revised.

Clays.—Clay production continued to hold steady, although a small amount of production was lost when one firm temporarily suspended operations.

Missouri continued to be a major refractories manufacturing center. A. P. Green Refractories Co. acquired the H. K. Porter Co. plant at Fulton, along with clay lands and raw mineral and other assets. The Fulton facility, which included 2 tunnel kilns and employed over 100 people, ceased production in mid-March 1973.

Table 6.—Missouri: Clays sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Year	Fire clay		Common clay		Total [1]	
	Quantity	Value	Quantity	Value	Quantity	Value
1969	1,040	4,968	1,211	1,437	[2] 2,251	[2] 6,405
1970	927	4,854	1,201	1,626	[3] 2,128	[3] 6,480
1971	872	4,896	1,440	2,558	[4] 2,354	[4] 7,454
1972	894	5,512	1,677	3,583	[5] 2,571	[5] 9,096
1973	829	7,563	1,565	2,371	[6] 2,551	[6] 11,626

[1] Data may not add to totals shown because of independent rounding.
[2] Excludes bentonite and fuller's earth.
[3] Excludes fuller's earth.
[4] Excludes kaolin; includes bentonite.
[5] Excludes bentonite and kaolin.
[6] Includes bentonite and kaolin.

Lime.—Missouri was the fourth largest lime-producing State in the Nation. Both lime and dead-burned dolomite were produced in record quantities during 1973. About three-fourths of the State's output is shipped out of State for a wide variety of uses.

Sand and Gravel.—High levels of road maintenance and other construction activities held sand and gravel output above the 1972 tonnages.

Table 7.—Missouri: Sand and gravel sold or used by producers
(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total [1]	
	Quantity	Value	Quantity	Value	Quantity	Value
1969	10,887	14,524	53	50	10,940	14,574
1970	12,395	15,327	51	52	12,446	15,379
1971	10,263	15,031	65	79	10,327	15,109
1972	10,068	14,778	14	27	10,082	14,806
1973	10,825	16,905	54	45	10,879	16,950

[1] Data may not add to totals shown because of independent rounding.

Table 8.—Missouri: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	W	W	W	242
Building	3,759	3,989	3,953	4,887
Fill	341	242	613	571
Filtration	4	W	--	--
Glass	697	2,237	707	2,298
Molding	W	W	94	353
Paving	1,597	1,707	1,681	1,978
Other uses [1]	490	2,243	321	1,712
Total [2]	6,888	10,420	7,369	12,041
Gravel:				
Building	1,682	2,375	1,613	2,516
Fill	31	29	265	131
Paving	1,280	1,671	999	1,095
Miscellaneous	162	252	516	999
Other uses [3]	25	32	62	123
Total [2]	3,180	4,358	3,456	4,864
Government-and-contractor operations:				
Sand: Paving	(4)	(4)	--	--
Total [2]	(4)	(4)	--	--
Gravel:				
Fill	--	--	28	21
Paving	7	17	18	12
Other uses	7	10	8	12
Total	14	27	54	45
Total sand and gravel [2]	10,082	14,806	10,879	16,950

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes engine, fire and furnace, grinding and polishing, oil (hydrafrac) (1972), abrasives, enamel, filler, foundry, pottery, porcelain, tile, and ground and unground sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast (1972).
[4] Less than ½ unit.

Stone.—Output of stone in the State reached a record high as requirements for construction, road maintenance, agriculture, and other uses continued to increase. The Missouri Highway Department alone almost doubled its purchases of stone for aggregate use in 1973.

The largest increase appeared to be in aggregates for construction paving and surfacing. A decline in limestone produced for the manufacture of lime resulting from a 3-month strike at Mississippi Lime Co. was partially offset by an increase in tonnage for cement manufacturing.

In Kansas City, Centropolis Crusher, Inc., began sinking a 17-foot-diameter, 1,200-foot shaft. Plans were to mine two levels. The 850-foot level will be in the Mississippian Burlington limestone and the 1,150-foot level in a Devonian limestone. At yearend the shaft was nearing the base of the Pennsylvanian.

The Missouri Land Reclamation Commission issued 85 permits to cover nearly 700 acres.

Farmers Limestone Co. of Old Appleton purchased 1,100 acres north of Neely's Landing to be used for future expansion of its operations. The property, which has 2 miles of frontage on the Mississippi River and two large limestone bluffs, has access to a railroad as well as to the river. Mining and shipping of stone from the new site will probably not be started for 2 or 3 years. Farmers Limestone provides rock for road work within a 25-mile radius of Old Appleton, shipping it as far south as Cape Girardeau, north to St. Marys, and west to Sedgewickville.

Ash Grove Cement Co., with headquarters in Kansas City, acquired Bates County Rock, Inc., of Butler. Bates County Rock will be operated as a subsidiary of Ash Grove. The company operates four

rock quarries in Missouri and Kansas and is developing a new quarry near Amsterdam, Mo., to provide limestone for use in air pollution control facilities at the new powerplant of Kansas City Power & Light Co. near LaCygne, Kans. Ash Grove operates cement-manufacturing plants in Kansas and Nebraska and lime-manufacturing plants in Oregon and Springfield, Mo. It also has other subsidiaries engaged in producing ready-mixed concrete and limestone products.

Table 9.—Missouri: Stone sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone	7	W	6	1,285
Crushed and broken:				
Bituminous aggregate	2,559	4,066	3,126	5,718
Concrete aggregate	5,694	9,501	7,737	13,410
Dense graded roadbase stone	5,081	8,118	5,666	9,543
Macadam aggregate	2,606	3,541	3,266	4,910
Surface treatment aggregate	2,336	4,280	3,636	7,185
Unspecified construction aggregate and roadstone	3,399	6,000	4,076	7,317
Agricultural purposes [1]	4,136	7,595	4,507	8,095
Cement and lime manufacture	10,799	10,446	10,729	11,332
Manufactured fine aggregate (stone sand)	146	384	166	435
Mineral fillers, extenders and whiting	174	975	158	976
Railroad ballast	W	62	62	113
Riprap and jetty stone	3,688	3,242	3,772	3,870
Other [2]	1,849	5,009	2,398	5,733
Total [3]	42,473	63,219	49,304	79,921

W Withheld to avoid disclosing individual company confidential data. Crushed and broken data withheld included with "Other."
[1] Data include agricultural limestone, other soil conditioners, and poultry grit and mineral food.
[2] Includes stone for terrazzo and exposed aggregate, roofing aggregates, filter stone, flux stone, chemicals, mine dusting, abrasives, glass, ferrosilicon, and uses not specified.
[3] Data may not add to to totals shown because of independent rounding.

Table 10.—Missouri: Stone sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Kind of stone	1972		1973	
	Quantity	Value	Quantity	Value
Dimension total [1]	2	358	6	1,285
Crushed and broken:				
Limestone [2]	41,679	60,440	48,750	76,613
Sandstone	221	W	W	W
Other stone [3]	571	2,779	548	2,024
Total	42,473	[4] 63,219	49,304	[5] 79,921

W Withheld to avoid disclosing individual company confidential data, included with "Other stone."
[1] 1972 data represent dimension granite only. 1973 data include limestone, granite, marble, and sandstone.
[2] Limestone used generally to include dolomite.
[3] Includes marble, granite, and traprock. 1972 data also represents dimension marble, and quantity data for dimension sandstone and limestone. Value data for dimension stone not included.
[4] Value data represent crushed and broken stone only.
[5] Data does not add to total shown because of independent rounding.

Sulfur.—Two firms recovered sulfur as sulfuric acid from gases discharged in lead-smelting operations. The larger plant, at the Herculaneum smelter of St. Joe Minerals Corp., had its first full year of operation in 1970. Amax Lead Co. of Missouri recovered sulfuric acid from its lead smelter near Boss. The combined capacity of these plants was about 500 tons of sulfuric acid per day. Most of the acid was sent to plants manufacturing fertilizer from phosphate rock. Amoco Oil Co. also recovered substantial tonnages of sulfur from its refining operations at Sugar Creek.

METALS

Metals accounted for about 48% of the total value of Missouri mineral output in 1973, compared with 50% in 1972. An

increase in the value of lead production combined with increased output and value of byproduct zinc and silver accounted for nearly all of a 13% gain in total value of mineral production.

Aluminum.—Noranda Aluminum, Inc., was the only primary aluminum producer in the State in 1973. The new aluminum smelter, which had its first full year of operation in 1972, has a capacity of about 75,000 tons of metal per year. Part of the output goes to an adjacent wire and rod mill operated by Noranda, and part is shipped as extrusion billet, sheet ingot, or casting ingot.

Copper.—Output of copper as byproduct or coproduct of lead and zinc production in the New Lead Belt declined because of difficulties in finding smelters that would take the concentrates.

Iron Ore.—Production of iron ore, mostly as high grade pellets, from two underground operations remained steady at slightly more than 2.6 million tons.

Meramec Mining Co., jointly owned by St. Joe and Bethlehem Steel Co., operated an underground iron ore mine near Sullivan. Pellet production by Meramec for the year was 1,630,000 long tons, slightly under 1972 levels.

Pilot Knob Pellet Co. continued with new construction and plant modification, including an alkali reduction system in the mill, the installation of equipment for limestone addition, and the conversion of fuel-burning facilities in the pellet plant. In the underground mine, the ventilation shaft was deepened.

The estimated cost of new and modified facilities was nearly $5 million. Since high alkali in iron ore pellets contributes to the buildup of slag in the blast furnaces, a flotation circuit was being added in the concentrator section to reduce the alkali. The flotation system necessitated additional regrind capacity in the pellet plant, so a new 2,000-h.p. ball mill was being installed. Iron ore pellets produced at Pilot Knob were shipped by unit train to Granite City Steel Co.

Table 11.—Missouri: Ferrous scrap and pig iron consumption
(Thousand short tons)

Year	Ferrous scrap	Pig iron	Total scrap and pig iron
1969	1,058	20	1,078
1970	1,062	21	1,083
1971	W	17	W
1972	W	W	W
1973	1,198	21	1,219

W Withheld to avoid disclosing individual company confidential data.

Lead.—Output of lead was nearly 487,200 tons in 1973, about 13% of the world output and more than 80% of the U.S. total. Although the tonnage was down slightly because of work stoppages, the dollar value of production was the highest ever recorded for a single commodity in the State. Missouri's share of the U.S. lead production has nearly doubled in the past few years, increasing from 44.3% of the U.S. total in 1965 to over 80% in 1973.

The potential capacity of lead mines and mills in southeast Missouri is more than 500,000 short tons of lead per year. These mines include St. Joe Minerals Corp.'s Indian Creek, Viburnum, Fletcher, and Brushy Creek Divisions; Ozark Lead Co.'s Sweetwater mine and mill; the Magmont mine and mill of Cominco American, Inc., and Dresser Industries Inc.; and AMAX Lead Co. of Missouri's Buick mine and mill (a joint venture of AMAX and Homestake Mining). The Hidgon mine of Bunker Hill Co. and NL Industries is partially developed, while the West Fork deposit of ASARCO is undeveloped. The annual capacity of southeast Missouri's three lead smelters—St. Joe's Herculaneum plant, AMAX-Homestake's Buick smelter, and ASARCO's Glover plant—is more than 455,000 short tons.

The closing of St. Joe Minerals Corp.'s historic Federal mine in 1972 was a milestone in Missouri mining history, but a more significant event was the official opening in May 1973 of the company's $19 million Brushy Creek mine and mill. The

new complex, about 12 miles south of Viburnum in western Reynolds County, is one of the world's most modern and efficient lead mining and milling operations.

Employing about 150 people, the Brushy Creek plant is expected to produce 50,000 tons of lead annually plus 1,200 tons of copper concentrate and 7,200 tons of zinc concentrate. The mill processes 5,000 tons of ore per day. It was reported that because of improved methods and equipment, a 4-cent savings per pound of lead produced will be realized at Brushy Creek over production costs for St. Joe's old Federal mine which had 450 employees when it closed.

The mining system is a simple, open stope method utilizing 25-foot pillars and 35-foot rooms. Rotary-percussion drill jumbos with remote controls are used to drill blastholes, and large front-end loaders are used for transporting ore to the shaft. After the ore is dumped into storage pockets, handling is completely automated throughout the rest of the process. The ore is fed by 6- by 10-foot vibrating feeders into a 42- by 48-inch jaw crusher for reduction to less than 6 inches in size. It then falls into an automatic loading hopper where two 8-ton skips are alternately filled and hoisted in balance. This automated system loads, hoists, and dumps a skip every 2 minutes. The mill (concentrator), which processes 5,000 tons of ore per day, produces lead, zinc, and copper concentrates. Ore from the skip bin is reduced to less than 1 inch in size by a secondary crusher before being conveyed to the rodmill for fine grinding. The product of the grinding circuit is a 50% water slurry containing lead, zinc, and copper minerals liberated from the gangue plus lead and copper collecting agents added at the rodmill. This slurry flows to a flotation machine where a frothing reagent is added.

Zinc, which is not activated, flows through with the gangue to the zinc circuit. The froth is further concentrated and is then pumped to a lead-copper separation circuit where the lead is depressed and the copper recovered by flotation. The zinc and gangue from the lead-copper circuit are pumped to the zinc circuit and conditioned with copper sulfate to activate the zinc mineral. Frothing and collecting reagents are added, and the zinc is recovered and cleaned by additional flotation. The mill tailing is pumped to a settling basin in a ravine below the mill, while the concentrate slurry is pumped to storage tanks where the solids settle and the water is recycled for mill usage. The concentrates are dewatered, put into 10-ton containers, and hauled 8 miles to a railroad loading station at Buick.

The grinding circuit is monitored by instruments that adjust the feed rate for maximum tonnage and control the addition of water to insure mineral liberation. A readout on an X-ray analyzer controls the flotation circuit and continuously monitors sample streams of the feed, concentrates, and tailings for mineral content as a basis for addition of flotation reagents. Concentrate filtering and drying are controlled by an operator.

Dust generated during crushing and screening is recovered as a slurry by a wet scrubber and returned for processing. Tailings from the concentrator, which include 4,600 tons of finely ground solids and 1,880,000 gallons of water per day, are disposed of through a system designed to protect the natural drainage system of the area.

Zinc.—Production of 82,350 tons of zinc made Missouri the Nation's leading zinc producer in 1973.

Table 12.—Missouri: Tenor of lead ore milled and concentrates produced in 1973

Total material	short tons	7,585,647
Metal content or ore: [1]		
Copper	percent	0.14
Lead	do	6.42
Zinc	do	1.09
Concentrates produced and average content:		
Copper-lead	short tons	19,280
Recovery ratio	percent	0.25
Average copper content	do	27.30
Average lead content	do	8.58
Lead	short tons	674,375
Recovery ratio	percent	8.89
Average lead content	do	73.58
Zinc	short tons	167,511
Recovery ratio	percent	2.21
Average zinc content	do	55.36

[1] Figures represent metal content of crude ore only as recovered in the concentrate.

Table 13.—Total value of mineral production in Missouri and production and value of lead in Missouri and the United States

Year	Total value of Missouri mineral production (thousands)	Lead production					
		Missouri				United States	
		Quantity (short tons)	Value (thousands)	Percent of U.S. production	Percent of world production	Quantity (short tons)	Value (thousands)
1969	$367,232	355,452	$105,889	69.8	r 10.0	509,013	$151,635
1970	392,996	421,764	131,751	73.8	11.3	571,767	178,609
1971	400,089	429,634	118,579	74.3	r 11.4	578,550	159,679
1972	451,817	489,397	147,113	79.1	12.7	618,915	186,046
1973	512,634	487,143	158,711	80.8	12.5	603,024	196,465

r Revised.

Table 14.—Missouri: Mine production (recoverable) of silver, copper, lead, and zinc

	1971	1972	1973
Mines producing: Lode	14	10	11
Materials sold or treated: Lead ore thousand short tons	8,625	8,486	7,586
Production (recoverable):			
Quantity:			
Silver troy ounces	1,660,879	1,971,530	2,057,732
Copper short tons	8,445	11,509	10,273
Lead do	429,634	489,397	487,143
Zinc do	48,215	61,923	82,350
Value:			
Silver thousands	$2,568	$3,322	$5,264
Copper do	8,783	11,785	12,224
Lead do	118,579	147,113	158,711
Zinc do	15,525	21,983	34,027
Total do	145,455	184,203	210,226

MINERAL FUELS

Mineral fuels accounted for 5% of the State's total mineral value. Coal continued to account for more than 99% of the total value of the energy group.

Energy.—The energy and fuels crisis overshadowed all other developments in Missouri during 1973. Many major industrial firms in the State were asked to curtail or discontinue the use of natural gas until the shortage was overcome. The Pilot Knob Pellet Co. was shut off from natural gas after November 1972. The company was using auxiliary propane-burning equipment to heat its iron ore pellets at about twice the cost of natural gas. The lead smelter of ASARCO at Glover not only had its gas cut off, but shut down temporarily because of a propane shortage.

An Energy Emergency Task Force was created by executive order of Governor Bond to take action in Missouri's fuel and energy situation. Subsequently a Missouri Energy Council was formed by the Governor to assume the functions of the Task Force and to assess the State's fuel resources, examine demand and possible conservation measures, and explore new energy sources.

Natural gas supplies for the St. Louis area at the end of 1973 were larger than at yearend 1972, according to Laclede Gas Co. Improvement in the supply situation was due to milder temperatures than during the previous year and to increased supplies from new Texas wells. Laclede participated in discoveries in Oklahoma and Louisiana that improved significantly the outlook for the St. Louis area gas supply.

Several requests for permission to burn coal instead of cleaner fuels in short supply were filed with air-pollution-control agencies by such consumers as Titanium Division of NL Industries, Inc., Washington University, and Mallinckrodt Chemical Co. Variances were being considered.

The Missouri Fuel Allocation Board was set up to administer fuel allocation programs. The Federal Bureau of Mines Liaison Officer began processing the State's

recommendations for hardship allocations of the middle distillates.

Electric utilities in Missouri were ordered to submit reports to the Missouri Public Service Commission on their energy production and the quantity of petroleum products their plants consume to provide the Fuel Allocation Board with greater knowledge of petroleum-based-fuel use in the State. The Missouri Chamber of Commerce established an Energy Data Exchange to assist State businessmen on energy problems.

Union Electric Co. of St. Louis announced plans for a nuclear power generating facility in Callaway County, 10 miles southeast of Fulton. Five utilities jointly entered into an intent agreement with the Westinghouse Electric Corp. for a total of six identical nuclear reactor systems, including two for Union Electric. Union Electric planned to complete its environmental report in 1974 and begin plant construction in late 1975. The first 1.2-million-kilowatt unit was to cost some $550 million and was expected to be in operation by late 1981.

Production of a nonpolluting fuel with a high octane number was one of the problems being studied at Washington University (St. Louis) Thermodynamics Research Laboratory.

Coal.—Ten strip mines (one less than in 1972) produced 4.6 million tons of coal in Missouri, the largest tonnage produced in 30 years; the value, $25 million, was the highest value recorded in any year.

A report entitled "Minable Coal Reserves of Missouri" focused attention on coal deposits that can be recovered under prevailing economic and technologic conditions and in terms of current and future coal needs.[4]

Missouri's coal resource base is more than 50 billion tons. Of this total, it is estimated that 12 billion tons constitute a remaining minable reserve. At the present rate of production, enough recoverable coal is available to last more than 1,000 years, and the recoverable tonnage could be increased by exploration. A recoverable strip-coal reserve of 1.8 billion tons is sufficient to last more than 360 years at the prevailing production rates.

Missouri Mining, Inc., was completing a new coal-screening plant and truck-loading facility near Unionville in Putnam County. A new washing and loading plant with a railroad spur also is being installed. The new operation is unique in that a coalbed is being mined in addition to a deposit of high-grade limestone which lies immediately beneath the coal seam.

Table 15.—Missouri: Bituminous coal strip production by county, 1973
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines	Production (thousand short tons)	Value (thousands)
Barton	1	600	W
Bates	1	969	W
Henry	2	1,726	$8,852
Howard	1	19	W
Macon	1	720	4,918
Putnam	1	72	W
Randolph	1	509	2,701
Vernon	2	42	299
Total[1]	10	4,658	24,999

W Withheld to avoid disclosing individual company confidential data.
[1] Data may not add to totals shown because of independent rounding.

Petroleum and Natural Gas.—Oil production in Missouri remained steady during 1973 with a total output of 59,800 barrels for the year. After dropping to an alltime low with the abandonment of the Turney gasfield, natural gas production increased, totaling 33 million cubic feet in 1973. Commercial gas production is now limited to three wells in the Polo gasfield, Caldwell County.

Drilling in Missouri jumped from a total of 5 wells in 1972 to 20 wells in 1973. Of the 20 wells completed, 16 were dry, 3 were oil, and 1 was a gas well. All the dry wells were exploratory wells. All the oil and gas completions were development wells. There were no new oil or gas discoveries in 1973.

Leasing activity was high during 1973 in the Forest City basin, where several important tests were drilled. Texaco, Inc., drilled eight Pennsylvania tests in the Missouri portion of this basin. An important Devonian test was drilled by Lone Star Producing Co. in Nodaway County. The increased leasing activity indicated renewed interest in the large potential reserves existing in the heavy oil sands of western Missouri. Reported leasing activity

[4] Robertson, C. E. Minable Coal Reserves of Missouri. Missouri Geol. Survey Rept. Inv. 54, 1973, 77 pp.

in Bates, Vernon, and northern Barton Counties reached an alltime high, surpassing the activity generated by the Shell Oil Co.'s research project in Vernon County during the early 1960's.

During 1973, the Missouri Oil and Gas Council conducted 2 public hearings and issued 21 drilling permits, compared with 6 drilling permits issued during 1972. The first hearing was scheduled by formal action of the Council for the purpose of hearing any and all objections or comments on proposed revision of rules and regulations pursuant to changes in the Missouri Statutes enacted by the 73d General Assembly in 1972. Elimination of a drilling permit fee along with greater latitude to operators in respect to plugging procedures and well location survey requirements were approved. Other changes approved included increases in bonding amounts and revised administrative procedures. A new rule providing for the temporary and eventual permanent plugging of wells where operations are suspended for a specified time was included in this revision. Copies of these rules and regulations, as revised in 1973, along with the unofficial revised Statutes of Missouri can be obtained from the Missouri Oil and Gas Council, P.O. Box 250, Rolla, Mo. 65401.

The second hearing was the result of a petition for the unitization of the Florissant oil field in St. Louis County. Statutory requirements having been met, the Council entered an order creating the Lange-Trenton Unit. This was the first unit operation in Missouri to be approved under the new statutes authorizing unitization based on a 75% approval of the royalty owners.

Early in 1973, Cities Service Gas Co. filed applications with State and Federal agencies relating to a proposed $42 million synthetic gas plant 3 miles northeast of Diamond in Newton County. Preliminary design work on the plant, based on the Lurgi Gasynthan process, was completed, and construction was planned to start early in 1974. Deliveries were expected to begin about October 1975. Synthetic gas from the plant will provide a supplemental supply for the Cities Service Gas Co. 8,300-mile pipeline system, which serves some 500 communities in 5 States. The estimated synthetic gas cost of $1.50 per thousand cubic feet is several times higher than that of natural gas being purchased by the pipeline company under existing contracts, some of which are several years old. An application requesting the import of 100,000 barrels of crude oil daily for the proposed gas plant was filed with the import board. The allocation would be used to refine 25,000 barrels of naphtha daily for use in manufacturing 125 million cubic feet per day of synthetic natural gas. The gas would be distributed through the company interstate pipeline system in Missouri, Kansas, Oklahoma, Texas, and Nebraska. The 75,000 barrels of daily residue from the gas operation, mostly fuel oil, would be sold to area refiners.

Table 16.—Principal producers

Commodity and company	Address	Type of activity	County
Asphalt, native:			
Bar-Co-Roc Asphalt Co	P.O. Box 11 Lantha, Mo. 64753	Mine	Barton.
Silica Rock Asphalt Corp	Sheldon, Mo. 64784	do	Vernon.
Barite:			
Dresser Minerals Div	P.O. Box 6504 Houston, Tex. 77005	do	Washington.
Milchem, Incorporated	P.O. Box 22111 Houston, Tex. 77027	Mine and mill	Do.
NL Industries, Inc., Baroid Division.	P.O. Box 1675 Houston, Tex. 77001	do	Do.
NL Industries, Inc., Delore Division.	P.O. Box 2808 Carondelet Sta. St. Louis, Mo. 63111	Mill	St. Louis.
Pfizer & Co	Box 47 Mineral Point, Mo. 63660	Mine and mill	Washington.
Cement:			
Alpha Portland Cement Co	15 South Third St. Easton, Pa. 18043	Plant and quarry	St. Louis.
Dundee Cement Co	P.O. Box 317 Dundee, Mich. 48131	do	Pike.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Cement—Continued			
Marquette Cement Manufacturing Co.	20 North Wacker Dr. Chicago, Ill. 60606	Plant and quarry	Cape Girardeau.
Missouri Portland Cement Co	7751 Carondelet Ave. St. Louis, Mo. 63105	do	Jackson and St. Louis.
River Cement Co	Festus, Mo. 63028	do	Jefferson.
Universal Atlas Cement Div., U.S. Steel Corp.	600 Grant St. Pittsburgh, Pa. 15230	do	Ralls.
Clay and shale:			
Allied Chemical Corp	Box 70 Morristown, N.J. 07960	Mine and plant	Gasconade.
Alton Brick Co	Box 1025 Maryland Heights, Mo. 63042	do	St. Louis.
Carter-Waters Corp	2440 Pennway Kansas City, Mo. 64108	do	Platte.
Dundee Cement Co	Dundee, Mich. 48131	do	Pike.
U.S. Gypsum: A. P. Green Refractories Co.	Mexico, Mo. 65265	do	Franklin and Gasconade.
Dresser Industries Inc.: Harbison-Walker Refractories Co.	2 Gateway Center Pittsburgh, Pa. 15222	do	Audrain, Callaway, Gasconade, Lincoln, Montgomery, St. Charles, Warren.
Kaiser Aluminum & Chemical	P.O. Box 499 Mexico, Mo. 65265	do	Audrain, Callaway, Gasconade, Montgomery, Osage, Warren.
Marquette Cement Mfg. Co	20 North Wacker Dr. Chicago, Ill. 60606	do	Cape Girardeau.
Midland Brick & Tile Co	Box 428 Chillicothe, Mo. 64601	do	Livingston.
Missouri Portland Cement Co	7751 Carondelet Ave. St. Louis, Mo. 63105	do	Jackson and St. Louis.
Universal Atlas Cement Div., U.S. Steel Corp.	P.O. Box 2969 Pittsburgh, Pa. 15230	do	Ralls.
Coal:			
Peabody Coal Co	301 North Memorial Dr. St. Louis, Mo. 63102	do	Henry, Macon, Randolph.
Copper: *See* Lead.			
Iodine:			
Hoffman-Taff, Inc	West Bennett Rd. Springfield, Mo. 65800	Plant	Greene.
Mallinckrodt Chemical Works	3600 North Second St. St. Louis, Mo. 63147	do	St. Louis.
West Agro-Chemical, Inc	42 - 16 West St. Long Island City, N.Y. 11101	do	Jackson.
Iron ore:			
Meramec Mining Co	Route 4 Sullivan, Mo. 63080	Underground mine	Washington.
Pilot Knob Pellet Co	Box 26 Ironton, Mo. 63650	do	Iron.
Lead:			
Cominco American, Inc	Box 430 Salem, Mo. 65560	do	Do.
Amax Lead Co. of Mo	Boss, Mo. 65440	do	Do.
Ozark Lead Co	Sweetwater, Mo. 63680	do	Reynolds.
St. Joe Minerals Corp	Boone Terre, Mo. 63628	do	Crawford, Iron, Reynolds, St. Francois, Washington.
Lime:			
Ash Grove Cement Co	1000 Ten Main Center Kansas City, Mo. 64105	Plant	Greene.
Marblehead Lime Co	300 West Washington Chicago, Ill. 60606	do	Marion.
Mississippi Lime Co	7 Alby St. Alton, Ill. 62002	do	Ste. Genevieve.
Valley Mineral Products Corp	915 Olive St. St. Louis, Mo. 63101	do	St. Francois.
Perlite (expanded): J. J. Brouk & Co.	1367 South Kingshighway Blvd. St. Louis, Mo. 63110	Expanding plant	St. Louis.
Roofing granules: GAF Corp	P.O. Box 278 Annapolis, Mo. 63620	Plant	Iron.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel:			
Eureka Sand & Gravel Co	Rt. 1, Box 77 Eureka, Mo. 63025	Stationary	St. Louis.
Holliday Sand & Gravel Co	6811 West 63d St. Overland Park, Kans. 66202	Dredge	Various.
Keener Gravel Co. Inc	P.O. Box 72 Dexter, Mo. 63841	Pit and plant	Stoddard.
Missouri Gravel Co	313 16th St. Moline, Ill. 61265	do	Lewis.
Norbroco, Inc	P.O. Box 414 Hazelwood, Mo. 63042	do	St. Louis.
Pennsylvania Glass Sand Corp	Berkeley Springs, W. Va. 25411	Stationary	St. Louis and St. Charles.
Riverside Sand & Dredging	5000 Bussen Rd. St. Louis, Mo. 63129	Dredge	St. Louis.
Simpson Sand and Gravel Co	15 Lookout Dr. Valley Park, Mo. 63088	do	Jefferson.
St. Charles Sand Co	Rt. 1, Box 253 Bridgeton, Mo. 63042	Stationary	St. Louis.
Winter Bros. Material Co	13098 Gravois Rd. St. Louis, Mo. 63127	do	Do.
Silver: *See* Lead.			
Stone:			
Ash Grove Cement Co	P.O. Box 70 Butler, Mo. 64730	3 quarries	Bates, Greene, Vernon.
Brown Quarries	Washington, Mo. 68090	Quarry	Various.
Dundee Cement Co	P.O. Box 317 Dundee, Mich. 48131	do	St. Louis.
Howard Construction Co	1504 North Osage St. Sedalia, Mo. 65301	2 quarries	Pettis and Saline.
Midwest Precote Co	7600 East 17th St. Kansas City, Mo. 64116	do	Clay and Platte.
Mississippi Lime Co	7 Alby St. Alton, Ill. 62002	Quarry	Ste. Genevieve.
Missouri Portland Cement Co	7751 Carondelet Ave. St. Louis, Mo. 63105	do	Jackson and St. Louis.
River Cement Co	Festus, Mo. 63028	do	Jefferson.
Vigus Quarries, Inc	7929 Alabama Ave. St. Louis, Mo. 63111	do	Jefferson and St. Louis.
Fred Weber Inc	7929 Alabama Ave. St. Louis, Mo. 63111	3 quarries	St. Charles, Jefferson, St. Louis.
West Lake Quarry & Material Co.	Rt. 1, Box 206, Taussig Rd. Bridgeton, Mo. 63042	do	St. Louis and Scott.
Vermiculite: W. R. Grace & Co., Zonolite Div.	62 Whittemore Ave. Cambridge, Mass. 01109	Exfoliating plant	St. Louis.
Zinc: *See* Lead.			

The Mineral Industry of Montana

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Montana Bureau of Mines and Geology for collecting information on all minerals.

By J. M. West [1]

A record high of $385.3 million in minerals was produced in Montana in 1973, up 25% from the value of 1972 output. Copper, mostly from Butte, accounted for 41% of the total value; the quantity produced was 8% greater than in 1972. The quantities of gold and silver produced rose 17% and 31%, respectively. Antimony production increased sharply owing to activities at a property in Sanders County. Nonmetallic mineral outputs were generally higher, except for clays, lime, and phosphate rock. The value of fuels in 1973 comprised 42% of the total mineral value. Coal output rose a significant 30% in quantity and 81% in value, and was expected to continue the upward trend. Quantities of petroleum and natural gas produced rose 2% and 68% respectively, but the rate of exploration activity, measured by footage drilled, declined 22%.

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in Montana [1]

Mineral	1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays [2] thousand short tons	304	$1,590	219	$1,298
Coal (bituminous) do	8,221	16,690	10,725	30,238
Copper (recoverable content of ores, etc.) short tons	123,110	126,064	132,466	157,634
Gem stones	NA	120	NA	150
Gold (recoverable content of ores, etc.) troy ounces	23,725	1,390	27,806	2,720
Iron ore (usable) thousand long tons, gross weight	9	W	13	W
Lead (recoverable content of ores, etc.) short tons	287	86	176	57
Lime thousand short tons	242	3,003	210	3,028
Manganese ore and concentrate (35% or more Mn) short tons, gross weight	578	W	239	W
Natural gas million cubic feet	33,474	4,117	56,175	13,240
Peat thousand short tons	1	W	1	W
Petroleum (crude) thousand 42-gallon barrels	33,904	103,924	34,620	115,423
Sand and gravel thousand short tons	10,116	17,149	11,694	13,819
Silver (recoverable content of ores, etc.) thousand troy ounces	3,325	5,603	4,350	11,127
Stone thousand short tons	4,074	5,627	5,054	9,559
Zinc (recoverable content of ores, etc.) short tons	12	4	73	30

Table 1.—Mineral production in Montana [1]—Continued

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Value of items that cannot be disclosed: Antimony, cement, fire clay, fluorspar, gypsum, natural gas liquids, phosphate rock, talc, tungsten, vermiculite, and values indicated by symbol W	XX	$22,309	XX	$26,962
Total	XX	307,676	XX	385,285
Total 1967 constant dollars	XX	253,863	XX	p 282,876

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes fire clay; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Montana, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Beaverhead	W	W	Stone, silver, sand and gravel, zinc, lead, gold, copper.
Big Horn	W	W	Coal, sand and gravel, petroleum, natural gas, stone.
Blaine	$289	$290	Petroleum.
Broadwater	W	W	Iron ore, sand and gravel, stone.
Carbon	5,225	W	Petroleum, sand and gravel, natural gas, stone.
Carter	W	W	Clays, sand and gravel, petroleum.
Cascade	188	W	Sand and gravel, clays, stone.
Chouteau	W	535	Sand and gravel, stone.
Custer	W	W	Sand and gravel, natural gas, stone.
Daniels	32	58	Sand and gravel, petroleum.
Dawson	W	2,366	Petroleum, sand and gravel, stone.
Deer Lodge	3,768	3,603	Lime, stone, sand and gravel, clays, silver, copper, gold.
Fallon	22,986	22,876	Petroleum, natural gas liquids.
Fergus	W	W	Gypsum, sand and gravel, clays, stone.
Flathead	491	1,142	Sand and gravel, silver, stone, lead, copper, gold, zinc.
Gallatin	W	8,537	Cement, sand and gravel, stone, clays.
Garfield	1,069	--	
Glacier	2,314	2,324	Petroleum, natural gas liquids, sand and gravel.
Golden Valley	7	30	Sand and gravel.
Granite	W	W	Silver, gold, copper, tungsten, stone, zinc, lead.
Hill	W	207	Sand and gravel.
Jefferson	5,815	W	Cement, stone, gold, sand and gravel, silver, copper, lead, zinc, clays.
Judith Basin	--	24	Stone.
Lake	W	W	Sand and gravel, peat.
Lewis and Clark	257	223	Sand and gravel, copper, silver, lead, gold, zinc, stone.
Liberty	1,167	1,152	Petroleum, sand and gravel.
Lincoln	5,483	W	Vermiculite, stone, sand and gravel.
McCone	2,101	1,420	Petroleum, sand and gravel.
Madison	W	W	Talc, sand and gravel, gold, silver, copper, zinc, lead, stone.
Meagher	30	168	Stone, gold.
Mineral	1,392	355	Stone, copper, sand and gravel, gold, silver, lead.
Missoula	W	W	Sand and gravel, stone.
Musselshell	3,689	W	Petroleum, coal, clays.
Park	W	W	Sand and gravel, stone.
Petroleum	101	6	Sand and gravel.
Phillips	14	15	Clays.
Pondera	419	47	Petroleum, sand and gravel.
Powder River	20,193	30,011	Petroleum, sand and gravel, natural gas, coal, stone.
Powell	W	W	Phosphate rock, sand and gravel, stone, silver, copper, zinc, lead, gold.
Ravalli	W	W	Fluorspar, sand and gravel, stone.
Richland	8,707	8,297	Petroleum, coal, sand and gravel, natural gas liquids, lime, stone.
Roosevelt	W	W	Petroleum, natural gas liquids, sand and gravel.
Rosebud	16,920	17,013	Coal, petroleum, sand and gravel, clays.
Sanders	W	324	Antimony, sand and gravel, stone.
Sheridan	W	6,565	Petroleum, sand and gravel.
Silver Bow	133,264	171,062	Copper, silver, gold, sand and gravel, stone, manganese.

See footnotes at end of table.

Table 2.—Value of mineral production in Montana, by county [1]—Continued
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Stillwater	$64	$1	Stone.
Sweet Grass	W	65	Sand and gravel, stone.
Teton	W	39	Sand and gravel, petroleum.
Toole	3,001	W	Petroleum, sand and gravel.
Treasure	W	W	Clays.
Valley	W	W	Sand and gravel.
Wheatland	--	50	Do.
Wibaux	W	8	Do.
Yellowstone	1,388	1,374	Sand and gravel, lime, petroleum, clays, stone.
Yellowstone National Park	576	1,196	Sand and gravel.
Combined counties [2]	27,081	37,530	
Undistributed [3]	39,639	66,372	
Total [4]	307,676	385,285	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Prairie County is not listed because no production was reported.
[2] Petroleum and natural gas production from fields underlying two or more counties.
[3] Includes mineral production which cannot be assigned to specific counties and values indicated by symbol W.
[4] Data may not add to totals shown because of independent rounding.

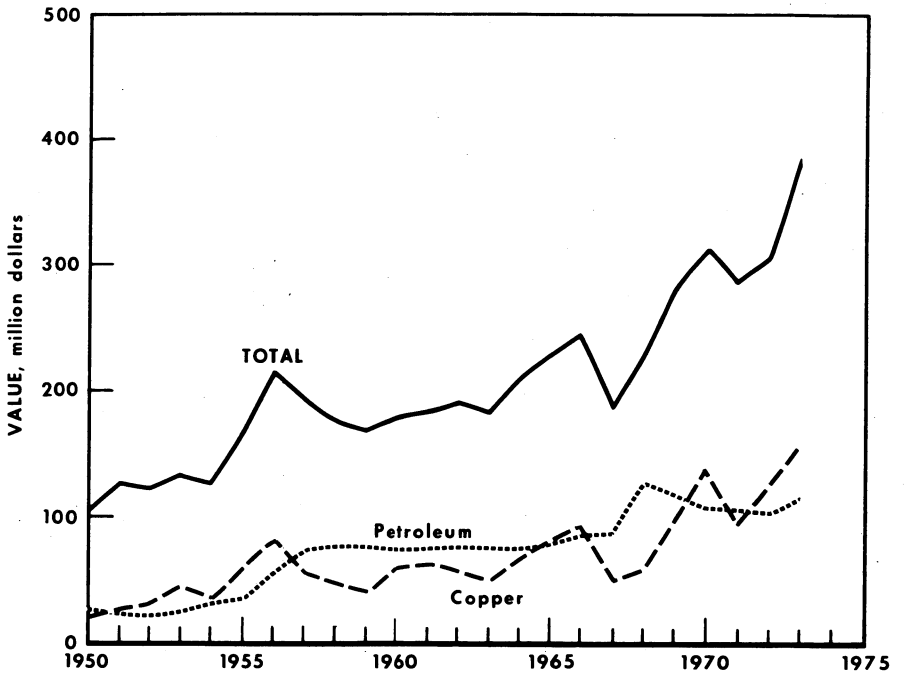

Figure 1.—Value of copper, petroleum, and total value of mineral production in Montana.

Table 3.—Indicators of Montana business activity

		1972	1973 p	Change, percent
Annual average labor force and employment:				
Total labor force	thousands	297.2	309.8	+4.2
Unemployment	do	18.5	19.6	+5.9
Employment:				
Manufacturing	do	24.7	24.4	−1.2
Wholesale and retail trade	do	53.1	56.4	+6.2
Mining	do	6.4	6.3	−1.6
Construction	do	13.1	13.4	+2.3
Transportation and public utilities	do	18.2	18.8	+3.3
Finance, insurance, real estate	do	8.9	9.4	+5.6
Services	do	38.3	42.2	+10.2
Government	do	55.4	55.3	−.2
Personal income:				
Total	millions	$2,875	$3,186	+10.8
Per capita		$3,999	$4,418	+10.5
Construction activity:				
Value of authorized nonresidential construction	millions	$30.7	$31.9	+3.9
Highway construction contracts awarded	do	e$75.0	$33.6	−55.2
Cement shipments to and within Montana	thousand short tons	245	285	+16.3
Farm marketing receipts	millions	$927.0	$1,139.1	+22.9
Mineral production value	do	$307.7	$385.3	+25.2

e Estimated. p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; U.S. Bureau of Mines.

The first ore shipment from The Anaconda Company's new Continental copper mine at Butte was made in November. The ore was shipped by train from the East Pit to Anaconda, Deer Lodge County, for milling. Plans were also being made to open a second pit to the south. The company continued work at the town of Anaconda on a 36,000-ton-per-year copper leach plant using a new process. The Anaconda Company also planned to expand refining capacity at its Great Falls plant by over one-third to treat additional copper from Butte and from a new open pit mine in Nevada. In addition, the company planned to reexamine the Heddleston copper-molybdenum area in Lewis and Clark County, where a project had been delayed because of environmental considerations. American Smelting and Refining Company negotiated for a lease on a potentially important copper-silver property in Lincoln County.

Coal mine expansion was centered at Decker in Big Horn County, and in the Colstrip area of Rosebud County, where a large steam electric-generating facility was under construction. Several companies were preparing new strip mines in at least two locations, one on Sarpy Creek in Big Horn County. The Montana Strip Mining and Reclamation Act of 1973 contained many provisions to insure adequate reclamation practices in the mining of coal, clay, phosphate rock, and uranium. Regulations for implementing the act were to be written by the Department of State Lands. The Montana Utility Siting Act of 1973 was also signed into law. The Act gave the Department of Natural Resources and Conservation the authority to require and review long-range planning by utilities, approve energy generation and conversion plant siting, and require preconstruction certifications.

The Montana legislature established a "resource indemnity trust" to be funded by taxing the miner 0.5% of the gross value of all mineral products removed from the ground. The funds will be deposited in a trust until $10 million is accumulated, at which time, interest on the money could be appropriated for improving the State environment. When the fund reaches $100 million, the principal in the trust would then become available for appropriation. A new law permits assessment work on mining claims to be performed at one location for all contiguous claims, thus removing the previous limitation of a 10-claim maximum. A law was also enacted to insure reclamation of lands affected by opencut mining of sand, gravel, and bentonite; the law is applicable to operations disturbing 10,000 cubic yards or more of earth.

A report of the Montana Agricultural Experiment Station in Bozeman described

preplanning studies of surface mining related especially to coal mine reclamation efforts.[2] Western Energy Co. and Decker Coal Co. financed the project. A large amount of information was compiled on the adaptability of various plant species to southeastern Montana soils and the best methods for seeding and fertilizer application.

Plans were being made to drill a well on a geothermal anomaly near Marysville, 20 miles northeast of Helena, to investigate the potential for geothermal power. The diameter of the 6,000-foot-deep well will be 26 inches at the top, tapering to 7⅞ inches at the bottom. The project was funded by the National Science Foundation and was expected to be underway by early 1974.

REVIEW BY MINERAL COMMODITIES

METALS

Aluminum.—Primary aluminum output at the Columbia Falls plant of The Anaconda Aluminum Co. decreased 15% compared with that of 1972, owing to electric power shortages. Imported alumina was used as a raw material.

Antimony.—The U.S. Antimony Corp. produced antimony concentrate at its mine and mill in the Thompson Falls area, Sanders County, at a 50% higher rate of production than in 1972. The firm reduced the product to about 98% antimony metal in a rotary furnace plant at the site. A second adit was driven on the orebody, and continued expansion was foreseen in mine output.

Copper.—Copper production rose 8% in 1973 and was valued at $158 million, compared with $126 million in 1972. All but about 180 tons of the copper was produced in Silver Bow County. Other copper-producing counties included Granite, Jefferson, Flathead, Madison, and Mineral Counties. The Anaconda Company mines in the Butte area accounted for most of the copper; the Berkley and Continental open pits supplied the bulk of the company's output. Less than one-fifth of the production was from the underground Mount Con and Steward mines at Butte.

The first phase of a $7 million expansion of The Anaconda Company electrolytic copper refinery at Great Falls was finished. The project, scheduled for completion in 1975, would add a fourth electrolytic circuit and a new melting furnace, thus increasing capacity 38% to 21,000 tons per month.

[2] Sindelar, B.W., R.L. Hodder, and M.E. Majerus. Surface Mined Land Reclamation Research in Montana. Mont. State Univ. Agr. Exp. Sta. Res. Rept. 40, April 1973, 122 pp.

Table 4.—Montana: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1973, by class of ore or other source material

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Dry gold	6	948	180	830	(2)	--	--
Dry gold-silver	11	16,974	1,913	75,730	16	73	53
Dry silver	16	23,246	175	182,012	27	79	6
Total	33	41,168	2,268	258,572	43	152	59
Copper	5	18,976,738	22,981	4,025,210	110,158	--	--
Lead	5	195	18	638	(2)	11	3
Lead-Zinc	5	328	41	4,122	1	13	11
Total	15	18,977,261	23,040	4,029,970	110,159	24	14
Other lode material:							
Gold tailings	1	10,608	665	8,076	9	--	--
Copper precipitates	2	28,977	--	--	22,169	--	--
Copper tailings	8	56,085	1,811	53,251	86	--	--
Total	11	95,670	2,476	61,327	22,264	--	--
Total lode material	57	19,114,099	27,784	4,349,869	132,466	176	73
Placer	1	--	22	--	--	--	--
Grand total	58	19,114,099	27,806	4,349,869	132,466	176	73

[1] Detail may not add to total because some mines produce more than one class of material.
[2] Less than ½ unit.

Table 5.—Montana: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing		Material sold or treated [1] (short tons)	Gold		Silver	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
1971, Total	46	3	13,573,429	15,613	$644,038	2,747,557	$4,247,725
1972, Total	37	2	17,232,749	23,725	1,390,288	3,325,052	5,602,713
1973:							
Beaverhead	4	--	2,051	16	1,566	10,564	27,022
Granite	10	--	15,414	941	92,039	104,234	266,632
Jefferson	10	--	16,973	1,275	124,708	38,845	99,366
Lewis and Clark	4	--	514	22	2,153	1,293	3,307
Madison	12	--	11,869	979	95,756	33,664	86,113
Meagher	--	1	--	22	2,152	--	--
Powell	1	--	115	2	196	390	998
Silver Bow	12	--	19,055,467	24,341	2,380,793	4,070,183	10,411,529
Undistributed [2]	4	--	11,696	208	20,344	90,696	232,001
Total [3]	57	1	19,114,099	27,806	2,719,707	4,349,869	11,126,968

	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1971, Total	88,581	$92,124,812	615	$169,657	361	$116,115	$97,302,347
1972, Total	123,110	126,064,454	287	86,392	12	4,303	133,148,150
1973:							
Beaverhead	1	729	5	1,780	5	1,882	32,979
Granite	18	21,979	4	1,247	6	2,414	384,311
Jefferson	19	22,694	69	22,490	40	16,585	285,843
Lewis and Clark	10	11,710	9	2,840	3	1,042	21,052
Madison	9	10,953	14	4,520	18	7,420	204,762
Meagher	--	--	--	--	--	--	2,152
Powell	(4)	519	1	301	1	401	2,415
Silver Bow	132,282	157,415,831	--	--	--	--	170,208,153
Undistributed [2]	126	150,046	74	24,022	1	383	426,796
Total [3]	132,466	157,634,461	176	57,200	73	30,127	171,568,463

[1] Does not include gravel washed.
[2] Deer Lodge, Flathead, and Mineral Counties combined to avoid disclosing individual company confidential data.
[3] Data may not add to totals shown because of independent rounding.
[4] Less than ½ unit.

Table 6.—Montana: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1973, by type of material processed and method of recovery

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Smelting of concentrates	22,860	4,029,135	109,935	11	3
Direct smelting of—					
Ore	2,448	259,407	267	165	70
Precipitates			22,169	--	--
Tailings	2,476	61,327	95	--	--
Total	4,924	320,734	22,531	165	70
Total lode material	27,784	4,349,869	132,466	176	73
Placer	22	--	--	--	--
Grand total	27,806	4,349,869	132,466	176	73

Table 7.—Montana: Mine production (recoverable) of gold, silver, copper, lead, and zinc, in Silver Bow County

Year	Mines producing	Material sold or treated (thousand short tons)	Gold (troy ounces)	Silver (thousand troy ounces)
	Lode			
1969	5	16,022	15,428	2,563
1970	4	18,745	19,454	3,590
1971	4	13,531	13,789	2,415
1972	5	17,208	22,535	3,159
1973	12	19,055	24,341	4,070
1882–1973	--	[1] 442,377	2,537,495	662,299

Year	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value (thousands)
1969	103,179	--	W	$103,321
1970	120,292	--	--	145,881
1971	88,503	--	--	96,344
1972	123,058	2	--	132,656
1973	132,282	--	--	170,208
1882–1973	8,867,096	415,427	2,406,818	4,735,098

W Withheld to avoid disclosing individual company confidential data.
[1] Complete data not available: 1882–1904.

At the Weed concentrator in Butte, The Anaconda Company increased milling rates to about 50,000 tons per day of ore. In April, the company broke ground for construction of a $25 million 36,000-ton-per-year copper-reduction plant using the Arbiter process, essentially a nonpolluting, ammoniacal-leach process of extraction. The resulting solutions are passed through a liquid ion-exchange circuit; this step is followed by electrolytic recovery in a cathode form. The plant was scheduled to be completed at Anaconda, Deer Lodge County, by late 1974. Projected plans for mining the Continental South Pit ore body were undecided. The pit limits would reach close to Hillcrest, a southeast subdivision of Butte. The Continental East Pit, near Columbia Gardens, was expected to reach a production volume of 14,000 tons per day in mid-1974. Ores were sent to the concentrator in Anaconda for treatment.

The Anaconda Company announced that it would renew an exploration program to further evaluate the Heddleston mining district in the Lincoln area, where extensive resources of copper and molybdenum have been established. Development of the deposits has been controversial because of environmental implications. Bear Creek Mining Co., a subsidiary of Kennecott Copper Corp., announced negotiations with American Smelting and Refining Company to lease Bear Creek Mining Co.'s Spar Lake copper-silver prospect south of Troy in Lincoln County. The property is estimated to contain 50 mil-

lion tons of ore grading 0.7% copper and 1.5 ounces of silver per ton. An underground mine was contemplated.

A geochemical soil-sampling program, conducted by the Montana Bureau of Mines and Geology, indicated the presence of disseminated copper and molybdenum over granitic intrusives in the Stemple Pass area of Lewis and Clark County. Additional investigations in the area were recommended. Copperfield Mining Co. and Iso Mines, Inc., reported completion of 70 drill holes averaging 200 feet in depth during exploration of a copper deposit near Twin Bridges, Madison County. Based on work through early 1973, reserves were estimated at 1.8 million tons averaging 1.3% copper.

Gold.—Gold production rose 17% in quantity and 96% in value in 1973. The large increase in value resulted from a sharp rise in the average market price to $97.81 per troy ounce. The Butte area of Silver Bow County accounted for 88% of all gold produced, virtually all a byproduct of copper production. Most other base-metal mines reported some production of byproduct gold. About 2,500 ounces, or 9% of all gold produced in the State, came from retreatment of 67,000 tons of old mill tailings at six locations. Placer gold was reported from only one small operation in Meagher County.

With the stimulus of higher prices, a number of gold exploration projects were active. Placer Amex Inc. explored the Golden Sunlight property near Whitehall, and applied for a mining permit (required by Montana law) in preparation for pilot-scale metallurgical testing. A gold property near Zortman in the Little Rocky Mountains, Phillips County, underwent exploratory drilling and was scheduled for bulk metallurgical testing. Underground reserves were estimated at 500,000 tons, averaging 0.39 ounce per ton of gold. Azcon Corp., a subsidiary of Consolidated Gold Fields Corp., planned an exploration program on Miller Mountain in the Big Belt Mountains, east of Canyon Ferry Lake. Rehabilitation work began on the old Kendall mine in the belief that large tonnages of a gold-bearing black ore noted in previous operations might now be minable. The Anaconda Company evaluated the gold potential of the Jardine area, in southern Park County; Sunshine Mining Co. examined gold properties in the Gilt-edge area of the Judith Mountains, Fergus County. Placer Amex conducted negotiations to explore the German Gulch gold property west of Butte in Silver Bow County.

Lead.—Lead production declined 39% to 176 tons in 1973. Production was reported from 25 operations. Jefferson and Flathead Counties provided most of the output.

Manganese.—Manganese ore was shipped to consumers from stocks of The Anaconda Company in Deer Lodge County. The material was metallurgical grade containing 52.7% manganese with 10.6% silica, and amounted to 239 short tons.

Platinum.—Johns-Manville Corp. continued exploration for platinum on its claims in the Stillwater Complex in Sweet Grass County. Assays as high as 0.45 ounce per ton were reported near the surface, but ore tonnages remained undetermined.

Silver.—Silver output rose 31% in quantity and 99% in value during the year. About 94% of all silver produced came from copper operations in the Butte area of Silver Bow County. Mill tailings were re-treated at several locations for recovery of about 61,000 ounces of silver, or about 1.5% of total production. About 67,000 tons of material was treated in these operations. The average silver price in 1973 was $2.558 per troy ounce compared with $1.685 per troy ounce in 1972; this increase caused a significant rise in prospecting activities in Montana silver districts. UV Industries, Inc., explored silver-gold claims in the German Gulch area, and Inspiration Consolidated Copper Co. was developing a property in the Black Pine mine area on the west side of Flint Creek Valley. Ore shipments began from the Hope silver properties, near Philipsburg. Exploration also took place in the Camp Creek and South Gulch areas south of the Highlands, the Beaverhead National Forest south of Elkhorn, the Comet Mountain area, the Vipond district, the Cooke City area in the Gallatin National Forest, and at the Emory mine east of the Deer Lodge Valley.

Tungsten.—The only producers in 1973 were the January Mining Co., operating the Trigger mine near Philipsburg, Granite County; and Mineral Processing Co., operators of a small mill located at Philipsburg. The General Electric Co. explored the Calvert mine in Beaverhead County.

Uranium.—Mobil Oil Corp. prospected for uranium in western Harding and eastern Carter Counties. Activities were centered in the Long Pines area of the Custer National Forest.

Zinc.—Zinc output rose sharply to 73 tons in 1973, mostly from deposits in Jefferson and Madison Counties. A total of 23 properties produced zinc. Ores were treated at the East Helena smelter of American Smelting and Refining Company.

NONMETALS

Cement.—Production and shipments of portland cement rose 8% during the year, and masonry cement shipments rose 20%. Two plants operated in the State, one near Helena and the other at Trident. Ideal Cement Co. completed improvements on equipment at its Trident operation, resulting in about a 10% expansion of capacity.

Clays.—Outputs of clays and shales declined in 1973. Production came from 17 mines in 11 counties and was used in building products, for iron ore pelletizing, and in muds for oil well drilling. The Lewistown Brick and Tile Co. in Fergus County and Lovell Clay Products in Yellowstone County produced facing brick from miscellaneous clays and shales. Treasure State Industries, Inc., produced material for lightweight aggregate near Great Falls, Cascade County. Three companies produced bentonite in Carter, Rosebud, and Treasure Counties.

Fluorspar.—One mine in Ravalli County, operated by Roberts Mining Co., produced all of the fluorspar output in the State. The product was sold mainly to the steel industry as a flux.

Gypsum.—Gypsum was mined and calcined by one company, the United States Gypsum Co., at Heath, in Fergus County. Output of crude and calcined gypsum rose 5%, setting a new production record for the State.

Lime.—Lime was produced in Deer Lodge, Richland, and Yellowstone Counties. Output was 13% lower than that of 1972. The bulk of production was used in sugar refining. Total lime consumption in Montana was 215,800 tons.

Sand and Gravel.—Output rose 16% in 1973 owing to increased demand for highway construction. Sand and gravel was produced in 46 of 56 counties in the State.

Table 8.—Montana: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	302	555	379	728
Fill	10	13	80	62
Paving	115	215	69	169
Other uses [1]	38	75	44	80
Total [2]	464	857	572	1,040
Gravel:				
Building	520	799	588	918
Fill	200	164	205	143
Paving	773	975	1,083	951
Miscellaneous	96	113	58	70
Other uses [3]	86	115	171	244
Total [2]	1,675	2,165	2,105	2,326
Government-and-contractor operations:				
Sand:				
Fill	15	2	2	2
Paving	165	677	334	299
Other uses	7	5	3	9
Total	187	684	339	310
Gravel:				
Building	60	43	73	62
Fill	239	139	355	268
Paving	7,395	13,214	8,151	9,763
Other uses	96	46	98	51
Total [2]	7,791	13,443	8,677	10,143
Total sand and gravel [2]	10,116	17,149	11,694	13,819

[1] Includes railroad ballast (1973) and other industrial sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast.

Stone.—Stone production rose 24% in quantity and 70% in value for the year. A total of 56 quarries operated in 31 counties. Lincoln County was the largest producing county, followed by Gallatin, Jefferson, Deer Lodge, and Silver Bow. The total for these counties was 4.48 million tons, 89% of the State output. Three quarries produced 71% of the total crushed and broken stone. One quarry, operated by the U.S. Army Corps of Engineers in Lincoln County, produced 2.65 million tons of traprock, valued at $5.29 million, for use as fill. Six quarries produced over 100,000 tons of stone each, and 39 quarries produced less than 25,000 tons of stone each. Four quarries produced dimension stone. Types of stone produced included traprock, limestone, granite, quartzite, and marble.

The Montana State Highway Department operated 17 quarries, producing 382,919 tons of traprock valued at $415,930. Trucks transported 94% of all the shipments of crushed and broken stone; the balance was moved by rail. Limestone was produced and used for cement by the Ideal Cement Co. at Trident, Gallatin County, and by Kaiser Cement & Gypsum Corp. near Helena, Jefferson County. Maronick Construction Co. produced limestone for flux in Jefferson County and The Anaconda Company produced it for flux and lime manufacture in Deer Lodge County. Pacific Silica Co. produced sandstone in Jefferson County for use in abrasives, cement, and for manufacturing ferrosilicon. Stauffer Chemical Co. produced quartzite for flux in Beaverhead County. Quartzite for terrazzo and exposed aggregate was produced at Bitter Root Valley Station, near Missoula.

Sulfur.—Sulfur was recovered from natural gas by two companies operating plants at Billings, Yellowstone County.

Talc.—Three companies operating six mines in Madison County produced 48% more talc in 1973 than in 1972. Most of the talc was used in ground form, but some was sold in crude form after washing. Most of the talc was shipped out of Montana after grinding and was used in the

manufacture of paper, paint, refractories, toilet preparations, rice polishing, ceramics, rubber, roofing materials, and insecticides.

Vermiculite.—W. R. Grace & Co., Construction Products Div., produced vermiculite at Libby, in Lincoln County, primarily for further treatment and sale outside of Montana. Robinson Insulation Co. exfoliated vermiculite at Great Falls, Cascade County, producing material for concrete and plaster aggregates, loose-fill and block insulation, and litter.

MINERAL FUELS

Coal.—Eastern Montana low-sulfur bituminous and lignite coals were in great demand in 1973 for shipment to central and eastern States for electric-power generation. Production expanded by 30% in quantity and 81% in value during the year. Coal was produced by 9 active mines in five counties. All but about 800,000 tons was shipped out of State.

Decker Coal Co., in the second year of operating a large strip mine at Decker, in Big Horn County, signed a contract about mid-year with the Detroit Edison Co. to deliver 180 million tons of coal in the next 26 years, beginning in 1976. Initial shipments of 4 million tons will eventually increase to 7 million tons per year. The coal was to be burned in two steam electric-generating plants at St. Clair, Mich.; one now in existence and one to be constructed in 1980. Burlington Northern, Inc., added three unit-trains to serve Montana-Wyoming coal mines, increasing coal haulage capacity 20%. A permit was issued by the Montana Department of Health and Environmental Sciences for a 700-megawatt, coal-fired electric-generating facility at Colstrip; construction was started during the year. The facility is a joint venture of Montana Power Co. and the Puget Sound Power and Light Co.

New taxes were levied on coal extraction early in the year, raising taxes to a range of 12 to 40 cents per ton. The rate depends on classification of the coal by British thermal unit values.

The Montana Strip Mining and Reclamation Act, also passed early in the year, had a delaying effect on coal mine development. Environmental impact statements were prepared for the proposed Sarpy Creek mine of Westmoreland Resources Co. in Big Horn County; the Big Sky mine of Peabody Coal Co. at Colstrip, Rosebud County; and the Decker Coal Co. mine at Decker, Big Horn County. Knife River Coal Co. obtained a permit in late 1973 to strip mine an estimated 300,000 tons per year of coal for electric-generating plants at Sidney. Montana Power Co. and four other utilities were reportedly planning to expand the capacity of power facilities under construction at Colstrip to 2,060 megawatts at a cost of $540 million. Western Energy Co., a subsidiary of Montana Power Co., operated the largest strip mine in the State near Colstrip. The firm expected a 50% drop in coal production in 1974 to about 2.4 million tons owing to the expiration of several coal contracts with eastern consumers. In December, the Montana Land Department issued a renewed strip mining permit to Western Energy Co.; the permit specified that the firm could mine 185 acres and disturb not more than 1,041 acres of land in the next 12 months. The company planned eventually to mine an area of 12,605 acres. Consolidation Coal Co. explored the Mammoth-Rehder coal seam in the Bull Mountain area, south of Roundup in Musselshell County; the firm reportedly spent $1.5 million on the project.

Table 9.—Montana: Bituminous and lignite coal production in 1973, by type of mine and county
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines			Production (thousand short tons)			Value (thousands)
	Underground	Strip	Total	Underground	Strip	Total	
Bituminous:							
Big Horn	--	1	1	--	W	W	W
Musselshell	1	3	4	1	25	26	W
Rosebud	--	2	2	--	W	W	W
Total	1	6	7	1	10,410	10,411	$29,463
Lignite:							
Powder River	--	1	1	--	1	1	W
Richland	--	1	1	--	313	313	W
Total	--	2	2	--	314	314	W
Grand total	1	8	9	1	10,724	10,725	30,238

W Withheld to avoid disclosing individual company confidential data.

Petroleum and Natural Gas.—Crude oil production rose 2% in quantity and 11% in value in 1973. Petroleum production amounted to 34.6 million barrels in 1973 and accounted for 30% of the value of total mineral output in the State. Over 50% of the crude oil came frome six fields: Bell Creek, in Powder River County; Cut Bank, in Glacier and Toole Counties; Cabin Creek, in Fallon County; Pine, in Dawson, Fallon, Prairie, and Wilbaux Counties; Pennel-Lookout Butte, in Fallon County; and Sumatra, in Rosebud County. Secondary recovery by waterflooding accounted for nearly one-third of total production.

Exploration footage drilled declined 22% compared with that in 1972, despite sharply higher crude oil prices for new production. One of the reasons was that drilling equipment became scarce and planned projects had to be delayed. Chouteau County drilling expanded threefold and resulted in 23 new gas wells in proved fields and 4 new exploratory gas wells. Hill County had the greatest number of completions at 27 gas wells in proved fields and 11 in new areas, although footage drilled was down 20%. A total of 46 oil wells were successfully completed compared with 83 in 1972, and 123 gas wells were completed compared with 125 in 1972. A gas discovery near Rapelje, in Stillwater County, was estimated to contain a recoverable reserve of 70 billion cubic feet, and a second discovery in northern Hill County tested at a rate of 11 million cubic feet of gas daily. Oil discoveries of potential importance were made in Blaine County and about 5 miles west of the Fairview field in Richland County.

Table 10.—Montana: Oil and gas well drilling completions in 1973, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Big Horn	--	--	--	--	--	7	7	27,930
Blaine	2	14	7	1	5	47	76	143,988
Carbon	--	--	1	--	--	4	5	27,111
Carter	--	--	--	--	--	3	3	11,481
Cascade	--	--	--	--	--	1	1	1,297
Chouteau	--	23	8	--	4	82	117	238,267
Custer	--	1	1	--	--	11	13	32,652
Daniels	--	--	--	--	--	1	1	7,331
Dawson	--	--	1	--	--	2	3	23,840
Fallon	1	--	1	--	--	1	3	28,590
Fergus	--	--	--	--	1	27	28	65,046
Garfield	--	--	--	--	--	4	4	29,475
Glacier	8	2	4	1	--	2	17	59,203
Golden Valley	--	--	--	--	--	1	1	1,843
Hill	--	27	19	--	11	54	111	177,265
Judith Basin	--	--	--	--	--	10	10	25,053
Liberty	3	2	4	--	2	14	25	66,787
McCone	--	--	2	--	--	5	7	54,211
Madison	--	--	--	--	--	1	1	500
Musselshell	8	--	10	2	--	14	34	134,487
Petroleum	2	--	--	--	--	2	4	13,349
Phillips	--	14	--	--	--	13	27	55,505
Pondera	1	--	2	--	1	3	7	15,656
Powder River	--	--	1	--	--	12	13	62,618
Richland	1	--	1	4	--	2	8	100,148
Roosevelt	1	--	1	1	--	4	7	62,415
Rosebud	6	--	3	1	--	21	31	140,873
Sheridan	1	--	1	--	--	2	4	34,265
Stillwater	--	7	--	--	3	9	19	43,897
Sweet Grass	--	--	--	--	--	2	2	10,341
Teton	1	--	1	--	--	5	7	14,683
Toole	1	4	8	--	1	15	29	68,834
Treasure	--	--	--	--	--	1	1	4,316
Valley	--	--	--	--	--	6	6	18,264
Wheatland	--	1	--	--	--	2	3	9,034
Wibaux	--	--	--	--	--	1	1	11,001
Yellowstone	--	--	--	--	--	6	6	26,914
Total	36	95	76	10	28	397	642	1,848,470

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Western Montana continued to import natural gas from Alberta, Canada, through pipelines of the Canadian-Montana Gas Co., Ltd., at a contracted rate of 20 billion cubic feet per year. About 80% of the natural gas consumed in western Montana came from Alberta. Colorado Interstate Gas Co. filed application with the Federal Power Commission to construct a $50 million, 233-mile gas pipeline from the southern border of Carbon County to the northern border of Chouteau County to supply markets outside Montana. Other lines in Montana were operated by the Northern Natural Gas Co. and Montana-Dakota Utilities Co. Montana natural gas production in 1973 totaled 56.2 million cubic feet, a sharp increase over that of 1972. Values were $13.2 million in 1973, compared with $4.1 million in 1972.

Table 11.—Principal producers

Commodity and company	Address	Type of activity	County
METALS			
Aluminum: Anaconda Aluminum Co	Columbia Falls, Mont. 59912	Reduction plant	Flathead.
	Great Falls, Mont. 59401	Rolling mill	Cascade.
Copper: The Anaconda Company	Anaconda, Mont. 59711	Smelter	Deer Lodge.
	Butte, Mont. 59701	Mine, concentrator, precipitating plant.	Silver Bow.
	Great Falls, Mont. 59401	Refinery, rolling mill.	Cascade.
Gold: The Anaconda Company	Anaconda, Mont. 59711	Smelter	Deer Lodge.
	Butte, Mont. 59701	Mine, concentrator, precipitating plant.	Silver Bow.
	Great Falls, Mont. 59401	Refinery, rolling mill.	Cascade.
Silver: The Anaconda Company	Anaconda, Mont. 59711	Smelter	Deer Lodge.
	Butte, Mont. 59701	Mine, concentrator, precipitating plant.	Silver Bow.
	Great Falls, Mont. 59401	Refinery, rolling mill.	Cascade.
NONMETALS			
Cement:			
Ideal Cement Co	420 Ideal Cement Bldg. Denver, Colo. 80202	Plant	Gallatin.
Kaiser Cement & Gypsum Corp	300 Lakeside Dr. Oakland, Calif. 94604	---- do	Jefferson
Clays:			
Hallett Minerals Co	P.O. Box 491 Forsyth, Mont. 59327	---- do	Rosebud, Treasure.
International Minerals and Chemicals Corp. Industries.	Old Orchard Rd. Skokie, Ill. 60076	Pit	Carter.
Kanta Products, Inc	P.O. Box 96 Three Forks, Mont. 59752	Pit and plant	Gallatin.
Baroid Div., NL Industries, Inc.	P.O. Box 1675 Houston, Tex. 77001	Pit	Carter.
Treasurelite, a division of Treasure State Industries, Inc.	P.O. Box 2750 Great Falls, Mont. 59401	Pit	Cascade.
Fluorspar: Roberts Mining Co	P.O. Box 365 Darby, Mont. 59829	Mine and plant.	Ravalli.
Gypsum:			
United States Gypsum Co	Lewistown, Mont. 59457	Underground mine and calcining plant.	Fergus.
Lime:			
The Anaconda Company	Anaconda, Mont. 59711	Plant	Deer Lodge.
Great Western Sugar Co	Box 5308 Denver, Colo. 80217	---- do	Yellowstone.
Holly Sugar Corp	Box 1052 Colorado Springs, Colo. 80901	---- do	Richland.
Phosphate rock:			
Cominco American, Inc	Garrison, Mont. 59731	Mine and plant.	Powell.
Stauffer Chemical Co	299 Park Ave. New York, N.Y. 10017	Plant	Silver Bow.
Sand and gravel:			
Gallatin Sand and Gravel	Box 248 Bozeman, Mont. 59715	Pit	Gallatin.
Krug Brothers	Laurel, Mont. 59044	Pit	Yellowstone.
McElroy & Wilkin Inc	P.O. Box 35 Kalispell, Mont. 59901	Pit	Flathead.
Midland Materials Co	Box 2521 Billings, Mont. 59103	Pit	Yellowstone.
Barry O'Leary	Box 1102 Billings, Mont. 59103	Pit	Do.
M.S. Ready Mix	Box 1501 Missoula, Mont. 59801	Pit	Missoula.
Redi Mix Concrete Co	Box 248 Polson, Mont. 59860	Pit	Lake.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
NONMETALS—Continued			
Sand and gravel—Continued			
Schultz and Lindsay Construction Co.	Box 1417 Billings, Mont. 59103	Pit	McCone.
R J. Struder and Sons	Box 20204 Billings, Mont. 59102	Pits	Flathead, Rosebud, Yellowstone.
Tressler & Low Ready Mix	Box 914 Helena, Mont. 59601	Pit	Lewis and Clark.
Stone:			
The Anaconda Company	Anaconda, Mont. 59711	Quarry and plant.	Deer Lodge.
Grant Construction Co	Haypen Lake, Ind. 83835	do	Jefferson.
Ideal Cement Co	420 Ideal Cement Bldg. Denver, Colo. 80202	do	Gallatin.
Kaiser Cement & Gypsum Corp	Permanente Rd. Permanente, Calif. 95014	do	Jefferson.
Sulfur: Montana Sulphur & Chemical Co.	P.O. Box 1084 Billings, Mont. 59103	Plant	Yellowstone.
Sulfuric acid: The Anaconda Company	Anaconda, Mont. 59711	do	Deer Lodge.
Talc and soapstone: Pfizer, Inc	Dillon, Mont. 59725	do	Beaverhead.
		Mine	Madison.
Vermiculite: W. R. Grace & Co	62 Whittemore Ave. Cambridge, Mass. 01109	Pit and plant	Lincoln.
MINERAL FUELS			
Coal:			
Decker Coal Co	Box 12 Decker, Mont. 59025	Strip mine	Big Horn.
Long Construction Co	Box 37 Colstrip, Mont. 59323	do	Rosebud.
Peabody Coal Co	301 N. Memorial Dr. St. Louis, Mo. 63102	Mine	Do.
Peat: Martin's Peat & Potting Soils.	Swan Lake, Mont. 59872	Bog	Lake.
Petroleum refining:			
Big West Oil Co. of Montana	Kevin, Mont. 59454	Refinery	Toole.
Continental Oil Co	Billings, Mont. 59101	do	Yellowstone.
Diamond Asphalt Co	Chinook, Mont. 59523	do	Blaine.
Exxon Corp., U.S.A	Billings, Mont. 59101	do	Do.
Farmer's Union Central Exchange, Inc.	Laurel, Mont. 59044	do	Yellowstone.
Jet Fuel Refinery	Mosby, Mont. 59058	do	Garfield.
Phillips Petroleum Co	Great Falls, Mont. 59401	do	Cascade.
Tesoro Petroleum Corp	8700 Tesoro Dr. San Antonio, Tex. 78286	do	Roosevelt.
Westco Refining Co	Box 318 Cut Bank, Mont. 59427	do	Glacier.

The Mineral Industry of Nebraska

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Conservation and Survey Division of the University of Nebraska, Nebraska Geological Survey, for collecting information on all minerals except fuels.

By William F. Keyes [1] and Raymond R. Burchett [2]

The value of mineral production in Nebraska in 1973 was $80.8 million, an increase of 10% over that of 1972. The increase was due to greater production and higher unit values for sand and gravel and stone, which are, along with cement, the most important minerals produced in Nebraska. Production of petroleum, the State's most important mineral product, declined 17%, and value of production declined 5%.

Legislation and Government Programs.—A mineral resource map of Nebraska on a scale of 1:1,000,000 was published by the Nebraska Geological Survey.[3] Locations of active pits or quarries of sand and gravel, sandstone, silt or siltstone, clay or shale, volcanic ash, and limestone are shown, along with the locations of oilfields and gasfields. Also included is a series of 14 small maps showing general areas of mineral occurrence in Nebraska. These include (1) the occurrence at or near the surface of sand and gravel, quartzite, limestone, uranium-bearing rocks, clay or shale, volcanic ash, gypsum, and bentonite; (2) the reported occurrences of diatomaceous earth and sodium and potassium salts; and (3) the potential for metallic minerals, availability of groundwater, and underground gas storage sites. The maps also show Precambrian configurations.

The Nebraska Geological Survey, in cooperation with the U.S. Geological Survey, also completed a geologic map of south-central Nebraska at a scale of 1:250,000,000 or approximately one-quarter inch to the mile.[4] Through the use of a combination of patterns and colors, consolidated bedrock exposed bedrock, and the thickness of unconsolidated mantlerock are shown on the same map.

A user-oriented Remote Sensing Center was established within the Conservation and Survey Div. of the University of Nebraska at Lincoln to interpret natural resources features within Nebraska. Aircraft and satellite imagery are the primary sources of this information. During 1973, information was obtained from satellite imagery to compile a general land-use map of Nebraska that was to be published in 1974.

Activity continued on the circular magnetic and gravimetric anomaly near the Johnson-Pawnee County line because of the current interest in rare-earth elements.

The Nebraska Geological Survey also continued a mineral resource inventory program in cooperation with the U.S. Soil Conservation Service and the Nebraska Department of Roads to obtain information on active and abandoned quarries, pits, and mines. An attempt was to be made to determine the number of acres mined and reclaimed for each operation.

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[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

[2] Research geologist, Nebraska Geological Survey.

[3] Burchett, R. R. Mineral Resource Map of Nebraska. Neb. Geol. Survey, 1973.

[4] Dreeszen, V. H., E. C. Reed, and R. R. Burchett, with G. E. Prichard. Bedrock Geologic Map Showing Thickness of Overlying Quaternary Deposits, Grand Island Quadrangle, Nebraska and Kansas. Nebr. Geol. Survey. 1973.

Table 1.—Mineral production in Nebraska [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays ---thousand short tons--	115	$143	158	$286
Gem stones	NA	11	NA	11
Lime ---thousand short tons--	34	685	31	651
Natural gas ---million cubic feet--	3,478	619	3,836	698
Petroleum (crude) ---thousand 42-gallon barrels--	8,705	29,423	7,240	28,035
Sand and gravel ---thousand short tons--	13,720	15,063	15,906	18,366
Stone ---do---	4,251	7,645	5,368	10,958
Value of items that cannot be disclosed: Cement, natural gas liquids, and pumice (1972) --	XX	20,086	XX	21,816
Total	XX	73,675	XX	80,821
Total 1967 constant dollars	XX	60,789	XX	p 59,339

p Preliminary. NA Not available. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

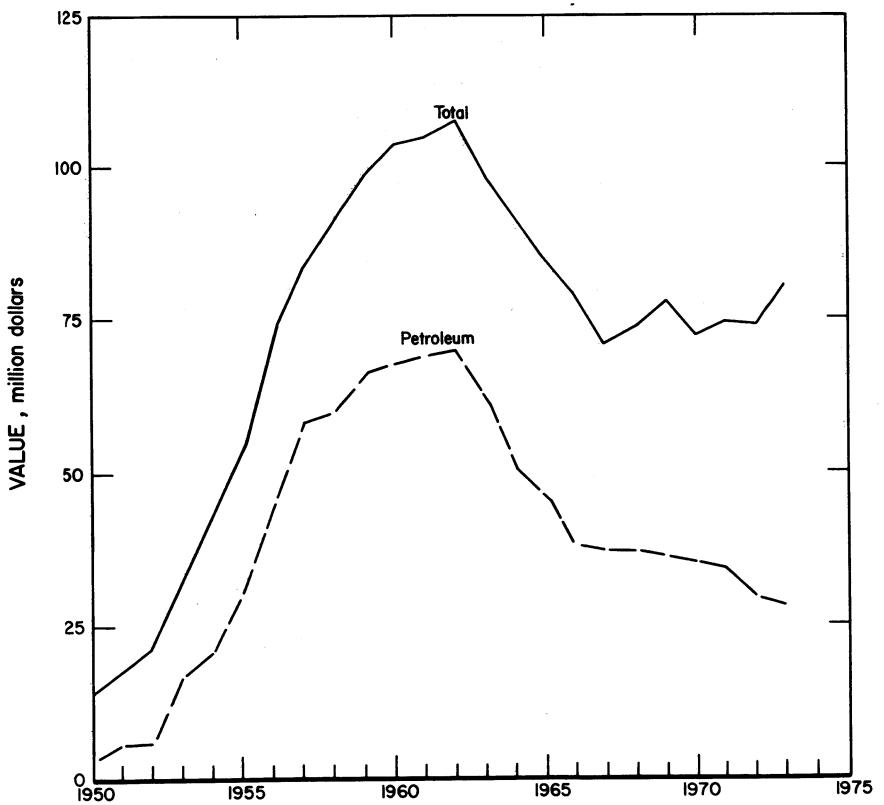

Figure 1.—Value of petroleum and total value of mineral production in Nebraska.

Table 2.—Value of mineral production in Nebraska, by county [1 2]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adams	W	W	Sand and gravel.
Antelope	$105	$108	Do.
Arthur	W	--	
Banner	3,594	W	Petroleum, sand and gravel, natural gas.
Boone	W	--	
Brown	W	W	Sand and gravel.
Buffalo	297	586	Do.
Burt	W	--	
Butler	W	W	Sand and gravel.
Cass	20,122	21,540	Cement, stone, sand and gravel, clays.
Cedar	192	238	Sand and gravel.
Chase	2	W	Do.
Cherry	W	W	Do.
Cheyenne	7,322	7,988	Petroleum, natural gas liquids, natural gas, sand and gravel.
Clay	204	W	Sand and gravel.
Colfax	105	128	Do.
Cuming	W	W	Do.
Custer	W	128	Do.
Dawson	368	467	Do.
Deuel	W	W	Natural gas, sand and gravel.
Dixon	W	W	Sand and gravel, stone.
Dodge	W	987	Sand and gravel.
Douglas	2,897	W	Sand and gravel, clays.
Dundy	W	11	Petroleum, sand and gravel.
Fillmore	--	152	Sand and gravel.
Franklin	55	124	Do.
Frontier	W	W	Petroleum, natural gas.
Furnas	37	59	Sand and gravel, petroleum.
Gage	W	W	Stone, sand and gravel.
Garden	W	W	Petroleum, sand and gravel.
Garfield	--	W	Sand and gravel.
Hall	270	614	Do.
Hamilton	W	23	Do.
Harlan	W	W	Petroleum, sand and gravel.
Hayes	W	W	Sand and gravel.
Hitchcock	W	678	Petroleum, sand and gravel.
Holt	163	190	Sand and gravel.
Howard	W	W	Do.
Jefferson	W	W	Sand and gravel, clays.
Johnson	W	--	
Kearney	35	38	Sand and gravel.
Keith	W	W	Do.
Keya Paha	3	3	Do.
Kimball	6,361	5,897	Petroleum, natural gas liquids, natural gas, sand and gravel.
Knox	140	203	Sand and gravel.
Lancaster	115	W	Sand and gravel, clays, stone.
Lincoln	39	132	Sand and gravel.
Loup	--	W	Do.
McPherson	W	W	Do.
Madison	W	291	Do.
Merrick	W	W	Do.
Morrill	1,722	W	Petroleum, sand and gravel, lime, natural gas.
Nance	W	W	Sand and gravel.
Nemaha	W	W	Stone.
Nuckolls	W	W	Cement, stone.
Otoe	W	W	Lime, stone, clays.
Pawnee	W	W	Stone.
Perkins	W	W	Sand and gravel.
Phelps	W	W	Do.
Pierce	144	159	Do.
Platte	1,012	1,049	Do.
Polk	W	W	Do.
Red Willow	10,175	8,887	Petroleum, sand and gravel.
Richardson	W	W	Petroleum, stone, sand and gravel.
Rock	1	2	Sand and gravel.
Saline	107	W	Do.
Sarpy	W	1,519	Stone, sand and gravel, clays.
Saunders	1,395	W	Sand and gravel.
Scotts Bluff	W	W	Petroleum, lime, sand and gravel, natural gas.
Seward	W	W	Stone.
Sheridan	221	16	Sand and gravel.
Stanton	W	W	Do.
Thayer	W	371	Sand and gravel, stone.
Thomas	W	52	Sand and gravel.
Valley	W	W	Do.
Washington	W	W	Stone.

See footnotes at end of table.

Table 2.—Value of mineral production in Nebraska, by county [1] [2]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Webster	$156	W	Sand and gravel.
Wheeler	W	W	Do.
York	169	$33	Do.
Undistributed [3]	16,147	28,147	Do.
Total [4]	73,675	80,821	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Blaine, Box Butte, Boyd, Dakota, Dawes, Gosper, Grant, Greeley, Hooker, Logan, Sherman, Sioux, Thurston, and Wayne.

[2] Value of petroleum is based on an average price per barrel for the State.

[3] Includes some sand and gravel which cannot be assigned to specific counties, gem stones, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Nebraska business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force—thousands	666.3	688.9	+3.4
Unemployment—do	22.5	22.7	+.9
Nonagricultural employment:			
Mining—do	1.6	1.7	+6.2
Construction—do	27.5	29.5	+7.3
Manufacturing—do	86.4	90.2	+4.4
Government—do	108.8	111.2	+2.2
Other nonagricultural employment—do	290.3	303.1	+4.4
Personal income:			
Total—millions	$6,642	$7,444	+12.1
Per capita	$4,355	$4,827	+10.8
Construction activity:			
Value of nonresidential construction—millions	$87.2	$101.8	+16.7
Number of new housing units	13,556	9,611	−29.1
Cement shipments to and within the State—thousand short tons	969	1,207	+24.6
Farm marketing cash receipts—millions	$3,054.2	$4,172.0	+36.6
Mineral production value—do	$73.7	$80.8	+9.6

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Cement was produced by Ash Grove Cement Co. at its plant near Louisville in Cass County, and by Ideal Cement Co. near Superior in Nuckolls County. The chief raw materials used were limestone, clay, and gypsum. Disposition of output was 61% to ready-mix companies, 20% to highway contractors, 9% to concrete-product manufacturers, 7% to building materials dealers, and 3% to other contractors. Apparent consumption of portland cement increased 25% to 1,192,000 tons, and apparent consumption of masonry cement increased 7% to 14,253 tons.

Clays.—Five firms produced clay in 1973. Clay production increased 37% over that of 1972, and the value of production increased 100%.

Ash Grove Cement Co. produced clay for cement manufacture near Louisville, Cass County. Omaha Brick Works produced clay for face and common brick near Ralston in Douglas County and in Sarpy County. Endicott Clay Products Co. produced clay to make face brick at Endicott in Jefferson County; a new brick plant was completed. Yankee Hill Brick Manufacturing Co. near Lincoln in Lancaster County, produced clay for common and face brick. Western Brick

& Aggregate Co., in Otoe County east of Nebraska City, produced clay for lightweight aggregate; new lifters in the company's rotary kiln increased production substantially.

Fertilizer Materials.—Three of the four ammonia producers in Nebraska also had urea and ammonium nitrate production facilities. These were Allied Chemical Co. at La Platte, Sarpy County; CF Industries Inc., at Fremont, Dodge County; and Phillips Chemical Co. at Beatrice, Gage County. Farmland Industries Inc. produced ammonia at a plant at Hastings in Adams County. In addition, Cominco-American Inc., produced ammonium nitrate at a plant at Beatrice.[5]

There was no production of phosphate rock or potash in Nebraska.

Lime.—Great Western Sugar Co. and Western Aggregates produced lime in Morrill, Scotts Bluff, and Otoe Counties for sugar refining and water purification. Output decreased 9% and was 12% below the record high of 1969. Total consumption was 57,490 tons.

Perlite.—No perlite is produced in Nebraska, but one manufacturer, the Zonolite Div. of W. R. Grace & Co., received perlite from outside the State and expanded it in a plant near Omaha. The expanded product was used as aggregate for plaster and concrete, for horticultural purposes, and as a filler material.

Pumice.—The LaRue Axtell Pumice Co., sole producer of pumice during 1972 at its mine in Lincoln County, was inactive during 1973. No other pumice production was reported.

Sand and Gravel.—Total production of sand and gravel in Nebraska increased 16%; value of production increased 22%. The average value increased from $1.10 per ton in 1972 to $1.15 per ton in 1973.

Among the largest producers were Central Sand & Gravel Co. in Butler, Madison, Pierce, and Platte Counties; Hartford Sand & Gravel Co. in Douglas, and Dodge Counties; Lyman-Richey Sand & Gravel Corp. in Cass, Dodge, Douglas, Morill, Platte, Sarpy, and Saunders Counties; and Western Sand & Gravel Co. in Cass and Saunders Counties. Leading in production of sand and gravel were Douglas and Saunders Counties.

Commercial operations accounted for 95% of the sand and 87% of the gravel produced in Nebraska in 1973. Government-and-contractor operations produced the remainder. About 65% of the sand produced commercially was used in building operations, and another 24% was used in paving. About 69% of the commercially produced gravel was used in paving, and 17% was used for building purposes.

Stone.—Sales of crushed and broken limestone in Nebraska increased 26% in quantity and 43% in value. Unit value increased from $1.80 per ton in 1972 to $2.04 per ton in 1973. Principal producers were Ash Grove Cement Co., Fort Calhoun Stone Co., Hopper Bros. Quarries, and Kerford Limestone Co.

Crushed and broken stone was used for concrete and concrete aggregate, road base, riprap, and agricultural purposes.

Talc.—The only producer of ground talc in Nebraska continued to be Cyprus Mines Corp., United Sierra Div., at its plant near Grand Island in Hall County. The unground talc was obtained from outside the State. The product was used in paper, ceramics, paint, rubber, insecticides, textiles and toilet articles.

Vermiculite.—W. R. Grace & Co., Construction Products Div., was the only producer of exfoliated vermiculite in 1973. Crude vermiculite was obtained from Montana. Principal uses of the expanded product were as loose-fill insulation, fire proofing, and concrete aggregate; some was used in horticulture.

MINERAL FUELS

The Nebraska Oil and Gas Conservation Commission issued 228 permits to drill for oil and gas in 1973. Of these, 110 were for exploratory wells, 71 were for development wells, and 44 were for stratigraphic tests. Drilling permits for exploratory and development wells were issued largely for Cheyenne (59), Kimball (31), Red Willow (15), and Morrill (14) Counties. Stratigraphic test permits were for Red Willow (18), Furnas (18), and Cheyenne (8) Counties. The largest number of development and exploratory wells were completed in Cheyenne County, followed by Kimball, Banner, Morrill, and Red Willow Counties. Both the number of wells and total footage drilled declined over 40%.

[5] Tennessee Valley Authority. 1973 Fertilizer Trends. Nat. Fertilizer Development Center Bull. Y-77, Muscle Shoals, Ala. June 1974, pp. 46–51.

Natural Gas.—Marketed production of natural gas in 1973 increased 10% to 3.8 billion standard cubic feet and value of production increased 13%. Major production was in Cheyenne County.

Natural Gas Liquids.—Natural gasoline and cycle products, and liquid petroleum gases and ethane were produced in Cheyenne and Kimball Counties.

Petroleum.—Production of crude petroleum declined about 17% to 7.2 million barrels. The number of active wells decreased from 1,114 to 1,107, and the number of capped wells decreased from 645 to 550. Major production was centered in Red Willow, Cheyenne, and Kimball Counties.

METALS

No metallic minerals were mined in Nebraska in 1973. The Omaha refinery of American Smelting and Refining Co. (ASARCO) recovered antimony, bismuth, gold, lead, and silver from out-of-State smelter products.

Table 4.—Nebraska: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of Mines	Quantity	Value	Number of Mines	Quantity	Value
Antelope	4	113	105	3	107	108
Banner	1	W	W	2	57	W
Buffalo	8	413	297	9	633	586
Butler	3	W	W	3	261	W
Cass	3	W	W	3	500	662
Cedar	6	171	192	5	225	238
Chase	1	W	2	3	46	W
Cheyenne	1	W	79	2	W	136
Clay	3	215	204	2	W	W
Colfax	3	109	105	5	114	128
Cuming	3	W	W	3	645	W
Custer	4	176	143	4	121	128
Dawson	5	433	368	5	527	467
Dodge	8	W	W	8	625	987
Douglas	11	2,586	2,893	10	2,909	3,439
Dundy	1	W	W	1	2	2
Fillmore	--	--	--	1	98	152
Franklin	3	54	55	3	126	124
Furnas	3	29	27	4	44	49
Gage	4	W	W	4	45	47
Hall	5	316	270	6	702	614
Hamilton	2	W	W	1	46	23
Hitchcock	2	W	W	4	59	48
Holt	7	255	163	7	284	190
Jefferson	5	302	W	4	W	W
Kearney	1	48	35	1	51	38
Keya Paha	1	27	3	1	3	3
Kimball	1	32	4	6	61	57
Knox	4	118	140	5	187	203
Lincoln	3	59	36	7	176	132
Madison	6	W	W	5	242	291
Phelps	1	160	W	1	234	W
Pierce	4	111	144	4	146	159
Platte	4	672	1,012	8	652	1,049
Red Willow	7	135	130	5	135	W
Rock	1	1	1	1	2	2
Saline	3	85	107	3	80	W
Sarpy	8	614	W	4	655	W
Saunders	4	1,243	1,395	3	1,271	W
Scotts Bluff	4	218	185	4	338	295
Sheridan	1	W	221	1	14	16
Thayer	3	W	203	4	336	370
Thomas	2	W	W	1	47	52
Webster	4	178	156	3	W	W
York	3	149	169	1	15	33
Undistributed [1]	r 36	4,699	6,220	44	3,087	7,539
Total [2]	197	13,720	15,063	214	15,906	18,366

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Adams, Arthur (1972), Boone (1972), Brown, Burt (1972), Cherry, Deuel, Dixon, Frontier (1972), Garden, Garfield (1973), Harlan, Hayes, Howard, Keith, Lancaster, Loup (1973), McPherson, Merrick, Morrill, Nance, Perkins, Polk, Richardson (1973), Stanton, Valley, and Wheeler Counties, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 5.—Nebraska: Sand and gravel sold or used by producers, by class of operations and use

(Thousand short tons and thousand dollars)

Class of operations and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,599	3,482	4,006	4,301
Fill	568	407	689	495
Paving	965	1,165	1,485	1,681
Other uses [1]	21	24	20	21
Total [2]	5,152	5,078	6,200	6,497
Gravel:				
Building	1,122	1,315	1,356	1,582
Fill	W	W	70	61
Paving	5,172	6,142	5,665	7,241
Railroad ballast	W	W	237	254
Miscellaneous	447	382	630	629
Other uses	423	458	240	229
Total [2]	7,164	8,298	8,196	9,996
Government-and-contractor operations:				
Sand:				
Paving	269	308	315	370
Other uses	--	--	1	1
Total	269	308	316	371
Gravel:				
Building	78	8	37	30
Fill	--	--	187	363
Paving	717	823	591	484
Other uses	339	549	379	625
Total [2]	1,134	1,380	1,193	1,502
Total sand and gravel [2]	13,720	15,063	15,906	18,366

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes railroad ballast (1973) and other unground sand.
[2] Data may not add to totals shown because of independent rounding.

Table 6.—Nebraska: Limestone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone total	(1)	3	(1)	5
Crushed and broken stone:				
Dense graded road base stone	346	569	632	1,277
Surface treatment aggregate	238	532	992	2,227
Agricultural limestone	318	W	133	W
Poultry grit and mineral food	59	W	53	W
Riprap and jetty stone	W	W	747	1,674
Other uses [2]	3,289	6,542	2,810	5,775
Total crushed and broken stone [3]	4,251	7,642	5,368	10,953
Grand total [3]	4,251	7,645	5,368	10,958

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Less than ½ unit.
[2] Includes stone used in concrete aggregate, bituminous aggregate, unspecified construction aggregate (1973), cement manufacture, asphalt and other fillers (1973), and uses not specified (1973).
[3] Data may not add to totals shown because of independent rounding.

Table 7.—Nebraska: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Banner	1	--	6	2	--	13	22	132,525
Burt	--	--	--	--	--	1	1	1,430
Cheyenne	6	--	10	2	--	24	42	213,016
Dawes	--	--	--	--	--	1	1	5,123
Deuel	--	--	--	--	--	2	2	7,292
Furnas	--	--	--	--	--	1	1	3,442
Hayes	--	--	--	--	--	3	3	14,103
Hitchcock	6	--	2	--	--	1	9	39,931
Kimball	1	--	10	2	--	14	27	171,410
Morrill	--	--	4	1	--	17	22	101,403
Red Willow	11	--	2	--	--	6	19	68,158
Richardson	1	--	--	--	--	1	2	4,992
Scotts Bluff	--	--	1	--	--	3	4	24,092
Sioux	--	--	--	--	--	8	8	42,398
Total	26	--	35	7	--	95	163	829,315

[1] Development wells as defined by American Petroleum Institute.
Source: American Petroleum Institute.

Table 8.—Nebraska: Number of active and capped oil and dry gas wells at yearend

County	Oil wells		Dry gas wells	
	Active	Capped	Active	Capped
Banner	169	111	--	--
Cheyenne	226	50	16	3
Deuel	--	--	10	1
Dundy	--	1	--	--
Frontier	9	2	--	--
Furnas	1	2	--	--
Garden	2	--	--	--
Harlan	8	1	--	--
Hitchcock	32	18	--	--
Kimball	282	164	1	--
Lincoln	--	3	--	--
Morrill	57	19	--	--
Red Willow	276	153	--	--
Richardson	14	21	--	--
Scotts Bluff	31	5	--	--
Total	1,107	550	27	4

Source: Nebraska Oil and Gas Conservation Commission.

Table 9.—Nebraska: Crude petroleum production, by county

(Thousand 42-gallon barrels)

County	1972	1973	Principal fields
Banner	1,056	909	Singleton, Stage Hill,[1] Johnson.
Cheyenne	1,854	1,696	Jormar, Margate, Southwest Sidney, West Engelland, Filon.
Dundy	1	2	East Indian Creek, Rock Canyon.
Frontier	63	55	Bed Canyon.[2]
Furnas	3	3	Southwest Wilsonville.
Garden	9	9	Richards and McCord.
Harlan	23	23	South Alma.
Hitchcock	131	163	Reiher.
Kimball	1,688	1,356	Sloss, Enders, Axial, Bertramson.
Lincoln	1	0	Red Willow Creek.
Morrill	436	428	Bridgeport.
Red Willow	2,972	2,250	Sleepy Hollow, Ackman, Danbury, Bed Canyon.[2]
Richardson	48	43	Dawson, Falls City, Barada.
Scotts Bluff	420	303	Cedar Valley, Stage Hill,[1] Minatare.
Total	8,705	7,240	

[1] Partly in Banner and Scotts Bluff Counties.
[2] Partly in Frontier and Red Willow Counties.

Table 10.—Nebraska: Crude oil production in the 25 largest fields in 1973

(42-gallon barrels)

Field	County	Annual output	Average daily output
Sleepy Hollow	Red Willow	1,579,112	4,326
Jormar	Cheyenne	215,650	591
Ackman	Red Willow	188,031	515
Silver Creek	do	180,915	496
Margate	Cheyenne	144,377	396
Cedar Valley	Scotts Bluff	143,974	394
Southwest Sidney	Cheyenne	137,414	376
Singleton	Banner	133,866	367
Bridgeport	Morrill	121,624	333
Stage Hill	Banner and Scotts Bluff	116,241	318
Pecos	Cheyenne	107,933	296
Danbury	Red Willow	96,031	263
Sloss	Kimball	87,521	240
Middle Creek	Cheyenne and Morrill	77,190	211
Johnson	Banner	74,531	204
West Engelland	Cheyenne	70,523	193
Enders	Kimball	69,966	192
Reiher	Hitchcock	66,641	183
Minatare	Scotts Bluff	64,422	176
Axial	Kimball	62,036	170
Bed Canyon	Frontier and Red Willow	61,448	168
Filon	Cheyenne	58,766	161
Bush Creek	Hitchcock	57,347	157
Midway	Red Willow	53,292	146
Bertramson	Kimball	50,124	137

Source: Nebraska Oil and Gas Conservation Commission.

Table 11.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Ash Grove Cement Co	1000 Tenmain Center Kansas City, Mo. 64105	Wet process, 6-rotary kiln plant.	Cass.
Ideal Cement Co., a division of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Wet process, 2-rotary kiln plant.	Nuckolls.
Clays:			
Ash Grove Cement Co	1000 Tenmain Center Kansas City, Mo. 64105	Open pit mine and plant.	Cass.
Endicott Clay Products Co.	Endicott, Nebr. 68350	----do----------	Jefferson.
Western Brick & Aggregate Co.	Box 1141 Nebraska City, Nebr. 68410	----do----------	Otoe.
Yankee Hill Brick Manufacturing Co.	Route 1 Lincoln, Nebr. 68502	----do----------	Lancaster.
Lime:			
Great Western Sugar Co., a subsidiary of Great Western United Corp.	Box 5308 Denver, Colo. 80217	Pot kiln at beet sugar plant.	Morrill.
		5 pot kilns at beet sugar plants.	Scotts Bluff.
Western Aggregates	Nebraska City, Nebr. 68410	Pot kiln at beet sugar plant.	Otoe.
Natural gas and petroleum [1]			
Sand and gravel (commercial):			
Central Sand & Gravel Co.	Box 626 Columbus, Nebr. 68601	Dredging operation	Butler.
		----do----------	Hall.
		----do----------	Pierce.
		2 dredging operations.	Madison.
		3 dredging operations.	Platte.
Hank Stalp Gravel Co	Box 6 West Point, Nebr. 68788	----do----------	Cuming.
Hartford Sand & Gravel Co.	Box 571 Valley, Nebr. 68064	2 dredging operations.	Douglas.
		4 pits ----------	Dodge.
Hooker Brothers, Inc	429 Wyandotte Grand Island, Nebr. 68801	Pits and plant	Hall.
Lyman-Richey Sand & Gravel Corp.	4315 Cuming St. Omaha, Nebr. 68131	Pit and plant	Cass.
		2 pits and plants	Dodge.
		----do----------	Douglas.
		Pit and plant	Morrill.
		----do----------	Platte.
		2 pits and plants	Sarpy.
		Pit and plant	Saunders.
McCann Sand & Gravel Co.	Valley, Nebr. 68064	2 dredging operations.	Douglas.
Nichols Construction Co	Geneva, Nebr. 68361	Pit and plant	Thayer.
Sawyer Sand and Gravel Co.	Holdredge, Nebr. 68949	Pit ----------	Buffalo.
Western Sand & Gravel Co.	Lincoln, Nebr. 68501 Lincoln, Nebr. 68501	3 dredging operations.	Saunders.
Wolf Sand and Gravel Co.	Morse Bluff, Nebr. 68648	Pits and plants	Do.
Stone:			
Ash Grove Cement Co	1000 Tenmain Center Kansas City, Mo. 64105	Quarry and plant	Cass.
City Wide Rock & Excavation Co.	38th & Mason Streets Omaha, Nebr. 68105	3 quarries and plant.	Sarpy.
Fort Calhoun Stone Co	1255 South St. Blair, Nebr. 68008	Quarry and plant	Thurston.
		----do----------	Washington.
Hopper Bros. Quarries	Weeping Water, Nebr. 68463	3 quarries and plant.	Cass.
		Quarry and plant	Nemaha.
		----do----------	Pawnee.
		----do----------	Saunders.
Ideal Cement Co., Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Quarry ----------	Nuckolls.
Kerford Limestone Co	Box 434 Weeping Water, Nebr. 68643	Quarry and plant	Cass.
United Rock Construction, Inc.	1117 Woodman of the World Bldg. Omaha, Nebr. 68102	----do----------	Do.

[1] Most of the major oil and gas companies and many smaller companies operate in Nebraska, and several commercial directories contain complete lists of them.

The Mineral Industry of Nevada

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, United States Department of the Interior, and the Nevada Bureau of Mines for collecting information on all minerals.

By V. Anthony Cammarota, Jr.[1]

The value of Nevada's mineral output reached $201.8 million in 1973 compared with $181.7 million in 1972. Production value of metals as a group increased 7.6%, nonmetals increased 20%, and mineral fuels (petroleum) increased 16.9%.

The production of copper, gold, mercury, and tungsten was down, but the higher unit prices in 1973 for these commodities, except tungsten, served to increase the production value of each over that of 1972. Of the metals, only antimony, iron ore, molybdenum, and silver showed both increased quantities and values. Gold production declined 38% as the two largest mines in the State devoted much effort to the development of new ore bodies. Copper production was down 7%, and its portion of the total value of the State's mineral production slipped from 57% in 1972 to 55% in 1973.

Of the 16 nonmetallic materials, 10 showed increases in the quantity produced, five showed decreases, and one was not available. The largest percentage gains were made by barite, gypsum, magnesium compounds, pumice, and sand and gravel, while clays, fluorspar, perlite, salt, and talc showed declines.

Trend and Developments.—According to a report issued by the Smelter Control Research Association, Inc. (SCRA), wet-limestone scrubbing in its present stage of development is not a reliable process for the removal of sulfur dioxide from the stack gas emissions at copper smelters. The SCRA tests were conducted at its pilot plant at McGill. The Bureau of Mines signed an agreement with SCRA for joint sponsorship of a program to investigate scrubbing systems for the removal of sulfur dioxide from copper smelter emissions.

Kennecott Copper Corp. began work on a $3 million modernization project to install 80 flotation cells, launders, and pumps to replace obsolete equipment at the Nevada Mines Division concentrator at McGill. In addition a new 750-foot smelter stack was being constructed as part of the air pollution abatement program. The Anaconda Company planned development of a new open pit mine, the Victoria, in the Antelope Mountain range 80 miles northeast of Ely. Startup is scheduled for early 1975, with an initial production rate of 9,000 tons of copper per year. Plans include construction of a concentrator with a capacity of 1,000 tons of ore per day. Concentrates will be shipped to the Arbiter Process plant being built by the company at Anaconda, Mont. Anaconda estimated that the ore body contains approximately 3.5 million tons of sulfide ore with an average copper grade of 2.45%. Byproducts will include bismuth, silver, and gold. Ranchers Exploration & Development Corp. blasted about 400,000 tons of ore containing approximately 2% copper into an open pit in preparation for leaching. The new operations are expected to produce 5,000 pounds of copper per day for the next 3 years.

Cliffs Copper Corp. at Mountain City prepared five ore dumps for heap leaching of copper ores that had been in the lower

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

levels of the Rio Tinto mine. The company expects the ore deposit to be fractured by subsidence so that the entire ore body can be leached in situ.

Carlin Gold Mining Co. mined and stockpiled ore from its Bootstrap deposit in Eureka County. The higher grade material will go to the Carlin mill and the lower grade ore will go to a leach pad. A heap leach operation was also planned at the Blue Star deposit where a drilling program was being completed. The Cortez pit of Cortez Gold Mines in Lander County was mined out by yearend. The nearby Gold Acres property was being developed for immediate production. The ore from Gold Acres, a portion of which will be heap leached, is expected to prolong the life of the Cortez facility for at least another year.

The increase in gold and silver prices brought renewed interest in the Comstock mining area and other areas of the State. The Mineral Engineering Co. announced the purchase of eight mining leases totalling 1,500 acres near Virginia City. Intermountain Exploration Co. resumed drilling on the southern extension of the Comstock Lode. Sunshine Mining Co. completed drilling at its property in Silver Peak. Reserves were estimated by the company at about 275,000 tons containing 14 to 16 ounces of silver per ton. Sunshine entered into an operating agreement with Mid-Continent Mining Corp. covering the Sixteen to One and Nivloc mines and several other properties in Esmeralda and Nye Counties. Mid-Continent estimated reserves of silver and gold at a gross value of over $40 million.

At the Getchell mine northeast of Winnemucca the Continental Oil Co. conducted a drilling program, and Cordilleran Explorations continued exploration on several properties south of Getchell. The Summa Corp. conducted a large heap leaching program on low-grade gold ores from the Manhattan mine in Nye County. Copper Range Exploration Co. at Round Mountain has invested about $1.2 million in a mill and leach tests over the past 2 years. Geologists from FMC Corp. found indications of gold near Tuscarora while exploring for antimony. A new near-surface discovery of silver-gold mineralization was made by Houston Minerals Inc. near Hamilton.

An additional contract has been awarded by the Office of Minerals Exploration (OME) for 500 feet of development work in the New Pass area west of Austin. The prior contract was about 50% completed with some 700 feet of crosscut remaining to reach the Superior Vein. An OME loan was made to Blue Sphinx, Inc., for diamond drilling at its gold property in the Gabbs Valley Range, Mineral County.

The Lawrence Radiation Laboratory and the University of California (Berkeley) engaged in a joint program of geophysical measurements in potential geothermal resource areas in north-central Nevada. Magma Power Co. and Union Oil Co. added additional acreage to their holdings in the Bradys Hot Springs-Fernley area, which the companies claim has excellent geothermal prospects. Sun Oil Co. and Calvert Exploration Co. reached an agreement to conduct a joint geothermal exploration program covering leases on 32,000 acres in Nevada.

Guadalupe Exploration Corp. conducted an oil drilling operation 65 miles northwest of Ely on 54,000 acres. A 25-man crew, including three geologists, began working around the clock in October.

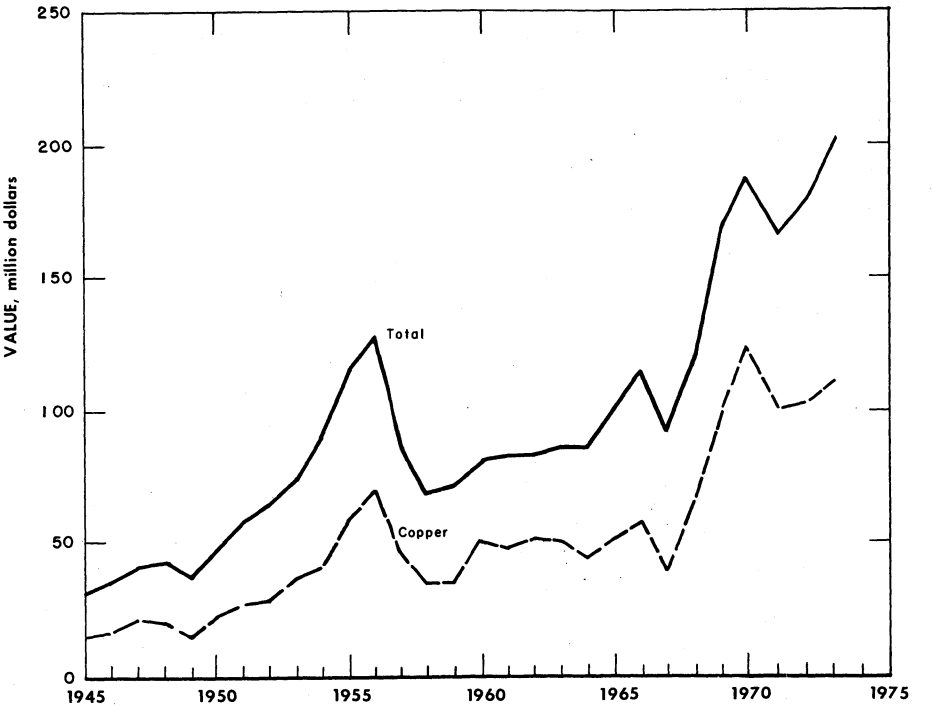

Figure 1.—Value of copper and total value of production in Nevada.

Table 1.—Mineral production in Nevada [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Barite ____ thousand short tons	317	$2,659	549	$4,691
Clays ____ do	40	183	36	176
Copper (recoverable content of ores, etc.) short tons	101,119	103,545	93,702	111,505
Gem stones	NA	110	NA	142
Gold (recoverable content of ores, etc.) troy ounces	419,748	24,597	260,437	25,473
Gypsum ____ thousand short tons	860	2,871	1,154	3,662
Iron ore (usable) thousand long tons, gross weight	W	W	119	W
Lead (recoverable content of ores, etc.) short tons	(2)	(2)	--	--
Mercury ____ 76-pound flasks	810	177	698	200
Petroleum (crude) ____ thousand 42-gallon barrels	100	W	96	W
Sand and gravel ____ thousand short tons	10,081	12,636	12,448	14,614
Silver (recoverable content of ores, etc.) thousand troy ounces	595	1,003	624	1,595
Stone ____ thousand short tons	3,329	5,926	3,595	5,429
Tungsten (W content) ____ thousand pounds	157	W	150	377
Value of items that cannot be disclosed: Antimony, cement, diatomite, fluorspar, lime, lithium minerals, magnesite, molybdenum, perlite, pumice, salt, talc, and value indicated by symbol W	XX	27,995	XX	33,949
Total	XX	181,702	XX	201,813
Total 1967 constant dollars	XX	149,922	XX	p148,171

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed". XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Less than ½ unit.

Table 2.—Value of minerals produced in Nevada, by county

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Carson City [1]	$134	W	Pumice, sand and gravel.
Churchill	W	$467	Diatomite, sand and gravel, salt, stone, silver, gold, tungsten.
Clark	16,769	19,818	Sand and gravel, lime, gypsum, stone, clays.
Douglas	W	W	Sand and gravel, stone.
Elko	1,253	1,244	Sand and gravel, barite, copper, tungsten.
Esmeralda	3,452	5,841	Lithium minerals, diatomite, sand and gravel, talc, clays, gold, tungsten.
Eureka	12,084	16,729	Gold, sand and gravel, iron ore, stone, antimony, mercury.
Humboldt	W	W	Stone, sand and gravel, barite, copper, clays, silver, gold.
Lander	31,515	27,857	Copper, gold, barite, silver, sand and gravel.
Lincoln	W	W	Stone, sand and gravel, perlite.
Lyon	52,963	51,643	Copper, cement, stone, sand and gravel, gypsum.
Mineral	W	W	Tungsten, sand and gravel, stone.
Nye	1,787	3,511	Magnesite, barite, petroleum, fluorspar, sand and gravel, pumice, clays, gold.
Pershing	7,126	8,019	Diatomite, gypsum, copper, mercury, iron ore, sand and gravel, clays, perlite, gold, tungsten.
Storey	W	W	Diatomite, sand and gravel, stone.
Washoe	3,124	W	Sand and gravel, pumice, clays, stone.
White Pine	46,712	58,849	Copper, gold, molybdenum, lime, silver, stone, sand and gravel, clays.
Undistributed [2]	4,784	7,829	
Total [3]	181,702	201,813	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Independent city, formerly Ormsby County.

[2] Includes some mercury (1973), and sand and gravel that cannot be assigned to specific counties, gem stones and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Nevada business activity

		1972	1973 [p]	Change, percent
Employment and labor force, annual average:				
Total	thousands	241.6	258.4	+7.0
Unemployed	do	16.9	16.0	−5.3
Employment:				
Mining	do	3.5	3.6	+2.9
Contract construction	do	14.5	17.8	+22.8
Manufacturing	do	9.5	11.3	+18.9
Government	do	39.7	41.2	+3.8
Other	do	156.3	168.7	+7.9
Personal income:				
Total	millions	$2,676	$3,047	+13.9
Per capita		$5,078	$5,560	+9.5
Construction activity:				
Valuation of private authorized nonresidential construction	millions	$106.7	$159.2	+49.2
Total authorized residential units		16,988	13,270	−21.9
Cement shipments to and within Nevada	thousand short tons	402	465	+15.7
Farm marketing receipts	millions	$112.6	$148.9	+32.2
Mineral production value	do	$181.7	$201.8	+11.1

[p] Preliminary.

Sources: Survey of Current Business, Employment and Earnings, Farm Income Situation, Construction Review, Area Trends in Employment and Unemploymnet, and the U.S. Bureau of Mines.

Legislation and Government Programs.—Public land orders of the U.S. Bureau of Land Management withdrew 136.8 acres of land in Nye County from all forms of appropriation including mining laws. Nevada received U.S. Treasury checks totaling $411,894 in bonuses, royalties, and rentals covering mineral leases and permits.

The Bureau of Mines continued to provide consulting service to the Atomic Energy Commission (AEC) on preshot and postshot structural installations in connection with underground nuclear tests on and adjacent to AEC's Nevada Test Site.

A district judge in Hawthorne ruled that two requirements in the 1971 State Mining Law that required filing of maps on mining claims were void because they are so indefinite and uncertain in their application that they cannot be enforced. The State appealed the decision, and until the matter is finally resolved, the law was considered to be still in effect.

Recent increases in the price of gold and silver stimulated interest in the research being conducted on precious metals at the Bureau of Mines Reno Metallurgy Research Center. A promising low-cost cyanidation-sulfide precipitation-carbon adsorption process was developed for recovering silver from mill tailings. The silver is precipitated and the effluent solution is passed through an activated carbon column to collect the gold. Pilot studies were initiated by a major gold producer to recover gold from carbonaceous ore using the Bureau's electrooxidation technique. Hydrometallurgical processes for treating lead-zinc concentrates without causing environmental degradation were under investigation. The technique employs aqueous chlorination to extract lead, zinc, and silver values followed by electrowinning in a fused salt bath. Other projects include hydrogen storage in the form of metal hydrides, a study of catalytic properties of the rare earths, and the production of nuclear-grade zirconium by solvent extraction. The major emphasis at the Boulder City Metallurgy Research Center was directed toward the operation of a minipilot plant for extracting alumina from clay. Tests continued on the use of sulfur in conventional aggregates to produce concrete materials with improved properties.

REVIEW BY MINERAL COMMODITIES

METALS

Copper.—The State was the Nation's fifth largest copper producer, although copper output decreased 7.3% below that of 1972. Most of the output came from operations of The Anaconda Company, Lyon County; Kennecott Copper Corp., White Pine County; and Duval Corp., Lander County. Kennecott's production increased as the company returned to a 7-day, 24-hour work schedule early in the year. The mine and concentrator had been operating on a 6-day production level since late 1971.

Two other producers, Ranchers Exploration & Development Corp. and Cliffs Copper Corp., increased production over that of 1972. A small quantity of copper was recovered as a byproduct from gold and gold-silver ores.

Table 4.—Nevada: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing		Material sold or treated (short tons)[1]	Gold		Silver	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
1971, Total	18	1	18,670,707	374,878	$15,463,719	601,470	$929,872
1972, Total	10	3	21,351,069	419,748	24,597,233	595,351	1,003,166
1973:							
Churchill	1	--	200	9	880	802	2,052
Esmeralda	--	1	--	6	587	--	--
Lyon	1	--	12,098,563	--	--	--	--
Nye	--	1	--	--	2,641	--	--
Pershing	1	2	1,120	91	8,901	--	--
White Pine	2	--	7,934,323	30,306	2,964,230	154,626	395,534
Other[2]	8	1	4,562,040	229,998	22,496,105	468,232	1,197,738
Total	13	5	24,596,246	260,437	25,473,344	623,660	1,595,324

	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1971, Total	96,928	$100,805,588	111	$30,540	71	$22,974	$117,252,693
1972, Total	101,119	103,545,425	(3)	31	--	--	129,145,855
1973:							
Churchill	--	--	--	--	--	--	2,932
Esmeralda	--	--	--	--	--	--	587
Lyon	33,749	40,161,850	--	--	--	--	40,161,850
Nye	--	--	--	--	--	--	2,641
Pershing	682	812,174	--	--	--	--	821,075
White Pine	45,790	54,490,473	--	--	--	--	57,850,237
Other[2]	13,479	16,040,389	--	--	--	--	39,734,232
Total	[4] 93,702	111,504,886	--	--	--	--	39,573,554

[1] Does not include gravel washed.
[2] Includes Elko, Eureka, Humboldt, and Lander Counties combined to avoid disclosing individual company confidential data.
[3] Less than ½ unit.
[4] Data do not add to total shown because of independent rounding.

Table 5.—Nevada: Mine production of gold, silver, copper, lead, and zinc in 1973, by class of ore or other source material, in terms of recoverable metal

Source	Number of mines[1]	Material sold or treated (thousand short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Dry gold and dry gold-silver[2 3]	6	2,852	220,677	117,507	585	--	--
Dry silver	1	3	271	42,014	--	--	--
Copper	3	21,728	39,354	463,634	84,233	--	--
Total	10	[4] 24,584	260,302	623,155	[4] 84,417	--	--
Other lode material: Copper precipitates and copper tailings[2 3]	5	13	5	505	8,884	--	--
Placer	5	--	130	--	--	--	--
Grand total[4]	18	24,596	260,437	623,660	93,702	--	--

[1] Detail will not necessarily add to totals shown because some mines produce more than one class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] Includes material that was leached.
[4] Data does not add to totals shown because of independent rounding.

Table 6.—Nevada: Mine production of gold, silver, copper, lead, and zinc in 1973, by type of material processed and method of recovery, in terms of recoverable metal

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Cyanidation	220,294	152,895	--	--	--
Smelting of concentrates	39,354	463,634	68,337	--	--
Leaching	(1)	(1)	15,896	--	--
Direct smelting of:					
Ore and copper tailings [2]	659	7,131	590	--	--
Copper precipitates	--	--	8,879	--	--
Total	40,013	470,765	93,702	--	--
Placer	130	--	--	--	--
Grand total	260,437	623,660	93,702	--	--

[1] Included in cyanidation.
[2] Combined to avoid disclosing individual company confidential data.

Gold.—Nevada was the Nation's third largest gold producer with 22% of the total U.S. output. Two lode gold mines, which provided most of the production, showed drastically reduced output because the old deposits were depleted and the new ones had not become fully operational. The balance was produced primarily as a byproduct gold from copper ores and from five small placer operations.

The new Bootstrap deposit of Carlin Gold Mining Co., Eureka County, was estimated to contain about 1 million tons of ore. The lower grade ore which was being stockpiled will be heap leached beginning in early 1975. The Blue Star deposit is about the same size as the Bootstrap, but the grade is higher and it contains some copper.

Cortez Gold Mines in Lander County began mining at the Gold Acres property late in the year. Ore to be leached averaged 0.035 ounce gold per ton, and ore containing over 0.05 ounce gold per ton went to the mill. Reserves have only partially been determined, but are expected to be in excess of 4 million tons, half of which would be milling grade.

A small amount of gold was produced by the Idaho Mining Co. which resumed heap leaching experiments on its gold properties in Windfall Canyon southeast of Eureka.

Iron Ore.—Usable iron ore production and shipments from three mines were slightly higher than in 1972. Direct shipping-grade ores were produced by Nevada-Barth Corp., Eureka County, and by Cooney Brothers and Nevada Iron Ore Co., Inc., both in Pershing County.

Mercury.—Production of mercury decreased 14% from that of 1972, but the State retained its position as the Nation's second largest producer with 32% of the total. Crofoot Tungsten Co. was the largest producer in the State with its Red Bird mine in Pershing County. Golden Cycle Technology Corp. produced some metal, and cinnabar concentrate for export, from its Pershing mine in Pershing County. The Carlin Gold Mining Co. continued to produce mercury as a byproduct from its gold mine in Eureka County. At the site of the former Cordero mine near McDermitt, Placer Amex Inc. conducted extensive geological work to delineate ore reserves at its open pit McDermitt mine. Placer hired environmental specialists to study site conditions, general topography, hydrology analysis, and flora and fauna.

Table 7.—Nevada: Mercury production, by method of recovery

Year	Recovery method					Total	
		Furnaced		Retorted			
	Operating mines	Ore treated (short tons)	76-pound flasks [1]	Ore treated (short tons)	76-pound flasks	76-pound flasks	Value [2] (thousands)
1969	24	108,715	[3] 7,735	[4] 9,985	430	8,165	$4,124
1970	13	89,200	4,884	258	25	4,909	2,001
1971	8	13,960	1,571	[5] 268	18	1,589	465
1972	3	W	W	W	W	810	177
1973	3	W	W	W	W	698	200

W Withheld to avoid disclosing individual company confidential data.
[1] Includes less than 100 flasks of byproduct mercury.
[2] Value calculated at average New York price.
[3] Includes mercury recovered from old surface ores, dumps, and placers.
[4] Includes 1,800 short tons of tailings.
[5] Includes ore treated in concentrators prior to retorting.

Molybdenum.—Molybdenum was recovered by Kennecott Copper Corp. as a coproduct of treating copper ores from the Ruth mine in White Pine County. Both production and shipments increased about four times the 1972 level.

Silver.—The production of silver increased 4.9% and the value increased 59% from that of 1972. Copper ores from two mines yielded most of the total lode silver. Some silver was produced from four small operations and a significant amount was produced by Cortez Gold Mines.

Tungsten.—The number of producing tungsten properties decreased from 13 in 1972 to seven in 1973 with tungsten concentrate production showing a 9% decrease. Rawhide Mining Co. increased production from its Scheelite mine near Rawhide, Mineral County, and accounted for most of the State's output. Most of the State's output was shipped to the tungsten carbide plant of Kennametal in Churchill County. A small amount was shipped to the Pine Creek ammonium paratungstate plant of Union Carbide Corp. near Bishop, Calif.

NONMETALS

Barite.—The quantity of primary barite sold or used by Nevada producers was up 73% from that of 1972. The number of active operations increased to 14 from seven in 1972. Most of the increased production came from IMCO Services, a division of Halliburton Company, which opened a new barite mine in Nye County 30 miles north of Belmont. The ore is trucked to the railhead at Mina and shipped to Houston, Tex. NL Industries, Inc., the only producer in Elko County in 1972, was joined by four other mines in 1973. Lander County, with six mines, accounted for 68% of the State total. Sales of ground barite, including tonnages used by producers, increased by 39%. Most of the ground and crushed barite was sold for use in well drilling.

Cement.—Portland cement was produced by Nevada Cement Co. in a dry-process plant at Fernley, Lyon County. Shipments increased 11% in quantity and 6.8% in value over those of 1972. Most of the cement was used by ready-mix concrete and concrete products manufacturers, building material dealers, and highway contractors.

Total consumption of cement in Nevada, including material received from out of State, was 465,308 tons, 16% higher than in 1972.

Clays.—Clays sold or used decreased in both quantity and value compared with the 1972 total. Common clay was obtained from a deposit near Flanigan, Washoe County, by Nevada Cement Co. for use at the company cement plant in Lyon County. Kelley-Moore Paint Co., Inc., mined kaolin near Lovelock, Pershing County. Western Talc Co. mined bentonite at the New Discovery mine in Nye County, the Toddy mine in Clark County, and the Blanco mine in Esmeralda County.

Diatomite.—Sales of prepared diatomite increased 3% in quantity and 11% in value compared with those of 1972. As in 1972, four deposits were mined. Eagle-Picher Industries, Inc., remained the largest Nevada producer from its Celatom mine in Pershing County, and the Tunnel Hill mine in Storey County. Product sales were

mainly for filtration, filler, and lightweight aggregate. United Sierra Division of Cyprus Mines Corp., the second largest producer, supplied diatomite from its mine in Churchill County to its plant at Fernley, Lyon County. General Refractories, Inc. (GREFCO), operated its mine at Basalt and a plant near Mina, both in Esmeralda County.

Fluorspar.—Production and shipments of metallurgical-grade fluorspar were about the same as in 1972. J. Irving Crowell, Jr., Nye County, was the only producer.

Gypsum.—Johns-Manville Products Corp., The Flintkote Co., U.S. Gypsum Co., and Art Wilson Co. mined gypsum in Clark, Lyon, and Pershing Counties. Output increased 34% to 1,154,000 tons, a new annual record. Flintkote, Johns-Manville, and U.S. Gypsum calcined gypsum in Clark and Washoe Counties. Output decreased 4% to 541,000 tons.

Lime.—The Flintkote Co. and Morrison & Weatherly Chemical Products produced lime in Clark and White Pine Counties for open-hearth steel furnaces, finishing lime, copper ore concentration, and other uses. Output increased 9%. Total consumption of lime in Nevada was 62,310 tons.

Lithium Compounds.—The output of lithium carbonate from the Silver Peak facility of Foote Mineral Co. in Esmeralda County increased 13% compared with that of 1972. The company reported that production and sales reached new highs and were at capacity levels. The use of lithium carbonate as a cell additive in aluminum potlines has clearly become the major market.

Magnesite.—Basic Inc., the only domestic producer of magnesite, operated an open pit mine at Gabbs, Nye County, and upgraded the ore in nearby processing facilities. Production of magnesite was about a fifth higher in 1973 compared with that of 1972. Most of the ore was used in the manufacture of refractories and special products.

Perlite.—All of the crude perlite was produced by two companies. U.S. Gypsum Co. operated a mine (Pearl Hill quarry) in Pershing County and Delamar Perlite worked the Mackie claims in Lincoln County. Most of the crude perlite output was sold to out-of-state consumers. Total sales, however, declined for the 16th consecutive year.

Pumice (Volcanic Cinder).—Output of pumice, pumicite, and volcanic cinder was about one third higher than that of 1972. Use in concrete admixtures, aggregate, landscaping, and roofing was up, but use in road construction was down substantially from the 1972 level. Cind R Lite Co. mined volcanic cinder from the Cinder Cone deposit southeast of Beatty, Nye County, for landscaping and concrete aggregate use. Volcanic cinder from the Cinderlite Aggregates property of Savage Construction Co., Inc., Carson City, was prepared for use in concrete aggregates, road construction, landscaping, and roofing. Pumicite from the Rilite Aggregate Co., Washoe County, was prepared for use in concrete aggregate.

Salt.—The sole salt producer in the State was Huck Salt Co., which leased and operated the Leslie Salt Co. solar evaporation plant in Churchill County. All of the production was used in Nevada, mostly for ice control on roads. The remainder was used in the meatpacking, tanning, casing, and dairy industries, in feed mixes, and by water-conditioning service companies and metal processors.

Sand and Gravel.—Output of sand and gravel rose from 10.1 million tons in 1972 to 12.4 million tons in 1973. There were 76 sand and gravel operations. Of these, 54 were classified as commercial and 22 were classified as Government-and-contractor. Most of the increased output came from Clark and Washoe Counties.

Stone.—About 3.6 million tons of stone was quarried at 20 locations, compared with 3.3 million tons at 22 locations in 1972. The increase was due mostly to a larger output of granite and dolomite. No marl, sandstone, or quartz were produced during the year.

Most of the limestone was converted to lime or used in cement. Some was also used as a metallurgical flux, primarily in the smelting of copper. Most of the dolomite was used in lime manufacture, and most of the granite and quartzite was used in road construction. Marble was quarried in Mineral County for terrazzo.

Public work crews and contractors produced limestone, granite, and quartzite in several counties for use as riprap, road base, and concrete aggregate.

Table 8.—Nevada: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Carson City [1]	4	120	58	3	41	37
Clark	23	5,571	7,061	25	6,297	8,831
Elko	10	259	1,095	12	334	689
Esmeralda	1	W	W	1	88	W
Eureka	1	W	7	2	2,030	905
Humboldt	4	82	75	3	43	49
Lander	--	--	--	1	6	13
Lincoln	2	W	78	3	W	63
Lyon	4	141	215	11	350	441
Mineral	--	--	--	2	121	W
Nye	3	W	W	6	197	139
Pershing	3	135	166	4	172	155
Storey	1	37	41	1	37	39
Washoe	15	2,567	2,697	16	2,274	2,244
White Pine	8	92	77	7	49	52
Undistributed [2]	r 5	1,077	1,066	6	411	955
Total [3]	84	10,081	12,636	103	12,448	14,614

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Independent city, formerly Ormsby County.

[2] Includes Churchill and Douglass Counties, and some sand and gravel that cannot be assigned to specific counties.

[3] Data may not add to totals shown because of independent rounding.

Table 9.—Nevada: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	945	1,454	1,214	2,212
Fill	546	397	585	385
Foundry	W	W	2	5
Paving	174	218	198	285
Other uses [1]	279	1,274	472	1,739
Total [2]	1,945	3,343	2,471	4,626
Gravel:				
Building	1,974	2,294	1,613	2,527
Fill	471	520	355	291
Paving	2,842	3,885	3,877	4,706
Miscellaneous	W	W	66	155
Other uses [3]	492	648	88	90
Total [2]	5,778	7,347	5,998	7,769
Government-and-contractor operations:				
Sand:				
Fill	25	25	83	36
Paving	704	759	111	149
Other uses	(4)	(4)	(4)	(4)
Total [2]	729	784	195	185
Gravel:				
Building	4	3	12	16
Fill	70	49	15	15
Paving	1,556	1,109	3,105	1,677
Other uses	--	--	651	326
Total [2]	1,630	1,161	3,783	2,034
Total sand and gravel [2]	10,081	12,636	12,448	14,614

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes glass, molding, fire or furnace, and other industrial sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast (1973).

[4] Less than ½ unit.

MINERAL FUELS

Petroleum.—The Eagle Springs oilfield remained the only producing area in the State. Production was 96,472 barrels compared with 99,985 barrels in 1972. The field has yielded a total of 2,722,123 barrels of oil through December 1973. The Nevada Oil and Gas Conservation Commission issued five well drilling permits in 1973, up from four issued in 1972.

Table 10.—Principal producers

Commodity and company	Address	Type of activity	County
Barite:			
Baroid Division, NL Industries, Inc.	P.O. Box 1675 Houston, Tex. 77001	Open pit mine	Elko.
Dresser Minerals Division, Dresser Industries, Inc.	P.O. Box 94 Houston, Tex. 77005	---- do ----	Lander.
FMC Corp	P.O. Box 3808 Modesto, Calif. 95352	---- do ----	Do.
Milchem, Inc., Mineral Division	P.O. Box 22111 Houston, Tex. 77027	---- do ----	Do.
Brucite: Basic Inc	845 Hanna Bldg. Cleveland, Ohio 44115	---- do ----	Nye.
Cement: Nevada Cement Co	Fernley, Nev. 89408	Dry-process, portland-cement plant.	Lyon.
Clays: Nevada Cement Co	Fernley, Nev. 89408	Open pit mine	Washoe.
Copper:			
The Anaconda Company	P.O. Box 1000 Weed Heights, Nev. 89443	---- do ----	Lyon.
Duvall Corp	P.O. Box 451 Battle Mountain, Nev. 89820	---- do ----	Lander.
Kennecott Copper Corp., Nevada Mines Division.	McGill, Nev. 89318	---- do ----	White Pine.
Diatomite:			
Eagle-Picher Industries, Inc	P.O. Box 1869 Reno, Nev. 89505	---- do ----	Pershing and Storey.
GREFCO, Inc	3450 Wilshire Boulevard Los Angeles, Calif. 90010	---- do ----	Esmerelda.
United Sierra Division, Cyprus Mines Corp.	P.O. Box 1201 Trenton, N.J. 08606	---- do ----	Churchill.
Fluorspar: J. Irving Crowell, Jr	P.O. Box 96 Beatty, Nev. 89003	Underground mine.	Nye.
Gold:			
Carlin Gold Mining Co	P.O. Box 672 Elko, Nev. 89801	Open pit mine	Eureka.
Cortez Gold Mines	Cortez, Nev. 89821	---- do ----	Lander.
Kennecott Copper Corp., Nevada Mines Division.	McGill, Nev. 89318	---- do ----	White Pine.
Gypsum:			
The Flintkote Co	P.O. Box 2678 Terminal Annex Los Angeles, Calif. 90054	---- do ----	Clark.
Johns-Manville Products Corp	4301 East Firestone Blvd. South Gate, Calif. 90280	---- do ----	Do.
United States Gypsum Co	101 South Wacker Drive Chicago, Ill. 60606	---- do ----	Pershing.
Iron ore: Nevada-Barth Corp	P.O. Box 425 Carlin, Nev. 89822	---- do ----	Eureka.
Lime:			
The Flintkote Co	P.O. Box 57367 Flint Station Los Angeles, Calif. 90057	Rotary kilns, batch and continuous hydrators.	Clark.
Morrison & Weatherly Chemical Products.	P.O. Box 1105 McGill, Nev. 89318	Rotary kilns	White Pine.
Lithium: Foote Mineral Co	Route 100 Exton, Pa. 19341	Dry lake brines	Esmeralda.
Magnesite: Basic Inc	845 Hanna Bldg. Cleveland, Ohio 44115	Open pit mine	Nye.
Mercury:			
Carlin Gold Mining Co	P.O. Box 672 Elko, Nev. 89801	---- do ----	Eureka.
Crofoot Tungsten Co	Rt. 2 Box 625 B Ukiah, Calif. 95482	Underground mine.	Pershing.
Molybdenum: Kennecott Copper Corp., Nevada Mines Division.	McGill, Nev. 89318	Open pit mine	White Pine.
Perlite:			
Delamar Perlite	Pioche, Nev. 89043	Underground mine.	Lincoln.
United States Gypsum Co	101 South Wacker Drive Chicago, Ill. 60606	Open pit mine	Pershing.
Petroleum:			
North American Resources Corp	811 San Jacinto Bldg. Houston, Tex. 77002	Producing crude-oil wells.	Nye.
Western Oil Lands, Inc	380 Linden St. Reno, Nev. 89502	---- do ----	Do.
Pumice: Rilite Aggregate Co	P.O. Box 5665 Reno, Nev. 89503	Open pit mine	Washoe.
Salt: Huck Salt Co	Rt. 2, Box 33 Fallon, Nev. 89406	Solar evaporation.	Churchill.

Table 10.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel:			
Bing Materials Co	P.O. Box 487 Minden, Nev. 89423	Open pit mine	Douglas.
R. Helms Construction Co	3025 Mill St. Reno, Nev. 89502	do	Washoe.
Las Vegas Building Materials, Inc	P.O. Box 530 Las Vegas, Nev. 89101	do	Clark.
Nevada Aggregates & Asphalt	P.O. Box 7424 Reno, Nev. 89502	do	Washoe.
Nevada Rock & Sand Co	P.O. Box 2775 Huntridge Station Las Vegas, Nev. 89101	do	Clark.
Simplot Silica Products	Box 308 Overton, Nev. 89040	do	Do.
Stewart Brothers Co	P.O. Box 2775 Huntridge Station Las Vegas, Nev. 89101	do	Nye.
Stock Mill & Supply Co	3336 Cinder Lane Las Vegas, Nev. 89103	do	Do.
Wells-Cargo, Inc	2894 West Spring Mountain Rd. Las Vegas, Nev. 89114	do	Do.
W. M. K. Transit Mix, Inc	1606 Industrial Rd. Las Vegas, Nev. 89102	do	Do.
Silver:			
Duval Corp	P.O. Box 451 Battle Mountain, Nev. 89820	do	Lander.
Kennecott Copper Corp., Nevada Mines Division.	McGill, Nev. 89318	do	White Pine
Stone:			
Nevada Cement Co	Fernley, Nev. 89408	Quarry	Lyon.
U.S. Lime Division, The Flintkote Co.	P.O. Box 57367 Flint Station Los Angeles, Calif. 90057	do	Clark.
Wells Cargo, Inc	2894 West Spring Mountain Rd. Las Vegas, Nev. 89114	do	Do.
Tungsten: Rawhide Mining Co., Kennametal Inc.	P.O. Box 378 Fallon, Nev. 89406	Underground mine.	Mineral.

The Mineral Industry of New Hampshire

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the New Hampshire Department of Resources and Economic Development for collecting information on all minerals except fuels.

By Avery H. Reed [1]

The total value of mineral production in New Hampshire increased 40% to $14.1 million compared with that of 1972, and was 37% above the 1971 record. Among the States, New Hampshire ranked 48th in total value of mineral production.

Leading producing counties were Hillsborough, Rockingham, and Merrimack. Leading producers were Kitledge Granite Corp. with 1 dimension granite quarry in Hillsborough County; Iafolla Industries, Inc., with 1 crushed-granite quarry and 2 sand and gravel pits; and the New Hampshire Department of Public Works and Highways with 10 granite quarries and 9 sand and gravel pits. These three companies accounted for 34% of the State's mineral output value.

[1] Supervisory physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Mineral production in New Hampshire [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays ---thousand short tons--	51	$70	43	$64
Gem stones	NA	42	NA	42
Sand and gravel ---thousand short tons--	6,020	6,256	7,795	8,597
Stone ---do---	528	3,743	1,836	5,416
Total	XX	10,111	XX	14,119
Total 1967 constant dollars	XX	8,343	XX	p 10,366

p Preliminary. NA Not available. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in New Hampshire, by county

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Belknap	W	W	Sand and gravel.
Carroll	W	$1,395	Sand and gravel, stone.
Cheshire	W	W	Sand and gravel.
Coos	$396	547	Sand and gravel, stone.
Grafton	667	815	Sand and gravel, stone, clays.
Hillsborough	3,114	3,558	Stone, sand and gravel.
Merrimack	2,100	2,057	Sand and gravel, stone.
Rockingham	1,070	W	Stone, sand and gravel, clays.
Strafford	313	553	Sand and gravel, clays, stone.
Sullivan	W	W	Sand and gravel, stone.
Undistributed [1]	2,450	5,193	
Total [2]	10,111	14,119	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes gem stones, and values indicated by symbol W.
[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of New Hampshire business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total labor force ---thousands--	321.1	328.6	+2.3
Unemployment ---do---	14.4	12.7	−11.8
Employment:			
Manufacturing ---do---	91.1	95.8	+5.2
Mining ---do---	.4	.4	--
Construction ---do---	15.4	16.6	+7.8
Services ---do---	50.3	52.7	+4.8
Government ---do---	41.2	43.0	+4.4
Other [1] ---do---	81.3	86.5	+6.4
Factory payrolls:			
Average weekly hours	39.8	39.7	−0.2
Average hourly earnings	$3.20	$3.38	+5.6
Personal income:			
Total ---millions--	$3,270	$3,621	+10.7
Per capita	$4,241	$4,578	+7.9
Construction activity:			
Portland cement shipments to New Hampshire thousand short tons--	243	279	+14.8
Mineral production value ---thousands--	$10,111	$14,119	+39.6

p Preliminary.
[1] Includes transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate.

Sources: Survey of Current Business; Employment and Earnings; Area Trends in Employment and Unemployment; and the U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Consumption of portland cement was 279,400 tons. Consumption of masonry cement was 13,040 tons. There are no cement plants in New Hampshire.

Clays.—W. S. Goodrich, Inc., Kane-Gonic Brick Corp., and Densmore Brick Co. mined 43,350 tons of common clay for common and face brick. Output decreased 15% below the 1972 record. The clay was mined in Grafton, Rockingham, and Strafford Counties.

Gem Stones.—The value of gem stones and mineral specimens collected was estimated at $42,000.

Gypsum.—National Gypsum Co. calcined gypsum at Portsmouth. Output decreased 9% below the 1972 record. The crude gypsum was imported from Canada.

Perlite.—National Gypsum Co. expanded perlite for plaster aggregate at Portsmouth. Output decreased 46% and was 62% below the 1971 record. The crude perlite was shipped into New Hampshire from western States.

Sand and Gravel.—Thirty operators mined sand and gravel at 40 mines in all 10 counties for building, paving, fill, and other uses. Output increased 29% to 7.8 million tons, but was 7% below the 1971 record. Leading counties were Merrimack, Carroll, and Hillsborough; these three counties accounted for 51% of the total output. Leading producers were Thomopoulis Sand and Gravel Pit; Tilton Sand & Gravel Inc.; R. S. Audley Inc.; and Manchester Sand, Gravel, & Cement Co. These producers accounted for 31% of the total output.

Stone.—Kitledge Granite Corp., John Swenson Granite Co., Inc., and Maine-New Hampshire Granite Co. quarried dimension granite in Hillsborough and Merrimack Counties for dressed architectural, construction, and monumental stone, and for curbing. Output decreased 5% below the 1972 record.

Lebanon Crushed Stone, Inc., crushed traprock in Grafton County. Output decreased 37%.

Iafolla Industries, Inc. opened a new granite quarry in Rockingham County.

The New Hampshire Department of Public Works and Highways crushed granite in Carroll, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan Counties for roadstone.

North Country Aggregates, Inc., crushed quartz in Hillsborough County for exposed aggregate in decorative concrete. Output increased 20%.

Total stone output increased to 1,836,000 tons, a record high. Production of crushed granite expanded greatly, mainly due to construction of the Interstate highway in Rockingham County.

Table 4.—New Hampshire: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972 Quantity	1972 Value	1973 Quantity	1973 Value
Commercial operations:				
Sand:				
Building	1,695	2,130	1,021	1,252
Fill	636	532	1,513	1,072
Paving	383	407	887	892
Other uses [1]	57	55	99	105
Total [2]	2,770	3,124	3,520	3,321
Gravel:				
Building	999	1,549	763	1,514
Fill	307	225	293	142
Paving	475	739	1,563	2,630
Miscellaneous	W	W	385	350
Other uses [3]	264	314	166	257
Total [2]	2,045	2,827	3,170	4,893
Government-and-contractor operations:				
Sand:				
Fill	--	--	4	1
Paving	189	59	514	245
Total	189	59	518	246
Gravel:				
Fill	39	5	--	--
Paving	977	241	587	136
Total	1,016	246	587	136
Total sand and gravel [2]	6,020	6,256	7,795	8,597

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Railroad ballast (1973) and other sand.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast (1973) and other gravel.

Table 5.—Principal producers

Commodity and company	Address	Type of activity	County
Clays:			
Densmore Brick Co	Lebanon, N.H. 03766	Pit	Grafton.
W. S. Goodrich, Inc	Epping, N.H. 03042	Pit	Rockingham.
Kane-Gonic Brick Corp	Gonic, N.H. 03867	Pit	Strafford.
Gypsum (calcined):			
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	Plant	Rockingham.
Perlite (expanded):			
National Gypsum Co	----do----------	----do	Do.
Sand and gravel:			
R. S. Audley, Inc	Rt. 3A, Bow, N.H. 03302	Pit	Merrimack.
Campton Sand and Gravel, Inc	Box 2, W. Campton, N.H. 03228	Pit	Grafton.
Cold River Sand & Gravel Corp.	Box 429, Bellows Falls, Vt. 05101	Pit	Cheshire.
J. J. Cronin Company	Box 176 N. Reading, Mass. 01864	Pit	Hillsborough.
Iafolla Industries, Inc	Peverly Hill Rd. Portsmouth, N.H. 03801	Pit	Rockingham and Strafford.
Keene Sand & Gravel, Inc	725 Main St. Keene, N.H. 03431	Pit	Cheshire.
Manchester Sand, Gravel & Cement Co.	Box 415, Hookset, N.H. 03106	Pit	Merrimack.
Ossipee Aggregate Corp	Route 16, Ossipee, N.H. 03864	Pit	Carroll.
Thomopoulis Sand & Gravel Pit	Londonderry, N.H. 03053	Pit	Rockingham.
Tilton Sand & Gravel Inc	Tilton, N.H. 03276	Pit	Belknap.
Stone:			
Granite, dimension:			
Kitledge Granite Corp	Armory Rd. Milford, N.H. 03055	Quarry	Hillsborough.
John Swenson Granite Co., Inc.	North State Street Concord, N.H. 03301	----do	Merrimack.
Quartz, crushed:			
North Country Aggregates, Inc.	Box 55 S. Lyndeboro, N.H. 03082	----do	Hillsborough.
Traprock, crushed:			
Lebanon Crushed Stone, Inc.	Plainfield Rd. W. Lebanon, N.H. 03784	----do	Grafton.

The Mineral Industry of New Jersey

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the New Jersey Division of Natural Resources, Bureau of Geology and Topography, for collecting information on all minerals except fuels.

By Donald C. Wininger [1]

The value of New Jersey's mineral production totaled $114.0 million, 11% over over that of 1972. Sand and gravel, one of the State's two major mineral products, increased 13% in value. Stone, the other leading commodity, increased 8.4%. Zinc which ranks a distant third, remained little changed in output value. Sussex was the leading mineral-producing county and was followed, in descending order of value, by Somerset, Cumberland, Passaic, Morris, and Ocean. Mineral production was reported for all counties except Salem.

[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Mineral production in New Jersey [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays ---thousand short tons--	212	$856	183	$666
Gem stones	NA	16	NA	16
Peat ---thousand short tons--	W	W	44	514
Sand and gravel ---do---	17,679	38,020	19,040	43,098
Stone [2] ---do---	r 15,223	r 42,044	15,902	45,585
Zinc (recoverable content of ores, etc.) short tons--	38,096	13,524	33,027	13,647
Value of items that cannot be disclosed: Lime, magnesium compounds, manganiferous residuum, greensand marl, stone (dimension), titanium concentrate, and values indicated by symbol W	XX	8,261	XX	10,490
Total	XX	r 102,721	XX	114,016
Total 1967 constant dollars	XX	84,755	XX	p 83,711

p Preliminary. r Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed". XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes certain dimension stone; included with "Value of items that cannot be disclosed".

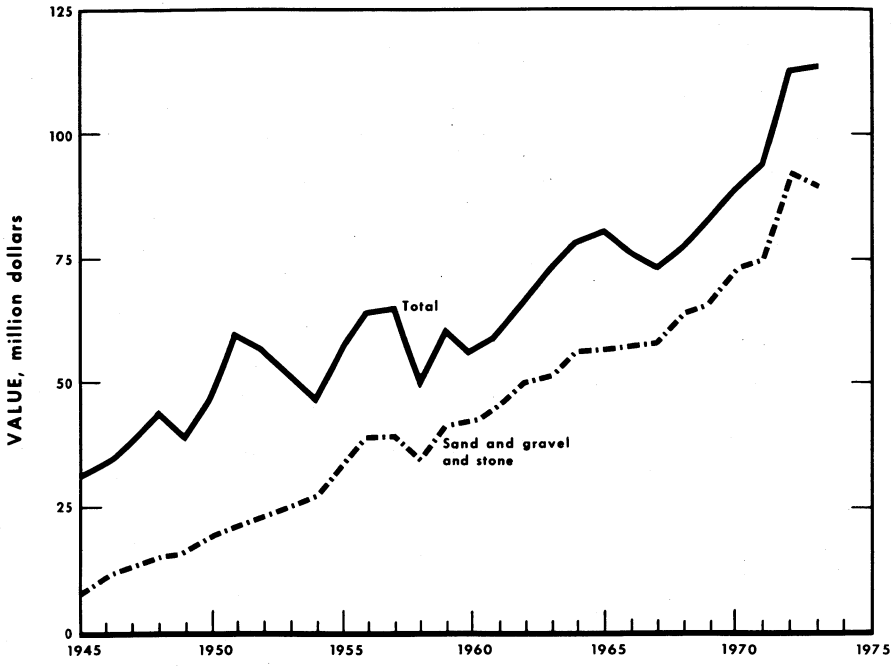

Figure 1.—Value of sand and gravel and stone, and total value of mineral production in New Jersey.

Table 2.—Value of mineral production in New Jersey, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Atlantic	$373	$436	Sand and gravel.
Bergen	1,267	W	Do.
Burlington	W	W	Sand and gravel, clays.
Camden	1,605	1,729	Do.
Cape May	W	W	Magnesium compounds, sand and gravel.
Cumberland	15,051	W	Sand and gravel, clays.
Essex	W	W	Stone.
Gloucester	546	876	Sand and gravel, greensand marl.
Hudson	1,678	W	Stone.
Hunterdon	2,920	3,851	Do.
Mercer	W	W	Do.
Middlesex	2,023	W	Sand and gravel, clays.
Monmouth	1,273	1,347	Sand and gravel.
Morris	7,760	7,304	Sand and gravel, stone.
Ocean	7,208	W	Sand and gravel, titanium concentrate.
Passaic	7,599	9,084	Stone, sand and gravel.
Somerset	r 19,491	20,642	Stone, clays.
Sussex	21,921	22,773	Zinc, stone, sand and gravel, peat, lime, magani-ferous residuum.
Union	W	W	Stone.
Warren	1,619	1,351	Sand and gravel, stone, peat.
Undistributed [2]	10,386	44,622	
Total [3]	r 102,721	114,016	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Salem county is not listed because no production was reported.

[2] Includes gem stones and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of New Jersey business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total work force ---------- thousands	3,123	3,192	+2.2
Unemployment ---------- do	182	178	−2.2
Employment:			
Manufacturing ---------- do	821.9	836.9	+1.8
Construction ---------- do	120.6	125.9	+4.4
Transportation and public utilities ---------- do	181.2	183.9	+1.5
Finance, insurance, and real estate ---------- do	125.4	131.2	+4.6
Service ---------- do	439.0	458.2	+4.4
Government ---------- do	405.3	419.3	+3.5
Mining ---------- do	3.2	3.4	+6.2
Payroll, average weekly earnings: Manufacturing	$163.2	$174.7	+7.0
Personal income:			
Total ---------- millions	$38,543	$42,389	+10.0
Per capita	$5,232	$5,759	+10.1
Construction activity:			
Number of housing units authorized	65,261	48,914	−25.0
Cement shipments to New Jersey--thousand short tons	2,254	2,338	+3.7
Mineral production value ---------- thousands	r $102,721	$114,016	+11.0

p Preliminary. r Revised.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; and the U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Shipments of portland cement into New Jersey totaled 2,252,000 short tons, 4% above those in 1972. Masonry cement shipments into New Jersey were 87,000 short tons, 9% above those in 1972. Most of the portland and masonry cement was manufactured in eastern Pennsylvania and eastern New York. Cement was distributed from five terminals, two in Jersey City, and one each in Bayonne, Elizabethport, and Newark.

Clays.—The quantity of clay produced decreased 14% as compared with that of 1972. Total value, however, was 22% lower, reflecting a decline in the average unit value. Common clay and shale accounted for 86% of the total tonnage and 77% of the value, and fire clay accounted for the remaining 14% of the tonnage and 23% of the value. Common clay and shale were used for face brick and sewer pipe, whereas fire clay was used for fire brick and block, refractory mortar, and sealing. Common clay and shale were produced in Somerset, Camden and Burlington Counties, in descending order of tonnage. Fire clay was mined in Middlesex and Cumberland Counties. Leading clay producers were Glen-Gery Corp., New Jersey Shale, Brick, & Tile Corp.

Gem Stones.—Collectors and dealers collected mineral specimens from several localities, mine dumps, and quarries, principally in the northern part of the State. The value of the material collected was estimated to be $16,000, unchanged from 1972.

Gypsum.—National Gypsum Co., The Flintkote Co., Kaiser Gypsum Co., Inc., and The Celotex Corp. calcined gypsum in Bergen, Burlington, and Camden Counties. Production increased 11% to 587,000 tons, a new annual record. Output was used mainly in the manufacture of wallboard, lath, and sheathing.

Iodine.—Consumption of organic and inorganic iodine by chemical and pharmaceutical companies in the State totaled 756,032 pounds compared with 684,000 pounds in 1972. The iodine was used for medicines, sanitation products, and other chemicals.

Lime.—Limestone Products Corp. of America produced lime in Sussex County for agriculture, water purification, sewage treatment, and other uses. Output declined 25% and was 63% below the 1969 record. Total consumption of lime in New Jersey was 146,224 tons.

Magnesium Compounds.—Production of refractory magnesia increased compared with that of 1972. A decrease in the average unit value, however, was reported. The refractory magnesia was produced in Cape May County from imported dolomite. J. T. Baker Chemical Co., Warren County, converted purchased materials to a variety of magnesium compounds.

Marl, Greensand.—Production of green-

sand marl remained unchanged in quantity and value from 1972. Marl, recovered by hydraulic mining from a pit in Gloucester County, was processed and used for water treatment and agricultural purposes.

Perlite.—Crude perlite mined in Colorado, Nevada, and New Mexico was expanded at three plants, two in Middlesex County and one in Mercer County. Expanded perlite was used primarily in roof insulation board and acoustical plaster; other uses included aggregate for ultralightweight concrete, loose-fill insulation and soil conditioner and as a lightweight filler.

Pigments.—Metal-base pigments, used primarily in the manufacture of paint, were produced at a number of plants in New Jersey. Iron oxide pigments were produced by Pigments and Specialities Div., Cities Service Co. in Mercer and Middlesex Counties, and by E. I. du Pont de Nemours & Co., Inc., in Essex County. Titanium dioxide was produced by The New Jersey Zinc Co., Gloucester City, and NL Industries, Inc., near Sayreville. The latter firm also manufactured lead pigments. Zinc oxide pigments were produced by Royce Chemical Co., Carlton Hill.

Sand and Gravel.—The total output of sand and gravel increased 7.7% from that of 1972, and the total value was 13% higher. Production of sand and gravel for construction increased 5% in quantity and 11.6% in value compared with 1972. Average value per ton increased $0.09 to $1.57 per ton. Of the 14.3 million tons of sand and gravel used for construction, approximately 18% was unprocessed. Output of industrial sand for all uses increased 22% in quantity and 17% in value reflecting a $0.20 decrease in the average value per ton. Industrial sand accounted for 22% of the tonnage and 45% of the value of all sand and gravel produced in the State. Almost all of the industrial sand was produced in Cumberland County where most operations used suction pumps mounted on barges floating on ponds fed by ground water. The sand and water slurry was pumped to processing plants for sizing, grinding, or other treatment. Many of the ponds created by removal of the sand were used for fishing and other recreational activities.

The number of sand and gravel operations was reported at 94 (one more than in 1972). Production came from 14 of the

Table 4.—New Jersey: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	138	842	116	776
Building	4,832	7,425	6,057	9,739
Engine	25	89	17	61
Fill	1,105	705	933	651
Glass	1,915	W	2,118	9,798
Molding	493	2,496	808	3,900
Paving	3,440	4,358	2,973	4,138
Pottery	52	623	W	W
Other uses [1]	930	12,665	1,244	5,038
Total [2]	12,929	29,202	14,265	34,101
Gravel:				
Building	1,930	4,428	1,876	4,129
Fill	929	917	767	660
Paving	1,147	1,975	1,437	2,647
Miscellaneous	642	1,347	537	1,239
Other uses	88	141	153	317
Total [2]	4,736	8,808	4,771	8,992
Government-and-contractor operations:				
Gravel:				
Paving	13	11	4	6
Total	13	11	4	6
Total sand and gravel [2]	17,679	38,020	19,040	43,098

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes fire or furnace, filtration, grinding and polishing (1973), railroad ballast (1972) and other ground sands.

[2] Data may not add to totals shown because of independent rounding.

State's 21 counties, and 6 counties produced more than 1 million tons each. Cumberland County ranked first in tonnage and value; its industrial sand accounted for more than one-third of the total value of sand and gravel produced in the State.

Only one operation produced more than 1 million tons, 8 produced from 500,000 to 1 million tons, and 42 produced from 100,000 to 500,000 tons. Shipments to consumers were primarily by truck (16.1 million tons) and rail (2.6 million tons).

Stone.—An increase in the level of building activity, especially highway construction, in the State's northern and northwestern counties, caused an increase in the demand for stone aggregate. Total stone production increased 4.5% in quantity and 8.4% in value from the 1972 level. Stone was quarried in 10 counties, led by Somerset, Passaic, Sussex, and Hunterdon Counties, in decreasing order of value. Types of stone produced in decreasing order of tonnage were basalt, granite, limestone, and sandstone. Basalt (traprock) continued as the leading type of stone quarried and accounted for 77% and 76%, respectively, of the State's total stone production and value. Output of 12.2 million tons was 3.4% higher than in 1972; average value increased from $2.71 per ton to $2.85. Somerset County with 7.1 million tons and Passaic County with 2.3 million tons were the leading basalt producers. Quarries were also active in Essex, Hudson, Hunterdon, Mercer, Morris, and Union Counties. Ninety-one percent of the output was used as aggregate for highway and building construction, but quantities also were sold for riprap and other uses.

Granite production increased 7% to 2.71 million tons. Average value decreased $0.07 per ton to $2.09. Quarries were operated at six loctions in Hunterdon, Morris, Passaic, and Sussex Counties. Small quantities were sold for riprap and fill; the bulk of the output was used for concrete aggregate and roadstone.

Crushed limestone was produced at two quarries in Sussex County and one in Warren County. Output was 9% higher than that of 1972, but total value increased about 11%, reflecting an increase in unit value. The limestone was used principally for agricultural stone (agstone), concrete aggregate, filler, hydrated lime, and poultry grit. Sandstone was quarried for dimension stone and flagstone in Hunterdon County.

Sulfur.—Shipments of byproduct sulfur increased 22% to 81,797 long tons. The total value was only 13% higher because the average price per long ton decreased to $23.14 from $25 in 1972. Elemental sulfur was recovered as a byproduct of petroleum refining at five plants, two each in Gloucester and Middlesex and one in Union County.

Vermiculite.—Exfoliated vermiculite was produced by one plant each in Mercer and Middlesex Counties from crude material shipped from other States or imported. The exfoliated vermiculite was used mainly as loose-fill insulation, plaster and lightweight concrete aggregate, fireproofing and for agricultural purposes.

METALS

Ferroalloys.—Shieldalloy Corp., Newfield, Gloucester County, produced ferroalloys of vanadium, titanium, boron, chromium, columbium, and columbium-nickel.

Table 5.—Crushed and broken stone shipped or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	2,291	5,797	2,721	6,888
Concrete aggregate (coarse)	481	1,223	342	809
Dense-graded road base stone	3,358	9,083	4,361	12,283
Macadam aggregate	335	717	284	703
Surface treatment aggregate	180	415	256	617
Unspecified construction aggregate and roadstone	6,853	18,262	6,058	17,350
Riprap and jetty stone	365	943	184	630
Other uses [1]	1,361	5,604	1,696	6,304
Total [2]	15,223	42,044	15,902	45,585

[1] Includes data for agricultural limestone, filter stone, stone used in lime manufacture and acid neutralization, fluxstone, asphalt and other fillers, roofing aggregates and uses not specified. Data for 1973 also includes stone used in manufactured fine aggregate.
[2] Data may not add to totals shown due to independent rounding.

Titanium.—Both quantity and value of ilmenite concentrate production were higher than in 1972. The average unit value was also higher. Glidden-Durkee Div. of SCM Corp. recovered ilmenite from a sand deposit about 3 miles north of Lakehurst, Ocean County. The material was concentrated and shipped to a company-owned plant at Baltimore, Md., for conversion to titanium dioxide pigment.

In June, American Smelting and Refining Co. began shipping ilmenite from its new operation near Lakehurst. The ilmenite is recovered from a sand deposit by dredging and then upgraded to a 63% titanium dioxide concentrate in two successive milling stages. Current reserve estimates of 180 million tons of 1.95% TiO_2 give the operation a life expectancy of at least 20 years at a production rate of 185,000 tons of ilmenite per year, boosting U.S. production by as much as 20%. Currently, all the concentrate is sold to E. I. du Pont de Nemours & Co. for manufacture of white pigments, under a 10-year contract.[2]

Zinc.—The quantity of manganiferous zinc ore mined at Sterling Hill, Sussex County, declined 13% from 1972. The ore was crushed and shipped directly to a company-owned smelter at Palmerton, Pa., where zinc and manganiferous residuum were recovered.

MINERAL FUELS

Peat.—Production and sales of peat increased from the 1972 level. Peat was recovered from bogs near Newton, Stanhope, and Sussex in Sussex County and from Great Meadows in Warren County. Most of the output was used for general soil improvement, but a small quantity was used in mushroom beds.

Petroleum.—There were still only five petroleum refineries in New Jersey with a combined daily capacity of over half a million barrels. All of the crude oil came from outside of the State.

[2] Li, Ta M. Startup of Manchester Mine and Mill Boosts U.S. Production of Primary Ilmenite. Eng. and Min. J., v. 174, No. 12, December 1973, pp. 71–75.

Table 6.—Principal producers

Commodity and company	Address	Type of activity	County
Clays:			
Fire clay:			
Crossman Co	P.O. Box 38 South Amboy, N.J. 08879	Pit	Middlesex.
Daniel Goff Division, Jesse S. Morie & Son, Inc.	P.O. Box 35 Mauricetown, N.J. 08329	Pit	Cumberland.
Miscellaneous clay:			
Church Brick Co	P.O. Box 129 Bordentown, N.J. 08505	Pit	Burlington.
Glen-Gery Corp	P.O. Box 563 Hammonton, N.J. 08037	Pit	Camden and Somerset.
New Jersey Shale Brick & Tile Corp.	P.O. Box 490 Somerville, N.J. 08876	Pit	Do.
Greensand marl: Inversand Co	226 Atlantic Avenue Clayton, N.J. 08312	Pit	Gloucester.
Gypsum, calcined:			
The Celotex Corp	North 1 River Road Edgewater, N.J. 07020	Plant	Bergen.
The Flintkote Co., Building Products Group-East.	480 Central Ave. East Rutherford, N.J. 07073	----do	Camden.
Kaiser Gypsum Co., Inc	Delanco, N.J. 08075	----do	Burlington.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	----do	Do.
Ilmenite: Glidden-Durkee Division of SCM Corp.	P.O. Box 5 Lakehurst, N.J. 08733	Pit	Ocean.
Iron oxide pigments (manufactured):			
Cities Service Co	380 Madison Ave. New York, N.Y. 10017	Plant	Mercer and Middlesex.
E.I. du Pont de Nemours & Co., Inc.	Du Pont Building D 10034 Wilmington, Del. 19898	----do	Essex.
Lime: Limestone Products Corp. of America.	122 Main St. Newton, N.J. 07860	----do	Sussex.
Magnesium compounds: Harbison-Walker Refractories, Div. of Dresser Industries.	2 Gateway Center Pittsburgh, Pa. 15222	----do	Cape May.

Table 6.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Peat:			
Hyper-Humus Co	Lafayette Rd. Newton, N.J. 07860	Bog	Sussex.
Kelsey Humus Co., Partac Peat Co.	Kelsey Park Great Meadows, N.J. 07838	Bog	Warren.
Mt. Bethel Humus Co., Inc	315 West 57th St. New York, N.Y. 10019	Bog	Sussex.
Netcong Natural Products	Lackawanna Drive Stanhope, N.J. 07874	Bog	Do.
Perlite (expanded):			
Grefco, Inc	3450 Wilshire Blvd. Los Angeles, Calif. 90010	Plant	Middlesex.
Petroleum refineries:			
Chevron Oil Co	1200 State St. Perth Amboy, N.J. 08861	----do	Do.
Hess Oil & Chemical Corp	One Hess Plaza Woodbridge, N.J. 07095	----do	Do.
Exxon Co. U.S.A	Box 22, Linden, N.J. 07036	----do	Union [1] and Hudson.
Mobile Oil Corp.[1]	P.O. Box 900 Dallas, Tex. 75221	----do	Gloucester.
Texaco Inc	P.O. Box 52332 Houston, Tex. 77052	----do	Do.
Sand and gravel:			
S. Braen & Co	Box 188 Wyckoff, N.J. 07481	2 pits	Bergen and Sussex.
Brick-Wall Corp	Route 70 Lakehurst, N.J. 08733	Pit	Ocean.
Fisher Bros. Sand & Gravel Co.	115 Hickory Lane Bayville, N.J. 08721	Pit	Do.
Houdaille Construction Materials, Inc.	10 Park Place Morristown, N.J. 07960	Pit	Morris, Ocean, Warren.
J. S. Morie & Sons, Inc	Box 35 Mauricetown, N.J. 08329	2 pits and 2 dredges.	Cumberland.
Penna Glass Sand Corp	Berkeley Spg., W.Va	Pit	Do.
Saxon Falls Sand & Gravel Co. Inc.	R D 3 Stanhope, N.J. 07874	Pit	Morris.
N. J. Sillica Sand Co	Millville, N.J. 08332	Pit	Cumberland.
Tuckahoe Sand & Gravel	P.O. Box 101 Tuckahoe, N.J. 08250	Pit	Cape May.
Whitehead Brothers Co	60 Hanover Rd. Florham Park, N.J. 07932	Pit	Cumberland.
Smelters (copper):			
American Metal Climax, Inc.	1270 Avenue of the Americas New York, N.Y. 10020	Plant	Middlesex.
American Smelting & Refining Co.	120 Broadway New York, N.Y. 10005	----do	Do.
The Anaconda Co	25 Broadway New York, N.Y. 10004	----do	Do.
Stone:			
Granite, crushed and broken:			
Braen Industries, Inc	Box 188 Wyckoff, N.J. 07481	Quarry	Morris.
Glen Gardner Quarry Corp.	Box 344 Glen Gardner, N.J. 08826	----do	Hunterdon.
Hamburg Quarry, Inc	Route 23 Hamburg, N.J. 07419	----do	Sussex.
Passaic Crushed Stone Co., Inc.	P.O. Box 348 Pompton Lakes, N.J. 07442	----do	Passaic.
Shahmoon Industries, Inc.	R. D. #1 Wharton, N.J. 07885	----do	Morris.
Somerset Crushed Stone Div.	Route 202, Mine Brook Rd. Bernardsville, N.J. 07924	----do	Hunterdon.
Tri County Asphalt Corp.	Route 15 Hopatcong, N.J. 07843	----do	Sussex.
Limestone, crushed:			
Farber White Limestone Co.	R D 1 Box 316 Franklin, N.J. 07416	----do	Do.
Limestone Products Corp. of America.	122 Main St. Newton, N.J. 07860	----do	Do.
Sandstone, dimension:			
Delaware Quarries	Lumberville, Pa. 18933	----do	Hunterdon.
Traprock (basalt), crushed and broken:			
Samuel Braen's Sons	P.O. Box 188 Wyckoff, N.J. 07481	----do	Passaic.
Callanan Trap Rock Corp.	South Bethlehem, N.Y. 12161	----do	Hudson.

See footnote at end of table.

Table 6.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Dock Watch Quarry Pit, Inc.	Box 245 Martinsville, N.J. 08836	Quarry	Somerset.
Fanwood Crushed Stone Co.	141 Central Ave. Westfield, N.J. 07090	do	Do.
Houdaille Construction Materials, Inc.	10 Park Place Morristown, N.J. 07960	do	Hunterdon, Passaic, Somerset, Union.
M. L. Kernan Quarry	500 Tillon Rd. South Orange, N.J. 07979	do	Essex.
Orange Quarry Co	318 Eagle Rock Ave. West Orange, N.J. 07050	do	Do.
Somerset Crushed Stone Division, Anthony Ferrante & Sons, Inc.	Route 202, Mine Brook Rd. Bernardsville, N.J. 07924	do	Somerset.
Trap Rock Industries, Inc.	Laurel Ave. Kingston, N.J. 08528	do	Hunterdon, Mercer, Somerset.
The Union Building & Construction Corp.	1111 Clifton Ave. Clifton, N.J. 07013	do	Passaic.
Warren Brothers Co., Sowerbutt-Standard District.	P.O. Box 2565 Paterson, N.J. 07502	do	Do.
Sulfur (recovered):			
The Anlin Co. of New Jersey-District.	1200 State St. Perth Amboy, N.J. 08861	Plant	Middlesex.
Vermiculite (exfoliated):			
Coralux Perlite Corp. of New Jersey.	P.O. Box 251 Metuchen, N.J. 08840	do	Do.
Zonolite Division, W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	do	Mercer.

[1] Also byproduct elemental sulfur.

The Mineral Industry of New Mexico

By Roman V. Sondermayer [1]

During 1973, New Mexico continued as a significant producer of minerals, mineral fuels, and related materials. Mineral production value totaled $1,305.6 million, a record high and an 18.9% increase over that of 1972. The increase in mineral production value resulted mostly from higher prices rather than significantly increased output of mineral commodities. The State ranked seventh among the 50 States in mineral production value and the industry comprised a major sector of the State's economy. Fuels were first in value of production with $840.8 million, followed by metals and nonmetals with $331.1 million and $133.7 million, respectively. Among 30 minerals reported produced in the State, eight accounted for about 96% of the total mineral production value. These minerals ranked by value, with percentages showing individual share of the total, were as follows: Petroleum (31.7%), natural gas (22.1%), copper (18.7%), natural gas liquids (8.2%), potassium salts (7.1%), uranium (4.5%), coal (2.4%), and sand and gravel (1.2%).

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in New Mexico [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays [2] thousand short tons	65	$108	88	$169
Coal (bituminous) do	8,248	29,794	9,069	31,862
Copper (recoverable content of ores, etc.) short tons	168,034	172,067	204,742	243,643
Gem stones	NA	68	NA	70
Gold (recoverable content of ores, etc.) troy ounces	14,897	873	13,864	1,356
Gypsum thousand short tons	W	W	255	1,220
Iron ore (usable) thousand long tons, gross weight	W	W	5	114
Lead (recoverable content of ores, etc.) short tons	3,582	1,077	2,556	833
Lime thousand short tons	28	W	44	793
Manganiferous ore (5 to 35 percent Mn) short tons	27,837	W	32,084	W
Mica, scrap thousand short tons	14	W	10	82
Natural gas million cubic feet	1,216,061	225,420	1,218,749	287,889
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels	10,338	29,970	9,848	32,449
LP gases do	27,859	45,689	29,652	74,427
Peat thousand short tons	2	46	3	50
Perlite do	476	5,698	478	5,024

See footnotes at end of table.

Table 1.—Mineral production in New Mexico [1]—Continued

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Petroleum (crude) thousand 42-gallon barrels	110,525	$376,778	100,986	$414,041
Potassium salts thousand short tons	2,296	91,115	2,168	91,996
Pumice do	311	809	339	1,001
Sand and gravel do	7,600	8,553	10,641	15,753
Silver (recoverable content of ores, etc.) thousand troy ounces	1,017	1,713	1,111	2,843
Stone thousand short tons	2,768	5,499	2,830	5,894
Uranium (recoverable content) thousand pounds	10,808	68,091	9,140	59,410
Zinc (recoverable content of ores, etc.) short tons	12,735	4,521	12,327	5,094
Value of items that cannot be disclosed: Carbon dioxide, cement, fire clay, fluorspar (1972), molybdenum, tin, salt, vanadium and values indicated by symbol W	XX	29,403	XX	29,631
Total	XX	1,097,292	XX	1,305,644
Total 1967 constant dollars	XX	905,376	XX	p 958,604

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed". XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes fire clay: included with "Value of items that cannot be disclosed."

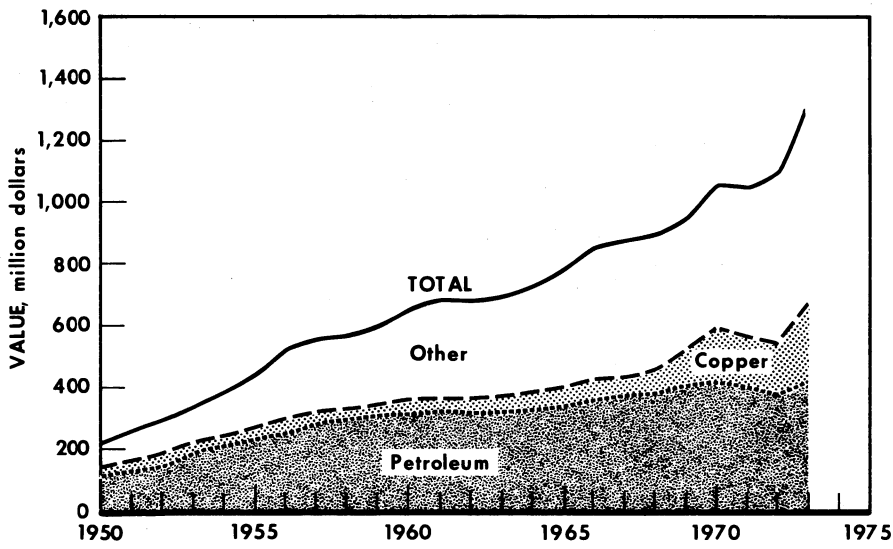

Figure 1.—Value of petroleum and total value of mineral production in New Mexico.

New Mexico was the leading producer of perlite and potassium salts in the United States. Furthermore, the State was among the leaders in output of uranium, copper, molybdenum, natural gas, natural gas liquids, pumice, and crude petroleum. Although there were mining operations throughout the State, most of the petroleum and natural gas was produced in the southeastern and northwestern parts. Copper output came from the southwestern corner of the State, uranium was mined and processed into yellow cake in the west-central part of the State, potash was

mined in the southeast, and most of the perlite was produced in the north-central part of New Mexico.

Most of the mineral industry's products were consumed outside the State, making New Mexico a significant supplier of raw materials to other States.

Principal events in the mining industry of New Mexico during 1973 included: Start of construction of a 100,000-ton-per-year copper smelter by Phelps Dodge Corp. near Animas, Hidalgo County; beginning of coal production at the West York strip mine, near Raton, Colfax County, operated by Kaiser Steel Corp.; preparation for coal gasification by El Paso Natural Gas Co. and Western Gasification Co. (WESCO); beginning of construction for a 30,000-barrel-per-day refinery near Lovington, Lea County; completion of a shaft at the Kerr-McGee Corp. Church Rock uranium property; the first underground production at The Anaconda Company Jackpile uranium mine in Valencia County; continuation of the decline in crude oil production; decline of energy production (expressed in Btu's); and loss of first place among uranium-producing States.

Table 2.—Value of mineral production in New Mexico, by county [1]
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Bernalillo	$13,876	$15,973	Cement, sand and gravel, stone, clays.
Catron	--	W	Sand and gravel, stone, tin.
Chaves	10,742	10,746	Petroleum, natural gas, sand and gravel.
Colfax	10,667	W	Coal, sand and gravel.
Curry	176	--	
DeBaca	W	W	Sand and gravel.
Doña Ana	380	W	Sand and gravel, stone, pumice, clays.
Eddy	193,218	224,195	Potassium salts, petroleum, natural gas, natural gas liquids, salt, sand and gravel, stone.
Grant	173,521	245,261	Copper, zinc, silver, gold, lead, molybdenum, lime, stone, manganiferous ore, sand and gravel.
Guadalupe	W	W	Sand and gravel.
Harding	W	W	Natural carbon dioxide.
Hidalgo	2,173	3,279	Copper, sand and gravel, stone, gold, silver, clays, zinc.
Lea	391,082	460,197	Petroleum, natural gas, natural gas liquids, sand and gravel, stone.
Lincoln	W	231	Sand and gravel, stone.
Luna	314	W	Sand and gravel, stone, clays.
McKinley	72,777	75,716	Uranium, natural gas liquids, petroleum, coal, natural gas, sand and gravel, stone, molybdenum.
Mora	W	281	Sand and gravel.
Otero	363	850	Sand and gravel, stone.
Quay	324	W	Do.
Rio Arriba	43,666	52,992	Natural gas, petroleum, natural gas liquids, sand and gravel, pumice.
Roosevelt	11,786	10,878	Petroleum, natural gas liquids, natural gas, stone.
Sandoval	8,544	12,384	Copper, sand and gravel, stone, gypsum, petroleum, natural gas, silver, peat, clays, pumice, gold, zinc.
San Juan	110,747	130,860	Natural gas, coal, petroleum, natural gas liquids, sand and gravel, clays, pumice.
San Miguel	W	W	Sand and gravel.
Santa Fe	1,750	1,852	Copper, sand and gravel, gypsum, pumice, gold, silver, clays.
Sierra	W	W	Sand and gravel.
Socorro	88	77	Zinc, lead, stone, gold, copper, silver.
Taos	21,842	21,601	Molybdenum, perlite, sand and gravel, mica, stone.
Torrance	W	175	Iron ore, sand and gravel.
Union	W	W	Pumice, sand and gravel.
Valencia	26,504	23,595	Uranium, sand and gravel, perlite, stone.
Undistributed [2]	2,753	14,506	
Total [3]	1,097,292	1,305,644	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Los Alamos County is not listed because no production was reported. The value of petroleum is based on an average price per barrel for the State. County data for uranium has been estimated for 1973.

[2] Includes some sand and gravel and stone that cannot be assigned to specific counties, gem stones, vanadium, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of New Mexico business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total work force ---------- thousands --	392.5	411.6	+4.9
Unemployment ---------- do ----	22.6	23.5	+4.0
Employment (nonagricultural):			
Mining ---------- do ----	16.2	16.1	−.6
Construction ---------- do ----	23.7	25.0	+5.5
Manufacturing ---------- do ----	25.5	27.3	+7.1
Transportation and public utilities -- do ----	21.1	22.7	+7.6
Wholesale and retail trade ---------- do ----	70.7	77.0	+8.9
Finance, insurance, and real estate - do ----	14.4	15.3	+6.2
Services ---------- do ----	60.1	62.9	+4.7
Government ---------- do ----	96.0	99.1	+3.2
Personal income:			
Total ---------- millions --	$3,796	$4,163	+9.7
Per capita ----------	$3,564	$3,764	+5.6
Construction activity:			
Total residential units authorized ----------	15,360	9,665	−37.1
Value of nonresidential construction - millions --	$95.5	$101.9	+6.7
Cement shipments to and within New Mexico thousand short tons --	582	612	+5.2
Mineral production value ---------- millions --	$1,097.3	$1,305.6	+19.0

p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; U.S. Bureau of Mines.

Legislation and Government Programs.—Environment and energy were the focal points of government activities related to the mineral industry of New Mexico during 1973. In April 1973, the Legislature passed and the Governor signed a bill to further delay application of a 1971 act requiring an environmental impact statement prior to many actions of State agencies. The law provided that the moratorium on environmental impact statements will be continued through June 1, 1974. In addition, the bill increased the membership of the State Advisory Council on Environmental Quality from three to seven and gave the Council the responsibility of studying the need for impact statements. The Council report and recommendations were to be presented to the 1974 legislative session.

The State Commissioner of Revenue ruled that sales of coal to coal gasification plants will be exempt from gross receipts tax. The decision was based on the recognized exemption granted to all components in the manufacturing process. However, the sale of synthetic gas would be subject to tax.

An Energy Crisis Bill was passed by the Legislature and signed by the Governor in the spring of 1973 and became effective in June. The bill will give the State a preferential right to purchase all minerals, including oil and gas, produced from State-owned trust lands. The major purpose of the bill was to assure that New Mexico has an adequate supply of gas and oil fuels.

On February 27, the New Mexico House of Representatives approved a bill reducing the excise tax rate on molybdenum produced at the Molybdenum Corp. of America (Molycorp) Questa mine, Taos County, from ¾% to ⅛%.

Papers relating to the mineral industry of the State were published by the Federal Bureau of Mines,[2] the U.S. Geological Survey,[3] and the New Mexico State Bureau of Mines and Mineral Resources (a division of the New Mexico Institute of Mining and Technology).[4]

The number of mining and oil and gas leases on Federal lands in New Mexico totaled 14,764, comprising 10,416,176 acres, almost one-third of the Federal lands in the State and about 13% of the total area of the State. Mining leases on Federal lands decreased from 745 at yearend 1972 to 648 a year later. Acreage in mining leases decreased by 9.7%, from 755,642 to 682,702 acres during 1973. Oil and gas leases decreased 2.7% to 9,733,474 acres during 1973.

[2] Liles, K. J., J. W. Brown, and G. V. Sullivan. Continuous Heavy Liquid Concentration of High-Clay Potash Ores. BuMines RI 7724, 1973, 14 pp.

[3] Jones, W. R., and R. M. Hernon. Ore Deposits and Rock Alternation of the Santa Rita Quadrangle, Grant County, New Mexico. U.S. Geol. Survey, PB 2-14371, 1973, 102 pp.

[4] Tranger, F. F. Water Resources and General Geology of Grant County, New Mexico. New Mexico Bureau of Mines and Miner. Res., Hydrologic Rept. 2, 1974, 210 pp.

Employment and Safety.—The mineral industry of New Mexico employed about 8% of the total labor force in the State. According to the 1973 Annual Report by the State Inspector of Mines, the breakdown of employment, by categories of activity, was as follows:

	Coal	Metals	Non-metals	Other	Total
Underground	187	1,232	1,370	--	2,789
Surface	574	1,911	1,267	--	3,752
Mill or plant	(1)	1,172	946	649	2,767
Other	(1)	469	291	--	760
Total	761	4,784	3,874	649	10,068

[1] Included in surface.

Employment in the petroleum- and gas-producing and refining industry was estimated to be about 16,000 persons.

During 1973 the mining industry used about 6.6 million pounds of high explosives and 54.3 million pounds of blasting agents. Active central mine rescue stations were located in Carlsbad, Eddy County; Grants, Valencia County; Lordsburg, Hidalgo County; and Silver City, Grant County. All funds necessary for maintaining these stations and training of personnel were provided by the mining companies of the area.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

New Mexico remained a major producer of mineral fuels and was a significant supplier of energy to other States during 1973.

Mineral fuels comprised 64.4% of the State's mineral output in terms of value. The value of petroleum and natural gas liquids increased and amounted to $520.9 million, or 62% of the total value of fuels; natural gas (marketed) production contributed $287.9 million, or 34%; and coal was valued at $31.9 million, or 4 %.

Although New Mexico ranked seventh in the United States in per capita consumption of energy, calorific value of mineral fuels production exceeded by far (approximately seven times) the States energy consumption. Petroleum, natural gas, and uranium remained prominent sources of primary energy. Coal, with large reserves, was expected to regain significance when coal gasification projects become operational.

During 1973 primary energy input (in Btu's) of New Mexico into the U.S. economy was 6.9% lower compared with that of 1972.

Calorific values of uranium and natural gas ranked first and second, respectively, among primary sources of energy produced in the State. The tabulation below shows details of calorific values of mineral fuels produced in New Mexico during 1972 and 1973.

	1972		1973	
	Quantity	10^{12} Btu	Quantity	10^{12} Btu
Coal ---- thousand short tons	8,248	201	9,069	220
Crude oil ---- thousand barrels	110,525	641	100,986	586
Natural gas liquids ---- do	38,197	176	39,500	182
Natural gas ---- million cubic feet	1,216,061	1,254	1,218,749	1,257
Uranium (U_3O_8) ---- short tons	5,404	2,161	4,570	1,828
Total	--	4,433	--	4,073

During 1972, the latest year for which complete data were available, consumption of energy in New Mexico showed natural gas to be the leading mineral fuel consumed in the State, with 49.7% of the total. Petroleum refinery products followed with 25.4% and bituminous coal added another 24.9%. Although New Mexico was the largest producer of uranium in the United States in 1972, there was no direct consumption of uranium in the State. The State's gross energy input,[5] by sectors, in trillion Btu [6] was as follows: Households,

[5] "Gross inputs" is the total energy input into the economy. It includes coal, petroleum, natural gas, and the electricity generated by hydroelectric and nuclear powerplants converted to equivalent energy inputs.

[6] Crump, L. H., and C. L. Readling. Fuel and Energy Data. United States by States and Regions, 1972. BuMines IC 8647, 1974, p. 45.

74.9, industry, 168.5; transportation, 150.8, generation of electric power, 217.4; and miscellaneous, 2.7. Per capita gross energy input was 571 million Btu, and per capita net energy input[7] was 390 million Btu.

Coal.—Increased output, beginning of production at the West York Strip mine near Raton, operated by Kaiser Steel Corp., and preparation for coal gasification were the principal events in the coal industry of the State. Coal production reached 9.1 million tons, a record high, during 1973. Value of output was $31,862,000 7.0% more than in 1972. The average price per ton of coal declined by 10 cents and was $3.51.

Six mines, one of which was an underground mine, were in operation. Coal mines employed a total of 761 persons, including 187 underground miners. Most of the coal was from the San Juan Basin in San Juan County. The electric power generating industry accounted for 99% of the total State coal consumption. According to the Federal Bureau of Mines,[8] the coal reserve base in New Mexico, on January 1, 1974, was as follows, in million short tons:

	Potential mining method		Total demonstrated coal reserves
	Underground	Surface	
Anthracite	2	--	2
Bituminous	1,527	250	1,777
Subbituminous	607	2,008	2,615
Total	2,136	2,258	4,394

The principal coal producer was the Navajo strip mine of Utah International, Inc., located southwest of Fruitland, San Juan County. The entire output of low-sulfur, high-ash coal from this mine was used at the Four Corners powerplant of the Arizona Public Service Co. Ash from the powerplant was returned to the mine for use as fill in reclaiming mined-out areas.

After all necessary permits were secured, the West York Strip mine, located close to the York Canyon underground mine, near Raton, Colfax County, started production. Kaiser, the operator of the new mine, invested about $5 million in its development. Output of the West York Strip mine was expected to reach 350,000 tons of coal per year. Removal of overburden was planned at a rate of 30 to 40 surface acres per year. Reclamation of the land to approved standards was scheduled to start almost immediately after removal of the coal.

Preliminary work on coal gasification continued during 1973. Of four synthetic pipeline gas (SPG) plants planned for the State, two plants were scheduled for construction, pending necessary approvals from State and Federal agencies. El Paso Natural Gas Co., with its 250-million-cubic-foot-per-day plant near Burnham, and WESCO, a joint venture of Pacific Coal Gasification Co. and Transwestern Coal Gasification Co., with its 250-million-cubic-foot-per-day plant located about 30 miles south of Farmington, were the two plants involved.

[7] "Total net inputs" (three sectors) is the total input into the various consuming sectors except the fuels used for generating electric power. It consists of direct fuels and electricity distributed from the electric power sector.

[8] U.S. Bureau of Mines. Demonstrated Coal Reserve Base of the United States on January 1, 1974. Mineral Industry Surveys, June 1974, 6 pp.

Table 4.—New Mexico: Bituminous coal production, by type of mine and county, 1973
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines			Production (thousand short tons)			Value (thousands)
	Underground	Strip	Total	Underground	Strip	Total	
Colfax	1	1	2	733	192	925	W
McKinley	--	2	2	--	469	469	W
San Juan	--	2	2	--	7,676	7,676	W
Total[1]	1	5	6	733	8,336	9,069	$31,862

W Withheld to avoid disclosing individual company confidential data, included in total.
[1] Data may not add to total shown because of independent rounding.

The El Paso Natural Gas Co. plant is expected to consume about 225 million tons of coal over a projected life of 25 years, or about 9 million tons per year. The total planned investment was $410 million. Coal will be furnished from a lease jointly acquired by El Paso and Consolidation Coal Co. Exploration established more than 700 million tons of recoverable subbituminous coal reserves. The coal is covered with less than 150 feet of overburden.

The WESCO plant will use 9.6 million tons of coal per year. About $40 million of the overall cost of $406 million will result from environmental cost. Utah International, San Francisco, Calif. was awarded a $875 million contract by WESCO to supply coal and water for this new coal gasification plant. The 25-year contract calls for delivery of a total of about 240 million tons of coal from Utah's reserves on the Navajo Reservation.

Natural Gas.—Natural gas remained the principal primary source of energy (in Btu) consumed during 1973. Marketed output of 1,218,749 million cubic feet was slightly higher than that of 1972. San Juan, Lea, Eddy, and Rio Arriba Counties provided about 99% of the marketed production. According to the New Mexico Oil Conservation Commission, at yearend there were 10,133 wells producing natural gas, 454 wells more than in 1972. As of yearend 1973, natural gas reserves were reported by the American Gas Association, Inc. (AGA), and by the American Petroleum Institute (API) at 12,488,363 million cubic feet, or about 1.2% more than in 1972. In the southeastern part of the State, reserves increased 7.2%, and in the northwestern part of the State reserves declined about 3.2%.

During 1972, the largest year for which complete consumption data were available, about 295,965 million cubic feet of gas were consumed in New Mexico, or 49.7% of the total Btu's consumed in the State. Industry was the largest consumer and accounted for about 148,654 million cubic feet; electric powerplants followed with 59,141 million cubic feet; households consumed about 51,864 million cubic feet; and transportation used approximately 36,306 million cubic feet.

Royalties and taxes recovered by the State from gas, at the production point, amounted to $23.8 million, 30% above those of 1972. Royalties amounted to $7.0 million, with the balance divided among school, severance, conservation, and ad valorem taxes.

Twenty-five gas exploratory wells were completed during 1973, a decrease of two wells from the 1972 level. Eddy County led other counties in number of exploratory gas well completions, with 17 wells. Table 6 shows the most significant gas discoveries in the State.

The representatives of Southern Gas Co. were negotiating to establish an underground gas storage facility under a 10,000-acre Federally owned tract near San Ysidro in Sandoval County. Storage capacity was not disclosed.

Natural Gas Liquids.—Production of natural gas liquids increased 3.4%, to 39.5 million barrels, and 41.3% in value. According to the New Mexico Oil and Gas Engineering Committee, a total of 1,067 billion cubic feet of gas was processed in 40 plants. After extraction of liquids, 934 billion cubic feet of gas was shipped to transmission companies, and 2 billion cubic feet was reinjected. Plant use, venting, and shrinkage accounted for 127 billion cubic feet, and the remainder was delivered directly to customers.

As of December 31, 1973, estimates made by the API and AGA indicated proved reserves of 413 million barrels of natural gas liquids,[9] a decline of 90 million barrels or about 18% from the 1972 estimate. Natural gas liquids reserves declined in both the northwestern and southeastern parts of the State. Downward revision of reserves accounted for about 57% of the total decline in natural gas liquids reserves.

Petroleum.—Although production declined during 1973, crude petroleum remained the largest single source of mineral income in New Mexico. In addition, the petroleum industry was the State's principal source of tax revenue and the largest nongovernmental employer. It also provided significant nondestructive use of land and attracted large quantities of out-of-State capital. Consumption of refinery products accounted for only one-sixth of the total quantity of crude oil produced in New Mexico.

Output of crude petroleum totaled 100,986,000 barrels, 9.5 million barrels (8.6%)

[9] American Gas Association, Inc., American Petroleum Institute, and Canadian Petroleum Association. Reserves of Crude Oil, Natural Gas Liquids and Natural Gas in the United States and Canada as of Dec. 31, 1973. V. 28, June 1974, p. 252.

less than in 1972. With a production value of $414 million, crude oil output ranked New Mexico sixth among producers in the United States. According to the State Oil Conservation Commission, 17,099 oil wells in 759 reservoirs were in production at yearend, a decrease of 188 wells and an increase of 10 reservoirs. There were 2,954 injection wells in secondary-recovery or pressure-maintenance projects. The Permian basin in southeast New Mexico remained the principal oil-producing area, accounting for about 93% of the total. Direct revenue to the State from petroleum production in 1973 totaled $47.4 million, an increase of 9.4%. Royalties amounted to $23.4 million with the balance divided among school, severance, conservation, and ad valorem taxes.

Table 5.—New Mexico: Production of crude oil and condensate, and natural gas, by county

County	Crude oil and condensate (thousand 42-gallon barrels)		Natural gas (million cubic feet)	
	1972	1973	1972	1973
Southeast New Mexico:				
Chaves	2,304	1,921	12,860	10,308
Eddy	19,194	18,040	168,117	211,256
Lea	78,127	71,835	419,343	420,153
Roosevelt	2,295	1,620	11,115	7,704
Subtotal	101,920	93,416	611,435	649,421
Northwest New Mexico:				
McKinley	1,853	1,674	1,570	2,355
Rio Arriba	1,895	1,616	185,025	178,647
San Juan	4,619	4,080	398,420	368,077
Sandoval	238	200	1,319	1,039
Subtotal	8,605	7,570	586,334	550,118
Total New Mexico	110,525	100,986	[1] 1,197,769	[1] 1,199,539

[1] Totals for natural gas differ from same totals in table 1. Bureau of Mines and the State of New Mexico use a different pressure basis for natural gas statistics.

Source: New Mexico Oil Conservation Commission. 1973 Oil and Gas Statistics.

As reported by the API, proved reserves of crude oil increased 10% to 642.9 million barrels at yearend. Additions to reserves from new fields and pools totaled 3,009,000 barrels; extensions and revisions added another 152 million barrels. An additional 319.5 million barrels of indicated reserves were estimated in known reservoirs, recoverable by fluid injection methods.

Based on API data, overall drilling activity in the State totaled 1,050 wells, and 5,458,923 feet, an increase of 16 wells and a decrease of 291,950 feet compared with the 1972 figures. The number of exploratory wells decreased from 216 in 1972 to 191 in 1973. The success ratio for wildcat drilling was 21.6%, slightly higher than the success ratio in 1972. For development drilling, the success ratio was 86.6%, an increase of 1.1% from the 85.5% in 1972. Eddy County, with 19 new gas and oil discoveries, and Lea County, with four oil and three gas discoveries, were the areas of most successful exploratory drilling.

Table 6.—New Mexico: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Bernalillo	--	--	--	--	--	1	1	11,115
Chaves	2	13	5	--	2	23	45	181,734
Colfax	--	--	--	--	--	12	12	46,040
Curry	--	--	--	--	--	2	2	13,473
De Baca	--	--	--	--	--	3	3	3,463
Eddy	44	70	32	2	17	45	210	1,555,340
Guadalupe	--	--	--	--	--	3	3	3,968
Hidalgo	--	--	--	--	--	1	1	4,001
Lea	167	20	35	4	3	13	242	1,497,631
Los Alamos	--	--	--	--	--	2	2	17,986
Luna	7	--	7	1		22	37	95,769
Mora	--	--	--	--	--	2	2	12,848
Quay	8	150	3	--	--	2	163	823,478
Rio Arriba	3	1	9	1	--	10	24	169,834
Roosevelt	--	13	1	1	--	10	25	73,114
Sandoval	40	206	23	--	3	3	275	940,411
San Juan	--	--	--	--	--	1	1	5,016
Sierra	--	--	--	--	--	1	1	1,539
Torrance	--	--	--	--	--	1	1	2,163
Total	271	473	115	9	25	157	1,050	5,458,923

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 7.—New Mexico: Principal oil and gas discoveries in 1973

County and field	Well	Operator	Location			Producing formation	Total depth (feet)	Initial production	
			Section	Township	Range			per Barrels of oil day	Thousand cubic feet of gas per day
Eddy:									
Unnamed	1-Love State	C & K	16	24 S	24 E	Wolfcamp	10,250	--	48,600
Do	1-NW Indian Basin.	Dean	28	20 S	23 E	Morrow	8,936	--	2,500
Lea:									
West Jal	West Jal	Skelly	20	25 S	36 E	Fusselman	17,083	--	16,500
McKinley:									
Unnamed	Northern Minerals No. 8.	Santa Fe Pacific Railroad.	29	16 N	6 W	Hospah	754	9	--
Rio Arriba:									
Basin	Shalk J.E. No. 2.	Lone Star Ind.—Shalk 62.	33	32 N	5 W	Gallup	7,717	--	10,000
San Juan:									
Ute Dome	Amoco Prod. No. 1.	Mountain Ute Gas Co.	25	32 N	14 W	Hermosa Paradox.	9,207	--	5,226

Six petroleum refineries were in operation: Caribou Four Corners Oil Co. at Kirkland, San Juan County; Famariss Oil and Refining Co. at Monument, Lea County; Navajo Refining Co. at Artesia, Eddy County; Plateau Inc. at Bloomfield, Lea County; Shell Oil Co. at Ciniza, McKinley County; and Thriftway Oil Co. at Bloomfield, San Juan County. Aggregate installed capacity was 57,480 barrels per day.

Famariss Oil and Refining Co. started construction of a new 30,000-barrel-per-day refinery at Lovington, Lea County. Completion of this construction was planned for 1974.

Holly Corp., an affiliate of Navajo Refining Co., announced plans to expand its refinery in Artesia by an additional capacity for processing 9,000 barrels of crude oil per day. The cost would be $1.2 million, and completion was scheduled for May 1974.

Runs of crude oil to stills totaled 16.9 million barrels, about 96% of operating crude oil throughout capacity. Except for 180,000 barrels, all crude oil for refinery throughput was produced within the State. Out-of-state shipments of crude oil produced in New Mexico totaled 82.9 million barrels, a decrease of 13.2% compared with 1972. Illinois received 48.6 million barrels; Texas, 14.9 million barrels; Indiana, 10.6 million barrels; and Missouri and Nebraska, 4.3 million barrels. The rest went to Ohio, Kansas, Oklahoma, Utah, and California.

METALS

The value of metal production increased to $331.1 million, an increase of 24.6% compared with $265.8 million in 1972. Higher production values for copper, gold, and silver accounted for the increase. Value of copper production accounted for 73.5% of total metal value in the State. The uranium share was an additional 17.9%. New Mexico also recorded production of iron ore, molybdenum, tin, vanadium, and zinc.

Copper.—During 1973 mine production of copper was the highest recorded in the history of New Mexico. The State ranked third, after Arizona and Utah, in copper output. There were 13 mines producing copper. Grant County, with nine mines, again was the leading county. The Chino mine near Santa Rita, Grant County, operated by Kennecott Copper Corp., and the Tyrone mine near Tyrone, Grant County, operated by Phelps Dodge Corp., were the leading copper-producing facilities in the State. Tables 8, 9, and 10 show details of copper production.

Table 8.—New Mexico: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1973, by class of ore or other source material

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Gold	1	2,782	411	4,867	6	4	1
Silver	1	14	--	256	(2)	--	--
Total	2	2,796	411	5,123	6	4	1
Copper, lead-zinc, zinc [3]	8	26,543,606	13,453	1,106,146	180,249	2,552	12,326
Other lode material:							
Copper cleanup	--	36	--	--	11	--	--
Copper precipitates	5	31,311	--	--	24,476	--	--
Total	5	31,347	--	--	24,487	--	--
Grand total	13	26,577,749	13,864	1,111,269	204,742	2,556	12,327

[1] Detail may not add to total because some mines produce more than one class of material.
[2] Less than ½ unit.
[3] Combined to avoid disclosing individual company confidential data.

Table 9.—New Mexico: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing [1]	Material sold or treated (short tons)	Gold		Silver		Copper		Lead		Zinc		Total value
	Lode		Troy ounces	Value	Troy ounces	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1971, total	13	18,554,543	10,681	$440,593	782,441	$1,209,653	157,419	$163,715,604	2,971	$819,940	13,959	$4,494,815	$170,680,605
1972, total	14	20,270,860	14,897	872,965	1,016,880	1,713,441	168,034	172,067,407	3,582	1,076,602	12,735	4,521,084	180,251,499
1973:													
Grant	9	25,420,988	11,109	1,086,572	967,633	2,475,206	196,296	233,592,502	2,488	810,742	12,259	5,065,582	243,030,604
Hidalgo	1	77,563	1,593	155,811	30,766	78,699	1,605	1,909,778	--	--	2	904	2,145,192
Socorro	1	1,542	27	2,641	709	1,814	2	2,125	68	22,142	64	26,512	55,234
Undistributed [2]	2	1,077,656	1,135	111,014	112,161	286,908	6,839	8,138,406	--	--	1	605	8,536,933
Total	13	26,577,749	13,864	1,356,038	1,111,269	2,842,627	204,742	243,642,811	2,556	832,884	[3] 12,327	5,093,603	253,767,963

[1] Operations at plants leaching runoff water not counted as producing mines.
[2] Includes Sandoval and Santa Fe Counties, combined to avoid disclosing individual company confidential data.
[3] Data do not add to total shown because of independent rounding.

Table 10.—New Mexico: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1973, by type of material processed and method of recovery

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Smelting of concentrates	13,453	1,105,869	180,228	2,552	12,326
Direction smelting of:					
Ore	411	5,400	27	4	1
Cleanup	--	--	11	--	--
Precipitates	--	--	24,476	--	--
Total	411	5,400	24,514	4	1
Grand total	13,864	1,111,269	204,742	2,556	12,327

The principal event in the copper industry was start of construction of the Phelps Dodge Corp. 100,000-ton-per-year copper smelter near Animas, Hidalgo County. The smelter will use the flash-smelting process developed by Outokumpu Oy of Finland. The plant was designed to produce 280 tons per day of 750-pound copper anodes containing 99% copper. About 475,000 tons of concentrate per year from the Tyrone mine will be fed to the smelter. The anodes will be shipped to the Phelps Dodge refinery at El Paso, Tex. Total cost for the smelter was reported to be almost $200 million. The smelter was planned to minimize environmental impact, and approximately 60% of total costs will be for pollution control. Employment was to be 300 persons with an annual payroll of $4 million.

A new town for employees was under construction about 10 miles north of the smelter. The project also included construction of a 36-mile industrial railroad connection to a transcontinental system. During 1973, $48 million was spent for the Animas smelter project.

Output at the Tyrone mine, operated by

Phelps Dodge Corp., increased by about 25,000 tons and reached 104,011 tons of copper.[10] Increased output resulted from a full year of production after completion of expansion in 1972.

At the Hurley smelter, Grant County, Chino Mines Division of Kennecott Copper Corp. continued construction of a sulfuric acid plant, part of Chino's air quality control plan. Completion was expected in mid-1974. Additions to installations for controlling emissions were completed. About half of all capital investments at Hurley were for pollution-abatement projects. In addition, a low-fuel direct smelting process was pilot-tested during 1973.

A break in the tailings dam at the Naciamento copper mine of Earth Resources Co., near Cuba, Sandoval County, stopped mill production for a 3-week period from the end of January through the first half of February.

Gold.—Output of gold was from 10 operations, mostly as a byproduct of copper mining in Grant, Hidalgo, Santa Fe, and Sandoval Counties. The quantity of gold produced during 1973 was 7% lower compared with that of 1972, but value of gold output increased 55% during 1973 reflecting the increased gold price.

Iron Ore.—About 5,000 long tons of iron ore was produced during 1973. Three operations, H. N. LaRue & Sons of Socorro, the Ancho Rico plant in Lincoln County, and the Continental copper mine in Grant County, operated by UV Industries, Inc., were involved in exploration or production.

The Continental copper mine produced magnetite as a byproduct of its copper production. The underground copper ore contains 22% to 23% magnetite, and the surface ore runs from 17% to 19%. Construction of a new 5,000-ton-per-day ore mill continued during 1973; its completion was scheduled for 1974.

Lead and Zinc.—The Ground Hog mine in Grant County, operated by American Smelting and Refining Company (ASARCO), remained the only significant lead and zinc producer in the State. In addition, small quantities of zinc were produced in Hidalgo County.

According to ASARCO's annual report for 1973, lead output at the Ground Hog mine was reported at 2,600 tons and zinc at 13,500 tons.[11]

Hydro Nuclear Corp. of Albuquerque continued work on reopening the Linchburg mine and starting production at nearby claims near Magdalena, Socorro County. A flotation mill was moved from Battle Mountain, Nev., to the Linchburg area. The mill will concentrate 150 tons of ore containing 9% zinc and 9% lead. The ore also contains about 0.5% copper, 1 to 2 ounces of silver, and 0.05 to 0.1 ounce of gold per ton.

Molybdenum.—Molybdenum was mined at the Questa mine, Taos County, and produced as a byproduct at the Chino copper mine, Grant County. Molybdenum was also recovered during uranium beneficiation at Kerr-McGee Corp.'s Ambrosia Lake installation.

The Questa operation reduced its labor force by 20% during 1973. Low prices were blamed for the layoff. The milling operations were not affected, but removal of waste overburden in the pit area was slowed and was extended over a 3-year period, instead of 13 months as previously planned.

The New Mexico House of Representatives reduced the excise tax rate on molybdenum from ¾% to ⅛%.

Silver.—Silver production and values showed increases of 9% and 65%, respectively, over 1972 figures. Most of the silver was a byproduct of copper, lead, and zinc mining, where larger base metal production resulted in increased silver output. The largest producer of silver was the Tyrone mine, operated by Phelps Dodge Corp., followed by Kennecott Copper Corp.'s Chino mines.

Uranium.—During 1973, New Mexico lost its leading position among uranium-producing States. The State ranked second, after Wyoming, in U_3O_8 output and accounted for 35.39% of the total. However, according to the Atomic Energy Commission (AEC), uranium reserves of the State were the largest in the country and accounted for 49% of the total. About 78 deposits contain 49,397,638 tons of ore with an average ore grade of 0.277% U_3O_8.

AEC reported three uranium processing mills in New Mexico having a nominal capacity of 13,500 tons of ore per day. These mills, all located in the general area of Grants, Valencia County, comprised 47% of total U.S. uranium mill capacity. The uranium industry (excluding exploration)

[10] Phelps Dodge Corp. Annual Report. 1973, 32 pp.

[11] American Smelting and Refining Company. Annual Report. 1973, 32 pp.

employed a total of 2,216 persons, of whom 1,638 worked in mines and 578 in mills.[12]

Surface exploration and development drilling increased from 3.3 million feet in 1972 to 3.8 million feet in 1973. New Mexico ranked second, after Wyoming, in footage drilled for uranium in the United States. Acreage held for uranium mining and exploration was 3.1 million acres, the same as in 1972. Five producers—Kerr-McGee Corp., The Anaconda Company, United Nuclear-Homestake Partners, United Nuclear Corp. Inc., and Homestake Mining Co.—accounted for 99% of the total value of uranium production during the year.

The Jackpile-Paguate uranium mine and Bluewater uranium mill, both in McKinley County, remained Anaconda's principle activity related to uranium in New Mexico. During 1973 a decision was made to reorganize and reemphasize the uranium producing function of the company. According to Anaconda's annual report, mine production was about 4.138 million pounds and deliveries of U_3O_8 totaled 4.7 million pounds, including some inventory rescheduled for delivery from 1972. For the first time in the long history of the Jackpile mine, underground production started during 1973.

In addition, Anaconda concluded a $2.5 million contract with Kop-Ran Development Corp., a subsidiary of Ranchers Exploration and Development Corp. (Ranchers), for a 2,000-foot incline on a 12.5% slope at the P–10 mine on the Paguate property. At the 380-foot mine level, a truck unloading system and a crushing facility will be installed. In addition to the incline and other underground development, Kop-Ran started construction of surface facilities consisting of a compressor building, shops, and offices. The contract work was scheduled for completion in 1975.

Shaft sinking was completed at Kerr-McGee's Church Rock No. 1 shaft on the Navajo Reservation, 14 miles northeast of Gallup. Station development and installation of shaft equipment was near completion at yearend. The company operated eight underground mines and a uranium mill in the Ambrosia Lake district. In the same area, development of a new Section 19 mine continued, and production was scheduled for 1975. Kerr-McGee's production in New Mexico was adversely affected by a strike of approximately 6 months' duration. Normal operation was resumed in December 1973.

United Nuclear-Homestake Partners operations continued at reduced levels at four mines and a mill located in the Ambrosia Lake district, McKinley County. Mill throughput averaged approximately 42% of its 3,500-ton-per-day capacity. The partnership entered into an agreement to process ores for Anaconda on a toll basis. Actual milling will start in January 1974 at a rate which will permit operation of the mill at nearly full capacity for 2 years. United Nuclear, outside of the partnership, operated three mines in the Ambrosia Lake area—the Ann Lee and Sandstone mine by solution methods and the Section 27 mine by conventional underground methods.

Preparation for mining continued at the L-Bar Ranch property, 50 miles west of Albuquerque. The operation was a joint venture of Reserve Oil & Mineral Corp. and Sohio Petroleum Co., a subsidiary of Standard Oil of Ohio. In addition to the mine, a 1,000-ton-per-day mill will be constructed. The major portion of the production from this facility will be used to fulfill a contract with General Atomic Co. Planned U_3O_8 capacity was 1.5 million tons per year. Completion date was expected to be late in 1976. Fluor Utah, Inc., is the prime contractor, and total cost will be about $20 million.

Ranchers and HNG Oil Co., a subsidiary of Houston Natural Gas Corp., started development of the Johnny M mine at the jointly held Section 7 uranium property at Ambrosia Lake, McKinley County. The ore body was discovered in 1968. A 14-foot diameter, 600-foot-deep shaft was nearing completion at yearend.

The Tennessee Valley Authority (TVA) was planning to finance a uranium exploration program in the western part of New Mexico. This exploration is designed to meet TVA's future uranium demand.

A preliminary study on the possibility of constructing a nuclear powerplant in New Mexico started in November 1973. The study was conducted by Public Co. of New Mexico and the El Paso Electric Co. The results of the first phase of the study was expected to be completed in the first part of 1974. The second phase of the study would specify possible sites for the nuclear

[12] Atomic Energy Commission, Grand Junction Office. Statistical Data of the Uranium Industry. Jan. 1, 1974, 67 pp.

plant and the size and type of reactors that would be used in the project.

The AEC started drilling to determine underground conditions at a proposed site for an atomic waste depository. Detailed planning and design for this facility was scheduled to start in 1977, pending promising results from drilling. In addition, the AEC will conduct other extensive studies prior to building the actual waste disposal facility. The full-scale depository operation is not expected to start before the year 2000.

NONMETALS

Value of nonmetals production increased 8% to $133.7 million and represented 10.2% of the State's total mineral production value. Potassium salts remained the most valuable nonmetallic mineral produced in New Mexico; its share of the total nonmetals output value was 68.7%.

Cement.—The State's only cement plant was located at Tijeras, east of Albuquerque, Bernalillo County, and was operated by Ideal Cement Co., a division of Ideal Basic Industries, Inc.

Clay.—Nine operations produced clay and shale during 1973. Bernalillo County, with two mines, led other counties, accounting for slightly less than half of the State output.

Gypsum.—White Mesa Gypsum Co., Republic Gypsum Co., and Duke City Gravel Products Co. mined crude gypsum in Santa Fe and Sandoval Counties.

The State Environmental Improvement Agency (EIA) tested air pollution control equipment at the Rosario plant of Republic Gypsum Co., located near Santa Fe. After completion of tests, EIA confirmed claims that stack emissions were under limits set by the State and permitted resumption of full production.

Mica.—A mica mine in Taos County and a mica mill in Santa Fe County were active during 1973. Both facilities were operated by Mineral Industries Commodities of America, Inc.

Development of the mica mine at La Madera, Rio Arriba County, near Ojo Caliente, which is 26 miles north of Espanola, was discontinued in the first part of 1973. The Rio Arriba Minerals Co., a wholly owned subsidiary of Western Energy Corp. of Santa Fe, was the operator. As a result of this decision, operations were postponed for an undetermined period.

Perlite.—New Mexico continued to lead the Nation with 88% of total crude perlite production. Grefco, Inc., with the El Grande mine, and Johns-Manville Perlite Corp., with the Seven Hill mine, both in Taos County, were the two largest producers in the State. Remaining production came from operations of Silbrico Corp. in Taos County and United States Gypsum Co. in Valencia County.

Grefco, Inc., completed installing a new air pollution control system at its mine. The installation will control perlite dust as well as emissions from stacks.

Potash.—New Mexico remained the leading producer of potash in the Nation, contributing about 83% of total U.S. output in 1973. The share of New Mexico in total U.S. potash output declined 3% compared with 1972 because Teledyne Potash Co. ceased production in order to start a modernization program. Six companies were engaged in potash production, all in Eddy County, southeastern New Mexico. Potash Co. of America and Kerr-McGee Corp. remained the most significant producers.

Table 11.—New Mexico: Crude potassium salts produced, and marketable salts produced and sold or used
(Thousand short tons and thousand dollars)

Period	Crude salts [1] (mine production)		Marketable potassium salts					
			Production			Sold or used		
	Gross weight	K_2O equivalent	Gross weight	K_2O equivalent	Value [2]	Gross weight	K_2O equivalent	Value
1972:								
January–June	8,718	1,460	2,128	1,187	47,018	2,336	1,294	51,400
July–December	8,567	1,411	1,994	1,108	44,097	1,753	991	38,461
Total [3]	17,285	2,871	4,122	2,296	91,115	4,089	2,285	89,861
1973:								
January–June	8,671	1,411	1,998	1,112	45,075	2,498	1,372	56,291
July–December	8,421	1,335	1,940	1,055	46,920	1,916	1,049	46,747
Total [3]	17,092	2,746	3,938	2,168	91,996	4,414	2,422	103,038

[1] Sylvite and langbeinite.
[2] Derived from reported value of "Sold or used."
[3] Data may not add to totals shown because of independent rounding.

Pumice.—In terms of output tonnage, New Mexico ranked fifth in the Nation in the production of pumice[13] There were eight pumice-producing operations in six counties. Twin Mountain Rock Co. in Union County, Morton Bros. in Doña Ana County, and General Pumice Corp. in Rio Arriba County were the largest producers.

Sand and Gravel.—Production of sand and gravel remained the most widespread mining activity in the State. The number of sand and gravel operations in 27 counties totaled 131, up from 103 in 1972. Shipments and value of sand and gravel increase 39.4% and 84.7%, respectively. Government-and-contractor operations accounted for 3.4 million tons, 32% of the total State output, a significant increase compared with 26% in 1972; commercial operations shipped the remainder.

Of 8.0 million tons of gravel, 4.1 million tons was used by commercial and government-and-contractor operations for road construction, and about 2.0 million tons for building construction. The remainder was used for fill and other purposes. Of 2.7 million tons of sand, a total of 1.5 million tons was used in building. The remainder was used for paving and fill.

[13] Statistics designated "pumice" also include such volcanic materials as scoria and volcanic cinders.

Table 12.—New Mexico: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,495	2,124	1,543	1,989
Fill	208	135	283	404
Paving	323	325	218	219
Other uses	(1)	(1)	(1)	(1)
Total[2]	2,027	2,584	2,044	2,612
Gravel:				
Building	1,879	2,572	1,838	2,511
Fill	56	42	153	116
Paving	1,449	1,580	3,005	4,864
Miscellaneous	198	116	34	49
Other uses	(3)	(3)	129	212
Total[2]	3,582	4,310	5,160	7,753
Government-and-contractor operations:				
Sand:				
Fill	64	30	47	36
Paving	67	99	564	1,552
Other uses	4	5	(3)	(3)
Total	135	134	611	1,588
Gravel:				
Building	--	--	170	178
Fill	1,582	1,299	1,540	1,302
Paving	225	186	1,107	2,307
Other uses	48	41	10	13
Total[2]	1,856	1,526	2,827	3,800
Total sand and gravel[2]	7,600	8,553	10,641	15,753

[1] Included with fill to avoid disclosing individual company confidential data.
[2] Data may not add to totals shown because of independent rounding.
[3] Less than ½ unit.

Table 13.—New Mexico: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Bernalillo	12	2,523	2,915	9	2,872	3,832
Catron	--	--	--	3	161	294
Chaves	6	257	252	7	421	398
Colfax	1	W	W	4	107	152
Doña Ana	8	339	206	15	596	496
Hidalgo	1	W	W	3	296	W
Lea	5	269	451	6	487	1,072
Lincoln	--	--	--	4	87	135
Luna	3	W	W	4	124	169
McKinley	1	4	6	1	106	357
Mora	1	W	W	1	43	281
Otero	7	190	238	10	525	568
Quay	3	179	324	2	W	W
Rio Arriba	8	417	377	3	133	179
Roosevelt	1	64	64	--	--	--
Sandoval	3	1,522	1,280	5	1,710	1,450
San Juan	9	362	473	10	596	947
Santa Fe	4	W	W	9	471	570
Sierra	5	42	38	3	W	W
Taos	5	77	106	5	W	93
Torrance	2	W	W	4	48	61
Valencia	5	W	W	7	421	W
Undistributed[1]	13	1,354	1,825	16	1,440	4,700
Total[2]	103	7,600	8,553	131	10,641	15,753

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes DeBaca, Eddy, Grant, Guadalupe, San Miguel, Socorro (1972), and Union Counties, and some sand and gravel that cannot be assigned to specific counties.
[2] Data may not add to totals shown because of independent rounding.

Stone.—There were 34 operating stone quarries in the State, 12 less than in 1972. Stone shipments increased 2.2% in tonnage and 7.1% in value.

Tables 14 and 15 give statistical details on stone activities in the State.

Other Nonmetals.—New Mexico also produced lime, sulfur, and vermiculite. Lime was calcined by the Chino Division of Kennecott Copper Corp. at Hurley, Grant County, for use at the copper smelter. Sulfur was a byproduct of natural gas processing in Eddy, Lea, and Roosevelt Counties. Fluorspar exploration was extensive throughout the State.

Table 14.—New Mexico: Stone sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973			Kind of stone produced in 1973
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Catron	--	--	--	1	60	91	Other stone.
Chaves	3	114	W	--	--	--	
Colfax	1	4	4	--	--	--	
Curry	2	77	176	--	--	--	
Doña Ana	2	W	15	5	115	W	Marble, other stone.
Grant	1	81	W	2	137	W	Limestone, other stone.
Hidalgo	--	--	--	2	109	164	Other stone.
Lea	5	W	W	3	169	379	Do.
Lincoln	3	211	450	1	64	96	Limestone.
Otero	2	81	125	2	148	282	Other stone.
Quay	--	--	--	1	20	30	Do.
Roosevelt	1	58	66	3	134	147	Do.
San Juan	3	32	34	--	--	--	
San Miguel	1	135	190	--	--	--	
Taos	1	W	43	1	W	43	Dolomite.
Torrance	1	10	11	--	--	--	
Union	1	294	747	--	--	--	
Valencia	3	2	4	1	36	18	Other stone.
Undistributed [1]	16	1,670	3,634	12	1,837	4,645	
Total [2]	46	2,768	5,499	34	2,830	5,894	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes Bernalillo, Eddy, Luna, McKinely, Rio Arriba (1972), Sandoval (1973), Santa Fe (1972), Socorro Counties and production for which no county breakdown is available.
[2] Data may not add to totals shown because of independent rounding.

Table 15.—New Mexico: Stone sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Kind of stone	1972		1973	
	Quantity	Value	Quantity	Value
Dimension:				
Marble	W	1	W	W
Other stone	W	W	W	W
Sandstone	W	W	W	W
Crushed and broken:				
Limestone [1]	1,388	3,000	1,118	2,555
Marble	W	1	W	1
Sandstone, quartz and quartzite	110	165	--	--
Traprock	397	938	W	W
Other stone	864	W	967	1,624
Undistributed	10	1,395	744	1,715
Total [2]	2,768	5,499	2,830	5,894

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Limestone used generally to include dolomite.
[2] Data may not add to totals shown because of independent rounding.

Table 16.—Principal producers

Commodity and company	Address	Type of activity	County
Carbon dioxide (natural):			
Schwartz Carbonic Co	Box 9737 El Paso, Tex. 79987	Well and extraction plant.	Harding.
S.E.C. Corp	---- do	---- do	Do.
Cement: Ideal Cement Co., a division of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Dry process, 2-rotary kiln plant.	Bernalillo.
Clays:			
El Paso Brick Co	Box 12336 El Paso, Tex. 79912	Open pit mine	Doña Ana.
Ideal Cement Co., a division of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	---- do	Bernalillo.
Kinney Brick Co., Inc	Box 1804 Albuquerque, N. Mex. 87103	---- do	Do.
Coal:			
Kaiser Steel Corp	Box 58 Oakland, Calif. 90604	Underground mine, crushing plant, dense media-froth flotation cleaning plant.	Colfax.
The Pittsburg & Midway Coal Mining Co.	1600 Tenmain Center Kansas City, Mo. 64105	Strip mine, crushing plant, chemical and water treatment plant.	McKinley.
Utah International, Inc	550 California St. San Francisco, Calif. 94104	Strip mine, crushing plant, dust suppression detergent treatment plant.	San Juan.
Copper:			
Kennecott Copper Corp., Chino Mines Division.	Hurley, N. Mex. 88043	Open pit mine, flotation mill, precipitation plant, smelter, and refinery.	Grant.
Phelps Dodge Corp., Tyrone Branch.	Drawer B Tyrone, N. Mex. 88065	Open pit mine and mill.	Do.
UV Industries [1]	136 East South Temple St. Salt Lake City, Utah 84111	Underground mine, open pit-underground mine, and flotation mill.	Do.
Gypsum: White Mesa Gypsum Co	124 Jackson NE. Albuquerque, N. Mex. 87108	---- do	Sandoval.
Iron ore: H.N. La Rue & Sons	Box 1224 Socorro, N. Mex. 87801	Mine and concentrator.	Torrance.
Lime: Kennecott Copper Corp., Chino Mines Division.	Hurley, N. Mex. 88043	Rotary-kiln plant	Grant.
Manganiferous ore: Luck Mining Co.	215 Market St. San Francisco, Calif. 94105	Open pit mine	Do.
Mica: Mineral Industries Commodities of America, Inc.	Box 2408 Santa Fe, N. Mex. 87501	---- do Dry grinding plant	Taos. Santa Fe.
Molybdenum:			
Kennecott Copper Corp., Chino Mines Division.	Hurley, N. Mex. 88043	*See* Copper	Grant.
Molybdenum Corporation of America, Questa Division.	280 Park Ave. New York, N.Y. 10017	Open pit mine and flotation mill.	Taos.
Natural gas and petroleum: [2]			
Peat: Humus Organic Products	P.O. Box 520 Bernalillo, N. Mex. 87004	Humus bog	Sandoval.
Perlite:			
Grefco, Inc., Dicalite Division	333 North Michigan Ave. Chicago, Ill. 60601	Open pit mine; crushing, screening, and air-separation.	Taos.
Johns-Manville Perlite Corp	2500 Miguelito Road Lompoc, Calif. 93436	---- do	Do.
Potash:			
AMAX Chemical Corp	Box 279 Carlsbad, N. Mex. 88220	Underground mine and refinery.	Eddy.

See footnotes at end of table.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Potash—Continued			
Duval, Corp., Potash Division	Box 511 Carlsbad, N. Mex. 88220	2 underground mines and refinery.	Eddy.
International Minerals & Chemical Corp.	Box 71 Carlsbad, N. Mex. 88220	Underground mine	Do.
Kerr-McGee Corp	Kerr-McGee Bldg. Oklahoma City, Okla. 73102	---- do ----	Lea.
National Potash Co	Box 731 Carlsbad, N. Mex. 88220	---- do ----	Eddy.
Potash Co. of America, a division of Ideal Basic Industries, Inc.	Box 31 Carlsbad, N. Mex. 88220	---- do ----	Do.
Teledyne Potash Co	Box 101 Carlsbad, N. Mex. 88220	---- do ----	Do.
Pumice:			
General Pumice Corp	Box 449 Sante Fe, N. Mex. 87501	Open pit mine and crushing and screening plant.	Rio Arriba.
Morton Bros	Box 2000 Las Cruces, N. Mex. 88001	---- do ----	Doña Ana.
Twin Mountain Rock Co	Box 1009 Sheridan, Wyo. 82801	---- do ----	Union.
Salt:			
Teledyne Potash Co	Box 101 Carlsbad, N. Mex. 88220	Solar evaporation and rock salt.	Eddy.
Sand and gravel (commercial):			
Albuquerque Gravel Products Co.	Box 829 Albuquerque, N. Mex. 87103	Stationary plant	Bernalillo.
Burn Construction Co	P.O. Box 670 Las Cruces, N. Mex. 88001	Portable plants	Various.
Springer Corp	Box 572 Albuquerque, N. Mex. 87103	Pit and stationary crushing and screening plant.	Bernalillo.
Sam Sanders Sand	Box 782 Clovis, N. Mex. 88101	Pit	DeBaca.
Universal Constructors Inc	Station B Box 6008 Albuquerque, N. Mex. 87125	Pit	Bernalillo.
Wylie Brothers Contracting Co	Box 8526 Albuquerque, N. Mex. 87108	5 portable plants	Bernalillo, Lea, Sandoval, Valencia.
Silver:			
Phelps Dodge Corp	*See Copper*	*See Copper*	Grant.
Stone:			
G.F. Atkinson Co	P.O. Box W Albuquerque, N. Mex. 87103	Quarry	Sandoval.
Ideal Cement Co., a division of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Quarry and plant	Bernalillo.
Uranium:			
The Anaconda Company, New Mexico Operations.	Box 638 Grants, N. Mex. 87020	Open pit mine and acid-leach process mill.	Valencia.
Kerr-McGee Corp	Box 218 Grants, N. Mex. 87020	6 underground mines and acid-leach process mill.	McKinley.
United Nuclear-Homestake Partners.	Box 98 Grants, N. Mex. 87020	6 underground mines and alkaline-leach process mill.	Do.
Zinc:			
American Smelting and Refining Co.[3]	120 Broadway New York, N.Y. 10005	Underground mine and mill.	Grant.

[1] Also gold and silver.
[2] Most of the major oil and gas companies and many smaller companies operate in New Mexico and several commercial directories contain complete lists of them.
[3] Also lead.

The Mineral Industry of New York

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the New York State Museum and Science Service for collecting information on all minerals except fuels.

By E. Chin [1]

The total value of New York's mineral production was $375.9 million in 1973 compared with $320.5 million in the previous year. New York was the sole producing State for wollastonite and the manufactured abrasive aluminum-zirconium oxide in 1973. The State ranked first nationally in the production of synthetic calcium-magnesium chloride, emery, garnet, ilmenite, abrasive grade aluminum oxide and continued to be a major producer of cement, salt, talc, and zinc.

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in New York [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays [2] ---thousand short tons--	1,601	$1,919	1,799	$2,146
Emery ---short tons--	2,883	W	2,883	W
Gem stones	NA	16	NA	16
Gypsum ---thousand short tons--	486	3,079	525	3,369
Lead (recoverable content of ores, etc.) --short tons--	1,089	327	2,304	751
Natural gas ---million cubic feet--	3,679	1,199	4,539	1,590
Peat ---thousand short tons--	15	200	11	166
Petroleum (crude) ---thousand 42-gallon barrels--	1,018	4,897	967	5,412
Salt ---thousand short tons--	5,604	43,866	5,202	42,364
Sand and gravel ---do----	26,722	36,952	29,544	41,396
Silver (recoverable contents of ores, etc.) thousand troy ounces--	25	42	54	139
Stone ---thousand short tons--	38,138	77,825	44,393	94,693
Zinc (recoverable content of ores, etc.) --short tons--	60,749	21,566	81,455	33,657
Value of items that cannot be disclosed: Cement, clay (ball), garnet (abrasive), iron ore, lime, mercury (1972), talc, titanium concentrates, wollastonite, and values indicated by symbol W	XX	r 128,566	XX	150,167
Total	XX	r 320,454	XX	375,866
Total 1967 constant dollars	XX	264,407	XX	p 275,961

p Preliminary. r Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes ball clay; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in New York, by county[1 2]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Albany	$31,068	$39,038	Cement, stone, clays, sand and gravel.
Allegany	W	W	Petroleum, sand and gravel, natural gas.
Broome	W	W	Sand and gravel, clays, stone.
Cattaraugus	6,073	7,189	Sand and gravel, petroleum, natural gas, peat.
Cayuga	W	W	Sand and gravel, stone, natural gas.
Chautauqua	730	W	Petroleum, natural gas, sand and gravel.
Chemung	W	W	Sand and gravel.
Chenango	W	W	Do.
Clinton	W	W	Stone, sand and gravel.
Columbia	W	16,434	Cement, stone, sand and gravel, clays.
Cortland	W	W	Sand and gravel.
Delaware	1,533	1,951	Stone, sand and gravel.
Dutchess	W	W	Stone, sand and gravel.
Erie	12,294	15,198	Stone, lime, sand and gravel, gypsum, natural gas, clays.
Essex	7,781	8,699	Titanium concentrates, wollastonite, iron ore, stone, sand and gravel, garnet.
Franklin	175	W	Sand and gravel, stone.
Fulton	118	121	Sand and gravel.
Genesee	3,517	4,558	Stone, gypsum, sand and gravel, natural gas.
Greene	28,467	W	Cement, stone.
Herkimer	969	W	Stone, sand and gravel.
Jefferson	W	W	Do.
Lewis	44	W	Do.
Livingston	18,133	11,938	Salt, sand and gravel, stone, natural gas.
Madison	W	W	Stone, sand and gravel, natural gas.
Monroe	4,608	W	Do.
Montgomery	W	W	Stone, sand and gravel.
Nassau	W	W	Sand and gravel, clays.
Niagara	W	W	Stone.
Oneida	W	W	Stone, sand and gravel.
Onondaga	25,208	27,838	Lime, stone, cement, salt, sand and gravel, clays.
Ontario	2,044	W	Sand and gravel, stone, natural gas.
Orange	W	W	Sand and gravel, stone, peat.
Orleans	812	W	Stone, sand and gravel.
Oswego	W	W	Sand and gravel, stone.
Otsego	W	W	Sand and gravel.
Putnam	W	W	Stone.
Rensselaer	W	W	Stone, sand and gravel.
Richmond	W	W	Sand and gravel.
Rockland	W	9,445	Stone, sand and gravel.
St. Lawrence	38,210	52,482	Zinc, iron ore, talc, stone, lead, sand and gravel, silver.
Saratoga	W	1,588	Stone, sand and gravel.
Schenectady	W	W	Sand and gravel.
Schoharie	W	W	Cement, stone, clays, sand and gravel.
Schuyler	W	W	Salt, sand and gravel.
Seneca	W	W	Stone, natural gas, peat.
Steuben	W	W	Sand and gravel, natural gas, stone, petroleum.
Suffolk	4,635	4,519	Sand and gravel.
Sullivan	W	W	Stone, sand and gravel.
Tioga	412	968	Sand and gravel.
Tompkins	5,656	5,217	Salt, stone, sand and gravel.
Ulster	W	22,942	Cement, stone, clays, sand and gravel.
Warren	W	8,764	Cement, garnet, stone, sand and gravel.
Washington	W	W	Stone, sand and gravel.
Wayne	1,294	1,225	Do.
Westchester	1,109	961	Sand and gravel, stone, peat, emery.
Wyoming	W	W	Salt, natural gas.
Yates	W	W	Salt.
Undistributed[3]	125,560	134,792	
Total[4]	320,453	375,866	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Bronx, Hamilton, Kings, New York, and Queens counties are not listed because no production was reported.

[2] Value of petroleum is based on an average price per barrel for the State.

[3] Includes gem stones, sand and gravel that cannot be assigned to specific counties, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of New York business activity

		1972	1973 p	Change, percent
Employment and labor force, annual average:				
Total labor force	thousands	7,507.0	7,442.7	−0.9
Unemployment	do	502.0	405.2	−19.3
Employment (nonagricultural):				
Mining	do	7.1	7.2	+1.4
Contract construction	do	268.1	278.5	+3.9
Manufacturing	do	1,601.5	1,622.2	+1.3
Transportation and public utilties	do	472.8	470.0	−.6
Wholesale and retail trade	do	1,445.0	1,462.6	+1.2
Finance, insurance, and real estate	do	594.7	592.3	−.4
Services	do	1,395.7	1,430.1	+2.5
Government	do	1,242.6	1,258.4	+1.3
Personal income:				
Total	millions	$96,280	$103,429	+7.4
Per capita		$5,247	$5,663	+7.9
Construction activity: Portland cement shipments to and within New York	thousand short tons	3,633	4,115	+13.3
Mineral production value	millions	$320.5	$375.9	+17.3

p Preliminary.
Sources: Survey of Current Business; Employment and Earnings; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

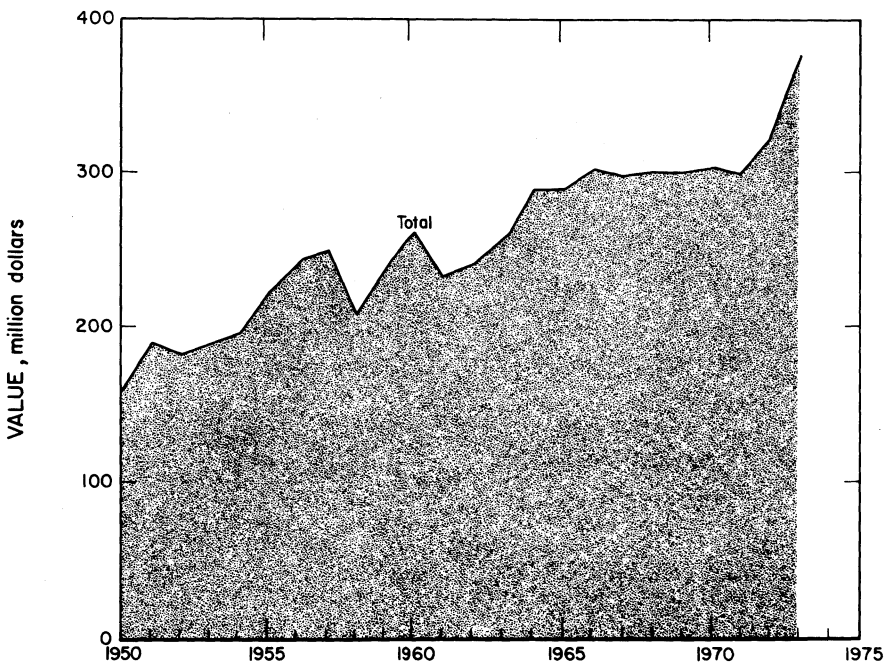

Figure 1.—Total value of mineral production in New York.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasives, Manufactured.—Almost 90% of the U.S. production of abrasive grade aluminum oxide was produced in Niagara County by the Electro Mineral Div. of The Carborundum Co., and General Abrasives Co., Div. of U.S. Industries, Inc. The entire U.S. production of aluminum-zirconium oxide was by General Abrasives Co. at its

Niagara Falls plant. The Carborundum Co. and Electro Refractories & Abrasives Div. of Ferro Corp. produced silicon carbide.

Metallic abrasives consisting of chilled iron shot and grit and cut wire shot were produced by Cleveland Metal Abrasives Co., Div. of Fanner Mfg. Co., and Pellets, Inc., in Erie County.

Calcium-Magnesium Chloride.—Allied Chemical Corp. produced synthetic calcium-magnesium chloride at its plant in Onondaga County as a byproduct of soda ash manufacturing. New York ranked first nationally in the production of synthetic calcium-magnesium chloride.

Cement.—Cement ranked first in value among the State's mineral-based industries. Nine plants were in operation of which eight were in eastern and one in western New York. Four plants produced portland cement exclusively; and five produced portland and masonry cements. Cement production was from seven counties; in quantity, Albany County ranked first, followed by Greene, Ulster, Columbia, Schoharie, Warren, and Onondaga Counties.

Clays.—Total production of common and shale clay in 1973 was 1.8 million short tons valued at $2,146,185. Common and shale clay was mined in Albany, Broome, Columbia, Erie, Nassau, Onondaga, Schoharie, and Ulster Counties. Ball clay was mined in Albany County. Clay was used in the manufacture of lightweight aggregate and portland cement and for pottery and abrasive bonding.

Emery.—Virtually all of the United States emery production was from the open pit mine of DeLuca Emery Mine, Inc., in Westchester County. Output of emery remained at the same level as that of the previous year. Uses for emery were mainly as aggregate for heavy-duty nonslip floors and pavements and for general abrasive purposes.

Garnet.—Abrasive garnet production in 1973 increased 9% in quantity and 17% in value above that of 1972. Garnet from an open pit mine in Warren County operated by Barton Mines Corp. was sold as coated abrasives for precision uses such as glass grinding and polishing and metal lapping. Garnet recovered as a byproduct of wollastonite mining by Interpace Corp. in Essex County was sold for use in sandblasting and for general abrasive purposes. New York State ranked first in the Nation in the production of garnet in 1973.

Gem Stones.—The production of gem stones and mineral specimens was principally by amateurs. The value of gem stone production was estimated to be $16,000 in 1973.

Graphite, Manufactured.—Graphite manufactured from petroleum coke and other materials was produced by three firms that operated plants in Niagara County. The producing companies were Airco Speer Carbon-Graphite Electrode Dept., Great Lakes Carbon Corp., Graphite Products Division, and Union Carbide Corp., Carbon Products Division. The principal uses were for anodes, electrodes, electric motor brushes, fibers, crucibles, and other refractories.

Gypsum.—Three companies, United States Gypsum Co., National Gypsum Co.. and Georgia-Pacific Corp., mined crude gypsum in Erie and Genesee Counties. Output increased 8% to 525,000 tons in 1973. These companies also produced calcined gypsum in Bronx, Erie, Genesee, Richmond, Rockland, and Westchester Counties. Output of calcined gypsum increased 8% to 1,230,000 tons in 1973. In order of output, New York ranked third nationally in the production of calcined gypsum.

Table 4.—New York: Crude gypsum production

(Thousand short tons and thousand dollars)

Year	Active mines	Quantity	Value
1969	4	492	2,945
1970	3	425	2,737
1971	3	415	2,376
1972	3	486	3,079
1973	3	525	3,369

Lime.—Two companies, Allied Chemical Corp., and Bethlehem Steel Corp., produced lime in Erie and Onondaga Counties for use in alkalies and steel furnaces. Output decreased 2% from that of the previous year. All the lime produced was consumed in New York. Total 1973 lime consumption in the State was 1,033,000 tons.

Perlite.—Crude perlite mined in Western States was expanded at plants of four companies in New York. National Gypsum Co. operated plants in Bronx and Erie Counties; Georgia-Pacific Corp., and Buffalo Perlite Corp. in Erie County; United States Gypsum Co. in Genesee, Richmond, and Rockland Counties. The most important use was

in the manufacture of acoustical building plaster. Other uses included loose fill insulation, soil conditioning, lightweight concrete aggregate, and filtration.

Salt.—Output of salt in 1973 was 5,201,846 short tons valued at $42,364,000. More than 0.5 million tons of salt were reported each from Livingston, Onondaga, and Yates Counties. The remainder of the salt production was from Schuyler, Tompkins, and Wyoming Counties.

Large quantities of salt were used for manufacturing chlorine, chemicals, and evaporated salt. Rock salt was used primarily for ice control on highways in the Northeastern States. Brine was used for the manufacture of soda ash, chlorine, and other chemicals. Salt for chemical manufacture was consumed mainly within the State.

Rock salt was produced from one mine each in Livingston, Tompkins, and Yates Counties. Brine was produced from one operation each in Onondaga and Schuyler Counties. Evaporated salt was produced from two operations in Schuyler County and from one operation in Wyoming County.

Table 5.—New York: Salt sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value
1969	5,582	45,561
1970	5,990	47,254
1971	5,303	43,601
1972	5,604	43,866
1973	5,202	42,364

Sand and Gravel.—Production of sand and gravel in the State in 1973 was 29.5 million short tons valued at $41,396,000. There were 242 sand and gravel operations within the State. These mines were operated by construction companies and Government operators working on various Federal, State, County, and other government contracts.

Table 6.—New York: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	8,795	13,573	9,751	15,174
Engine	W	W	43	89
Fill	1,396	549	2,769	1,282
Paving	2,997	4,181	2,598	4,038
Railroad ballast	W	W	6	2
Other uses [1]	719	1,654	767	1,880
Total [2]	13,907	19,958	15,935	22,466
Gravel:				
Building	5,594	9,684	5,526	9,917
Fill	1,135	905	1,553	1,207
Paving	3,265	4,953	3,463	5,787
Railroad ballast	--	--	1	2
Miscellaneous	573	663	988	981
Other uses	119	158	149	252
Total [2]	10,687	16,363	11,680	18,147
Government-and-contractor operations:				
Sand:				
Fill	36	12	107	31
Paving	30	8	9	18
Other uses	427	152	385	178
Total [2]	492	172	501	227
Gravel:				
Building	--	--	2	1
Fill	462	72	387	86
Paving	1,120	365	1,002	438
Other uses	54	21	38	32
Total [2]	1,636	459	1,429	556
Total sand and gravel [2]	26,722	36,952	29,544	41,396

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes filtration, molding, and other sands.
[2] Data may not add to totals shown because of independent rounding.

Table 7.—New York: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Broome	5	470	907	5	549	1,000
Cattaraugus	12	1,907	3,186	13	2,463	3,851
Cayuga	2	W	W	3	123	245
Chautauqua	8	700	162	3	431	136
Chenango	3	213	W	3	266	W
Delaware	1	22	10	3	50	82
Dutchess	17	1,890	3,162	19	3,015	3,853
Erie	7	961	2,099	6	927	2,036
Essex	6	W	W	5	144	116
Franklin	2	81	48	3	133	317
Fulton	6	180	118	6	192	121
Genesee	6	324	W	5	374	W
Herkimer	3	67	W	4	204	W
Jefferson	4	W	187	4	237	213
Lewis	2	44	8	2	52	8
Livingston	12	1,084	W	10	1,377	1,497
Monroe	7	477	W	7	425	808
Montgomery	1	W	58	1	W	W
Niagara	1	(1)	1	--	--	--
Oneida	11	1,208	2,041	9	1,287	2,074
Onondaga	6	692	631	6	1,130	1,338
Ontario	19	960	1,068	16	847	1,212
Orange	10	835	1,382	10	1,155	2,267
Orleans	4	W	W	5	180	314
Oswego	4	333	W	4	360	W
Rensselaer	15	882	1,252	11	652	W
Rockland	3	364	600	3	W	W
St. Lawrence	7	393	381	9	533	444
Saratoga	6	258	559	5	268	437
Schenectady	4	535	W	3	W	W
Schoharie	1	5	W	1	20	3
Schuyler	1	57	6	1	37	14
Steuben	5	779	1,149	5	836	1,437
Suffolk	13	4,509	4,635	9	4,306	4,519
Sullivan	5	224	W	5	248	385
Tioga	4	240	412	5	561	968
Wayne	6	203	W	5	181	W
Westchester	1	164	W	1	277	W
Undistributed [2]	r 25	5,662	12,890	27	5,705	11,700
Total [3]	255	26,722	36,952	242	29,544	41,396

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Includes Albany, Allegany, Chemung, Clinton, Columbia, Cortland, Madison (1973), Nassau, Otsego, Richmond, Tompkins, Ulster, Warren (1973), Washington Counties as well as some sand and gravel that cannot be assigned to specific counties.

[3] Data may not add to totals shown because of independent rounding.

Stone.—In comparing mineral products, the total value of stone production was second only to the value of cement production. Crushed limestone and dolomite, considered together as carbonate rock, accounted for most of the tonnage and value of all stone produced.

The chief uses for crushed dolomite and limestone were as an aggregate in bituminous materials, concrete, and macadam, and for the manufacture of cement and lime. Other uses were agricultural stone, railroad ballast, asphalt filler, and fluxing stone.

Basalt (traprock) ranked second in quantity of stone production within the State. The chief uses were for concrete aggregate and road stone.

Sandstone, which included quartzite, was quarried as dimension stone and as crushed stone. The chief uses of dimension sandstone were for curbing and flagging, and for architectural applications. Crushed sandstone was used for concrete aggregate and road stone.

Slate was quarried and prepared for use as flagstone, roofing, structural, and sanitation stone. Granite was quarried and dressed mostly for building stone, while crushed granite was used for concrete aggregate, road stone, and railroad ballast.

Table 8.—New York: Crushed and broken limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	4,976	11,802	7,947	18,213
Concrete aggregate	5,805	11,752	6,487	13,822
Dense graded road base stone	5,512	11,571	6,381	13,450
Macadam aggregate	412	1,036	507	1,318
Surface treatment aggregate	1,540	3,524	1,683	3,684
Unspecified construction aggregate and roadstone	3,102	6,570	4,352	9,224
Agricultural limestone	318	1,456	348	1,671
Cement manufacturing	7,826	7,114	6,612	8,089
Railroad ballast	189	372	199	396
Riprap and jetty stone	598	1,361	895	2,013
Other uses [1]	4,073	9,031	4,757	8,264
Total [2]	34,350	65,589	40,168	80,144

[1] Data include flux stone, stone sand, chemical stone, drain fields, fill, building products, and uses not specified. Data for 1973 also include stone used in lime manufacture, mine dusting, bedding materials, and filter stone.

[2] Data may not add to totals shown because of independent rounding.

Sulfur.—Ashland Oil, Inc., recovered 3,859 long tons of sulfur at its Buffalo Refinery in Erie County in 1973.

Talc.—The 1973 output of talc decreased 10% in quantity and 3% in value from the 1972 level. New York was the second largest talc-producing State. Gouverneur Talc Co., Inc., and International Talc Co., Inc., mined talc from two underground mines in St. Lawrence County. International Talc Co., Inc., also mined talc from an open pit operation in St. Lawrence County. Crude talc was ground in company-owned mills and used mainly in ceramics and as a mineral filler in paints. Smaller quantities were exported and used as a mineral filler in floor tile, rubber, paper, and other miscellaneous products.

Vermiculite.—Crude vermiculite mined in other States was exfoliated at the Construction Products Division Plant of W. R. Grace & Co., Weedsport, Cayuga County. The expanded vermiculite was used for loose fill insulation, soil conditioning, ultralightweight concrete aggregate, and building plaster aggregate.

Wollastonite.—The entire U.S. production of crude wollastonite was mined and beneficiated at the Willsboro mine in Essex County, operated by Interpace Corp. Production in 1973 of refined wollastonite increased 25% and value of shipments increased 28% above the 1972 level. The refined wollastonite was used as an ingredient in ceramic products and as a filler in paints and plastics.

METALS

Aluminum.—Production in both tonnage and value of primary aluminum from the Massena plants of the Aluminum Company of America (Alcoa) and Reynolds Metals Co. in St. Lawrence County increased from that of 1972. Alcoa was expanding its facility at a cost of $60 million. Upon completion of the expansion program in mid-1976, capacity at Alcoa's Massena facility will be increased from 135,000 short tons of primary aluminum metal per year to 190,000 short tons per year.

Iron Ore.—The entire mine production of magnetite in 1973 was from two open pit operations: NL Industries, Inc., McIntyre Development, in Essex County as a byproduct of ilmenite production; and Jones & Laughlin Steel Corp., in St. Lawrence County. Shipments of magnetite increased 5% over the previous year's shipments. All of the ore was beneficiated and the resulting concentrates were agglomerated before shipment. Principal uses for magnetite were in the manufacture of pig iron, steel, and cement, in heavy media separation, and as ballast.

Lead.—Lead was recovered as a byproduct of zinc mining at the Balmat and Edwards mines of St. Joe Minerals Corp., in St. Lawrence County. Lead recovery varies from year to year depending on the proportion of ore coming from that section of the operation where the vein has a higher lead content. The lead concentrates was shipped to the company lead smelter at Herculaneum, Mo.

Silver.—Silver was recovered from lead concentrates shipped from the Balmat and Edwards mines of St. Joe Minerals Corp., in St. Lawrence County. Silver recovery reflects the demand for silver-free lead.

Titanium (ilmenite).—Ilmenite concentrate was produced at the MacIntyre Development of NL Industries, Inc., the largest ilmenite mine in the United States. The open pit titaniferous magnetite deposit is located near Tahawus, Essex County. Shipments and value in 1973 were, respectively, 5% and 13% over the 1972 levels. The output was used principally in the manufacture of titanium dioxide pigment. The State ranked first nationally in the production of ilmenite.

Zinc.—New York ranked second to Missouri as a zinc producer in both quantity and value. The entire production in the State was from the Balmat and Edwards mines of the St. Joe Minerals Corp., in St. Lawrence County.

Table 9.—New York: Mine production (recoverable) of silver, lead, and zinc

	1971	1972	1973
Mines producing: Lode	2	2	2
Material sold or treated: Zinc ore, thousand short tons	779	852	1,094
Production (recoverable):			
Quantity:			
Silver, troy ounces	17,928	25,070	54,345
Lead, short tons	877	1,089	2,304
Zinc, do.	63,420	60,749	81,455
Value:			
Silver, thousands	$28	$42	$139
Lead, do.	242	327	751
Zinc, do.	20,421	21,566	33,657
Total, do.	20,691	21,935	34,547

MINERAL FUELS

Natural Gas.—The production of natural gas in New York in 1973 increased 23% over production in the previous year. The quantity and value of natural gas production in the State for 1969–73 were as follows:

Year	Quantity [1] (million cubic feet)	Value (thousand dollars)
1969	4,861	1,458
1970	3,358	1,017
1971	2,202	661
1972	3,679	1,199
1973	4,539	1,590

[1] Marketed production of natural gas represents gross withdrawal less gas used for repressuring and quantities vented and flared.

Natural gas was produced in thirteen counties; Steuben County was the largest producer, followed by Erie, Chautauqua, Allegany, Cattaraugus, Cayuga, Genesee, Ontario, Wyoming, Madison, Livingston, Seneca, and Monroe Counties. At yearend, there were 592 wells producing natural gas.

Peat.—Production and shipments of peat in 1973 were both 11,221 short tons. Shipments of peat by four producers were valued at $165,859 in 1973. Orange County was the leading producing area; output was also reported from Westchester, Cattaraugus, and Seneca Counties. The use for peat was mainly in general soil improvement although some peat was used in potting soil mixtures.

Petroleum.—Crude oil production in the State was 967,000 barrels in 1973, a decrease of 51,000 barrels from the 1972 production. The 1973 value of crude oil produced was $5,412,000 compared with $4,897,000 in the previous year. In order of output, Cattaraugus was the largest oil-producing County, followed by Allegany, Chautauqua, and Steuben Counties. At yearend 1973, there were 5,200 producing wells compared with 5,427 wells at the end of 1972.

Table 10.—Oil and gas well drilling in 1973, by county

County	Proved field wells[1]			Exploratory			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Allegany	24	--	2	--	--	1	27	41,658
Broome	--	--	1	--	--	--	1	6,420
Cattaraugus	41	--	--	--	--	--	41	63,545
Chautauqua	29	17	4	--	2	--	52	89,502
Delaware	--	--	--	--	--	2	2	13,421
Erie	--	4	--	--	--	--	4	5,786
Genesee	--	2	--	--	--	--	2	3,147
Madison	--	--	--	--	--	1	1	4,927
Ontario	--	1	1	--	--	--	2	3,689
Otsego	--	--	--	--	--	1	1	2,723
Schoharie	--	--	--	--	--	1	1	4,284
Steuben	1	--	--	2	1	7	11	35,350
Tioga	--	--	--	--	--	2	2	10,369
Tompkins	--	--	--	--	--	1	1	3,674
Total	95	24	8	2	3	16	148	288,495

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 11.—Principal producers

Commodity and company	Address	Type of activity	County
Abrasives (artificial):			
The Carborundum Co. Electro Mineral Div.	P.O. Box 423 Niagara Falls, N.Y. 14302	Plant	Niagara.
General Abrasives Co., Div. of U.S. Industries, Inc.	2100 College Ave. Niagara Falls, N.Y. 14302	do	Do.
Cleveland Metal Abrasive Co. Div. of Fanner Mfg. Co.	Brookside Park Cleveland, Ohio 44109	do	Erie.
Pellets, Inc	531 S. Niagara St. Tonawanda, N.Y. 14150	do	Do.
Smelters (aluminum):			
Aluminum Co. of America	1210 Alcoa Bldg. Pittsburgh, Pa. 15222	do	St. Lawrence.
Reynolds Metals Co	P.O. Box 27003-ZA Richmond, Va. 23215	do	Do.
Cement:			
Alpha Portland Cement Co.[1]	15 South Third St. Easton, Pa. 18043	do	Greene.
Atlantic Cement Co., Inc.[1] Div. of Newmont Mining Corp.	P.O. Box 30 Stamford, Conn. 06904	do	Albany.
Glens Falls Portland Cement Co.,[2] Div. of Flintkote Co.	313 Warren St. Glens Falls, N.Y. 12801	do	Warren.
Hudson Cement Division,[2] Colonial Sand & Stone Co., Inc.	1740 Broadway New York, N.Y. 10019	do	Ulster.
Lehigh Portland Cement Co.[2]	718 Hamilton St. Allentown, Pa. 18105	do	Greene.
Marquette Cement Mfg. Co.[3]	20 N. Wacker Dr. Chicago, Ill. 60606	do	Do.
Penn Dixie Cement Corp.[1]	P.O. Box 152 Nazareth, Pa. 18064	do	Schoharie.
Universal Atlas Cement Div.,[1] U.S. Steel Corp.	Chatham Center Pittsburgh, Pa. 15230	do	Columbia.
Clays (miscellaneous):			
Atlantic Cement Co., Inc., Div. of Newmont Mining Corp.	P.O. Box 30 Stamford, Conn. 06904	Pit	Albany.
Hudson Lightweight Stone Div. Colonial Sand & Stone Co., Inc.	1740 Broadway New York, N.Y. 10019	Pit	Ulster.
Hudson Valley Lightweight Aggregate Corp.	P.O. Box 9138 Richmond, Va. 23227	Pit	Do.
New York Trap Rock Corp., Div. Lone Star Cement Corp.	162 Old Mill Rd. W. Nyack, N.Y. 10994	Pit	Do.
Powell & Minnock Brick Works, Inc.	Coeymans, N.Y. 12045	Pit	Albany.
Universal Atlas Cement Div., U.S. Steel Corp.	Chatham Center Pittsburgh, Pa. 15230	Pit	Albany and Columbia.
Emery:			
DeLuca Emery Mine, Inc	926 Constant Ave. Peekskill, N.Y. 10566	Pit	Westchester.
Garnet:			
Barton Mines Corp	North Creek, N.Y. 12853	Pit	Warren.

See footnotes at end of table.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Gypsum:			
Georgia-Pacific Corp., Gypsum Div.[4].	P.O. Box 311 Portland, Ore. 97207	Underground mine and calcining plant.	Erie.
		Calcining plant...	Westchester.
National Gypsum Co.[4]	325 Delaware Ave. Buffalo, N.Y. 14202	Underground mine and calcining plant.	Erie.
		Calcining plant...	Bronx.
United States Gypsum Co.[4] ...	101 S. Wacker Dr. Chicago, Ill. 60606	Underground mine and calcining plant.	Genesee.
		Calcining plant...	Richmond and Rockland.
Iron ore:			
Jones & Laughlin Steel Corp..	Star Lake, N.Y. 13690....	Pit	St. Lawrence.
NL Industries, Inc., McIntyre Development.	Tahawus, N.Y. 12879.....	Pit	Essex.
Lead: See Zinc.			
Lime:			
Bethlehem Steel Corp	701 E. Third St. Bethlehem, Pa. 18016	Plant	Erie.
Industrial Chemicals Div., Allied Chemical Corp.	P.O. Box 70 Morristown, N.J. 07960	..... do	Onondaga.
Peat:			
Sterling Forest Peat Co., Inc..	P.O. Box 608 Tuxedo, N.Y. 10987	Bog	Orange.
Petroleum:			
Mobil Oil Corp	Buffalo, N.Y. 14221.....	Refineries	Do.
Frontier Oil & Refining Co., Div. of Ashland Oil & Refining Co.	Tonawanda, N.Y. 14150...	..... do	Do.
Salt:			
Evaporated:			
Morton Salt Co.....	110 N. Wacker Dr. Chicago, Ill. 60606	Well	Wyoming.
Watkins Salt Co., Inc.[5]....	Box 150 Watkins Glen, N.Y. 14891	..... do	Schuyler.
Rock:			
Cargill, Inc.....	1620 Northstar Center Minneapolis, Minn. 55402	Underground	Tompkins.
International Salt Co.....	Clarks Summit, Pa. 18411..	..... do	Livingston.
Brine:			
Industrial Chemicals Div.,[6] Allied Chemical Corp.	P.O. Box 70 Morristown, N.J. 07960	Well	Onondaga.
Sand and gravel:			
Broad Hollow Estates.....	Box 722, Rte. 110 Melville, N.Y. 11746	Pit	Suffolk.
Buffalo Slag Co., Inc.....	111 Great Arrow Ave. Buffalo, N.Y. 14216	4 plants	Allegany, Cattaraugus, and Steuben.
Colonial Sand & Stone Co., Inc.	1740 Broadway New York, N.Y. 10019	Pit	Nassau and Dutchess.
General Crushed Stone Co.....	712 Drake Bldg. Easton, Pa. 18042	Pit	Cattaraugus and Chemung.
A. Milano & Sons Inc.....	P.O. Box 26 Groton-on-Hudson, N.Y. 10520	Pit	Dutchess.
Roanoke Marbro Sand & Gravel Corp.	P.O. Box 172 Riverhead, Long Island, N.Y. 11901	Pit	Suffolk.
Silver: See Zinc.			
Stone:			
Granite (dimension):			
Di Rienzo Brothers.....	107 Main St. Tuckahoe, N.Y. 10707	Quarry	Westchester.
Lake Street Granite Quarry Inc.	Lake Street White Plains, N.Y. 10600	..... do	Do.
Limestone and dolomite (crushed and broken):			
Appalachian Stone Division, Martin Marietta Corp.	Box 120 Mercersburg, Pa. 17236	..... do	Rockland.
Buffalo Crushed Stone Co..	10 Park Place Morristown, N.J. 07960	..... do	Erie.
The Buffalo Slag Co., Inc. Federal Crushed Stone Div.	111 Great Arrow Ave. Buffalo, N.Y. 14216	..... do	Do.
The Callanan Road Improvement Co.	So. Bethlehem, N.Y. 12161..	..... do	Albany and Ulster.

See footnotes at end of table.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Limestone and dolomite (crushed and broken)—Continued			
Dolomite Products Co.[7]	1150 Penfield Rd. Rochester, N.Y. 14625	Quarry	Monroe.
General Crushed Stone Co.	712 Drake Bldg. Easton, Pa. 18042	do	Cayuga, Genesee, Herkimer, Jefferson, Livingston, Onondaga, Ontario, Wayne.
Industrial Chemical Div., Allied Chemical Corp.	P.O. Box 70 Morristown, N.J. 07960	do	Onondaga.
Niagara Stone Div. of Great Lakes Color Printing Corp.	Quarry Road Niagara Falls, N.Y. 14304	do	Niagara.
Miscellaneous (crushed):			
Fitzgerald Bros. Construction Co., Inc.	504 Broadway Troy, N.Y. 12180	do	Rensselaer.
Sandstone (dimension):			
Adirondack Stone Quarries, Inc.	P.O. Box 184 Malone, N.Y. 12953	do	Franklin.
Finger Lakes Stone Co., Inc.	Box 401 Ithaca, N.Y. 14850	do	Tompkins.
Willis Hankins	Hancock, N.Y. 13783	do	Delaware.
Heldeberg Bluestone & Marble Inc.	East Berne, N.Y. 12059	do	Albany and Delaware.
Johnston & Rhodes Bluestone Co.	East Branch, N.Y. 13756	do	Delaware.
W. R. Strong & Son	43 Wheeler St. Deposit, N.Y. 13754	Processor	Broome. Delaware.
Paul Tompkins Estate	Hancock, N.Y. 13783	do	Do.
Sandstone (crushed and broken):			
Northern Aggregates Inc.	1306 Silk Road Fulton, N.Y. 13069	do	Oswego.
Steuben Crushed Div., A. L. Blades & Sons, Inc.	County Route No. 10 Bath, N.Y. 14810	do	Steuben.
Sullivan Highway Products Corp.	P.O. Box 392 Monticello, N.Y. 12701	Quarry	Orange and Sullivan.
Slate (dimension):			
Darius Slate Products	Middle Granville, N.Y. 12849	do	Washington.
A. A. Hadeka Quarry	49 South St. Poultney, Vt. 05764	do	Do.
McCullen Slate Co	R.D. 1 Granville, N.Y. 12832	do	Do.
Ritchie Brothers Slate Co.	Middle Granville, N.Y. 12849	do	Do.
Western Slate Co	Box 104 Granville, N.Y. 12832	do	Do.
Talc:			
Gouverneur Talc Co., Inc	Gouverneur, N.Y. 13642	Underground	St. Lawrence.
International Talc Co., Inc	420 Lexington Ave. New York, N.Y. 10006	do	Do.
Titanium concentrate: Ilmenite:			
NL Industries, Inc.[8]	100 Chevalier Ave. So. Amboy, N.J. 08879	Pit	Essex.
Wollastonite:			
Interpace Corp.[9]	Willsboro, N.Y. 12996	Underground	Do.
Zinc:			
St. Joe Minerals Corp.[10]	250 Park Ave. New York, N.Y. 10017	Mine	St. Lawrence.

[1] Also crushed limestone and shale.
[2] Also crushed limestone.
[3] Also crushed limestone and clay.
[4] Also expanded perlite.
[5] Also brine.
[6] Also evaporated salt and crushed limestone.
[7] Also sand and gravel.
[8] Also iron ore.
[9] Also garnet.
[10] Also silver and lead.

The Mineral Industry of North Carolina

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Office of Earth Resources, North Carolina Department of Natural and Economic Resources, for collecting information on all minerals except fuels.

By Roland W. Merwin [1] and Stephen G. Conrad [2]

In 1973 North Carolina's total mineral production was valued at $146.9 million, an increase of approximately $31.4 million, or 27% above that of 1972.

Stone was the leading mineral commodity produced, contributing 54% of the total mineral production value, followed by sand and gravel, which accounted for 13%. Common clay and shale, feldspar, lithium minerals, mica, olivine, phosphate rock, and talc and pyrophyllite were also important contributors. Together they accounted for 23% of the State's 1973 value of mineral production. The remaining 10% was derived from the production of asbestos, cement, gem stones, iron ore, and kaolin.

The leading mineral producers were Ideal Cement Co., Martin Marietta Aggregates, Nello L. Teer Co., Texasgulf, Inc., and Vulcan Materials Co. Together they accounted for 57% of the State's mineral production value.

North Carolina ranked first in value among the States in the production of feldspar, lithium minerals, mica, and olivine; and fourth in value in the production of asbestos and phosphate rock.

Legislation and Government Programs.—The Office of Earth Resources, Department of Natural and Economic Resources, was actively engaged in geologic and other investigations concerning North Carolina's mineral potential and industry development. One of their publications described the mineral localities in North Carolina.[3] Another report described the topography, geology and mineral resources of North Carolina.[4] A third report listed the publications of the Division of Mineral Resources.[5]

During the year the Division of Mineral Resources, Office of Earth Resources, continued the preparation of a series of mineral resource summaries in conjunction with geologic mapping of specific 7-½ minute quadrangles.

The North Carolina Mining Act of 1971 requires mine operators to observe sound conservation practices and to reclaim for useful purposes all lands disturbed by mining. Permits are required for each mine where the affected land area is greater than 1 acre, and are dependent upon approved reclamation plans and surety bonds.

Pursuant to the provisions of the act, the Mining Division, Office of Earth Resources, conducted 521 mine inspections during 1973, reporting that 884 acres were disturbed during the year and that 472 acres were reclaimed at active mines. At yearend 1973, there were 401 mining operations

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[1] Supervisory physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

[2] Director, Office of Earth Resources, North Carolina Department of Natural and Economic Resources.

[3] Patterson, O. F., III, and C. R. Gannis (rev. by). Mineral Localities of North Carolina. N.C. Dept. Nat. and Econ. Res., Office Earth Res., Div. Miner. Res., Inf. Circ. 16, 1973, 128 pp.

[4] Allen, E. P. (rev. by). An Introduction to the Topography, Geology, and Mineral Resources of North Carolina. N.C. Dept. Nat. and Econ. Res., Office Earth Res., Div. Miner. Res., Educational Ser. 2, 1973, 20 pp.

[5] Conrad, S. G. List of Publications of the Division of Mineral Resources. N.C. Dept. Nat. and Econ. Res. Office Earth Res., Div. Miner. Res. January 1974, 9 pp.

Table 1.—Mineral production in North Carolina [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays [2] thousand short tons	3,862	$4,473	4,109	$5,057
Feldspar short tons	439,838	6,030	523,595	8,820
Gem stones	NA	32	NA	40
Mica, scrap thousand short tons	91	2,942	106	4,423
Sand and gravel do	r 12,823	r 13,812	15,897	19,327
Stone do	32,297	62,741	38,782	80,065
Talc and pyrophyllite short tons	89,334	594	95,833	1,094
Value of items that cannot be disclosed: Asbestos, cement, clay (kaolin), iron ore, lithium minerals, olivine, phosphate rock	XX	24,896	XX	28,104
Total	XX	r 115,520	XX	146,930
Total 1967 constant dollars	XX	95,316	XX	p 107,876

r Revised. p Preliminary. NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in North Carolina, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Alamance	W	W	Stone, clays, sand and gravel, talc.
Alexander	$8	$13	Sand and gravel.
Alleghany	W	W	Stone.
Anson	W	W	Sand and gravel.
Ashe	90	W	Stone.
Avery	996	W	Mica, stone, clays, sand and gravel, iron ore.
Beaufort	W	W	Phosphate rock, sand and gravel.
Bertie	W	W	Sand and gravel.
Bladen	W	46	Do.
Brunswick	11	84	Do.
Buncombe	W	3,907	Stone, sand and gravel, clays.
Burke	W	W	Stone.
Cabarrus	W	W	Stone, clays, sand and gravel.
Caldwell	6	W	Stone, sand and gravel.
Camden	2	W	Sand and gravel.
Carteret	3	--	
Caswell	W	W	Stone.
Catawba	W	W	Stone, sand and gravel, clays.
Chatham	W	W	Clays, stone, sand and gravel.
Cherokee	W	W	Stone, talc.
Chowan	5	5	Sand and gravel.
Clay	33	W	Do.
Cleveland	6,893	8,143	Stone, lithium minerals, mica, feldspar, clays, sand and gravel.
Columbus	2	--	
Craven	W	W	Stone, sand and gravel.
Cumberland	W	W	Sand and gravel, clays.
Currituck	10	13	Sand and gravel.
Davidson	W	W	Sand and gravel, stone, clays.
Davie	38	W	Stone, sand and gravel.
Duplin	W	W	Do.
Durham	W	W	Stone, clays.
Edgecombe	285	634	Sand and gravel.
Forsyth	W	W	Stone, sand and gravel.
Franklin	W	W	Sand and gravel.
Gaston	W	W	Lithium minerals, feldspar, stone, sand and gravel.
Gates	6	20	Sand and gravel.
Graham	W	--	
Granville	W	W	Stone, talc.
Greene	W	W	Sand and gravel.
Guilford	6,594	W	Stone, clays, sand and gravel.
Halifax	W	W	Clays, sand and gravel.
Harnett	4,049	W	Sand and gravel, clays.
Haywood	W	W	Stone, sand and gravel.
Henderson	W	W	Stone, clays.
Hertford	185	134	Sand and gravel.
Hoke	6	15	Do.

See footnotes at end of table.

Table 2.—Value of mineral production in North Carolina, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Hyde	$5	$20	Sand and gravel.
Iredell	1,266	W	Stone, sand and gravel, clays.
Jackson	W	W	Stone, sand and gravel.
Johnston	W	W	Do.
Jones	W	W	Do.
Lee	1,517	W	Stone, clays, sand and gravel.
Lenoir	W	W	Sand and gravel.
Lincoln	24	25	Do.
McDowell	W	501	Do.
Macon	W	W	Stone, sand and gravel.
Madison	240	W	Do.
Martin	1	14	Sand and gravel.
Mecklenburg	W	W	Stone.
Mitchell	5,860	W	Feldspar, mica, sand and gravel, stone.
Montgomery	W	W	Stone, sand and gravel, clays.
Moore	566	W	Sand and gravel, talc, stone, clays.
Nash	W	W	Stone, sand and gravel.
New Hanover	W	18,169	Cement, stone, clays, sand and gravel.
North Hampton	W	W	Sand and gravel.
Onslow	W	W	Stone, sand and gravel.
Orange	W	W	Stone, talc, sand and gravel.
Pamlico	4	8	Sand and gravel.
Pasquotank	12	29	Do.
Pender	9	2	Do.
Perquimans	5	11	Do.
Pitt	W	W	Stone, sand and gravel.
Polk	W	W	Do.
Randolph	W	W	Stone.
Richmond	W	829	Stone, sand and gravel.
Robeson	W	42	Sand and gravel.
Rockingham	W	W	Stone, clays, sand and gravel.
Rowan	2,776	W	Do.
Rutherford	W	W	Stone, sand and gravel.
Sampson	W	W	Sand and gravel, clays.
Scotland	9	33	Sand and gravel.
Stanly	539	592	Clays.
Stokes	W	W	Sand and gravel, stone, clays.
Surry	W	W	Stone, sand and gravel.
Swain	W	W	Stone.
Transylvania	W	W	Stone, sand and gravel.
Union	W	W	Stone, clays.
Vance	W	W	Stone.
Wake	W	W	Stone, sand and gravel.
Washington	W	42	Sand and gravel.
Watauga	W	W	Stone, sand and gravel.
Wayne	337	375	Sand and gravel.
Wilkes	W	W	Stone, sand and gravel.
Wilson	W	W	Do.
Yadkin	--	W	Stone, sand and gravel.
Yancey	1,427	1,976	Olivine, mica, stone, sand and gravel, asbestos.
Undistributed [2]	82,501	111,251	
Total [3]	116,323	146,930	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported; Dare, Person, Tyrrell, and Warren.

[2] Includes gem stones, some sand and gravel (1973) that cannot be assigned to specific counties, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of North Carolina business activity

		1972	1973 p	Change, percent
Employment and labor force, annual average:				
Total labor force	thousands	2,321.0	2,387.0	+2.8
Unemployment	do	93.0	83.0	−10.8
Employment (nonagricultural)	do	1,911.6	1,962.4	+2.7
Construction	do	114.9	119.2	+3.7
All manufacturing	do	756.0	770.0	+1.9
Mining	do	3.8	3.8	--
Personal income:				
Total	millions	$19,809	$21,726	+9.7
Per capita		$3,799	$4,120	+8.4
Construction activity:				
Value of private nonresidential construction	millions	$366.9	$362.6	−1.2
State Highway Commission:				
Value of contracts awarded	do	e $160.0	$127.0	−20.6
Cement shipments to and within North Carolina	thousand short tons	2,142	2,266	+5.8
Farm marketing receipts	millions	$1,699.1	$2,415.6	+42.2
Mineral production value	do	$115.5	$146.9	+27.2
Export trade	do	$349.5	$363.8	+4.1
Import trade	do	$449.6	$487.3	+8.4

e Estimated. p Preliminary.

Sources: Survey of Current Business, Employment and Earnings, Farm Income Situation, Construction Review, Area Trends in Employment and Unemployment, Roads and Streets, and Federal Bureau of Mines.

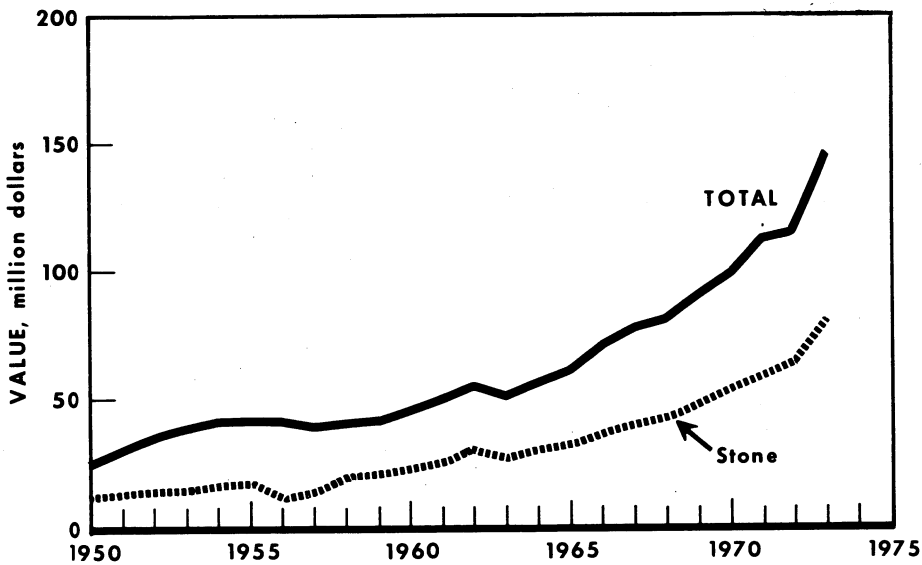

Figure 1.—Value of stone and total value of mineral production in North Carolina.

under permit, covering a total of 10,594 bonded acres. The distribution of permits by commodity, number of mines, and bonded acres was as follows:

Commodity	Number of mines	Bonded acreage
Sand and gravel	188	3,655
Crushed stone	93	3,094
Industrial minerals	38	2,382
Clay and shale	43	989
Dimension stone	19	416
Gem stones	20	59

The Asheville Minerals Research Laboratory of North Carolina State University continued an active program of nonmetallic minerals research, principally in cooperation with the State's mineral industry. Mineral research was conducted on glass sand, pyrophyllite, feldspar, mineral and chemical plant wastes, olivine, asbestos, scrap mica, limestone, and many other mineral commodities. Several publications resulted from the research.

One publication described and compared various techniques for the beneficiation of olivine.[6] Another publication described the beneficiation of olivine for foundry sand by calcining.[7] A third publication evaluated North Carolina's potential feldspar resources.[8] An additional publication listed all of the research reports and publications of the Minerals Research Laboratory.[9]

North Carolina is nationally recognized for its promotion and support of regional and developmental organizations. In 1970, a common geographical framework for regional planning in North Carolina, consisting of 17 regions, was established. Subsequently, lead organizations were chosen from each of the planning regions to serve as central sources for the expression of regional development objectives and program priorities. During the year, the Federal Bureau of Mines provided mineral production data for the planning regions to be incorporated in the reports on specific planning areas.

By adopting a Seven-Year Highway Improvement Program in October 1973, North Carolina, for the first time, embarked on a definite schedule that provided for an integrated network of street and highway facilities. This program was designed to best use available funds to meet the needs of the greatest number of North Carolinians. Planning was begun on a balanced system integrating the particular advantages of air, land, and water transportation on a long-range basis.

Trends and Developments.—Capital expenditures and industry expansions in 1973 broke all previous investment records for the State, and marked the ninth consecutive year the figures have surpassed the half-billion-dollar mark. The Division of Commerce and Industry of the North Carolina Department of Natural and Economic Resources reported that total capital investments in new and expanded industries during 1973 amounted to over $727 million. These investments created 22,172 new industrial jobs and added $135 million to industrial payrolls. There were 104 new plants, and 208 expansions of existing operations during the year.

North Carolina power companies faced many challenges during the year in an effort to keep abreast of increased electric power demands. New construction budgets for nuclear and fossil-fueled plants were announced during the year by the State's three principal electric power producing companies. Duke Power Co. announced plans to build a $1 billion nuclear plant in Davidson County, which would add 1.2 million kilowatts of generating capability to the system. During the year, Duke also completed Unit 1 of its Oconee Nuclear Station, and began commercial operations in July; 14 additional steam units were scheduled to join the system in the 11 years from 1974 to 1984. Carolina Power & Light Co. (CP&L), completed, and placed in commercial operation a 720,000-kilowatt coal-fired electric unit at Roxboro. Plans were also announced by CP&L for the 3.6-million-kilowatt Shearon Harris nuclear plant to be constructed in Wake County, southwest of Raleigh. Coal was the primary fuel used during 1973 at CP&L plants; 67% of the energy generated in the system came from the burning of coal. Virginia Electric & Power Co. (VEPCO), serving the northeastern area of the State, showed moderate growth over 1972. VEPCO assisted several firms in locating in its North Carolina service area, and continued to make economic studies in five North Carolina counties to assist in orderly growth and planning.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Asbestos.—Amphibole asbestos was mined by Powhatan Mining Co. in Yancey County. The output decreased substantially from that of 1972, both in quantity and in value.

Cement.—Ideal Cement Co. produced portland and masonry cement at its Castle Hayne plant in New Hanover County. Apparent consumption of portland and masonry cements in North Carolina, including

[6] Lewis, R. M. Comparison of Olivine Beneficiation Techniques. N.C. State Univ., Sch. Eng., Miner. Res. Lab., Rept. MRL-1, May 1972, 15 pp.

[7] Redeker, I. H. Beneficiation of Olivine for Foundry Sand by Calcining. N.C. State Univ., Sch. Eng., Miner. Res. Lab., Rept. MRL-2, August 1972, 17 pp.

[8] Neal, J. P., L. S. Winer, P. A. Carpenter, W. F. Wilson, and J. M. Parker III. Evaluation of Potential North Carolina Feldspar Resources. N.C. State Univ., Sch. Eng., Miner. Res. Lab., Rept. MRL-3, May 1973, 67 pp.

[9] North Carolina State Minerals Research Laboratory. List of Publications. April 1973, 4 pp.

that received from outside the State, was 2,252,000 tons, an increase of 5% over that of 1972.

Clays.—North Carolina ranked second by quantity among the States in the production of common clay and shale, and ranked sixth by value. Common clay was mined by 25 companies from 48 mines in 23 counties. Production increased 6% in quantity and 13% in value over that of 1972. Seventeen mines in Chatham, Lee, Rockingham, Stanly, and Union Counties accounted for 64% of the State's production in quantity and 62% in value. The leading common clay and shale producers by quantity were Boren Clay Products Co., Kendrick Brick and Tile Co., Pine Hall Brick and Pipe Co., Sanford Brick Corp., and Solite Corp. Together their 15 operations accounted for 54% of the common clay and shale quantity and 53% of the value.

Sixty-nine percent of the common clay and shale was consumed in manufacturing face brick by 20 companies, at 38 plants. The leading producers were Boren Clay Products Co., Isenhour Brick and Tile Co., Kendrick Brick and Tile Co., Pine Hall Brick and Pipe Co., and Sanford Brick Corp. Together their 13 plants consumed 61% of the common clay and shale used for this purpose. Other major uses for common clay and shale, in descending order, were for lightweight aggregate, common brick, cement, and sewer pipe.

North Carolina has been the Nation's leading brick producer since 1962, and continued in this position through 1973. In 1973, North Carolina manufactured approximately 1.2 billion brick valued at $61.8 million, for 14% of the total U.S. production. Approximately 3,000 people were employed in the brick industry, with a payroll of $20.3 million.

Harris Mining Co., with a mine in Avery County, was the sole producer of water-washed kaolin. Kings Mountain Mica Co. produced unprocessed kaolin at a mine in Cleveland County. The combined output of water-washed and unprocessed kaolin increased moderately in quantity and value from that of 1972. The water-washed kaolin was used mainly in the manufacture of dinnerware and electrical insulators. The unprocessed kaolin was used largely in the production of face brick.

Feldspar.—North Carolina ranked first nationally in the production of feldspar, accounting for 66% of U.S. production in quantity and 69% in value. State production increased 19% in quantity and 46% in value above that of 1972. Six companies operated nine mines in Cleveland, Gaston, and Mitchell Counties. The leading producers were Lawson-United Feldspar and Mineral Co., Sobin Chemicals (formerly International Minerals & Chemical Corp.), and The Feldspar Corp. Flotation concentrate accounted for 79% of the produc-

Table 4.—North Carolina: Common clay and shale sold or used by producers, by county

(Short tons)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Alamance	2	W	W	2	89,630	$103,200
Buncombe	--	--	--	1	36,000	41,400
Catawba	1	24,673	$27,200	1	4,890	5,630
Chatham	4	630,630	718,367	4	661,344	785,968
Cumberland	1	14,750	29,500	1	17,700	26,600
Davidson	1	104,000	93,600	1	90,000	90,000
Guilford	3	122,125	134,400	3	122,832	141,300
Harnett	4	79,243	89,600	4	79,412	93,570
Henderson	2	60,000	66,000	1	54,000	62,100
Iredell	1	24,673	27,200	1	38,668	44,500
Lee	4	548,323	581,550	4	540,850	596,950
Rockingham	5	571,801	423,301	5	644,673	517,500
Rowan	2	99,026	109,000	4	247,557	285,100
Sampson	1	43,252	47,600	1	44,290	51,000
Stanly	3	527,669	539,000	3	514,564	591,800
Stokes	1	4,719	2,360	1	16,402	8,201
Union	1	197,564	494,000	1	258,500	646,300
Undistributed [1]	9	809,987	1,090,505	10	647,862	966,049
Total	45	3,862,435	4,473,183	48	4,109,174	5,057,166

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Cabarrus, Cleveland (1972), Durham, Halifax, Montgomery, Moore, New Hanover, and data indicated by symbol W.

tion by quantity and 80% by value. Most of the remaining production was in the form of feldspar silica mix. There was only minor production of hand-cobbed feldspar.

Four feldspar producers operated six feldspar-grinding plants in Cleveland and Mitchell Counties. Ground feldspar shipments decreased 2% in quantity and increased 2% in value, compared with those of 1972. The major demand for feldspar was in the glass industry, followed by pottery manufacturing. The main destinations of ground feldspar shipments were Illinois (11%), Ohio (10%), Indiana (10%), and West Virginia (9%). The remaining 60% of the shipments went to numerous States, none of which accounted for more than 5% each.

Gem Stones.—Amateur collectors of gems and minerals accounted for the production of precious and semiprecious stones in several areas of the State. Some of the better known gem stones are emeralds, rubies, agates, garnets, tourmalines, and sapphires. The North Carolina General Assembly passed a bill designating the emerald as the official State precious stone. The emerald has been found in western North Carolina and near Hiddenite, Alexander County.

Graphite.—Synthetic graphite products, including anodes and electrodes, were produced by the Great Lakes Carbon Corp. at a plant near Morganton, Burke County, using coal tar pitch shipped into the State.

Gypsum.—National Gypsum Co. announced in August 1973 that it would build a gypsum wallboard plant near Wilmington at a site on the Cape Fear River. The plant would cost about $10 million and is expected to employ about 200 persons. Starting and completion dates for the facility were not given.

Lithium Minerals.—North Carolina ranked first in the Nation in lithium mineral production. Two producing mines in North Carolina accounted for a substantial portion of U.S. lithium production in 1973. Foote Mineral Co. operated a mine and mill at Kings Mountain, Cleveland County. The concentrate was shipped outside the State for further processing. Lithium Corp. of America, Inc., operated a mine and lithium chemicals plant near Bessemer City, Gaston County. State production was substantially more in both quantity and value than in 1972.

Foote Mineral Co. announced plans for the construction of a lithium carbonate plant at its Kings Mountain operation. The plant was scheduled to begin operations by early 1976, and is expected to produce 12 million pounds of lithium carbonate annually, an addition of approximately 20% more capacity to the lithium supply of the market economy countries. The reserves at Kings Mountain were estimated to be sufficient to sustain forecast production levels for more than 40 years.[10]

Mica.—The State led the Nation in scrap mica production, and accounted for 60% of the domestic output by quantity and 73% by value. State production increased 16% in quantity and 50% in value over that of 1972. Eight companies reported production of scrap mica from 10 mines in Avery, Cleveland, Mitchell, and Yancey Counties. Leading producers were Deneen Mica Co., Inc., Harris Mining Co., Kings Mountain Mica Co., Inc., and U.S. Gypsum Co. Together their five operations accounted for 75% of the scrap mica production by quantity and 90% by value. No production of sheet mica was reported during 1973.

Ground mica was produced by seven companies with eight plants in Buncombe, Cleveland, Macon, Mitchell, and Yancey Counties. Five plants used dry methods, two used wet methods, and one used both methods. The output increased 8% in quantity and 20% in value above that of 1972. The leading producers were Diamond Mica Co., Harris Mining Co., and The English Mica Co. Together, their four operations accounted for 64% of the ground mica production by quantity and 73% by value.

The major uses for ground mica were for joint cement, paint, roofing, rubber, and well drilling. Together these uses accounted for 95% of the output by quantity and 93% by value.

Olivine.—North Carolina led the Nation in olivine production value. International Minerals and Chemical Corp. and Northwest International mined and beneficiated olivine in Yancey County. The output was substantially more than in 1972, in both quantity and value. The material was used for molding sand by the foundry industry.

[10] Foote Mineral Co. 1973 Annual Report, Chemicals and Minerals Division. P. 4.

Table 5.—North Carolina: Ground mica sold or used by producers, by use

Use	1972			1973		
	Quantity short tons	Value		Quantity short tons	Value	
		Total	Average per ton		Total	Average per ton
Roofing	13,528	$489,408	$36.18	15,340	$598,945	$39.04
Paint	10,485	1,698,382	161.51	17,534	2,347,651	133.89
Rubber	5,564	W	W	5,670	992,929	175.12
Wallpaper	492	79,150	160.87	W	W	W
Plastics	357	W	W	310	56,967	183.76
Other uses [1]	27,978	2,361,917	84.42	24,372	1,529,972	62.78
Total	58,404	4,623,857	79.17	63,226	5,526,464	87.41

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes joint cement, textile coating, well drilling, other uses, and uses indicated by symbol W.

Phosphate Rock.—The production of phosphate rock at the Lee Creek fertilizer complex of Texasgulf, Inc., Beaufort County, increased slightly in quantity and decreased slightly in value from that of 1972. The major portion of the output was used for the production of phosphoric acid, triple superphosphate, and diammonium phosphate. Only a relatively small quantity was exported as phosphate rock.

The addition of a third train, which was completed in December 1973, expanded Lee Creek phosphoric acid and sulfuric acid production by 50%. Lee Creek's phosphorus capacity was increased to an annual rate of 510,000 short tons of 100% P_2O_5. In September 1973, a further major expansion was announced. This would include the addition of a fourth sulfuric acid and phosphoric acid train, new mining equipment, and ore beneficiation facilities designed to produce phosphate rock at rates sufficient to supply a possible fifth and sixth acid train and to provide additional rock for sale. By 1976, the annual domestic and export shipments from Lee Creek were expected to total over 1,850,000 tons that would include some 675,000 tons of dry fertilizer materials, 675,000 tons of phosphoric acid, and more than 500,000 tons of phosphate rock.[11]

Sand and Gravel.—Sand and gravel continued to be the second leading mineral commodity in terms of value produced in the State. It was produced in 79 counties by 94 companies at 150 commercial operations and by the State Highway Commission's 65 operations. Seven large commercial operations, with individual outputs of more than 500,000 tons, accounted for 40% of the State's total sand and gravel production by quantity. The combined output increased 24% in quantity and 40% in value above that of 1972.

Commercial sand and gravel comprised 82% of the total State production by quantity and 90% by value. Twenty-five commercial operations in Anson, Buncombe, Cumberland, Davidson, Harnett, and Moore Counties accounted for 59% of the commercial production by quantity and 65% by value. The leading commercial sand and gravel producers were Becker Sand and Gravel Co., W. R. Bonsal Co., Hedrick Gravel and Sand Co., B. V. Hedrick Sand and Gravel Co., Nello L. Teer Co., and Sinking Sandrock Co. Together their 12 operations accounted for 50% of the commercial sand and gravel production by quantity and 59% by value.

Commercial operations provided all of the sand and gravel used for building purposes, and 74% of that used for paving. Transportation of commercial sand and gravel was 85% by truck and 15% by railroad.

L-O-F Glass, Inc., completed and placed in operation its new $40-million float glass plant near Lauringburg, Scotland County. The plant contains 850,000 square feet, including 15 acres of warehouse space capable of storing 50 million square feet of glass. The main furnace is 200 feet long by 40 feet wide, and is capable of curing 2,200 tons of glass at a time. The new plant will be fired primarily by natural gas, but will use a fuel oil backup system. Glass sand feed for the plant is being supplied from out-of-State sources.

Stone.—Stone was again the principal mineral commodity produced in the State in terms of value. The output increased 20% in quantity and 28% in value over

[11] Texasgulf, Inc. 1973 Annual Report. P. 9.

Table 6.—North Carolina: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Alexander	1	18	8	1	18	13
Ashe	1	50	90	--	--	--
Avery	3	W	191	3	176	360
Beaufort	4	W	W	2	47	70
Bertie	2	W	W	3	137	W
Bladen	2	W	W	3	97	46
Brunswick	1	50	11	3	40	84
Buncombe	4	W	408	4	934	W
Caldwell	1	12	6	2	W	W
Camden	1	9	2	3	29	W
Carteret	1	10	3	--	--	--
Catawba	6	111	107	6	105	146
Chatham	--	--	--	1	5	5
Chowan	1	20	5	1	5	5
Columbus	1	19	2	--	--	--
Craven	2	W	W	1	42	21
Cumberland	4	W	W	6	786	W
Currituck	1	39	10	1	27	13
Davidson	1	W	W	3	993	853
Davie	3	65	38	4	81	W
Duplin	5	101	W	3	W	W
Edgecombe	9	298	285	8	436	634
Forsyth	1	65	45	2	W	W
Franklin	1	7	W	2	W	W
Gaston	3	W	W	3	W	99
Gates	1	23	6	1	40	20
Halifax	1	62	12	1	51	26
Harnett	r 4	r 2,091	r 3,156	4	W	W
Haywood	1	W	W	2	W	234
Hertford	2	W	185	2	201	134
Hoke	1	57	6	1	15	15
Hyde	1	20	5	1	40	20
Iredell	3	178	W	2	W	W
Jackson	1	W	W	1	26	W
Johnston	2	W	W	4	104	74
Jones	1	W	W	2	60	W
Lee	3	210	W	3	W	W
Lenoir	4	W	W	4	149	W
Lincoln	1	32	24	1	33	25
McDowell	3	W	W	6	292	501
Macon	2	38	38	1	27	W
Martin	1	4	1	1	20	14
Montgomery	1	W	W	4	188	114
Moore	5	578	223	8	754	788
Nash	1	35	2	1	36	2
New Hanover	1	17	4	3	W	W
Onslow	1	10	3	2	W	W
Pamlico	1	13	4	1	12	8
Pasquotank	1	46	12	5	33	29
Pender	1	38	9	1	4	2
Perquimans	1	20	5	2	15	11
Pitt	5	538	256	6	696	455
Polk	1	12	5	1	5	3
Richmond	2	63	437	3	217	255
Robeson	2	W	W	1	84	42
Rockingham	6	118	114	5	65	89
Rutherford	1	122	61	3	W	W
Scotland	1	25	9	3	34	33
Stokes	1	93	65	1	92	70
Surry	3	W	W	4	32	24
Transylvania	1	W	W	1	14	21
Union	1	27	24	--	--	--
Washington	2	W	W	2	70	42
Watauga	1	W	427	1	86	147
Wayne	5	345	337	13	516	375
Wilkes	3	W	W	2	132	197
Wilson	2	62	W	3	W	115
Yadkin	1	(1)	(1)	1	23	29
Undistributed [2]	r 26	7,072	7,171	34	7,776	13,063
Total [3]	r 168	r 12,823	r 13,812	213	15,897	19,327

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Includes Alamance, Anson, Burke (1972), Cabarrus, Clay (1973), Cleveland, Greene, Guilford, Madison (1973), Mitchell (1973), Northampton, Orange (1973), Rowan, Sampson, Wake, and Yancey Counties, and some sand and gravel that cannot be assigned to specific counties.

[3] Data may not add to totals shown because of independent rounding.

Table 7.—North Carolina: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	r 4,006	r 4,311	4,878	5,209
Fill	195	148	580	364
Paving	r 2,037	r 1,693	2,401	2,697
Gravel:				
Building	r 1,169	r 2,290	1,408	3,015
Paving	r 1,073	r 1,372	2,438	3,265
Other sand and gravel [1]	r 930	r 2,584	1,306	2,795
Total [2]	r 9,410	r 12,400	13,010	17,346
Government-and-contractor operations:				
Sand:				
Fill	130	19	754	469
Paving	2,035	892	1,284	863
Other uses	696	210	398	287
Total [2]	2,861	1,121	2,435	1,619
Gravel:				
Fill	--	--	15	15
Paving	552	292	385	308
Other uses	--	--	52	39
Total [2]	552	292	452	362
Total sand and gravel [2]	r 12,823	r 13,812	15,897	19,327

r Revised.
[1] Includes filtration, fire and furnace, blast (1973), glass melting (1973), and other sands; and fill, railroad ballast, miscellaneous, and other gravel.
[2] Data may not add to totals shown because of independent rounding.

that of 1972. Production was reported from 58 counties by 52 commercial producers with 114 quarries, and by the State Highway Commission's one quarry. Thirty-one large quarries, with individual outputs of more than 500,000 tons, accounted for 72% of the State's total stone production by quantity. Eighteen operations in Cleveland, Guilford, Mecklenburg, New Hanover, and Wake Counties produced 36% of the stone by quantity and 35% by value. The leading stone producers by quantity were Central Rock Co., Inc., Ideal Cement Co., Martin Marietta Aggregates, Nello L. Teer Co., and Vulcan Materials Co. Together, their 49 operations accounted for 82% of the stone production by quantity and 80% by value.

The production of crushed granite at 75 quarries accounted for 81% of the State's one output by quantity and 75% by value. Production increased 20% in quantity and 29% in value over that of 1972.

Major quantities of other types of crushed and broken stone were produced at nine limestone and five traprock operations. Relatively minor outputs were reported by two marble, three marl, two quartz, four sandstone, and one miscellaneous rock operations. Combined, they accounted for 19% of the State's stone production in quantity and 21% in value. The production of these categories of stone increased 22% in quantity and 41% in value above that of 1972.

The major uses for crushed and broken stone were as roadbase and surfacing materials (64%), bituminous and macadam aggregate (13%), concrete aggregate (13%), and other uses (10%). Transportation was by truck (94%) and railroad (6%).

Dimension stone production was reported by 11 granite, 2 slate, and 3 individual marble, quartzite, and sandstone quarries. Granite dimension stone accounted for 86% of dimension stone by quantity and 82% by value. The total tonnage of dimension stone produced was small, amounting to less than 0.2% of the State's stone production, but the value accounted for 4% of the State total for stone. The output increased by 3% in quantity above that of 1972, but decreased 27% in value.

Talc and Pyrophyllite.—The production of talc and pyrophyllite increased 7% in quantity and 84% in value over that of 1972. Talc was produced by Hitchcock Corp. in Cherokee County. The main uses were for toilet preparations and in the textile industry. Pyrophyllite was produced

Table 8.—North Carolina: Crushed granite sold or used by producers, by county

County	1972			1973		
	Number of quarries	Quantity (short tons)	Value (thousands)	Number of quarries	Quantity (short tons)	Value (thousands)
Avery	1	40,892	$74	2	W	W
Cabarrus	1	73,420	73	1	76,510	$153
Clay	1	27,016	33	--	--	--
Guilford	5	W	W	5	4,193,010	7,735
Haywood	1	20,000	W	1	W	W
Jackson	1	W	240	1	W	W
Madison	1	150,000	227	1	171,000	288
Richmond	2	283,646	W	1	215,185	574
Surry	2	W	W	3	W	1,580
Wake	4	W	W	4	2,471,620	6,397
Undistributed [1]	50	25,516,998	45,968	56	24,118,709	43,512
Total [2]	69	26,111,972	46,615	75	31,246,034	60,241

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Alamance, Alleghany, Ashe (1973), Buncombe, Burke, Caldwell, Caswell (1973), Catawba, Chatham, Cleveland, Davidson, Davie (1973), Forsyth, Gaston, Graham (1972), Granville, Henderson, Iredell, Lee, Macon (1973), Mecklenburg, Mitchell, Moore, Nash, Orange, Pitt, Polk, Randolph, Rockingham, Rowan, Rutherford, Stokes, Transylvania, Union, Vance, Watauga, Wilkes, Wilson, Yadkin (1973), and Yancey Counties.

[2] Data may not add to totals shown because of independent rounding.

by four companies operating six mines in Alamance, Granville, Moore, and Orange Counties. The major part of the production was used by the ceramic, insecticide, and refractory industries. Leading producers were Piedmont Minerals Co., Inc., in Orange County, and Standard Minerals Co., Inc., in Moore County.

Vermiculite.—W. R. Grace & Co. operated an exfoliating plant in Guilford County, and Carolina Wholesale Florists, Inc., operated a plant in Lee County. Both companies used crude vermiculite shipped into the State. The combined output was moderately greater than in 1972, both in quantity and value. The principal uses for the finished product were as insulation (60%), aggregate (35%), and other uses (5%).

METALS

Aluminum.—Primary aluminum was produced by the Aluminum Co. of America (Alcoa) at a plant near Badin, in Stanly County, using imported alumina. The production increased moderately in quantity and value above that of 1972.

Iron Ore.—Greenback Industries, Inc., operated the Cranberry mine and concentrator in Avery County. The production was in the form of a high-quality magnetite product for special uses. The output increased substantially in both quantity and value above that of 1972.

MINERAL FUELS

There was no production of mineral fuels in North Carolina during 1973.

Petroleum and Natural Gas.—Eight exploratory wells were drilled in North Carolina during 1973; all were dry and subsequently abandoned. The depths of the holes ranged from 500 to 6,071 feet for a total footage drilled of 31,825 feet. Three wells were drilled in Dare County, with a total footage of 16,884 feet, and five wells in Carteret County with a total footage of 14,941 feet.

Leases for oil and gas exploration on State-owned submerged lands were continued by Cities Service Oil Co. in the northeastern Coastal Plain region, and by Colonial Oil and Gas Co. in the southeastern Coastal Plain region.

Chevron Oil Co., a division of Standard Oil Co. of California, acquired drilling rights on several thousand acres in, Chatham, Lee, Moore, and Wake Counties. The company announced that it plans to begin oil and natural gas exploration as soon as its land acquisition program is completed.

Table 9.—Principal producers

Commodity and company	Address	Type of activity	County
Aluminum: Aluminum Company of America.	1501 Alcoa Bldg. Pittsburgh, Pa. 15219	Smelter	Stanly.
Asbestos: Powhatan Mining Co.	6721 Windsor Mill Rd. Baltimore, Md. 21207	Open pit mine	Yancey.
Cement: Ideal Cement Co., Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Plant	New Hanover.
Clays:			
Kaolin:			
Harris Mining Co	Box 628 Spruce Pine, N.C. 28777	Open pit mine and plant.	Avery.
Kings Mountain Mica Co., Inc.	Kings Mountain, N.C. 28086	Open pit mine	Cleveland.
Miscellaneous:			
Boren Clay Products Co.	Pleasant Garden, N.C. 27313	4 open pit mines and plants.	Chatham, Guilford, Sampson.
Pine Hall Brick and Pipe Co.	Box 4325, North Station Winston-Salem, N.C. 27105	----do----	Rockingham.
Sanford Brick Corp.	Box 38 Gulf, N.C. 27256	3 open pit mines and plant.	Chatham, Lee, Stanly.
Solite Corp	Box 9138 Richmond, Va. 23227	Open pit mine and plant.	Rockingham.
Feldspar:			
The Feldspar Corp.[1]	Spruce Pine, N.C. 28777	3 open pit mines and 2 plants.	Mitchell.
Foote Mineral Co	Box 792 Kings Mountain N.C. 28086	Open pit mine and plant.	Cleveland.
Sobin Chemicals[1]	Old Orchard Road Skokie, Ill. 60079	Open pit mine and 2 plants.	Mitchell.
Kings Mountain Silica Co., Inc.	Box 709 Kings Mountain, N.C. 28086	2 open pit mines and 2 plants.	Cleveland.
Lawson-United Feldspar and Mineral Co.[1]	Minpro, N.C. 28777	Open pit mine and plant.	Mitchell.
Iron ore: Cranberry Magnetite Division, Greenback Industries Inc.	Box 63 Greenback, Tenn. 37742	Underground mine and plant.	Avery.
Lithium minerals:			
Foote Mineral Co	Box 792 Kings Mountain, N.C. 28086	Open pit mine and plant.	Cleveland.
Lithium Corp. of America, Inc.	Box 428 Bessemer City, N.C. 28016	----do----	Gaston.
Mica, scrap:			
Deneen Mica Co., Inc	Newdale, N.C. 28714	----do----	Yancey.
Harris Mining Co	Box 628 Spruce Pine, N.C. 28777	3 open pit mines and 2 plants.	Avery and Mitchell.
Kings Mountain Mica Co., Inc.	Kings Mountain, N.C. 28086	2 open pit mines and 2 plants.	Cleveland.
Mica, grinders:			
Deneen Mica Co., Inc	Newdale, N.C. 28714	Open pit mine and plant.	Yancey.
Diamond Mica Co	Box 648 Spruce Pine, N.C. 28777	Plants	Mitchell and Yancey.
The English Mica Co	Ridgeway Center Bldg. Stamford, Conn. 06905	Plant	Cleveland.
Harris Mining Co	Box 628 Spruce Pine, N.C. 28777	2 open pit mines and 2 plants.	Mitchell.
Olivine: Northwest International.	Box 672 Spruce Pine, N.C. 28777	Open pit mine and plant.	Yancey.
Perlite, expanded: Carolina Perlite Co., Inc.	Box 741 Hillside, N.J. 07205	Plant	Rowan.
Phosphate rock: Texasgulf, Inc.	200 Park Avenue New York, N.Y. 10017	Open pit mine and plant.	Beaufort.
Sand and gravel:			
Becker Sand & Gravel Co.	Box 848 Cheraw, S.C. 29520	3 open pit mines	Cumberland, Harnett, Moore.
W. R. Bonsal Co	Box 38 Lilesville, N.C. 28091	Open pit mine	Anson.
Grove Stone and Sand, Branch of B. V. Hedrick Gravel and Sand Co.	Swannanoa, N.C. 28778	----do----	Buncombe.
Lessees of B. V. Hedrick Gravel and Sand Co.	Lilesville, N.C. 28091	----do----	Anson.
Nello L. Teer Co	Box 1131 Durham, N.C. 27702	----do----	Harnett.
Sinking Sandrock Co	P.O. Box 1207 Lexington, N.C. 27292	----do----	Davidson.

See footnote at end of table.

Table 9.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone:			
Granite, crushed:			
Central Rock Co., Inc.	Box 510 Greensboro, N.C. 27409	Quarry	Guilford.
Foote Mineral Co	Box 792 Kings Mountain, N.C. 28086	Open pit mine	Cleveland.
Franklin Stone Co	P.O. Box 696 Franklin, N.C. 28734	Quarry	Macon.
Martin-Marietta Aggregates.	Box 2479 Raleigh, N.C. 27602	24 quarries	Alamance, Catawba, Chatham, Davidson, Guilford, Iredell, Mecklenburg, Pitt, Randolph, Rockingham, Rowan, Union, Wake.
Nello L. Teer Co	Box 1131 Durham, N.C. 27702	5 quarries	Granville, Nash, Wake, Wilson.
Vulcan Materials Co.	Box 7506 Reynolds Station Winston-Salem, N.C. 27106	15 quarries	Buncombe, Caswell, Davie, Forsyth, Granville, Guilford, Henderson, Rockingham, Surry, Stokes, Vance, Wilkes.
Granite, dimension:			
Harris Granite Quarries Co.	P.O. Box 1038 Salisbury, N.C. 28144	3 quarries	Cabarrus and Rowan.
North Carolina Granite Corp.	Box 151 Mt. Airy, N.C. 27030	Quarry	Surry.
Troitino and Brown, Inc.	Box 5595 Asheville, N.C. 28803	----do----	Avery.
Limestone, crushed:			
Ideal Cement Co	420 Ideal Cement Bldg. Denver, Colo. 80202	----do----	New Hanover.
Martin-Marietta Aggregates.	Box 2479 Raleigh, N.C. 27602	4 quarries	Cleveland, Craven, New Hanover, Onslow.
Marble, crushed and dimension: Columbia Marble Co.	Box 330 Sylacauga, Ala. 35150	Quarry	Cherokee.
Slate, dimension:			
Jacob's Creek Stone Co., Inc.	P.O. Box 608 Denton, N.C. 27239	2 quarries	Davidson and Montgomery.
Sandstone, crushed:			
The Feldspar Corp	Spruce Pine, N.C. 28777	2 open pit mines	Mitchell.
Sandstone, dimension:			
Jacob's Creek Stone Co., Inc.	P.O. Box 608 Denton, N.C. 27239	Quarry	Montgomery.
Traprock, crushed: Nello L. Teer Co.	Box 1131 Durham, N.C. 27702	----do----	Durham.
Talc and pyrophyllite:			
Pyrophyllite:			
Boren & Harvey, Inc.	Box 7247 Greensboro, N.C. 27407	Open pit mine	Granville.
Glendon Pyrophyllite.	Box 306 Carthage, N.C. 28327	4 open pit mines and plant.	Alamance and Moore.
Piedmont Minerals Co., Inc.	P.O. Box 7247 Greensboro, N.C. 27407	Open pit mine and plant.	Orange.
Standard Minerals Co., Inc.	Robbins, N.C. 27325	----do----	Moore.
Talc: Hitchcock Corp	Box 35 Murphy, N.C. 28906	Underground mine and plant.	Cherokee.
Vermiculite, expanded:			
Carolina Wholesale Florists, Inc.	Box 537 Sanford, N.C. 27330	Plant	Lee.
W. R. Grace & Co., Construction Production Div.	62 Whittemore Avenue Cambridge, Mass. 02140	----do----	Guilford.

[1] Also feldspar grinding.

The Mineral Industry of North Dakota

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the State Geological Survey of North Dakota under a cooperative agreement for collecting information on all minerals except fuels.

By Joseph B. Huvos [1]

In 1973, the total value of North Dakota's mineral production was $111.9 million, an increase of 14% from that of 1972. The value of fossil fuel production, excluding natural gas liquids, was $98.7 million, $12.2 million more than that of 1972. Changes in value of selected commodities produced in North Dakota in 1973 were as follows: Crude petroleum increased $11.3 million, lignite increased $0.9 million.

The total value of sand and gravel output, the only major nonmetallic material, was $6 million, $0.26 million more than that of 1972. Among items, the value of which was withheld, the value of natural gas liquids increased 21.6%; that of clay, 35.9%; lime, 23.4%; that of stone decreased 80%. The value of salt increased 33%; no peat was produced in 1973.

Legislation and Government Programs.—In 1973, the North Dakota Senate passed and sent to the House a bill on reclamation of strip-mined areas. The bill would have required the spreading of 2 feet of topsoil over the graded area but an amendment to the bill carried the following specifications: * * * "provided, however, that if two feet of such material (topsoil) is not available within the permit area, all topsoil, or approved surface material that is available shall be spread over the regraded area." The North Dakota Water Commission approved a declaration of intent to provide water for the proposed West River Division Project.

A new state law in North Dakota pertaining to underground transmission facilities, including oil and gas pipelines, became effective October 1. Under the new regulations, companies owning transmission facilities must give written notice to the registrar of deeds in the county where the facilities are located; this notice must include a description of the facilities by region; township number; township name, if any; range; and city name.

The Public Service Commission has authorized the Belle Fourche Pipeline Company to build a 20-mile crude oil pipeline in McKenzie County. The $6,000, 3,000-barrel-per-day pipeline and associated facilities will provide all-weather transportation from the Rough Rider Field to the Red Wing Creek Field, from which point trucks will be used.

The North Dakota State Water Commission has approved a conditional water permit for the Minnkota Power Cooperative. It provided 7,500 acre-feet of water from the Missouri River for a 400-megawatt addition to Minnkota's electric generating plant near Center, North Dakota. The storage of 7,480 acre-feet of water for the present generating units from the Square Butte Creek was also authorized.

[1] Foreign mineral specialist, Division of Fossil Fuels—Mineral Supply.

Several Federal and State government publications were issued in 1973 that would be of interest to the mineral industry.[2]

Table 1.—Mineral production in North Dakota[1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Coal ---- thousand short tons	6,632	$13,416	6,906	$14,328
Gem stones	NA	2	NA	2
Natural gas ---- million cubic feet	32,472	5,455	27,703	5,457
Petroleum (crude) ---- thousand 42-gallon barrels	20,624	67,647	20,235	78,916
Sand and gravel ---- thousand short tons	6,681	5,757	6,011	6,021
Value of items that cannot be disclosed: Clays, lime, natural gas liquids, pumice (1972), salt, and stone	XX	5,809	XX	7,129
Total	XX	98,086	XX	111,853
Total 1967 constant dollars	XX	80,931	XX	p 82,122

p Preliminary. NA Not available. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Bluemle, J. P. Geology of Nelson and Walsh Counties, North Dakota. Part I. N. Dak. Geol. Survey, Bull. B–57, 1973.

Croff, M. G. Ground Water Resources of Mercer and Oliver Counties, North Dakota. Part III. N. Dak. Geol. Survey, Bull. B–56, 1973.

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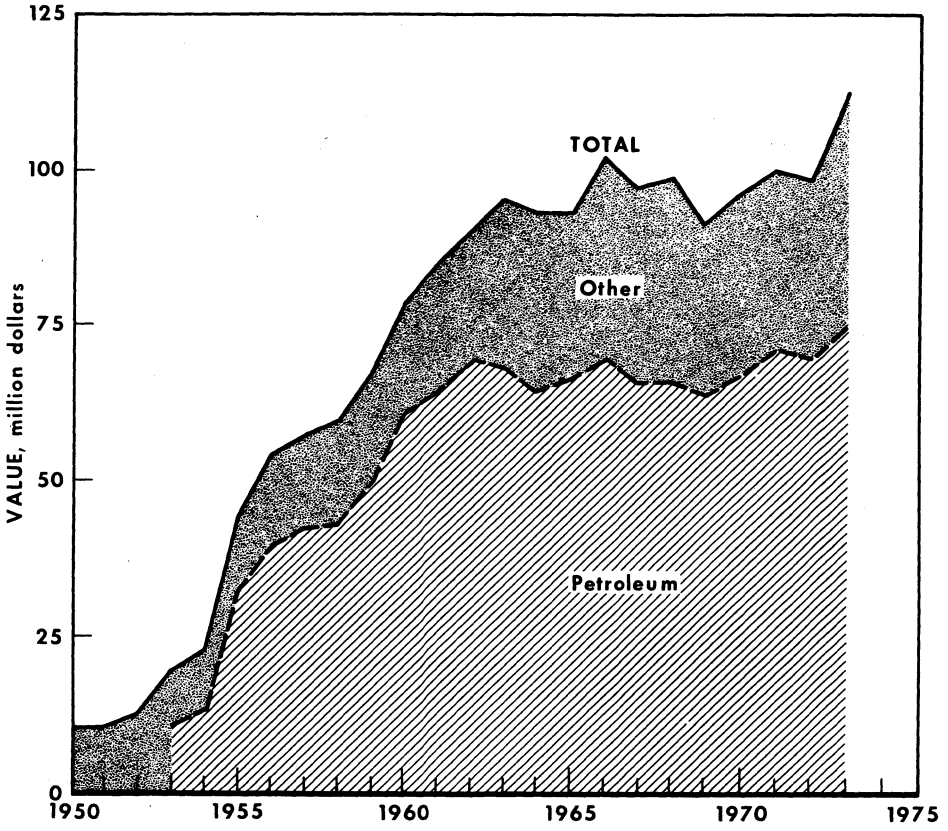

Figure 1.—Value of petroleum and total value of mineral production in North Dakota.

Table 2.—Value of mineral production in North Dakota, by county [1]
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adams	W	W	Coal.
Barnes	$161	$198	Sand and gravel.
Benson	--	76	Do.
Billings	6,094	8,654	Petroleum.
Bottineau	W	W	Petroleum, sand and gravel.
Bowman	3,710	6,210	Petroleum, coal, sand and gravel.
Burke	7,949	7,423	Petroleum, coal, natural gas liquids, sand and gravel.
Burleigh	W	878	Sand and gravel.
Cass	W	50	Do.
Cavalier	W	2	Do.
Dickey	W	20	Do.
Divide	W	W	Petroleum, sand and gravel.
Dunn	39	40	Petroleum.
Eddy	W	W	Sand and gravel.
Foster	W	W	Do.
Golden Valley	308	W	Petroleum, sand and gravel.
Grand Forks	114	W	Sand and gravel.
Grant	W	W	Coal.
Griggs	10	84	Sand and gravel.
Kidder	W	W	Do.
Logan	W	W	Do.

See footnotes at end of table.

Table 2.—Value of mineral production in North Dakota, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
McHenry	W	W	Petroleum, sand and gravel.
McIntosh	W	W	Sand and gravel.
McKenzie	$13,140	$15,912	Petroleum, sand and gravel.
McLean	W	W	Sand and gravel.
Mercer	6,677	W	Coal.
Morton	W	W	Sand and gravel, clays.
Mountrail	1,466	1,482	Petroleum.
Oliver	W	W	Coal, sand and gravel.
Pembina	800	W	Sand and gravel, lime.
Pierce	W	28	Sand and gravel.
Ransom	W	85	Do.
Renville	5,810	W	Petroleum, sand and gravel.
Richland	81	--	
Rolette	W	W	Sand and gravel.
Sargent	W	--	
Sheridan	W	W	Sand and gravel.
Slope	397	390	Petroleum.
Stark	4,591	4,192	Petroleum, coal, sand and gravel.
Steele	W	--	
Stutsman	W	259	Sand and gravel.
Towner	W	W	Do.
Traill	226	339	Do.
Walsh	117	249	Do.
Ward	2,990	2,925	Coal, petroleum, sand and gravel.
Wells	--	50	Sand and gravel.
Williams	20,469	23,413	Petroleum, natural gas liquids, salt, sand and gravel, coal.
Undistributed [2]	22,936	38,894	
Total [3]	98,086	111,853	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Emmons, Hettinger, La Moure, Nelson, Ramsey, and Sioux.

[2] Includes gem stones, natural gas, stone (1973), some sand and gravel which cannot be assigned to specific counties, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of North Dakota business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ---- thousands	251.9	259.0	+2.8
Employment ---- do	239.4	245.7	+2.6
Unemployment ---- do	12.5	13.3	+6.4
Nonagricultural employment:			
Mining ---- do	1.6	1.7	+6.2
Construction ---- do	11.9	11.5	−3.4
Manufacturing ---- do	10.6	11.9	+12.3
Government ---- do	50.0	50.2	+.4
Transportation and public utilities -- do	12.3	12.6	+2.4
Wholesale and retail trade ---- do	47.9	51.3	+7.1
Finance, insurance, and real estate -- do	7.4	7.7	+4.1
Services ---- do	33.0	35.0	+6.1
Personal income:			
Total ---- millions	$2,363	$3,061	+29.5
Per capita	$3,738	$4,782	+27.9
Construction activity:			
Highway construction contracts awarded millions	[e] $40.0	$40.9	+2.2
Cement shipments to and within North Dakota thousand short tons	319	353	+10.7
Value of authorized nonresidential construction millions	$31.7	$45.5	+43.5
Number of authorized residential units	53,690	39,560	−26.3
Farm marketing receipts ---- millions	$1,341.8	$2,159.8	+61.0
Mineral production value ---- do	$98.1	$111.9	+14.1

[e] Estimate. [p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

Coal (Lignite).—At the 12 operating strip mines, each producing more than 1,000 salable short tons annually, production was 6.9 million tons in 1973, valued at an average of $2.07 per ton, an increase of 5¢ per ton. In 1973, an estimated million cubic yards of overburden was stripped. The overburden ranged from 29 to 65 feet in thickness above the 5½- to 15-foot-thick coal seams. Four mines producing over 1 million tons per year delivered a total of 5.7 million tons in 1973. Four mines producing between 100,000 and 1 million tons annually, collectively produced 1.2 million tons. The other four mines, each with an annual output of less than 100,000 tons produced the remainder. Of the total state production of 6.9 million tons in 1973, 5.0 million tons were sold in open market, while 1.9 million tons were used by producers. Of the total shipments, 3,704,915 were by rail; 49,774 tons were by truck; 2,998,487 tons were used at mine-mouth electric powerplants; and 152,866 tons were shipped by other methods, not stated.

Stripping equipment included 17 power shovels and 10 draglines, of which 17 were electric or diesel powered. One shovel and four draglines each had 16- to 50-cubic-yard buckets; 5 shovels and 3 draglines had 6- to 15-cubic-yard buckets; while 11 shovels and 3 draglines had buckets of less than 6-cubic-yard capacity. Other equipment included 1 power drill, 13 front-end loaders, 2 wheel excavators, 13 motor graders, 8 coal drills, 2 power brooms, and an undetermined number of haulage trucks.

Mercer County produced over 59% of the State's lignite production.

Michigan-Wisconsin Pipeline Company, a subsidiary of American Natural Gas, has asked the State for a permit to use North Dakota water resources for four proposed coal gasification plants in the western part of the State. The company's request was under consideration by the North Dakota Joint Energy Council, which will make a recommendation on the permit to the State Water Commission.

Table 4.—North Dakota: Lignite strip production, by county, 1973
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines	Production (thousand short tons)	Value (thousands)
Adams	1	1	W
Bowman	1	185	W
Burke	1	482	W
Grant	1	5	W
Mercer	3	4,101	W
Oliver	1	1,563	W
Stark	2	108	W
Ward	1	452	W
Williams	1	8	W
Total[1]	12	6,906	$14,328

W Withheld to avoid disclosing individual company confidential data.
[1] Data may not add to totals shown because of independent rounding.

Natural Gas.—Marketed natural gas totaled 27,703 million cubic feet, 14.7% less than in 1972. The average value at 19.7 cents per thousand standard cubic feet was up 2.9 cents, over that of 1972. No new gas discoveries were made in 1973. Again most of the gas came from three natural gas processing plants. Some dry gas came from producing wells. Estimated proved reserves of natural gas, totaled 441.6 billion cubic feet at the start of the year, but were increased to 448.2 billion cubic feet at yearend, partly because of revisions.[3]

By yearend, there were 44 producing gas and condensate wells in North Dakota.

Natural Gas Liquids.—The production of natural gas liquids, comprising liquid petroleum and natural gasoline cycle products declined 6.2%; their value increased 21.6%. Three natural gas processing plants—Lignite Gas Plant at Lignite, Novil

[3] American Gas Association, American Petroleum Institute, and Canadian Petroleum Association. Reserves of crude oil, natural gas liquids and natural gas in the United States and Canada, and United States productive capacity as of December 31, 1973. V. 28, June 1974.

Tioga Gas Plant at Gregor, and Signal Companies, Inc., at Tioga—continued processing casing head gas. Sulfur was recovered at two of these operations—the Signal Companies, Inc., plant and the Lignite Gasoline plant. Estimated total proved reserves of natural gas liquids at the start of 1973 were 45.4 million barrels compared with 53.3 million barrels at yearend.[4]

Petroleum.—Crude oil production declined for the seventh consecutive year, because development failed to offset the normal depletion of reservoirs. Output was down 1.9% below the 1972 level while the total value of the oil produced increased by 16.7%. The value per barrel up (18.9%) from $3.28 in 1972 to $3.90 in 1973.

In 1973, there were 122 well completions in North Dakota, an increase of 23 over that of 1972, when a low of only 99 wells were completed in the State, reversing general downtrend in exploration during the last decade.

Concentration of work was as before in Bottineau and McKenzie Counties. There was activity in 20 counties, with McLean, Oliver, and Sioux Counties new to the list while Benson, Golden Valley, and Grand Forks Counties were no longer on it.

Of the wells drilled in the State, 32.8% were successful in producing oil, as opposed to a success rate of 30% in the Mountain States.

The State's 72 wildcat wells yielded only 4 oil producers in 1973. One was a new field discovery. Another was a new producing well in the Stoneview field along the Nesson anticline and the third was an extension of Red River oil production in Coyote Creek field, Bowman County, South Western North Dakota.

The Nokota Co. completed a Tyler discovery two miles west of the Dickinson field, with a swab rate of 154 barrels of oil per day. The 8–08 Zastoupil, sec 31, T 140 N, R 97 W, Stark County, produces a 34-gravity oil, perforated at 7,999 to 8,005 feet. This discovery is apparently separated from the Dickinson field, Tyler pool, by a dry hole.

In Bowman County, one and a half miles southeast of Coyote Creek field, Farmers Union Central Exchange completed a Red River well flowing 410 barrels of oil, 511,000 cubic feet of gas and 38 barrels of water per day. The 7X–27 Miller, sec 27, T 131 N, R 104 W, is within the defined area of Coyote Creek field but found production in a subsurface structure separate from that which produces at the original wells. The well is perforated in the Red River Band D Zone. Oil shows were also found in the A and C zones of Red River.

A Red River deeper pay discovery was officially recorded in Stoneview field, Burke County. North American Royalties and H. L. Hunt found the Winnipegosis (Devonian) and Red River (Ordovician) productive at 1 Holte-Bank of North Dakota, sec 31, T 161 N, R 94 W in 1972. But due to mechanical difficulties, the well was completed only from the Winnipegosis that year. Early in 1973, the operators reworked the well and dually completed it from the two pays with Red River gaged at 75 barrels of 55 gravity condensate and 2,500,000 cubic feet of gas per day. This deep-test well, the first drilled in the field also found oil shows in the Nisku, in two zones of the Duperow, and in the Silurian. Hunt and North American confirmed the dual deep pay discovery with a south offset that produced from both zones. Madison oil production was established at Stoneview in the late 1950's.

McKenzie County's Red Wing Creek and Rough Rider fields led the State's development work. At least eight oil wells were completed in the Red Wing Creek field by the True Oil Company, but the operator released no detail on the works. One of the wells, 42–28 Bredwick, sec 28, T 148 N, R 101 W, produces from the Kibbey formation and is the first well in the state to be completed from that zone of the Mississippian. On the west side of the Red Wing Creek field, earlier production was from the Mission Canyon formation. Only three of the 1973 wells were completed for the record. A gas plant was constructed in the field during the year and a transmission line laid to the Montana Dakota Utilities system near the town of Alexander.

Eighteen miles south of Red Wing Creek, in the south unit of the Rough Rider field, Tiger Oil and others completed three offset wells to a Madison formation discovery. Tiger Oil Companies 3–32 Roughrider-Federal, sec 32, T 145 N, R 101 W, flowed 1,552 barrels of oil per day through a 20/64-inch choke. It is a southwest offset to

[4] Table 5 of work cited in footnote 3.

the Belco Petroleum Co. discovery completed in 1972.

Cardinal Petroleum Corp. completed a half dozen Madison formation oil wells in Bottineau County's Wiley field. The Amerada Hess Company embarked on a development program in the Devonian formation unit in the Beaver Lodge field. Four producing wells were completed there before the end of the year.[5]

At yearend, there were 1,404 wells capable of producing oil, three more than at the beginning of 1973, with an average production of 39.5 barrels per well a day. At yearend proved reserves were 179 million barrels.[6]

Table 5.—North Dakota: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Billings	--	--	--	--	--	2	2	16,902
Bottineau	13	--	7	--	--	13	33	127,648
Bowman	2	--	1	1	--	3	7	67,924
Burke	--	--	2	--	--	1	3	19,762
Divide	1	--	--	--	--	2	3	36,432
Dunn	--	--	--	--	--	2	2	16,423
McHenry	--	--	--	--	--	3	3	13,095
McKenzie	11	--	3	2	--	8	24	234,421
McLean	--	--	--	--	--	2	2	12,833
Morton	--	--	--	--	--	1	1	4,500
Mountrail	--	--	--	--	--	3	3	31,858
Oliver	--	--	--	--	--	1	1	3,800
Pierce	--	--	--	--	--	1	1	3,800
Ramsey	--	--	--	--	--	1	1	1,720
Renville	3	--	--	--	--	6	9	44,333
Sioux	--	--	--	--	--	1	1	3,890
Slope	--	--	1	--	--	3	4	32,766
Stark	1	--	--	1	--	6	8	66,416
Ward	--	--	--	--	--	7	7	42,850
Williams	5	--	--	--	--	2	7	72,324
Total	36	--	14	4	--	68	122	853,697

[1] Development wells as defined by American Petroleum Institute.
Source: American Petroleum Institute.

Table 6.—North Dakota: Crude oil production, by county

County	Quantity		Principal fields in 1973 in order of production
	1972	1973	
Billings	1,858	2,221	Medora, Fryburg, Rocky Ridge.
Bottineau	2,938	2,842	Newburgh, South Westhope, Wiley.
Bowman	981	1,457	Cedar Creek, Medicine Pole Hills.
Burke	1,750	1,436	Rival, North Tioga, Northeast Foothills, Black Slough.
Divide	209	188	North Tioga, Stoneview.
Dunn	12	3	Lost Bridge.
Golden Valley	90	70	Square Butte.
McHenry	20	20	Pratt.
McKenzie	3,978	4,057	Antelope, Charlson, Blue Buttes, Hawkeye, Clear Creek.
Mountrail	447	381	Tioga.
Renville	1,765	1,755	Sherwood, Glenburn.
Slope	120	104	Eleven Bar.
Stork	1,242	915	Dickinson, Zenith.
Ward	459	298	South Lone Tree, Lone Tree.
Williams	4,755	4,488	Beavers Lodge, Tioga, Grenora, Capa.
Total quantity	20,624	20,235	
Total value	$67,647	$78,916	

Source: Quantity, No. Dak. Geological Survey; Value, U.S. Bureau of Mines.

NONMETALS

Clays.—Compared with 1972, the total production of clays was 29.3% more, and its total value increased by 35.9%.

All related activities were in Morton County by two companies: Baukol-Noonan, Inc., manufactured lightweight aggregate, and the Hebron Brick Co., with three mines in the county made face brick.

[5] Petroleum Information Corporation. Resume—1973. Denver, Colo., 1974, pp. RM21–23, RM–35, RM–50.

[6] Work cited in footnote 3.

Gem Stones.—Total value of gem stones gathered in the State during the year was the same as that in 1972, according to estimates. Stones usually produced in the State included agate, chalcedony, jasper, and petrified wood.

Lime.—American Crystal Sugar Co. produced lime in Pembina County for sugar refining. Output increased 6% but was 17% below the 1969 record. The lime was consumed in North Dakota. Total lime consumption in North Dakota was 41,350 tons.

Salt.—The Hardy Salt Company (formerly Dakota Salt and Chemical Co.) produced evaporated salt in vacuum pans; some of it was in pressed blocks. Production was 18.9% more in quantity and 33.0% more in value than in 1972. Located in Williams County, the firm is the State's only salt producer.

Sand and Gravel.—There were 134 active sand and gravel operations in 1973, 27 less than in 1972. These operations included commercial, Federal, county, and municipal plants. The volume of sand and gravel production decreased 10%, while it's value increased 4.6%.

Table 7.—North Dakota: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	470	757	463	633
Fill	W	W	201	235
Paving	82	85	110	97
Other uses	305	200	34	56
Total[1]	856	1,043	807	1,022
Gravel:				
Building	665	1,204	611	1,252
Fill	226	182	203	187
Paving	2,864	2,107	2,586	2,211
Miscellaneous	31	55	40	30
Other uses[2]	66	87	37	105
Total[1]	3,851	3,635	3,478	3,786
Government-and-contractor operations:				
Sand:				
Fill	79	31	87	40
Paving	84	8	89	56
Total	163	39	176	96
Gravel:				
Building	135	110	131	131
Fill	90	11	164	79
Paving	1,521	909	1,247	906
Other uses	65	9	7	2
Total[1]	1,811	1,039	1,550	1,118
Total sand and gravel[1]	6,681	5,757	6,011	6,021

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Data may not add to totals shown because of independent rounding.
[2] Includes railroad ballast (1972).

Stone.—Shipments of stone in 1973 decreased 83.4% in quantity and 80% in value. Unit value was $2.00 per ton for all stone. Almost all stone shipped was by truck.

Sulfur.—Natural gas processing plants at Lignite, Burke County, owned by Texaco, Inc., and at Tioga, Williams County, owned by The Signal Companies, Inc., recovered elemental sulfur as a byproduct. This commodity is not included in table 1.

Vermiculite.—In 1973, vermiculite continued to be shipped into the State and was exfoliated and sold by the Robinson Insulation Co. at Minot. Some of its uses in decreasing order were block insulation, loose fill insulation, concrete aggregate, plaster aggregate, and litter (agriculture).

Table 8.—Principal producers

Commodity and company	Address	Type of activity	County
Clays:			
Baukol-Noonan, Inc	Noonan, N. Dak. 58765	Open pit mine and plant.	Morton.
Hebron Brick Co	Hebron, N. Dak. 58638	Open pit mine	Do.
Coal:			
Baukol-Noonan, Inc	Noonan, N. Dak. 58765	Strip mine; crushing plant, thermal drying.	Burke.
Consolidation Coal Co., Western Division.	Box 200 Stanton, N. Dak. 58571	Strip mine	Oliver.
		Crushing plant	Mercer.
		Strip mine and crushing plant.	Ward.
Knife River Coal Mining Co	Bismarck, N. Dak. 58501	do	Bowman, Mercer.
North American Coal Corp., Lignite Division.	12800 Shaker Blvd. Cleveland, Ohio 44120	do	Mercer.
Lime: American Crystal Sugar Co	P.O. Box 419 Denver, Colo. 80201	Shaft kiln at beet sugar refinery.	Pembina.
Natural gas and petroleum:			
Amerada Hess Corp	Box 2040 Tulsa, Okla. 74102	Crude oil wells: Fryburg field.	Billings.
		Crude oil wells: Lost Bridge field.	Dunn.
		Crude oil wells: Antelope, Blue Buttes, and Charlson fields.	McKenzie.
		Crude oil wells: Beaver Lodge field.	Williams.
Amoco Oil Co	910 South Michigan Ave. Chicago, Ill. 60680	Refinery	Morton.
Chevron Oil Co., Western Division.	1700 Broadway Denver, Colo. 80202	Crude oil wells: Glenburn field.	Renville.
Chandler & Associates, Inc	1401 Denver Club Bldg. Denver, Colo. 80202	Crude oil wells: Sherwood Field.	Bottineau.
Hunt Oil Co. (Hunt Industries)	1401 Elm Dallas, Tex. 75202	Crude oil wells: North Tioga field and gas processing plant.	Burke.
Amoco Production Co	Box 591 Tulsa, Okla. 74102	Crude oil wells: Black Slough and Rival fields.	Do.
Petroleum, Inc	300 West Douglas Wichita, Kans. 67202	Crude oil wells: Sherwood field.	Bottineau.
Shell Oil Co	50 West 50th St. New York, N.Y. 10020	Crude oil wells: Cedar Creek field.	Bowman.
The Signal Companies, Inc	1010 Wilshire Blvd. Los Angeles, Calif. 90017	Crude oil wells: Tioga field.	Mountrail.
		Crude oil wells: Beaver Lodge field and gas processing plant.	Williams.
Tenneco Oil Co	Box 2511 Houston, Tex. 77051	Crude oil wells: Glenburn field.	Renville.
Texaco, Inc	Box 52332 Houston, Tex. 77052	Crude oil wells: Blue Buttes and Charlson fields.	McKenzie.
Union Oil Co. of California	Box 7600 Los Angeles, Calif. 90017	Gas processing plant.	Burke.
		Crude oil wells: Sherwood field.	Renville.
Westland Oil Co	Box 1549 Minot, N. Dak. 58701	Refinery	Williams.
Salt: Hardy Salt Co	P.O. Drawer 449 St. Louis, Mo. 63166	Well and plant	Do.
Sand and gravel:			
Lindteiger Construction Co	Turtle Lake, N.D. 58575	Pit	McLean.
Joe Mayo & Son	Box 310 Cavalier, N.D. 58220	Pit	Pembina.
Minot Sand and Gravel Co	Box 116 Minot, N. Dak. 58702	Pit and plant	Ward.
Schriock Constr., Inc	Rural Route 3, Radio City Minot, N. Dak. 58701	1 plant	Various.
Tennefos Constr. Co., Inc	2504 Fifth Ave., South Fargo, N. Dak. 58101	2 plants	Do.

The Mineral Industry of Ohio

By Joseph A. Sutton [1]

For the 12th consecutive year, value of mineral production increased in Ohio. Mineral production, valued at $807 million, was again dominated by increased values for cement, coal, lime, natural gas, petroleum, stone and sand and gravel. These commodities accounted for 93% of the $82.2 million increase over the 1972 total. The State's principal mineral commodity in terms of value was coal. The quantity produced however, was 5.2 million tons less than the 51.0 million tons recorded in 1972. With the exception of Fulton County, mineral production was reported in all of the State's 88 counties. Harrison County, with mineral production value of $57.5 million, was the State's leading mineral-producing county. Nationally, Ohio continued to be an important producer of bituminous coal, stone, lime, salt, and clay.

[1] Physical scientist, Division of Ferrous Metals-Mineral Supply.

Table 1.—Mineral production in Ohio [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Cement:				
Masonry ---- thousand short tons	161	$4,684	176	$5,641
Portland ---- do	2,968	57,953	3,456	73,362
Clays ---- do	4,125	11,273	4,732	12,456
Coal (bituminous) ---- do	50,967	303,819	45,783	338,792
Gem stones	NA	8	NA	8
Lime ---- thousand short tons	4,413	75,569	4,389	77,028
Natural gas ---- million cubic feet	89,995	35,271	93,610	39,786
Peat ---- thousand short tons	4	67	4	64
Petroleum (crude) - thousand 42-gallon barrels	9,358	35,179	8,796	44,690
Salt ---- thousand short tons	6,147	47,710	4,657	41,643
Sand and gravel ---- do	43,506	59,932	48,987	69,982
Stone ---- do	48,498	90,821	[2] 55,107	[2] 98,009
Value of items that cannot be disclosed: Abrasive stone, gypsum, and dimension stone (1973)	XX	2,462	XX	5,518
Total	XX	724,748	XX	806,979
Total 1967 constant dollars	XX	597,989	XX	[p] 592,484

[p] Preliminary. NA Not available. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes dimension stone; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Ohio, by county [1]
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adams	$1,673	$1,790	Stone.
Allen	W	W	Stone, sand and gravel.
Ashland	W	W	Sand and gravel.
Ashtabula	W	W	Lime, sand and gravel.
Athens	1,278	987	Stone, sand and gravel.
Auglaize	W	W	Sand and gravel, stone, clays.

See footnotes at end of table.

Table 2.—Value of mineral production in Ohio, by county [1]—Continued
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Belmont	W	W	Coal, stone, sand and gravel.
Butler	$3,957	$4,787	Sand and gravel, stone.
Brown	W	W	Sand and gravel.
Carroll	2,253	2,234	Coal, stone, clays, sand and gravel.
Champaign	W	W	Sand and gravel, peat.
Clark	W	W	Sand and gravel, stone.
Clermont	W	W	Stone, sand and gravel.
Clinton	W	W	Do.
Columbiana	W	W	Coal, clays, sand and gravel.
Coshocton	18,945	W	Coal, sand and gravel, stone, clays.
Crawford	W	W	Stone, sand and gravel.
Cuyahoga	14,535	10,503	Salt, lime, clays, sand and gravel, peat.
Darke	W	W	Sand and gravel, clays.
Defiance	W	W	Sand and gravel.
Delaware	W	W	Stone, lime, clays.
Erie	W	11,247	Lime, stone, sand and gravel.
Fairfield	W	650	Sand and gravel.
Fayette	W	W	Stone.
Franklin	12,688	12,534	Sand and gravel, stone, clays, peat.
Gallia	W	W	Stone, sand and gravel, coal.
Geauga	W	W	Stone, sand and gravel.
Greene	24,704	28,872	Cement, stone, sand and gravel, clays.
Guernsey	6,197	2,497	Coal.
Hamilton	6,213	7,170	Sand and gravel.
Hancock	W	W	Stone, lime.
Hardin	W	W	Stone.
Harrison	50,030	57,541	Coal, stone, clays.
Henry	W	W	Sand and gravel, clays.
Highland	1,071	W	Stone.
Hocking	W	W	Coal, clays, sand and gravel.
Holmes	4,087	4,425	Coal, stone, clays, sand and gravel.
Huron	W	W	Sand and gravel, stone.
Jackson	W	W	Coal, clays, stone.
Jefferson	33,936	34,758	Coal, clays.
Knox	W	W	Sand and gravel, stone.
Lake	29,414	26,306	Lime, salt, stone, sand and gravel.
Lawrence	6,421	W	Cement, clays, sand and gravel, stone, coal.
Licking	1,213	W	Sand and gravel, clays, stone.
Logan	877	1,121	Stone, sand and gravel.
Lorain	7,781	10,050	Lime, stone, sand and gravel, grindstone.
Lucas	W	W	Cement, stone, sand and gravel, clays.
Madison	W	W	Stone, sand and gravel.
Mahoning	8,957	9,377	Stone, coal, clays, sand and gravel, peat.
Marion	W	2,083	Stone, sand and gravel, clays.
Medina	W	W	Sand and gravel, clays.
Meigs	2,559	5,294	Coal, sand and gravel, salt.
Mercer	W	W	Stone.
Miami	W	W	Stone, sand and gravel.
Monroe	W	W	Coal, stone, sand and gravel.
Montgomery	W	W	Sand and gravel, stone.
Morgan	W	W	Coal, sand and gravel, stone.
Morrow	100	98	Sand and gravel.
Muskingum	41,451	47,812	Coal, cement, stone, sand and gravel, clays.
Noble	W	4,966	Coal, stone.
Ottawa	W	13,559	Stone, lime, gypsum.
Paulding	13,357	16,313	Cement, stone, clays.
Perry	W	W	Coal, stone, clays.
Pickaway	W	W	Sand and gravel, stone.
Pike	1,102	1,045	Do.
Portage	4,139	5,419	Sand and gravel.
Preble	W	W	Sand and gravel, stone.
Putnam	W	W	Stone, clays, sand and gravel.
Richland	W	W	Sand and gravel, clays, peat.
Ross	W	W	Sand and gravel, stone.
Sandusky	W	35,684	Lime, stone.
Scioto	1,317	1,425	Stone, clays, sand and gravel.
Seneca	W	W	Lime, stone, clays.
Shelby	W	414	Stone, sand and gravel.
Stark	12,390	15,219	Cement, sand and gravel, coal, stone, clays, peat.
Summit	30,011	19,186	Salt, cement, lime, sand and gravel, stone.
Trumbull	W	W	Sand and gravel.
Tuscarawas	13,698	14,808	Coal, clays, sand and gravel, stone.
Union	W	W	Stone.
Van Wert	1,149	W	Stone, clays.
Vinton	W	W	Coal, stone, clays.
Warren	W	W	Sand and gravel, stone.
Washington	W	782	Do.

See footnotes at end of table.

Table 2.—Value of mineral production in Ohio, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Wayne	$14,345	$16,420	Salt, sand and gravel, stone, coal, clays.
Williams	W	W	Sand and gravel, peat.
Wood	W	2,587	Stone.
Wyandot	10,435	10,666	Stone, lime, sand and gravel, clays, peat.
Undistributed [2]	342,462	366,345	
Total [3]	724,748	806,979	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

1 Fulton County is not listed because no production was reported. Natural gas and petroleum values are not listed by counties because data are not available; included with "Undistributed."

[2] Includes some sand and gravel and stone (1972) that cannot be assigned to specific counties, natural gas, petroleum, gem stones, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Ohio business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ---- thousands	4,534	4,617	+1.8
Unemployment ---- do	251	197	−21.5
Employment (nonagricultural):			
Manufacturing ---- do	1,344.6	1,421.9	+5.7
Transportation and public utilities ---- do	223.1	224.3	+.5
Wholesale and retail trade ---- do	816.6	857.2	+5.0
Financial, insurance, and real estate ---- do	167.9	174.3	+3.8
Services ---- do	616.3	647.9	+5.1
Government ---- do	589.1	596.4	+1.2
Contract construction ---- do	157.7	167.4	+6.2
Mining ---- do	23.0	23.1	+.4
Personal income:			
Total ---- millions	$48,888	$53,788	+10.0
Per capita	$4,534	$5,012	+10.5
Construction activity:			
Number of housing units authorized	86,112	59,624	−30.8
Value of private nonresidential construction - millions	$692.5	$785.7	+13.5
Cement shipments to and within the State, thousand short tons	3,570	4,055	+13.6
Mineral production value ---- millions	$724.7	$807.0	+11.4

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; U.S. Bureau of Mines.

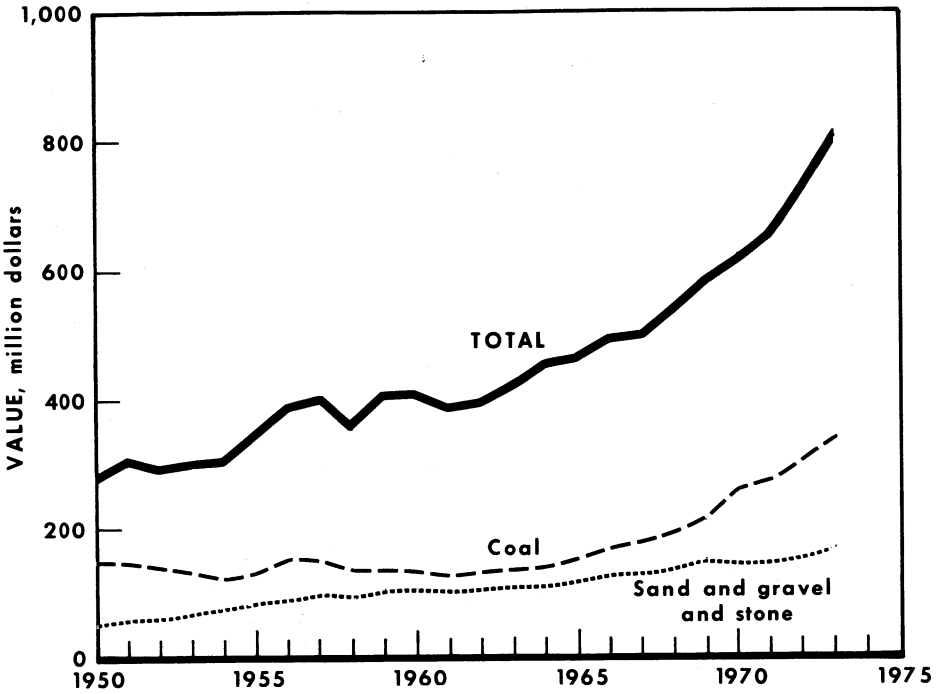

Figure 1.—Value of coal, sand and gravel, and stone, and total value of mineral production in Ohio.

Legislation and Government Programs.—The Ohio Department of Natural Resources was drafting legislation that would extend surface mining controls to sand and gravel, clay, shale, limestone, and sandstone operations. The legislation is to be patterned after Ohio's recently enacted surface mine law that applies only to coal. The Department of Natural Resources has separated reclamation from forestry activities. A new Division of Reclamation takes over the administration of Ohio's surface coal mine law that was formerly handled by the Division of Forestry and Reclamation, which has been renamed the Division of Forestry and Preserves.

Amended House Bill 221, requiring that all fines imposed for Oil and Gas Law violations be credited to the Oil and Gas Well Plugging Fund, and permitting the fund to be used for plugging abandoned wells, was passed and became effective November 21, 1973.

Amended substitute Senate Bill 54, allowing a strip mine operator to satisfy the surety requirements for a strip mine license by depositing building and loan association certificates of deposit, was passed and became effective September 28, 1973.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—Production and value of abrasive stone (grindstone) were above that of 1972. Output was from one operation in Lorain County as a byproduct of sandstone quarrying at Amherst.

Cement.—Portland cement was produced at eight plants of which five also produced masonry cement. Shipments of portland and masonry cement were 16.4 and 9.5%, respectively, above those of the previous year. Average value per ton of portland cement increased from $19.52 to $21.22;

average value of masonry cement increased from $29.09 per ton to $32.05. Consumption of cement in the State totaled 3.8 million tons of portland cement and 0.2 million tons of masonry cement. Raw materials used in making portland cement included limestone and cement rock, slag, clay and shale, sand, gypsum, and iron-bearing materials. Yearend stocks of portland cement were 141,000 tons below those of the previous year, and stocks of masonry cement were 7,201 tons less than those of the previous year.

Portland cement shipments by type of customer were as follows: Ready-mix concrete, 2.2 million tons; concrete product manufacturers, 0.6 million tons; building materials, 0.2 million tons; and contractors and other users, 0.5 million tons. Approximately 2.7 million tons was shipped by truck, and 0.2 million tons, by rail. Most of the cement was delivered in bulk form; only 4% of the portland cement was shipped in containers.

Table 4.—Ohio: Portland cement statistics

	1972	1973
Number of active plants	8	8
Production short tons	2,885,182	3,117,065
Shipments from mills:		
Quantity short tons	2,968,081	3,456,120
Value	$57,953,227	$73,361,539
Stocks at mills, Dec. 31, short tons	355,604	215,371

Clays.—Production of clays (common clay-shale, and fire clay) was 16% above that of 1972. Clay used in refractories totaled 1,095,474 tons compared with 803,493 tons in 1972. Of the total clay produced in the State, 77% was common clay and shale used chiefly in making heavy clay products, and 23% was fire clay used chiefly for refractory products. Clay output for use in manufacturing heavy clay products (mainly building brick) was 22% above that of the previous year. Clay output for refractories was 36% above the 803,493 tons produced in 1972, and most of the clay was used in firebrick, block, and shapes. Of the 34 counties producing common clay and shale, Tuscarawas, Cuyahoga, Stark, Greene, and Hocking were the leading areas, accounting for 61% of the common clay and shale tonnage. Among the 11 counties producing fire clay, Jefferson, Columbiana, and Tuscarawas led in production and accounted for 68% of the fire clay tonnage.

The average value for clays sold in 1973 was 10 cents per ton below that of 1972. Average unit value per ton of various types of clays was: Common clay and shale, $1.69, and fire clay, $5.77.

Gem Stones.—Gem and mineral specimen collectors, mostly members of mineral and lapidary clubs, were active at mines and quarries throughout the State. Value of materials collected remained the same as that of 1972. Specimens collected included calcite, celestite, flint, and jasper. Flint, the State's official gem stone, was recovered chiefly at Flint Ridge in southeastern Licking County and the adjacent area of Muskingum County.

Graphite (Synthetic).—The Ohio Carbon Co. at Cleveland produced synthetic graphite from petroleum coke. Output was shaped for use in electrical motor brushes, hermetic sealings, and pitch coke.

Gypsum.—United States Gypsum Co. and the Celotex Corp. mined gypsum in Ottawa County. Output decreased 6%. Celotex, United States Gypsum, and National Gypsum Co. calcined gypsum in Lorain and Ottawa Counties. Output was 434,000 tons, about the same as in 1972.

Lime.—Eighteen companies produced lime at 19 plants in 12 counties. Leading counties were Sandusky, Lake, Lorain, and Seneca. Leading producers were Diamond Shamrock Chemical Co., United States Steel Corp., Martin-Marietta Chemicals, Basic Inc., and Pfizer Inc. Output decreased to 4,389,000 tons, 1% below the 1972 record. Among the States, Ohio ranked first in lime production. The lime was used for BOF steel furnaces, refractory dolomite, alkalies, glass, and other uses. The lime was used in Ohio, Pennsylvania, Michigan, West Virginia and other States, and Canada, and other countries. Lime consumption in Ohio was 3,425,000 tons.

Table 5.—Ohio: Lime sold or used by producers, by use
(Short tons)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Steel, BOF	1,647,000	$26,860,000	1,935,000	$31,870,000
Refractory dolomite	645,100	12,290,000	803,600	15,750,000
Glass	361,700	5,899,000	345,200	5,685,000
Steel, open-hearth	100,100	1,633,000	130,500	2,149,000
Finishing lime	118,200	3,080,000	101,600	2,903,000
Steel, electric	103,900	1,695,000	81,020	1,334,000
Masons lime	49,230	1,280,000	63,530	1,815,000
Water purification	77,290	1,261,000	50,990	839,800
Agriculture	11,190	293,500	13,550	335,600
Sewage treatment	14,270	232,700	12,830	211,300
Other uses[1]	1,285,000	21,050,000	851,700	14,140,000
Total[2]	4,413,000	75,569,000	4,389,000	77,028,000

[1] Includes alkalies, magnesite, calcium carbide, soil stabilization, sugar refining, fertilizer, other metallurgical uses, whiting, rubber, and other uses.
[2] Data may not add to totals shown because of independent rounding.

Perlite (Expanded).—Crude perlite shipped from Western States was processed and expanded at four plants located in Cuyahoga, Hamilton, Lorain, and Ottawa Counties. The quantity of expanded perlite sold or used in 1973 decreased by 5%. Most of the expanded material was processed for plaster aggregate, industrial aggregate, and formed products.

Salt.—Ohio continued as a leading salt producing state, ranking fifth in national output. Salt sold or used was about 1.5 million tons below that of the previous year, and its value decreased about $6 million to $41.6 million. United States production of salt in the form of brine, evaporated brine, and rock, sold or used by producers, totaled 43.9 million tons, 1.1 million tons less than in 1972. Rock salt recovered from underground mines in Cuyahoga and Lake Counties was sold mainly for highway ice control and chemical applications. Evaporated salt produced in Cuyahoga, Meigs, Summit, and Wayne Counties was sold for a wide variety of uses; some was marketed as pressed block. Evaporated salt producers used both the vacuum and the open-pan processes for recovering the salt. Lake County with two operations continued to rank first in output.

Sand and Gravel.—Sand and gravel production increased 13% above that of 1972. Value was 16% higher and totaled almost $70 million. Output was 5.5 million tons more than that of 1972. The increase was attributed mainly to higher demand for building and paving materials. Commercial sand and gravel used in building and highway construction totaled 41.8 million tons, almost 3.3 million tons more than in 1972. Production and value of industrial sand was equal to 579,000 tons valued at approximately $2.6 million. Most of the industrial sand was marketed for molding, furnace construction, and repair.

Sand and gravel was produced in 66 counties. Franklin, Hamilton, Butler, Portage, Montgomery, and Warren Counties, each with output in excess of 2 million tons, were the leading areas. In addition, seven other counties had production exceeding 1 million tons. Commercial producers processed 91% of the total tonnage by washing, screening, sizing, or crushing. Over 47.3 million tons of sand and gravel was shipped to consumers by truck, and the remainder, by rail or water. The number of commercial operations totaled 365.

Table 6.—Ohio: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	7,158	9,519	7,660	10,393
Fill	1,563	1,178	1,870	1,610
Molding	171	566	225	1,378
Paving	8,765	11,080	9,785	13,074
Other uses [1]	393	981	881	1,972
Total [2]	18,050	23,323	20,421	28,426
Gravel:				
Building	8,406	12,302	9,377	14,446
Fill	1,743	1,629	2,561	2,174
Paving	14,094	20,801	14,951	22,578
Miscellaneous	728	1,323	1,029	1,555
Other uses [3]	255	325	409	553
Total [2]	25,226	36,379	28,327	41,307
Government-and-contractor operations:				
Sand:				
Building	9	13	9	14
Paving	92	101	95	107
Total [2]	100	114	105	121
Gravel:				
Fill	10	10	9	14
Paving	119	106	125	115
Total [2]	129	116	134	128
Total sand and gravel [2]	43,506	59,932	48,987	69,982

[1] Includes railroad ballast, blast, engine, filtration, fire or furnace, oil (hydrofrac) 1973, foundry, glass (1973), and some unground sand.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast.

Table 7.—Ohio: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Ashtabula	5	91	151	7	103	171
Auglaize	3	W	W	5	400	583
Butler	17	3,313	3,957	14	4,076	4,787
Champaign	4	217	301	3	W	W
Clark	9	1,427	1,649	9	1,262	1,579
Clinton	1	30	30	1	24	38
Coshocton	7	471	611	7	565	739
Crawford	1	W	W	1	32	W
Cuyahoga	2	151	W	2	183	168
Delaware	1	90	132	—	—	—
Erie	6	104	W	7	199	W
Fairfield	4	575	W	4	413	650
Franklin	15	5,546	8,370	15	5,311	7,941
Gallia	3	W	277	4	W	298
Geauga	6	643	1,199	5	718	1,632
Greene	11	1,362	1,624	11	1,436	1,784
Hamilton	15	4,472	6,202	16	5,044	7,170
Knox	5	725	896	5	857	1,190
Lake	4	W	W	4	203	W
Lawrence	3	223	283	3	W	357
Licking	9	1,017	1,178	8	1,220	1,399
Logan	4	146	206	6	227	318
Lorain	2	W	W	3	341	411
Lucas	5	686	801	6	926	949
Madison	4	216	276	5	202	273
Marion	3	167	W	4	217	W
Medina	5	W	W	6	684	989

See footnotes at end of table.

Table 7.—Ohio: Sand and gravel sold or used by producers, by county—Continued
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Miami	7	754	941	8	1,066	1,329
Montgomery	16	2,752	3,659	14	2,825	3,893
Morgan	1	W	W	1	271	W
Morrow	1	W	100	1	W	98
Portage	20	2,563	4,139	23	3,294	5,419
Richland	7	768	954	7	846	1,241
Ross	4	689	918	6	753	923
Scioto	4	120	166	4	W	W
Shelby	6	342	332	6	262	204
Stark	12	1,186	2,055	15	1,743	3,005
Summit	14	647	861	18	1,132	1,762
Trumbull	2	214	W	2	W	W
Tuscarawas	8	1,121	1,671	8	1,360	2,103
Warren	9	1,688	2,306	13	2,223	3,074
Washington	6	378	498	6	451	646
Wayne	4	660	932	4	669	965
Wyandot	5	262	287	5	378	494
Undistributed [1]	r 62	7,690	11,972	63	7,074	11,397
Total [2]	342	43,506	59,932	365	48,987	69,982

r Revised. W Withheld to avoid disclosing individual company confidential data; included in "Undistributed."

[1] Includes Allen, Ashland, Athens, Belmont (1973), Brown, Carroll, Clermont, Columbiana, Darke, Defiance, Henry, Hocking, Holmes, Huron, Mahoning, Meigs, Monroe, Muskingum, Pickaway, Pike, Preble, Putnam, Sandusky (1972), Union (1972), and Williams Counties, and other sand and gravel that cannot be assigned to any specific county.

[2] Data may not add to totals shown because of independent rounding.

Slag (Iron-Blast-Furnace).—Production of iron-blast-furnace slag was 6.9 million tons valued at $14.8 million, according to the National Slag Association. Output was 31% above that of 1972; average unit price decreased from $2.24 to $2.15 per ton, 3 cents below the national average of $2.18. Seventy-nine percent of the total processed slag was screened air-cooled material; the remainder consisted of granulated and lightweight (expanded) slag. The air-cooled slag was used chiefly as aggregate for concrete and bituminous construction, highway and airport construction, and as railroad ballast. Most of the granulated slag was used in highway construction. The chief use for expanded slag was as an aggregate in concrete blocks and lightweight concrete. The State continued to rank second in production of processed slag, accounting for 23% of the national output.

Stone.—Output of stone increased for the second consecutive year, reflecting the continuing high level of activity in all phases of highway and building construction. Greater demand for crushed limestone (including dolomite) used as aggregate was the major contributing factor for the increase. Production of crushed limestone was 11.6% above that of 1972 and accounted for most of the State's total stone output. Production and value of dimension limestone increased over that of 1972. Output was used mainly as rubble, and some was sold as dressed architectural stone. Output was from quarries in Miami and Seneca Counties. Of the 60 limestone-producing counties, Sandusky County continued as the leading area with output of about 5 million tons. Wyandot, Mahoning, Ottawa, Erie, Lucas, and Franklin Counties also were important limestone-producing areas.

Dimension sandstone production and value increased, although there was a lower average unit value in 1973. Output was 106,000 tons valued at nearly $3.0 million compared with 87,000 tons and $2.8 million in 1972. Most of the sandstone was used in the form of rubble, rough blocks, and sawed stone. Crushed and broken sandstone (including quartzite) production totaled 1,149,000 tons valued at $3.6 million, an increase of 24% and 33% in production and value, respectively. The stone was marketed mainly for aggregate, riprap-jetty, flux stone, and glass manufacturing. Sandstone was quarried in 17 counties; Lorain, Scioto, and Coshocton Counties were the leading areas for dimension stone, and Geauga, Huron, and Summit Counties, for crushed and broken stone.

Table 8.—Crushed and broken limestone and dolomite sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	2,804	5,454	3,666	6,194
Concrete aggregate	6,520	10,427	8,336	13,589
Dense graded road base stone	4,499	7,048	7,502	12,514
Macadam aggregate	6,811	11,049	8,000	13,053
Surface treatment aggregate	1,582	2,701	2,441	4,546
Unspecified construction aggregate and roadstone	6,653	12,332	4,091	6,751
Agricultural purposes [1]	1,461	2,836	1,429	2,680
Cement manufacture	4,857	7,586	4,878	8,321
Lime manufacture	2,650	5,757	2,250	4,290
Manufactured fine aggregate (stone sand)	204	283	281	420
Dead-burned dolomite	1,303	2,313	2,513	4,213
Flux stone	3,640	5,925	3,387	5,784
Railroad ballast	973	1,435	1,191	1,643
Riprap and jetty stone	501	920	1,464	2,953
Other uses [2]	3,026	9,150	2,529	7,416
Total [3]	47,484	85,216	53,957	94,368

[1] Data include agricultural limestone and poultry grit and mineral food.
[2] Includes chemical and refractory stone, asphalt and other fillers, glass manufacture, building products, filter stone, mine dusting, whiting, acid neutralization (1973), terrazzo and exposed aggregate, fill, and uses not specified.
[3] Data may not add to totals shown because of independent rounding.

Sulfur (Recovered Elemental).—Production and sales of elemental sulfur recovered at the Toledo refinery of Sun Oil Co. and the Canton refinery of Ashland Oil and Refinery Co., were greater than that reported in 1972. The companies recovered sulfur by the catalytic oxidation of hydrogen sulfide.

Vermiculite (Exfoliated).—The Cleveland Gypsum Co., division of Cleveland Builders Supply Co., processed crude vermiculite shipped from out-of-State at its Cleveland plant. Production and sales were equal to those of 1972. The exfoliated vermiculite was used for fertilizer carrier, soil conditioning, and other applications.

MINERAL FUELS

Coal (Bituminous).—Output of bituminous coal was 5.2 million tons below that of the previous year; value increased about $35 million, to $338.8 million. In terms of value, bituminous coal continued to be the State's principal mineral commodity. Strip mines supplied 62% of the total tonnage; underground mines supplied 35%, and auger mines supplied 2%. A total of 235 mines producing 1,000 tons or more were active, 71 less than in 1972. Underground mines active in the State decreased by 7 to a total of 28; strip mines decreased by 60, and auger mines declined by 4.

Strip-mined tonnage was 5.5 million tons below that of 1972 and totaled 28.5 million tons valued at $195 million. Average value per ton of strip-mined coal increased from $5.29 in 1972 to $6.82. Belmont County was the leading area in tonnage and accounted for 8.9 million tons, followed by Jefferson, Harrison, and Muskingum Counties with 3.7 million, 3.5 million, and 3.0 million tons, respectively. Coshocton and Tuscarawas Counties, each with production exceeding 1.4 million tons, also were leading producing areas.

Seventeen coal-cleaning and preparation plants were active, four less than in 1972. Of the total tonnage cleaned, 70% was from underground mines, and 30% was from strip mines. Over 1 million tons of coal was dried after cleaning at four preparation plants. At mines having crushing and treatment facilities, 28 million tons of coal was crushed. Production at captive mines totaled 4,979,000 tons compared with 843,000 tons in 1972. Of the State's total coal output, 28.8 million tons were shipped by rail or water, 11.5 million tons, by truck, and the rest was consumed locally.

The State's bituminous coal-mine fatal injury rate of 0.09 per million short tons was one of the lowest in the Nation and was well below the national average of 0.26. Work fatalities totaled 4, and nonfatal injuries totaled 653. Of the four fatalities that occurred during the year, two were at underground mines and two were at strip mines. The underground fatalities were the result of haulage and roof fall accidents. The strip mine fatalities were the result of machinery and off mine property accidents.

Table 9.—Ohio: Bituminous coal production in Ohio, by type of mine and county, 1973
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total [1]	
Belmont	7	28	5	40	7,134	8,903	301	16,338	$125,642
Carroll	--	4	1	5	--	245	19	265	1,853
Columbiana	3	17	5	25	34	746	72	852	5,034
Coshocton	1	9	1	11	774	1,693	68	2,535	21,437
Gallia	--	2	1	3	--	18	6	24	123
Guernsey	--	3	--	3	--	368	--	368	2,497
Harrison	4	11	1	16	3,744	3,460	113	7,316	57,117
Hocking	--	6	--	6	--	247	--	247	1,303
Holmes	--	7	1	8	--	622	14	636	3,768
Jackson	5	5	1	11	241	748	10	999	5,111
Jefferson	3	27	10	40	881	3,661	271	4,813	32,185
Lawrence	--	1	--	1	--	22	--	22	W
Mahoning	--	6	--	6	--	398	--	398	2,367
Meigs	2	--	--	2	358	--	--	358	W
Monroe	1	--	--	1	882	--	--	882	W
Morgan	--	1	--	1	--	757	--	757	W
Muskingum	1	8	2	11	38	3,010	91	3,139	24,269
Noble	--	2	--	2	--	677	--	677	W
Perry	1	5	--	6	2,141	535	--	2,677	18,843
Stark	--	7	--	7	--	331	--	331	2,282
Tuscarawas	--	19	3	22	--	1,469	67	1,536	10,114
Vinton	--	7	--	7	--	569	--	569	3,322
Wayne	--	1	--	1	--	47	--	47	W
Undistributed	--	--	--	--	--	--	--	--	21,525
Total [1]	28	176	31	235	16,225	28,527	1,031	45,783	338,792

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Data may not add to totals shown because of independent rounding.

Coke and Coal Chemicals.—Production of oven coke in Ohio was 5.6% above that of 1972 and totaled 9.4 million tons valued at $348 million.

Peat.—Shipments of peat remained the same as that of 1972, while the value of peat sold in 1973 was 5% below that of 1972. Output was from seven counties; Richland County with one operation ranked first in tonnage. Of the total sales, 57% was humus, 33% was moss peat, and 10% was reed-sedge peat. Approximately 84% of the peat was sold in bulk for general soil improvement. The rest was sold for a variety of uses; the most important was as an ingredient for potting soils.

Petroleum and Natural Gas.—Production of petroleum was 7% less than that of 1972, while production of natural gas increased 4%. However, total well completions and footage drilled increased from 1,331 to 1,504 wells and 5,301,296 to 6,316,648 feet, respectively, according to the American Petroleum Institute. A total of 1,444 development and 60 wildcat completions were reported. Development wells were drilled in 38 counties; Tuscarawas, Muskingum, Guernsey, and Stark were the leading areas. Wildcat completions were reported in 26 counties. The leading area for wildcat activity was Trumbull County.

Reserves on December 31, 1972, were 1,146,677 million cubic feet of natural gas (14.73 pounds per square inch absolute, at 60° F) and 127.4 million barrels of crude petroleum, according to the American Gas Association and the American Petroleum Institute. Compared with those at the end of 1973, reserves of natural gas increased by 32,714 million cubic feet, and reserves of crude petroleum were reduced 2.5 million barrels. Of the natural gas reserves, 370,748 million cubic feet was held in underground storage.

The total crude capacity of the refineries as of January 1, 1973, was 537,300 barrels per calendar day, 11,400 barrels more than in 1972. Cracking, reforming, coking, and alkylation operating capacity expressed in terms of gasoline production, totaled 292,090 barrels per calendar day compared with 285,090 barrels the previous year. Other products recovered at the refineries included asphalt, coke, lubricant, and paraffin. Refineries were operated at Canton, Findlay, Cleaves, Lima, and Toledo.

Table 10.—Ohio: Oil and gas well drilling in 1973, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Adams	--	--	--	--	--	2	2	769
Ashland	2	--	2	--	--	--	4	2,124
Ashtabula	3	37	7	--	--	2	49	169,081
Athens	2	5	1	--	--	1	9	22,372
Auglaize	--	1	--	--	--	--	1	1,450
Carroll	66	--	1	--	--	--	67	363,842
Champaign	--	--	--	--	--	1	1	2,000
Columbiana	--	18	--	--	4	--	22	124,794
Coshocton	23	32	8	--	--	2	65	214,754
Defiance	--	--	--	--	--	1	1	2,612
Erie	--	--	--	--	--	1	1	1,598
Fairfield	4	2	--	--	--	--	6	15,515
Gallia	--	1	--	--	--	--	1	1,641
Geauga	1	17	--	--	--	--	18	74,411
Guernsey	28	57	5	--	2	--	92	456,079
Harrison	--	5	1	--	--	--	6	30,855
Hocking	37	7	6	--	--	--	50	145,279
Holmes	8	63	5	--	--	--	76	305,674
Jackson	--	5	--	--	1	--	6	6,189
Knox	11	5	3	--	--	--	19	52,883
Lake	--	1	--	--	--	--	1	3,040
Licking	18	6	1	--	--	--	25	66,676
Logan	--	--	--	--	--	1	1	2,914
Mahoning	2	22	1	--	5	1	31	155,884
Marion	--	1	1	--	--	--	2	4,756
Medina	1	10	4	--	3	2	20	70,317
Meigs	1	17	1	--	--	--	19	56,296
Mercer	--	--	2	--	--	--	2	2,499
Monroe	4	4	--	--	--	--	8	10,718
Morgan	4	36	10	--	--	3	53	201,928
Morrow	--	--	11	--	--	--	11	31,781
Muskingum	37	174	26	--	--	--	237	1,006,214
Noble	--	58	9	--	1	--	68	387,816
Perry	41	28	12	--	--	1	82	268,321
Pickaway	--	--	1	--	--	--	1	3,043
Pike	--	--	--	--	--	1	1	824
Portage	1	2	--	--	2	--	5	21,984
Richland	3	2	2	--	--	2	9	28,410
Scioto	--	7	--	--	--	--	7	5,457
Stark	49	32	3	--	2	--	86	403,180
Summit	--	--	--	--	--	2	2	7,930
Trumbull	--	29	1	--	9	2	41	189,833
Tuscarawas	33	199	7	--	2	1	242	1,222,061
Vinton	1	--	3	--	2	--	4	7,698
Washington	--	14	4	--	--	1	19	46,725
Wayne	13	12	4	--	--	1	30	116,126
Wyandot	--	--	--	--	--	1	1	295
Total	393	909	142	--	31	29	1,504	6,316,648

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

METALS

Aluminum.—Output and value of primary aluminum produced at the Hannibal reduction plant of Ormet Corp. were greater than that of 1972. A higher average value per ton was also reported. Ormet Corp., jointly owned by Olin Corp. (formerly Olin-Mathieson Chemical Corp.) and Revere Copper and Brass, Inc., reduced alumina obtained by barge from a company-owned plant at Burnside, La.

Beryllium.—Brush Wellman, Inc., expanded its facility at Elmore, Ohio, to provide additional furnace and casting capacity and was in the process of constructing a building to house a new rolling mill for beryllium-copper and phosphor-bronze alloys. Beryllium metal, alloys, and compounds were produced at the Elmore plant from beryllium hydroxide received from company operated facilities located in Delta, Utah.

Ferroalloys.—Ohio continued as the leading producer among 16 ferroalloy-producing States. Shipments were 23% above those of the previous year, and production consisted mainly of ferroalloys of boron, chromium, columbium, manganese, silicon, and silvery pig iron.

Iron and Steel.—Steel production at Ohio plants was 26.5 million short tons, 11.1%

above that of 1972, according to the American Iron and Steel Institute. Production of pig iron was 18.4 million tons, 2.0 million tons above that of 1972. Pig iron shipments increased and totaled 18.5 million tons valued at $1.5 billion. Of the 42 blast furnaces in the State, 31 were active and 11 were idle. Ohio plants received 4.9 million tons of domestic iron ore and 3.7 million tons of imported iron ore. Iron ore receipts were 1.7 million tons more than those of 1972. Receipts of agglomerates increased by 2.6 million tons and totaled 19.2 million tons. Of the agglomerated material, 17.7 million tons was domestic regular iron ore pellets.

Blast furnaces consumed 4.2 million tons of domestic and 1.8 million tons of foreign iron ore as well as 1.9 million tons of agglomerates. In addition, 2.4 million tons of limestone and 1.4 million tons of dolomite were consumed as fluxing material. Tonnages of other materials consumed included coke and coke breeze, 11.8 million; home and purchased scrap, 747,000; slag scrap, 251,000; mill cinder and roll scale, 818,000; open-hearth, basic oxygen, and Bessemer slag, 779,000; and flue dust, 12,000. Approximately 4 million tons of slag and 196,000 tons of scrap iron were produced at blast furnaces, and 668,000 tons of flue dust was recovered. Blast furnaces consumed substantial quantities of supplemental fuels including natural gas, bunker oil, and fuel tar.

Titanium.—The RMI Co. produced titanium sponge metal by sodium reduction of titanium tetrachloride at its Ashtabula plant, and the Sherwin-Williams Co. continued to produce titanium pigments (titanium dioxide) used in manufacturing paint.

Zirconium.—Foote Mineral Co. processed zircon at its Cambridge plant to produce magnesium-zirconium alloys called "Grainals." Harshaw Chemical Co., Inc., recovered zirconium oxide at its Cleveland plant for use as ceramic-base colors. Ohio Ferro-Alloys Corp. produced zirconium-silicon alloys at Brilliant. Zirconium Corp. of America produced zirconium oxide as well as zirconia refractories at its Cleveland plant. The Chas. Taylor Sons Co. of Cincinnati produced zircon refractories. Continental Minerals Processing Corp. milled zircon at Sharonville for use by the iron and steel foundries and the ceramic industry. TRW Inc. and Sherwood Refractories Co. produce zircon cores and molds for the investment casting of high-temperature alloys. TRW Inc. also produced zircon concentrates for sand blasting molds.

Table 11.—Principal producers

Commodity and company	Address	Type of activity	County
Abrasives: Metallic:			
Cleveland Metal Abrasive Co., division of Fanner Manufacturing Co.	Brookside Park Cleveland, Ohio 44109	2 plants	Cuyahoga, Lucas.
Globe Steel Abrasives Co	P.O. Box 1247, P.O. Annex Mansfield, Ohio 44903	Plant	Richland.
Metal Blast, Inc	871 East 67th St. Cleveland, Ohio 44103	do	Cuyahoga.
National Metal Abrasive Co	3560 Norton Rd. Cleveland, Ohio 44111	do	Do.
Steel Abrasives, Inc	Hamilton, Ohio 45010	do	Butler.
Cement:			
Columbia Cement Co., subsidiary of Filtrol Corp.[1]	P.O. Box 31 Barberton, Ohio 44203	do	Summit.
Diamond-Kosmos Div., Flintkote Co.	Middle Branch, Ohio 44652	do	Stark.
Peninsular Div. General Portland Cement Co.[2]	709 Clay St. Ft. Wayne, Ind. 46802	do	Paulding.
Marquette Cement Manufacturing Co.[3]	20 North Wacker Dr. Chicago, Ill. 60606	do	Lawrence.
Medusa Cement Co., division of Medusa Corp.[4]	P.O. Box 5668 Cleveland, Ohio 44101	do	Lucas.
Southwestern Portland Cement Co.[2]	P.O. Box 191 Fairborn, Ohio 45324	do	Greene.
Universal Atlas Cement Div.,[2] U.S. Steel Corp.	600 Grant St. Pittsburgh, Pa. 15230	do	Do.

See footnotes at end of table.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clays:			
Fire clay:			
Cedar Heights Clay Co	P.O. Box 368 Oak Hill, Ohio 45656	4 pits	Jackson.
H. K. Porter Co., Inc	Porter Bldg. Pittsburgh, Pa. 15219	2 underground mines.	Columbiana and Jefferson.
Common clay and shale:			
Belden Brick Co.[5]	P.O. Box 910 Canton, Ohio 44701	7 pits	Holmes and Tuscarawas.
Bessmer Cement Co	510 Hanna Bldg. Cleveland, Ohio 44115	Pit	Mahoning.
General Portland Inc	709 Clay St. Fort Wayne, Ind. 46802	Pit	Paulding.
Hydraulic Press Brick Co.	705 Olive St. St. Louis, Mo. 63101	Pit	Cuyahoga.
Medusa Corp	P.O. Box 5668 Cleveland, Ohio 44101	Pit	Lucas.
Zoar Mining Co	Box 550 Zoar, Ohio 44697	Pit	Stark.
Coal (bituminous):			
Central Ohio Coal Co	Box 18, Bowling Green Station New York, N.Y. 10004	Strip	Morgan and Muskingum.
Cravat Coal Co	Box 157 Holloway, Ohio 43985	3 strip mines	Belmont and Harrison.
Hanna Coal Co., division of Consolidation Coal Co.	Cadiz, Ohio 43907	5 strip mines	Belmont, Jefferson, Harrison.
Do		Auger	Belmont, Jefferson, Harrison.
Do		Underground	Harrison.
Hardy Coal	Berlin, Ohio 44610	4 strip mines	Coshocton, Holmes, Tuscarawas.
North American Coal Corp	12800 Shaker Blvd. Cleveland, Ohio 44120	3 underground mines.	Belmont and Jefferson.
Do[6]		do	Monroe and Belmont.
Ohio River Collieries Co	Route 1 Bloomingdale, Ohio 43910	Strip	Belmont.
Do		Auger	Do.
Peabody Coal Co	301 North Memorial Dr. St. Louis, Mo. 63102	2 strip mines	Coshocton and Perry.
Do		Underground	Perry.
R. & F. Coal Co	Box 218, Cadiz, Ohio 43907	5 strip mines	Belmont, Harrison, Noble.
Simco-Peabody Coal Co	301 North Memorial Dr. St. Louis, Mo. 63102	do	Coshocton.
Do		Underground	Do.
Youghiogheny & Ohio Coal Co.	4614 Prospect Ave. Cleveland, Ohio 44103	3 underground mines.	Belmont and Harrison.
Ferroalloys:			
Foote Mineral Co	Route 100 Exton, Pa. 19341	2 plants	Guernsey and Jefferson.
Interlake Steel Corp	13-5th & Perry Ave. Chicago, Ill. 60604	do	Washington.
Ohio Ferro-Alloys Corp	839 30th Northwest Canton, Ohio 44709	3 plants	Jefferson, Monroe, Muskingum.
Union Carbide Corp	P.O. Box 176 Marietta, Ohio 45750	2 plants	Ashtabula and Washington.
Graphite (synthetic):			
Ohio Carbon Co	12508 Berea Rd. Cleveland, Ohio 44111	do	Cuyahoga.
Gypsum:			
Crude:			
Celotex Corp.[7]	1500 North Dale Mabry Tampa, Fla. 33607	Pit	Ottawa.
United States Gypsum Co.[7]	101 South Wacker Dr. Chicago, Ill. 60606	Underground	Do.
Calcined: National Gypsum Co.	325 Delaware Ave. Buffalo, N.Y. 14202	Plant	Lorain.
Lime:			
Basic Inc	845 Hanna Bldg. Cleveland, Ohio 44115	do	Seneca.
Cuyahoga Lime Co	Menlo Park, N.J. 08817	do	Cuyahoga.
Diamond Shamrock Chemical Co., Unit of Diamond Shamrock Corp.	300 Union Commerce Bldg. Cleveland, Ohio 44115	do	Lake.

See footnotes at end of table.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Lime—Continued			
National Lime & Stone Co	First National Bank Bldg. Findlay, Ohio 45840	Plant	Wyandot.
Huron Lime Co	P.O. Box 428 Huron, Ohio 45840	do	Erie.
Ohio Lime Co	Woodville, Ohio 43469	do	Sandusky.
Pfizer, Inc	836 National Bank Bldg. Toledo, Ohio 43604	do	Do.
PPG Industries, Inc	Barberton, Ohio 44203	do	Summit.
Republic Steel Corp	Box 6778 Cleveland, Ohio 44101	do	Lake.
Martin-Marietta Chemicals	Executive Plaza II Hunt Valley, Md. 21030	do	Sandusky.
Union Carbide Corp., Chemicals & Plastics.	P.O. Box 299 Marietta, Ohio 45750	do	Ashtabula.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	do	Ottawa.
United States Steel Corp	600 Grant St. Pittsburgh, Pa. 15230	do	Lorain.
Peat:			
Lingvai Peat Co	Route 2, Box 82 Edgerton, Ohio 43517	Bog	Williams.
Dan E. Poljak	19675 Sheldon Rd. Cleveland, Ohio 44130	Bog	Cuyahoga.
Reynolds Farms, Inc	Route 1 Shelby, Ohio 44875	Bog	Richland.
Perlite (expanded):			
Celotex Corp	320 South Wayne Ave. Cincinnati, Ohio 45215	Plant	Hamilton.
Cleveland Gypsum Co., a division of Cleveland Builders Supply Co.[8]	2100 West Third St. Cleveland, Ohio 44113	do	Cuyahoga.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Lorain.
Petroleum refineries:			
Ashland Oil and Refining Co.	1409 Winchester Ave. Ashland, Ky. 41101	2 plants	Hancock and Stark.
Chevron Asphalt Co	555 Market St. San Francisco, Calif. 94105	Plant	Hamilton.
Gulf Oil Corp	Pittsburgh, Pa. 15219	2 plants	Hamilton and Lucas.
Standard Oil Co. of Ohio	Midland Bldg. Cleveland, Ohio 44115	do	Allen and Lucas.
Sun Oil Co[9]	1608 Walnut St. Philadelphia, Pa. 19103	Plant	Lucas.
Salt:			
Brine:			
Diamond Shamrock Chemical Co., unit of Diamond Shamrock Corp.	300 Union Commerce Bldg. Cleveland, Ohio 44115	Well	Lake.
PPG Industries, Inc.[10]	P.O. Box 31 Barberton, Ohio 44203	do	Summit.
Evaporated:			
Diamond Crystal Salt Co.[11]	916 South Riverside St. Clair, Mich. 48079	do	Do.
Excelsior Salt Works, Inc.	P.O. Box 267 Pomeroy, Ohio 45769	do	Meigs.
Morton Salt Co., a division of Morton International, Inc.	110 North Wacker Dr. Chicago, Ill. 60606	do	Wayne.
Rock:			
International Salt Co.[10]	Clarks Summit, Pa. 18411	Underground	Cuyahoga.
Morton Salt Co., a division of Morton International, Inc.	110 North Wacker Dr. Chicago, Ill. 60606	do	Lake.
Sand and gravel:			
American Aggregates Corp	Garst Ave. at Ave. B Greenville, Ohio 45331	9 pits	Champaign, Clark, Darke, Franklin, Licking, Montgomery.
Do		Dredge	Clark.
American Materials Corp	P.O. Box 154 Hamilton, Ohio 45010	2 pits	Butler.
Do		Pit	Hamilton.
F. H. Brewer Co	P.O. Box 128 Lancaster, Ohio 43130	2 pits	Athens and Fairfield.

See footnotes at end of table.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel—Continued			
Hilltop Concrete Corp	Lane Ave. Cincinnati, Ohio 45214	2 pits	Greene and Montgomery.
Moraine Materials Co	2500 East River Rd. Dayton, Ohio 45409	do	Montgomery.
Morrow Gravel Co	3535 Round Bottom Rd. Cincinnati, Ohio 45244	Pit	Warren.
Muskingum River Gravel Co	Box 671 Zanesville, Ohio 43701	Plant	Muskingum.
Ohio Gravel Co., a division of Dravo Corp.	5253 Wooster Rd. Cincinnati, Ohio 45226	7 pits	Butler, Hamilton, Warren.
Standard Slag Co	1200 Stambaugh Bldg. Youngstown, Ohio 44501	3 pits	Pike and Scioto.
Tri-State Materials Corp	Box 1933 Parkersburgh, W. Va. 26100	Pit	Meigs.
Smelters:			
Aluminum: Ormet Corp		Plant	Monroe.
Titanium sponge: Reactive Metals, Inc.		do	Ashtabula.
Zinc: American Zinc Co		do	Franklin.
Stone:			
Dolomite (crushed and broken):			
Basic Inc	845 Hanna Bldg. Cleveland, Ohio 44115	Quarry	Seneca.
Standard Lime & Refractories Co., a division of Martin-Marietta Corp.	2000 First National Bank Bldg. Baltimore, Md. 21203	do	Sandusky.
Woodville Lime & Chemical Co.	Box 218 Woodville, Ohio 43316	do	Do.
Limestone (crushed and broken):			
American Aggregates Corp.	Garst Ave. at Ave B Greenville, Ohio 45331	4 quarries	Franklin.
Carbon Limestone Co	Lowellville, Ohio 44436	do	Mahoning.
Davon, Inc	Box 5765 Columbus, Ohio 43221	2 quarries	Adams, Highland.
France Stone Co	1800 Toledo Trust Bldg. Toledo, Ohio 43604	4 quarries	Lucas, Ottowa, Sandusky, Seneca, Wood.
Marble Cliff Quarries Co	2100 Tremont Center Columbus, Ohio 43221	3 quarries	Delaware, Franklin, Preble.
Maumee Stone Co	P.O. Box 369 Maumee, Ohio 43537	4 quarries	Lucas, Paulding, Wood.
National Lime & Stone Co.	First National Bank Bldg. Findlay, Ohio 45840	8 quarries	Allen, Auglaize, Crawford, Delaware, Hancock, Marion, Putnam, Wyandot.
PPG Industries, Inc	P.O. 31 Barberton, Ohio 44203	Quarry	Muskingum and Summit.
Sandusky Crushed Stone Co., Inc.	P.O. Box 527 Sandusky, Ohio 44870	do	Erie.
Standard Slag Co	1200 Stambaugh Bldg. Youngstown, Ohio 44501	2 quarries	Mahoning and Ottawa.
Limestone (dimension):			
Gregory Stone Co., Inc	1860 N. Gettysburg St. Ludlow Falls, Ohio 45339	do	Miami.
E. R. Lintner Co	Route 3, Flat Rock Rd. Bellevue, Ohio 44811	do	Seneca.
Quartzite (crushed):			
R. W. Sidley, Inc	R.F.D. 1 Thompson, Ohio 44086	do	Geauga.
Sandstone (crushed and broken):			
Cleveland Quarries Co	Amhurst, Ohio 44001	Quarries	Lorain.
Mesenburg Bros. Inc	Collins, Ohio 44826	Quarry	Huron.
PPG Industries, Inc	P.O. Box 31 Barberton, Ohio 44203	do	Summit.
Sandstone (dimension):			
Briar Hill Stone Co	Glenmont, Ohio 44628	10 quarries	Coshocton, Holmes, Knox.

See footnotes at end of table.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Cleveland Quarries Co [12]	Amherst, Ohio 44001	7 quarries	Lorain.
Waller Brothers Stone Co.	McDermott, Ohio 45652	3 quarries	Scioto.

[1] Also limestone.
[2] Also clay and limestone.
[3] Also clay and cement rock.
[4] Also sand, shale, and limestone.
[5] Also shale.
[6] One operation in two counties.
[7] Also calcined gypsum and expanded perlite.
[8] Also exfoliated vermiculite.
[9] Also byproduct sulfur.
[10] Also evaporated salt.
[11] Also brine.
[12] Also grindstones and crushed and broken sandstone.

The Mineral Industry of Oklahoma

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Oklahoma Geological Survey under a cooperative agreement for collecting information on all minerals except fuels.

By L. G. Southard,[1] K. S. Johnson,[2] and J. F. Roberts,[2]

Mineral value in Oklahoma reached a high of $1,323,625,000 a net gain of 9.3% over that of 1972. This was the seventh consecutive year in which value of minerals exceeded $1 billion. Fossil fuels, including helium, remained the State's dominant mineral product, accounting for 92.6% of all mineral output value. Natural gas declined in volume 2.0%, but value increased 13.4% compared with that of 1972. Natural gas liquids increased in quantity and value 4.8% and 44.7%, respectively. Coal decreased in both quantity and value; crude petroleum decreased in quantity but increased in value compared with that of the previous year. Helium decreased in quantity and value. Overall nonmetallic mineral output value increased 23.0%, and amounted to 7.2% of the State's total mineral value. Value of metals declined 19.8% and amounted to 0.2% of Oklahoma's total mineral value.

[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.
[2] Geologist, Oklahoma Geological Survey, Norman, Okla.

Table 1.—Mineral production in Oklahoma [1]

	1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays [2] thousand short tons	938	$1,398	1,298	$1,871
Coal (bituminous) do	2,624	19,112	2,183	16,779
Gypsum do	1,196	3,888	1,429	5,796
Helium:				
High purity million cubic feet	r 176	r 6,160	181	6,335
Crude do	163	1,956	115	1,380
Natural gas do	1,806,887	294,523	1,770,980	334,110
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels	14,559	42,709	14,674	49,070
LP gases do	27,148	57,011	29,044	95,264
Petroleum do	207,633	709,033	191,204	723,273
Pumice thousand short tons	W	W	1	W
Salt do	W	W	5	36
Sand and gravel do	7,901	11,138	12,154	14,941
Stone do	19,448	26,574	22,316	34,999
Zince (recoverable content of ores, etc.) short tons	W	W	--	--
Value of items that cannot be disclosed: Cement, clay (bentonite), copper, lime, silver, tripoli, and values indicatd by symbol W	XX	37,296	XX	39,772
Total	XX	r 1,210,798	XX	1,323,626
Total 1967 constant dollars	XX	999,029	XX	p 971,806

p Preliminary. r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed". XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes bentonite; included with "Value of items that cannot be disclosed".

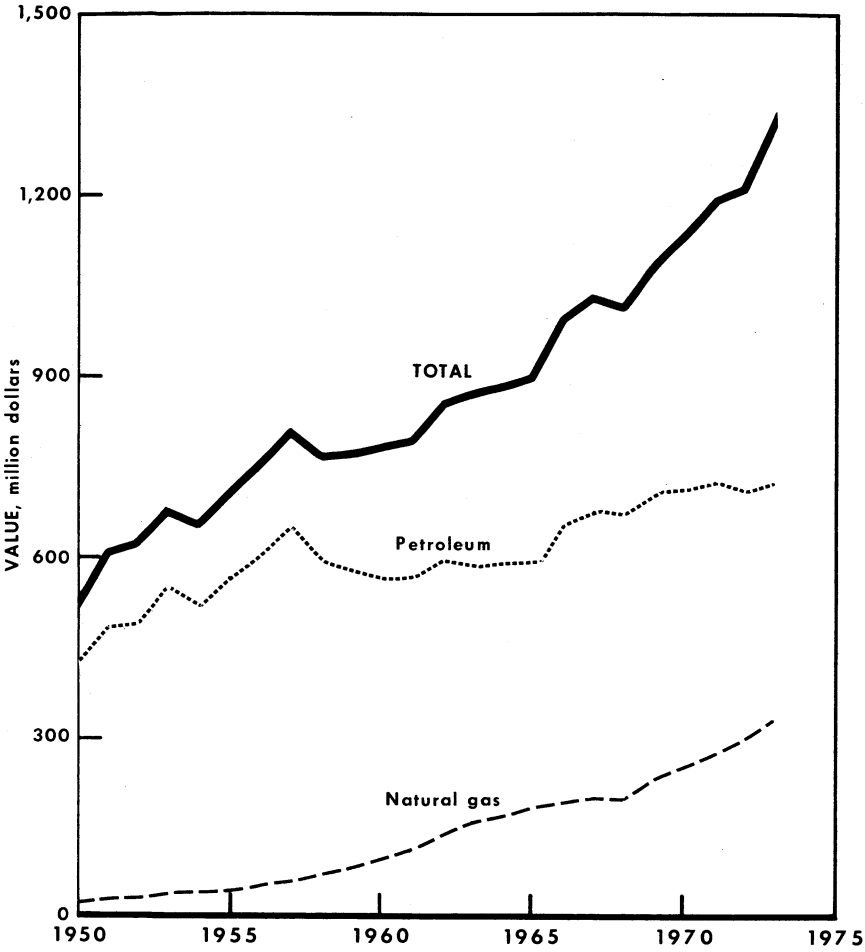

Figure 1.—Value of natural gas, petroleum, and total value of mineral production in Oklahoma.

Table 2.—Value of mineral production in Oklahoma, by county [1]

County	1972	1973	Minerals produced in 1973 in order of value
Adair	--	W	Sand and gravel.
Alfalfa	$8,127	$15,082	Petroleum, natural gas, natural gas liquids, sand and gravel.
Atoka	656	W	Stone, sand and gravel, petroleum.
Beaver	48,566	52,314	Natural gas, petroleum, natural gas liquids, pumice.
Beckham	7,395	9,922	Natural gas, natural gas liquids, petroleum.
Blaine	20,024	29,735	Natural gas, petroleum, natural gas liquids, gypsum, sand and gravel.
Bryan	2,195	2,231	Petroleum, natural gas, sand and gravel, stone.
Caddo	21,992	20,807	Petroleum, natural gas, gypsum, natural gas liquids, stone, sand and gravel.
Canadian	12,662	27,396	Natural gas, petroleum, natural gas liquids, sand and gravel, clays, gypsum,
Carter	85,059	99,353	Petroleum, natural gas liquids, natural gas, sand and gravel, stone.
Cherokee	W	W	Stone, sand and gravel.
Choctaw	35	195	Do.
Cimarron	r 18,385	16,724	Helium, natural gas, petroleum, natural gas liquids.
Cleveland	13,405	12,923	Petroleum, natural gas, natural gas liquids, sand and gravel.
Coal	1,941	2,361	Petroleum, natural gas, stone.
Comanche	4,586	5,388	Stone, gypsum, petroleum, natural gas.
Cotton	W	W	Petroleum, sand and gravel, natural gas.
Craig	W	4,927	Coal, stone, petroleum, natural gas.
Creek	31,138	33,848	Petroleum, stone, natural gas liquids, natural gas, clays.
Custer	5,876	6,880	Natural gas, natural gas liquids, petroleum, sand and gravel, clays.
Delaware	--	1	Sand and gravel.
Dewey	30,449	36,957	Natural gas, petroleum, natural gas liquids, clays.
Ellis	8,375	11,363	Natural gas, petroleum.
Garfield	28,565	30,364	Petroleum, natural gas liquids, natural gas, sand and gravel.
Garvin	77,218	79,875	Petroleum, natural gas liquids, natural gas.
Grady	61,006	49,078	Petroleum, natural gas, natural gas liquids, sand and gravel.
Grant	5,002	6,114	Petroleum, natural gas, natural gas liquids.
Greer	276	282	Stone, petroleum, clays, natural gas, sand and gravel.
Harman	--	10	Salt.
Harper	24,608	29,421	Natural gas, natural gas liquids, petroleum, sand and gravel.
Haskell	W	W	Natural gas, coal.
Hughes	4,676	4,195	Petroleum, natural gas, sand and gravel.
Jackson	3,835	3,795	Copper, gypsum, petroleum, sand and gravel, silver.
Jefferson	2,215	W	Petroleum, natural gas.
Johnston	W	W	Sand and gravel, stone.
Kay	15,243	20,189	Natural gas liquids, petroleum, sand and gravel, stone, natural gas.
Kingfisher	70,497	73,527	Petroleum, natural gas, natural gas liquids, sand and gravel.
Kiowa	1,411	1,858	Stone, petroleum, natural gas.
Latimer	16,326	W	Natural gas.
Le Flore	6,984	5,281	Natural gas, clays, sand and gravel.
Lincoln	9,013	9,139	Petroleum, natural gas, natural gas liquids.
Logan	7,066	6,978	Petroleum, natural gas, natural gas liquids, sand and gravel.
Love	7,014	6,940	Petroleum, natural gas, natural gas liquids.
McClain	22,991	22,178	Petroleum, natural gas, natural gas liquids, sand and gravel.
McCurtain	197	W	Sand and gravel, stone.
McIntosh	793	W	Natural gas, petroleum.
Major	44,285	51,490	Natural gas, petroleum, natural gas liquids, sand and gravel.
Marshall	5,919	5,671	Petroleum, natural gas liquids, natural gas, sand and gravel.
Mays	W	W	Cement, stone, clays, sand and gravel.
Murray	7,801	9,113	Stone, petroleum, sand and gravel, natural gas.
Muskogee	2,985	1,964	Petroleum, sand and gravel, coal, stone.
Noble	5,737	6,726	Petroleum, natural gas.
Nowata	1,822	1,469	Petroleum, stone, coal, natural gas.
Okfuskee	3,856	3,660	Petroleum, natural gas, natural gas liquids.
Oklahoma	23,253	29,366	Natural gas liquids, petroleum, sand and gravel, natural gas, clays.
Okmulgee	3,321	3,569	Petroleum, natural gas liquids, stone, natural gas.
Osage	43,845	41,260	Petroleum, stone, natural gas.
Ottawa	W	W	Stone, tripoli, sand and gravel.
Pawnee	5,072	5,196	Petroleum, stone, sand and gravel, natural gas.
Payne	8,761	10,402	Petroleum, stone, natural gas, sand and gravel.
Pittsburg	9,673	9,686	Natural gas, stone, sand and gravel.

See foonotes at end of table.

Table 2.—Value of mineral production in Oklahoma, by county [1]—Continued

County	1972	1973	Minerals produced in 1973 in order of value
Pontotoc	$29,335	$34,191	Petroleum, cement, stone, sand and gravel, clays, natural gas.
Pottawatomie	8,396	8,469	Petroleum natural gas.
Pushmataha	--	W	Sand and gravel, natural gas.
Roger Mills	2,193	3,260	Natural gas, petroleum.
Rogers	16,170	19,905	Cement, coal, stone, petroleum, clays, natural gas.
Seminole	29,917	30,553	Petroleum, natural gas liquids, stone, natural gas, clays.
Sequoyah	5,487	3,277	Lime, natural gas, stone, sand and gravel.
Stephens	99,665	109,123	Petroleum, natural gas liquids, natural gas.
Texas	90,565	97,224	Natural gas, petroleum, natural gas liquids, sand and gravel.
Tillman	W	875	Petroleum, sand and gravel.
Tulsa	10,067	11,909	Stone, petroleum, sand and gravel, clays, natural gas.
Wagoner	348	W	Petroleum, sand and gravel.
Washington	2,892	2,514	Petroleum, sand and gravel, stone, natural gas.
Washita	581	W	Natural gas, petroleum.
Woods	12,458	12,541	Natural gas, petroleum, salt.
Woodward	13,487	17,666	Natural gas, natural gas liquids, petroleum, sand and gravel.
Undistributed [2]	37,105	54,919	
Total [3]	r 1,210,798	1,323,626	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Petroleum is based on an average price per barrel for the state.
[2] Includes value of items that cannot be assigned to specific counties and values indicated by symbol W.
[3] Data may not add to totals shown because of independent roundings.

Table 3.—Indicators of Oklahoma business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total labor force ---------- thousands	1,074.1	1,111.2	+3.5
Unemployment ---------- do	48.7	47.1	−3.3
Employment:			
Construction ---------- do	41.1	45.0	+9.5
Manufacturing ---------- do	140.0	150.4	+7.4
Mining ---------- do	36.4	35.6	−2.2
Other [1] ---------- do	596.7	618.2	+3.6
Personal income:			
Total ---------- millions	$9,995	$11,156	+11.6
Per capita ----------	$3,795	$4,189	+10.4
Construction activity:			
Building permits:			
Number of new units authorized ----------	30,874	15,601	−49.5
Value of authorized nonresidential construction ---------- millions	$292.5	$287.3	−1.8
Cement shipments to and within Oklahoma thousand short tons	1,462	1,484	+1.5
Mineral production value ---------- millions	$1,210.8	$1,323.6	+9.3

p Preliminary.
[1] Includes services; wholesale and retail trade; finance, insurance and real estate; transportation and public utilities; and government.
Sources: Employment and Earnings; Construction Review; Survey of Current Business; and U.S. Bureau of Mines.

Employment and Wages.—The Oklahoma Employment Security Commission reported 35,600 persons employed in the mineral industry in 1973, compared with 37,300 persons in the previous year. The petroleum industry accounted for 94.4% of the State's mineral industry employment. Average total number of persons employed in other phases of the mineral industry amounted to 2,000.

Transportation.—In 1973, commerce on the McClellan-Kerr River Navigation System between Fort Smith, Arkansas, and the Port of Catoosa, Oklahoma, amounted to 851,875 tons compared with 1,115,871 tons in 1972, a decrease of 23.7%. Sand and gravel accounted for the largest tonnage, 206,900 tons, followed by coal, and iron and steel with 181,075 tons and 147,853 tons, respectively. Other products included

rock, sodium hydroxide, fertilizers, grain, petroleum, molasses, chemicals, paper, and other miscellaneous products.

Legislation and Government Programs.—The Oklahoma Advisory Council was established by the State Legislature to advise the Legislature and the Governor on the need for, nature of, and establishment of policy dealing with energy supplies and distribution within the State. Charged with considering the development of Oklahoma's energy resources, conservation of the State's resources, and maintenance and improvement of the environment, the council was also subsequently given the responsibility of establishing a Fuel Allocation Office for coordination of the Federal Mandatory Fuel Allocation Program.

The State of Oklahoma established the Oklahoma Environmental Finance Authority to issue bonds for financing construction of pollution control facilities required by law to reduce local air and water pollution. Sun Oil Company, the first recipient of aid, required between $8 and $9 million to install secondary waste water treatment at its Tulsa and Duncan refineries, a third-stage cyclone to reduce dust emission at the Tulsa catalytic cracker, and equipment to reduce sulfur emissions from burning refinery fuel gas at Duncan. Recipients of aid pay the interest and principal on the bonds to purchasing private investors.

The Federal Bureau of Mines Energy Research Center at Bartlesville conducted research in five categories: Petroleum production and environmental research; thermodynamics research; petroleum chemistry and refining research; and fuel combustion research.

Research on petroleum composition includes a project on the identification of oil spills. A data bank showing unique properties of crude oils that are shipped by tankers is being developed to provide information for identifying the sources of oil spills.

In research on re-refining waste lubricating oils, a solvent-extraction and distillation procedure was developed that removes contaminants from waste lubricating oils without adversely affecting the hydrocarbon composition of the oil.

The systematic scheme developed by the Bureau of Mines to separate heavy crude oil distillates into compound-type concentrates was applied to five crude oils from fields of international importance. Research was continued on spectral characterization of these concentrates to provide information needed for efficient processing of these low-grade distillates into quality fuels.

Oil shale research in 1973 included work on producing and evaluating fractures in oil shale, recovering shale oil by in situ retorting of a fractured shale bed, and evaluating effects of retorting variables on oil yield and quality.

Ninety-one additional crude oils from new domestic and foreign oilfields were analyzed to provide information on the quality of oils that are available to the Nation's refiners. Each year samples are obtained for analysis from oilfields that contain significant reserves. These analyses were added to the more than 8,000 analyses in a data bank.

Surveys were conducted and published showing the quality of summer and winter gasolines, diesel fuels, burner fuels, and aircraft fuels. These surveys provide information on the quality of available fuels so that consumer specifications can be tailored to assure quality fuels without restricting availability.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Oklahoma, like all States, experienced shortages of all types of hydrocarbon fuels that were under price control. Controls were lifted and crude oil prices rose in the latter part of the year, but oil operators were faced with the shortages of drilling rigs and other oil field supplies.

The number of oil and gas wells drilled in Oklahoma in 1973 decreased slightly from the number drilled in 1972. According to the American Petroleum Institute (API), 2,281 wells were drilled in 1973 compared with 2,300 wells drilled the previous year, a decrease of 1%. Total footage drilled amounted to 12,434,277 feet. Average footage per well was 5,451 feet compared with 5,347 feet in 1972.

Of the 2,281 wells drilled in Oklahoma, 898 were completed to produce oil, 539 to produce gas, and 844 wells or 37% were dry holes. Exploratory drilling accounted for a total of 352 wells, which resulted in 35 oil wells, 69 gas wells and 248 dry holes. Efforts to find new oil and gas deposits registered a success ratio of 29.5%.

Osage County again accounted for the most wells drilled with 178 followed by Kingfisher and Major Counties with 127 and 115, respectively.

Carbon Black.—Continental Oil Co., the only producer of carbon black in Oklahoma, continued production from liquid hydrocarbons at its Ponca City plant in Kay County. There was a slight decrease in quantity in 1973 compared with that of 1972, but value increased 12.3%. Carbon black is used by the rubber industry in the manufacture of tires, shoe soles and heels, gaskets, conveyer belts, and other products.

Coal.—Bituminous coal production amounted to 2,183,000 short tons in 1973 compared with 2,624,000 short tons in 1972. This was a 16.8% decrease below that produced in 1972.

Coal is found in an area of about 15,000 square miles of the eastern part of the State. Coalbeds that have been mined in the past ranged in thickness from 0.7 to 8 feet, whereas coalbeds mined in 1973 were 10 to 30 inches thick. Coal production was in five counties bordering or near the McClellan-Kerr Arkansas River Navigation System (Craig, Rogers, Muskogee, Haskell, and Nowata). Oklahoma no longer has any operating underground coal mines. The Howe Coal Co. permanently sealed its Bokoshe No. 1 mine in Le Flore County, and Kerr-McGee Corporation's Choctaw mine is still on standby.

The U.S. Geological Survey estimated remaining coal reserves in the State to be about 3.2 billion tons with additional resources in unmapped and unexplored areas estimated at 30 billion tons. This places Oklahoma 17th in the Nation in coal reserves.

Three coal companies terminated operations in Oklahoma in 1973. Howe Coal Co. and Western Continental, Inc., both ceased mining late in 1972 and then closed all other facilities in 1973. Ohio River Collieries closed its operation in 1973.

A 2-year feasibility study that began in 1971 to determine the practicality of using nuclear energy to convert low-grade Oklahoma coal to synthetic natural gas was favorable. The feasibility of the process was determined following completion of a contract study by Gulf General Atomic, Inc., San Diego, Calif., and Stone & Webster Engineering Corporation of Boston. The Office of Coal Research, U.S. Department of the Interior, announced that an agreement had been reached for a final engineering evaluation of the study by another independent engineering firm.

The Oklahoma Geological Survey is continuing its investigation of the State's bituminous coal resources and their potential uses. The study was scheduled to be completed in 1974.

Oklahoma Gas & Electric Co. announced that it will use low-sulfur coal mined in Wyoming to fire four new 550,000-kilowatt electric generating units, two at Muskogee and two near Pawnee. When completed, each pair of units will consume about 3 million tons of coal annually. At present prices, minable coal in Oklahoma is too high in sulfur content to comply with Federal antipollution standards. The Wyoming coal will be hauled to Oklahoma in unit trains of 100 cars each. The decision to turn to coal as primary boiler fuel was made because of the prospect of an inadequate supply of natural gas in the years ahead.

Helium.—Helium extracted from natural gas at the Bureau of Mines, Keyes, Okla., plant amounted to 296 million cubic feet. High purity (Grade A) helium output was 181 million cubic feet valued at $6.3 million, compared to the 1972 figures of 176 million feet valued at $6.2 million. Crude helium output was 115 million cubic feet valued at $1.4 million compared with 163 million cubic feet valued at $2.0 million in the previous year. All helium produced is measured at 14.7 psia at 70° F.

Ashland Oil and Refining Co. was awarded a judgment against Phillips Petroleum Co., Bartlesville, Okla., in a 6-year-old helium suit. Ashland claimed that title to the helium in natural gas taken from 18 Ashland wells in the Texas Panhandle did not pass to Phillips under gas purchase contracts and that Phillips should pay for the helium as it was extracted. The base price of this helium was $10.30 per thousand cubic feet.

Natural Gas.—Natural gas is Oklahoma's premium fuel, and the State ranked third in the Nation, supplying 7.9% of domestic output. Oklahoma's marketed natural gas production amounted to 1.8 trillion cubic feet, a decrease of 2% from that of the previous year. Natural gas production was obtained from 8,945 wells in 64 counties. The average wellhead value was 18.9 cents per thousand cubic feet compared with 16.3 cents per thousand cubic feet in 1972.

The American Gas Association (AGA), as of December 31, 1973, estimated natural gas reserves to be 14 trillion cubic feet, a decrease of 393,295 million cubic feet from that of a year ago. Reserves equaled approximately 8.0 cubic feet of gas for each cubic foot produced in 1973.

Oklahoma Natural Gas Co. announced and started construction of a 200-mile transmission pipeline to move natural gas from the Anadarko Basin in western Oklahoma into its distribution system. Line capacity of the transmission system will be 300 million cubic feet of gas per day. Capacity can be increased to 500 million cubic feet by adding compression facilities.

Arkansas Louisiana Gas Co. constructed a 43-mile natural gas transmission pipeline to connect a new source of gas supply to the Lawton-Chickasha-Duncan distribution system. This is part of Arkansas Louisiana Gas Co.'s 300-mile Anadarko Basin pipeline that extends from the Texas Panhandle to Wilburton in southeastern Oklahoma. This line interconnects with the company's four separate gas distribution systems in Oklahoma, and will connect to the utility's Arkansas-Louisiana-Texas system at Wilburton.

A three-judge federal court ruled in favor of the Federal Power Commission which had challenged orders of the Oklahoma Corporation Commission which, in effect set a minimum price for Oklahoma-produced natural gas at the Wellhead supplying interstate gas consumers.

Natural Gas Liquids.—Output of natural gas liquids increased in 1973 with the recovery of 43,718,000 barrels of liquefied petroleum gases (LPG) and natural gasoline and cycle products. This was an increase of 4.8% above that of 1972. LPG accounted for 66.4% of the volume and 66.0% of the value. At yearend, 86 natural gas processing plants were operating in Oklahoma. These plants have a processing capacity of about 4.5 billion cubic feet of gas per day. The State ranked third in the nation in the production of natural gas liquids, following Texas and Louisiana. According to the AGA, proved natural gas liquids reserves was estimated to be 289,102,000 barrels, a decrease of 46,059,000 barrels from that of 1972.

In February, huge rocks appeared to be sprouting from smooth pasture land about 5 miles south of Elk City in Beckham County. Initial investigation revealed that a blowout had occured, resulting in a hole about 30 by 50 feet wide and 15 feet deep plus several large cracks parallel to a crack bed. Large rocks were thrown as far as 75 feet, several 30-ton boulders were lifted to an upright position, and 15-foot trees in the vicinity were tilted 45°. The blowout site is about 2,000 feet south of Shell Oil Company's Yelton LPG well, where liquefied petroleum gas (LPG), mostly propane, had been pumped into a pear-shaped storage cavity dissolved from salt of the Blaine Formation at a depth of 1,360 to 1,411 feet. Shell tested the storage system for leakage and found that approximately 30 gallons of propane per day was escaping. Apparently, the propane moved laterally along a thief zone or zones in the shallow subsurface until it built up sufficient pressure to cause a noncombustible erruption.

Petroleum.—Oklahoma crude oil production has declined for the last 6 years. In 1967, crude oil production reached 230.7 million barrels; since then, production has declined to 191.2 million barrels in 1973, a 17.2% decline in 6 years. Average wellhead value of crude oil in Oklahoma was $3.78 per barrel compared with $3.41 in 1972, an increase of 10.9%. Nationwide, Oklahoma ranked fourth in the production of crude petroleum and accounted for 5.7% of the U.S. total. Stephens County led the State's oil-producing counties with a total of 25.6 million barrels, followed by Carter and Garvin Counties, which produced 24.8 and 16.7 million barrels, respectively.

Production was obtained from 72,880 wells compared with 73,745 wells in 1972. Average daily production from all producing wells amounted to 7.2 barrels per day. The Oklahoma Corporation Commission ordered the continuation of the 200% depth-acreage formula allowable since indicated demand for Oklahoma crude oil remained higher than productive capability.

Stocks of crude oil originating in Oklahoma at the beginning of the year were 13.1 million barrels, whereas at the end of the year, stocks declined to 12.3 million barrels.

The API at yearend estimated Oklahoma's crude oil reserves to be 1,270,964,000 barrels, a decrease of 32,040,000 barrels below 1972 reserves. The State ranks fifth in the Nation in crude oil reserves exceeded only by Texas, Alaska, Louisiana, and California.

Increases in crude oil prices were recorded a number of times during 1973. The higher prices will prolong the life of many marginal oil wells. More than 55,000 of the producing oil wells in the State were considered economically marginal at the beginning of the year. Production from these wells accounted for more than 40% of the State's total production, and reserves represented more than 50% of the State's proved reserves.

Production of crude oil failed to meet the allowables set by the Corporation Commission during 1973. The continuing shortage of crude oil supplies forced the Midland Cooperative refinery to shut down for a time and other refineries to operate below capacity.

Table 4.—Oklahoma: Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

Commodity	Proved reserves Dec. 31, 1972	Changes in proved reserves due to extensions, revisions, and new discoveries in 1973	Proved reserves Dec. 31, 1973	Change from 1972 (percent)
Crude oil _ thousand 42-gallon barrels __	1,303,004	147,539	1,270,964	—2.5
Natural gas liquids _____ do ____	335,161	—5,959	289,102	—13.7
Natural gas _____ million cubic feet __	14,492,030	1,374,488	14,098,735	—2.7

Source: American Petroleum Institute and American Gas Association.

Two groups of companies plan to construct crude oil pipelines from the Gulf Coast to Oklahoma. One group known as the Seaway Pipeline will originate at the Seadock onshore terminal near Freeport, Tex. and terminate at Cushing, Okla. Much of the oil for this pipeline will be imported via the proposed Seadock project, an offshore tanker unloading facility designed to handle very large crude tankers. Capacity of Seaway pipeline would be 600,000 barrels daily through a 34-inch-diameter line. At Cushing, the pipeline will connect with existing pipelines to supply crude oil to refineries in the Texas Panhandle, Oklahoma and Kansas. This system will also provide Chicago area refineries an alternate link to the Gulf Coast. The pipeline is expected to be in operation in late 1975.

The other pipeline, known as the Texoma Pipeline Co., will carry crude oil from Nederland, Tex., to Cushing, Okla., where it will join other major oil pipelines. The line was estimated to cost $91 million; completion was expected in January 1975. Oil from the line will supply refineries in Oklahoma and Kansas. The 26-inch diameter line will have a capacity of 330,000 barrels daily.

Kerr-McGee Corporation announced that it was doubling the capacity of its Wynnewood, Okla., crude oil refinery to 68,000 barrels daily at a cost of $40 million to $50 million. Construction of the facilities should be completed by the end of 1975.

Table 5.—Oklahoma: Crude oil production, indicated demand, and stocks, in 1973, by month

(Thousand 42-gallon barrels)

Month	Production	Indicated demand	End-of-month stocks originating within Oklahoma
January	15,916	17,288	11,772
February	17,072	16,745	12,099
March	15,662	16,345	11,416
April	15,709	15,939	11,186
May	16,376	15,329	12,233
June	15,748	16,354	11,627
July	16,217	16,571	11,273
August	15,579	15,146	11,706
September	16,229	16,162	11,773
October	15,955	14,860	12,868
November	14,885	14,588	13,165
December	15,856	16,767	12,254
Total			
1973	191,204	192,094	XX
1972	207,633	210,362	XX

XX Not applicable.

Table 6.—Oklahoma: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of well	Footage
Alfalfa	63	21	9	--	8	1	102	632,456
Atoka	--	--	--	--	1	3	4	37,335
Beaver	6	26	28	--	--	1	61	430,554
Beckham	--	16	1	--	1	2	20	109,348
Blaine	8	23	23	1	3	4	62	582,285
Bryan	--	--	--	--	--	1	1	11,118
Caddo	2	7	2	2	5	7	25	252,470
Canadian	26	13	12	4	6	5	66	628,529
Carter	93	2	12	1	--	1	109	384,997
Cimarron	3	11	6	--	--	3	23	109,441
Cleveland	2	--	1	--	--	3	6	33,673
Coal	5	1	2	--	1	2	11	53,796
Comanche	--	--	7	--	--	3	10	24,664
Cotton	--	--	3	--	--	4	7	15,377
Craig	--	--	1	--	--	2	3	1,925
Creek	41	2	12	--	--	1	56	139,258
Custer	--	--	--	--	1	1	2	35,713
Dewey	21	18	20	1	5	3	68	669,661
Ellis	3	23	22	--	2	6	56	530,307
Garfield	11	15	5	1	1	4	37	203,872
Garvin	16	2	15	--	--	16	49	258,134
Grady	8	1	7	2	2	9	29	308,090
Grant	3	--	2	1	--	7	13	64,328
Greer	--	3	2	--	2	1	8	10,987
Harmon	--	--	--	--	--	1	1	5,816
Harper	--	41	25	1	2	5	74	475,056
Haskell	--	3	7	--	--	1	11	80,507
Hughes	2	4	9	--	1	6	22	97,953
Jackson	--	--	1	--	--	--	1	2,500
Jefferson	4	--	--	--	--	3	7	35,762
Johnston	--	--	--	1	--	3	4	16,164
Kay	23	1	18	--	1	6	49	160,750
Kingfisher	68	28	26	2	1	2	127	941,319
Kiowa	7	--	10	--	1	1	19	27,461
Latimer	--	2	2	--	1	--	5	45,600
Le Flore	--	3	--	--	--	2	5	31,947
Lincoln	15	4	15	2	1	11	48	198,963
Logan	10	--	13	1	1	7	32	168,693
Love	8	--	5	--	--	1	14	85,174
McClain	2	1	2	2	--	3	10	100,489
McIntosh	--	10	1	--	5	1	17	48,263
Major	37	47	29	1	1	--	115	877,151

Table 6.—Oklahoma: Oil and gas well drilling completions, by county—Continued

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Marshall	--	--	--	--	2	2	4	32,866
Murray	5	--	5	--	--	7	17	61,204
Muskogee	4	2	1	--	--	1	8	10,320
Noble	23	1	5	1	1	5	36	124,736
Nowata	22	--	4	--	--	--	26	19,467
Okfuskee	6	5	11	--	1	3	26	74,520
Oklahoma	1	--	4	1	--	6	12	62,825
Okmulgee	27	6	14	--	--	--	47	103,937
Osage	83	31	48	5	5	6	178	387,427
Pawnee	7	--	5	3	--	5	20	65,453
Payne	18	1	7	--	1	4	31	119,809
Pittsburg	--	18	6	--	--	9	33	182,667
Pontotoc	19	1	8	--	--	8	36	105,314
Pottawatomie	16	1	11	1	--	4	33	157,062
Pushmataha	--	--	--	--	--	1	1	6,293
Roger Mills	2	1	--	--	--	1	4	56,019
Rogers	17	--	2	--	--	--	19	9,807
Seminole	27	--	30	1	--	5	63	252,742
Stephens	55	6	17	--	--	5	83	443,501
Texas	14	21	18	--	--	7	60	342,198
Tillman	--	--	1	--	--	3	4	13,916
Tulsa	14	--	1	--	--	--	15	24,643
Wagoner	1	--	6	--	--	--	7	8,355
Washington	12	1	1	--	--	--	14	16,958
Woods	2	13	11	--	1	3	30	171,300
Woodward	1	34	25	--	5	20	85	653,002
Total	863	470	596	35	69	248	2,281	12,434,227

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 7.—Oklahoma: Crude petroleum production, by field
(Thousand 42-gallon barrels)

Field	1972	1973	Cumulative to Dec. 31, 1973
Allen	2,880	2,645	124,400
Bowlegs	1,345	1,750	157,051
Burbank	4,715	3,870	500,487
Cement	2,390	2,470	138,744
Cushing	2,980	3,245	460,033
Edmond, West	730	715	154,521
Eola-Robberson	4,585	4,355	104,335
Fitts	1,600	2,180	148,254
Glenn Pool	2,090	2,150	307,582
Golden Trend	11,955	9,875	393,954
Healdton	5,595	6,880	286,367
Hewitt	5,590	6,880	212,253
Oklahoma City	1,850	1,860	731,868
Seminole Greater	1,345	1,190	198,510
Sho-Vel-Tum	33,800	33,320	968,206
Sooner Trend	14,390	11,480	176,334
St. Louis	1,290	1,185	215,003
Other fields	108,503	95,154	NA
Total	207,633	191,204	--

NA Not available.

Source: Oil and Gas Journal data adjusted to Bureau of Mines total.

NONMETALS

Cement.—Three plants were active in 1973 in manufacturing portland and masonry cement in Oklahoma. Portland cement consumed in the State totaled 1,418,000 short tons, whereas masonry cement consumed in the State amounted to 66,000 short tons. Production of portland and masonry cement increased 4.6% and 1.8%, respectively, compared with that of 1972. Raw materials used in making portland cement included limestone, clay and shale, sand, gypsum, and iron-bearing materials. Types of portland cement shipped included general use and moderate heat, high-early strength, white, and oil well cement. The disposition of portland cement by type of customer was as follows: Ready-mix concrete companies, 62%; concrete product manufacturers, 10%; building material dealers, 12%; and contractors and other users, 16%.

In order to comply with Oklahoma air pollution control regulations, Ideal Basic Industries, Inc. is spending $2.8 million for electrostatic precipitators and associated dust-handling facilities for the Ideal Cement Co. plant in Ada, Okla. The new precipitators, which collect dust from kiln gas, will replace the existing dust collection system. In addition to the new precipitators, 41 dust collection systems are in operation throughout the plant.

Clay and Shale.—Output of common clay and shale increased both in quantity and value above that of 1972 by 38.4% and 33.8%, respectively. Bentonite, an absorptive and colloidal clay, was mined in Dewey County.

The Wewoka Brick and Tile Co. changed its name to Commercial Brick Corporation. The corporation has a project to spend $2.7 million to remodel and rebuild with 60 employees. Annual production of 26 million bricks is expected.

L. S. Fisher ceased mining bentonite in Dewey County, although sale of stockpiled material was continuing.

Oklahoma Brick Corp. constructed a $750,000 automated concrete-brick and block plant near Union City. The plant has a capacity of 30 million brick per year per shift. It is adjacent to the company's older plant that also was automated in 1973 and can now produce 65 million brick annually.

Oklahoma Brick Corp. also announced plans to construct a $3 million lightweight aggregate plant at the Union City site, and will use local shale as the feed. This will be the third lightweight aggregate plant in the State.

Acme Brick Co. completed its new $2 million plant at Tulsa. The plant, with 11 new steeljacketed beehive kilns, has a capacity of 40 million brick per year.

Gypsum.—Production of gypsum, a major mineral commodity for the construction industry, continued to increase in quantity and value. Gypsum was mined from open pits in Blaine, Caddo, Canadian, Comanche, and Jackson Counties in western Oklahoma. Quantity and value in 1973 increased 19.5% and 49.1%, respectively, above that of 1972. Large reserves of high-purity gypsum of Permian age crop out and are at shallow depth in three regions of western Oklahoma. The northwest and southwest regions contain gypsum beds in the Blaine Formation that are 10 to 30 feet thick and are generally 95% to 98% pure. The west-central region contains the Cloud Chief Gypsum, which is 20 to 90 feet thick and has a purity of 92% to 97%. Reserves, estimated at 48 billion short tons by the Oklahoma Geological Survey, are almost equally divided among the three regions. Seven mines were in operation in the State in 1973 and processed the gypsum for wallboard, for plaster, as a retarder in portland cement, and as a soil conditioner.

Lime.—St. Clair Lime Co., the only producer of chemical-grade lime in the State, operated only its Marble City facility in Sequoyah County in 1973. The productive capacity of the new kiln is 450 tons per day, and the capacity of an older kiln is 220 tons per day. St. Clair Lime Co. uses stone that is 98.8% to 99.3% calcium carbonate from the Quarry Mountain Formation of Silurian age. The lime is used for soil stabilization, mason's lime, and other chemical uses. Total lime consumption in Oklahoma was 204,700 tons.

Salt.—Permian rock salt underlies most of western Oklahoma at depths of 30 to 3,000 feet. Individual salt beds 5 to 25 feet thick are interbedded with thinner layers of shale and anhydrite. Five large salt plains are fed by natural brine springs that emit 150 to 3,000 tons of salt per day. Reserves, estimated at 20 trillion tons by the

Oklahoma Geological Survey, are virtually untapped. Production of salt in the State was from evaporation plants located in Harmon and Woods Counties. It is used mainly for stockfeed, recharging water softeners, and deicing roads. Quantity and value increased 66.6% and 240.0%, respectively, compared with that of 1972.

Sand and Gravel.—Production of sand and gravel in 1973 totaled 12.2 million short tons, valued at $14.9 million. Production of high-purity silica sand was reported by Pennsylvania Glass Sand Corp. of Oklahoma and Midcontinent Glass Sand Co., in Johnston and Pontotoc Counties; plant-run (washed) glass sand is more than 99.8% silica. Feldspathic sand for the glass industry is produced from the Arkansas River by Arkhola Sand and Gravel Co. in Muskogee County.

Pennsylvania Glass Sand Corp. is building a $4 to $5 million glass sand plant near Mill Creek in Johnston County. The company already has one plant there that has one plant there that has been operating since 1947. The new plant is expected to process up to 500,000 tons of fine-grade silica sand per year. Because of its high grade, this special sand is shipped all over the world. It is used to make glass, cookware, bottles, and other products.

Ford Motor Company is constructing a multimillion dollar glass plant on a 218-acre site southeast of Tulsa. The plant, known as the Tulsa Glass plant, will cover 640,000 square feet and was scheduled to be in operation in 1974 with approximately 750 employees.

Table 8.—Oklahoma: Sand and gravel solid or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,078	3,572	4,418	4,831
Fill	1,186	599	2,525	1,246
Paving	1,935	2,094	2,468	2,655
Other uses [1]	848	3,568	981	3,797
Total [2]	7,048	9,832	10,392	12,529
Gravel:				
Building	120	188	419	759
Fill	W	W	78	47
Paving	120	130	195	264
Miscellaneous	W	W	17	25
Other uses	19	31	11	27
Total [2]	258	349	720	1,121
Government-and-contractor operations:				
Sand:				
Building	34	478	5	3
Fill	299	401	712	1,101
Paving	220	46	211	89
Other uses	--	--	23	5
Total [2]	553	925	952	1,198
Gravel:				
Building	4	22	--	--
Fill	7	7	--	--
Paving	31	4	90	93
Total [2]	42	33	90	93
Total sand and gravel [2 3]	7,901	11,138	12,154	14,941

W Withheld to avoid disclosing individual company confidential data; including wth "Other uses."
[1] Includes ground and unground sand.
[2] Data may not add to totals shown because of independent rounding.
[3] Data not directly comparable with previous years because of increased industry coverage.

Stone.—Production of stone in 1973 amounted to 22,316,000 short tons, compared with 19,448,000 short tons in 1972. This was a 14.7% increase in production, whereas value increased 31.7%. Material marketed as stone included dolomite, limestone, sandstone, quartz, and traprock.

Table 9.—Oklahoma: Stone sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Kind of stone	1972		1973	
	Quantity	Value	Quantity	Value
Dimension:				
Limestone [1]	2	28	2	24
Granite	3	367	4	443
Total	5	395	6	467
Crushed and broken:				
Limestone [1]	18,035	24,537	21,242	33,010
Other stone [2]	1,407	1,641	1,068	1,522
Total	19,442	26,178	22,310	34,532
Grand total [3]	19,448	26,574	22,316	34,999

[1] Data include dolomite.
[2] Data include sandstone, quartz, and traprock.
[3] Data may not add to totals shown because of independent rounding.

Sulfur.—Pioneer Gas Producing Co. recovered sulfur from sour natural gas at its plant in Marshall County. Production decreased 10.1% compared with that of the previous year.

Tripoli.—Output of tripoli, a lightweight silica rock used in abrasives, buffing compounds, oil well drilling mud and in foundry processes, decreased slightly in quantity and increased in value in 1973. The Carborundum Co. in Ottawa County is the largest producer.

Volcanic Ash (Pumice).—Volcanic ash was produced in Beaver County by Axtell Mining Corp. Quantity and value decreased in 1973.

METALS

Copper.—According to Oklahoma's Chief Mine Inspector, 186,687 tons of copper-bearing shale was strip mined in Jackson County in 1973, compared with 243,671 tons in 1972.

Copper output in 1973 decreased in quantity and value below that of the previous year. Eagle-Picher Industries, Inc., continued strip mining 6 to 10 inches of copper-shale ore at its Creta mine in Jackson County; the mine was opened in September 1965. A second copper-shale property, near Mangum in Greer County, is being developed by Lobaris Copper Co.

Universal Oil Products Co. announced that it intends to construct a multimillion dollar plant near Shawnee, Okla., for its Wolverine Tube Division. The new Shawnee plant would produce copper tubing for the construction, air conditioning and refrigeration, chemical processing, and a number of other industries. Wolverine Tube Division manufactures tubing in sizes ranging from that of the thin pencil lead to 3½ inches in diameter. The new plant will measure 300,000 square feet and represent an investment of approximately $10 million.

Silver.—The quantity and value of silver recovered in 1973 as a byproduct from smelting cooper concentrate by Eagle-Picher Industries, in Jackson County, decreased in both quantity and value.

Smelters.—APEX Smelting (Amax group) announced that it would build a $2.6 million secondary aluminum and zinc alloy plant at Checotah, Okla. The project, scheduled to come on stream in late 1974, was to have an annual capacity of up to 40 million pounds of zinc alloy.

Electron Corporation of Littleton, Colo., chose Blackwell, Okla., as the site for a $4.8 million electric foundry that promises to employ as many as 400 persons. Announcement of the new industry was particularly timely since Blackwell Zinc Co.'s 57-year-old smelting plant was in the final throes of an 18-month phaseout.

Table 10.—Principal producers

Commodity and company	Address	Type of activity	County
Carbon Black:			
Continental Carbon Co	P.O. Box 22085 Houston, Tex. 77027	Furnace	Kay.
Cement:			
Dewey Rocky Mountain Cement Co.[1]	1210 Fourth Nat. Bank Tulsa, Okla. 74119	Quarry and plant	Rogers.
Ideal Cement Co., a division of Ideal Basic Industries, Inc.[1]	420 Ideal Cement Bldg. Denver, Colo. 80202	---- do	Pontotoc.
Oklahoma Cement Co. Div. OKC Corp.[1]	P.O. Box 68 Pryor, Okla. 74361	---- do	Mayes.
Clays:			
Acme Brick Co	P.O. Box 425 Fort Worth, Tex. 76101	Mine and plant	Custer, Oklahoma, Tulsa.
Chandler Materials Co	Box 627 Tulsa, Okla. 74101	---- do	Rogers, Oklahoma.
Filtrol Corp	3250 East Washington Los Angeles, Calif. 90023	---- do	Dewey.
Mangum Brick Co	Box 296 Mangum, Okla. 73554	---- do	Greer.
Oklahoma Brick Corp	Box 87 Union City, Okla. 73090	---- do	Canadian.
Sapulpa Brick & Ttle Corp	Box 460 Sapulpa, Okla. 74066	---- do	Creek.
Superior Clay Products, Inc	Box 1501 Ada, Okla. 74820	---- do	Pontotoc.
United Clay Pipe Co	Box 552 Seminole, Okla. 74868	---- do	Seminole.
Commercial Brick Corporation	415 West 10th St. Wewoka, Okla. 74884	---- do	Do.
Coal:			
Bills Coal Co., Inc	Route 1 Welch, Okla. 74369	Strip mine	Craig.
Garland Coal & Mining Co	Box 186 Fort Smith, Okla. 72901	---- do	Haskell.
Lone Star Steel Co	Box 35888 Dallas, Tex. 75235	---- do	Do.
McNabb Coal Co	Box C Catoosa, Okla. 74105	---- do	Rogers.
Peabody Coal Co	301 North Memorial Drive St. Louis, Mo. 63102	---- do	Craig. Rogers.
Sierra Coal Corp	Box 549 Claremore, Okla. 74017	---- do	Muskogee.
United Coal Corp	Box 218 Inola, Okla. 74036	---- do	Rogers.
Copper and silver: Eagle-Picher Industries, Inc.	P.O. Box 910 Miami, Okla. 74354	---- do	Jackson.
Helium: U.S. Bureau of Mines	P.O. Box 46 Keyes, Okla. 73947	Helium processing.	Cimarron.
Gypsum:			
Republic Gypsum Co	1100 Mercantile Bank Bldg. Dallas, Tex. 75201	Quarry and plant	Jackson.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	---- do	Blaine.
Universal Atlas Cement, a division of United States Steel Corp.	600 Grant St., Box 2969 Pittsburgh, Pa. 15230	Quarry	Do.
Lime: St. Clair Lime Co	Box 894 Oklahoma City, Okla. 73101	Plant and quarry	Sequoyah.
Natural gas liquids:			
Champlin Petroleum Co	Fort Worth, Tex. 76100	Natural gas liquids processing.	Garfield, Oklahoma.
Cities Service Oil Co	Bartlesville, Okla. 74003	---- do	Garfield, Kay, Oklahoma, Texas.
Humble Oil & Refining Co	Tulsa, Okla. 74100	---- do	Dewey, Kingfisher.
Mobil Oil Corp	Taloga, Okla. 73667	---- do	Dewey, Grady, Stephens, Texas, Woodward.
Phillips Petroleum Co	Bartlesville, Okla. 74003	---- do	Garvin, Oklahoma.
Skelly Oil Co	Oklahoma City, Okla. 73100	---- do	Beckham, Carter, Dewey.
Signal Oil & Gas Co	Ardmore, Okla. 73401	---- do	Carter.
Shell Oil Co	Tulsa, Okla. 74100	---- do	Stephens.
Sun Oil Co	---- do	---- do	Cleveland, Grant, Harper, Kay, Lincoln, McClain.

See footnote at end of table.

Table 10.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Natural gas liquids—Continued			
Texaco, Inc	Tulsa, Okla. 74100	Natural gas liquids processing.	Beaver, Caddo, Lincoln, Love.
Union Texas Petroleum, a division of Allied Chemical Corp.	do	do	Major.
Warren Petroleum Corp	do	do	Beaver, Garvin, Grady, Stephens.
Petroleum refineries:			
Allied Materials Corp	Stroud, Okla. 74079	Refinery	Lincoln.
Apco Oil Corp	Cyril, Okla. 73029	do	Caddo.
Bell Oil and Gas Co	Ardmore, Okla. 73401	do	Carter.
Champlin Petroleum Co	Enid, Okla. 73701	do	Garfield.
Continental Oil Co	Ponca City, Okla. 74601	do	Kay.
Kerr-McGee Corp	Wynnewood, Okla. 73098	do	Garvin.
Midland Cooperatives, Inc	Cushing, Okla. 74023	do	Payne.
Okmulgee Refining Co	Okmulgee, Okla. 74447	do	Okmulgee.
Sun Oil Co., DX Div	Duncan, Okla. 73533	do	Stephens.
	Tulsa, Okla. 74100	do	Tulsa.
Texaco, Inc	do	do	Do.
Tonkawa Refining Co	Arnett, Okla. 73832	do	Ellis.
Salt:			
Blackmon Salt Co	Freedom, Okla. 73842	Solar evaporation.	Woods.
Western Salt Co	Route 2 Erick, Okla. 73645	do	Harman.
Sand and gravel:			
Bagby-Harris Sand Co	P.O. Box 926 Jenks, Okla. 74037	Dredge	Tulsa.
Joe Brown Sand & Gravel Co	Box 102 Sulphur, Okla. 73086	Stationary	Murray.
The Dolese Co	13 Northwest 13th St. Oklahoma City, Okla. 73103	do	Canadian, McClain, Kingfisher, Logan, Garfield.
McMichael Concrete Co	Box 9486 Tulsa, Okla. 74107	Dredge	Tulsa.
Midcontinent Glass Sand Co	Roff, Okla. 74865	Stationary	Pontotoc.
Mohawk Rock & Sand Co	1340 East 16th St. Tulsa, Okla. 74120	Dredge	Tulsa.
Pennsylvania Glass Sand Corp. of Oklahoma.	Berkeley Springs West Va. 25411	Stationary	Johnston.
Sand Products, Inc	3405 East Reno Oklahoma City, Okla. 73117	Stationary and dredge.	Oklahoma.
Tulsa Sand Co	Box 1954 Tulsa, Okla. 74101	Stationary	Pawnee, Tulsa.
Arkhola Sand & Gravel Co	323 Merchants Bank Bldg. Ft. Smith, Ark. 72901	do	Muskogee.
Stone:			
Anchor Stone Co	Box 1630 Tulsa, Okla. 74106	Quarry	Tulsa.
Arkhola Sand & Gravel Co	323 Merchants Bank Bldg. Ft. Smith, Ark. 72901	do	Cherokee.
Dolese Brothers Co	13 Northwest 13th St. Oklahoma City, Okla. 73103	do do	Caddo, Carter. Coal, Comanche, Kiowa, Murray, Pittsburgh, Seminole.
Eagle-Picher Industries, Inc	P.O. Box 910 Miami, Okla. 74354	do	Ottawa.
The Quapaw Company	Box 72 Drumright, Okla. 74030	do	Creek, Okmulgee.
Sooner Rock and Sand Co	2835 Northeast 23rd Oklahoma City, Okla. 73111	do	Murray.
Standard Industries, Inc	P.O. Box 15670 Admiral Station Tulsa, Okla. 74115	do	Osage, Tulsa.
Trinity Concrete Products Co	Box 1290 Dallas, Tex. 75221	do	Atoka.
Tulsa Rock Co	Box 15691 Admiral Station Tulsa, Okla. 74115	do	Tulsa.
Tripoli: The Carborundum Co., American Tripoli Div.	Seneca, Mo. 64865	Open pit	Ottawa.
Volcanic ash: Axtell Mining Corp	Laverne, Okla. 73848	do	Beaver.
Smelters:			
American Metal Climax, Inc., Blackwell Zinc Co.	Blackwell, Okla. 74631	Zinc	Kay.
Kaiser Chemicals, Inc	Tulsa, Okla. 74100	Magnesium	Tulsa.
National Zinc Co	Bartlesville, Okla. 74003	Zinc	Washington.

[1] Also crushed and broken limestone, and clays.

The Mineral Industry of Oregon

By John D. Corrick [1]

The value of minerals produced in Oregon in 1973 increased to $81.5 million, an increase of 6.5% over the 1972 value of $76.5 million. Nonmetals accounted for 88% of the total value in 1973 compared with 90% in 1972. Higher production of clays, mercury, lime, nickel and stone accounted for the increase and offset value losses in the production of sand and gravel, silver and gem stones.

In the metals mining industries, nickel ranked first among metals produced in the State. Nevertheless, output of refined nickel decreased 2% in 1973 when compared with that produced in 1972. Oregon's primary aluminum productive capacity was severely curtailed during much of 1973 as a result of reduced hydroelectric power. However, Reynolds Metals Co. started its fourth aluminum reduction potline at the Troutdale plant during the year. Mercury again was produced in the State in 1973 after no production in 1972.

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Mineral production in Oregon [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays ---- thousand short tons --	151	$238	168	$291
Gem stones ----	NA	793	NA	700
Lime ---- thousand short tons --	96	2,129	106	2,552
Mercury ---- 76-pound flasks --	--	--	W	W
Nickel (content of ores and concentrates) short tons --	16,864	W	18,272	W
Pumice ---- thousand short tons --	W	W	1,006	1,902
Sand and gravel ---- do ----	24,489	34,981	22,802	32,751
Silver (recoverable content of ores, etc) thousand troy ounces --	2	4	1	3
Stone ---- thousand short tons --	10,915	18,380	13,411	21,843
Value of items that cannot be disclosed: Cement, copper, diatomite, gold, talc, tungsten, and values indicated by symbol W ----	XX	19,991	XX	21,424
Total ----	XX	76,516	XX	81,466
Total 1967 constant dollars ----	XX	63,133	XX	[p] 59,812

[p] Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Oregon, by county
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Baker ----	$6,314	$5,655	Cement, stone, sand and gravel, clays, gold, pumice, silver, copper.
Benton ----	1,024	628	Sand and gravel, stone, clays.
Clackamas ----	13,879	11,117	Cement, sand and gravel, stone, clays.
Clatsop ----	W	1,000	Stone, sand and gravel.
Columbia ----	2,109	W	Sand and gravel, stone.

Table 2.—Value of mineral production in Oregon, by county—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Coos	$574	$1,513	Stone, sand and gravel.
Crook	W	W	Stone, sand and gravel, clays.
Curry	W	960	Stone, sand and gravel.
Deschutes	1,500	1,366	Pumice, sand and gravel, stone.
Douglas	10,743	13,696	Nickel, sand and gravel, stone, pumice, mercury.
Gilliam	W	19	Stone.
Grant	W	W	Stone, sand and gravel, gold.
Harney	451	W	Stone.
Hood River	W	250	Stone, sand and gravel.
Jackson	1,044	2,282	Sand and gravel, stone.
Jefferson	W	W	Stone, sand and gravel.
Josephine	954	1,132	Sand and gravel, stone, gold, talc.
Klamath	1,649	2,247	Stone, sand and gravel, pumice, clays.
Lake	949	648	Stone, pumice, sand and gravel, diatomite.
Lane	3,647	W	Sand and gravel, stone, clays.
Lincoln	W	1,135	Stone, sand and gravel.
Linn	1,222	1,490	Sand and gravel, stone.
Malheur	1,470	W	Lime, sand and gravel, stone.
Marion	2,290	W	Sand and gravel, stone, clays.
Morrow	48	W	Sand and gravel, stone.
Multnomah	8,247	9,225	Sand and gravel, lime, stone, clays.
Polk	W	W	Sand and gravel, stone.
Sherman	1,249	148	Stone.
Tillamook	699	781	Sand and gravel, stone.
Umatilla	W	1,096	Stone, sand and gravel.
Union	2,115	527	Sand and gravel, stone.
Wallowa	111	29	Sand and gravel.
Wasco	W	W	Sand and gravel, stone.
Washington	2,749	6,126	Stone, sand and gravel, clays.
Wheeler	W	90	Stone.
Yamhill	533	W	Stone, sand and gravel, clays.
Undistributed [1]	10,947	18,303	
Total [2]	76,516	81,466	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes gem stones, some sand and gravel that cannot be assigned to specific counties, and values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Oregon business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ---- thousands	949.7	991.0	+4.3
Unemployment ---- do	54.4	25.6	−3.3
Employment: [1]			
Construction ---- do	30.2	38.7	+28.1
Lumber and wood products ---- do	71.5	76.0	+6.3
Food products ---- do	19.6	21.3	+8.7
Mining ---- do	1.6	1.3	−18.8
Manufacturing ---- do	178.5	194.4	+8.9
Personal income:			
Total ---- millions	$9,354	$10,451	+11.7
Per capita	$4,287	$4,697	+9.6
Construction activity:			
Number of authorized private and public residential units	31,010	20,940	−32.5
Value of nonresidential construction millions	$182.8	$238.5	+30.5
Value of highway contracts awarded ---- do	[e] $96.0	$64.7	−32.6
Cement shipments to and within Oregon thousand short tons	806	835	+3.6
Cash receipts from farm marketings ---- millions	$683.7	$994.9	+45.5
Mineral production value ----do	$76.5	$81.5	+6.5

[e] Estimate. [p] Preliminary.

[1] From December 1972 to December 1973.

Sources: Oregon's Labor Force Trends; Survey of Current Business; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; U.S. Bureau of Mines.

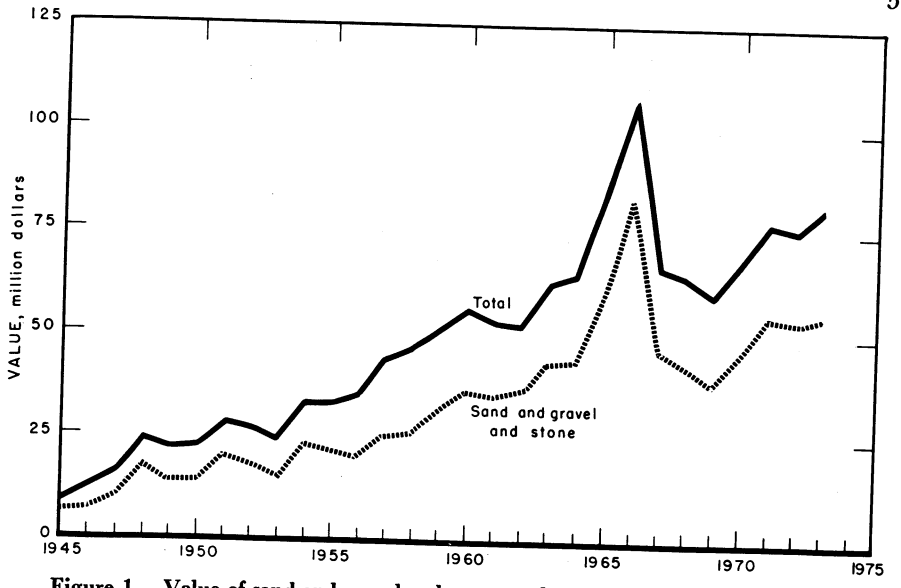

Figure 1.—Value of sand and gravel and stone, and total value of mineral production in Oregon.

The Atomic Energy Commission (AEC) issued a final environmental impact statement on Portland General Electric's (PGE) Trojan nuclear powerplant in 1973. The report was favorable, in that the AEC stated the plant would not have any significant impact on the environment that would prevent issuance of an operating license. A $25 million synthetic natural gas plant was being built by Fluor Corp. for Northwest Natural Gas Co. near Portland. The plant was to obtain feedstock from Alberta, Canada.

Oregon's stature as an exporting state grew in 1973, when the value of exports reached $1.7 billion. This was a $900 million increase over the 1972 export value. Imports valued at $600 million gave the State a $2.3 billion year in foreign trade. Major destinations of exports were Japan, $704.5 million; Republic of Korea, $303.8 million; Taiwan, $74.3 million; and Italy, $74.3 million.

Employment, Trade, and Markets.—Estimated 1973 yearend employment in Oregon was 973,200 compared with 924,200 in 1972, according to figures published by the Oregon Employment Division, Department of Human Resources. The total civilian work force at the end of December 1973 was 1,035,000 compared with 987,700 at end of 1972. The increases occurred in employment and work force despite the handicaps of seasonal weather conditions and the impact of energy and materials shortages. Seasonally adjusted unemployment at yearend 1973 was 5.8% of the labor force compared with 6.2% at yearend 1972.

Principal industries showing increased employment in 1973 were stone, clay, glass and concrete products, electrical equipment and supplies, and machinery. The mining industry showed an increase in employment of 7.7% between December 1972 and December 1973. During 1973, employment rose 10% in both the primary metals manufacturing sector and the fabricated metals sector. Oregon's new-hires rate of 4.5 (seasonally adjusted) was a full point higher than the United States rate of 3.5 in December 1973. Nevertheless, the layoff rate of 1.7 for Oregon exceeded the national layoff rate of 1.1 and occurred principally in lumber and wood products, fabricated metals, and transportation equipment. The quit rate, which partially reflects a worker's assessment of job opportunities, decreased from 2.8 to 2.5 between November and December of 1973. The uncertain prospects for new job opportunities combined with high fac-

tory layoffs tended to keep workers on the job and reduced the quit rate to its lowest level in 2 years. Oregon's wage and salary employment index[2] was 127.3 in December 1973, compared with 120.0 in December 1972. This approximated the Nation's pattern, which reached 118.4 in December 1973, compared with 114.3 a year earlier. Nevertheless, Oregon's wage and salary employment index continued to grow at a faster rate than did the national index.

Oregon's economy appeared quite stable throughout 1973 despite the gasoline shortage and spotty shortages of other materials. The net result was a rising weekly earnings index that peaked at 151.8 at yearend. The National average at yearend was 148.9. Hourly earnings in manufacturing rose 6.7% in 1973, and average weekly earnings increased from $163.24 in December 1972 to $187.54 in December 1973. The increase in average weekly earnings was a result of an increase in the average weekly hours worked. The hours worked increased from 36.6 in December 1972 to 39.4 in December 1973. The average hourly rate for primary metal workers increased from $4.99 in December 1972 to $5.51 in December 1973 and for fabricated metal workers from $4.60 to $4.66. Workers in primary metals manufacturing showed the greatest monthly gain in hourly salary, advancing from $5.37 in November to $5.51 in December. The increase was a result of increased overtime in both the ferrous and nonferrous sectors.

Legislation and Government Programs.—The joint research and development program between the Oregon Department of Geology and Mineral Industries and the Federal Bureau of Mines for locating potential geothermal reservoirs within the State proceeded on schedule during 1973. At the end of August, the shallow drilling phase of the study was completed. The emphasis of the program was then shifted from fieldwork to processing and analyzing data. Approximate sites for heat flow wells were selected; however, final locations were to be dependent upon local geology and accessibility. By yearend, bid specifications were to be written, drillers contacted, and supplementary environmental impact statements prepared. During the final quarter of 1973, fieldwork was confined to locating and logging pre-drilled wells, logging the monitor wells, and making another logging cycle of all shallow holes.

At yearend, the Secretary of the Interior was attempting to interest cosponsors from industry in the construction of a $2 million experimental plant in Oregon to convert lumbering wastes to low-sulfur oil. Plant construction, to take 9 months, was to begin in August 1974. The plant site was to be at the Bureau of Mines Metallurgy Research Center in Albany. The basic process for converting wood refuse and other organic wastes to oil was developed by the Bureau's Energy Research Center at Pittsburgh, Pa. Plans were for the pilot plant to handle up to 3 tons of dry waste per day, and produce more than 6 barrels (252 gallons) of low-sulfur oil.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—The only cement producer in Oregon, Oregon Portland Cement Co., operated two plants; one at Lime, Baker County, and one at Lake Oswego, Clackamas County. The Lake Oswego plant capacity was not fully utilized in 1973 because of problems with a large kiln. Output of portland cement increased by 5.6% when compared with that of 1972.

Combined shipments from three plants located in Oregon and Nevada totaled 923,000 tons of finished portland cement in 1973 compared with 854,209 tons in 1972. Average value of portland cement shipped from these plants in 1973 decreased from that of 1972.

Officials of Oregon Portland Cement Co. announced plans in 1973 to construct new concrete storage silos and truck loading facilities at its manufacturing plant at Lake Oswego. The two new storage silos were to double the storage capacity of the plant. The facilities were to be completed by April 1974 to take full advantage of the normal upswing in construction that

[2] This index and all others used in the text use a base of 1967=100.

occurs during the spring and summer months. The additions will incorporate the latest dust collecting methods available. The company markets its diversified product line in seven Western States.

Clays.—Output of clay and shale increased 11.3% in 1973 over that produced in 1972. Thirty-seven mines were responsible for the 168,000 tons of clay and shale produced in 1973.

Ten counties accounted for Oregon's clay and shale production in 1973; the major portion was produced in Washington, Multnomah and Baker Counties. Value of production increased 22% compared with that of the previous year. Increased consumption of clay and shale occurred principally in lightweight aggregate, portland cement and drilling mud.

Lime.—Ash Grove Cement Co., Amalgamated Sugar Co., and Pacific Carbide & Alloys Co. produced 106,000 tons of lime valued at $2.6 million in 1973 compared with 95,673 tons valued at $2.1 million in 1972. The plants were located in Multnomah and Malheur Counties. The lime was used principally in sugar refining, pulp and paper, and calcium carbide manufacturing. The major portion of the lime was consumed in Oregon and Washington.

Pumice and Volcanic Cinder.—Output of pumice increased in 1973 compared with that of 1972. The major portion of the 1,006,098 tons produced in 1973 was used in road construction. Other uses for pumice were in concrete aggregate, concrete admixture (pozzolan), landscaping, and miscellaneous uses.

The controversy over the validity of claims to pumice deposits at Rock Mesa in the Three Sisters Wilderness area of Oregon moved closer to a settlement in 1973. The U.S. Forest Service, through the Secretary of Agriculture, filed an application for the withdrawal of 2,400 acres of Federal land. The public land included both the Deschutes and Willamette National Forest, which encompass Rock Mesa. Filing of the application temporarily closed the areas to further prospecting or location of nonmetal claims. The withdrawal of the land did not affect the status of claims filed before the application date. U.S. Pumice Supply Co. of Los Angeles, Calif., has most of Rock Mesa covered by mining claims. The company reportedly intends to exercise its claims once the company's deposits at Mono Craters in California become depleted. U.S. Pumice's access to the pumice at Rock Mesa will depend upon validation of its claims, compliance with environmental constraints, and undoubtedly numerous challenges before the Secretary of the Interior's appeals board and the courts. U.S. Pumice produces block pumice for use as bunion scrapers, hamburger grill cleaners, patio building blocks, and other household products.

Sand and Gravel.—Output of sand and gravel decreased to 22.8 million tons in 1973, a decrease of 6.9% from that of 1972. Production for the preceding years was 15.7 million tons in 1969, 17.5 million tons in 1970, 20.2 million tons in 1971, and 24.5 million tons in 1972. The average price per ton increased from $1.43 in 1972 to $1.44 in 1973.

All but Gilliam, Harney, Sherman & Wheeler Counties reported production of sand and gravel in 1973. A total of 180 mines and pits were in operation in 1973 compared with 150 in 1972 and 195 in 1971. Production came principally from Multnomah, Lane and Clackamas Counties.

Clackamas County Commissioners denied a request for mining gravel and crushed rock on 20 acres of land near the city of Camby. The operation was to be located on land 300 feet from the Molalla River. Opponents of the operation claimed that it would be detrimental to the river and that the noise would be excessive. The continuation of sand and gravel mining on Ross Island in the Willamette River near Portland was still in question at yearend. Sand and gravel has been mined from this area by Ross Island Sand & Gravel Co. since 1926. The company mined about 7,000 tons per day of gravel. Two factors were to decide the fate of mining on Ross Island: (1) Adoption and enforcement of a lower Willamette River management plan by the State Land Board and (2) a final environmental impact statement for the area being prepared by the Corps of Engineers. Walling Sand and Gravel Co. obtained a conditional use permit from the Marion County Planning Commission to operate a sand and gravel quarry east of the Salem city limits. Conditions of the permit required

that the company meet established plant air and water pollution standards and that the land be reclaimed. The plant was expected to begin operating in 1974.

Table 4.—Oregon: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,030	4,514	1,570	2,532
Fill	575	1,429	1,211	1,100
Paving	1,914	3,307	646	1,029
Railroad ballast	3	45	4	6
Other use [1]	263	281	332	508
Total [2]	5,785	9,576	3,764	5,174
Gravel:				
Building	5,582	8,125	4,519	6,683
Fill	1,572	1,589	1,964	1,681
Paving	7,173	10,396	7,307	11,273
Railroad ballast	156	230	13	19
Miscellaneous	377	419	707	1,084
Other uses	92	127	775	1,070
Total [2]	14,951	20,885	15,285	21,810
Government-and-contractor operations:				
Sand:				
Fill	W	W	--	--
Paving	W	W	1,040	2,081
Total [2]	12	15	1,040	2,081
Gravel:				
Building	W	W	--	--
Fill	246	217	48	35
Paving	3,433	4,199	2,614	3,624
Other uses [3]	62	87	51	27
Total [2]	3,741	4,504	2,713	3,686
Total sand and gravel [2]	24,489	34,981	22,802	32,751

W Withheld to avoid disclosing individual company confidential data.
[1] Includes engine (1973) and other industrial sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes building (1972).

Stone.—Production of stone increased 19% in tonnage and 16% in value in 1973 when compared with that of 1972. Major uses of stone were in dense graded roadbase stone, unspecified construction aggregate and roadstone, bituminous aggregate and surface treatment aggregate. Those uses showing the greatest increase in tonnage sold or used in 1973 compared with those of 1972 were macadam aggregate (5 fold) and fill (2 fold). Uses showing a significant decrease in tonnage sold or used in 1973 were other uses, down 33% and surface treatment aggregate down 10%.

Table 5.—Oregon: Stone sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone total	1	30	1	58
Crushed and broken:				
Bituminous aggregate	1,273	1,955	1,406	2,098
Concrete aggregate	W	W	675	1,738
Dense graded road base stone	3,328	4,953	4,311	7,753
Macadam aggregate	57	83	369	578
Surface treatment aggregate	1,350	1,891	1,221	1,956
Unspecified construction aggregate and roadstone	2,015	3,566	2,585	3,422
Fill	120	112	363	135
Railroad ballast	432	596	525	843
Riprap and jetty stone	973	1,478	1,037	1,725
Other uses [1]	1,367	3,717	918	1,537
Crushed total [2]	10,915	18,350	13,410	21,784
Grand total [2]	10,915	18,380	13,411	21,843

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes stone used in agricultural purposes, filter stone, manufactured fine aggregate, terrazzo (1973), cement and lime manufacture, flux, bedding (1973), drain fields, glass, and unspecified uses. The 1972 data also include stone used for refractory stone and building products.
[2] Data may not add to totals shown because of independent rounding.

METALS

Aluminum.—Although Oregon's aluminum refining industry was hard hit by a hydroelectric power shortage in 1973, the companies were able to shift production to areas of the United States that were not affected. Estimates of the aggregate aluminum production loss caused by the power shortage in the Pacific Northwest were nearly 250,000 tons. The power cutback was caused by low stream flow in the Columbia River Basin, which was a result of a lesser runoff from a smaller snowpack. Actual aluminum production in Oregon in 1973 increased by 50% when compared with that of 1972.

Reynolds Metals Co. started its fourth aluminum reduction potline at the Troutdale plant in 1973. The fourth line had a capacity of 25,000 tons per year and brought the Troutdale plant production to 105,000 tons out of a total plant capacity of 130,000 tons. Plant employment was estimated at 700 persons and had returned to the level it had reached prior to Reynolds shutting down operations because of an imbalance in supply and demand for primary aluminum. At yearend, Reynolds and Martin-Marietta Aluminum, Inc., the other aluminum producer in Oregon, were anticipating returning to full productive capacity in 1974.

Mitsui and Co. of Japan acquired a 50% interest in the aluminum production division of American Metals Climax Co. (AMAX). AMAX was to construct a 160,000-ton-per-year aluminum plant at Warrenton, Oreg. The Mitsui investment was expected to assure AMAX of the resources needed to complete the plant. Under terms of the sale, AMAX was to assume the existing long-term debt of the aluminum division, and Mitsui was to contribute $125 million in cash. The Mitsui investment would give the Japanese company a 50% interest in 43 AMAX aluminum-related facilities in the United States and foreign countries. AMAX submitted applications in July 1973 to the Oregon Department of Environmental Quality (DEQ) for permits to begin construction of the Warrenton plant. The company held a contract for 240 megawatts of power to be supplied by Bonneville Power Administration by April 1976. AMAX expected to begin plant construction in 1974. Company officials stated that the plant would be a showcase for the aluminum industry with an air pollution control system capable of keeping fluoride emissions to not more than 1.5 pounds per ton of aluminum produced. Nevertheless, the company faced strong opposition from the shrimp and tourist industries of Oregon. When completed, the $200 million complex will employ 770 people and will be the largest single manufacturing plant investment ever reported in Oregon.

A federal court jury awarded $353,155 in punitive and compensatory damages to a fruit grower in the Dalles area of Ore-

gon. The defendant in the case was the Harvey Aluminum Co. now known as Martin-Marietta Aluminum Inc. The complaint charged Harvey with trespassing by spewing hydrogen chloride gases into the air that then settled on orchards. The gas was a waste emission from the production of aluminum during the years 1965-71.

Gold and Silver.—The quantity and value of gold produced in Oregon during 1973 increased in quantity and increased in value when compared with that of 1972. Silver recovered from ores amounted to 1,282 ounces valued at $3,279 in 1973 compared with 2,252 ounces valued at $3,795 in 1972. The average annual price was $97.81 per ounce of gold and $2.558 per ounce for silver.

Cornucopia Minerals Co. of Denver, Colo., resumed mining its gold placer deposit on Pine Creek in Oregon after shutting down operations in 1972 for the winter. The company planned to go "public" by selling 1 million shares of stock, with the shares being registered only in Colorado. Company officials stated that 1973 capital investment plans called for using a second dragline crane to mine ore.

A federal court in Oregon dismissed a suit brought against the State by two gold miners. The plaintiffs asked for $350,000 for damages which they claimed arose from the DEQ forcing them out of business by setting water quality standards excessively high. The suit was dismissed on the basis of the 11th amendment to the Constitution, which does not permit litigation of civil suits against States in Federal courts unless the State waives the specific prohibition.

Iron and Steel.—Oregon Steel Mills (OSM), a division of Gilmore Steel Corp., commissioned a new million-dollar facility for surface processing of new steel products at its Rivergate property in north Portland. The plant was to clean and prime-paint new steel before it was used or shipped to customers. The facility can handle vast quantities of steel in the form of plate, beam, fabricated, or other shapes. Air pollution control equipment included negative air-pressure spray cabinets, 240 special sateen cotton bags, and water curtains to trap dirt, dust, paint particles, or solvents that might otherwise escape. Reportedly, OSM was to close down its melting shop in Portland by yearend 1974. The reason given for the closure was that new environmental regulations coming into force at the beginning of 1975 would make it uneconomical to operate the furnaces.

Cascade Steel Rolling Mills, Inc., of McMinnville was merged into Klinger Steel Co. of Stockton, Calif., at midyear. The merger with Klinger made substantial resources available to Cascade for use in covering debts and expansion plans. The expansion plans called for modifications to the rolling mill hot bed and a new crane for the melt mill and were to be completed by yearend. Air-pollution control equipment for the plant was also under study during the year. Cascade had to cut steel production by 40% in January as a result of a shortage in scrap steel. The scrap shortage problem lasted through the first quarter of 1973.

Mercury.—Mercury was produced again in Oregon after 1 year of no production in 1972. Two mines were in operation in 1973 compared with none in 1972 and two mines in 1971. The average value per flask of mercury in 1973 was $286.23.

Molybdenum.—Johns-Manville Products Co. filed claims on 4,400 acres of land in the Wallowa-Whitman National Forest, Blue Mountain Division in 1973. The claims were located in the North Powder River drainage area and reportedly contained copper and molybdenum. Exploratory drilling by the company was severely criticized by ranchers in the area. The drilling was being done to determine the size, depth, and grade of the low-grade molybdenum-copper deposit. There was no further data available on the company's assessment of the deposit at yearend.

Nickel.—Hanna Mining Co. processed 1,353,458 dry short tons of nickel laterite ore containing 1.35% nickel from its Nickel Mountain mine in Douglas County. The ore contained 18,272 tons of nickel, 12,937 of which were recovered in 25,874 tons of ferronickel. This represented a 2% decrease in nickel recovered compared with that of 1972. Hanna maintained the price of ferronickel throughout the year at $1.38 per pound of contained nickel, f.o.b. Riddle, Oreg.

Silicon.—Kawecki Berylco Industries, Inc., planned to invest about $5.5 million to double the production capacity at its high-purity silicon plant in Springfield. The facility supplied silicon to the alumi-

num, electronics, and abrasives industries. Construction was to begin in 1974 and be completed by 1975. The new facilities were to include a much larger furnace, an expanded finished goods building, new crushing and screening equipment, an additional raw materials storage area, and a railroad siding. Also included in the plans were the latest available pollution control devices.

Titanium.—Precision Castparts Corp. was considered the world's largest producer of big aerospace and aircraft investment castings in 1973. The company supplied castings to the major builders of gas turbine jet engines such as General Electric Co., Pratt and Whitney Aircraft Div. of United Aircraft Corp. and Garrett Airesearch Manufacturing Div. of Garrett Corp. Company officials expected aircraft engine-related sales in 1973 to grow at a 10% to 15% rate over those of 1972.

A new but growing titanium-related industry in Oregon was that of casting golf club heads. Reportedly, this new commercial market was using a considerable amount of plant capacity at Rem Metals, Inc., in Albany. In a related development, Martin-Marietta Corp. was reported to be nearing production of golf club shafts made of titanium. Titanium was being used because it was lighter than aluminum, stronger than steel, and had a minimum of torque (whippiness).

Zirconium.—Teledyne-Wah Chang of Albany was awarded a $2,482,765 Air Force contract to produce zirconium sponge particles for use in air-delivered munitions. The company sustained a $15,000 loss as a result of a weekend fire that started in a scrap barrel. Company officials reported that the fire caused no structural damage to the plant.

MINERAL FUELS

In 1973, the Oregon Legislature passed authorizing legislation (Senate Bill 424) directing the Public Utility Commissioner of Oregon to conduct an energy study and report its findings to the 1975 legislative session. Under the legislation, the Governor appointed on September 10 a nine-member advisory committee to help draft a proposed State energy policy and to recommend legislation on energy-related issues. Three of the members represented energy-related industries; three, environment-related organizations; two, major users of energy; and one, the public. Because of the influential nature of the individual panel members, their recommendations were expected to receive careful consideration by members of the Oregon House and Senate.

Geothermal Power.—Results of a joint research and development program between the State of Oregon and the Federal Bureau of Mines for locating potential geothermal reservoirs within the State are reported under the heading of Government Programs in this chapter.

Gulf Oil Co., which held about 100,000 acres of fee land in Klamath and Lake Counties, expected to spud in the first of two geothermal test wells in late 1973. The first well was to be 6,000 feet deep in the Goose Lake Basin area near Lakeview. Other counties in Oregon that have identifiable geothermal sites were Harney, Malheur, and Union.

Natural Gas.—Northwest Natural Gas Co. began construction in 1973 on a $25 million synthetic natural gas plant northwest of Portland. The plant was being constructed by Fluor Corp. and was scheduled for completion in November 1974. The plant, the first of its kind west of the Mississippi River, will produce synthetic natural gas from natural gas condensates piped in from Alberta, Canada. The pipeline from Alberta to Portland was yet to be built. The entire project was expected to cost $75 million. At yearend, Northwest was considering the construction of a $10 million liquified natural gas (LNG) plant on the shore of Yaquina Bay near Newport. The installation would include a 300,000-barrel holding tank for the LNG and would be one of the largest such facilities on the west coast. The company held preliminary talks during 1973 with Phillips Petroleum Co. about obtaining the gas from Alaska.

Nuclear.—The AEC issued a final environmental impact statement on PGE's Trojan nuclear powerplant in 1973. The statement reported that the plant will have no significant impact on the environment that would prevent issuance of an operating license. A proposed license condition called for PGE to monitor for any environmental effects of plant operation. The plant was to be operational by July 1975. PGE abandoned its option to purchase the

Miles Lake nuclear plant site near Cape Kiwanda in Tillamook County in 1973. The 703-acre site had been under investigation by PGE for more than a year. The reason given for site abandonment was that deep drilling and seismic probing indicated that foundation conditions for the main plant were less than completely satisfactory. In related activities, PGE filed an application for a site certificate to construct and operate both nuclear and coal-fired thermal powerplants at its Boardman site. The company was to make application to the AEC for a nuclear plant construction permit late in the year. PGE expected to have the Boardman plant on line in 1980.

Petroleum.—Standard Oil of California abandoned its wildcat drilling operation in the Blue Mountains of Malheur County in August 1973. The hole produced no show of gas or oil. Standard plugged the hole below 2,000 feet and gave the upper portion of the hole to the Oregon Department of Geology and Mineral Industries. The Department will use the hole for temperature survey studies being undertaken as part of a grant from the Federal Bureau of Mines. Standard's 4-year-old permit to explore for gas and oil off Oregon's coast was renewed in 1973 by the State Land Board for an additional 2 years.

Table 6.—Principal producers

Commodity and company	Address	Type of activity	County
NONMETALS			
Cement: Oregon Portland Cement Co	111 Southeast Madison St. Portland, Oreg. 97214	Plant	Baker and Clackamas.
Clays:			
Columbia Brick Works	1320 Southeast Water St. Portland, Oreg. 97214	Pit and plant	Multnomah.
Empire Building Materials Co	9255 N.E. Halsey St. Portland, Oreg. 97220	do	Washington.
Forest Grove Brick Works Inc	Box 371 Forest Grove, Oreg. 97116	Pit	Do.
Klamath Falls Brick & Tile Co	P.O. Box 573 Klamath Falls, Oreg. 97601	Pit and plant	Klamath.
Molalla Clay Products Inc	Route 3, Box 140 Molalla, Oreg. 97038	Pit	Clackamas.
Monroe Clay Products Co	P.O. Box A Monroe, Oreg. 97456	Pit and plant	Benton.
Needy Brick & Tile Co	Route 1, Box 102 Hubbard, Oreg. 97032	do	Clackamas and Marion.
Oregon Portland Cement Co	111 Southeast Madison St. Portland, Oreg. 97214	Pit	Baker.
Williamina Clay Products Co., Inc	9780 Southwest Hunziker St. Tigard, Oreg. 97223	Pit and plant	Yamhill and Lane.
Diatomite: A. M. Matlock	P.O. Box 3307 Eugene, Oreg. 97402	Mine and plant	Lake.
Lime:			
Amalgamated Sugar Co	Nyssa, Oreg. 97913	Plant	Malheur.
Ash Grove Cement Co	101 West 11th St. Kansas City, Mo. 64105	do	Multnomah.
Pacific Carbide & Alloys Co	P.O. Box 17008 Portland, Oreg. 97200	do	Do.
Perlite (expanded): Supreme Perlite Co	P.O. Box 66 North Portland, Oreg. 97043	do	Do.
Pumice:			
Central Oregon Pumice Co	5 Greenwood Ave. Bend, Oreg. 97701	Mine and plant	Deschutes.
Graystone Corp	Box 1087 Bend, Oreg. 97701	do	Do.
Sand and gravel:			
Beaver State Sand & Gravel	P.O. Box 1427 Roseburg, Oreg. 97495	Pit	Douglas.
Copeland Sand and Gravel Inc	P.O. Box 608 Grants Pass, Oreg. 97526	Pit	Josephine.
Delta Sand & Gravel, Inc	999 Division Ave. Eugene, Oreg. 97402	Pit and plant	Lane.

Table 6.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
NONMETALS—Continued			
Sand and gravel—Continued			
Eugene Sand and Gravel Co	Box 1067 Eugene, Oreg. 97401	Pit and plant	Lane.
Glacier Sand and Gravel Co	5979 East Marginal Way Seattle, Wash. 98134	do	Multnomah.
Ross Island Sand & Gravel Co	4129 S.E. McLoughlin Blvd. Portland, Oreg. 97222	Pit	Do.
Tigard Sand & Gravel Co. Inc	16470 S.W. 72d Ave. Tigard, Oreg. 97223	Pit	Washington.
Valley Concrete & Gravel Co	P.O. Box 38 Independence, Oreg. 97351	Pit	Polk.
Wildish Sand and Gravel	P.O. Box 1106 Eugene, Oreg. 97401	Pit	Lane.
Willamette Hi-Grade Concrete Co	Foot North Portsmouth Avenue Portland, Oreg. 97203	Dredge and plant.	Multnomah.
Stone:			
L. H. Cobb	8275 Southwest 145th Ave. Beaverton, Oreg. 97005	Quarry and plant.	Washington.
Grant Sharp Construction Co	Route 4, Box 240 Molalla, Oreg. 97038	Quarry	Clackamas.
Klamath Rock Products	P.O. Box 1180 Klamath Falls, Oreg. 97601	do	Klamath.
McCall Crushing Inc	1075 Wilco Rd. Stayton, Oreg. 97383	do	Do.
Oregon Portland Cement Co	111 Southeast Madison St. Portland, Oreg. 97214	Quarry and plant.	Baker.
Quality Rock Co	Route 2, Box 608 Beaverton, Oreg. 97005	do	Washington.
Rivergate Rock Products	7881 N.W. St. Helens Rd. Portland, Oreg. 97229	Quarry	Multnomah.
Rogers Construction Co	P.O. Box 16537 Portland, Oreg. 97216	3 quarries	Clackamas, Multnomah, Washington.
Springfield Quarry Rock Products Inc.	702 South 28th St. Springfield, Oreg. 97477	Quarry	Lane.
Talc and soapstone: John H. Pugh	2891 Elk Lane Grants Pass, Oreg. 97526	Mine	Josephine.
Vermiculite (exfoliated):			
Supreme Perlite Co	P.O. Box 66 North Portland, Oreg. 97643	Plant	Do.
Vermiculite-Northwest, Inc	P.O. Box A Auburn, Wash. 98002	do	Do.
METALS			
Aluminum:			
Martin-Marietta Aluminum, Inc	1800 K St., N.W. Washington, D.C.	Smelter	Wasco.
Reynolds Metal Co	Troutdale, Oreg. 97060	Plant	Multnomah.[1]
Ferroalloys:			
Hanna Nickel Smelting Co	Riddle, Oreg. 97469	do	Douglas.
Union Carbide Corp., Ferroalloys Div.[2]	Portland, Oreg. 97200	do	Multnomah.
National Metallurgical Co	Springfield Oreg. 97477	do	Lane.
Mercury: Alcona Mining, Inc	366 South 79 St. Springfield, Oreg. 97477	Mine	Douglas.
Nickel: Hanna Mining Co	Riddle, Oreg. 97469	do	Do.
Steel:			
Cascade Steel Rolling Mills, Inc	McMinnville, Oreg. 97128	Plant	Yamhill.
Oregon Steel Mills	Portland, Oreg. 97200	do	Multnomah.
Zirconium:			
Oregon Metallurgical Corp	P.O. Box 580 Albany, Oreg. 97321	do	Linn.
Teledyne Wah Chang	1600 N. Pacific Hwy. P.O. Box 460 Albany, Oreg. 97321	do	Do.

[1] Closed November 30, 1971.
[2] Produces ferromanganese and silicomanganese.

The Mineral Industry of Pennsylvania

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Pennsylvania Bureau of Topographic and Geologic Survey, Department of Environmental Resources, under a cooperative agreement for collecting information covering mineral production from mines, quarries, and wells.

By Franklin D. Cooper [1]

Pennsylvania mineral production reached a record output value of $1,401.9 million, a $170.4 million increase above that of 1972 but only $13.2 million more based on 1967 constant dollars. Compared with 1972, increases in value were attained by anthracite, bituminous coal, cement, iron ore pellets, clays excluding kaolin, lime, natural gas, natural gas liquids, peat, petroleum (crude), sand and gravel, stone, and zinc. The output value of copper decreased, and the value of gem stones was unchanged. Compared with the 1972 figures, the average f.o.b. mine value of anthracite increased $1.22 per ton and that of bituminous coal advanced $1.16 per ton. Collectively, solid-fuels production accounted for 62.5% of the total mineral production value, and the value of all fossil fuels equaled 66.2% of the total mineral production value.

Leading producing counties, with primary commodities in parentheses, were: Washington, Indiana, Greene, Cambria, and Armstrong Counties (bituminous coal); Northampton (cement); Centre (lime); and Schuylkill (anthracite). Pennsylvania led the Nation in production of stone and was second in cement and lime, third in bituminous coal and cadmium, and fourth in tripoli.

[1] Physical scientist, Division of Fossil Fuels—Mineral Supply.

Table 1.—Mineral production in Pennsylvania [1]

Mineral	1972		1973	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Masonry thousand short tons	451	$12,401	490	$14,443
Portland do	8,214	156,008	8,563	171,653
Clays do	2,682	15,829	[2] 2,975	[2] 16,664
Coal:				
Anthracite do	7,106	85,251	6,830	90,260
Bituminous do	75,939	694,267	76,403	786,792
Copper (recoverable content of ores, etc.) short tons	2,611	2,673	1,845	2,195
Gem stones	NA	9	NA	9
Lime thousand short tons	1,891	33,802	2,260	40,949
Mica, scrap thousand long tons	W	W	--	--
Natural gas million cubic feet	73,958	22,389	78,514	32,976
Peat thousand short tons	22	320	28	411
Petroleum (crude) thousand 42-gallon barrels	3,441	16,414	3,282	18,440
Sand and gravel thousand thousand short tons	18,757	36,804	20,576	42,830
Stone do	67,307	124,340	78,564	150,346
Zinc (recoverable content of ores, etc.) short tons	18,344	6,512	18,857	7,792
Value of items that cannot be disclosed: Clay (kaolin) (1973), iron ore, natural gas liquids, tripoli, and values indicated by symbol W	XX	24,466	XX	26,140
Total	XX	1,231,485	XX	1,401,900
Total 1967 constant dollars	XX	1,016,098	XX	[p] 1,029,275

[p] Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Pennsylvania, by county [1] [2]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adams	W	W	Stone, lime, clays.
Allegheny	$60,548	$69,481	Coal, cement, stone, petroleum, clays, sand and gravel.
Armstrong	58,365	59,184	Coal, sand and gravel, clays, stone, petroleum.
Beaver	3,689	W	Sand and gravel, coal, clays, petroleum.
Bedford	W	1,862	Stone, sand and gravel.
Berks	35,241	40,951	Iron ore, cement, stone, clays, coal, sand and gravel.
Blair	W	W	Stone, coal, sand and gravel.
Bradford	W	W	Sand and gravel.
Bucks	13,628	17,471	Stone, sand and gravel, clays.
Butler	25,870	W	Coal, cement, lime, stone, sand and gravel, petroleum, clays.
Cambria	W	W	Coal, stone.
Carbon	W	3,492	Coal, sand and gravel, stone.
Centre	20,859	W	Lime, coal, stone, clays.
Chester	W	W	Stone, lime, clays.
Clarion	W	37,481	Coal, stone, petroleum, clays, sand and gravel.
Clearfield	47,716	57,277	Coal, clays.
Clinton	W	W	Coal, stone, clays.
Columbia	W	W	Sand and gravel, stone, coal, peat.
Crawford	555	1,339	Sand and gravel, petroleum.
Cumberland	W	4,255	Stone, sand and gravel, clays.
Dauphin	W	W	Stone, coal, sand and gravel.
Delaware	W	W	Stone.
Elk	W	W	Coal, petroleum, natural gas liquids, stone.
Erie	W	2,146	Sand and gravel, peat, petroleum.
Fayette	18,468	22,712	Coal, stone, clays, petroleum.
Forest	W	W	Petroleum, sand and gravel.
Franklin	W	W	Stone, sand and gravel.
Fulton	535	W	Do.
Greene	100,067	112,527	Coal, petroleum, stone.
Huntingdon	W	W	Sand and gravel, stone, clays.
Indiana	72,629	88,032	Coal.
Jefferson	W	W	Coal, clays, petroleum.
Juanita	366	432	Stone.
Lackawanna	4,848	W	Coal, stone, peat.
Lancaster	W	14,843	Coal, stone, sand and gravel, clays.
Lawrence	33,367	W	Cement, coal, stone, sand and gravel, clays, peat.
Lebanon	17,040	W	Lime, iron ore, copper, stone.
Lehigh	28,226	W	Cement, stone.
Luzerne	31,059	32,922	Coal, stone, sand and gravel, clays, peat.
Lycoming	4,182	5,015	Sand and gravel, stone, coal, tripoli.
McKean	W	W	Petroleum, clays, stone.
Mercer	3,512	W	Coal, sand and gravel, stone, petroleum.
Mifflin	W	W	Sand and gravel, stone.
Monroe	W	2,359	Stone, sand and gravel, clays, peat.
Montgomery	W	W	Stone, cement, lime, clays.
Montour	W	W	Stone.
Northampton	84,217	95,514	Cement, stone, sand and gravel.
Northumberland	W	W	Coal, stone, sand and gravel, clays.
Perry	W	W	Stone.
Philadelphia	--	--	
Pike	--	518	Sand and gravel.
Potter	29	W	Petroleum, stone.
Schuylkill	W	W	Coal, stone, sand and gravel, clays.
Snyder	W	W	Stone, coal.
Somerset	28,503	42,296	Coal, stone, clays, sand and gravel.
Sullivan	581	381	Coal.
Susquehanna	661	739	Stone, coal.
Tioga	W	3,130	Coal, sand and gravel.
Union	W	W	Stone, clays.
Venango	W	W	Petroleum, coal, sand and gravel, natural gas liquids.
Warren	1,261	3,430	Petroleum, sand and gravel.
Washington	W	W	Coal, petroleum, stone, clays.
Wayne	W	W	Stone, sand and gravel.
Westmoreland	29,369	W	Coal, stone, sand and gravel.
Wyoming	W	W	Sand and gravel.
York	28,994	31,305	Cement, stone, lime, clays, sand and gravel.
Undistributed [3]	477,102	650,804	
Total [4]	1,231,485	1,401,900	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Cameron County is not listed because no production was reported.

[2] Value of petroleum is based on an average price per barrel for the State.

[3] Includes some stone and petroleum that cannot be assigned to specific counties, natural gas, gem stones, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Pennsylvania business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ---- thousands --	4,899.0	5,010.2	+2.3
Unemployment ---- do ----	265.0	242.2	−8.6
Employment (nonagricultural):			
Manufacturing ---- do ----	1,433.6	1,475.6	+2.9
Construction ---- do ----	205.1	212.6	+3.7
Mining ---- do ----	40.0	39.7	−.8
Transportation and public utilities ---- do ----	264.2	267.1	+1.1
Wholesale and retail trade ---- do ----	862.6	886.2	+2.7
Finance, insurance, and real estate ---- do ----	201.1	205.5	+2.2
Services ---- do ----	717.5	742.4	+3.5
Government ---- do ----	651.4	651.0	−.1
Personal income:			
Total ---- millions --	$53,249	$58,252	+9.4
Per capita ----	$4,465	$4,894	+9.6
Construction activity:			
Value of authorized nonresidential construction -- millions --	$464.5	$506.5	+9.0
Number of new residential units authorized ----	63,449	55,214	−13.0
Cement shipments to and within Pennsylvania thousand short tons --	3,428	3,666	+6.9
Mineral production value ---- millions --	$1,231.5	$1,401.9	+13.8

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; U.S. Bureau of Mines.

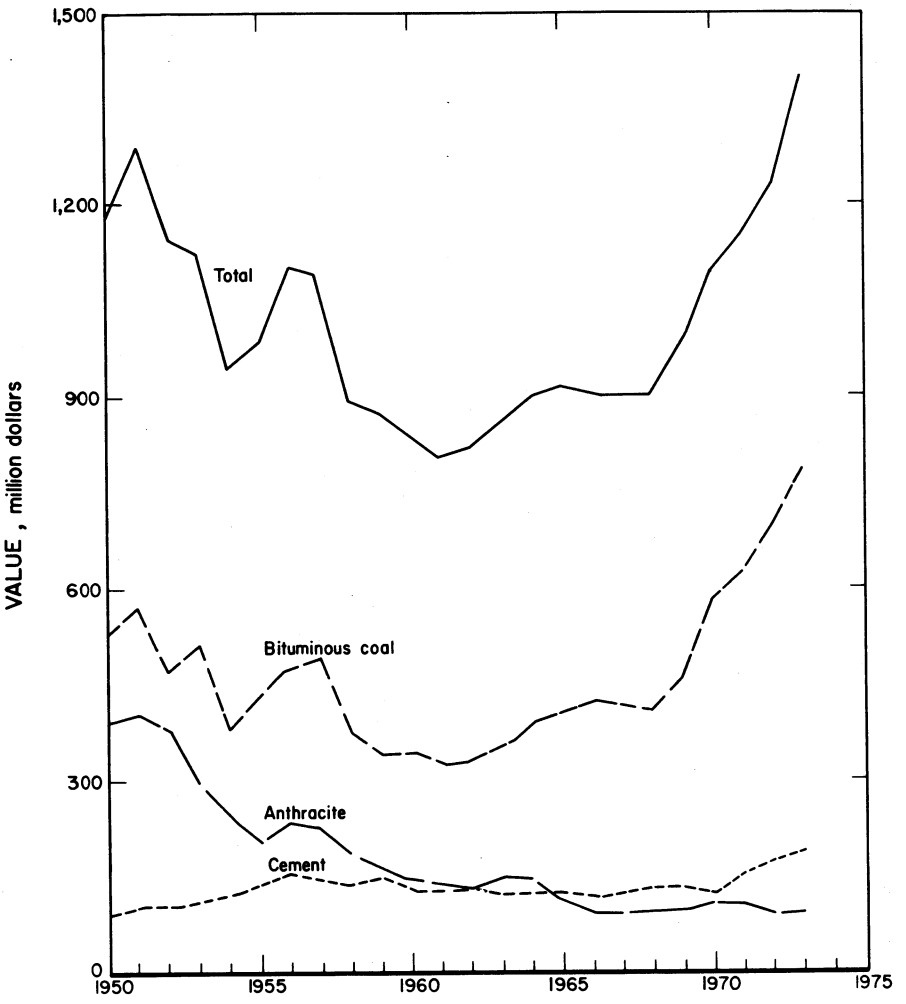

Figure 1.—Value of bituminous coal, anthracite, cement, and total value of mineral production in Pennsylvania.

Legislation and Government Programs.—Act 10A, for appropriating moneys in the Land and Water Development Fund which were derived from the issuance and sale of bonds and notes pursuant to the "Land and Water Conservation and Reclamation Act", was passed by the General Assembly and signed into law during 1973.

The Bureau of Mines awarded $1.5 million in contracts for the rehabilitation of its experimental mine in Bruceton. Work performed there by McCarthy Engineering and Construction, Inc., Tulsa, Okla., included the installation of advanced-type rock anchors, the removal of several thousand cubic yards of broken rock by a pneumatic conveying system, the construction of bulkheads, the installation of fibrous concrete on roof and walls, and instrumentation for monitoring simulated coal dust explosions. Other contracts were with the North American Galis Co. of Blairsville including a $90,000 "stretch car"—a multipurpose mine vehicle capable of being expanded or contracted hydraulically—and $240,000 to develop a machine for supporting mine roof with wire-rope trusses. Bituminous Coal Research, Inc.

(BCR), Monroeville, was granted $21,696 for a report on the use of water-flushed bits on coal-cutting machinery to minimize the dispersion of respirable dust. The report summarized 146 projects grouped into categories comprising dust control, machine design, respiratory protection, sampling instrumentation, dust physics, dust analysis, mining technology, epidemiological study, and research and facility development.

The Bureau of Mines granted $140,000 to Lehigh University for a 3-year project to design more effective coal dust samplers and to determine if the finest dust particles were accurately detected by sampling devices presently in use.

From 70% to 90% of the pyritic sulfur content was removed in pilot plant tests by the Bureau of Mines on several Pennsylvania coals. Organic sulfur was not removed in the two-stage flotation process used.

Ground breaking ceremonies were held February 6 at Bruceton for the Bureau of Mines 75-ton-per-hour Synthane coal gasification, pilot plant. Rust Engineering Co., on a $9,650,000 contract awarded January 11, will supply the detailed engineering, procurement, and construction efforts. The plant is designed to demonstrate the manufacture of pipeline-quality synthetic natural gas from all ranks of coal, including caking varieties, using a patented coal pretreatment step. Completion was slated for August 1974.

On January 15, the Office of Coal Research (OCR) of the U.S. Department of the Interior awarded a contract for $8,194,000 to Westinghouse Electric Corp. for the first phase of a project to develop at Waltz Mills a system for converting coal to a nonpolluting fuel gas. The program will be carried on by OCR, Westinghouse, Public Service of Indiana, Bechtel Corp., Amax Coal Co., and Peabody Coal Co. Pennslyvania Power and Light Co. (PPL) and Columbus and Southern Ohio Electric Co. (CSOE) also participated in the funding. OCR will assume 70% of the research and development costs. The industry team will bear the rest of the cost and also the full cost of a combined-cycle-power generating plant. After proving the feasibility of the interim powerplant, a gasifier and an electricity generating plant will be constructed by 1978 to be operated by Public Service of Indiana at Dresser, Ind. to produce enough gas for turbines capable of generating 100 to 130 megawatts (MW) of electricity. OCR awarded a $94,853 contract to General Electric Co. (GE) to improve the high-temperature operations of advanced magnetohydrodynamic (MHD) systems for generating electricity from coal. GE will provide an additional $133,000 for the experimental work to be performed over a 14-month period at its Space Sciences Laboratory at Valley Forge.

The University of Pittsburgh on a $103,000 Federal grant was investigating the safe removal of methane during coal mining and possible techniques for its recovery.

In 1973 Pennsylvania State University (Penn State) was spending about $1.8 million in grants for coal research, which were about 75% Federally funded. Penn State, on a project supported by the National Science Foundation's (NSF) Research Applied to National Needs (RANN) program, determined the dissipation of industrial waste heat by municipal waste water. Fields were soaked with sewage effluent; then water, at the temperature of coolant water discharged from a typical electric powerplant, was pumped through pipes buried in the moist soil. For 12 years, Penn State has studied the spray irrigation of sewage effluent in a project called "Living Filter." NSF made a grant to Penn State to improve the technology of coal liquefaction to produce a low-sulfur-content product resembling No. 6 fuel oil.

Pursuant to the Appalachian Regional Development Act of 1965, as amended, eight mine-fire-control projects were underway during 1973. One costing $50,502 was started and completed in Allegheny County, one costing $63,223 was in progress in Washington County, one costing $77,210 was completed in Indiana County, and four costing $3,769,351 were completed in Luzerne County. The 2-year maintenance period for two fire control projects in Westmoreland County was also completed. Three subsidence control projects costing $10,786,682 were started in Lackawanna County, and one subsidence project costing $532,212 was started and completed in Luzerne County. One mine-refuse-bank reclamation project costing $62,532 was started and completed in Lackawanna County. No work was started, in progress, or completed on well sealing

or mine pollution control. All of the active projects had 75% Federal funding and 25% State funding. Work funded equally by Federal and state governments under Public Law 162, Phase D, Project No. 46 was started in the Western Middle anthracite field on mine-water monitoring stations at an estimated total cost of $250,000.

The Department of the Interior in August approved the first mine-refuse-bank-reclamation project under the Appalachian Regional Development Act. The joint Federal-State project will reclaim a total of 33.0 acres at two municipally owned sites. The Bureau of Mines supervised the leveling of about 250,000 cubic yards of burned-out mine waste to reclaim the acreage for industrial development.

In February, the Department of the Interior approved a Federal-State project to control mine subsidence threatening $29 million of property in Scranton. The work, by a private contracting firm, required the hydraulic injection of approximately 1 million cubic yards of crushed mine and preparation plant waste through boreholes into the abandoned Pine Brook mine.

During the year, the DER received bids for the following Appalachian Regional Council (ARC) mine flushing projects: The National Colliery mine at Minooka in the Big, New County, Clark, No. 1 Dunmore, and No. 2 Dunmore veins; the Pine Brook mine in Scranton; and the Top Clark, Bottom Clark, and Third veins of the Powderly colliery in Carbondale. The Minooka project, considered as a pilot demonstration project, was eligible to receive funds from the Bureau of Mines totaling about 60% of the estimated $8 million total cost for drilling boreholes, furnishing and installing casing pipe, and pressure flushing 190,000 tons of breaker refuse into the voids. The Pine Brook project required drilling, the installation of various diameters of pipe casing, the flushing of 1,694,000 tons of processed refuse solids into the voids, and the construction of 17,124 square feet of bulkheads in the mine-void area. The Carbondale project required the flushing of 250,000 tons of refuse material using a controlled method of flushing and an additional 250,000 tons of refuse material flushed by the blind method if it was not possible to use the controlled flushing method for the entire 500,000 tons.

On February 6, Federal and State officials assessed the extent of current fires in those strip-mined pits in the Wyoming Valley that were used as flood-debris disposal sites following Hurricane Agnes. Proposals were tentatively devised for fighting a known fire in Wilkes-Barre Township and other reported fires. The Bureau of Mines made infrared scanning surveys followed by ground inspection. One fire near Plymouth and a second near the Veterans' Hospital were later extinguished.

In early October the Economic Development Council of Northeastern Pennsylvania (EDCNP) was designated by the ARC as a mine subsidence research center for the region comprising northeastern Pennsylvania. EDCNP will be responsible for the free flow of information among consultants, labor, mine owners, government officials, and the public; it will provide staff support in all areas of mining-related problems; and it will assist DER and consultants in obtaining needed advice and information.

The Bureau of Mines prepared preliminary plans for isolating fires in the Glen Burn culm bank at Shamokin after locating the fires by infrared imagery. In late September DER submitted a proposal to ARC for extinguishing the fires.

On March 6, DER received bids from six contractors for exploratory drilling to the Hillman vein at the abandoned Baltimore Colliery of the Hudson Coal Co. near Wilkes-Barre. The Empire Contracting Co. of Old Forge submitted an apparent low bid of $18,352. On the same date DER received bids from seven contractors for exploratory drilling at the abandoned No. 9 colliery in Pittston. Silver Brook Anthracite, Inc., submitted the lowest bid at $54,940 for drilling to the Checker and Pittston veins to determine the extent of subsidence.

Table 4 summarizes four categories of Operation Scarlift projects completed in the 5-year period ending December 31, 1973.

Table 5 lists the Appalachian projects approved for Pennsylvania during 1973 in fields related to mining.

Table 6 lists the mineral-industry-oriented Pennsylvania Industrial Development Authority (PIDA) loans approved in 1973.

Table 7 lists the mineral-industry-oriented PIDA loans pending final approval as of December 31, 1973.

Table 4.—Pennsylvania: Operation Scarlift: Summary of the projects completed in the 5-year period ending December 31, 1973

Project category	Anthracite		Bituminous		Total	
	Number	Cost	Number	Cost	Number	Cost
Stream pollution abatement	30	$7,718,128	125	$15,069,160	155	$22,787,288
Air pollution	11	12,281,786	8	181,012	19	12,462,798
Underground mine fires	5	74,030	27	8,918,634	32	8,992,664
Subsidence	11	1,088,974	35	1,633,459	46	2,722,433
Total	57	$21,162,918	195	25,802,265	252	46,965,183

Source: Resources Management, Pennsylvania Department of Environmental Resources Bond Issue Report for Period Ending December 1973, p. 91.

Table 5.—Appalachian projects approved for Pennsylvania in fields related to mining

Project	County	Total cost of project	ARC funds	State funds
Oregon-Welch Hill Section Emergency Subsidence	Luzerne	$4,400,000	$3,300,000	$1,100,000
Swoyersville Emergency Subsidence	do	2,750,000	2,062,500	687,500
Plymouth Emergency Subsidence	do	3,300,000	2,475,000	825,000
Mt. Carmel Emergency Subsidence Project	Northumberland	220,000	165,000	55,000
Total		10,670,000	8,002,500	2,667,500

Source: Bureau of Appalachian Development, Department of Commerce. Commonwealth of Pennsylvania.

Table 6.—Pennsylvania: Mineral-industry oriented PIDA loan projects approved, 1973

SIC code	Industry group	Number of projects	Loans, amount	Project cost	Planned employment	Estimated payroll[1]
32	Stone, clay, glass, concrete	4	$1,318,780	$3,296,950	264	$2,877,490
33	Primary metals	6	2,864,480	7,161,200	590	6,228,320
34	Fabricated metal products	11	980,100	2,284,000	258	3,093,391
35	Machinery, other than electrical	8	2,299,240	6,821,412	650	5,880,904
36	Electrical machinery, equipment, and supplies	5	1,094,022	2,797,555	644	3,552,800
37	Transportation equipment	5	2,840,000	8,550,000	2,244	9,846,000
65	Land development for industrial parks	1	728,390	5,402,000	NA	NA
89	Research and development	1	531,900	1,182,000	275	1,785,000
	Total	41	12,656,912	37,495,117	4,925	33,263,905

NA Not availabble.
[1] Payroll for industry groups are total of project estimates at the time loans were approved; they do not reflect current earnings rates or actual company payrolls for 1973.

Source: Pennsylvania Industrial Development Authority. Summary of Loan Projects 1956–1972. Report 34, p. v. Pennsylvania Industrial Development Authority. Summary of Loan Projects 1956–1973. Report 36, p. 15.

Table 7.—Pennsylvania: Mineral-industry oriented PIDA loan projects tentatively approved pending final approval as of December 31, 1973

SIC code	Industry group	Number of projects	Loans, amount	Project cost	Planned employment	Estimated payroll
32	Stone, clay, glass, concrete products	3	$1,872,696	$4,293,916	143	$1,419,830
33	Primary metals	4	4,627,062	11,567,655	1,014	8,066,000
34	Fabricated metal products	5	302,080	760,200	111	811,380
35	Machinery, other than electrical	9	867,500	2,345,000	258	2,156,692
36	Electrical machinery, equipment and supplies	7	7,281,300	24,000,000	2,159	26,721,271
37	Transportation equipment	2	180,000	486,000	220	1,250,000
65	Land development for industrial parks	7	1,735,536	5,525,486	NA	NA
	Total	37	16,886,174	48,978,257	3,905	40,425,173

NA Not available.

Source: Pennsylvania Industrial Development Authority. Summary of Loan Projects 1956–1973. Report 36, p. 17.

According to the Federal Highway Administration (FHA), the total cost of projects in progress or authorized for the Interstate and Defense Highway system in Pennsylvania at yearend equaled $1,009.9 million, $24.4 million more than at yearend 1972. Projects in progress or authorized at the end of 1973 for primary, secondary, and urban highway extensions totaled $530.6 million, $13.0 million more than at yearend 1972. The total cost of primary, secondary, and urban highway extensions completed in 1973 was $97.5 million. Interstate and Defense Highway mileage opened to traffic in 1973 totaled 0.58 mile, increasing the length of such highway opened to traffic since July 1, 1956 to 1,411.01 miles; at yearend 75.26 miles were under construction; 67.56 miles were in the design stage; and 21.07 miles were in the preliminary status or not yet in progress.

In 1973, DOT awarded contracts totaling $393.7 million including $34.8 million to repair flood damages which resulted from Hurricane Agnes. Construction contract expenditures for 1973 totaled $341.1 million distributed as follows: Interstate system, $101.6 million; primary, $33.1 million; secondary, $14.9 million; urban $36.9 million; Appalachian $38.8 million; 100% State, $98.7 million; and flood, $17.1 million. Total construction expenditures were $20.6 million greater than in 1972. Highway maintenance expenditures, including snow and ice removal, totaled $178.7 million.

As of January 1, 1974, DOT had 750 active construction contracts with a total value of $1,702,715,813. At the start of 1973, there were 605 contracts with a total value of $1,634,591,513.

Three Bureau of Mines publications were released in 1973 that discuss problems relating to the mineral industry of Pennsylvania.[2]

The U.S. Geological Survey issued two publications that contain information on Pennsylvania.[3]

Four publications were released in 1973 by the Pennsylvania Bureau of Topographic and Geologic Survey.[4]

The Pennsylvania Bureau of Topographic and Geologic Survey, in cooperation with the U.S. Geological Survey and the U.S. Bureau of Mines, placed on open file physical and chemical data for 162 clay-shale samples in the Greater Pittsburgh region. The report also suggested potential uses for the materials.

The Pennsylvania Bureau of Topographic and Geologic Survey, in cooperation with the U.S. Geological Survey, placed on open file a detailed report on sources of construction aggregates in the Greater Pittsburgh area. Active producers of sand and gravel, crushed stone, and slag are identified, and information on geological formations, physical tests, and current uses of aggregates from each active operation is given.

Penn State, under contracts with OCR, prepared three reports that were released in 1973. One 134-page report analyzes strip-mining methods and equipment selection, suggests strip-mining methods for future application, recommends sound reclamation practices on disturbed land, and described how the selection of equipment is strongly influenced by geological factors as well as the establishment of vegetation on overburden spoil. A second report summarizes the content of 8 major metallic elements and 22 trace metallic elements in the ashes of 57 coal and lignite samples. A third report describes the testing of a wide range of coals for acetylene production. Of 30 samples of coals of various origins and compositions studied, the highest yields of acetylene were obtained from high-volatile bituminous coals.

In January, Governor Shapp ordered an

[2] Manning, R. E. Muffler for Pneumatic Drill. BuMines Open File Rept. 28–73 prepared by U.S.S. Engineers and Consultants, Inc., January 24, 1973, 24 pp; available for consultation at the Bureau of Mines libraries at Pittsburgh, Pa., Denver, Colo., Twin Cities, Minn., and Spokane, Wash., and at the Central Library. U.S. Department of the Interior, Washington D.C.

McCullock, C.M., and M. Deul. Geologic Factors Causing Roof Instability and Methane Emission Problems. BuMines RI 7769, 1973, 25 pp.

U.S. Bureau of Mines. Methods and Costs of Coal Refuse Disposal and Reclamation. BuMines IC 8576, 1973, 36 pp.

[3] Brobst, D. H., W. P. Pratt, and D. E. McKelvey. Summary of the U.S. Mineral Resources. U.S. Geol. Survey Circ. 682, 1973, 19 pp.

U.S. Geological Survey. United States Mineral Resources. Prof. Paper 820, 1973, 722 pp.

[4] Hoskins, D. M. Fossil Collecting in Pennsylvania. Bull. G–40 (reprint), 1973, available from the Pennsylania Bureau of Publications, P.O. Box 1365, Harrisburg, Pa.

Lytle, W. S. Oil and Gas Developments in Pennsylvania in 1972. Pa. Geol. Survey Progress Rept. 186, 1973, 36 pp.

Rudd, N. Subsurface Liquid Waste Disposal and Its Feasibility. Geol. Survey Environmental Geol. Rept. 3, 1973.

Sponseller, R. D. Analyses and Measured Sections of Pennsylvania Bituminous Coals. Pennsylvania Geol. Survey Mineral Resources Report 66, 1973, 478 pp.

additional $250,000 in the next State budget for accelerated research on coal conservation, coal use, and coal transportation.

The Governor sponsored the Pennsylvania Industrial Fuel Energy Seminar held in Harrisburg August 22. Cosponsors were the Pennsylvania Coal Mining Association, Keystone Bituminous Coal Association, Associated Petroleum Industries of Pennsylvania, Pennsylvania Electric Association, Pennsylvania Gas Association, and Pennsylvania Petroleum Association. Attendance at the seminar represented, in aggregate, over 40% of the State's total energy demand. Industrial spokesmen contributed their knowledge and understanding of the fuels situation and suggested ways to conserve domestic and industrial energy. In September, the Governor named a seven-member task force to determine how much fuel would be available and, if a shortage was indicated, to propose an allocation program for domestic and industrial consumers. The Governor's special representative on coal problems held a meeting in Pottsville December 17 as a direct result of the energy crisis. Representatives of the Department of Environmental Resources (DER) and the Bureau of Mines were concerned with expanding anthracite production, finding new markets, and assuring potential customers that their needs for anthracite could be satisfied.

Environment.—*Air Pollution.*—In March, DER held hearings on plans for reducing the levels of carbon monoxide in Allegheny and Philadelphia Counties before submitting the plans to EPA. DER resolved to meet EPA's primary air pollution standards by the 1975 deadline, although more time was requested to develop plans to meet EPA's secondary clean air standards.

Expenditures for existing or planned air quality control measures in Philadelphia County during 1973–74 included $150,000 for a baghouse system to collect 0.05 ton per day (17 tons per year) of particulates from one red lead furnace; $100,000 for a baghouse installation to recover 0.15 ton per day (37.5 tons per year) of particulates at an aluminum dross plant; $300,000 for baghouse systems at two asphalt batching plants to collect 1.2 tons per day (240 tons per year) of particulates; $400,000 for coke oven modifications and a baghouse system at a coke manufacturing plant to collect 1.0 ton per day (365 tons per year) of particulates; and two projects costing $6 million total in the fourth year of a 5-year program at a petroleum refinery to reduce total hydrocarbon emissions by 3 tons per day (1,095 tons per year).

Air pollution control in Allegheny County was the objective of many activities and actions. The Allegheny County Air Pollution Control Board granted a variance to the Pittsburgh Coal Co. to either April 30 or September 1974, depending on the performance of pollution controls installed to eliminate particulates emitted from a thermal coal dryer at the company's McDonald plant. In April the Board granted an 18-month variance to the Mesta Machine Co. relating to sulfur dioxide and particulate emissions from a coal-fired boiler at its Homestead plant. Also in April a variance until December 1974 was granted to Atlantic Richfield Co. (ARCO) to install a gasoline-vapor collection and disposal system at its Lawrenceville terminal. The Board also granted a variance until September 1973 on particulate emissions from crushing-and-pressing equipment at the McKees Rock plant of the Metallurgical Exoproducts Corp.

The Allegheny County Bureau of Air Pollution Control Annual Report for 1973 indicated that 60 monitoring stations showed a 13% decrease in sulfur dioxide levels compared with those of 1972. The decrease was attributed mostly to conversion from coal to natural gas or oil as fuels, the shutdown of obsolete coal-fired boilers, and the use of lower sulfur coal. The sulfur dioxide emissions from specific sources decreased from 220,000 tons in 1972 to 190,500 tons in 1973. In high-pollution areas, sulfur dioxide concentrations were down 7% to 20% from 1972 levels. However, the 1973 concentration still exceeded the EPA standard of 0.03 part per million (ppm) slated to become effective in 1975.

Duquesne Light Co. shut down six coal-fired boilers at its Reed Station on Brunot Island, thereby ending the use of coal for electricity generation in Pittsburgh and the emission of more than 12,000 tons of sulfur dioxide per year. The company also completed the conversion from coal to oil at its Allegheny steam heating plant, ending the use of coal as a source of heat for many downtown Pittsburgh buildings.

West Penn Power Co. shut down three obsolete boilers that had emitted nearly 19,000 tons of sulfur dioxide per year from its Springdale station. The Jones and Laughlin Steel Corp. (J & L) reduced sulfur dioxide emissions from its Pittsburgh Works nearly 5% by using coal having a lower sulfur content. United States Steel Corp. (U.S. Steel) plants throughout Allegheny County reduced sulfur emissions overall from 43,645 tons in 1972 to 40,780 tons in 1973. The 7% reduction resulted mainly by using low-sulfur coal. By terminating the use of coal at its East Pittsburgh boiler plant, Westinghouse Electric Corp. cut sulfur emissions nearly 100%, from 3,340 tons in 1972 to 190 tons in 1973.

Concentrations of particles of dust and soot, too fine to settle, increased about 10% over 1972 levels, based on data from 19 high-volume sampling stations, despite substantial reductions in emissions from several individual plants. The increase was attributed mostly to near-capacity iron and steel production during the year. Notable reductions were achieved by the cement industry, where installation of cyclone collectors reduced stack emissions 89% from 2,700 tons in 1972 to 300 tons in 1973. Conversion from coal to oil at downtown Pittsburgh steam-heating plants cut particulate emissions by more than a third, from 2,300 tons in 1972 to 1,500 tons in 1973. The downtown Oakland and Braddock areas of Pittsburgh showed the highest concentrations of suspended particulates, while the Springdale, North Fayette, South Fayette, and Greater Pittsburgh Airport sites, far from the Monongahela Valley with its stepped-up steel production, showed no increase over levels a year earlier. Dustfall also was a problem in Clairton and Braddock.

Allegheny County Commissioners approved a schedule of tougher penalties for criminal violations of air pollution standards. Fines were raised from $30 to $300 per day to $100 to $1,000 per day for a first violation. Violations repeated within 2 years of the first conviction were subject to a misdemeanor fine ranging from $500 to $5,000.

Legal action against U.S. Steel was appealed to higher courts. The Allegheny County Health Department and the DER filed an appeal in Commonwealth Court seeking to reverse the decision of Common Pleas Judge Silvestri Silvestri, who refused to impose a $300,000 fine on the corporation or hold it in contempt for noncompliance with an agreement to reduce emissions at the Clairton coke works. The case began in January 1972 when the county and Commonwealth filed a joint equity suit to force the steelmaker to install the best available equipment to eliminate air pollution at the coke works. Nine months later, a consent decree calling for specific control measures estimated to cost $4.5 million was signed by government and company officials. In a separate action the Health Department appealed to Commonwealth Court to uphold its denial of permits for construction of two boilers at the Clairton coke works, because the stacks proposed would not be tall enough to disperse pollutants.

During 1973 the Air Pollution Control Bureau issued more that 75 compliance orders calling on polluting firms to submit timetables for abatement. Among them were plans of action requested from J & L to install facilities to desulfurize coke oven gas at its Pittsburgh works by July 1977, with interim standards to be met in 1974; Shenango Inc. to desulfurize coke oven gas by June 1975, and cleaned up coke oven emissions by December 1975; and U.S. Steel to control fugitive emissions from basic oxygen furnaces at both its Edgar Thomson works and Duquesne works within 3 years.

Allegheny County Commissioners, responding to recommendations from the Air Pollution Advisory Committee and the Board of Health, empowered the Variance Board to hear Health Department complaints against polluters, set compliance schedules, and impose fines ranging up to $10,000 per day for each violation and $2,500 for every day the violation continued. The Commissioners also amended the air pollution code to provide special short-term variances, effective only during the winter of 1973–74, for firms that could not obtain low-sulfur fuels. Two types of variances were available: An emergency 30-day variance, nonrenewable, for firms faced with sudden and unavoidable fuel cutbacks, and a 120-day fuel-usage variance for firms and institutions that had advance notice of a loss of their supply of low-sulfur fuel. By the end of 1973 only one firm, the Duquesne Light Co., had asked for such a variance to burn

high-sulfur oil temporarily in its Allegheny steam heating plant, which was converted earlier from coal to comply with county regulations.

The U.S. Geological Survey and the Susquehanna River Basin Commission (SRBC) began, in January, an 18-month study, jointly funded by Federal and State governments, of the acid mine drainage (AMD) problem in Kingston Borough. Monitoring devices were installed at seven locations.

The status of DER's AMD studies and projects is shown in table 8.

Table 8.—Pennsylvania: Status of AMD studies and projects, 1973

	Bituminous coal		Anthracite	
	Number of studies or projects	Cost [1] (thousands)	Number of studies or projects	Cost [1] (thousands)
New studies initiated in 1973	16	$1,092	4	$398
Studies funded prior to 1973	15	947	4	486
Studies completed in 1973	5	427	8	889
Design projects initiated in 1973	26	9,640	4	1,310
Design projects in progress, contracted for prior to 1973	39	13,321	5	2,180
Design projects completed in 1973	28	4,643	5	3,137
Construction projects started in 1973	22	3,401	4	3,115
Construction projects in progress in 1973, (started prior to 1973)	30	2,938	2	659
Construction projects completed in 1973	22	8,493	6	4,869

[1] Based on contracts or estimated construction costs.

In early 1973, the U.S. Supreme Court, in a split decision involving a suit against Pennsylvania Industrial Chemical Corp., Clairton, (a producer of coal-tar and petroleum products, reclaimed oils, and synthetic resins), over turned an Appeals Court ruling that an 1899 law did not apply to the corporation's discharge of waste products into a navigable waterway. The 1899 law was not expected to be used in future actions because EPA's enforcement actions were taken under a 1972 law.

DER planned to build two settling ponds to collect iron precipitates from AMD discharged from the abandoned Wildwood mine near North Allegheny County. Portals and air shafts were sealed in 1972, but the seals failed to stop the discharge into Pine Creek of an estimated 1.5 million gallons per day of AMD containing up to 800 ppm of iron.

The Pennsylvania Supreme Court, in a 6 to 0 decision handed down March 16, upheld the right of DER to order coal mining companies to treat AMD even though it did not originate in their mines but had to be pumped out to enable mining to continue. The decision affected the Indianola mine of the Harmer Coal Co. and the Hutchinson mine of the Pittsburgh Coal Co. The court held that the only solution to the problem was to treat the AMD and that no hardship would result on the companies by increasing the cost of such treatment.

Despite a massive campaign by coal industry lobbyists, the Pennsylvania Environmental Quality Board reversing an earlier action voted 16 to 0 on May 18 to permit no more than 1.5 ppm iron in all intrastate streams. As a result of the reversal, DER for the first time could regulate AMD and other potential water pollutants.

In January, EPA made a $476,000 demonstration grant to the Allegheny County Sanitary Authority (Alcosan) to develop a program to identify, monitor, and control toxic or hazardous materials from the industrialized Greater Pittsburgh area. Alcosan sent questionnaires to all industries discharging wastes into the Alcosan system so that the type, amount, and location of waste water sources could be identified.

In December, a check of Little Dear Creek by the Allegheny County Bureau of Tests indicated that AMD and coal washery wastes had essentially been eliminated by cleanup operations at the Russelton mine of Republic Steel Corp. Some of the improvement was attributed to the contouring and seeding of coal-refuse dumps.

DER received bids on March 8 for the installation of six gas and temperature monitoring stations at three sites each in Plymouth Township and Swoyerville Borough where flood debris had been dumped into abandoned anthracite strip pits in mid-1972. The debris-filled abandoned Pagnotti pit in Plymouth Township was the site of several fires in February that threatened Swoyerville as well as Plymouth Borough. The situation was serious because the fires were above the Ross vein, which overlies the Red Ash vein. The site was approximately 175 feet deep, 200 feet wide, and 2,000 feet long. The DER awarded a contract to extinguish the fires and spread a 5-foot-thick earth cover on the extinguished debris.

The Third International Ash Utilization Symposium held in Pittsburgh March 13 and 14 highlighted developments in large-scale tonnage uses of fly ash and bottom ash. The meeting was sponsored by the Bureau of Mines, National Ash Association, National Coal Association, Edison Electric Institute, and the American Public Power Association.

Industry engineers at the American Mining Congress meeting in Pittsburgh in May called for more flexible regulations on coal-refuse disposal. The former State Secretary of Mines suggested research programs on the use of coal-refuse for highway construction and as an aggregate in concrete.

White, Chubb, and Charmbury described the use of anthracite refuse in horticulture.[5]

Mined Land Reclamation.—Thirty papers were presented at the Research and Applied Technology Symposium on Mined Land Reclamation held in Pittsburgh March 7 and 8. The National Coal Association sponsored the meeting to exchange information on the expansion of technology and research to convert reclamation from an art to a scientific discipline.

Members of the Congressional Environment Committee and the Congressional Committee on Mines and Mining in April toured five strip-mined sites in Butler, Jefferson and Venango Counties to observe examples of total restoration. Pennsylvania law requires that restoration work must begin as soon as coal is removed and that the mine operators must post a minimum bond of $500 per acre, which is not refunded until restoration is approved by DER.

Consolidation Coal Co. sold 4,000 acres overlying its worked out Solar deep mine in western Allegheny County to Aloe Brothers for $753,000. Coal remaining in stumps and pillars will be strip-mined and sold to Duquesne Light Co. for use at its Phillips Station. During this stripping project, estimated to require 3 to 5 years, limestone underlying the coal will be blasted to permit percolation of AMD from the mine workings; some of the limestone will be used in road construction. In some areas, the strip pits will be used as sanitary landfill sites until final grading operations are started. The acreage will eventually be restored to prime land in the area between the Greater Pittsburgh Airport and U.S. Route 22.

Table 9, from the annual report of the DER's Bureau of Surface Mine Reclamation, shows information on bank reclamation in bituminous coal producing counties of the State.

[5] White, J. W., W. R. Chubb, and H. B. Charmbury. Anthracite Refuse as a Soilless Medium. Min Eng., v. 25, No. 3, March 1973, pp. 48–49.

Table 9.—Pennsylvania: Spoil bank reclamation at bituminous coal mines

County	Trees planted in 1973		Grasses planted in 1973	
	Number of sites	Acres	Number of sites	Acres
Allegheny	1	6.00	5	82.16
Armstrong	12	152.60	18	430.90
Beaver	8	211.70	--	--
Butler	1	28.00	16	369.72
Cambria	6	67.72	8	196.80
Centre	24	412.64	1	49.30
Clarion	36	701.30	21	523.00
Clearfield	73	1,456.55	4	119.20
Elk	7	99.60	1	45.30
Fayette	--	--	24	199.32
Fulton	1	25.00	--	--
Greene	--	--	4	44.40
Indiana	8	90.06	11	225.09
Jefferson	22	383.89	13	186.77
Lawrence	4	48.40	8	207.60
Somerset	3	46.20	15	306.20
Tioga	4	138.67	5	176.98
Venango	1	2.70	2	41.00
Washington	--	--	13	399.48
Westmoreland	1	10.00	16	191.39
Total	212	3,881.03	185	3,794.61

Table 10 shows information on bituminous coal surface-mining operations that appear in the 1972 Annual Report of the Licensing and Bonding Division, Bureau of Surface Mine Reclamation, DER.

Table 10.—Pennsylvania: Bituminous coal surface mining operations

Mine drainage control:	
Applications:	
Received:	
New	600
Amended	145
Issued:	
New	258
Amended	94
Enforcement action:	
Permits revoked	0
Permits suspended	7
Reinspections reports	4,946
Violations—mine drainage control	325
Strip mines:	
Total surface mine operators, 1972	740
Mining permits:	
Applications received for permit	900
Original (7,336.99 acres)	364
Amended (6,408.32 acres)	389
Corrected and reissued (1,718.77 acres)	52
Bond deposit:	
Surety at $1,000 per acre	$1,542,300.00
Surety at $500 per acre	4,440,784.50
Collateral at $1,000 per acre	93,400.00
Collateral at $500 per acre	1,772,026.75
Total	7,848,511.25
Collateral reapplied	$202,500.00
Bond released:	
At $1,000 per acre	$100,380.00
At $500 per acre	3,749,284.48
At $400 per acre	64,417.00
At $300 per acre	15,912.00
Total	3,929,993.48
Completion reports inspected:	
Approved partials	134
Approved acres—partial	2,771.98
Approved finals	255
Approved acres—final	4,411.43
Completion reports:	
Received	462
Number of acres	9,584.75
Suspension of mining license:	
Hearing or conferences	15
License suspended	0
Operations ceased	9
Bituminous mines working:	
Strip	568
Auger	27

In November, Federal funds were allocated to build a park on strip-mined land in Pennsylvania's 22d Congressional District to honor the late Rep. John P. Saylor, a leading conservationist during his 24 years in Congress.

A total of 369.3 acres of land reclaimed by mine operators in the anthracite region were seeded in grasses and legumes, and 25.0 acres were planted with shrub seedlings comprising Asiatic crabapple, multiflora rose, autumn olive, tartarian honeysuckle, and coralberry. The seedlings were planted on selected strip-mined sites to obtain the greatest benefit as food or cover for wildlife. In comparison with prior years, only 12,000 tree seedlings were planted on a few sites that were also seeded in grasses and legumes. This reduction in tree planting and the increase in grass seeding reflected the increased interest in obtaining a faster growing, complete vegetative cover to help control and reduce sedimentation.

In midyear, the associate deputy secretary of DER stated that a lack of manpower would probably prevent full implementation of the State's All-Surface Mining and Reclamation Act. His report to the Environmental Quality Board showed that the number of surface mine operators had increased 90% from 390 to 743, while in the same period the regulating staff had increased only 3%. To implement the Board's recommendations and guidelines, the only action possible appeared to be to give priority to the surface mining of coal since it had the greatest potential for pollution problems. Noncoal surface mining would be assigned secondary priority on the basis of urgency and need of applicants for permits. Reportedly, the lack of inspectors and personnel to process permits was attributed to eliminating part of the $2.7 million from 1973–74 budget proposals for DER.

Electricity Generation.—*Fossil Fueled.*—Construction continued on the Bruce Mansfield steam electric station, a project jointly controlled by five electric utilities and called CAPCO, to supply electricity to western Pennsylvania and northern and central Ohio. In July, CAPCO announced that a third 825–MW coal-fired generating unit would be built, with completion scheduled in 1978. DER asked on February 2 to approve installation of a sulfur dioxide removal system, developed by Chemical Construction Corp., for two 825–MW coal-fired generating units. On May 19 the Beaver County Industrial Development Authority approved a $68.5 million revenue bond issue to partially finance pollution control facilities estimated to cost $133 million at the Bruce Mansfield station.

Two oil-fired peaking units and three more under construction at Duquesne Light Co.'s Reed Station will have a 138-MW total capacity. The Allegheny County Air Pollution Appeals Board granted Duquesne a variance on the Phillips station until May 1, 1974, because of failure to meet the scheduled installation of air pollution control equipment.

Pennsylvania Power and Light Co. (PPL) started full operation of the 750-MW coal-fired No. 2 unit at its Montour station in April.

PPL continued work on two 800-MW oil-fired steam electric units at the Martins Creek site on the Delaware River where two small coal-fired units were in use. At yearend Unit No. 3 was 68% complete and Unit No. 4 was 11% complete. Unit No. 3 was expected to reach commercial operation in early 1975 following one year of test. Despite the short supply of oil in late 1973, the Martins Creek units were not to be converted to coal from oil. Such a conversion would have delayed electricity generation for 5 to 6 years. The new units will burn either crude or residual oil, and they will be used instead of combustion turbines for electricity generation because the latter can burn only No. 2 (home heating) oil and at a significantly lower efficiency. Work on the 82-mile Interstate Energy Co. pipeline between Marcus Hook and the Martins Creek station had not been started despite authorization by the PUC in February 1973. Additional approvals had to be obtained from the Delaware River Basin Commission (DRBC) and other agencies and authorities. Because the pipeline could not be completed in time for the startup of the No. 3 unit, PPL made provisions for emergency rail unloading and terminal facilities at Martins Creek and terminal facilities at Marcus Hook.

The Lehigh County Industrial Development Authority on April 11 placed on sale $28 million of tax-exempt first mortgage bonds to finance pollution-control systems at several PPL stations. On March 16 and April 6, the FPC received PPL's

requests for the renewal of 50-year licenses for one hydroelectric plant in Clarion County and one plant in Wayne and Pike Counties.

In 1973, PPL generated 26 billion kilowatt-hours of electricity, of which 96% came from coal-fired units that required about 9 million tons of solid fuels. PPL provided about 7 billion kilowatt-hours of electricity to companies more dependent on oil, mostly those in the Pennsylvania-New Jersey-Maryland (PJM) power pool. This coal-generated power was estimated to have eliminated the purchase of about 300 million gallons of oil by PJM.

PPL had coal resources totaling 120 million tons through ownership or control of five mines in west-central Pennsylvania and through long-term contracts for open-market coal. Increases in the cost of open-market coal were recovered through a fuel adjustment surcharge in PPL's rate structure that was approved by the Pennsylvania PUC and the FPC in 1970.

PPL scheduled operation of its seventh unit train in 1974. Each existing unit train hauled more than 10,000 tons of coal each trip over Penn-Central tracks. Legislation providing $560 million for the reorganization of seven bankrupt railroads including the Penn Central gave PPL some assurance of continued rail haulage service.

The United Gas Improvement Corporation (UGI), the electric utility division of which served 52,000 customers in Pennsylvania, announced that it would participate with other utilities in a nuclear or fossil-fueled generating plant, or both, to gain 200 megawatts of new capacity needed by 1980. UGI tentatively agreed to commit $75 million for the new generating capacity for which cost and engineering studies were being made.

The following data on future fuel use was reported in Keystone News Bulletin's 20th Annual Electric Utility Survey. Total figures for 1974–76 are shown in thousands tons of coal equivalent for several Pennsylvania electric utilities as follows: Duquesne Light Co., coal 13,835, and oil 499; Pennsylvania Electric Co., coal 39,167, and oil zero; Pennsylvania Power Co., coal zero; PPL, coal 26,826, and oil 3,410; Philadelphia Electric Co. including jointly owned utilities, coal 10,860, oil 16,895, and gas zero.

Table 11 indicates net generation, fuel consumption, and unit costs in Pennsylvania's 42 steam-electric plants in 1973.

Table 11.—Pennsylvania: Net generation, fuel consumption, and unit costs in 42 steam-electric plants

Installed generating capacity	thousand kilowatts	19,353.1
Net generation	million kilowatt-hours	100,447.7
Coal:		
Consumption	thousand tons	38,915
Btu per pound		11,966
Cost f.o.b. plant:		
Per ton		$10.77
Per million Btu		$0.45
Oil:		
Consumption	thousand barrels	17,453
Btu per gallon		142,684
Cost f.o.b. plant:		
Per barrel		$5.14
Per million Btu		$0.864
Gas:		
Consumption	million cubic feet	365
Btu per cubic foot		1.050
Cost per million cubic feet		NA

NA Not available.

Source: National Coal Association. Steam-Electric Plant Factors. 24th ed., December 1974, 110 pp.

Nuclear Powered.—The total capacity of nuclear-powered electric generating units[6] under construction or planned in Pennsylvania as of September 1973 follows:

[6] Keystone News Bulletin. Status of the U.S. Nuclear-Powered Generating Units as of September 30, 1973. V. 31, No. 12, December 1973, p. 6.

Scheduled date of commercial operation	Capacity, net MW
1973	1,065
1974	2,736
1976	905
1978	852
1979	2,117
1980	1,065
1981	2,192
1983	1,140
1973–83	12,072

However, according to an FPC report,[7] commercial operations of nuclear-powered plants under construction will certainly be delayed because of the rescheduling of associated facilities, equipment failures, low productivity of labor, changes in regulatory procedure under the Occupational Safety and Health Act (OSHA), and safety checks by the Atomic Energy Commission (AEC). The Chairman of the Pennsylvania PUC warned that a 2-year delay in getting these plants in operation would cause Pennsylvania's reserve electric power capacity to almost vanish.

In early October the AEC barred the construction by the New Jersey Public Service Electric and Gas Co. of a $900 nuclear-power steam-electric station on the New Jersey side of the Delaware River 11 miles northeast of Philadelphia because of the proximity of the site to Philadelphia and its satellite towns and cities. The company lost $25 million in studies for the 2,200-MW plant, and $5 million for excavations already performed.

On December 7, Duquesne Light Co. officials met with an AEC advisory committee on reactor safeguards to discuss design features of the proposed Beaver Valley No. 2 nuclear-powered steam-electric station at Shippingport. A construction permit for the plant depended on the AEC's decision. In late October, Nuclear Fuel Services Inc. signed a $4 million contract to provide transportation and nuclear fuel reprocessing services for CAPCO's 856-MW Beaver Valley No. 1 unit under construction at Shippingport.

In November, Kerr-McGee Corp., Oklahoma City, Okla., was awarded a $150 million contract from CAPCO for 12 million pounds of U_3O_8 produced from uranium hexafluoride at Sequoyah, Okla. Delivery of the U_3O_8 was to begin in 1977 and continue through 1985. The major portion of the U_3O_8 will be delivered to CAPCO's Beaver Valley electric generating complex, and the remainder will be delivered to two CAPCO electric generating units at Berlin Heights, Ohio, and Port Clinton, Ohio.

In late December, PPL awarded $155 million in contracts for nuclear fuel for its Susquehanna Station 5 miles north-east of Berwick. Anaconda Sales Co. will provide the initial fuel loadings for the station's twin boiling-water-reactor generating units scheduled for commercial operation beginning in 1979 and 1981. Both units' fuel requirements from 1981 through 1985 will be provided by Gulf Nuclear Fuels Co., a division of Gulf Oil Corp. The contract with Gulf included fabrication of eight reloads for the units. The total amount of uranium fuel to be supplied by the two companies was 3,200 tons. PPL signed an additional contract in December with the AEC for enrichment of uranium for Unit No. 1 from 1978 to 1987. An enrichment contract for Unit No. 2 fuel will be signed before June 30, 1974, as required by AEC procedures.

PPL received AEC construction permits for the generating units of the 2,200-MW Berwick plant in early November following 31 months of review of the proposed project by Federal, regional, State, and local agencies. PPL then began construction work on a $1.4 billion nuclear-powered steam electric plant on a 995-acre site in Salem Township near Berwick. Unit No. 1 was scheduled for commercial operation in 1979 and Unit No. 2 in 1981.

In late October, the Philadelphia Electric Co. received a permit from the AEC to operate the 1,065-MW Peach Bottom No. 2 nuclear-powered boiling-water reactor at 100% of capacity. The facility had been operated at 10% capacity since construction was completed in August. A spokesman said the unit should be up to 100% capacity in 1 or 2 months.

A preliminary report ordered by the AEC was released March 8 indicating that radiation levels in a 500-square-mile area surrounding the 15-year-old, 100-MW Shippingport nuclear-powered generating plant operated by Duquesne Light Co. were no higher than normal background counts. Further studies tended to confirm the AEC report. The plant's safety was originally questioned by a University of Pittsburgh professor of radiology who claimed that radiation from the plant in-

[7] FPC News. FPC Staff Reports on Delays of Scheduled Operation of Electric Generating Units. V. 6, No. 10, week ended March 9, 1973, p. 6.

creased infant mortality in the vicinity of Aliquippa and contaminated milk from nearby dairies.

A study conducted by Gilbert Associates, Inc., Reading, of the proposed operation of cooling towers at Metropolitan Edison Co.'s Three Mile Island nuclear-powered steam electric station near Harrisburg concluded that such an operation would have no ill effects on the nearby Harrisburg International Airport. The station will have four 372-foot-high natural draft cooling towers. Scheduled completion of Unit No. 1 was in mid-1974 and of Unit No. 2 in 1976.

Opposition to the licensing of the nuclear-powered steam electric station on Three Mile Island near Harrisburg was withdrawn in November when the operator agreed to install additional low-radiation filter equipment at the plant.

A Duquesne Light Co. spokesman stated in early December that in 1973 less than 2% of Pennsylvania's electricity came from nuclear-powered plants, and that in 1981 the percentage will be 35%. In the meantime, the use of coal for electrical generation will decrease from 80% to 49% in 1981. The spokesman further stated that a 2,000-MW-capacity nuclear-power steam-electric plant could eliminate the use of between 20 million and 30 million barrels of oil or 4.8 to 7.2 million tons of coal annually.

Table 12.—Pennsylvania: Fuel consumption, 1973
(10^{12} Btus)

Fuel	Electricity generation [1]	Industrial	Transportation	Residential	Commercial	Government and other
Coal	852	872	--	38	120	146
Petroleum	143	320	864	--	232	326
Petroleum & other	--	--	--	403	--	--
Natural gas	--	300	--	412	100	15
Natural gas and nuclear	15	--	--	--	--	--
Total	1,010	1,492	864	853	452	487

[1] Hydropower also equaled 42×10^{12} Btu for electricity generation.

Source: Smigel, A. E. Statistical Benchmarks for Energy in Pennsylvania. Pennsylvania Department of Commerce, Release 5-4-74, April 1974, 5 pp.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Anthracite.—Production, which totaled 6.83 million short tons, was the smallest in 11 consecutive years and was 3.9% less than in 1972. However, its $90.26 million value was 5.9% more than in 1972 because of an increase in average value of $1.21 per ton to $13.21 per ton.

Commercial exports, principally to Canada and Western Europe, totaled 716,546 tons, 26,905 tons less than in 1972. The Federal Government continued purchasing anthracite to supply most of the solid-fuel needs of the U.S. Armed Forces in West Germany. Such purchases totaled 442,499 tons, compared with 447,728 tons in 1972.

U.S. consumption (in thousand tons) was distributed as follows: Residential and commercial heating, 2,917; electric utilities, 1,442; industrial and miscellaneous uses, 603; coke plants, 467; sintering and pelletizing, 231; and colliery fuel, 11.

Production originated from 86 underground mines having 716 employees, 113 strip mines having 1,633 employees, 62 bank operations 327 employees, and 7 dredging operations having an estimated 50 employees.

Table 13.—Pennsylvania: Anthracite production and value, by county
(Thousand short tons and thousand dollars)

County	Production	Value
Berks, Lancaster, Snyder	441	3,070
Carbon	116	1,621
Columbia	12	184
Dauphin	40	510
Lackawanna	232	3,795
Luzerne	1,982	29,663
Northumberland	959	11,940
Schuylkill	3,003	39,081
Sullivan	41	381
Susquehanna	4	15
Total	[1] 6,830	[2] 90,260

[1] Includes dredged production, 441.
[2] Includes dredged production, 3,070.

Schuylkill and Luzerne Counties accounted for 73% of the total production. Schuylkill County was the leading producing county with about 77% of the total deep-mined production, about 44% of the total strip-mined production, and 68% of the production from bank operations.

Production (in thousand tons) by origin was distributed as follows: Deep mines, 726; strip mines, 3,279; bank operations, 2,384; and dredging operations, 441. All production, except that from dredging operations, came from the processing of raw coal and culm bank solids in 95 breakers and washeries having 1,357 employees.

Run-of-mine (ROM) material containing 416,000 tons of salable product, and amounting to more than 57% of the total underground production, was mechanically loaded. Underground mechanical loading on the basis of tons of contained salable product comprised 220,000 tons by 72 scraper loaders, 100,000 tons by 4 mobile loaders, and 96,000 tons by a total of 47 duckbills, pit-car loaders, and self-loading conveyors.

Strip mining and bank operations collectively used 138 diesel-powered front-end loaders, 16 electric shovels, 34 diesel shovels, 1 gasoline dragline, 34 electric draglines, and 77 diesel draglines.

Productivity data (excluding dredging) for the industry are shown in table 14. Compared with 1972 data, productivity declined.

Table 14.—Pennsylvania: Anthracite productivity data, 1972–73

Activity	Production (short tons)		Man-days [1]		Productivity (tons per man-day) [1]		Percent change
	1972	1973	1972	1973	1972	1973	
Deep mined:							
Extraction	896,991	702,843	197,242	173,141	4.55	4.06	−10.8
Preparation	896,991	702,843	41,654	35,235	21.53	19.95	−7.3
Total or average	896,991	702,843	238,890	208,376	3.75	3.37	−10.1
Strip mined:							
Extraction	3,492,444	3,284,905	393,825	381,198	8.87	8.62	−2.8
Preparation	3,492,444	3,284,905	162,205	164,660	21.53	19.95	−7.3
Total or average	3,492,444	3,284,905	556,030	545,858	6.28	6.02	−4.1
Culm bank:							
Extraction	2,072,658	2,305,265	48,656	76,333	42.60	30.20	−29.1
Preparation	2,072,658	2,305,265	96,242	115,545	21.53	19.95	−7.3
Total or average	2,072,658	2,305,265	144,898	191,878	14.30	12.01	−16.0
State total: [2]							
Extraction	6,462,903	6,293,013	639,723	630,672	10.10	9.98	−1.2
Preparation	6,462,903	6,293,013	300,101	315,440	21.53	19.95	−7.3
Total or average	6,462,903	6,293,013	939,824	946,112	6.88	6.65	−3.4

[1] Includes personnel engaged in maintenance, haulage, stripped land surface reclamation, etc.
[2] Excludes dredged coal.

NOTE.—All data in this table were derived from annual reports, published by the Anthracite and Bituminous Division of the Pennsylvania Department of Environmental Resources, that summarize mandatory monthly reports submitted by the anthracite industry.

According to DER data, one fatality occurred in Luzerne County due to a roof fall. Of the 370 non-fatal accidents in the industry, 182 occurred in Schuylkill County and 104 in Luzerne County. Active underground mines comprised 24 rated as gaseous and 62 rated as non-gaseous. The entire industry consumed 1,634,657 pounds of various dynamites and 29,880,947 pounds of other permissible explosives.

Railroad shipments totaled 2,951,000 tons valued at $39,239,000 ($13.30 per ton). Truck shipments totaled 3,868,000 tons valued at $50,489,000 ($13.14 per ton). Colliery fuel totaled 11,000 tons valued at $172,000 ($15.64 per ton). The value of 441,000 tons of dredged produc-

tion was $3,070,000 ($6.96 per ton). Total nondredging production was 6,378,000 tons and averaged $13.63 per ton.

The approximate average and range of sulfur content of Pennsylvania anthracites follows: [8]

Area	Percent Sulfur	
	Average	Range
Northern anthracite field	0.87	0.5–3.5
Middle anthracite field	.60	.3–1.7
Southern anthracite field	.68	.3–1.7
Pennsylvania anthracite seams	.76	.3–3.5
Pennsylvania anthracite culm	.80	.4–2.7

On October 25, PPL announced that it would stop dredging in the lower Susquehanna River where the company had recovered anthrafines since 1924. Reportedly, floodwaters from Hurricane Agnes in June 1972 scattered the remaining [illegible], and economical recovery no longer was feasible.

In an action instituted under the Federal Coal Mine Health and Safety Act of 1969, the Bureau of Mines on February 14 filed suit against a corporation trading under the name Penn State Mining, Inc., to compel sealing of the entrance of its abandoned No. 1 Slope mine in Dickson.

The Blue Coal Corp., as a result of payments to the black lung benefit fund, on August 15 increased the price of anthracite at the breaker by about $1 per ton. The new prices were pea $21.50; buckwheat and rice $20.95; and chestnut $22.95. Customers also paid for truck haulage depending on the length of haul.

The DER's Bureau of Topographic and Geologic Survey published the following data showing the anthracite mined and remaining reserves (in short tons) as of January 1, 1970:

County	Mined out	Reserves
Carbon	320,000,000	310,000,000
Columbia	130,000,000	480,000,000
Dauphin	140,000,000	740,000,000
Lackawanna	1,600,000,000	390,000,000
Lebanon	4,000,000	1,000,000,000
Luzerne	2,800,000,000	1,700,000,000
Northumberland	680,000,000	1,900,000,000
Schuylkill	2,200,000,000	9,900,000,000
Susquehanna	1,000,000	5,000,000
Wayne	4,000,000	6,000,000
Total	7,879,000,000	16,431,000,000

According to a UGI official no construction was started in 1973 on a proposed 300-MW steam-electric plant in the Northern anthracite field. The proposed plant would be fueled with upgraded culm bank material burned in Ignifluid combustor furnaces.

Bituminous Coal.—Pennsylvania was the third largest bituminous-coal-producing State and had 4 of the 50 largest producing mines in the United States. Three underground mines and one strip mine collectively produced 9,880,240 tons or 6.8% of the total production from the countrys 50 largest producing mines.[9]

In late 1973, Pennsylvania coal operators indicated that surface-mined production could probably be increased in 3 to 6 months by approximately 6 million tons annually if sufficient supplies of diesel oil and ammonium nitrate were available for blasting use, if railroad service was adequate and if air pollution standards were relaxed for at least 5 years so that capital would become available with which to expand production. The availability and cooperation of labor would also be required.

Bethlehem Steel Corp. announced plans in December to open the new Cambria No. 78 underground mine near Johnstown. Development work estimated to cost $9 million was to start in early 1974, and some coal production was scheduled for 1975. Eventually the mine will employ 250 persons. The site had 3,422 acres of metallurgical-grade coal. Life of the mine was estimated at more than 20 years.

In April, Helvetia Coal Co., a subsidiary of the Rochester and Pittsburgh Coal Co., started development work estimated at $5.2 million for its Lucerne No. 8 mine near Clarksburg. The mine eventually will produce 300,000 tons annually and will employ about 100 men by 1975 or 1976. Coal from the mine will be delivered to the Homer City electric generating complex.

In March, National Steel Corp. announced the start of a new mine near Johnstown to produce low-volatile metallurgical coal. Consolidation Coal Co. will do the development work and operate the mine for National Steel. Starting in 1975 the mine is slated to employ 180 persons and to produce 750,000 tons annually. The site has 1,900 acres of 7-foot-thick coal, about 400 feet below

[8] Pennsylvania Geologic Survey. Pennsylvania Geology, v. 4, No. 6, December 1973, p. 3.
[9] Coal Age. The 50 Biggest Bituminous Mines in 1973. V. 79, No. 4, April 1974, p. 42.

the surface. The project will include a preparation plant and water treatment facilities to prevent contamination of Dark Shad Creek.

United States Steel Corp. scheduled limited production sometime in 1974 from its new Dilworth mine in Greene County, 65 miles south of Pittsburgh. The run-of-mine coal will be processed at the Robena preparation plant. The corporation's recently opened Mt. Braddock deep mine in Fayette County was being brought up to full capacity to yield 2,000 tons per day of cleaned coal.

The reopening of the Leechburg Coal Co.'s deep mine in Armstrong County, scheduled for late 1973, was delayed by a dispute between the company and DER over a 100-foot barrier between old workings and the new area the company planned to mine. DER contended that the barrier would prevent drainage from the new area into the old workings, thereby increasing the water pressure sufficiently to cause blowouts at the seam outcrop. The company opposed leaving the barrier because it contained coal valued at $800,000.

In early May, the Pittsburgh Coal Co. Div., Consolidation Coal Co., closed its Hutchinson mine in Westmoreland County and idled 170 miners. Coal reserves in the mine, which once produced 525,000 tons annually, were exhausted. At about the same time, Pittsburgh Coal Co. laid off 80 men of its 250-man force at its Westland mine in Washington County because of large financial losses.

In early April, the Commonwealth Court ordered two new coal mining developments in Greene County to suspend operations until drainage permits were obtained from DER. The suspensions affected four or five mine shafts at U.S. Steel's Dilworth mine and an air shaft at the Blacksville mine of Consolidated Coal Co.

On July 18 fire destroyed a coal tipple at Bethlehem Steel Corp.'s Ehrenfeld Mine No. 38 and damaged several loaded railroad cars and a conveyor belt outside the mine.

As a result of a labor dispute between the UMWA and Union Carbide Co., the company's Fawn mine was struck January 3. Pickets prevented 500 miners from working at Consolidated Coal Co.'s Renton mine and Harmar Coal Co.'s Harmar mine and Oakmont mine, even though these three mines were not involved in the dispute.

On April 30 about 500 miners and other employees left work at Florence Mining Co.'s Robinson and No. 2 portals and at the preparation plant that supplied coal to the Conemaugh steam-electric station. On May 1, the walkout spread to the Blacklick portals of the Florence Mining Co. and Helen Mining Co.'s "A" portal, idling 500 workers.

On March 6, pickets from a UMWA local shut down six mines and idled about 1,600 workers because of an intra-union pension dispute. Mines shut down in Armstrong County were the Cadogan mine of the Allegheny River Mining Co. and the Carpentertown mine of the Carpentertown Coal and Coke Co., owned by Sharon Steel Corp. Mines shut down in Indiana County were the Jane, Emily, and Margaret mines of Rochester and Pittsburgh Coal Co., employing a total of 800 workers, and the Helen mine employing 325 workers and owned by North American Coal Co. The mines resumed partial production March 8 after a court-ordered termination of the picketing.

A walkout strike at J&L's Vesta No. 4 mine and Vesta No. 5 mine near California ended March 14. The week-old strike followed a pay dispute with employees who left the mine during investigation of a bomb threat.

A 2-day walkout strike at U.S. Steel's Robena complex started November 18 and idled 1,200 workers because of a seniority dispute in September 1973.

U.S. Steel's Robena No. 1 mine employees won the Sentinel of Safety, the highest mine safety award, by accumulating 740,496 man-hours without a disabling injury in 1972. Employees at U.S. Steel's Maple Creek No. 2 mine and the Robena No. 2 mine also worked throughout 1972 without a disabling injury, but these mines accumulated less hours worked.

Republic Steel's Clyde mine at Fredericktown and the Russelton mine at Russelton operated during 1973 without a lost-time accident. The Clyde mine won the Republic Coal Mine President's Award because it worked more man-hours than Russelton.

Bethlehem Steel Corp. received U.S. patent 3,696,923 for the separation and recovery of fine coal particles from water discharged from coal preparation plants. The system will be installed at the corporation's Ellsworth preparation plant Washington County. The invention per-

mits the recycle or discharge of water without causing pollution. The process can treat a water-coal slurry containing 15 to 35 weight-percent fine coal by froth flotation to produce water containing less than 0.1 weight-percent fine coal particles. The method was available for licensing.

Transco Energy, Marcus Hook, planned a 250-million-cubic-foot-per-day (MMcfd) SNG plant based on the BASF-Lurgi process. The plant was scheduled for completion by Fluor Corporation in early 1974.[10]

Bench-scale tests at Gulf Oil Co.'s research laboratory, Harmarville, developed a catalytic coal liquefaction process that produced a form of crude oil with very encouraging results. An expanded and integrated pilot plant was being designed to permit use of the process on coals having varied sulfur and ash contents.

On January 24 the General State Authority (GSA) directed all architects to specify coal-burning equipment in new public buildings. The GSA decision followed a request to use electricity for heating a correctional institute in Mercer County.

On January 15, the Governor ordered cutbacks in the use of energy in all State offices and urged homeowners and other users to conserve oil or face a serious energy crisis. The Governor presented recommendations to reduce by 10% to 20% the consumption of heating oil in about 1.3 million oil-heated homes in Pennsylvania.

Delta Mining, Inc., near Jennerstown, using a shortwall mining system in the 6.5-foot Lower Kittanning seam, averaged 550 tons per shift and achieved a production of 900 tons per shift for a single day. The floor of the drift mine was dark shale, and the immediate roof was heavily laminated shale having excellent caving characteristics. The shortwall mining began July 11 under 75 to 130 feet of cover. Face lengths ranged from 130 to 170 feet, and the depth of panel averaged 650 feet.

Dravo Corp. was awarded a $4.6 million contract to design and construct a coal preparation plant in Duquesne Light Co.'s Warwick mine near Greensboro. The new facility, scheduled for completion in January 1974, will produce 1,000 tons per hour of cleaned coal, all from the Warwick mine. The preparation plant will have a Dorr-Oliver Cabletorq thickener capable of recovering 1,600 tons per day of minus 28-mesh coal, two-stage water-only cyclones, and also heavy-media cyclones. About half of Duquesne's coal requirement were produced by the Warwick mine.

Barnes & Tucker Co.'s new coal preparation plant, engineered and constructed by Heyl & Patterson, Inc., attained promised tonnage and product quality October 1.

Shipments of new equipment to the State's deep mines in 1973 included 1 mobile loader, 33 continuous miners, 2 cutting machines, 4 longwall units, 31 shuttle cars, 37 rubber-tired tractors, 54 battery-powered front-end loaders, 51 rubber-tired mine cars, and 53 gathering and haulage conveyors.

Washington, Greene, Indiana, Cambria, and Armstrong Counties produced 37.80 million tons, or 81.8% of the total deep-mined coal. Clearfield, Clarion, Somerset, Armstrong, and Indiana Counties produced 17.83 million tons, or 59.8% of the total strip-mined coal. Butler, Armstrong, Indiana, Elk, and Jefferson Counties produced 71.6% of the total auger-mined coal. Cambria County produced 70.2% of the coal reclaimed from refuse piles. Collectively, Washington, Indiana, Greene, Cambria, and Armstrong Counties produced 45.61 million tons, or 59.7% of the State's total bituminous coal production, and had 18,147 employees or 67.9% of the total employees of the State's bituminous coal industry.

Active mines producing more than 1,000 tons per year totaled 964; 134 were deep mines, 25 less than in 1972; 775 were strip mines, 153 more than in 1972; and 55 were auger mines, the same number as in 1972.

The 76.40-million-ton production in 1973 was valued at $786.8 million, compared with the 75.94 million tons produced and valued at $694.3 million in 1972.

The average f.o.b. mine value increased to $10.30 per ton from $9.14 per ton in 1972. Open market sales totaled 52.93 million tons and averaged $8.71 per ton at the mine; 23.47 million tons of captive coal averaged $13.88 per ton at the mine.

[10] Oil and Gas Journal. Gas Processing-Worldwide Construction. V. 71, No. 13, Mar. 25, 1973, pp. 122–123.

Table 15.—Pennsylvania: Bituminous coal production in Pennsylvania, by type of mine and county, 1973

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total[1]	
Allegheny	7	13	1	21	3,631	618	11	4,260	$51,037
Armstrong	14	71	14	99	4,138	2,586	77	6,801	53,427
Beaver	1	2	--	3	128	12	--	140	1,331
Blair	--	1	--	1	--	57	--	57	430
Butler	3	35	10	48	52	986	99	1,137	8,128
Cambria	18	31	1	50	6,054	1,650	14	7,717	108,334
Centre	1	15	--	16	469	499	--	968	9,751
Clarion	--	90	--	90	--	4,595	--	4,595	36,357
Clearfield	5	141	4	150	713	5,703	20	6,436	48,860
Clinton	--	7	--	7	--	453	--	453	3,305
Elk	--	17	3	20	--	650	23	673	4,686
Fayette	3	58	2	63	771	1,408	4	2,183	18,918
Greene	16	18	--	34	8,232	464	--	8,696	112,263
Indiana	24	54	4	82	7,328	1,745	44	9,117	88,032
Jefferson	4	47	4	55	71	1,454	19	1,544	12,380
Lawrence	--	16	5	21	--	507	24	531	3,459
Lycoming	--	3	--	3	--	132	--	132	576
Mercer	--	5	--	5	--	239	--	239	1,989
Somerset	17	73	5	95	1,329	3,203	24	4,556	39,441
Tioga	--	2	--	2	--	555	--	555	2,966
Venango	--	12	--	12	--	441	--	441	2,406
Washington	14	33	1	48	12,044	1,233	5	13,282	159,175
Westmoreland	7	31	1	39	1,248	638	3	1,889	19,541
Total[1]	134	775	55	964	46,207	29,829	366	76,403	786,792

[1] Data may not add to totals shown because of independent rounding.

Approximately 51.2 million tons were transported by rail and water, 22.2 million tons by unit train, 7.2 million tons by conveyor belt, and 17.7 million tons by truck. Approximately 300,000 tons was used for local domestic heating, for heat and power at mines, and for coke manufacture.

Sixty-eight mechanical cleaning plants, three less than in 1972, produced 45.7 million tons of salable coal. The percentages of cleaned coal by origin were 84.0 deep mines and strip mines 16.0. Wet washing equipment by types and the approximate production of cleaned coal in million tons were tables 3.7, launders 0.3, from flotation 2.0, dense medium 18.7, classifiers 1.8, and jigs 12.3. Pneumatic-type equipment produced 6.9 million tons of cleaned coal. Cleaning plant refuse totaled 17.3 million tons.

The percentage of bituminous coal cleaned by various types of equipment follow:

Type of equipment	Underground		Strip mines, non-captive
	Captive	Non-captive	
Classifiers	0.77	1.01	--
Flotation	7.58	2.29	--
Jigs	19.16	22.08	56.97
Launders	8.59	--	--
Dense medium:			
Sand	13.34	4.98	--
Magnetite	42.29	28.97	28.14
Tables	8.27	9.80	3.87
Pneumatic	--	30.87	11.02
Total	100.00	100.00	100.00

Six companies operated 13 thermal drying units to produce 5.39 million tons of coal. Of the 59.6 million tons of coal crushed in 18 plants, 45.7 million tons were cleaned at 68 plants performing crushing.

According to the 1973 DER Annual Report of the Anthracite and Bituminous Coal Divisions, 22 deep mine operators, whose production exceeded 500,000 tons per year, collectively produced 40,860,105 tons of salable product. Six strip mine operators, whose production exceeded 500,000 tons per year, collectively produced 6,001,371 tons of salable product. Underground mines consumed 73,194 pounds of dynamites and other permissible explosives. Strip and auger mines consumed 6,387,138 pounds of dynamites, 146,492,553 pounds of AN–FO, and 145,065 pounds of other permissibles.

The DER report distributed the total production of 76,796,661 tons as underground mines 46,327,179 tons, strip mines 29,326,629 tons, auger mines 311,419 tons, and reclaimed from refuse piles 831,434 tons. The report listed 620 operators, some of whom operated in more than one of the State's 47 bituminous districts. The total production came from 455 deep mine operators, 343 companies that operated strip and auger mines, and 8 companies that operated refuse piles for coal recovery.

Continuous-mining machines totaled 466, 32 fewer than in 1972, and produced 41.6 million tons of coal, 1.4 million tons less

than in 1972. Because 41 machines were not designed to perform loading, mobile loaders were teamed with them to load 2.3 million tons from the mine floor; these 41 machines mined and loaded 2.3 million tons onto feeder conveyors. The other 425 machines mined and loaded 39.3 million tons into shuttle cars and rubber-tired trailers.

Fourteen longwall systems produced 2,749,018 tons of coal, 395,000 tons more than the 2,354,000 tons produced by 12 longwall systems in 1972. In 1973, 1 planer-type installation produced 197,500 tons, and 13 shearer-type installations produced 2,551,518 tons.

Two mobile loaders discharged 13,427 tons into mine cars or onto conveyors, and 1,729,289 tons were loaded into shuttle cars and rubber-tired mine cars by 45 mobile loaders. Coal loaded by hand totaled 103,834 tons.

A total of 56 cutting machines, 14 fewer than in 1972, were used to cut 1,842,767 tons. Coal shot from the solid totaled 3,783 tons.

Coal drilling by 34 handheld or post-mounted drills, 20 less than in 1972, was used to produce 415,002 tons of coal, and 21 mobile drills, the same number as in 1972, were used to produce 1,421,670 tons of coal.

Roof bolting employed 239 rotary drills, 79 fewer than in 1972, and 169 percussion drills, 62 fewer than in 1972. Roof or rock drills used for other purposes included 12 percussion drills, 8 fewer than in 1972, and 2 rotary-percussion drills.

Equipment used for haulage of run-of-mine coal, operating supplies, and personnel in deep mines included 1,015 trolley locomotives, 87 fewer than in 1972; 29 battery-powered locomotives, 9 fewer than in 1972; 11, 876 rail mine cars, 500 fewer than in 1972; 507 miles of mainline track and 250 miles of other track; and 717 gathering and haulage conveyor belts, 83 more than in 1972, that averaged 2,059 feet in length and totaled 279.6 miles compared with 241.1 miles in 1972. Considerable intermediate haulage was done by 1,103 cable reel shuttle cars and 23 battery-powered shuttle cars, 6 shuttle buggies, 346 rubber-tired tractors, and 693 rubber-tired trailers.

The 46.20 million-ton deep-mined production averaged $12.02 per ton f.o.b. mine, compared with $10.39 per ton for the 49.13-million-ton production in 1972.

Strip mining equipment included 470 power shovels, 34 more than in 1972, and 315 draglines, 14 more than in 1972. Approximately 95.1% of the shovels and draglines were diesel powered, and 80.4% were rated at less than 5-cubic-yard capacity. Ninety carryall scrapers were in operation, 44 more than in 1972. Other strip-mining equipment included 1,009 bulldozers, 29 horizontal drills, 150 vertical drills, 668 front-end loaders, 6 wheel excavators, 1 power broom, 62 motor graders, and 11 coal drills. No data on truck haulage of run-of-mine coal were available. The 29.83-million-ton strip-mined production averaged $7.68 per ton f.o.b. mine, compared with $6.86 per ton for the 26.26-million-ton production in 1972. C & K Coal Co. was the largest producer of strip-mined coal with 2,373,171 tons from 23 operations, all in Clarion County.

Active equipment for auger mining included 47 augers, 16 bulldozers, and 6 front-end loaders. The 366,410-ton auger-mined production averaged $6.91 per ton at the mine, compared with $6.37 per ton for the 542,000-ton production in 1972.

According to DER data, the bituminous coal industry had 26,722 employees who accrued a total of 6,279,670 man-days. The 16 fatalities in the industry comprised 5 by roof falls, 6 by inside transportation, 1 by outside transportation, 2 by outside machinery, and 2 in strip mines. Nonfatal accidents totaled 1,349. The DER report summarized bituminous coal employees in 1973 as 16,346 inside employees comprising 13 shot firers, 14 pick miners, 65 cutting-machine operators, 59 machine hand loading miners, 11,149 mechanical loading employees, and 5,046 all others; and 10,376 outside employees comprising 2,124 superintendents, foremen, and clerks, 48 employees at beehive coke plants, and 8,204 all others. The DER report further distributed the 26,722 total employees as 19,084 related to 150 underground mines, 5,192 to 903 strip mines, 103 to 49 auger mines, 2,267 to 160 tipples and preparation plants, and 76 to the recovery of salable product from 12 refuse pile operations.

Bituminous coal productivity for 1972 and 1973 is compared in table 16.

Table 17 summarizes data for deep mines, and table 18 summarizes data for strip and auger mines.

Table 19 summarizes data on methane emission in 9 counties, from 39 mines each emitting at least 100,000 cubic feet per day from each bed.

Table 16.—Pennsylvania: Bituminous coal productivity data, 1972–73

Activity	Production (thousand short tons)		Man-days (thousands) [1]		Productivity: Tons per man-day		Productivity: Percent change
	1972 [2]	1973 [3]	1972	1973	1972	1973	
Underground:							
Captive, cleaned:							
Mining	20,943	20,411	2,179.0	2,323.0	9.61	8.79	−8.5
Cleaning and preparation	20,943	20,411	179.2	197.9	116.89	103.14	−11.8
Total or average	20,943	20,411	2,358.2	2,520.9	8.88	8.10	−8.8
Noncaptive, cleaned:							
Mining	23,349	17,997	1,852.7	1,379.3	12.60	13.05	+3.6
Cleaning and preparation	23,349	17,997	143.7	135.7	162.50	130.48	−19.3
Total or average	23,349	17,997	1,996.4	1,515.0	11.70	11.88	+1.5
Noncaptive, crushed:							
Mining	4,792	7,799	441.7	821.4	10.85	9.49	−12.5
Crushing [4]	4,792	7,799	10.0	40.9	479.20	190.68	−60.2
Total or average	4,792	7,799	451.7	862.3	10.61	9.04	−15.8
Strip:							
Noncaptive, cleaned:							
Mining	11,061	7,478	444.1	292.8	24.91	25.54	+2.5
Cleaning and preparation	11,061	7,478	81.2	92.4	136.21	80.93	−40.6
Total or average	11,061	7,478	525.3	385.2	21.06	19.41	−7.8
Noncaptive, crushed:							
Mining	14,656	21,829	586.7	854.8	24.98	25.54	+1.8
Crushing [4]	14,656	21,829	45.4	115.1	322.81	189.65	−41.3
Total or average	14,656	21,829	632.1	969.9	23.19	22.51	−2.9
Auger:							
Noncaptive, cleaned:							
Mining	20	4	.5	([5])	40.00	55.56	+38.9
Cleaning and preparation	20	4	.2	([6])	100.00	181.82	+81.8
Total or average	20	4	.7	--	28.57	42.55	+48.9
Noncaptive, crushed:							
Mining	519	362	12.6	6.6	41.19	54.84	+33.1
Crushing [4]	519	362	1.2	1.9	432.50	190.52	−55.9
Total or average	519	362	13.8	8.5	37.61	42.59	+13.2
Recovery from refuse, noncaptive:							
Mining	523	523	2.7	14.0	193.70	37.36	−80.7
Cleaning and preparation	523	523	3.7	2.1	141.35	249.04	+76.2
Total or average	523	523	6.4	16.1	81.45	32.48	−60.1
Total, captive and noncaptive:							
Mining	75,863	76,403	5,520.0	5,691.9	13.74	13.42	−2.3
Cleaning and preparation	55,896	46,449	408.0	428.1	137.00	108.50	−20.8
Crushing	19,967	29,954	56.6	157.9	352.75	189.70	−46.2
Total or average	75,863	76,403	5,984.6	6,277.9	12.68	12.17	−4.0

[1] Source: Pennsylvania Department of Environmental Resources. Includes personnel engaged in maintenance, haulage, land surface reclamation, etc.
[2] Source: Pennsylvania Department of Environmental Resources.
[3] Source: Bureau of Mines.
[4] Includes crushing, sizing, and loading as normally performed at tipples.
[5] 72 man-days.
[6] 22 man-days.

Table 17.—Pennsylvania: Underground bituminous coal mine data

Coalbed (Geological name)	Type of mine					Coalbed thickness (inches)		Production by mine type (thousand tons)			Acres mined [1]
	Shaft	Slope	Drift	Gaseous	Non-gaseous	Range	Weighted average	Shaft	Slope	Drift	
Brookville	--	2	--	--	2	60–72	64	--	474	--	123.4
Double Freeport	1	2	--	3	--	--	84	922	730	--	327.8
Lower Freeport	--	3	18	6	15	30–60	46	--	2,119	2,653	1,729.0
Thick Freeport	--	1	1	2	--	96–108	104	--	544	617	186.1
Upper Freeport	--	5	14	8	11	36–66	49	--	3,269	1,914	1,763.0
Upper and Lower Freeport	--	1	--	1	--	--	78	--	919	--	196.4
Lower Kittanning	4	6	19	12	17	28–72	46	1,706	2,546	2,716	2,524.6
Middle Kittanning	--	--	3	--	3	32–42	32	--	--	286	148.9
Upper Kittanning	--	--	19	2	17	32–72	54	--	--	1,411	435.5
Upper and Lower Kittanning	1	--	--	1	--	--	42	1,044	--	--	414.3
Mahoning	--	1	--	--	1	--	54	--	4	--	1.2
Miller "B"	--	--	2	--	2	34–42	34	--	--	43	21.1
Pittsburgh	11	12	11	24	10	60–108	77	8,625	8,609	3,938	4,582.6
Redstone	--	--	1	--	1	--	50	--	--	1	.3
Sewickley	--	--	6	2	4	48–84	71	--	--	1,237	290.4
Total	17	33	94	61	83	--	60	12,297	19,214	14,816	12,690.6

[1] At 1,000 tons run-of-mine production and 720 tons salable production per acre-foot.

NOTE.—All data in this table were derived from annual reports, published by the Anthracite and Bituminous Division of the Pennsylvania Department of Environmental Resources, that summarize mandatory monthly reports submitted by the bituminous coal industry.

Table 18.—Pennsylvania: Bituminous coal strip and auger mine data

Coalbed (Geological Name)	Strip				Auger			
		Thickness (inches)				Thickness (inches)		
	Production (thousand tons)	Range	Weighted average	Acres disturbed [1]	Production (thousand tons)	Range	Weighted average	Acres disturbed [2]
"A" Rider	19	--	22.0	7.4	--	--	--	--
Bakerstown	71	28–36	30.1	20.6	--	--	--	--
Bloss	39	--	43.0	7.8	--	--	--	--
Brookville	1,632	13–60	32.1	435.8	--	--	--	--
Brush Creek	52	24–44	29.6	15.1	--	--	--	--
Cannel	1	--	20.0	0.4	--	--	--	--
Clarion	3,256	26–72	36.0	775.2	--	--	--	--
Clay Rider	17	--	18.0	8.1	--	--	--	--
Freeport:								
Lower	2,093	16–60	32.1	558.9	30	28–48	33.0	15.3
Upper	4,164	20–72	38.0	939.2	95	35–48	42.9	36.7
Upper and Lower	1,924	20–60	34.1	483.6	21	27–42	32.1	10.9
Kittanning:								
Lower	4,802	13–96	33.0	1,247.2	57	28–48	35.4	26.8
Middle	2,581	12–60	30.5	725.3	84	29–37	30.6	46.0
Upper	1,646	20–52	31.3	450.7	3	--	60.0	0.8
Lower and Upper	1,404	24–60	32.7	368.0	--	--	--	--
Lower and Middle	--	--	--	--	19	24–48	42.5	7.7
Mahoning	41	--	42.0	8.1	2	--	40.0	0.8
Mercer	139	18–48	21.3	55.9	--	--	--	--
Miller "B"	107	--	38.0	24.1	--	--	--	--
Morgan	407	--	48.0	72.7	--	--	--	--
Moshannon	10	31–48	31.4	2.7	--	--	--	--
Pittsburgh	2,369	32–144	70.9	286.4	--	--	--	--
Redstone	597	24–60	40.7	125.7	--	--	--	--
Rider	9	--	24.0	3.2	--	--	--	--
Sewickley	210	16–60	46.3	38.9	--	--	--	--
Seymour	133	--	33.0	34.5	--	--	--	--
Waynesburg	1,604	38–80	51.2	268.5	--	--	--	--
Total	29,327	18–96	36.1	6,964.0	311	24–60	35.8	145.0

[1] Based on 1,400-short-ton recovery per acre-foot.
[2] Based on 720-short-ton recovery per acre-foot.

NOTE.—This table was derived from information published in the Annual Report of the Anthracite and Bituminous Division of Pennsylvania Department of Environmental Resources.

Table 19.—Pennsylvania: Methane emission from mines emitting at least 100,000 cubic feet per day from each bed

County	Number of mines	Total average methane emission (thousand cubic feet per day)
Allegheny	4	1.6
Armstrong	3	0.7
Cambria	7	9.8
Fayette	1	0.2
Greene	6	11.7
Indiana	5	4.8
Somerset	1	0.3
Washington	10	12.4
Westmoreland	2	0.5
Total	39	42.0

Source: Irani, M. C., P. W. Jeran, and M. Deul. Methane Emission From U.S. Coal Mines in 1973. A Survey. A Supplement to IC 8558. Bureau of Mines IC 8659, 1974, 47 pp.

Coke.—Nine companies operated 12 oven coke plants having 3,376 slot-type ovens. Nine plants produced coke for blast furnaces, one plant produced both blast furnace coke and foundry coke, and two plants produced foundry coke only. Collectively, the plants received 23,273,102 short tons of bituminous coal having varied volatile-matter contents as follows:

Volatile matter content (weight percent)	Short tons
Plus 31.0	15,745,040
22.1 to 31.0	2,607,567
14.0 to 22.0	4,920,495
Total	23,273,102

Several of the plants also received 97,559 short tons of Pennsylvania anthracite. The origin of the bituminous coal receipts was—

State	Short tons
Pennsylvania	12,187,578
Eastern Kentucky	2,317,497
West Virginia	7,650,135
Virginia	1,117,815
Illinois	77
Total	23,273,102

The 12 plants carbonized 23,985,064 short tons of bituminous coal averaging $17.97 per ton and 17,756 short tons of anthracite averaging $14.95 per ton. The apparent decrease of coal in storage during the year was 711,962 short tons of bituminous coal and 25,197 tons of anthracite.

The production of coke and coke breeze and the yield based on the weight of coal mixtures carbonized follow:

Type	Production (short tons)	Yield (weight percent)
Blast furnace coke	15,385,702	NA
Foundry coke	551,982	NA
Coke for other industrial uses	772,423	NA
Coke breeze	884,980	3.67
Total (breeze free)	16,710,107	69.32

NA Not available.

The price of foundry coke f.o.b. ovens averaged $54.44 per ton. Output of the 12 plants accounted for 26.3% of the U.S. coke production.

Pennsylvania's coke plants also produced 254,748.6 million cubic feet (MMcf) of coke oven gas at an average yield of 10,567 standard cubic feet (scf) per ton of coal carbonized. The gas was distributed as follows: For heating ovens, 112,610.7 MMcf; used under boilers, 10,650.0 MMcf valued at $0.266 per thousand cubic feet (mcf); used in steel plants, 128,379.8 MMcf valued at $0.329 per Mcf; distributed to city gas systems, 977.4 MMcf valued at $0.166 per Mcf; sold for other industrial uses, 678.0 MMcf valued at $0.206 per Mcf; and unaccounted for 1,452.7 MMcf.

In addition, the 12 plants produced 202,762,053 gallons of tars, of which 144,606,142 gallons was used by the producing plants. Tar refiners purchased 66,298,886 gallons at an average price of $0.120 per gallon. Stocks of tars at yearend totaled 21,841,784 gallons.

Eight plants produced 117,536 short tons of ammonium sulfate from 12,995,087 tons of coal at an average yield of 18.16 pounds of ammonium sulfate per ton of coal carbonized.

Ten plants carbonizing 23,389,116 tons of coal produced 68,087,179 gallons of crude light oil at an average yield of 2.91 gallons per ton of coal carbonized. Two plants produced 777,040 gallons of intermediate light oil. Three plants produced 7,365,179 gallons of naphthalene. Three plants produced 51,580,740 gallons of nitration-grade benzene, 434,061 gallons of other industrial grades of benzene, 9,475,254 gallons of nitration grade toluene, and 1,914,460 gallons of all grades of xylenes. Four plants produced 1,714,535 gallons of all grades of solvent naphthas. Two plants produced 2,789,602 gallons of all other light-oil-based derivatives.

One beehive coke plant in Armstrong County and two beehive plants in Fayette County collectively carbonized 334,032 tons of coal, all of which came from Pennsylvania except 8,906 tons from West Virginia. The coal carbonized averaged $13.06 per ton in value at the ovens. Three beehive plants produced 191,518 tons of blast-furnace-grade coke having an average value of $29.56 per short ton. The plants also produced 1,600 tons of coke for other industrial uses that averaged $34.00 per ton in value. The yield of breeze-free metallurgical coke was 57.81% of the weight of coal carbonized.

Shenango, Inc., a major producer of foundry coke at Neville Island, increased the price of foundry coke f.o.b. ovens by $3 to $59.75 per ton on November 1 and to $61.75 per ton on December 13.

In late December, Koppers Co., Pittsburgh, agreed to lease and operate the Erie, Pa., byproduct coke plant and related facilities of Interlake, Inc.

Natural Gas Liquids.—The total production of natural gas liquids in only two producing counties was 17% less than in 1972, but its value was 5.2% greater.

Two natural gas processing plants, with a combined rated capacity of 5.0 MMcf and a daily average throughput of 2.9 MMcf, produced 3,000 gallons per day of propane, 1,500 gallons per day of normal butane, and 2,120 gallons per day of debutanized natural gasoline.[11]

Peat.—Nine operations in six counties reported a total production of 30,293 short tons, 30.9% more than in 1972. Lackawanna County was the leading producer, followed by Luzerne County. Other producing counties were Columbia, Erie, Law-

[11] Oil and Gas Journal. 1974 Survey of Gas-Processing Plants. V. 72, No. 27, July 8, 1974, p. 80.

rence, and Monroe. Sales totaling 27,802 short tons were 24.0% greater in weight and 28.4% greater in value. Sales averaged $14.77 per ton, 49 cents per ton more than in 1972. Bulk sales totaled 19,880 tons and averaged $12.67 per ton. Sales of packaged peat totaled 7,922 tons and averaged $20.02 per ton. The tonnage and average value of sales by type of peat were moss, 10,292 tons at $11.74 per ton in bulk, and 836 tons at $18.32 per ton packaged; reed-sedge, 9,302 tons at $13.33 per ton in bulk (no reed-sedge was sold packaged); humus, 286 tons at $24.59 per ton in bulk, and 7,086 tons at $20.22 per ton packaged.

Petroleum and Natural Gas.—The Bureau of Topographic and Geologic Survey, Oil and Gas Geology Division, reported that the production of crude petroleum decreased 5% compared with that of 1972. Pennsylvania-grade crude petroleum production totaled 3.2 million barrels valued at $18.4 million, with an additional 76,000 barrels of Corning-grade crude oil valued at $363,550. The latter was produced mostly in Crawford County from the Medina (Lower Silurian) Sandstone. The number of producing wells decreased from 32,596 in 1972 to 31,539 in 1973. Estimated proved recoverable reserves of crude oil at yearend totaled 39.6 million barrels, an increase of 2.9 million barrels from that of yearend 1972. Natural gas production totaled 78.5 billion cubic feet (Bcf), an increase of 6% from that of 1972, and averaged 42 cents per 1,000 standard cubic feet. A total of 66.7 Bcf of gas was produced from the shallow (Upper Devonian or younger) reservoirs, while production from the deep (Middle Devonian or older) reservoirs totaled 11.8 Bcf. The estimated number of producing gas wells increased to about 16,800 or 200 more than in 1972. Estimated proved reserves of natural gas totaled 1,494 Bcf, including 606 Bcf in storage at yearend. This was a total increase of 87 Bcf from that of 1972.

The Division also reported 1,099 new wells drilled and 47 wells deepened during 1973. Of these, 525 were oil wells, 484 gas wells, 9 oil and gas wells, 43 service wells, 12 gas storage wells, and 90 dry holes. Of the old wells drilled deeper, 32 produced gas, 2 produced oil, 2 were gas storage wells, and 11 were dry holes. Total footage of all wells (1,099) drilled was 2,689,454. Of 1,099 well completions, excluding service and gas storage wells, 99 were exploratory (44% successful) and 1,000 were development (96% successful), an increase in the number of wells of 50% and 20% respectively.

Table 20.—Pennsylvania: Oil and gas well drilling completions, by county

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Armstrong	--	43	3	--	--	--	46	152,583
Bedford	--	--	--	--	--	1	1	11,597
Bradford	--	--	--	--	--	2	2	15,337
Butler	2	2	--	--	--	--	4	7,009
Cambria	--	--	--	--	3	1	4	16,012
Cameron	--	--	2	--	2	1	5	33,396
Clarion	1	2	1	--	--	1	5	8,666
Clearfield	--	17	3	--	5	5	30	105,746
Crawford	6	2	1	--	1	--	10	37,621
Elk	2	9	3	--	3	7	24	68,180
Erie	--	--	3	--	2	1	6	18,224
Fayette	--	1	--	--	--	1	2	5,798
Forest	84	6	1	1	--	3	95	99,290
Fulton	--	--	--	--	--	1	1	3,572
Indiana	--	312	5	--	15	2	334	1,165,490
Jefferson	--	25	2	--	1	3	31	93,032
McKean	128	8	4	--	2	9	151	274,850
Mercer	1	1	--	--	--	1	3	11,899
Potter	--	--	1	--	--	5	6	39,460
Somerset	--	--	--	--	--	1	1	9,800
Susquehanna	--	--	--	--	--	1	1	8,534
Tioga	--	--	--	--	--	4	4	21,582
Venango	204	1	7	1	3	1	217	199,459
Warren	94	--	1	1	--	1	97	93,875
Washington	--	1	--	--	--	1	2	8,048
Westmoreland	--	13	--	--	4	--	17	55,841
Total	522	443	37	3	41	53	1,099	2,564,901

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Deep drilling (Middle Devonian or older) increased from 63 wells in 1972 to 69 wells in 1973, including 10 wells drilled deeper as in 1972, the majority of the deep development drilling was in the Medina gas area of Crawford County where two gas wells, five oil and gas wells, and one dry hole were drilled in the Indian Springs field. Two of the oil and gas wells had initial production rates of 30 barrels of oil per day of Corning-grade crude. Production of Corning-grade crude from the Medina wells amounted to 76,000 barrels, down 2,000 barrels from that of 1972. Most of the activity in the shallow gasfields was in the following counties: Indiana 312 wells, Armstrong 34, Jefferson 21, Clearfield 20, Westmoreland 14, McKean 9, and Elk 8. The majority of the shallow oil development was in the following counties: Venango—205 wells producing from the Red Valley and Venango Second sandstones, Warren—95 oil wells with Glade sand production, Forest—82 wells with production from the Red Valley and Venango Second sandstones, and McKean—126 wells producing from the Bradford and associated sandstones. Seismic activity was off 102 crew-weeks from that in 1972. Most of the seismic testing was Vibroseis. Seismic crews logged 161 crew-weeks costing operators over $2,400,000 during 1973, compared with 263 crew-weeks during 1972, a decrease of 39% in crew-weeks. The seismic surveys were made in Allegheny, Bedford, Blair, Bradford, Butler, Cambria, Cameron, Centre, Clarion, Clearfield, Clinton, Elk, Fayette, Jefferson, Lackawanan, Lycoming, McKean, Pike, Potter, Somerset, Sullivan, Venango, Washington, Wayne, Westmoreland, and Wyoming Counties.

The Pennsylvania Game Commission leased 13,744 acres in 1973 for the exploration or development of oil and gas. At the end of 1973 the Commission had 37 active leases totaling 22,796 acres. Forty-eight wells were producing on 30 of the above leases, and one dry hole was drilled. Through competitive bidding, 10 tracts of State Forest or Park lands were leased during 1973. The total bonus or first-year rental received for these tracts was $215,326. The average of all sales was $12.41 per acre. After the first year, the rental was $1 per acre per year with royalties equal to one eighth or more of all production. The income from oil and gas development on State Forest and Park lands totaled $617,414, including $123,032 in royalty payments and $494,382 for tract rentals, gas storage, right of ways, etc. At yearend, 249,408 acres (60,841 acres included for gas storage) of State Forest and Park lands were under lease for oil and gas exploration and development.

Active rotary-drill weeks totaled 578. Only six rotary drilling rigs were active in the week ending April 2. The maximum activity was in the week ending December 3 when 19 rotary drills were in operation.

The American Gas Association (AGA), reported that as of December 31, 1973 Pennsylvania had 68 dry gas reservoirs with a total capacity of 783.4 Bcf, equal to 12.4% of the U.S. gas storage reservoir capacity. At yearend these reservoirs, serviced by 2,141 wells, held 614.1 Bcf (14.73 psia and 60° F) of gas, or 15.7% of the U.S. total in gas storage reservoirs. In 1973, the 68 reservoirs received 343.4 Bcf, delivered 303.4 Bcf, and attained a net gain of 40.0 Bcf of gas stored.[12]

The average price of new gas at the wellhead was 45 cents per Mcf. Gas in some areas of northern Pennsylvania was purchased at 60 cents per Mcf at the wellhead.

Late in the year Pennsylvania-grade crude oil from new and stripper wells was priced at $10.65 per barrel in the Bradford district, $10.28 per barrel in the Middle district, and $10.13 per barrel in the Southwest district. Corning-grade crude oil from Crawford County sold for $10.00 per barrel.

Two Maraflood projects to stimulate crude oil recovery were operating, one in the oil-wet Bradford Third sandstone at a 1,800-foot depth in McKean County, and one in the water-wet First Venango sandstone at a 500-foot depth in Warren County.

Six deep wells were testing the Medina (Lower Silurian) Sandstone 6 miles southwest of Meadville. In Fayette County a deeper pool wildcat was testing the Tuscarora Sandstone (Medina) 8 miles south of Uniontown. A deeper pool test to the Upper Silurian was staked in McKean County 3 miles southwest of Clermont. In Potter County two wells were drilled to the "Oriskany-no-sand" area to test the Oriskany interval. Two wildcats in Somer-

[12] American Gas Association. The Underground Storage of Gas in the United States and Canada. Pub. XY0274, Dec. 31, 1973, 22 pp.

set County were being drilled to test the Oriskany. A third wildcat about 13.5 miles southeast of Connellsville was projected to drill to the Cambrian at 20,500 feet. Another Cambrian test was located in Tioga County about 2.5 miles southeast of Marshlands where the well was reamed at 3,517 feet before continuing drilling to 5,300 feet. A deeper pool wildcat near Franklin, Venango County, was drilled to 6,085 feet and was then tested after fracturing the Medina sandstone.

The American National Petroleum Co. reported a gas flow of 1.1 million cubic feet per day (MMcfd) from a new well in Elk County at a 2,282- to 2,560-foot interval from the Sheffield, First Bradford, and Second Bradford zones.

Westrans Petroleum Inc., a subsidiary of Westrans Industries Inc., completed a well in the Devonian sandstone in Armstrong County. The 7,310-foot well had a shut-in wellhead pressure of 3,950 psi and an initial flow rate of 7 MMcfd. After completion of a pipeline in February gas was marketed intrastate at about 50 cents per Mcf.

A Standard Oil Co. (Indiana) subsidiary, Amoco Production Co., completed a new well 10 miles northeast of Somerset in the Oriskany Sandstone in the interval from 8,636 to 8,670 feet. During an initial 18-hour test, the well produced 4.2 MMcfd of dry gas through an 18/64-inch choke. Amoco held leases on 3,000 acres in the immediate area and planned an offset well one-half mile southwest of the completed well to define the size of the discovery.

Equitable Gas Co. was readying a new underground gas storage reservoir in Greene County to start gas injection by midyear. The reservoir will provide the company with 1.75 Bcf of additional storage capacity. In late April, Equitable asked the PUC for a rate increase that would average 60 cents per month for each of its retail customers in Pennsylvania.

Philadelphia Electric Co. was given conditional approval by the PUC for a $12 million annual increase in natural gas rates effective February 15. The 13% average increase was the first by the company in 20 years.

A rate increase by Peoples Natural Gas Co., Pittsburgh, on October 11 with PUC approval, which amounted to $5.7 million annually, cost the average residential customer using gas for heating 90 cents per month, and cost nonheating customers 30 cents per month. The company served 298,000 customers in 16 Pennsylvania counties.

The Jeanette Corp., a glass manufacturer, asked the PUC to disregard the gas curtailment plan of the Peoples Natural Gas Co. The plan put 200 employees out of work, cut production by 16%, and threatened 100 more jobs.

Governor Shapp asked the PUC in November to relieve the Carnegie Natural Gas Co., Pittsburgh, of a curtailment of the gas it received from Texas Eastern Transmission Co. The request was based on an alarming decrease in ammonium nitrate production by Carnegie that reportedly caused a loss of some strip coal production.

On January 5 the FPC dismissed an application by Transco Energy Co., Houston, Tex., to build an $85 million synthetic natural gas (SNG) plant at Twin Oaks, Delaware County. FPC planned to examine in a formal hearing the end uses of the mixture of SNG and natural gas that the company proposed to market.

The PUC gave approval to Interstate Energy Co., Houston, Tex., a subsidiary of Gulf Interstate Co., Houston, Tex., to build a $45 million, 82-mile pipeline to link Interstate's terminal at Marcus Hook with PPL's Martins Creek steam-electric plant under construction near Easton. The line will transport low-sulfur-content residual oil or crude petroleum.

The Philadelphia Electric Co. was constructing a $11 million liquefied natural gas (LNG) peak-shaving facility at West Conshohocken.

Pennsylvania's LPG underground storage capacity totaled 1,061,000 barrels.[13]

ARCO at its Philadelphia refinery in late 1972 installed the first gasoline-vapor recovery unit of its type on the east coast. The skid-mounted system used oil as absorbent at a low pressure thereby avoiding the hazardous compression of vapors, to recover about 1,000 gallons of gasoline per day. Also scheduled for completion by September 1973 was a new 57,000-barrel-per-day (bpd) vacuum tower integrated to a 125,000-bpd crude still whose capacity

[13] Oil and Gas Journal. LP-Gas Underground Storage Capacity. V. 71, No. 33, Aug. 13, 1973, p. 62.

had been increased from 95,000 bpd; a 20,000-bpd heavy-gas-oil hydrodesulfurizer; a 41,000-bpd distillate desulfurizer; and a Claus sulfur-recovery plant having two parallel sections each producing 70 long tons per day. In 1972, a new 30,000-bpd catalytic Magnaformer started operation at the refinery.

BP Oil Corp., a Sohio subsidiary, in mid-February announced a $120 million modernization of its Marcus Hook refinery, including $70 million for pollution control equipment. The modifications will bring the crude-throughput capacity to 150,000 bpd and will meet all Federal and State pollution regulations, including those for noise pollution, effective in 1975. The modernization will provide for product improvements, the production of lead-free gasoline, and the desulfurization of distillate fuels oils. BP in early 1973 contracted with Foster-Wheeler Corp. for a Universal Oil Products Co. HF alkylation process unit to produce 8,000 bpd of high-octane motor alkylate, with provision for the removal of gaseous hydrofluoric acid from a flare system by the use of lime, and a separate pond to handle cooling water from the unit.

Gulf Oil Co.'s Philadelphia refinery was constructing a 15,000-bpd HF alkylation unit. On November 19, Sun Oil Co. increased the prices of residual fuel oil by amounts ranging from 34% to 38% for No. 4, No. 6 regular grade, and No. 6 with 1% maximum sulfur content, f.o.b. Pennsylvania terminals. Sun Oil was constructing a 13-MMcfd refinery-gas-recovery unit at Marcus Hook. United Refinery Co., Warren, completed a 30,000-bpd electric desalter, increased crude distillation capacity to 30,000 bpd, and completed a catalytic reformer.

Capacities of 11 refineries operating in Pennsylvania as of January 1, 1974, are shown in table 21.

Table 21.—Pennsylvania: Capacities of operating refineries, January 1, 1974

	Western Pennsylvania		Eastern Pennsylvania	
	Pennsylvania grade crude oil	Interstate and foreign crude oil	Interstate and foreign crude oil	Total
Number of refineries	6	1	4	11
Crude capacity:				
Barrels per calendar day	35,120	38,000	616,500	689,620
Barrels per stream day	37,215	38,000	654,000	729,215
Charge capacity, barrels per stream day:				
Vacuum distillation	9,778	8,000	230,000	247,778
Thermal operations	2,750	--	24,000	26,750
Catalytic-cracking, fresh feed	--	10,000	186,900	196,900
Catalytic-cracking, recycle	--	200	20,500	20,700
Catalytic reforming	8,208	10,000	179,000	197,208
Catalytic hydrocracking	2,700	--	30,000	32,700
Catalytic hydrorefining	--	--	133,000	133,000
Catalytic hydrotreating	10,250	16,500	201,000	227,750
Alkylation	--	1,400	36,700	38,100
Production capacity, barrels per stream day:				
Aromatics isomerization	--	--	57,900	57,900
Lubricants	12,628		17,000	29,628
Asphalt	--	4,000	31,500	35,500

Source: Cantrell, A. Annual Refinery Survey. Oil and Gas Journal, v. 72, No. 13, Apr. 1, 1974, pp. 82, 84, 100.

The 1973 consumption of gasoline in Pennsylvania was 4,874,673,000 gallons, 1.3% more than in 1972.

Near Bradford, the Bureau of Mines installed a microseismic monitoring system employing explosive charges detonated at various locations to obtain directional acoustic velocity data in the strata to guide the development of a fracture-mapping technique to achieve better reservoir performance.

NONMETALS

Abrasives.—Silicon carbide abrasives were produced by Satellite Alloy Co., Alle-

gheny County. On April 3, the Allegheny County Air Pollution Appeals Board demanded that the firm control its emission of sulfur dioxide. The plant employed 41 persons and reportedly was 1 to 3 plants in the United States producing silicon carbide abrasives for use in steelmaking, electronics, refractories, heating elements, and marble and granite cutting.

Four companies in three counties produced metallic abrasives consisting of steel shot and grit and chilled iron shot and grit. Because one company in Pittsburgh produced no metallic abrasives during 1973 but did sell both chilled and annealed iron shot and grit, total sales in the State exceeded total production by 8,651 short tons.

Cement.—Portland cement shipments from 19 plants in 8 counties were 4.2% greater in quantity and 10% greater in value than in 1972. The average increase of value was $1.05 per short ton greater than in 1972. Masonry cement shipments from 15 plants in 8 counties were 8.6% greater in quantity and 16.5% greater in value than in 1972. The average value of masonry cements was $1.98 per short ton greater than in 1972.

Northhampton and Lawrence Counties were the largest producers of both portland and masonry cements. Of the 15 plants in Berks, Lehigh, Montgomery, Northampton, and York Counties, four performed wet grinding, nine performed dry grinding, and two performed dry grinding only on clinker received from out-of-plant sources. Of the five plants in Allegheny, Butler, and Lawrence Counties, three performed wet grinding and two performed dry grinding.

The 15 plants in 5 eastern counties ground 5,923,471 short tons of clinker in equipment rated at 7,132,000 short ton's annual capacity. The five plants in three western counties ground 2,371,151 short tons of clinker in equipment rated at 2,836,000 short ton's annual capacity.

Methods and tonnages of shipments of portland cement from terminals to consumers and from plants to consumers in short tons follow:

	Shipments (thousand short tons)	
	Bulk	Container
Transport method:		
Rail	1,640,312	134,008
Truck	6,243,936	1,047,968
Barge	123,662	--
Total	8,007,910	1,181,976

Disposition of portland cement by type of customer was—

	Percent
Ready-mix concrete companies	59
Concrete products manufacturers	22
Building material dealers	10
Contractors and other uses	9

Consumption of energy for the 20 producing plants was—

Natural gas cubic feet	630,424,000
Fuel oil 42-gallon barrels	1,127,000
Bituminous coal short tons	1,471,000
Anthracite do	118,000
Electricity generated kilowatt-hours	24,062,000
Electricity purchased do	1,161,651,000

Total stocks of cements in short tons at producing plants were—

	Portland	Masonry
Dec. 31, 1972	621,900	42,132
Dec. 31, 1973	534,618	38,612

Whitehall Cement Manufacturing Co. awarded a $650,000 contract to the Fuller Co. to supply pyroprocessing equipment for Whitehall's Cementon, Pa., plant expansion. Fuller will supply a 250,000-ton-per-year kiln and clinker cooler system. The four-stage preheater was manufactured at Fuller's Catasaqua, Pa. plant and the 12-by-65-foot kiln and clinker cooler will be fabricated at Fuller's Allentown, Pa., plant. Kaiser Engineers was in charge of the $9 million program that included an A-frame clinker storage building, homogenizing silos, and a 3,500-hp finish mill. An existing control computer system will be extended to the new kiln and mill.

Early in 1973 limited production started at the Egypt, Pa., plant that Coplay Cement Manufacturing Co. acquired from Giant Portland Cement Co. in 1972. Reportedly the capacity of the Egypt plant was increased to 2.5 million barrels per year (470,000 short tons).

Clays.—Total production of common clay and shale, excluding kaolin, and fire clay was 13% greater in tonnage but was only 10% greater in value than in 1972, because of a $0.19 decrease in average value to $5.60 per ton. Common clay and shale accounted for 70.0% of the total tonnage and 33.6% of the value of all clays and shales, excluding kaolin. Thirty companies in 26 counties produced common clay and shale and 29 companies in 8 counties produced fire clay. Common clay and shale averaged $2.68 per ton, and fire clay averaged $12.41 per ton. Two companies produced 30.9% of the common clay and shale, and two companies pro-

duced 30.2% of the fire clay. Table 22 shows the tonnages of clays sold or used by producers, by use, for 1972 and 1973.

Medusa Corp. produced unprocessed kaolin in Cumberland County, and Narbon Mining and Chemical Corp. produced calcined kaolin in Lancaster County.

Table 22.—Pennsylvania: Clays sold or used by producers, by use
(Short tons)

Use	1972	1973[1]
Common brick	412,384	238,078
Face brick	1,024,822	1,378,052
Firebrick, block, and shapes	639,205	750,534
Flue linings	W	52,236
High alumina refractories	37,269	W
Brakes clutches, and linoleum	1,748	1,858
Lightweight aggregate	72,500	80,000
Mortar and cement, refractory	43,728	14,286
Portland and other cements	273,181	224,532
Pottery	--	490
Sewer pipe	95,274	98,892
Drain, quarry, and structural tile	33,292	29,234
Other[2]	29,828	41,706
Exports:		
Face brick	--	28,171
Refractories	9,486	8,949
Brick and glazed tile	8,834	--
Sewer pipe	--	28,170
Total	2,681,551	2,975,188

W Withheld to avoid disclosing individual company confidential data; included in "Other."
[1] Excludes kaolin.
[2] Includes animal feed (1972), paint (1972), pesticides and related products (1972), refractory grogs and crudes, rubber (1972), terra cotta (1973), water treatment (1972), and data indicated by symbol W.

Shales and clays of western Pennsylvania were discussed.[14]

Gem Stones and Minerals.— A large beryl crystal from Chester County was donated to the William Penn Memorial Museum in Harrisburg.

The following mineral species were verified as new minerals occurring in Pennsylvania: Acanthite, anatase, berndite, bitsmuthite, brookite, cassiterite, cornubite, epsomite, herzenbergite, hexahydrite, langite, mascagnite, ottemannite, posnjakite, realgar, selenium, and selenolite. None are presently economic.

Mineral collectors obtained representative specimens of wavellite, cacoxenite, sphalerite, galena, celestite, barite, cobaltite, arsenopyrite, millerite, sulfur, selenium, tschermigite, and quartz. Sales of these and other minerals increased in the past few years.

Graphite (Synthetic).—Three companies produced synthetic graphite using petroleum coke, lampblack, pitch, black oil, and natural gas as the principal raw materials. Principal uses for the synthetic graphite were for carbon raisers, and for machined and rough shapes. Compared with 1972, production was 7.8% less, but value was 15.6% greater.

Gypsum.—U.S. Gypsum Co. calcined gypsum at Philadelphia. Output was 14% greater than in 1972, and value was 24% greater.

Kyanite.—Combustion Engineering Inc., Stamford, Conn., commenced expansion of its Washington, Pa., kyanite facilities, which will increase the processing of kyanite by more than 30,000 tons per year.

Lime.—Nine plants in seven counties produced 2,260,000 total tons of burned and hydrated lime, 19.5% more than in 1972. Value of the total production was 21.1% more than in 1972. The average value of all production in 1973 was $18.11 per short ton, 24 cents per ton more than in 1972. Pennsylvania ranked second in the United States with 10.7% of the total production and 11.1% of the total value. Centre County was the leading producer in the State with 34.3% of the total production and 30.67% of the total value.

[14] Williams, E. G., R. R. Holbrook, E. W. Lithglow, and B. R. Wilson. Properties and Occurrence of Bloating Clays and Shales in the Pennsylvanian of Western Pennsylvania. AIME Preprint 73-H-336, September 1973, 12 pp.

Table 23.—Pennsylvania: Lime sold or used by producers, by use

Use	1972		1973	
	Quantity (short tons)	Value	Quantity (short tons)	Value
Steel, b.o.f.	851,800	r $14,250,000	1,219,000	$21,050,000
Water purification	181,300	3,033,000	241,400	4,169,000
Mason's lime	r 80,260	r 1,768,000	106,100	2,061,000
Steel, electric	79,360	r 132,800	100,200	1,730,000
Sewage treatment	72,080	1,206,000	95,330	1,646,000
Steel, open-hearth	r 190,700	r 3,190,000	84,720	1,463,000
Agriculture	70,520	1,313,000	63,420	1,189,000
Acid mine water	34,950	584,700	41,000	708,100
Finishing lime	r --	--	26,940	521,000
Paper and pulp	22,210	371,600	26,290	454,000
Tanning	6,116	r 102,300	W	W
Other [1]	r 302,100	r 7,851,000	255,600	5,959,000
Total [2]	1,891,000	33,802,000	2,260,000	40,950,000

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Total".
[1] Includes refractory dolomite, insecticides, other metallurgy, sand-lime brick, explosives, wire drawing, silica brick, other ore concentration, petroleum refining, food, paint, alkalies, other chemical uses, soil stabilization (1972), and uses indicated by symbol W.
[2] Data may not add to totals shown because of independent rounding.

Mica.—Micalith Mining Co., Inc., at its Hokes mine near Glenville, York County, mined crude mica from a deposit in schist. The dry ground product was used in the manufacture of paints and welding rods. Production was less than in 1972 but its value was greater.

Aguda Mining Corp. Pittsburgh, planned a wet grinding plant to process mica near Lancaster from a purported 35-million-ton deposit.

Mullite.—The Remmey Div., A.P. Green Refractory Co., produced high-temperature sintered synthetic mullite at a plant in Philadelphia County. Compared with 1972, production was 26.5% less and value was 34.6% less.

Perlite.—Crude perlite was shipped into the State and expanded at seven plants by seven companies operating in seven counties. Production totaled 36,490 short tons. The quantity sold or used was 35,230 short tons, with an average value of $58.33 per short ton. Principal uses for the product were for plaster, horticulture, and cement aggregates. Minor uses for filter aid, low-temperature insulation, fillers, foundry uses, insulating board, formed products, castable insulation, and bonding mortars.

Sand and Gravel.—On August 17, the Environmental Quality Hearing Board ruled against DER restrictions preventing dredging on holidays and weekends, or in areas within 50 feet of the shoreline.

In the 1973 National Sand and Gravel Association safety contest covering the period from July 1, 1972, to June 30, 1973, recipients of Certificates of Achievement were the New Freedom plant of George F. Pettinos, Inc., Ardmore; and the Amity Hall plant of Pennsylvania Supply Co., Harrisburg.

Compared with 1972, the total production of sand and gravel increased 9.6% and its value increased 16.4%. The average increase in value was 12 cents per short ton. The production by 81 companies in 39 counties came from 84 stationary plants, 19 portable plants, 16 dredges, and 3 plants using unspecified types of equipment.

Table 24.—Pennsylvania: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	5,164	9,265	5,366	10,747
Fill	100	129	123	182
Paving	2,441	4,649	3,625	7,293
Other uses [1]	3,384	8,247	3,386	8,840
Total [2]	11,090	22,291	12,500	27,062
Gravel:				
Building	3,992	7,389	4,520	8,862
Fill	340	301	462	463
Paving	2,866	5,940	2,718	5,790
Miscellaneous	363	747	377	653
Other uses	106	137	(3)	(3)
Total [2]	7,667	14,513	8,077	15,767
Total sand and gravel [2]	18,757	36,804	20,576	42,830

[1] Includes blast, engine, filtration, fire and furnace, foundry, glass, grinding and polishing, molding, oil (hydrafrac), abrasives, chemical, enamel, filler, pottery, and other uses.
[2] Data may not add to totals shown because of independent rounding.
[3] Included with miscellaneous gravel.

Stone.—Compared with 1972, production was 16.7% greater and value was 18.1% more because of an average increase in value to $1.91 per ton from $1.89 per ton in 1972.

Dimension stone from 31 quarries accounted for 0.13% of the total tonnage and 3.19% of the total value. The average price of all dimension stone was $45.77 per ton, compared with $51.60 per ton in 1972.

The average price of all crushed and broken stone production at $1.85 per ton was 7 cents greater than in 1972. Limestone accounted for 74.3% of the tonnage and 73.6% of the value of all crushed and broken stone production; traprock accounted for 7.8% of the production and 6.7% of the value; and dolomite, granite, quartzite, sandstone, and other stone, collectively, accounted for 17.9% of the tonnage and 20.4% of the value. Crushed and broken stone was produced at 231 quarries.

Rock dust for use in underground coal mines was produced at seven locations. The 135,243-ton production averaged $5.25 per ton at the producing sites.

Michigan Limestone Co., a subsidiary of U.S. Steel, abandoned a 3-square-mile area at Hillsville in Lawrence County, where unregulated strip mining of limestone had been done for 50 years.

Eureka Stone Quarries at Milford, Pike County, installed a 1,000-ton-per-hour hydraulic impulse breaker.

New Enterprise Stone & Lime Co. started an automatic central mix plant at its Roaring Spring quarry. The new plant had a 9-cubic-yard mixer capable of producing 300 cubic yards of concrete per hour.

A 6-cubic-yard tracked wheel loader replaced two 2.5-cubic-yard shovels for loading shot rock at the Pennsylvania Supply, Inc., Hummelstown quarry. Loading time was reduced by 50%.

The Rock Hill operation of General Crushed Stone Co. near Quakerstown was revamped to get the maximum production of finer sizes in the 5/16- by 3/16-inch range with at least 85% in the minus ¼-inch specification. The operation was the first of the firm's Pennsylvania operations that could deliver tertiary reduction products as a major output.

Table 25.—Pennsylvania: Stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973			Kind of stone produced in 1973
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Allegheny	--	--	--	3	W	1,122	Limestone, sandstone.
Armstrong	4	173	397	5	174	478	Limestone.
Berks	12	4,649	6,377	16	5,352	7,983	Limestone, standstone, traprock.
Blair	8	1,213	2,164	7	1,368	2,559	Limestone, dolomite, quartzite.
Bucks	20	4,929	7,631	15	5,026	9,902	Limestone, sandstone, traprock.
Butler	7	1,592	3,894	7	2,004	5,111	Limestone, sandstone.
Carbon	3	101	W	2	W	W	Limestone, quartzite.
Centre	9	2,537	4,245	9	2,830	6,226	Limestone.
Chester	7	3,536	5,903	8	4,137	7,311	Limestone, sandstone, traprock, quartzite.
Clarion	3	220	W	4	302	789	Limestone, sandstone.
Cumberland	6	1,758	2,998	7	1,947	3,465	Do.
Dauphin	4	1,659	2,667	7	2,630	3,957	Do.
Huntingdon	5	667	1,236	5	764	1,510	Limestone, quartzite.
Juniata	1	242	366	1	275	432	Limestone.
Lancaster	17	4,350	7,974	7	5,696	10,883	Limestone, dolomite, other.
Lawrence	4	2,095	3,470	5	1,505	2,622	Limestone.
Lehigh	9	2,215	3,450	9	2,631	4,106	Limestone, slate.
Luzerne	4	669	1,072	4	1,039	1,713	Sandstone.
Montgomery	15	5,182	9,592	14	7,156	13,728	Limestone, sandstone, dolomite, granite, traprock, other.
Northampton	17	6,020	11,388	18	5,757	10,912	Limestone, quartzite, slate.
Northumberland	2	W	W	3	480	1,029	Limestone, sandstone.
Potter	3	1	29	3	1	30	Sandstone.
Schuylkill	3	W	670	3	W	W	Limestone, sandstone, quartzite.
Somerset	4	874	2,101	5	690	W	Limestone, sandstone.
Susquehanna	7	W	661	7	W	724	Sandstone.
Westmoreland	10	1,758	3,657	8	2,178	4,951	Limestone, sandstone.
York	10	4,410	9,537	10	4,461	10,339	Limestone, sandstone, dolomite.
Undistributed[1]	52	16,454	32,861	53	20,162	38,461	Limestone, sandstone, quartzite, traprock, other stone.
Total[2]	247	67,307	124,340	255	78,564	150,346	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Adams, Bedford, Cambria, Clinton, Columbia, Delaware, Elk, Fayette, Franklin, Fulton, Greene (1973), Lackawanna (1973), Lebanon, Lycoming, McKean, Mercer, Mifflin, Monroe, Montour, Perry, Snyder, Union, Washington, Wayne Counties, and production for which there was no county breakdown.

[2] Data may not add to totals shown because of independent rounding.

Table 26.—Pennsylvania: Stone sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone [1]	49	836	59	895
Curbing and flagging	21	542	22	634
Other uses [2]	22	3,318	23	3,277
Total [3]	91	4,696	105	4,806
Crushed and broken stone:				
Bituminous aggregate	6,125	10,860	7,476	15,113
Concrete aggregate	8,740	13,997	7,151	12,860
Dense graded roadbase stone	15,346	25,346	20,308	33,955
Macadam aggregate	2,018	3,969	1,624	2,960
Surface treatment aggregate	3,321	5,240	3,333	5,001
Unspecified construction aggregate and roadstone	7,404	13,024	11,540	21,759
Agricultural purposes [4]	1,064	3,456	2,345	6,988
Cement manufacture	11,106	14,678	12,045	16,685
Fill	118	94	--	--
Filter stone	W	W	236	W
Flux stone [5]	3,405	7,278	4,087	9,357
Glass	115	434	90	W
Lime manufacture	2,752	5,361	3,634	8,443
Manufactured fine aggregate (stone sand)	444	1,052	427	1,167
Mineral fillers, extenders, and whiting	508	2,667	728	3,092
Railroad ballast	1,500	2,564	1,738	2,944
Refractory stone	179	1,316	W	W
Riprap and jetty stone	676	1,393	956	1,813
Special uses and products [6]	154	769	141	754
Other uses [7]	2,240	6,146	601	2,648
Total [3]	67,216	119,644	78,459	145,540
Grand total	67,307	124,340	78,564	150,346

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes rough blocks, rough construction stone, cut stone, house stone veneer, and dressed construction stone.
[2] Includes roofing slate, millstock, flooring slate, and other uses not specified.
[3] Data may not add to totals shown because of independent rounding.
[4] Includes agricultural limestone. 1973 data also include agricultural marl and other soil conditioners and poultry grit.
[5] 1973 data include dead-burned dolomite.
[6] Includes mine dusting and abrasives.
[7] Includes acid neutralization stone and other uses not specified. 1972 data also include dead-burned dolomite, roofing aggregates, poultry grit, and building products.

Sulfur.—Three petroleum refineries operated by three companies in Delaware and Philadelphia Counties produced 24,518 long tons of sulfur (100% basis) and sold 25,105 long tons of sulfur (100% basis). Stocks of sulfur decreased from 1,555 long tons on January 1 to 968 long tons at yearend. Compared with 1972, sales of recovered elemental sulfur increased 13.3% in tonnage, while value decreased 13.4%.

Vermiculite (Exfoliated).—Crude vermiculite shipped into the State was exfoliated by four companies operating in four counties. Total production exceeded that of 1972 by 2.9%. The total quantity sold or used by producers was 9.1% greater than in 1972, and its value was 19.1% greater. The major uses of the product was for loose fill insulation and concrete aggregates.

Tripoli (Rottenstone).—Crude tripoli was mined and processed by Keystone Filler & Manufacturing Co., Lycoming County. Compared with 1972, the tonnage sold or used was 6.9% greater and its value was 4.3% more.

METALS

Aluminum.—Aluminum Co. of America (Alcoa) in July signed a contract with the Group for Recycling in Pennsylvania (GRIP) to purchase scrap aluminum from GRIP's centers in southwestern Pennsylvania. About 1,000 pounds per month was transferred to the Alcoa Technical Center for use in a program to develop improved recycling techniques.

Beryllium.—Kawecki Berylco Industries Inc. (KBI) shut down its beryl operation at Hazleton, where beryllium beads had been produced. The prospect of spending more than $1 million for liquid and solid waste treatment systems was a major factor in the decision to cease operation. About 85 to 100 workers were affected. After nine months of litigation the Occupational Safety and Health Review Commission on August 13 accepted a plan for reducing airborne beryllium at KBI's Hazleton plant within 4 to 13 months. KBI installed annealing furnaces in its Reading plant to increase beryllium strip capacity by 30%.

Cadmium.—Smelter production of cadium was 28% less than that of 1972 but its value was 2.2% greater.

Iron Ore.—Bethlehem Steel Corp. pro-

duced iron ore at its Grace underground mine in Berks County and at its Cornwall open pit in Lebanon County. Except for a minor tonnage, all concentrates were pelletized prior to shipment to Bethlehem's steelmaking facilities. Production of pellets was 0.8% less in 1973 than in 1972, but their value was 2.7% greater. On July 2, 1973, the Cornwall mine was closed following many years of operation by Bethlehem and predecessor companies. No pyrites were produced from any of the iron ore mined in 1973. Minor tonnages of chalcopyrite were produced from the ore mined at both the Cornwall and Grace mines. Explosives consumed at the Grace mine comprised 500,230 pounds of dynamites and 178,000 pounds of Nylite #303.

Iron Oxide Pigments.—The total tonnage of natural and manufactured iron oxide pigments sold was 10.4% less than in 1972, but the total value of these products was 11.0% greater.

Iron and Steel.—According to the American Iron and Steel Institute (AISI), the State's raw steel production was 33,925,000 short tons, compared with 30,416,000 short tons in 1972. Total blast furnace production of pig and silvery irons and ferralloys was 23,028,000 short tons, 10.5% more than in 1972. Blast furnace production of ferroalloys was 382,000 short tons, compared with 483,000 short tons in 1972.

Active blast furnaces numbered 32 on January 1 and 36 at yearend. Idle blast furnaces totaled 23 on January 1 and 18 at yearend. The average net consumption of blast furnace coke plus a minor tonnage of coke breeze was 1,135 pounds per short ton of hot metal, 50 pounds less than the national average. Supplemental fuels injected into blast furnaces through tuyeres comprised 1,714 MMcf of natural gas, 33,364,685 gallons of bunker C oil, 26,308,665 gallons of No. 6 and high-sulfur oils, and 4,489,429 gallons of crude coal tar. On a Btu-basis, all supplemental fuels injected into blast furnaces through tuyeres equaled approximately 450,000 short tons of 90% carbon coke.

Blast furnace pig iron plus hot metal was classed as 94.6% basic, 3.1% Bessemer, and 2.3% malleable and foundry. Stocks of pig iron at furnaces totaled 170,636 tons on January 1 and 184,270 tons at yearend. Shipments of pig iron and hot metal for sale, transferred for interplant consumption, and withdrawn from stock during 1973 totaled 22,685,783 tons and averaged $76.08 per ton in value. Stocks of agglomerates totaled 2,132,825 tons on January 1 and 1,819,432 tons at yearend. Stocks of iron ore were 9,233,183 tons on January 1 and 7,593,679 tons at yearend.

Consumption of materials for the production of 33,925,000 tons of raw steel in Pennsylvania in 1973 is shown in table 27.

Table 27.—Pennsylvania: Material consumption for raw steel production
(Short tons)

Material	Agglomerating plants	Blast furnaces	Steel furnaces	Total
Iron ores:				
Nonmanganiferous:				
U.S.	2,727,418	6,149,479	7,110	8,884,007
Foreign	9,798,817	3,717,568	551,568	14,067,953
Manganiferous:				
U.S.	--	2,782	--	2,782
Foreign	3,207	88,585	--	91,792
Total	12,529,442	9,958,414	558,678	23,046,534
Sinter, regular	--	4,042,005	4,055	4,046,060
Sinter, flux	--	11,177,722	--	11,177,722
Pellets, regular	--	7,398,162	55,049	7,453,211
Agglomerates, foreign	--	2,689,170	31,907	2,721,077
Total	--	25,307,059	91,011	25,398,070
Fluxes:				
Limestone	1,576,599	1,134,324	594,569	3,305,492
Burnt lime	--	--	986,346	986,346
Dolomite	1,123,147	1,136,270	436,206	2,695,623
Fluorspar	--	--	101,064	101,064
Other fluxes	113,820	199,748	309,084	622,652
Total	2,813,566	2,470,342	2,427,269	7,711,177
Other Materials:				
Mill cinder and roll scale	1,041,855	351,891	23,263	1,417,009
Flue dust, raw	635,254	74,369	--	709,623
Slag (open hearth, basic oxygen, and bessemer)	431,631	698,093	--	1,129,724
Coke, breeze-free	--	13,461,618	--	13,461,618
Coke, breeze	785,518	67,525	--	853,043
Anthracite, Pennsylvania	215,462	67,500	1,232	284,194
Pig iron and hot metal	--	392,518	20,830,955	21,223,473
Total	3,109,720	15,113,514	20,855,450	39,078,684
Scrap:				
Home and purchased	--	1,393,823	11,909,268	13,303,091
Slag scrap	--	63,688	48,578	112,266
Other	--	600	265,858	266,458
Total	--	1,458,111	12,223,704	13,681,815
Grand Total	18,452,728	54,307,440	36,156,112	108,916,280

Total annual capacity of continuous hot-dip galvanizing lines operated by six companies in Pennsylvania was 968,000 short tons.[15] The annual capacity of oxygen-steelmaking (LD) vessels in Pennsylvania in 1973 is shown in table 28

[15] Metal Bulletin Monthly. Continuous Hot-Dip Galvanizing Lines. No. 38, February 1974, pp. 15–16.

Table 28.—Pennsylvania: Oxygen steelmaking capacity in Pennsylvania in 1973

Operator	Location	Vessels		Startup date	Rated annual capacity (thousand tons)
		Number	Capacity (tons)		
Alan Wood Steel Co	Conshohocken	2	150	1968	1,250
Allegheny Ludlum Steel Corp	Natrona	2	80	1966	500
Bethlehem Steel Corp	Bethlehem	2	270	1968	2,500
Crucible, Inc	Midland	2	105	1968	900
Jones & Laughlin Steel Corp	Aliquippa	2	80	1957	1,000
United States Steel Corp	Duquesne	2	220	1963	2,600
Do	Braddock	2	230	1972	2,250
Wheeling-Pittsburgh Steel Corp	Monessen	2	200	1964	1,800
Total or average	--	16	167	--	12,800

Source: Iron and Steel Engineer. World-wide Oxygen Steelmaking Capacity—1973. V. 51, No. 3, March 1974, p. 62.

According to American Metal Market,[16] steelmaking in the Pittsburgh area was at 97% to 98% of full capacity and was 17% to 20% more than the 1967 average. The rate of steel production in both April and October was 35 million tons annually.[17]

There were few, if any, cutbacks in steelmaking because of lack of furnace melting scrap. More scrap was available as prices advanced during the year. For example on November 8, some buyers in the open market paid $79 per gross ton for No. 1 heavy melting grades, No. 1 dealer bundles brought $92 per gross ton, and rails and railroad specialties were $80 to $95 per gross ton, up from $57 in April. On November 1, Allegheny Ludlum Steel applied a surcharge on its products based on an increase of 75 cents per ton for each $1 increase in the price of its railroad specialty scrap purchases in excess of the April 1 price. The surcharge for each following month was based on the price published in the American Metal Market for the last of the preceding month.

Most Pennsylvania producers followed U.S. Steel's posting of higher prices effective June 15 on sheet and strip steel. Wheeling-Pittsburgh's cold rolled strip advanced $12 per ton, and its electrogalvanized sheet increased $14 per ton. U.S. Steel's price hikes included $8 per ton of hot-rolled sheet and hot-rolled band, $9 per ton of hot-rolled strip and cold-rolled strip, $10 per ton of Vitronamel sheet, $11 per ton for galvanized sheet including corrugated sheet, and $12 per ton for terne sheet. On August 1, U.S. Steel boosted prices on large-diameter welded pipe.

In early spring, seven Pennsylvania producers of high-alloy and regular grades of tool and die steels announced a 6% price increase on both base prices and extra charges.

Alan Wood Steel Co., Conshohocken, completed the replacement of goosenecks, was converting drives on gas exhausters, was modifying larry cars for staged-coal charging, and installed steam lines to service the ascension pipes on its coke ovens. One of the company's two blast furnaces was damaged in early September when, reportedly, molten metal contacted cooling water. The Eichleay Corp., Pittsburgh, received a contract to rebuild and reline a blast furnace at an estimated cost of $3 million. The contract also included the installation of a McKee-type revolving distributor in the furnace and a variable-throat wet scrubbing system for cleaning blast furnace gas. The furnace's hearth diameter was to be increased 1 foot to 19 feet. The project was to start early in 1974 and be completed in 2 months. An oil preheater system was completed in the basic oxygen furnace (BOF) shop, and work was in progress on a coke plant waste-ammonia-disposal system.

Allegheny Ludlum Industries, Brackenridge, started operation of a waste water treatment facility at its Bagdad plant in Leechburg, Armstrong County. In January, Allegheny-Ludlum was ordered to submit an acceptable plan for controlling emissions resulting from the processing of steel slag wastes and from dust resulting from the hauling and dumping of slag produced at the Brackenridge Works. The firm also investigated the use of oxygen-lance cutting torches to eliminate dust and fumes. In September, the firm started operation of a new heat-treating line for the annealing of silicon electrical steel and for covering the steel with a glasslike coating.

The Tubular Products Div., Babcock & Wilcox Co., produced forging-quality alloy steel bars in new grades and sizes, in electric arc furnaces. The bars were available in 46 thicknesses ranging from 2.25 to 8.50 inches and in 26 sizes of round-cornered squares ranging from 4 to 14 inches. In early May, B & W announced plans for a $44.8 million expansion program which included a new seamless tube mill at Ambridge. The expansion will increase the capacity of the Tubular Products Division from 500,000 tons to 700,000 tons per year. By mid-August, a new argon-oxygen-desulfurization system (AOD) for stainless and high-alloy grades of steel was scheduled to start operation in the Wallace Run No. 1 electric furnace shop. In September, B & W completed a $7.2 million expansion program to increase the production of cold-drawn steel tubing at its Beaver Falls plant.

In June, Bethlehem announced plans to phase out open-hearth furnaces at Johnstown by mid-1977, and to replace

[16] American Metal Market. V. 80, No. 51, Mar. 14, 1974, p. 4; v. 80, No. 188, Sept. 26, 1973, p. 4; v. 80, No. 192, Oct. 3, 1973, pp. 4–5; v. 80, No. 207, Oct. 25, 1973, p. 4.

[17] Pennsylvania Business Survey. State Economy Sets New Records. V. 12, December 1973, pp. 1–2.

them with an electric furnace shop costing $35 million. The prospect of spending an estimated $100 million for pollution-control equipment played a major part in the decision. The company's present steelmaking capacity of 2.3 million tons per year would be cut to 1.0 million tons in 1977. The plan would phase out all eight 180-ton-capacity open hearths, three of four blast furnaces, three batteries of coke ovens, and numerous semifinishing and finishing operations. On completion of the $87 million program, employment would drop to 7,100 from 11,800, the annual payroll would be $90 million, down from the current $130 million, and purchases in the Johnstown area would be about $4 million, $1 million less than in 1973. The Johnstown plant was very dependent on the Penn-Central Railroad for the transportation of raw materials. In early December, Bethlehem suggested that it was willing to postpone the scheduled closedown of 1.3 million tons of steelmaking capacity at Johnstown if Federal and State environmental agencies would relax their standards at the Johnstown plant.

The corporation at its Bethlehem plant was replacing No. 1 and No. 2 coke-oven batteries and was installing a 100-MMcfd unit supplied by Black, Sivall and Bryson (BS&B), Houston, Tex., to desulfurize coke-oven gas and recover elemental sulfur. The unit, due for completion in 1975, will use a new patented Bethlehem process. Some improvements were made on one blast furnace, and rebuilding of several blast furnace stoves was finished. A 48-inch rolling mill was reconditioned. In February, the BOF shop produced a 260-ton carbon-vanadium steel ingot, the largest ever made, that was converted by Bethlehem's press forge department into a hydroturbine shaft for the Allis-Chalmers Corp. as a part of the power-generating equipment in the Bonneville Power Pool. Early in 1973, Bethlehem announced plans to phase out its steel foundry, in Palmer Township near Allentown, because of the low volume of orders and the high cost of modernization.

Construction of $365,000 pollution-control facilities for a ferromanganese pig casting operation was undertaken at Bethlehem's Johnstown plant. The Johnstown "L" blast furnace produced 4.6 million tons of iron during the life of a single-grade NMA carbon-brick lining installed in the bosh in May 1967. During the tear-out in March it was found that the minimum thickness of the carbon brick in the bosh was 3 inches.

Bethlehem's Steelton plant operated three 150-ton, 22-foot-diameter, 60,000-kva furnaces in its steel-producing shop. The record production in the shop was approximately 110,000 tons in January. The shop produced specialty products, mainly for railroad accessories, from a product mix which was 60% rebar and 40% railroad rail.

The Blaw-Knox Foundry & Mill Machinery, Inc., closed its Union Steel Works at Lawrenceville because of an unfavorable economic outlook. More than 700 persons were employed when the plant was at peak production. The firm also decided not to reopen its Lewis Machine Co., at Groveton.

Carpenter Technology Corp., Reading, was installing electroslag refining (ESR) facilities, electrical coils for No. 4 mill motors and generators, and a Sendzimir cold-rolling mill. A controlled-atmosphere continuous-roller hearth furnace started operation. Work was in progress on air pollution control systems.

The Bakerstown Container Corp. started construction in May at Bakerstown of a $425,000 addition to its plant for recycling and reprocessing 30- and 55-gallon steel drums and containers. The potential capacity of the plant will be increased from about 3,000 to as many as 8,000 drums per week. The payroll will be doubled to 44 persons. The project's cost was financed by arrangements made by the Allegheny County Industrial Development Authority.

The Crucible Stainless Steel Div., Colt Industries, put into commercial operation in March at Midland, a continuous caster built by DeMag AG of Duisberg, West Germany, to handle molten stainless steel previously purified in four AOD, 100-ton-capacity furnaces. The caster eliminated pouring molten steel into ingot molds, stripping ingots from the molds, reheating ingots and rolling them into slabs. Equipment for producing edge-finished stainless strip was transferred to the Midland plant from the firm's phased-out Spaulding plant at Harrison, N.J. Pollution-control systems costing $3.5 million were installed during the year.

Edgewater Corp., Oakmont, completed a dust collection system for a melt shop

and planned the installation of two boring mills for railroad-car wheel production at a cost of $650,000. The firm improved forging facilities at its Latrobe plant and operated a nearby natural gas producing field that supplied about 30% of the plant's requirements.

Jessop Steel Co., Washington, installed a bulk lime storage facility and awarded a turnkey contract to Holley, Kenney, Schott Inc., to engineer and construct a 270,000-cubic-foot-per-minute system for collecting fume and dust from an electric-arc furnace. In November Jessop reported that 100 heats of stainless steel had been processed in an AOD vessel during the life of a single refractory lining.

In March, DER set a March 31, 1974, deadline for abatement of air polution from two coal-fired boilers at Jones & Laughlin Steel Corp.'s (J & L) Aliquippa Works. The DER directive also required J & L to control particulate emissions from a sinter plant by November 30, 1974, and to control air pollution from its coke ovens by May 22, 1975. In late July, J & L agreed to pay a $500 fine for an excessive particulate discharge from an open hearth furnace stack at its Hazelwood plant. In October, the Allegheny County Air Pollution Variance Board refused J & L permission to continue emitting excessive particulate matter from its Hazelwood boiler house. In late May, an estimated 13,000 gallons of sulfuric acid leaked from a tank at the Aliquippa Works into the Ohio River. Lime and caustic soda were dumped into the river to neutralize the acid.

On January 16, J & L announced plans to close the ingot mold foundry at its Pittsburgh Works because a crane in the foundry was limited to handling 10 tons of hot metal, a quantity too small to produce larger molds needed in the firm's revitalization program. In January only one of five blast furnaces in the Pittsburgh Works was active because J & L's policy was to make most of its steel at the Pittsburgh Works by the extensive use of scrap. In 1973, J & L solved some of its coke shortage by the use of Pennsylvania anthracite, which cost less than coke purchased at $50 per ton on the open market.

J & L awarded the Koppers Co. a $53.0 million prime contract for a 56-oven coke battery, to be equipped with the latest equipment, including pipeline charging of coal. When completed in 1975, the new battery will replace two old batteries of ovens, one of which was being dismantled in midyear. In late November 1 million tons per year of L–D capacity was idle at the Aliquippa Works. About 20,000 tons of molten steel production was lost because of a break in an oxygen line.

The Lukens Steel Co. Coatesville, operated an electroslag refining (ESR) facility designed to produce plates up to 12 inches thick, pattern weights up to 36,000 pounds in many widths and lengths, and slabs weighing up to 50,000 pounds and measuring 30 inches thick and 60 inches wide. Lukens produced nuclear quality A533 Grade B steel up to 8 inches thick for use by the Chicago Bridge & Iron Co. in fabricating five rings weighing 1,600 tons total for Philadelphia Electric Co.'s Limerick No. 2 nuclear reactor near Pottstown. Lukens held a minority interest in a plant to be built by Fluidized Iron Ore Reduction (FIOR) in Venezuela for producing prereduced iron ore briquets for use in Luken's electric furnaces as a means of obviating high scrap prices.

In April, Mesta Machine Co., West Homestead, requested a variance until December 31, 1974, from the Allegheny County Air Pollution Control Board for its four-open-hearth shop. Mesta planned to install either a baghouse or an electrostatic precipitator to clean furnace exhaust gases.

Mini-Met Industries Inc., Cleveland, Ohio, planned to start construction of a $28 million ministeel mill at Erie. The mill is designed to produce 205,000 tons of cold-heading wire rod and 40,000 tons of forging-quality billets annually. The schedule planned to have a melt and billet shop completed 1 year after groundbreaking and a rolling mill completed 6 months later. It was expected that the mill would provide 850 jobs in Erie County and more than triple Erie's port traffic.

The National Forge Co., Erie, completed a fume and dust-control system to serve two 75-ton and one 35-ton electric steel furnaces.

In December, National Castings Div., Midland-Ross Corp. announced plans to spend more than $1 million at Sharon for a thermal sand reclamation system to recover about 300 tons per day.

In May, Obenchain Corp., Washington, demonstrated a pilot plant operation for the one step conversion of iron oxide to steel. The process used pellets containing carbon and iron ore or mill scale. Reportedly, carbon in the form of anthracite, petroleum coke, or coke breeze could be used efficiently. About 12,000 tons of the pellets were charged in a blast furnace of McLouth Steel Corp., but the results were not publicized.

Pennsylvania Malleable Iron Div., Gulf and Western Co., spent $4 million on a modernization program at its Landisville plant. Equipment installed included two 10-ton coreless induction furnaces, 250- and 500-pound pouring ladles and monorail systems, 18 jolt-squeeze molding machines, double-deck oscillating pan feeders to separate castings from sand, an automated sand-handling system, and sand storage silos.

Pittsburgh Annealing Box Co. designed and built a corrugated muffle for the bright annealing of strip up to 2,200° F. Reportedly, the 60-foot-long muffle was the largest of its type ever fabricated.

In July, SCM Corp.'s Glidden-Durkee operation in Johnstown started to double its capacity to produce stainless steel and specialty metal powders. The $1.7 million expansion involved the installation of two 4,000-pound electric melting furnaces, water atomization units, screens, heat-treating furnaces, and blending and packaging equipment.

The Tube City Iron & Metal Co., Glassport, and Ag-Met Inc., of Hazleton, on July 11 announced plans to start up in the fall of 1973 at a undisclosed site in Allegheny County a plant capable of fragmentizing 11,000 automobiles monthly to produce 7,500 tons of quality steel scrap.

In January, Sharon Steel Corp., a subsidiary of NVF Co., contracted with Pennsylvania Engineering Corp. (Pecov) for the major portion of the work and equipment required to complete a 150-ton BOF converter shop at Farrel. Sharon planned to use the new furnace for its primary BOF steel production while maintaining existing rotating Kaldo furnaces on a standby basis. Reportedly, the high costs of refractories for the Kaldo furnaces placed Sharon at a competitive disadvantage.

In early September, Sharon announced a major investment in new blast and electric furnaces that will increase its ironmaking capability to 3,100 tons from 2,600 tons per day within 2 years. Sharon's Carpentertown Coal and Coal Div., at Templeton, modernized coke cars and revamped its coal preparation plant.

Shenango announced plans to install, air pollution control equipment costing $3.5 million at its Neville Island plant. The project included coke oven gas desulfurization units and equipment for the recovery of elemental sulfur.

Universal-Cyclops Specialty Steel Div., Cyclops Corp., installed a new 2-high, 4-high blooming mill with two 3,500-hp drives and additional air pollution controls on a 40-ton electric-arc furnace at Bridgeville. New nitric acid pickling equipment was completed at the firm's Pittsburgh plant, and work was completed at Titusville on an additional 30-ton crucible for a vacuum induction-melting furnace, a hot and/or cold shape-rolling mill, and pollution controls for bar pickling equipment.

On September 26, U.S. Steel submitted a plan to the Allegheny County Air Pollution Control Board to install new stage-charging systems on all batteries of ovens at the Clairton Coke Works. Allegheny County officials and DER rejected the plan within a week. EPA reentered the controversy in October after previously stating that Federal authorities were powerless to do anything about the air pollution situation at the Clairton Works. In early November, EPA cited U.S. Steel for 63 violations at the Clairton Works of federally approved air pollution control regulations. The company was given 30 days to clear up the violations. On August 27 the Allegheny County Board denied a variance to continue until July 1975 the release of pollutants from U.S. Steel's sintering plants at the Homestead Works and at the Edgar Thomson Works. The Board granted U.S. Steel a variance until December 1, 1973, to continue operation of its sulfuric acid plant at Neville Island. In early July, U.S. Steel let a contract to M. W. Kellogg, Houston, Tex. to engineer a three-unit desulfurization plant at the Clairton Works, comprising a vacuum carbonate unit, a tail gas desulfurization system, and a unit to remove hydrogen cyanide. A fire in a gas-compressor room at the Clairton Works on September 24 forced U.S. Steel to bleed raw gas from

19 coke batteries as a precautionary measure. The Allegheny County Board did not cite the firm because a brisk wind cleared the smoke from the nearby Monongahela River valley. The Allegheny County Board in early December asked U.S. Steel to submit a plan by January 15, 1974 to control fugitive emissions from BOF shops at the Duquesne section of the Edgar Thomson Works.

On February 6, Commonwealth Court upheld a $2,000 fine against U.S. Steel for discharging untreated wastes into the Monongahela River from the Homestead Works. A broken underground coupling was blamed for a 57,000-gallon fuel-oil spill from U.S. Steel's Duquesne Works on June 1 into the Monongahela River. Clean Water, Inc., a New Jersey firm, operated booms and skimmers to clear the oil from the river, reportedly at a cost between $50,000 and $100,000. On June 19, U.S. Steel arranged financing of several pollution control systems for the Clairton Works at a cost of $32,150,000. The largest project to clean all process water used at the works was financed by a $22.5 million tax-exempt bond issue, issued by the Allegheny County Industrial Development Authority. U.S. Steel arranged to increase an earlier Regional Industrial Development Corp. bond issue to $9,659,000, making possible larger desulfurizing units to remove hydrogen sulfide from coke oven gas by a cryogenic process operated at under minus 200° F. In July, the ore sintering plant at Saxonburg dumped its millionth carload of ore. From June 1958 to July 1973 the plant produced 59 million tons of high-grade sintered ore that was shipped to U.S. Steel's blast furnaces in the Pittsburgh district.

On November 30, FPC ordered Texas Eastern Transmission Co. to restore a full supply of natural gas to U.S. Steel's ammonia plant at Clairton. Earlier Texas Eastern had cut supplies by 46% to the plant, which produced ammonium nitrate for use by strip mine operators and farmers.

No. 22 coke oven battery at U.S. Steel's Clairton Works resumed operation in October following a rebuilding program to reduce the emissions of air pollutants. Stage charging was installed on all of Clairton's coke batteries. Other U.S. Steel facilities completed in 1973 included a casting facility at the Fairless Works in Morrisville, and equipment to produce heavy wall oil-country casing at the Duquesne Works. Also at the Duquesne Works a rodmill was modernized and improvements to the universal plate mill were completed. A medium-size blast furnace was rebuilt at U.S. Steel's National Works in McKeesport.

A 10-count lawsuit by the DER in early 1973 asked that U.S. Steel be fined $2 million for discharging phenol and cyanide into waterways and emitting hundred of tons of air contaminants at its Fairless Works. The company claimed that it had already spent $36 million on controls at Fairless and that complete compliance would cost an additional $50 million to $100 million.

Washington Steel Corp., Washington, planned to invest $18 million for a new mill to roll alloy grades and stainless slabs into coiled sheet for its Sendzimir cold-rolling mills. Tippins Machinery Co., Pittsburgh, was selected to build the mill using roll stands from other mills; Ajax-Magnethermic was to furnish the electric-induction slab heating furnaces; and the Mellon-Stuart Co. contracted to construct the mill building. Completion of the entire project was scheduled for early 1975. The new mill was rated at 250,000 tons annually.

Lead.—Tonolli Co. of Canada, Ltd., constructed a 67,000-square foot plant near Nesquehoning, Carbon County, for lead recycling operations that will provide jobs for 50 to 60 persons. Melting equipment comprised rotary and reverberatory furnaces and kettles.

Molybdenum.—The Blaw Knox Chemical Plants Div., Dravo Corp., in September started the preliminary design of a commercial horizontal lime scrubber for removal of sulfur dioxide at the Langeloth, Pa., molybdenum smelter of the Climax Div., AMAX Corp. The rotating scrubber was developed by the National Lime Association and named after its inventor, C. J. Lewis. Reportedly, the scrubber will cost $3 million to $4 million.

A 3-day strike by 143 workers represented by the United Steelworkers of America (USW) ended August 22 at the Molybdenum Corp. of America's Washington plant following ratification of a 3-year contract. The facility produced ferroalloy products of molybdenum, columbium, tungsten, and rare earths.

Nickel.—The Whittaker Metals Alloy

Div., Whittaker Corp., at Greenville, operated the largest secondary nickel electric furnace in the country to produce pig nickel for the stainless steel industry. The plant's capacity was 1,500 tons per month. Standard pigs contained 35% nickel and 15% chromium; the remainder comprised iron and minor amounts of molybdenum, cobalt, and copper. Carpenter Technology Corp., Reading, installed a Sendzimir cold strip mill to produce nickel alloy strip.

Platinum.—Matthey Bishop Inc., Malvern, continued construction of a plant and equipment to produce catalytic devices to meet the clean air standards imposed for the 1975 automobiles model year.

Rare Earths.—Matthey Bishop, Inc., Malvern, was granted a nonexclusive license by CTS Corporation, Elkhart, Ind., for the manufacture and resale of resistor materials containing ruthenium oxide.

Zinc.—The New Jersey Zinc Co. mined zinc ore near Freidensville averaging 6.7% zinc content. Metallic minerals in the ore were sphalerite and pyrite in a quartz and dolomite gangue. The output of the mine was 2.8% greater than in 1972 and its value was 19.6% greater.

The zinc smelter and electrolytic refinery capacity of New Jersey Zinc Co., Palmerton, was 120,000 short tons per year. The St. Joe Minerals Corp. plant at Monaca had annual zinc capacity of 260,000 short tons.[18]

Two zinc producers in Pennsylvania produced 438,112 short tons of sulfuric acid (100% basis) and consumed 531,430 short tons (100% basis).

The Beaver County Industrial Development Authority offered $22.5 million in revenue bonds to finance air and water pollution abatement facilities at the zinc smelter of St. Joe Minerals Corp., near Monaca. The firm announced plans to expand its zinc smelting facilities at Monaca by 40,000 tons per year of slab zinc equivalent, an increase of 15% over existing capacity.

Zirconium.—The Westinghouse Electric Corp., Blairsville, installed four cold mills to produce Zircaloy tubing in sizes ranging from 0.25 inch to 1.50 inches.

[18] McMahon, A. D., C. H. Cotterill, J. T. Dunham, and W. L. Rice. The U. S. Zinc Industry: A Historical Perspective. BuMines IC 8629, 1974, 76 pp.

Table 29.—Principal producers

Commodity and company	Address	Type of activity	County
Abrasives:			
Nonmetallic: Satellite Alloy Corp.	9800 McKnight Road Pittsburgh, Pa. 15237	Plant	Allegheny.
Metallic:			
Abrasive Metals Co	26th & B. & O. RR Pittsburgh, Pa. 15222	do	Do.
Durasteel Abrasive Co	2601 Smallman Street Pittsburgh, Pa. 15222	do	Westmoreland.
Pangborn Div., the Carborundum Co.	Box 380 Hagerstown, Md. 21740	do	Butler.
Cement:			
Allentown Cement, Div., National Gypsum Co.[1]	7th St. at Thruway Allentown, Pa. 18101	do	Berks.
Allentown Cement, Div., National Gypsum Co.	do	do	Montgomery.
Bessemer Cement Co., subsidiary of Louisville Cement Co.	510 Hanna Bldg. Cleveland, Ohio 44115	do	Lawrence.
Coplay Cement Mfg. Co.[1]	North 2nd Street Coplay, Pa. 18037	do	Lehigh.
Do	Easton Road Coplay, Pa. 18037	do	Northampton.
G & W. H. Corson, Inc	Plymouth Meeting, Pa. 19462	do	Montgomery.
Martin Marietta Cement[1]	Box 5618 Baltimore, Md. 21210	do	Northampton.
Green Bag Cement Co., Div., of Marquette Cement Manufacturing Co.	20 North Wacker Drive Chicago, Ill. 60606	do	Allegheny.
Hercules Cement Co., Div. of Amcord Inc.	1770 Bathgate Road Bethlehem, Pa. 18018	do	Northampton.
Keystone Portland Cement Co.[1]	2200 Hamilton Street Allentown, Pa. 18105	do	Do.
Lone Star Industries Inc.[1]	Box 6237 West End Dr. Richmond, Va. 23230	do	Do.

See footnotes at end of table.

Table 29.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Cement—Continued			
Medusa Portland Cement Co.[2]	Box 5668 Cleveland, Ohio 44101	Plant	Lawrence.
Medusa Portland Cement Co.[3 4]	---- do	---- do	York.
National Portland Cement Co.[1]	1023 West St. George Ave. Linden, New Jersey 07036	---- do	Northampton.
Penn-Dixie Cement Corp.[5]	Box 152 Nazareth, Pa. 18064	---- do	Butler.
Penn-Dixie Cement Corp.[1]	---- do	---- do	Northampton.
Universal Atlas Cement Div., U.S. Steel Corp.	600 Grant St. U.S. Steel Bldg. Pittsburgh, Pa. 15230	---- do	Allegheny.
Universal Atlas Cement Div., U.S. Steel Corp.[1]	---- do	---- do	Northampton.
Whitehall Cement Manufacturing Co.[1]	123 South Broad St. Philadelphia, Pa. 19109	---- do	Lehigh.
Clay and shale:			
Fire:			
Drexel Refractories Div., Drexel Dynamics Corp.	Box 50 Kittanning, Pa. 16201	Underground	Armstrong.
Freeport Brick Co., Kittanning Brick Div.	R.D. 1 Adrian, Pa. 16120	---- do	Do.
Harbison Walker Refractories.	2 Gateway Center Pittsburgh, Pa. 15222	Pits	Cambria, Centre, Clearfield, Fayette, Somerset.
Clearfield Clay Prod., Co	Box 1110 Clearfield, Pa. 16830	3 mines	Clearfield.
Reese Brothers	Houtzdale, Pa. 16651	2 mines	Do.
Ralph A. Veon, Inc	Darlington, Pa. 16115	Pit	Lawrence.
Common clay and shale:			
Bylite Corp	Box 1628 North End Station Wilkes-Barre, Pa. 18705	Pit	Luzerne.
Darlington Brick and Clay Products Co.[7]	Darlington, Pa. 16115	Mines	Beaver.
Glen-Gery Corp	227 North 5th St. Reading, Pa. 19601	Pit	Berks, Northumberland, Union, York.
Hanley Co	28 Kennedy St. Bradford, Pa. 16701	Pit	McKean, Jefferson.
Marion Brick Corp	341 Mt. Vernon Ave. Marion, Ohio 43302	Mine	Clearfield.
McAvoy Vitrified Brick Co	Phoenixville, Pa. 19460	Pit	Chester.
McQuiston Coal Co.[6]	109 East Moody Ave. New Castle, Pa. 16101	Pit	Lawrence.
Milliken Brick Co., Inc	2100 Montier St. Pittsburgh, Pa. 15221	Pit	Allegheny.
Coal:			
Anthracite:			
Blue Coal Corp.[4]	101 South Main St. Ashley, Pa. 18706	Underground	Luzerne.
Blue Coal Corp.[7]	---- do	Culm bank	Do.
Blue Coal Corp.[8]	---- do	Strip	Do.
Gilberton Coal Co	Gilberton, Pa. 17934	Culm bank	Northumberland.
Glen-Nan Coal Co., Inc	St. Mary's and River Rd. Wilkes-Barre, Pa. 18702	Underground	Luzerne.
Greenwood Stripping Corp	1 Venice Street Nesquehoning, Pa. 18240	Strip	Carbon, Schuylkill.
Jeddo-Highland Coal Co.[8]	800 Exeter Ave. West Pittston, Pa. 18643	---- do	Luzerne.
Jeddo-Highland Coal Co.[4]	---- do	Culm bank	Do.
Kerris & Helfrick, Inc	Lehigh and Popular St. Mount Carmel, Pa. 18751	Strip	Columbia, Northumberland, Schuylkill.
Leon E. Kocher Coal Co	Box 127 Valley View, Pa. 17983	Underground	Schuylkill.
Lehigh Valley Anthracite, Inc.	800 Exeter Ave. West Pittston, Pa. 18643	Culm bank	Carbon, Schuylkill, Luzerne.
Do	---- do	Strip	Columbia, Luzerne, Schuylkill.
Reading Anthracite Co	200 Mahantongo St. Pottsville, Pa. 17901	Culm bank	Northumberland, Schuylkill.
Do	---- do	Strip	Do.

See footnotes at end of table.

Table 29.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Coal—Continued			
Bituminous:			
Barnes & Tucker Co	357 Lancaster Ave. Haverford, Pa. 19041	Underground	Cambria.
Bethlehem Mines Corp	701 East 3rd St. Bethlehem, Pa. 18016	do	Cambria, Washington.
Buckeye Coal Co	Box 900 Youngstown, Ohio 44501	do	Greene.
C & K Coal Co	Box 69 Clarion, Pa. 16214	Strip mine	Clarion.
The Florence Mining Co.[8]	P.O. Box 35 Seward, Pa. 15954	Underground	Indiana.
Gateway Coal Co., for J & K Steel Corp.	Box 608 California, Pa. 15419	do	Do.
Helvetia Coal Co	655 Church St. Indiana, Pa. 15701	do	Do.
Jones & Laughlin Steel Corp.	Box 608 California, Pa. 15419	do	Greene.
Mathies Coal Co	Box 500 Library, Pa. 15129	do	Washington.
Pittsburgh Coal Co.[4]	do	do	Do.
Republic Steel Corp.[4]	P.O. Box 6778 Cleveland, Ohio 44101	do	Allegheny.
Do	do	do	Westmoreland, Washington.
Rochester and Pittsburgh Coal Co.	655 Church St. Indiana, Pa. 15701	do	Armstrong.
United States Steel Corp	525 Wm. Penn Pl. Pittsburgh, Pa. 15219	do	Washington.
Graphite (synthetic):			
Airco Speer Carbon Products, Div., of Air Reduction Co., Inc.	Theresia St. St. Marys, Pa. 15857	Plant	Elk.
Chas., Pfizer & Co., Inc., MPM Division.	235 East 42d St. New York, N.Y. 10017	do	Northampton.
Stackpole Carbon Co	St. Marys, Pa. 15857	do	Elk.
Gypsum (calcined):			
United States Gypsum Co.[9]	101 South Wacker Dr. Chicago, Ill. 60606	do	Philadelphia.
Iron Ore:			
Bethlehem Mines Corp.[1]	701 East 3d St. Bethlehem, Pa. 18016	Underground	Berks.
Bethlehem Mines Corp.[11]	do	do	Lebanon.
Iron oxide pigments:			
Crude:			
Allegheny Ludlum Steel Corp.	2000 Oliver Bldg. Pittsburgh, Pa. 15222	Plant	Allegheny.
Lanzendorfer Minerals Co	Twin Rocks, Pa. 15960	Pit	Cambria.
Finished:			
Minerals, Pigments & Metals Div., Chas. Pfizer & Co., Inc.	640 North 13th St. Easton, Pa. 18042	Plant	Northampton.
The Prince Manufacturing Co.	Bowmanstown, Pa. 18030	do	Carbon.
Reichard-Coulston, Inc	15 East 26th St. New York, N.Y. 10010	do	Northampton.
Lime:			
The J. E. Baker Co.[1]	Box 1189 York, Pa. 17405	do	York.
Mercer Lime & Stone Co	1640 Oliver Bldg. Pittsburgh, Pa. 15222	do	Butler.
National Gypsum Co.[1]	325 Delaware Ave. Buffalo, N.Y. 14202	do	Centre.
Warner Co.[1]	1721 Arch Street Philadelphia, Pa. 19103	do	Centre, Chester.
Peat:			
Benton Peat	Benton, Pa. 17814	Bog	Columbia.
Blue Ridge Industries, Inc	Box 128, R.D. 2 White Haven, Pa. 18661	Bog	Luzerne.
D. M. Boyd Co	226 Francis Street New Wilmington, Pa. 16142	Bog	Lawrence.
Corry Peat Products Co	515 West Columbus Ave. Corry, Pa. 16407	Bog	Erie.
International Peat, Inc	R.D. 1 White Haven, Pa. 18661	Bog	Luzerne.

See footnotes at end of table.

Table 29.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Peat—Continued			
Lake Benton Peat Moss	1418 North Main Street Scranton, Pa. 18508	Bog	Lackawanna.
Pennsylvania Peat Moss, Inc	21st and Laurel Streets Hazleton, Pa. 18201	Bog	Luzerne, Monroe.
Stillers Blue Ridge Peat Co	R.D. 1 White Haven, Pa. 18661	Bog	Luzerne.
Perlite (expanded):			
Armstrong Cork Co	Lancaster, Pa. 17603	Plant	Lancaster.
Pennsylvania Perlite Corp	Box 2002 Lehigh Valley, Pa. 18001	do	Lehigh, York.
Petroleum refineries:			
Atlantic Richfield Co	206 South Broad St. Philadelphia, Pa. 19102	do	Philadelphia.
BP Oil Corp	600 Fifth Ave. New York, N.Y. 10001	do	Delaware.
Gulf Oil Corp	Box 7408 Philadelphia, Pa. 19101	do	Erie.
Kendall Refining Co., Div., of Witco Chemical Co.	Bradford, Pa. 16701	do	McKean.
Pennzoil United, Inc	Oil City, Pa. 16301	do	Venango.
Quaker State Oil Refining Corp	Farmers Valley, Pa. 16749	2 Plants	McKean, Venango.
Sun Oil Co	1608 Walnut Street Philadelphia, Pa. 19101	Plant	Do.
United Refining Co	Warren, Pa. 16365	do	Warren.
Valvoline Oil Co., Div., of Ashland Oil and Refining Co.	Freedom, Pa. 15042	do	Beaver.
Wolf's Head Oil Refining Co., Inc.	Reno, Pa. 16343	do	Venango.
Sand and gravel:			
Alpha Portland Cement Co	Martins Creek, Pa. 18063	Pit and mill	Northampton.
Davison Sand & Gravel Co	34th Ave. and 4th St. New Kensington, Pa. 15068	Dredge	Westmoreland.
Deavo Corp Keystone	One Oliver Plaza Pittsburgh, Pa. 15222	do	Beaver.
Erie Sand Steamship Co	Erie, Pa. 16500	do	Erie.
Haudaille Constro. Materials Inc.	10 Park Place Morristown, N.J. 07960	Pit	Northampton.
Lycoming Silica Sand Co	401 Broad St. Box 159 Montoursville, Pa. 17754	Pit	Lycoming.
Mahoning Valley Sand Co	Box 1236 New Castle, Pa. 16102	Pit and plant	Lawrence.
Pennsylvania Glass Sand Corp	Berkeley Springs, W. Va. 25411	Pit	Huntingdon, Mifflin, Venango.
Warner Co	1721 Arch St. Philadelphia, Pa. 19103	Pit	Bucks.
Wyoming Sand and Stone Co	Galls, Pa. 18615	Pit	Wyoming.
Smelters:			
The New Jersey Zinc Co	Palmerton, Pa. 18071	Plant	Carbon.
St. Joe Minerals Corp	Josephtown, Pa. 15061	do	Beaver.
Stone:			
Limestone and dolomite—crushed:			
Appalachian Stone Div., Martin-Marietta Corp.	Box 120 Mercersburg, Pa. 17236	Quarry	Centre, Chester, Fayette, Franklin.
Bethlehem Mines Corp	701 East 3rd St. Bethlehem, Pa. 18016	do	Adams.
Do	do	do	Mifflin, Montgomery, Northampton.
Bradford Hills Quarries, Inc.	Box 231 Easton, Pa. 18042	do	Chester, Lancaster, Perry.
G. & W. H. Corson, Inc.[12]	Plymouth Meeting, Pa. 19462	do	Montgomery.
Eureka Stone Quarry, Inc	Lower State and Pickertown Rds. Eureka, Pa. 18914	Quarry	Bucks.
Eastern Industries, Inc	Box 188 Wescosville, Pa. 18090	do	Berks, Lehigh.
Lycoming Silica Sand Co	Box 159 Montoursville, Pa. 17754	do	Columbia, Lycoming, Montour.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Berks, Centre, York.
New Enterprise Stone & Lime.	New Enterprise, Pa. 16664	do	Bedford, Blair, Franklin, Huntingdon.

See footnotes at end of table.

Table 29.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Sandstone and quarzite—crushed:			
Coolbaugh Sand & Stone, Inc.	32 Railroad Ave. Scranton, Pa. 18505	Quarry	Luzerne.
Latrobe Construction Co [1]	Box 150 Latrobe, Pa. 15650	Underground	Westmoreland.
Summit Quarries, Div., of J. Robert Bazley, Inc.	Box 298 Pottsville, Pa. 17901	Quarry	Schuylkill.
Sandstone and quartzite—dimension:			
Delaware Quarries	Lumberville, Pa. 18933	do	Bucks.
Media Quarry Co	131 East 2d St. Media, Pa. 19063	do	Delaware.
Slate—dimension:			
Anthony Dally & Sons, Inc	Robinson Ave. Pen Argyl, Pa. 18072	do	Northampton.
Emerald Slate Corp	Alpha Road Wind Gap, Pa. 18091	do	Do.
Penn Big Bed Slate Co., Inc.	446 Main St. Slatington, Pa. 18080	do	Lehigh.
Stephens-Jackson Co	Main St. and Schanck Ave. Pen Argyl, Pa. 18072	do	Northampton.
D. Stoddard & Sons, Inc	Bangor, Pa. 18013	do	Do.
Traprock (basalt)—crushed and broken:			
The General Crushed Stone Co.	712 Drake Bldg. Easton, Pa. 18042	do	Bucks, Delaware.
Warner Co	1721 Arch St. Philadelphia, Pa. 19103	do	Berks.
Granite—crushed:			
Mignatti Construction Co., Inc.	2310 Terwood Ave. Bethayres, Pa. 19006	do	Montgomery.
Sulfur:			
Atlantic Richfield Co	3144 Passyunk Ave. Philadelphia, Pa. 19145	Plant	Philadelphia.
Tripoli (rottenstone):			
Keystone Filler & Manufacturing Co.	Muncy, Pa. 17756	Pit	Lycoming.
Vermiculite (exfoliated):			
Hyzer & Lewellen	Box 155 Southhampton, Pa. 18966	Plant	Bucks.
W. R. Grace & Company, Construction Prod. Div.	62 Whittemore Ave. Cambridge, Mass.	do	Lawrence.

[1] Also limestone.
[2] Also limestone and shale.
[3] Also limestone and clay.
[4] 2 operations.
[5] Also limestone and sand and gravel.
[6] Also fire clay.
[7] 3 operations.
[8] 4 operations.
[9] Also expanded perlite.
[10] Also byproduct cobalt and pyrites.
[11] Also byproduct gold, silver, copper, cobalt, and pyrites.
[12] Also lime.

The Mineral Industry of Puerto Rico, the Panama Canal Zone, the Virgin Islands, Pacific Island Possessions, and Trust Territory of the Pacific Islands

By J. M. West [1] and Sarkis G. Ampian [2]

PUERTO RICO [3]

Puerto Rican mineral production, consisting entirely of nonmetallic minerals, rose 22% in value to $107.6 million in 1973. Half of the increase was accountable to cement. The greatest gain other than in cement was in stone production, which was 16% higher in quantity and 28% higher in value than in 1972. Despite expanded output of cement, up 6%, shortages in that material were widespread during the year owing to expanding construction activities coupled with good construction weather. Cement production would have been even greater had it not been for electric power interruptions in the first part of the year.

The Federal Bureau of Mines and the Puerto Rican Department of Natural Resources (DNR) cooperated in preparing revised petroleum regulations and new health and safety regulations covering jurisdiction over inspection activities and including a plan for eventual commonwealth inspection of the island's mineral operations. Safety inspections of quarries began in July by personnel of the Mine Safety and Enforcement Administration (MESA), U.S. Department of the Interior. An estimated 125 to 175 mineral-producing and mineral-processing operations were expected to be visited regularly.

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[1] Supervisory physical scientist, Division of Nonferrous Metals—Mineral Supply.
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[3] Prepared by J. M. West.

Table 1.—Mineral production in Puerto Rico [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Cement, portland ____ thousand short tons	1,946	$31,756	2,062	$41,203
Clays ____ do	361	382	464	473
Lime ____ do	42	1,776	42	2,215
Salt ____ do	29	580	29	580
Sand and gravel ____ do	7,478	21,237	p 7,480	p 21,243
Stone ____ do	13,504	32,793	15,647	41,856
Total	XX	88,524	XX	107,570
Total 1967 constant dollars	XX	73,041	XX	p 78,978

p Preliminary. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Puerto Rico, by district

District	1972	1973	Minerals produced in 1973 in order of value
Aguadilla	$2,769	W	Stone and sand and gravel.
Arecibo	4,207	$851	Stone.
Guayama	1,552	244	Sand and gravel.
Humacao	1,626	118	Do.
Mayaguez	3,922	3,347	Stone, sand and gravel, salt.
Ponce	24,104	23,054	Cement, lime, stone, sand and gravel, clays.
San Juan	20,043	29,330	Cement, stone, sand and gravel, clays.
Various	30,301	[1] 50,626	
Total	88,524	107,570	

W Withheld to avoid disclosing individual company confidential data included with "Various."
[1] Includes some stone and sand and gravel that cannot be assigned to specific districts, and values indicated by symbol W.

In July strikes interrupted municipal services (fire protection, sanitation, water, and electricity) in several major cities, including San Juan. Later in the year, the Puerto Rican Power Authority, which produces most of the island's power, sought new supplies of fuel oil because of reportedly dwindling reserves. The Power Authority's daily consumption of residual fuel oil was estimated at 50,000 barrels. Meanwhile, the principal supplier, Commonwealth Oil Refining Co., Inc. (CORCO), contested in court the authority of the island's Environmental Quality Board (EQB) to enforce the low-sulfur standards of 2% applied to the Power Authority's fuel oil. Expensive renegotiation of an existing supply contract was at stake. In November, the Federal Mandatory Allocation Program for Middle Distillates went into effect, and a new Commonwealth Office of Fuels was established to deal with fuel emergencies throughout the island. About 700 Puerto Rican firms reportedly were short of fuel and about to close in November as a result of the general fuel shortage. Unsuccessful attempts were made to negotiate purchases of crude and refined oil products from Venezuela.

Puerto Rico's Economic Development Administration (Fomento) signed contracts worth $3 million for engineering studies of a possible superport on Mona Island, 42 miles west of Puerto Rico. Construction of a port had been contested by ecology-protection interests. The site was expected to include refineries, powerplants, petrochemical facilities, and transshipment services The port would be built, owned, and operated by the Commonwealth and financed through bonds.

A new generating unit was added to the island's electrical system, increasing capacity by 410,000 kilowatts to a total of 2.6 million kilowatts. The unit was placed on-line in mid-August. About yearend, an additional 450,000 kilowatts was expected from a new unit at Aguirre, on the southern coast, and a similar amount was expected from another unit to be added in mid-1974.

The U.S. Geological Survey (USGS) prepared a map showing major structural trends and generalized geology of Puerto Rico, the Virgin Islands, and surrounding subsea areas.[4] Other maps were published

[4] Garrison, L. E., and others. Preliminary Tectonic Map of the Eastern Greater Antilles Region. Misc. Geol. Inv. Map No. I-732, U.S. Geol. Survey, 1973.

covering northeastern Puerto Rican stratigraphy,[5] general geology of the Rio Grande quadrangle,[6] and the geology of the Isle De Mona quandrangle.[7] Occurences of copper, molybdenum, gold, silver, nickel, iron, manganese, and other metals were plotted on a geologic map of Puerto Rico, Culebra, Vieques, and Mona Islands.[8] Studies of the Bayamon area showed that supplies of construction materials such as limestone and sand and gravel were abundant.[9]

REVIEW BY MINERAL COMMODITIES

Nonmetals.—*Cement.*—Production and shipments of cement rose in 1973 as a result of heavy demand by the island's construction industry. Puerto Rican Cement Co., Inc., the major producer (with plants in Ponce and San Juan, provided about 80% of the output; the balance was from the San Juan Cement Co. The latter company continued work on installing a third kiln and was expected to have it in operation early 1974. About 40% of all cement was shipped in bagged form. At the Ponce plant of the Puerto Rican Cement Co., Inc., a changeover was completed from white to all gray cement production, raising the gray cement capacity 2 million bags, or about 100,000 tons per year. Both cement-producing companies voiced concern about sources of investment for expansion, in view of the existing low profit margins on sales. The problem was particularly acute because of the requirement for costly pollution-control equipment.

Table 3.—Puerto Rico: Portland cement salient statistics
(Thousand short tons and thousand dollars)

	1972	1973
Number of active plants	3	3
Rated capacity, Dec. 31	2,256	NA
Production	1,959	2,060
Shipments from mills:		
Quantity	1,946	2,062
Value	31,756	41,203
Stocks at mills, Dec. 31	39	45

NA Not available.

Other Construction Materials.—A planning group in the DNR began a study of the sand and gravel resources of Puerto Rico. The purpose of the study was to obtain accurate reserve and production data by which to assess the availability of raw materials for construction.

[5] Briggs, R. P. The Lower Cretaceous Figuera Lava and Fajardo Formation in the Stratigraphy of Northeastern Puerto Rico. U.S. Geol. Survey Bull. 1372–G, 1973, pp. G1–G10.
[6] Pease, M. H., Jr., and R. P. Briggs. Geologic Map of the Rio Grande Quadrangle, Puerto Rico. Misc. Geol. Inv. Map No. I–733, U.S. Geol. Survey, 1973.
[7] Briggs, R. P., and V. M. Seiders. Geologic Map of the Isle DeMona Quadrangle, Puerto Rico. Misc. Geol. Inv. Map No. I–718, U.S. Geol. Survey, 1973.
[8] Cox, D. P. and R. P. Briggs, Metallogenic Map of Puerto Rico. Misc. Geol. Inv. Map No. I–721, U.S. Geol. Survey, 1973.
[9] Monroe, W. H. Geologic Map of the Bayamon Quadrangle, Puerto Rico. Misc. Geol. Inv. Map No. I–751, U.S. Geol. Survey, 1973.

Table 4.—Puerto Rico: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973 p	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	2,323	6,071	2,324	6,074
Fill	657	714	657	714
Paving	1,147	3,052	1,148	3,055
Total [1]	4,128	9,837	4,129	9,843
Gravel:				
Building	2,011	7,280	2,011	7,280
Fill	258	323	259	324
Paving	849	3,004	849	3,004
Total [1]	3,118	10,608	3,119	10,608
Government-and-contractor operations:				
Sand:				
Building	190	644	190	644
Paving	42	148	42	148
Total	232	792	232	792
Total sand and gravel [1]	7,478	21,237	7,480	21,243

p Preliminary.
[1] Data may not add to totals shown because of independent rounding.

Table 5.—Puerto Rico: Stone sold or used by producers
(Thousand short tons and thousand dollars)

Year	Dimension limestone		Crushed limestone	
	Quantity	Value	Quantity	Value
1969	101	292	5,238	9,380
1970	101	292	5,549	9,777
1971	142	441	9,662	15,856
1972	139	426	10,194	17,033
1973	162	859	11,631	22,153

Year	Miscellaneous stone[1]		Total[2]	
	Quantity	Value	Quantity	Value
1969	1,646	3,878	6,985	13,550
1970	1,646	3,878	7,296	13,947
1971	2,326	13,550	12,130	29,847
1972	3,171	15,333	13,504	32,793
1973	3,854	18,844	15,647	41,856

[1] Includes granite (1969–70), marble and traprock (1971–73), and other stone.
[2] Data may not add to totals shown because of independent rounding.

Metals.—*Copper.*—Controversy continued over development plans for copper deposits in west-central Puerto Rico. In December, the Commonwealth broke off negotiations with the two firms that had explored the deposits—Kennecott Copper Corp. and American Metal Climax, Inc.—and announced that it would conduct public bidding to decide who should exploit the deposits. The investment by the two companies in acquiring land and delineating the ore bodies had been estimated at about $10 million to date. Three principal ore bodies in the Adjuntas-Utuado and Lares areas were estimated to contain in excess of 200 million tons of ore averaging 0.73% copper.

Steel.—Puerto Rico consumed about 250,000 tons anually of commercial steel bars. Most of this was used for concrete-reinforcing. About one-fifth was supplied by the country's only steel producer, Industrial Siderurgica, Inc., which manufactured reinforcing bars entirely from scrap; the balance of the requirement was imported, mainly from Europe, Brazil, and Canada.

Mineral Fuels.—Exports of refined oil products to the United States and foreign destinations totaled 38 million barrels, including 19.1 million barrels of gasoline and 8.5 million barrels of distillate.

Imports of crude and unfinished oil for use as feedstock to refiners and petrochemical processors decreased 1% from those in 1972, averaging 331,600 barrels per day. Imports for refining were processed into 101.9 million barrels of products, including 28.5 million barrels of gasoline, 13.1 million barrels of distillates, 25.9 million barrels of residual fuel oil, and 34.4 million barrels of other products. Residual fuel oil and finished products totaling 25,000 barrels per day were also imported for direct consumption. A total of 9.1 million barrels of imported finished products included 0.1 million barrels of gasoline, 3.5 million barrels of jet fuel, and 5.5 million barrels of other products.

Gasoline price controls were established for island refiners in late July at 17.45 cents per gallon for 98-octane premium and 15.975 cents per gallon for regular gas. Taxes remained at 11 cents per gallon; retail prices per gallon were set at 42.7 cents for premium and 39.1 cents for regular. Refiners objected to the control levels because of the recent sharp increases in prices of imported feedstocks. Owing to world shortages of crude and refined products, Puerto Rican supplies became critically short in the last few months of the year. Near the end of the year, price increases of 13.3 cents per gallon were granted by the Consumers Affairs Department covering regular and premium gasolines. Prices of other products were also increased to pass on higher raw material costs.

In late summer, CORCO signed a 20-year contract with Indonesia and was scheduled to begin receiving condensates in late 1976 or early 1977. Hercor Chemical Corp., a joint venture of Hercules, Inc., and CORCO, completed a $25 million expansion of its Penuelas plant, increasing paraxylene capacity from 225 to 525 mil-

lion pounds per year. The compound was important in the manufacture of polyester fibers. Power shortages were reported to have cut petrochemical production sharply during the year at Guayanilla, on Puerto Rico's southern coast.[10]

PANAMA CANAL ZONE [11]

Mineral production ceased in the Panama Canal Zone in 1971. The Republic of Panama supplied the sand and gravel, basalt, and andesite used as aggregate in concrete, roadstone, railroad ballast, and riprap. Most of the construction work, with the exception of routine maintenance by the Panama Canal Co., was performed by local contractors.

VIRGIN ISLANDS [12]

The U.S. Virgin Islands, located in the Caribbean, consist of about 50 islands of volcanic origin. St. Croix, St. Thomas, and St. John are the main islands. Most of the population and commercial activity of the Virgin Islands is centered on these three large islands.

Mineral production consisted chiefly of basalt traprock, which is crushed for use in concrete and asphalt aggregate, or roadstone. Caribbean Material Supply Co., Springfield Crusher Division of Masonry Products, Inc., St. Croix Sand and Gravel Co., Devcon International Corp. (on St. Croix), and Controlled Concrete Inc. (on St. Thomas) accounted for the total production. Output in 1973 decreased 9%. Construction projects, largely in tourist facilities, were slowed due to a leveling off in tourism. An accelerated highway construction program, due in part to eligibility in 1971 for Federal highway funds, was continuing. Low-cost public housing construction, in cooperation with programs of the U.S. Department of Housing and Urban Development (HUD), also continued in 1973. The once-critical housing shortage has been completely eliminated.

Table 6.—Production of traprock in the Virgin Islands [1]

1972		1973	
Quantity (Short tons)	Value	Quantity (Short tons)	Value
726,088	$2,255,048	664,323	$2,859,545

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Interceptor and collector lines were being added to the completed St. Croix sewage system and treatment facilities, which started in 1971. The St. Thomas sewage and treatment facilities, also started in 1971, were rescheduled for completion within 12 to 18 months. The rescheduling was prompted because of delays associated with the rocky St. Thomas terrain.

The Virgin Island Water and Power Authority (VIWPA) increased its fuel storage capacity at St. Croix by 108,000 barrels and started site preparation in St. Thomas for a similar increase in fuel storage capacity. VIWPA also brought onstream a gas turbine generator on St. Croix and diesel generators on St. Croix and St. Thomas. VIWPA also awarded a bid to Envirogenics, a division of Aerojet General Co., for constructing two 2.25 million-gallon-per-day desalination plants, one on St. Thomas and the other on St. Croix.[13] The desalination plants will be vertical evaporation units located next to powerplants to take advantage of the readily available, low-cost turbine-exhaust steams as the distillation heat source.[14]

The Hess Oil Virgin Islands Corporation (HOVIC), a division of Amerada Hess Corp. has awarded design and construction contracts for expanding its refinery and storage facility on the southern shore of St. Croix to Litwin Corp., a subsidiary of Amtel, Inc. The estimated cost of the expansion was $125 million.[15] HOVIC also announced the purchase of a $2.5 million air pollution monitoring device for installa-

[10] Chemical Week. Puerto Rico Brightens Outlook For Chemical Plants. V. 113, No. 15, Oct. 10, 1973, pp. 25–26.
[11] Prepared by Sarkis G. Ampian.
[12] Prepared by Sarkis G. Ampian.
[13] Virgin Islands, Governor of. 1973 Annual Report to the Secretary of the Interior for the Fiscal Year Ended June 1973. 144 pp.
[14] Chemical Engineering. CE Construction Alert. V. 80, No. 9, Apr. 3, 1973, p. 78.
[15] Engineering News-Record. Virgin Islands. V. 191, No. 16, Oct. 18, 1973, p. 39.

tion on its incinerator stack. The device will feature an alarm system to alert the refinery of equipment malfunctions. Applications have also been made by HOVIC and Virgin Islands Refinery Corp. (VIRCO) for submerged-land permits for constructing offshore crude oil transfer facilities. HOVIC has proposed a single-anchor-leg-mooring (SALM) buoy system, and VIRCO proposed a fixed-platform, docking-type facility. The SALM system is an alternative to the 100-foot-deep channel and harbor ordinarily required by the new supertankers. The VIRCO docking facility was part of its overall plan to locate a 200,000-barrel-per-day light Arabian low-sulfur crude oil refinery on St. Croix's southern shore.

The first shipments of Boké bauxite were delivered to Martin Marietta Aluminum Inc.'s St. Croix Bayer alumina plant, recently enlarged to 360,000 short tons per year, from mining operations that began producing after 6 years of development.[16] Martin Marietta Aluminum Inc. has now become fully integrated, from mine to smelter to fabrication for the customer.[17] (Martin Marietta Aluminum is a member of the Halco consortium with the Guinean Government; the 10-member-companies hold 51% of the stock, and the Government holds 49%.) The alumina produced in St. Croix was shipped to company-owned reduction plants in Goldendale, Wash., and Dalles, Oreg.

Revocation of offshore sand dredging permits in 1971, prompted by the possible ecological damage to the beaches of the islands, was continued. The main islands, as in 1971, still had only a 6-month supply of building sand. A plan was offered by the Government of the Virgin Islands for recalling all dredging permits for review and resubmission every 2 years.

PACIFIC ISLAND POSSESSIONS [18]

REVIEW BY ISLANDS

American Samoa.—The territory of American Samoa is of volcanic origin and very mountainous, consisting of seven tropical islands in the South Pacific. The main island is Tutuila where the village of Pago Pago and the capital of Fagatogo are located. Tutuila contains over 80% of the territory's population. Most of the Samoan mineral production, mainly volcanic cinder, traprock, and limestone, is in Tutuila. All production in 1973 was by Government crews.

The cinder and rock were crushed to provide aggregate for cement and asphalt concrete. The pit-run cinder and rock were used in compacted fills, seawalls, roads, and road improvements. The Department of Public Works completed a major new highway to the mountain village of Aoloaufou. Design of access roads to all North Shore villages was in progress as a part of the Federal Highway System, and pioneer-type access roads to the villages of Afono and Vatia were underway. Construction neared completion on a 12-inch-diameter water main from Nuu'uli to Faga'alu, which will connect the Pago Pago area with the new well field in Tafunafou. The Construction Division of the Department maintained and operated a concrete plant and rock crusher, which produced 6,000 cubic yards of ready-mix concrete. The Department also constructed sewer pipelines and treatment facilities in the Tafuna area and added four Government-operated potable water systems.[19]

Guam.—Coral limestone was quarried and crushed in many municipalities throughout the territory for aggregate use. The total output for 1973 increased 50% in quantity and 58% in value. Producers were Hawaiian Rock Products, Inc.; Pacific Rock Corp.; Perez Bros., Inc.; and the Public Works Department of the Guam Government. Guam's economic upswing, attributed to the rapid growth of tourism (mostly from Japan) and a growing population, led by construction projects, continues to set the pace, as in previous years.

Kaiser Cement and Gypsum Corporation's $600,000 Cabras Island cement distribution plant, started in 1973, was still under construction. The new facility near Apra Harbor was to have a storage capacity of 8,500 tons of cement, 5,000 square feet of warehouse for bagging and storing sack

[16] Martin Marietta Corp. 1973 Annual Report. Pp. 10–11.
[17] Mining Magazine. Boke's First Shipment. V. 129, No. 3, Sept. 1973, p. 181.
[18] Prepared by Sarkis G. Ampian.
[19] American Samoa. 1973 Annual Report. 91 pp.

cement, and modernized bulk truck-loading and transferring equipment. Kaiser's other facility at Agana also has an 8,500-ton storage capacity.

Table 7.—Mineral production in the Pacific Island Possessions [1]

Area and mineral	1972 Quantity (Short tons)	1972 Value	1973 Quantity (Short tons)	1973 Value
American Samoa:				
Volcanic cinder	--	--	36,634	$214,000
Limestone	48,703	$413,976	63,444	152,374
Total	XX	413,976	XX	366,374
Guam: Limestone	831,234	1,982,778	1,245,746	3,139,367

XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Wake.—The Wake Island group is a coral atoll consisting of Wake, Wilkes, and Peale Islands. Wake is the main island; Wilkes and Peale Islands contain only air and sea navigation facilities. No coral limestone was recovered in 1973. Stockpiled crushed coral limestone was used chiefly in road maintenance during the year. Previously, coral limestone had been recovered by clamshell draglines on Wake Island by the Federal Aviation Administration (FAA). The crushed limestone aggregate was used in concrete for new housing and rehabilitation of existing structures, and in asphalt for road improvements.

The Civil Administration of Wake Island was transferred to the Department of the Air Force by the Department of the Interior on June 24, 1972. The Navy and the FAA had previously been given this responsibility by the U.S. Department of the Interior. Wake has a 9,800-foot runway capable of handling the largest modern aircraft. The present disposition of the islands was unclear, and the future coral limestone demand is uncertain.

Other Pacific Island Possessions.—No mineral production was reported for the islands of Canton, Enderbury, Jarvis, Johnston, Midway, or Palmyra.

TRUST TERRITORY OF THE PACIFIC ISLANDS

Production of bauxite, manganese ore, limestone, and phosphate rock (notably from Babelthaup in the Palau District) has not been reported for years. The possibility of renewed production is considered negligible. Volcanic rock, used as aggregate in concrete, was produced locally on many of the islands scattered throughout the islands of Micronesia. Continued small-scale production of aggregates for construction and a limited production of ceramic-grade clays will be the only materials mined in the Trust Territory in the foreseeable future.

A new Trust Territory road program was established for both constructing and upgrading present roads on a priority basis. To date, over 30 miles of roads have either been designed, completed, or under construction during the year on Palau, Majuro, Ponape, Kusaie, Saipan, and Yap. In addition, a feasibility study was completed by the Northrop Corp. for a 900-foot bridge connecting the island of Babelthaup to the district center of Koror, Palau. The bid opening for the bridge was scheduled for late in 1973. Construction of a new Saipan generating plant was also completed during the year, replacing the island's main generating facility, which was destroyed by fire. The new plant allows sufficient capacity for future development.

The Mineral Industry of Rhode Island

By Frank B. Fulkerson [1]

Production by the mineral industry of Rhode Island in 1973 was valued at $4.3 million, practically unchanged from that of 1972. The value of sand and gravel comprised 71% of the total value. Crushed stone accounted for nearly all the remainder. A small quantity of gem stones was gathered by hobbyists.

Value of sand and gravel production declined 7% owing to a decrease in average value per ton. The value of stone output increased 30%.

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[1] Industry economist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Value of mineral production in Rhode Island, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Kent	W	W	Sand and gravel.
Newport	$45	$48	Stone, sand and gravel.
Providence	2,009	W	Do.
Washington	312	W	Sand and gravel.
Undistributed [2]	1,926	4,292	
Total	[3] 4,291	4,340	
Total 1967 constant dollars	3,541	[p] 3,186	

[p] Preliminary. W Withheld to avoid disclosing individual company confidential data included with "Undistributed."

[1] Bristol county is not shown because no production was reported.

[2] Includes gem stones, some sand and gravel which cannot be assigned to specific counties (1972), and values indicated by symbol W.

[3] Data does not add to total shown because of independent rounding.

Table 2.—Indicators of Rhode Island business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ---thousands--	411.7	418.0	+1.5
Unemployment ---do----	27.0	26.1	−3.3
Employment:			
Mining ---do----	[1]	[1]	--
Construction ---do----	15.1	15.2	+0.7
Manufacturing ---do----	119.5	124.1	+3.8
Services ---do----	59.9	62.2	+3.8
Government ---do----	54.7	53.5	−2.2
Other [2] ---do----	106.8	107.3	+ .5
Payroll average weekly earning: Manufacturing	$124.4	$132.4	+6.4
Personal income:			
Total ---millions--	$4,340	$4,651	+7.2
Per capita	$4,483	$4,780	+6.6
Construction activity:			
Cement shipments to Rhode Island ---thousand short tons--	206	194	−5.8
Mineral production value ---thousands--	$4.3	$4.3	--

[p] Preliminary.

[1] Included with services.

[2] Includes transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate.

Sources: Survey of Current Business; Employment and Earnings; Area Trends in Employment and Unemployment; and the U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Consumption of portland cement and masonry cement was 187,000 tons and 6,000 tons, respectively. There are no cement plants in Rhode Island.

Gem Stones.—The value of gem stones and mineral specimens collected was estimated at $2,000.

Sand and Gravel.—Production of sand and gravel increased 17% in tonnage but decreased 7% in value. Average value per ton decreased from $1.60 in 1972 to $1.27 in 1973. The use pattern was building, 43%; paving, 30%; and fill, miscellaneous gravel, and industrial sand, 27%. Leading producers were A. Cardi Construction Co., Inc., Forte Brothers, Inc., and Rhode Island Sand & Gravel Co., Inc.; these producers accounted for 63% of the total output.

Stone.—Output of stone by three companies increased 25% in quantity and 30% in value. The Conklin Limestone Co., Inc., quarried and crushed limestone at Ashton. The limestone was sold for agricultural, terrazzo, roofing, filler, and flux purposes. M. A. Gammino Construction Co. produced granite at Cranston for use as bituminous and concrete aggregate, road base stone, riprap, and stone sand. Peckham Brothers Co., Inc., crushed miscellaneous stone near Middletown for macadam aggregate and road base use.

The Rock of Ages Corp., Barre, Vt., began a quarrying operation at Foster. Black granite was to be quarried and shipped to Barre for finishing. The Foster zoning board restricted use of machinery on the property from 7 a.m. to 5 p.m. and stipulated that an 8-foot-high livestock fence be placed around the quarry perimeter. No stone was shipped from the new quarry in 1973.

MINERAL FUELS

Petroleum.—At its East Providence petroleum refinery, Mobil Oil Corporation processed unfinished oils from the gulf coast and foreign countries to produce asphalt and fuel oil. Capacity of the small refinery in 1973 was 10,000 barrels per stream day.

Table 3.—Rhode Island: Sand and gravel sold or used, by use

(Thousand short tons and thousand dollars)

Use	Quantity	Value
Sand:		
Building	500	571
Fill	56	64
Paving	450	582
Other uses [1]	100	301
Total [2]	1,106	1,517
Gravel:		
Building	542	700
Paving	282	525
Miscellaneous [3]	499	353
Total [2]	1,322	1,578
Total sand and gravel	2,429	3,095

[1] Includes molding, blast, filtration, and other sand.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes fill and other gravel.

Table 4.–Principal producers

Commodity and company	Address	Type of activity	County
Petroleum:			
Mobil Oil Corporation	1001 Wampanoag Trail E. Providence, R.I. 02915	Refinery	Providence.
Sand and gravel:			
Acme Sand and Gravel Inc	100 Armento St. Johnston, R. I. 02919	Pit	Do.
A. Cardi Construction Co., Inc.	451 Arnold Road Coventry, R.I. 02816	Pit	Kent.
Forte Brothers, Inc	14 Whipple St. Berkeley, R.I. 02900	Pit	Providence.
Holliston Sand Co., Inc	Slatersville, R.I. 02876	Pit	Do.
Rhode Island Sand & Gravel Co., Inc.	Kilvert St. Hillsgrove, R.I. 02886	Pit	Kent.
J. Romanella & Sons Inc	Box 546, Westerly, R.I. 02891	Pit	Washington.
J. Santoro, Inc	11 Herbert St. Providence, R.I. 02909	Pit	Providence.
Silvestri Brothers	Johnston, R.I. 02919	Pit	Do.
South County Sand & Gravel Co., Inc.	North Rd. Peace Dale, R.I. 02883	Pit	Washington.
Tasca Sand & Gravel Co	Box 113,R.F.D. 4 Esmond, R.I. 02917	Pit	Providence.
Stone:			
Limestone, crushed:			
The Conklin Limestone Co., Inc.	R.F.D. 1 Lincoln, R.I. 02865	Quarry	Do.
Other stone, crushed and broken:			
M. A. Gammino Construction Co	728 Valley St. Providence, R.I. 02908	----do----	Do.
Peckham Brothers Co., Inc.	P.O. Box 193 Newport, R.I. 02840	----do----	Newport.

The Mineral Industry of South Carolina

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the South Carolina Division of Geology, State Development Board, for collecting information on all minerals except fuels.

By Robert G. Clarke [1]

The value of mineral production in South Carolina in 1973 increased 7% over that of 1972, reaching a record high of $88.4 million. Clays, mica, peat, sand and gravel, and stone production increased in both quantity and value. Vermiculite and cement decreased slightly in quantity but increased in value of production. Fuller's earth and gem stones were new commodities produced in 1973, and feldspar production ceased.

The production of kaolin and vermiculite in South Carolina ranked second nationally in quantity and value; that of mica ranked fourth in quantity and fourth in value; that of fuller's earth ranked seventh in both quantity and value; and that of peat ranked eleventh in quantity and value.

Legislation and Government Programs.—The South Carolina Mining Act was passed by the State legislature June 7, 1973, and approved by Governor John C. West, June 11, 1973. The purposes of the Act are to provide: (a) That the usefulness, productivity, and scenic values of all lands and waters involved in mining within the State will receive the greatest practical degree of protection and restoration and (b) that from the effective date of the Act, July 1, 1974, no mining shall be carried on in the State unless plans for such mining include reasonable provisions for protection of the surrounding environment and for reclamation of the area of land affected by mining. The Land Resources Conservation Commission was the State agency named in the Act of enforce the regulations.

Amendments passed in 1974 to the South Carolina Mining Act postponed the effective deadline for filing a reclamation plan to January 1, 1975, but required the mine operators to be responsible for all land mined after July 1, 1974.

The Division of Geology of the South Carolina State Development Board collected and evaluated basic geologic data, advised utilities and other firms on geologic conditions for structural foundations and subsurface storage, and advised mining-oriented firms on exploration for various mineral commodities such as clays, crushed stone, gold, gravel, lightweight aggregate, limestone, manganese, sericite, silica sand, sulfide ores of copper and zinc, uranium, and vermiculite.[2] The Division of Geology signed a contract in February 1973, with the National Aeronautic and Space Administration for a Skylab/EREP (Earth Resources Experiment Package) aerial remote sensing project. The contract was entitled "Application of Multispectral Photography to Mineral and Land Resources of South Carolina."

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[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

[2] Olson, N. K. Geologic Activities in South Carolina During 1973. Geologic Notes. South Carolina State Development Board, Div. of Geol. Winter 1973, v. 17, No. 4, pp. 83–113.

Table 1.—Mineral production in South Carolina [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays ---thousand short tons--	2,221	$11,268	[2] 2,250	[2] $12,877
Gem stones	--	--	NA	5
Peat ---thousand short tons--	W	W	14	W
Sand and gravel ---do----	7,916	12,121	8,179	12,628
Stone ---do----	12,482	21,819	14,985	24,280
Value of items that cannot be disclosed: Cement, clays (fuller's earth) (1973), feldspar (1972), mica (scrap), vermiculite, and values indicated by symbol W	XX	37,105	XX	38,571
Total	XX	82,313	XX	88,361
Total 1967 constant dollars	XX	67,916	XX	[p] 64,875

[p] Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed". XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes fuller's earth; included with "Value of items that cannot be disclosed".

Table 2.—Value of mineral production in South Carolina, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Aiken	$8,080	$9,568	Clays, sand and gravel.
Berkeley	W	W	Stone, clays.
Cherokee	W	2,772	Stone, clays.
Chesterfield	897	W	Sand and gravel, stone, clays.
Colleton	W	W	Peat.
Dorchester	W	19,249	Cement, stone, sand and gravel, clays.
Edgefield	24	44	Clays.
Fairfield	1,564	W	Stone, clays.
Florence	W	W	Sand and gravel.
Greenville	W	W	Stone, sand and gravel.
Greenwood	W	1,325	Stone, clays, sand and gravel.
Horry	W	W	Sand and gravel, clays.
Jasper	W	W	Sand and gravel.
Kershaw	1,274	1,211	Sand and gravel, clays, stone.
Lancaster	W	W	Mica, clays, sand and gravel.
Laurens	W	W	Vermiculite, stone.
Lexington	7,000	W	Sand and gravel, stone, clays.
Marion	W	W	Sand and gravel, clays.
Marlboro	W	W	Do.
Newberry	W	W	Clays, stone.
Oconee	W	--	
Orangeburg	W	18,003	Cement, stone, clays, sand and gravel.
Pickens	W	2,460	Stone.
Richland	3,625	W	Stone, clays, sand and gravel.
Saluda	W	W	Clays.
Spartanburg	W	W	Stone, sand and gravel.
Sumter	W	W	Sand and gravel, clays.
York	W	W	Stone.
Undistributed [2]	59,847	33,728	
Total [3]	82,313	88,361	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] The following counties are not listed because no production was reported; Abbeville, Allendale, Anderson, Bamberg, Barnwell, Beaufort, Calhoun, Charleston, Chester, Clarendon, Darlington, Dillon, Georgetown, Hampton, Lee, McCormick, Union, and Williamsburg.
[2] Includes gem stones, some sand and gravel which cannot be assigned to specific counties, and values indicated by symbol W.
[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of South Carolina business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total work force ----------thousands--	1,142.6	1,197.9	+4.8
Unemployment ----------percent of work force--	49.2	43.4	−11.8
All employment (nonagricultural) ----------thousands--	920.3	989.5	+7.5
Wage and salary employment:			
Mining ----------do----	1.7	1.8	+5.9
Contract construction ----------do----	61.4	70.2	+14.3
Transportation, communication, public utilities ----------do----	40.4	42.4	+5.0
Manufacturing ----------do----	354.6	375.7	+6.0
Trade ----------do----	159.9	174.5	+9.1
Finance, insurance, and real estate ----------do----	33.8	37.4	+10.7
Services ----------do----	102.9	114.5	+11.3
Government ----------do----	165.6	173.0	+4.5
Personal income:			
Total ----------millions--	$9,268	$10,406	+12.3
Per capita ----------	$3,477	$3,817	+9.8
Construction activity:			
Value of nonresidential construction ----------millions--	$95.8	$115.6	+20.7
Number of housing units authorized ----------	34,107	24,033	−29.5
Farm marketing receipts ----------millions--	$588.7	$792.1	+34.6
Mineral production value ----------do----	$82.3	$88.4	+7.4

p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; U.S. Bureau of Mines.

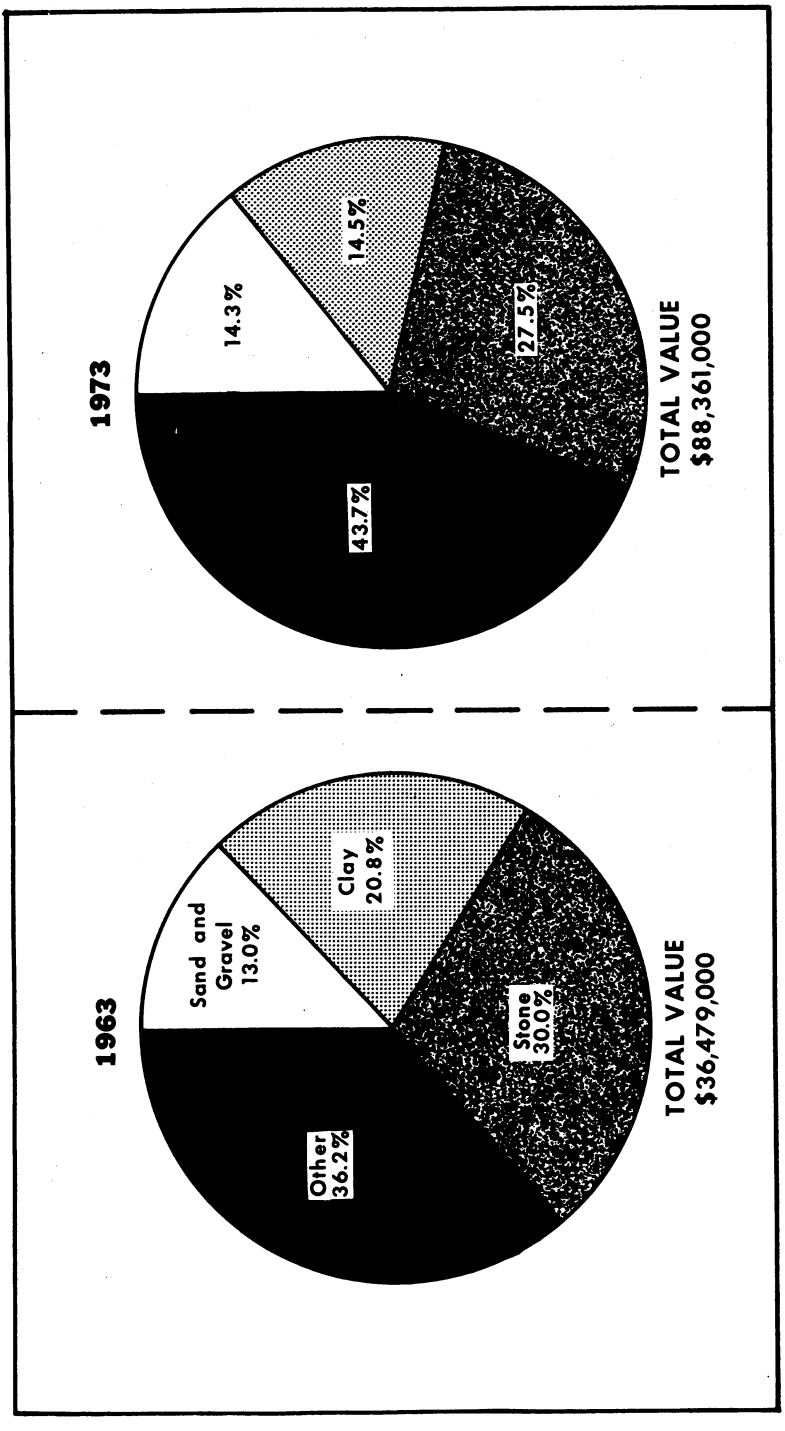

Figure 1.—Value of stone, and total value of mineral production in South Carolina.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Portland and masonry cements were produced by Giant Portland Cement Co. in Dorchester County and Santee Portland Cement Corp. in Orangeburg County. Shipments of portland cement decreased 3% and shipments of masonry cement increased 8%. Ninety-nine percent of the portland cement shipped was types I and II for general use; the remainder was pozzolan and type III, high-early strength. Portland cement consumed in South Carolina totaled 1,029,000 tons; masonry cement consumption was 162,000 tons. Most of the shipments were for ready-mix concrete products and building materials usage; a small percentage went into highway construction. Natural gas and fuel oil were used as fuels depending on seasonal rates and availability. All electric energy used was purchased. The raw materials used consisted mostly of limestone or marl, common clay, gypsum, iron-bearing materials, air-entraining compounds, and grinding aids. Shipments of cement directly from plant to ultimate consumer represented more than 85% of the total shipped, and the remainder was to terminals as the first destination. More than 90% of shipments were in bulk. About 70% of the shipments were by truck and 30% by rail. According to data furnished by the U.S. Bureau of Census, 1973 imports through the Charleston, S.C., customs district included 273,000 tons of cement and clinker for domestic consumption.

Clays.—Excluding fuller's earth, total clay production accounted for 15% of the value of mineral production in South Carolina. The quantity increased 1% and the value increased 14%.

Production of kaolin increased 11% in quantity to 755,000 tons, and the value increased 15% to $10,353,682. Output of kaolin in South Carolina was second highest in the Nation in both quantity and value. The principal domestic uses for air-floated kaolin were in rubber, fertilizers, pesticides and fungicides, and adhesives. The principal use for unprocessed kaolin was in face brick. Air-floated kaolin was produced by seven companies; and unprocessed kaolin, by five companies. The leading companies were J. M. Huber Corp., Dixie Clay Co., Division of R. T. Vanderbilt Co., and Cyprus Industrial Minerals Co. Ranked by quantity of production, the counties in which kaolin was produced were Aiken, Lexington, Richland, Kershaw, Marlboro, and Chesterfield.

Production of common clay and shale decreased 3% in quantity and increased 11% in value. Twenty-seven mines were operated by 17 companies in 18 counties. By quantity of production, the leading counties ranked in descending order were as follows: Dorchester, Marlboro, Richland, Lancaster, Greenwood, and Cherokee. The leading producers by quantity produced were Richtex Corp. in Fairfield and Richland Counties, Southern Brick Co. in Greenwood, Newberry, and Saluda Counties and Ashe Brick Co. in Lancaster County.

According to data published by the U.S. Bureau of the Census, in its monthly Current Industrial Report, Clay Construction Products, South Carolina usually ranked fifth or sixth in the production of brick (building or common and face). North Carolina, South Carolina, and Virginia comprise a regional marketing area which accounted for 25% of the production and shipments of brick in 1972 and 1973 in the United States.

Table 4.—South Carolina kaolin sold or used by producers, by kind and use

(Thousand short tons)

Kind and use	1972	1973
Air-floated:		
Adhesives	19	20
Fertilizers	42	41
Firebrick, block, and shapes	8	5
Pesticides and related products	23	21
Rubber	227	248
Exports [1]	61	72
Other uses [2]	59	91
Total [3]	439	499
Unprocessed:		
Face brick; fireplace, block, and shapes (1972); and other (1973)	242	256
Total	242	256
Grand total	681	755

[1] Fertilizers and rubber.
[2] Includes animal feed; electrical porcelain (1973); fiberglass; fine china/dinnerware; floor and wall tile (1972); glazes, glass, and enamels (1973); gypsum products; plant; paper filling; plastics (1973); pottery; sanitary ware; and other uses.
[3] Data may not add to totals shown because of independent rounding.

Feldspar.—Spartan Minerals Company of Pacolet, Spartanburg County, was acquired by Lithium Corporation of America, a subsidiary of Gulf Resources and Chemical Corporation, for about $1 million in cash and notes. Spartan Minerals Company formerly recovered feldspar as a byproduct from purchased granite fines from a quarry nearby in Spartanburg County. Under the new ownership, the plant processed material imported from North Carolina and hence South Carolina dropped from the list of States in which feldspar was mined.

Gem Stones.—The collection of gem stone materials was all by amateurs as no commercial industry exists. Some of the materials were sold to hobby shops and to retail establishments which cater to tourists. A list of areas and of the stones which are collected is contained in a publication of the Division of Geology.[3]

Mica.—A fine-grained variety of mica, sericite, was produced from sericite-rich ores at the operation of The Mineral Mining Corp. in Lancaster County. Production increased 14% in quantity and 61% in value. Mica output from South Carolina ranked nationally fourth in quantity and value. After dry milling, the sericite-rich product was sold for uses mainly in paint, joint cement, and electronics.

Sand and Gravel.—Sand and gravel was produced in 17 counties at 36 locations and ranked fourth in value of mineral commodities produced in South Carolina. Sand and gravel used in construction totaled 8.2 million short tons valued at $12.6 million. The average value increased from $1.53 per ton in 1972 to $1.54 per ton in 1973. Nearly all sand and gravel was commercial production.

Pennsylvania Glass Sand Corp. of Berkeley Springs, W. Va., began a $2.5 million expansion of its silica operations in Lexington County near Edmund.[4] The plant supplies high-quality silica sands to the glass, fiber glass, ceramic, and chemical industries in the Southeast. The two-phase expansion program will double the capacity of the milling and beneficiating departments and provide capacity increases in the mining and wet-processing departments.

The first phase was completed in 1973–74, and the second phase is expected to be completed in 1975. The leading sand and gravel producing counties ranked in descending order of quantity were Lexington, Sumter, Marlboro, and Chesterfield; ranked in descending order of value the leading counties were Marlboro, Lexington, Sumter, and Chesterfield Counties.

[3] McCauley, C. K. Gem Stone Resources of South Carolina. State Development Board, S.C., Div. of Geol., Bull. 30, 1964, 34 pp.
[4] The State (Columbia, S.C.). Silica Plant Plans Expansion. Jan. 16, 1973.

Table 5.—South Carolina: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Blast sand	37	140	28	146
Building sand	4,213	3,366	4,571	3,869
Fill sand	147	67	272	130
Paving sand	716	W	648	425
Other sand and gravel [1]	2,805	8,549	2,661	8,058
Total [2]	7,916	12,121	8,179	12,628

W Withheld to avoid disclosing individual company confidential data; included with "Other sand and gravel."

[1] Includes glass (ground), molding, fire-furnace, engine, filtration, abrasives, chemical, filler, foundry, glass (unground), pottery, other, and a small amount of Government-and-contractor sand and gravel (1973).

[2] Data may not add to totals shown because of independent rounding.

Table 6.—South Carolina: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Aiken	1	W	184	4	W	W
Chesterfield	4	703	W	5	759	W
Lancaster	1	27	32	1	29	29
Lexington	9	2,127	3,300	8	1,756	3,378
Richland	1	287	367	1	W	W
Undistributed [1]	r 17	4,771	8,239	17	5,636	9,222
Total [2]	33	7,916	12,121	36	8,179	12,628

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Cherokee (1972), Dorchester, Florence, Greenville, Greenwood (1973), Horry, Jasper, Kershaw, Marion, Marlboro, Orangeburg, Spartanburg, Sumter, and some sand and gravel that cannot be assigned to specific counties (1973).

[2] Data may not add to totals shown because of independent rounding.

Stone.—The quantity and value of stone produced increased 20% and 11% respectively. The value of stone production accounted for 27% of the total value of mineral production in the State.

Becker Sand & Gravel Co., Division of Gifford-Hill and Co., Inc., of Dallas, Tex., opened a 250-ton-per-hour crushed granite plant in May 1973 near Jefferson in Chesterfield County.[5] Becker Sand & Gravel Co. produces an excess of sand-sized material at its sand and gravel operations and the crushed granite will be used to supplement the coarser aggregate sizes. The plant was designed to be highly flexible and to produce a wide variety of materials to State and Federal specifications. Portable plant sections make it possible to adjust plant operations to meet changes in specifications or to expand output with minimum delay. The output in May 1973 was rated at 100 tons per hour of minus 1½-inch crusher run, 100 tons per hour of washed concrete stone, and 10 tons per hours of screenings.

Crushed granite was produced in 16 counties at 16 quarries by seven companies: Becker Sand & Gravel Co., Blythe Bros. Co., Clement Bros. Co., Lone Star Industries, Inc., Martin-Marietta Corp., Sloan Construction Co., Inc., and Vulcan Materials Co. Greenville, Pickens, Richland, Spartanburg, and Lexington Counties, in that order, led in the production of crushed granite in South Carolina. Crushed granite was used for road base stone, concrete aggregate, bituminous aggregate, miscellaneous aggregate, macadam aggregate, road base stone, road surface treatment, railroad

[5] Trauffer, W. E. Becker's New 250-tph Crushed Granite Plant. Pit & Quarry, v. 66, No. 111, May 1974, pp. 64–66, 82, 92, 93.

ballast, rip-rap and jetty stone, and filtration, in descending order of use. More than 90% of the crushed granite was transported by truck; and the remainder by rail.

Dimension granite was produced from five quarries mostly for monumental use. Winnsboro Granite Co. operated a quarry in Fairfield County. Comolli Granite Co. operated a quarry in Kershaw County. Kershaw Granite Co., Inc., a Division of Coggins Granite Industries, operated two quarries in Kershaw County and a quarry in Newberry County.

Crushed limestone was produced by Vulcan Materials Co. from a quarry in Cherokee County and by Martin-Marietta Corp. from a quarry in Berkeley County. The principal uses for crushed limestone, in descending order, were for road base stone, agricultural limestone, rip-rap and jetty stone, concrete aggregate, bituminous aggregate, road surface treatment, and railroad ballast. Crushed marl was produced by Giant Portland Cement Co. from a quarry in Dorchester County and by Santee Portland Cement Corp. from a quarry in Orangeburg County. Crushed marl was used by both producing companies in the manufacture of cement.

Vermiculite.—The production of crude vermiculite decreased 2% in quantity from that of 1972, and the value increased 3%. Construction Products Div., W. R. Grace & Co., produced crude vermiculite in Laurens County, and exfoliated vermiculite in Greenville and Laurens Counties. Patterson Vermiculite Co. produced crude and exfoliated vermiculite in Laurens County. Exfoliated vermiculite was used as follows: 44% for soil additives, 38% for lightweight aggregates (concrete, plaster, and fireproofing), and 18% for insulation (loose and block).

The production of crude vermiculite in South Carolina was less than that in Montana, the only other State in which vermiculite was produced in 1973. Forty percent of all vermiculite produced in the United States comes from mines in South Carolina.[6]

METALS

Ferroalloys.—Airco Alloys Division of Airco, Inc., produced special alloys at Charleston, Charleston County.

Gold.—According to geologists in South Carolina, the increased price of gold revived interest in old lodes in both Carolinas and in Georgia. South Carolina has listed 135 abandoned gold mines.[7]

Iron and Steel.—Georgetown Steel Co., a subsidiary of Korf Industries of West Germany, operates a plant at Georgetown, Georgetown County, with a rated annual capacity of 500,000 tons, 100% bars, especially high-carbon.[8] The plant has three electric furnaces which have a capacity of 80 tons per heat. Two continuous casting machines each produce a 4½-inch-square casting at 100 inches per minute or 15 tons per hour.

Zirconium.—M & T Chemicals, Inc., operated a grinding plant near Andrews, Georgetown County, for the production of milled zircon for foundry, refractory, ceramic, and glass uses. Zircon was obtained from out-of-State sources.

MINERAL FUELS

Peat.—United States Peat Corp. reported production of 14,000 tons of peat from its bog near Green Pond, Colleton County. The increase in production moved South Carolina into 11th place in the rank of States which report production of peat. All of the peat was used for general soil improvement.

[6] News (Belton, S.C.). Vermiculite—It May Provide Some Energy Answers. July 19, 1973.

[7] McCauley, C. K., and J. R. Butler. Gold Resources of South Carolina. State Development Board, S. C., Div. of Geol., Bull. 32, 1966, pp. 18–22.

[8] Journal of Metals. Continuous Casting Installations in Steel Plants of the United States. V. 25, No. 10, October 1973, pp. 40–45.

Table 8.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Giant Portland Cement Co	150 Strafford Ave. Wayne, Pa. 19087	Plant	Dorchester.
Santee Portland Cement Corp	Box 698 Holly Hill, S.C. 29059	do	Orangeburg.
Clays:			
Kaolin:			
Cheraw Brick Works Inc	Box 207 Cheraw, S.C. 29520	2 mines	Chesterfield.
Cyprus Mines Corp	Box 1201 Trenton, N.J. 08606	Mine	Aiken.
Dixie Clay Co	230 Park Ave. New York, N.Y. 10017	2 mines	Do.
J. M. Huber Corp	630 Third Ave. New York, N.Y. 10017	4 mines	Do.
Southeastern Clay Co	Box 1055 Aiken, S.C. 29801	6 mines	Do.
Common clay and shale:			
Ashe Brick Co	Van Wyck, S.C. 29744	Mine	Lancaster.
Broad River Brick Co	Box 550 Gaffney, S.C. 29340	do	Cherokee.
Giant Portland Cement Co	150 Strafford Ave. Wayne, Pa. 19087	do	Dorchester.
Guignard Brick Co	Box 568 Cayce, S.C. 29033	3 mines	Lexington.
Palmetto Brick Co	Box 430 Cheraw, S.C. 29520	Mine	Marlboro.
Richtex Corp	Box 3307 Columbia, S.C. 29203	6 mines	Fairfield, Lexington, Richland.
Santee Portland Cement Co	Box 698 Holly Hill, S.C. 29059	Mine	Orangeburg.
Southern Brick Co	Box 208 Ninety Six, S.C. 29666	2 mines	Greenwood and Newberry.
Feldspar, crude:			
Spartan Minerals Co	Route 1, Box 14A Pacolet, S.C. 29372	Plant	Spartanburg.
Mica, flake and scrap:			
The Mineral Mining Corp	Kershaw, S.C. 29067	Mine	Lancaster.
Peat: United States Peat Corp	Box 568 Walterboro, S.C. 29488	Bog	Colleton.
Sand and gravel:			
Becker Sand & Gravel Co	Box 848 Cheraw, S.C. 29520	5 mines	Chesterfield, Dorchester, Marlboro, Sumter.
Columbia Silica Sand Co	Box 1519 Columbia, S.C. 29202	2 mines	Lexington.
Foster Dixiana Sand Inc	P. O. Box 5447 Columbia, S.C. 29250	Mine	Do.
Palmetto Quarries Co	Drawer 5185 Columbia, S.C. 29205	do	Richland.
Pennsylvania Glass Sand Corp	Gen. Operations Dept. Berkeley Springs, W. Va. 25411	do	Lexington.
Stone:			
Granite, crushed:			
Martin-Marietta Corp	Box 2568 Raleigh, N.C. 27602	4 quarries	Fairfield, Lexington, Richland, York.
Lone Star Industries, Inc	Drawer 5185 Columbia, S.C. 29205	3 quarries	Fairfield, Greenwood, Richland.
Vulcan Materials Co	Drawer 8834 Greenille, S.C. 29604	4 quarries	Greenville, Laurens, Pickens, Spartanburg.
Granite, dimension:			
Comolli Granite Co	Box 898 Elberton, Ga. 30635	2 quarries	Kershaw.
Kershaw Granite Co., Inc	Box 250 Elberton, Ga. 30635	3 quarries	Kershaw and Newberry.
Winnsboro Granite Co	Rion, S.C. 29132	Quarry	Fairfield.
Limestone, crushed:			
Martin-Marietta Corp	Box 2568 Raleight, N.C. 27602	do	Berkeley.
Vulcan Materials Co	Drawer 8834 Greenville, S.C. 29604	do	Cherokee.

Table 8.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Marl, crushed:			
Giant Portland Cement Co.	150 Strafford Ave. Wayne, Pa. 19087	Quarry	Dorchester.
Santee Portland Cement Co.	Box 698 Holly Hill, S.C. 29059	----do----	Orangeburg.
Vermiculite:			
Crude:			
W. R. Grace & Co. Construction Products Div.	62 Whittemore Ave. Cambridge, Mass. 02140	Several mines	Laurens.
Patterson Vermiculite Co.	Route 1 Enoree, S.C. 29335	Mine	Do.
Exfoliated:			
W. R. Grace & Co	62 Whittemore Ave. Cambridge, Mass. 02140	2 plants	Greenville and Laurens.
Patterson Vermiculite Co.	Route 1 Enoree, S.C. 29335	Plant	Laurens.

The Mineral Industry of South Dakota

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the South Dakota State Geological Survey for collecting information on all minerals except fuels.

By J. M. West [1]

South Dakota's record production of minerals in 1973 was valued at $81.1 million, an increase of 24% over the previous record value in 1972. Gold contributed the greatest share of the increase and comprised 43% of the total value. An approximate 23% increase in the value of cement production was also important. Metals accounted for 43.3% and nonmetals for 55.5% of the total mineral output value in 1973. Petroleum accounted for only 1.2% of the total.

The State was back in first place among U.S. gold-producing States after falling to second behind Nevada in 1972. The Homestake gold mine produced 357,575 ounces of gold valued at $34.97 million. Legislation was considered to reimpose the State ore tax that was repealed in 1970 and that primarily affected the Homestake Mining Co. However, the Legislature's Interim Tax Committee, after hearing testimony in September, recommended that no action be taken by the next legislature to reinstate the tax.

The Lead-Deadwood Sanitary District Board requested an extension of the completion date for a sanitary sewer project in the Centennial Valley, where Homestake wastes and tailings were to go for disposal. The original schedule called for State and Environmental Protection Agency approval by December 1, 1973, the letting of bids by December 1, 1974, and project completion by November 1, 1975. Opponents of the project contended that cyanide and other toxic materials in the tailings would leak into ground water aquifers and make the water unfit for human use. Meanwhile, the Sanitary District and the Homestake Mining Co. attempted to establish an impermeable foundation for the project's dam after discovering gypsum on the floor of the area.

The State legislature passed an amendment to the Surface Mining Land Reclamation Act of 1971 releasing the pegmatite miner, who mines less than 1,000 tons of material per year, from payments for permits and bonds. It still remained necessary to obtain a permit and file a reclamation plan. Only if the production from one property exceeded 1,000 tons per year, however, did the miner have to post bonds for reclamation.

On August 7 the Earth Resources Observations Systems (EROS) Data Center was dedicated northeast of Sioux Falls. The facility was established to collect and process data on a wide variety of earth features including detectable mineral resources.

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[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in South Dakota [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Beryllium concentrates ____ short tons	W	W	--	--
Clays [2] ____ thousand short tons	185	$156	201	$181
Feldspar ____ short tons	r 25,000	r 400	W	W
Gem stones	NA	42	NA	42
Gold (recoverable content of ores, etc.) troy ounces	407,430	23,875	357,575	34,974
Gypsum ____ thousand short tons	24	43	W	W
Lime ____ do	W	W	63	1,206
Mica (scrap) ____ do	W	W	--	--
Petroleum (crude) thousand 42-gallon barrels	219	574	275	988
Sand and gravel ____ thousand short tons	12,748	14,793	13,963	16,587
Silver (recoverable content of ores, etc.) thousand troy ounces	100	168	72	184
Stone ____ thousand short tons	2,665	10,864	2,745	11,607
Value of items that cannot be disclosed: Cement, clays (bentonite), uranium (1972), vanadium (1972), and values indicated by symbol W	XX	14,535	XX	15,370
Total	XX	r 65,450	XX	81,139
Total 1967 constant dollars	XX	54,003	XX	p 59,572

p Preliminary. r Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes bentonite; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in South Dakota, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Aurora	$39	$42	Sand and gravel.
Beadle	106	W	Do.
Bon Homme	29	45	Do.
Brookings	W	W	Sand and gravel, stone.
Brown	W	420	Sand and gravel.
Brule	W	28	Do.
Buffalo	W	W	Do.
Butte	W	W	Clays, sand and gravel.
Campbell	W	151	Sand and gravel.
Charles Mix	9	69	Do.
Clark	W	14	Do.
Clay	14	17	Do.
Codington	W	W	Do.
Corson	W	16	Do.
Custer	r 395	W	Feldspar, petroleum.
Davison	W	19	Sand and gravel.
Day	W	W	Do.
Deuel	13	30	Do.
Dewey	W	45	Do.
Douglas	115	143	Do.
Edmunds	--	W	Do.
Fall River	W	W	Sand and gravel, stone.
Faulk	23	45	Sand and gravel.
Grant	W	7,608	Stone, sand and gravel.
Gregory	W	W	Sand and gravel.
Haakon	W	--	
Hamlin	70	41	Sand and gravel.
Hand	74	W	Do.
Hanson	W	W	Stone, sand and gravel.
Harding	W	1,020	Petroleum, sand and gravel.
Hughes	W	17	Sand and gravel.
Hutchinson	W	151	Do.
Hyde	W	W	Do.
Jerauld	38	13	Do.
Kingsbury	16	11	Do.
Lake	W	W	Do.
Lawrence	24,566	35,300	Gold, silver, sand and gravel, stone.
Lincoln	55	W	Sand and gravel.
Lyman	78	--	
McCook	W	W	Sand and gravel.
McPherson	W	W	Do.

Table 2.—Value of mineral production in South Dakota, by county [1]—Continued
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Marshall	W	$156	Sand and gravel.
Meade	W	W	Sand and gravel, gypsum.
Miner	--	26	Sand and gravel.
Minnehaha	W	W	Stone, sand and gravel.
Moody	W	W	Sand and gravel.
Pennington	r $14,872	17,026	Cement, stone, lime, sand and gravel, clays, feldspar.
Perkins	87	102	Sand and gravel.
Potter	36	60	Do.
Roberts	W	W	Do.
Sanborn	41	77	Do.
Shannon	W	11	Do.
Spink	27	132	Do.
Sully	W	31	Do.
Tripp	39	83	Stone, sand and gravel.
Turner	W	138	Sand and gravel.
Union	21	63	Do.
Walworth	--	4	Do.
Washabaugh	W	W	Do.
Yankton	179	237	Do.
Ziebach	W	25	Do.
Undistributed [2]	r 24,509	17,723	
Total [3]	r 65,450	81,139	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Bennett, Jackson, Jones, Mellette, Stanley, and Todd.

[2] Includes gem stones, some sand and gravel that cannot be assigned to specific counties and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

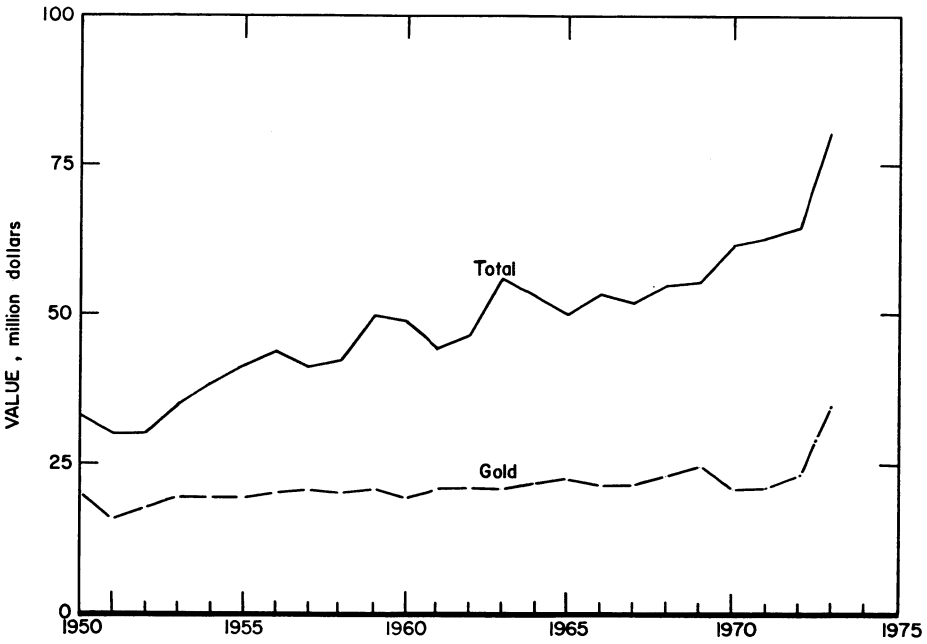

Figure 1.—Value of mine production of gold, and total value of mineral production in South Dakota.

Table 3.—Indicators of South Dakota business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total labor force ---- thousands --	287.6	297.9	+3.6
Employment ---- do ----	276.9	288.0	+4.0
Unemployment ---- do ----	10.7	9.9	−7.5
Nonagricultural employment:			
Mining ---- do ----	2.2	2.4	+9.1
Construction ---- do ----	9.0	10.4	+15.6
Manufacturing ---- do ----	18.5	19.7	+6.5
Government ---- do ----	59.3	59.1	−.3
Other nonagricultural employment ---- do ----	106.5	113.6	+6.7
Personal income:			
Total ---- millions --	$2,512	$2,943	+17.2
Per capita ----	$3,699	$4,296	+16.1
Construction activity:			
Highway construction contracts awarded thousands --	e $47.5	$46.3	−2.5
Cement shipments to and within South Dakota thousand short tons --	326	335	+2.8
Number of authorized residential units ----	3,728	3,687	−1.1
Value of nonresidential construction ---- millions --	$35.0	$35.8	+2.3
Mineral production value ---- thousands --	$65,450	$81,139	+24.0

e Estimate. p Preliminary.

Source: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

In late September, the Governor formed the State Energy Policy Council to advise him on energy supply and distribution. Other functions of the Council were to recommend to Government officials and publicize methods of averting fuel crises.

The experimental coal gasification plant at Rapid City continued under test and was able to produce a satisfactory crude gas product after several trials. Steps were planned to upgrade the product into pipeline gas by extracting sulfur and carbon dioxide.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—South Dakota's State-owned cement plant produced 3,109,333 barrels (about 584,000 short tons) of cement in 1973, an increase of nearly 17% from output in 1972.[2] Because of expanding markets in the region served by the plant, a $20 million expansion was planned to raise capacity to 6 million barrels (1.13 million tons) by June 1976. New storage terminals were planned at Fargo, N.D., and Denver, Colo., to service the expected larger marketing area. Also, a plan was to be implemented to replace natural gas with low-sulfur Wyoming coal for fuel. Conversion was expected to cost $1.5 million.

Clays.—Bentonite production accounted for about half the quantity and the bulk of the value of clays produced in South Dakota in 1973. Part of the bentonite was shipped east for use in taconite pelletizing. Other types of clay were used for cement, lightweight aggregate, and brickmaking. The only bentonite processing plant was that of the American Colloid Co. Bricks were manufactured at Belle Fourche and shipped to a number of States.

Feldspar.—Production of feldspar was higher than that in 1972. Most of the product was ground by Pacer Corp., owner of a mill at Custer. Shipments of the milled material went to many States.

Gypsum.—The South Dakota Cement Commission operated a small surface mine in Meade County and produced gypsum for use in cement manufacture.

Lime.—Pete Lien & Sons produced lime in Pennington County for use in soil stabilization, water purification, sewage treatment, and various chemical applications. The lime was used in South Dakota, Colo-

[2] Rapid City Journal. $20 Million State Cement Plant Expansion Approved. No. 29260, Feb. 1974, p. 8.

rado, and other States. Output rose 11% for a new record. Consumption in South Dakota totaled 34,950 short tons.

Sand and Gravel.—About 57 counties produced sand and gravel. Total production was 14.0 million tons, 55% of which was produced for Government agencies. A total of 173 mines operated in 1973 compared with 167 in 1972. Output consisted of 12% sand and 88% gravel.

Table 4.—South Dakota: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

Couunty	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Aurora	1	60	39	1	64	42
Beadle	3	W	106	3	W	W
Bon Homme	1	W	29	1	68	45
Brookings	8	521	571	9	268	324
Brown	3	139	W	9	532	420
Brule	1	W	W	1	37	28
Butte	2	W	W	4	31	29
Campbell	3	W	W	3	104	151
Charles Mix	3	W	9	5	159	69
Clark	1	W	W	1	20	14
Clay	2	W	14	2	W	17
Codington	7	485	W	6	W	W
Corson	4	W	W	1	52	16
Davison	2	W	W	3	34	19
Deuel	1	27	13	1	51	30
Dewey	2	W	W	1	45	45
Douglas	3	100	115	3	172	143
Fall River	4	254	220	2	W	W
Faulk	1	23	23	1	45	45
Grant	2	W	W	2	145	134
Hamlin	3	91	70	3	W	41
Hand	5	136	74	5	W	W
Hanson	1	W	W	1	191	197
Harding	2	W	W	1	68	50
Hughes	2	W	W	1	107	17
Hutchinson	3	W	W	7	157	151
Jerauld	1	52	38	1	60	13
Kingsbury	3	W	16	2	38	11
Lawrence	6	486	496	4	84	118
Lincoln	3	75	55	2	W	W
Lyman	2	105	78	--	--	--
Marshall	5	W	W	5	158	156
Miner	--	--	--	1	54	26
Minnehaha	14	912	912	10	907	899
Moody	4	153	W	4	124	W
Pennington	8	823	1,114	6	879	1,064
Perkins	5	104	87	4	78	102
Potter	1	W	36	1	60	60
Sanborn	1	W	41	3	132	77
Shannon	1	W	W	1	29	11
Spink	1	73	27	3	168	132
Sully	3	W	W	1	35	31
Tripp	--	--	--	1	39	39
Turner	2	W	W	3	117	138
Union	1	30	21	1	84	63
Walworth	--	--	--	1	2	4
Yankton	3	162	179	5	244	237
Ziebach	1	W	W	1	42	25
Undistributed [1]	r 32	7,938	10,411	36	8,279	11,352
Total [2]	167	12,748	14,793	173	13,963	16,587

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Buffalo, Custer (1972), Day, Edmunds (1973), Gregory, Haakon (1972), Hyde, Lake, McCook, McPherson, Meade, Roberts, and Washabaugh Counties, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 5.—South Dakota: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	604	765	878	1,182
Fill	96	45	302	295
Paving	382	399	266	351
Other uses [1]	21	28	20	27
Total [2]	1,104	1,238	1,467	1,855
Gravel:				
Building	340	506	475	773
Fill	195	112	311	220
Paving	3,760	3,994	3,590	3,963
Miscellaneous	334	399	18	19
Other uses [3]	39	175	400	470
Total [2]	4,668	5,186	4,795	5,445
Government and-contractor operations:				
Sand:				
Fill	--	--	1	1
Paving	104	124	275	315
Other uses	35	25	--	--
Total [2]	139	148	276	316
Gravel:				
Building	26	18	288	207
Fill	18	5	112	56
Paving	6,675	8,080	6,773	8,543
Other uses	118	118	254	166
Total [2]	6,837	8,221	7,426	8,971
Total sand and gravel [2]	12,748	14,793	13,963	16,587

[1] Includes railroad ballast and "Other uses."
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast (1972).

Stone.—Stone production was 3% higher in quantity and 7% higher in value than that in 1972. Increased prices for dimension stone, chiefly granite from the Milbank area mines in Grant County, northeastern South Dakota, were mainly responsible for rising values. Dimension stone also included some quartzite in 1973. Crushed and broken stone comprised 98% of the total stone quantity but accounted for only 36% of the value. Of 2.7 million tons of crushed and broken stone mined, 38% went into concrete aggregate, and the balance went into roadstone, railroad ballast, and a variety of miscellaneous uses.

Table 6.—South Dakota: Stone sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Kind of stone	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone total [1]	37	7,017	40	7,474
Crushed and broken:				
Limestone	1,685	1,945	1,661	1,843
Other stone [2]	944	1,905	1,043	2,290
Total [3]	2,665	10,864	2,745	11,607

[1] Data include granite, quartz (1972), and quartzite (1973).
[2] Data include quartz (1972), and quartzite.
[3] Data may not add to totals shown because of independent rounding.

Table 7.—South Dakota: Stone sold or used by producers, by use
(Thousand short tons and thousand dollars, unless otherwise specified)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and architectural work	W	W	W	W
Dressed architectural ---- thousand cubic feet	[1] 239	W	281	W
Rough monumental ---- do				
Dressed monumental ---- do	178	4,290	128	W
Total (thousand short tons)	37	7,017	40	7,474
Crushed and broken stone:				
Bituminous aggregate	339	584	236	472
Concrete aggregate	781	1,360	1,027	2,015
Macadam aggregate	1	1	1	1
Surface treatment aggregate	51	75	107	149
Cement manufacture	600	391	([2])	([2])
Riprap and jetty stone	58	108	33	63
Other uses [2]	799	1,329	1,299	1,433
Total[3]	2,628	3,847	2,704	4,133
Grand total [3]	2,665	10,864	2,745	11,607

W Withheld to avoid disclosing individual company confidential data; included in "Dimension stone total."
[1] Data includes a minor amount of stone used in structural and sanitary purposes, (1972).
[2] Includes stone used for agricultural lime, lime manufacture, other filler, dense graded roadbase stone, railroad ballast, uses not specified, terrazzo, (1972). 1973 data also include stone used in unspecified construction aggregate and roadstone, and cement manufacture.
[3] Data may not add to totals shown because of independent rounding.

METALS

Gold and Silver.—At Lead, S.D., the Homestake Mining Co. produced 357,575 ounces of gold and 71,939 ounces of silver from 1.57 million tons of ore milled. Outputs were down 12% for gold and 28% for silver from the 1972 amounts. Total values, however, rose 46% and 10% for gold and silver, respectively. The average grade recovered was 0.227 ounce per ton in gold content compared with 0.278 ounce per ton in 1972, an 18% drop in grade. The percentage of gold recovered from the ore compared with the content determined by sampling rose to nearly 95% by yearend as a result of utilizing a new charcoal-in-pulp process for gold/cyanide extraction. The new unit began functioning in March 1973 and replaced a 65-year-old slime treatment plant at Deadwood. A shortage of skilled miners continued to limit production from the Homestake mine. Effective April 1, the work week for miners was shortened to 40 hours as a result of stipulations in a labor contract signed in August 1972. Company efforts to increase the work week were rejected later in the year.

Table 8.—South Dakota: Mine production (recoverable) of gold and silver

	1971	1972	1973
Mines producing: Lode	1	1	1
Material sold or treated: Gold ore ---- thousand short tons	1,800	1,467	1,574
Production (recoverable):			
Quantity:			
Gold ---- troy ounces	513,427	407,430	357,575
Silver ---- do	106,785	99,992	71,939
Value:			
Gold ---- thousands	$21,179	$23,875	$34,974
Silver ---- do	165	168	184
Total ---- do	21,344	24,043	35,158

Table 9.—South Dakota: Homestake mine ore milled and receipts for gold produced

Year	Ore milled (thousand short tons)	Receipts for gold products	
		Total (thousands)	Per ton
1969	1,935	$24,570	$12.70
1970	1,954	21,059	10.78
1971	1,800	21,179	11.77
1972	1,467	23,875	16.27
1973	1,574	34,974	22.22

Source: Homestake Mining Co. Annual Reports.

A contract was let late in 1973 to sink the No. 7 winze and deepen the No. 8 shaft from the 7200 level to the 8000 level. A major crosscut was driven on the 5300 level into new ground, and several stopes were prepared for extraction by blasthole methods, which dilute the ore but provide greater manshift tonnages. Ore reserves were estimated to total 9.05 million tons averaging 0.249 ounce of gold per ton at the end of 1973.

Uranium and Vanadium.—Susquehanna Western, Inc., curtailed uranium ore production at Edgemont owing to unsatisfactory uranium oxide prices. The firm maintained a small crew doing underground exploration. Mines Development Co. recovered vanadium from old tailings received from out-of-State, and the leach liquors from this operation then were sent through a recovery circuit for uranium. A small amount of yellow cake was recovered by this method during the year.

During 1973, Mobil Oil Co. was reportedly conducting extensive exploration activities for uranium in western Harding County and across the border in Carter County, Mont. Drilling depths indicated any ore bodies found would be developed and mined by underground methods.

MINERAL FUELS

Coal (Lignite).—Prospecting permits were issued by the State School and Public Lands Department for coal on lands located near Camp Cook in Harding County. Private lands were also leased for coal exploration in the same county. Approximately 21,000 acres of State lands were covered by permits at the end of 1973, including 14,700 acres in Harding County, 5,480 acres in Fall River County, and 837 acres in Custer County. Some of the lease areas were reportedly being explored for uranium in addition to coal. The State Environmental Protection Department required bonding and submission of a plan of operations and land reclamation before any coal mining could begin.

The pilot coal gasification plant, built by Consolidation Coal Co. and operated by Stearns Roger Corp. on the outskirts of Rapid City, successfully produced gas during 1973 in test runs, and subcontracts were awarded for construction of a $1.7 million methanation unit to improve the product to pipeline-quality gas. The additional work was scheduled for completion in mid-1974.

Petroleum.—Crude oil production increased 26% in quantity and 72% in value in 1973. The State had 26 producing oil wells, most of them in the Buffalo field, northwest of Buffalo in Harding County. About 65% of total production was from the Buffalo field. One well, the Depco 42-27, in Yellow Hair field, supplied about 30% of total State production. Three wells in the Barker Dome field and one in the South Medicine Pole field produced the balance of the crude. Natural gas, used for repressuring, was produced at about 10 wells.

Exploration footage declined 37%, and of 21 holes drilled outside of proved fields, 4 were successful in finding oil. One hole in a proven field was also successful. Completion of a well by Depco, Inc., the 1-Ferkingstad well, resulted in the establishment of a new field named the State Line. The field embraced 12 sections, 3 of which were located in the eastern part of T 23 N, R 4 E, and 9, in the western part of T 23 N, R 5 E. About 4 miles south of the southern boundary of the new field, Hanover Planning Co., Inc., and Kenneth L. Luff completed a discovery well on the Travers Ranch. A permit was

issued to drill an oil test in the southern part of the State, 3 miles southeast of Provo.

An oil and gas lease sale on State lands in August resulted in leasing of 33,000 acres in six western counties. The highest price was $6.37 per acre for 80 acres in Harding County.

Table 10.—South Dakota: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Butte	--	--	--	--	--	2	2	5,044
Fall River	--	--	--	--	--	2	2	5,120
Haakon	--	--	--	--	--	1	1	2,533
Harding	1	--	--	4	--	8	13	81,918
Hughes	--	--	--	--	--	1	1	2,416
Lyman	--	--	--	--	--	1	1	1,921
Shannon	--	--	--	--	--	1	1	900
Tripp	--	--	--	--	--	1	1	2,247
Total	1	--	--	4	--	17	22	102,099

[1] Development wells as defined by American Petroleum Institute.
Source: American Petroleum Institute.

Table 11.—Principal producers

Commodity and company	Address	Type of activity	County
Cement: South Dakota Cement Commission.	Drawer 351 Rapid City, S. Dak. 57701	Wet-process, 3-rotary-kiln plant.	Pennington.
Clays:			
American Colloid Co	5100 Suffield Ct. Skokie, Ill. 60076	Open pit mine and plant.	Butte.
Light Aggregates, Inc	Box 1922 Rapid City, S. Dak. 57701	---- do	Pennington.
South Dakota Cement Commission	Drawer 351 Rapid City, S. Dak. 57701	Open pit mine	Do.
Feldspar: Pacer Corp	Box 311 Custer, S. Dak. 57730	Open pit mines and dry-grinding plant.	Custer.
Gold: Homestake Mining Co	Lead, S. Dak. 57754	Underground mine, cyanidation mill, and refinery.	Lawrence.
Gypsum: South Dakota Cement Commission.	Drawer 351 Rapid City, S. Dak. 57701	Open pit mine	Meade.
Lime: Pete Lien & Sons	Box 3124, P.O. Annex Rapid City, S. Dak. 57703	1-rotary-kiln, 1-vertical-kiln, continuous-hydrator plant.	Pennington.
Petroleum:			
The Ozark Corp	Box 2491 Casper, Wyo. 82601	Crude oil wells	Custer (Barker Dome field).
Pennzoil United, Inc	900 Southwest Tower Houston, Tex. 77002	---- do	Harding (Buffalo field).
Phillips Petroleum Co	Frank Phillips Bldg. Bartlesville, Okla. 74003	---- do	Do.
Sand and gravel (commercial):			
Birdsall Sand and Gravel Co., Inc	Box 767 Rapid City, S. Dak. 57701	Pit and plant	Fall River and Pennington.
Concrete Materials Inc	3000 W. Madison St. Sioux Falls, S. Dak. 57104	Pits	Minnehaha.
H. W. Faber & Sons Construction	Sheldon, Iowa 51201	---- do	Various.
Highway Construction Co	Box 511 Rapid City, S. Dak. 57701	2 plants	Pennington.
Mannerud Inc	612 13th Avenue Brookings, S. Dak. 57006	1 plant	Brookings.
N & M Construction Inc	Box 337 Sturgis, S. Dak. 57785	Pit	Meade.
Reynolds Construction Co	Box 689 Sioux Falls, S. Dak. 57101	Pit	Minnehaha.
Wellborg Brothers Inc	Dell Rapids, S. Dak. 57022	2 pits and mill	Hamlin and Hand.
Silver: Homestake Mining Co	Lead, S. Dak. 57754	*See* Gold	Lawrence.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone:			
Cold Spring Granite Co	Cold Spring, Minn. 56320.	2 quarries	Grant.
Concrete Materials Co	3000 West Madison Street Sioux Falls, S. Dak. 57104	Quarry and plant	Minnehaha.
Dakota Granite Co	Box 269 Milbank, S. Dak. 57252	2 quarries	Grant.
Hills Materials Co	Box 1392 Rapid City, S. Dak. 57701	Quarry and plant	Pennington.
Lee Construction Co	Box 348 Spearfish, S. Dak. 57783	Quarry	Lawrence.
L. G. Everist, Inc	302 Paulton Bldg. Sioux Falls, S. Dak. 57102	Quarry and plant ---- do	Minnehaha. Pennington.
Pete Lien & Sons	Box 3124, P.O. Annex Rapid City, S. Dak. 57703	---- do	Do.
South Dakota Cement Commission	Drawer 351 Rapid City, S. Dak. 57701	---- do	Do.
Spencer Quarries, Inc	Spencer, S. Dak. 57374	Quarry	Hanson.
Woidneck Construction Co	710 Wilson St. Winner, S. Dak. 57580	---- do	Tripp.

The Mineral Industry of Tennessee

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Tennessee Division of Geology, for collecting information on all minerals.

By Herbert R. Babitzke,[1] William D. Hardeman,[2] and Robert E. Hershey [3]

The 1973 production of the Tennessee mineral industry was valued at $276 million, an increase of 2% over that of 1972. Tennessee was the leading producing State for ball clay and pyrite.

The development and continued exploration of the zinc ore body in middle Tennessee and the announcement of plans for a new electrolytic zinc refinery at Clarksville were the most significant aspects of Tennessee's mineral industry in 1973.

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.
[2] Liaison officer, Bureau of Mines, Nashville, Tenn.
[3] State geologist, Department of Conservation, Division of Geology, Nashville, Tenn.

Table 1.—Mineral production in Tennessee [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Cement:				
Portland ---------- thousand short tons --	1,695	$37,176	1,711	$42,402
Masonry ---------- do ----	176	4,104	201	7,908
Clays [2] ---------- do ----	1,718	7,719	1,719	9,083
Coal (bituminous) ---------- do ----	11,260	81,386	8,219	66,827
Copper (recoverable content of ores, etc.) ---------- short tons --	11,310	11,581	8,500	10,115
Gold (recoverable content or ores, etc.) ---------- troy ounces --	176	10	68	7
Natural gas ---------- million cubic feet --	25	8	20	6
Petroleum (crude) thousand 42-gallon barrels --	198	W	201	W
Phosphate rock ---------- thousand short tons --	2,154	10,732	2,512	12,799
Sand and gravel ---------- do ----	10,839	15,328	12,010	20,145
Silver (recoverable content of ores, etc.) thousand troy ounces --	83	141	73	187
Stone ---------- thousand short tons --	35,942	55,512	42,742	71,116
Zinc (recoverable content of ores, etc.) ---------- short tons --	101,722	36,111	64,172	26,516
Value of items that cannot be disclosed: Barite, clay (fuller's earth), lime, pyrites, and values indicated by the symbol W ----	XX	10,006	XX	8,579
Total ----------	XX	269,814	XX	275,690
Total 1967 constant dollars ----------	XX	222,624	XX	p 202,412

p Preliminary. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes fuller's earth; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Tennessee, by county [1 2]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Anderson	W	W	Coal, stone.
Bedford	W	$854	Stone.
Benton	W	W	Sand and gravel, stone.
Bledsoe	W	W	Coal.
Blount	W	2,423	Stone.
Bradley	W	W	Do.
Campbell	$16,225	W	Coal, stone, sand and gravel.
Cannon	W	195	Stone.
Carroll	W	W	Clays.
Carter	W	W	Stone.
Claiborne	W	W	Coal, stone, petroleum.
Clay	W	265	Stone, petroleum.
Cocke	W	147	Stone.
Coffee	W	W	Sand and gravel, stone.
Cumberland	2,515	W	Stone, sand and gravel, coal.
Davidson	13,212	W	Stone, cement, clays.
Decatur	W	W	Stone, sand and gravel.
DeKalb	231	243	Stone.
Dickson	W	W	Do.
Dyer	--	38	Sand and gravel.
Fayette	W	64	Do.
Fentress	2,883	821	Coal, stone, petroleum.
Franklin	5,142	8,919	Cement, stone, sand and gravel, clays.
Gibson	W	W	Clays.
Giles	968	W	Phosphate rock, stone.
Grainger	35	W	Stone.
Greene	W	W	Do.
Grundy	W	518	Coal, stone.
Hamblen	W	W	Stone.
Hamilton	16,651	20,181	Cement, stone, sand and gravel, clays.
Hancock	W	--	
Hardeman	W	W	Sand and gravel.
Hardin	W	W	Stone, sand and gravel.
Hawkins	W	W	Do.
Haywood	W	12	Sand and gravel.
Henderson	W	W	Do.
Henry	2,568	W	Clays, sand and gravel.
Hickman	W	W	Phosphate rock.
Humphreys	W	W	Sand and gravel, stone.
Jackson	--	W	Stone.
Jefferson	26,981	23,977	Zinc, stone.
Johnson	W	W	Stone.
Knox	22,347	19,486	Cement, stone, lime, zinc, sand and gravel, clays.
Lauderdale	W	83	Sand and gravel.
Lawrence	W	438	Stone.
Lincoln	W	W	Do.
Loudon	W	1,610	Stone, clays, barite, sand and gravel.
McMinn	W	W	Stone, sand gravel.
McNairy	W	129	Sand and gravel.
Macon	W	W	Stone.
Madison	--	W	Sand and gravel.
Marion	W	W	Cement, coal, stone.
Marshall	W	W	Stone.
Maury	W	W	Phosphate rock, stone.
Meigs	W	W	Stone, barite.
Monroe	759	W	Stone, sand and gravel.
Montgomery	W	W	Stone.
Moore	30	--	
Morgan	3,626	3,310	Coal, petroleum, natural gas.
Obion	W	168	Sand and gravel.
Overton	460	W	Stone, petroleum.
Perry	182	W	Sand and gravel.
Pickett	W	(3)	Petroleum.
Polk	20,231	17,139	Copper, pyrites, zinc, silver, sand and gravel, gold.
Putnam	1,410	1,973	Stone, coal, sand and gravel, petroleum.
Rhea	W	W	Stone.
Roane	W	1,907	Stone, coal, sand and gravel.
Robertson	W	W	Stone, petroleum.
Rutherford	W	1,400	Stone.
Scott	11,574	8,009	Coal, petroleum, natural gas.
Sequatchie	W	3,222	Coal.
Sevier	W	W	Stone, sand and gravel.
Shelby	4,072	6,408	Sand and gravel.
Smith	W	57	Stone.
Stewart	W	404	Do.
Sullivan	W	W	Cement, stone, clays.
Sumner	W	W	Stone.

See footnotes at end of table.

Table 2.—Value of mineral production in Tennessee, by county [1] [2]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Tipton	$13	W	Sand and gravel.
Unicoi	W	W	Sand and gravel, stone.
Union	W	W	Stone.
Van Buren	W	W	Coal.
Warren	W	W	Stone, natural gas.
Washington	W	W	Sand and gravel, stone, clays.
Wayne	W	W	Sand and gravel.
Weakley	4,761	$5,258	Clays.
White	1,094	W	Stone.
Williamson	5,360	6,539	Phosphate rock, stone.
Wilson	W	W	Stone.
Undistributed [4]	106,486	139,493	
Total [5]	269,814	275,960	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Cheatham, Chester, Crockett, Houston, Lake, Lewis, and Trousdale.

[2] Value of petroleum is based on one average price per barrel for the State.

[3] Less than ½ unit.

[4] Includes some sand and gravel that cannot be assigned to specific counties and values indicated by symbol W.

[5] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Tennessee business activity

		1972	1973 [p]	Change, percent
Employment and labor force, annual average:				
Total work force	thousands	1,719.3	1,798.0	+4.6
Unemployment	do	62.4	54.7	−12.3
Total nonagricultural employment	do	1,451.3	1,538.7	+6.0
Mining	do	6.9	6.9	--
Manufacturing	do	490.6	521.7	+6.3
Construction	do	76.1	83.7	+10.0
Transportation and public utilities	do	69.1	72.4	+4.8
Wholesale and retail trade	do	295.7	315.6	+6.7
Finance, insurance, and real estate	do	62.0	66.9	+7.9
Services	do	210.3	227.1	+8.0
Government	do	240.6	244.4	+1.6
Personal income:				
Total	millions	$14,796	$16,279	+10.0
Per capita		$3,671	$3,946	+7.5
Construction activity:				
Number of new housing units authorized		45,997	38,177	−17.0
Value of nonresidential construction	millions	$312.3	$383.3	+22.7
Cement shipments to and within Tennessee	thousand short tons	1,800	1,952	+8.4
Mineral production value	millions	$296.8	$275.7	+2.2

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; U.S. Bureau of Mines.

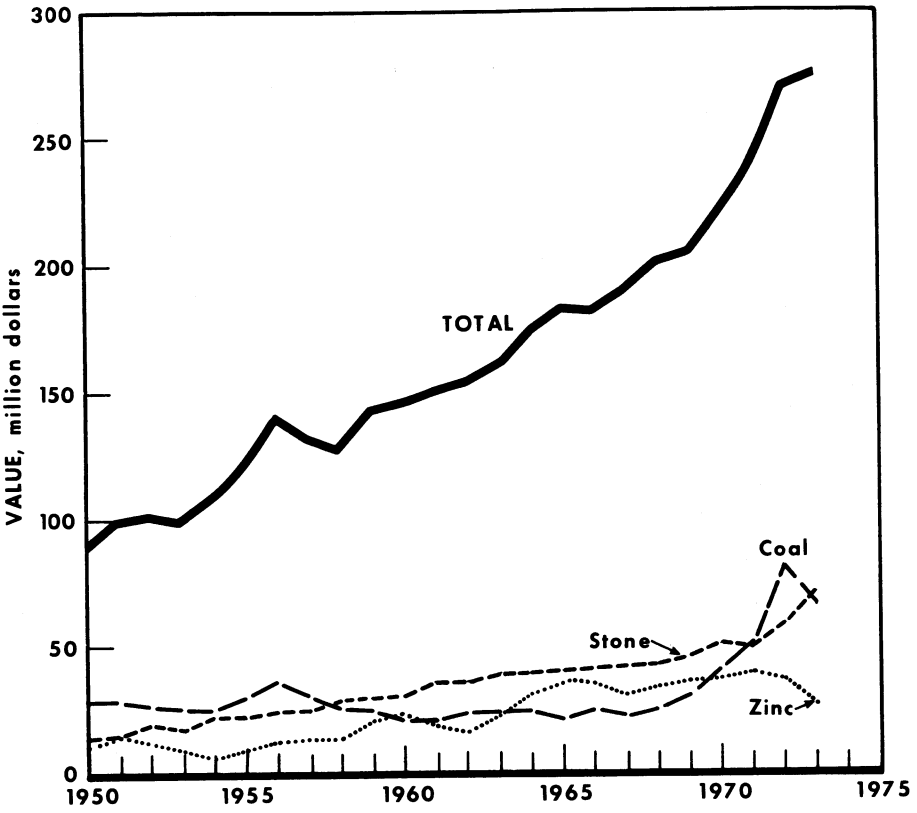

Figure 1.—Value of stone, coal, zinc, and total value of mineral production in Tennessee.

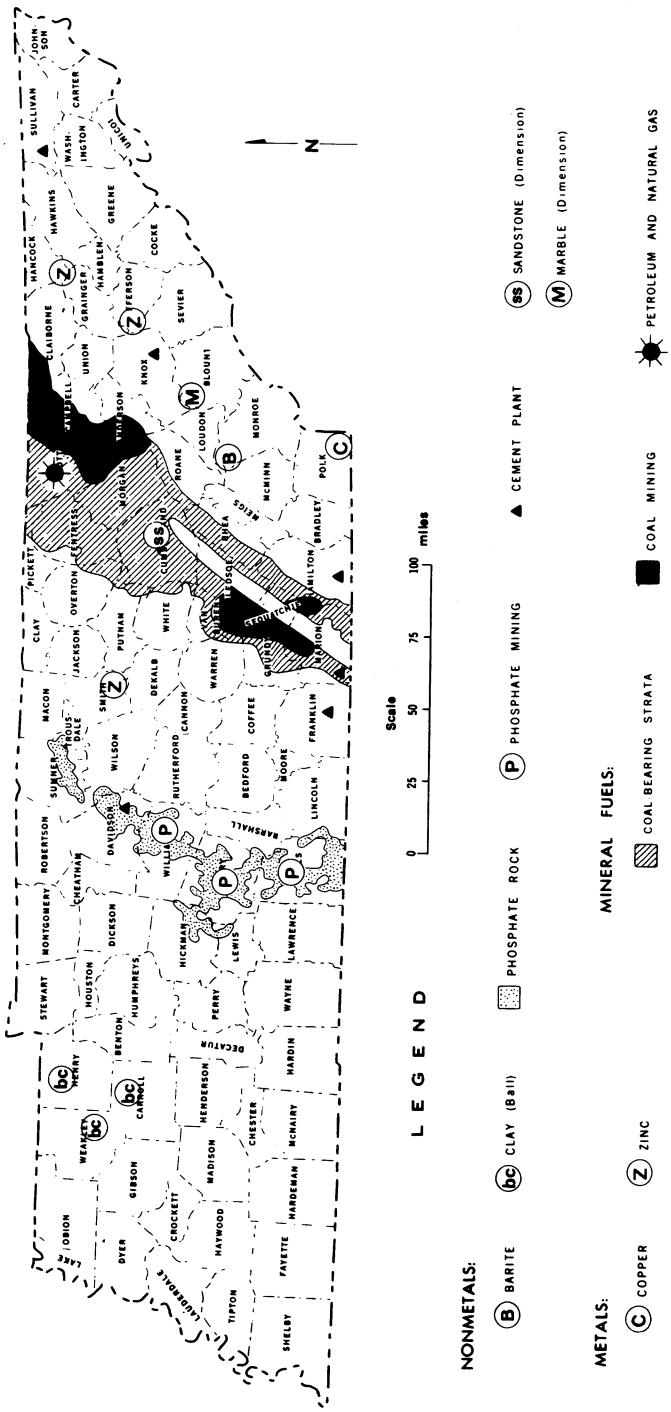

Figure 2.—Generalized map of selected mining areas and industries in Tennessee.

Legislation and Government Programs.—The Tennessee Division of Geology continued its State-wide program of quadrangle mapping of geology and mineral resources. Fifteen new geologic maps with summaries of the mineral resources were published for the following 7-½-minute quadrangles: Appleton, Brick Church, Beech Grove, Centertown, Fredonia, Fayetteville, Hartsville, Hillsdale, Kingston Springs, Oak Hill, Pickwick, Noah, Roddy, Tullahoma, and Westmoreland. This mapping program is a continuing cooperative project with the Tennessee Valley Authority (TVA), and 282 maps and mineral resources summaries have been published since the program began in 1962. In another cooperative mapping program with TVA, seven total intensity magnetic quadrangle maps were published: Cookeville East, Monterey, Obey City, Dry Valley, Monterey Lake, Campbell Junction and Isoline. In cooperation with the Federal Bureau of Mines, a detailed report on the strippable coal reserves of the northern Cumberland Plateau area was published. A detailed report on the "Geology of Knox County, Tennessee" was also published.

An inventory of mining establishments and mineral processing industries was completed. The inventory contains pertinent information on 647 operations and was made by the Divisions of Geology with the assistance of grants from both the Bureau of Mines and TVA.

The Tennessee Division of Surface Mining (Conservation Department) continued its supervision of surface mining and mine reclamation on all commodities surface-mined in Tennessee with the exception of quarries. Offices are maintained in Nashville and Knoxville. During 1973, 4,742 acres were permitted for surface mining operations. Permits for coal (3,116 acres) and phosphate (781 acres) constituted the the major portion of the acreage permitted.

TVA continued construction on three major power plants: the Sequoyah nuclear plant, the Racoon Mountain pumped storage plant, and the Watts Bar nuclear plant. The first unit of the Sequoyah plant (near Chattanooga) is now scheduled for commercial operations in June 1977; the first unit at the Racoon Mountain project (also near Chattanooga) in October 1976, and the first unit at Watts Bar (near Knoxville) in December 1979. Construction continued on the Normandy Dam on the Duck River in middle Tennessee; completion was slated for January 1976.

The Geologic Branch of TVA continued its investigation and appraisal of thermal powerplant sites along the Tennessee and Cumberland Rivers. A system of sophisticated geophysical logging techniques was used to reduce the amount of core drilling needed in the investigations.

The Mineral Resources Section of the Geologic Branch continued its program of airborne magnetic surveying. An area of 2,100 square miles north and west of Chattanooga was flown on a 1-mile spacing. Data were being processed by computer methods, and the resulting magnetic contour maps will be published by the Tennessee Division of Geology as a cooperative project. The section continued to compile mineral resource-related data for storage in the U.S. Geological Survey Computerized Resources Information Bank (CRIB) system. A detailed report on the old Coker Creek gold area was completed and was in process of publication by the Division of Geology.

The U.S. Geological Survey conducted cooperative water resources and geological investigations with various State agencies, primarily the Division of Water Resources and the Division of Geology; and also conducted independent studies, such as its program of Land Resources Analysis and a region-wide program to study the oil and gas potential of the Appalachian Region. The cooperative topographic mapping program continued with the support of the Tennessee Division of Geology. The final quadrangles needed for complete State coverage were in process.

The Mining Enforcement and Safety Administration (MESA) maintained a subdistrict office in Knoxville (metal and nonmetallic mining inspection) and field offices in Jellico and Jasper (coal mining inspection).

Taxes.—Tennessee had a privilege tax on oil of 4.2 cents per barrel and 5% gross value tax on gas. Effective October 1, 1972, the severence tax on coal was 1-½% of the market value, not to exceed 10 cents per ton.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Nonmetals accounted for 62% of the total mineral production value in Tennessee, an increase of 22% over that of 1972. The two principal nonmetallic commodities were stone and cement.

Barite.—Two companies operated open pit mines and two plants in the Sweetwater district of eastern Tennessee. NL Industries, Inc., Baroid Div., shipped ore to New Orleans to be used in foundries or to be ground for use as drilling mud. B.C. Wood Co. shipped ore out of State as crude barite. Output of barite increased in quantity, but decreased in value compared with 1972 figures. Permits were issued by the Tennessee Department of Conservation, Division of Surface Mining, allowing 6 acres of land to be disturbed for production of barite in 1973.

Cement.—Shipments of portland cement were 1.7 million tons valued at $42 million, increases of 1% and 14%, respectively, over those of 1972. Masonry cement shipments during the year were 200,580 tons, valued at $7.9 million. Quantity increased 14% over that of last year, but the value nearly doubled. Portland cement was produced by four companies at six plants, and masonry cement was produced at five plants.

Raw materials used were limestone, clay and shale, sand, gypsum, and iron-bearing materials. About 67% of the portland cement was consumed for ready-mix concrete, 20% was used for concrete products, 6% for building materials, and 7% for contractors and other uses. Types of portland cement shipped included types I and II (general use and moderate heat), type III (high-early-strength), white, slag-pozzolan, and expansive.

Cement plants were faced with emission problems. The emissions reportedly posed no health hazzard, but were more of a nuisance with carbon tending to settle, especially on automobiles.[4]

Clays.—Tennessee produced 64% of the total ball clay in the United States, thus ranking the State as first in ball clay production in 1973. Other clays produced included fire clay, fuller's earth, and miscellaneous clays. Permits were issued by the State allowing 360 acres of land to be distributed for clay removal in 1973.

Ball clay production was 487,625 tons valued at $7.7 million, increases of 13% in quantity and 20% in value over those of 1972. This clay was mined from open pits in Carroll, Gibson, Henry, and Weakley Counties. Major uses for ball clay were for floor and wall tile, pottery, sanitary ware, common brick, crockery and other earthenware, electrical porcelain, fine china, glazes, glass and enamels, firebrick, high alumina refractories, kiln furniture, oil refining catalysts, drilling mud, pesticides, rubber asphalt emulsion, and quarry tile. About 11% of the clay products produced were exported.

Production of fuller's earth, all of which was from Henry County, and value were up from those of 1972. Major uses for this clay was for oil and grease absorbent, pet absorbent, and pesticides.

Miscellaneous clay production was down from that of 1972 but value was up. This clay was used for common building and face brick, lightweight aggregate, and cement.

Table 4.—Tennessee: Ball clay sold or used by producers, by use
(Short tons)

Use	1972	1973
Floor and wall tile	76,820	74,486
Pottery	100,029	113,380
Sanitary ware	164,300	171,047
Other uses[1]	89,977	128,712
Total	431,126	487,625

[1] Includes common brick (1973); catalysts for oil refining (1973); crockery and other earthenware; drilling mud (1973); fine china/dinnerware; electrical porcelain; asphalt emulsion; firebrick, block, and shapes; glazes, glass, and enamels; high alumina refractories (1973); kiln furniture; pesticides and related products; rubber; asphalt tile; quarry tile (1973); and exports.

Graphite.—Synthetic graphite was produced from petroleum coke by Union Carbide Corp. at its plant near Columbia, Tenn. The graphite was used chiefly in the manufacture of furnace electrodes. Production increased over that of last year.

Lime.—Williams Lime Mfg. Co. and

[4] The Chattanooga Times. Cement Plant is Found With Emission Problem. V. 104, No. 145, May 9, 1973, p. 3.
———. Pollution Laws May Shut Plant. V. 104, No. 213, July 16, 1973, p. 2.

Tennessee Lime Co. produced lime in Knox County for paper and pulp, water purification, lithium manufacture, and other uses. Output decreased 8% and was 17% below the 1967 record. Total consumption of lime in Tennessee during the year was 155,700 tons.

The Foote Mineral Co., Asbury plant was sold on December 7, 1973, to the Rangaire Corp. Cleburne, Tex. The name will be Tennessee Lime Co., a subsidiary of the Rangaire Corp.

Mullite.—Tennessee Electro Minerals Corp. at Greenville produced a small quantity of synthetic mullite in 1973. All the mullite was used for special-duty refractory material.

Perlite.—Chemrock Corp. continued expanding crude perlite at its plant in Nashville. The product was used as filter aids, concrete aggregate, plaster aggregate, and horticulture aggregate.

Phosphate Rock.—Tennessee ranked third in the Nation in phosphate rock production and value. The mining activity and plants are located in Giles, Hickman, Maury, and Williamson Counties in middle Tennessee.

Marketable production was 2,511,853 tons in 1973, valued at $12.8 million, an increase of 17% in tonnage and 19% in value. Most of the phosphate rock mined was used in the manufacture of elemental phosphorus and a small amount was used in fertilizer production.

Production was by Monsanto Co., Hooker Chemical Corp., Stauffer Chemical Co., and TVA. All the phosphate rock was mined by open pit methods and shipped to plants near the mines. Permits were issued by the State allowing 781 acres of land to be distributed in 1973 for mining phosphate rock.

The industry was operating at full capacity during the year, and demand continued to increase.

Pyrite.—Tennessee led the Nation in pyrite output in 1973 even though production tonnage and value decreased from that of last year. The only producer in the State was Cities Servce Co. at Copperhill, Tenn. Pyrite was recovered by flotation from sulfide ore mined in Polk County. Markets for the industrial chemicals recovered continued to be strong throughout the year. Cities Service Co. sold 910,000 tons of sulfuric acid, a major portion of which came from Tennessee.

The modernization and expansion of manufacturing facilities in Copperhill, Tenn., was completed in early 1973. However, by yearend, the iron roasting and pelletizing unit had not operated satisfactorily, and major modifications were going to be required. Production of primary products will be limited until the revamping is completed.[5]

Sand and Gravel.—Sand and gravel production and value increased 11% and 31%, respectively, over that of 1972.

Shelby County continued to be the leading producing county during the year supplying 37% of the total sand and gravel produced, followed by Benton County with 13%. Commercial sand and gravel production accounted for 95% of the total; the remainder was produced by State and county Governments for paving and buildings. Production came from 51 locations, and permits were issued by the State allowing 479 acres of land to be disturbed for the removal of sand and gravel in 1973.

Benton County continued production of industrial, underground sand used for glass and molding. Nearly all of this sand was produced by Hardy Sand Co. for the Ford Motor Co. glass plant in Nashville.

[5] Cities Service Co. 1973 Annual Report. Pp. 9–10.

Table 5.—Tennessee: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Benton	6	1,426	2,275	7	1,533	2,623
Coffee	--	--	--	1	279	W
Decatur	1	166	265	1	W	275
Dyer	--	--	--	1	101	38
Fayette	2	W	W	4	86	64
Franklin	1	W	W	3	199	W
Grundy	1	208	416	--	--	--
Haywood	1	W	W	1	32	12
Humphreys	1	W	W	2	548	W
Lauderdale	1	W	W	4	W	83
McNairy	1	W	W	2	123	129
Obion	2	W	W	4	223	168
Perry	1	182	182	2	673	W
Shelby	7	3,111	4,072	16	4,489	6,408
Tipton	1	114	13	4	W	W
Undistributed [1]	r 25	5,634	8,107	27	3,722	10,344
Total [2]	51	10,839	15,328	79	12,010	20,145

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Campbell, Cumberland, Gibson (1972), Greene (1972), Hamilton, Hardeman, Hardin, Hawkins, Henderson, Henry (1973), Knox, Loudon, McMinn, Madison (1973), Monroe, Polk, Putnam, Roane (1973), Sevier, Stewart (1972), Unicoi, Washington, and Wayne and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 6.—Tennessee: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,314	4,580	3,460	5,801
Chemical	--	--	15	W
Fill	97	96	418	430
Glass	W	W	304	1,413
Molding	181	640	217	689
Paving	1,620	2,561	1,501	2,782
Other uses [1]	455	1,445	412	1,457
Total [2]	5,667	9,322	6,328	12,573
Gravel:				
Building	2,797	3,403	2,462	3,861
Fill	93	110	301	359
Paving	W	W	2,036	2,703
Miscellaneous	259	229	W	W
Other uses [3]	1,625	2,093	331	387
Total [2]	4,775	5,834	5,129	7,311
Government-and-contractor operations:				
Sand: Paving	2	2	--	--
Gravel:				
Building	38	3	--	--
Paving	358	166	554	262
Total	396	169	554	262
Total sand and gravel [2]	10,839	15,328	12,010	20,145

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes blast (1973), engine, fire or furnace, grinding and polishing, oil (hydrofrac) (1973), foundry, and other industrial sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast.

Silicon Carbide.—The Carborundum Co. at Jacksboro produced silicon carbide in 1973. The product was used for abrasives, refractories, and metallurgical applications.

Stone.—Stone regained its lead as the major mineral commodity produced in Tennessee in terms of value by supplying 26% of the State's income from mineral products in 1973. Production was 42.7 million tons valued at $71 million, increases of 19% and 28%, respectively, over those of 1972. Davidson County continued to lead in production, followed by Knox County.

Limestone was produced at 116 quarries, dolomite at 2, marble at 6, sandstone at 3, and quartzite at 3, for a total of 130 production sites in 61 counties. A total of 84 companies were in operation at the quarries. Of the 130 sites, 91 produced more than 100,000 tons of stone, and 9 quarries produced more than 900,000 tons in 1973.

Crushed limestone continues to be of the greatest significance in terms of tonnage and value of all the stone produced, 99% and 96%, respectively. End uses for limestone were dense graded road base stone (36%), concrete aggregate (12%), bituminous aggregate (11%), agricultural purposes (7%), macadam aggregate (5%), cement (5%), and numerous miscellaneous uses (24%).

Most of the dolomite produced was for agricultural uses. The marble was primarily used as rough blocks or cut stone, whereas the crushed marble was for terrazzo and exposed aggregate. The sandstone was used for house stone veneer and flagging; the crushed and broken form was used for bituminous aggregate, abrasives, and in the production of ferrosilicon. Most of the quartzite was irregular-shaped stone, house stone veneer, rubble, and cut stone.

Table 7.—Tennessee: Crushed limestone [1] sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value
Bedford	1	W	W	1	W	854
Cannon	1	W	W	1	118	195
Clay	1	77	118	1	W	261
Cocke	1	W	W	1	118	147
Davidson	7	5,030	7,373	8	5,738	8,741
DeKalb	1	W	231	1	W	243
Fentress	1	178	262	2	229	369
Franklin	4	1,097	W	4	W	W
Giles	2	W	W	1	255	424
Grundy	1	W	W	1	W	95
Jefferson	3	826	881	3	870	975
Knox	7	2,333	4,058	7	2,936	4,928
Lawrence	1	88	W	1	262	438
Marion	4	1,529	1,644	4	1,739	2,537
McMinn	2	580	949	2	W	W
Moore	1	W	30	--	--	--
Pickett	1	24	36	--	--	--
Rutherford	4	W	W	3	1,032	1,400
Smith	1	W	W	1	41	57
Stewart	1	210	261	1	252	404
Unicoi	--	--	--	1	114	140
Warren	2	W	W	2	W	453
Washington	5	137	240	5	122	229
White	1	164	349	4	W	W
Undistributed [2]	r 63	23,467	36,866	61	28,648	45,151
Total [3]	116	35,740	53,297	116	42,473	68,041

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Limestone used generally to include dolomite.

[2] Includes Anderson, Benton, Blount, Bradley, Campbell, Carter, Claiborne, Coffee, Cumberland, Decatur, Dickson, Greene, Hamblen, Hamilton, Hancock (1972), Hardin, Hawkins, Humphreys, Jackson (1973), Johnson, Lincoln, Loudon, Macon, Marshall, Maury, Meigs, Monroe, Montgomery, Overton, Putnam, Rhea, Roane, Robertson, Sevier, Sullivan, Sumner, Union, Williamson, and Wilson Counties and production for which no county breakdown is available.

[3] Data may not add to totals shown because of independent rounding.

Table 8.—Tennessee: Crushed limestone [1] sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	2498	3,707	4,786	7,776
Concrete aggregate	5,115	7,478	5,290	8,055
Dense graded road base stone	12,345	18,361	15,417	23,716
Macadam aggregate	2,245	3,285	2,317	3,592
Surface treatment aggregate	1,713	2,566	1,799	2,951
Unspecified construction aggregate and roadstone	4,715	6,856	4,619	7,686
Agricultural purposes [2]	2,541	3,913	2,852	4,554
Cement manufacture	2,474	3,266	2,270	3,897
Lime manufacture			192	268
Fill	50	88	--	--
Manufactured fine aggregate (stone sand)	85	103	638	1,284
Railroad ballast	120	W	W	W
Riprap and jetty stone	825	1,262	949	1,427
Other uses [3]	1,016	2,412	1,343	2,835
Total [4]	35,740	53,297	42,473	68,041

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Limestone used generally to include dolomite.
[2] Data includes agricultural limestone, poultry grit, and mineral food.
[3] Includes chemicals, drain fields, filter stone (1973), flux stone (1972), glass (1972), other fillers, refractory stone (1973), roofing aggregates, and uses not specified.
[4] Data may not add to totals shown because of independent rounding.

Vermiculite.—Construction Products Div. of W. R. Grace & Co. at Nashville expanded crude vermiculite in 1973. The product was used for concrete aggregate, plaster aggregate, loose fill insulation, and horticulture.

METALS

Metals accounted for 13% of the total value of mineral production in 1973. Zinc was 72% of the metal value, and copper accounted for most of the remainder. Total metal production was down 36% from that of 1972.

Aluminum.—Tennessee ranked third in the Nation in quantity and value of aluminum produced in 1973. Production and value were up 44% and 39%, respectively, over those of 1972. The Aluminum Co. of America (Alcoa) at Alcoa, Tenn., Blount County, and Consolidated Aluminum Corp. (Conalco) in Humphreys County produced all the aluminum metal from alumina imported from outside the State. Conalco (owned 60% by Swiss Aluminium Ltd. and 40% by Phelps Dodge Corp.) has a combined annual capacity of 175,000 tons per year of primary aluminum at its reduction plants at New Johnsonville, Tenn., and Lake Charles, La.[6]

Alcoa continued producing aluminum at capacity during the year. In addition to the smelting plant, Alcoa also operates a fabricating plant at Alcoa. Construction was authorized for an additional scrap recycling plant at Tennessee. The plant will be capable of handling 36,000 tons of aluminum scrap annually.[7]

Copper.—Copper production in Tennessee was 8,500 short tons valued at $10 million in 1973, down 25% in tonnage and 13% in value, respectively, from those of last year. Cities Service Co. in Polk County was the only producer of copper in the State.

The mines ranged from 1,000 to 3,000 feet below the surface. Production comes from four mines, Boyd, Calloway, Cherokee, and Eureka. All is by hard rock mining, which requires few supporting timbers. A primary ore crusher is also underground.

Leading output of Cities Service Co. in volume was sulfuric acid, followed by iron pellets, and copper. Output from the Tennessee mines was reduced as a result of roasting and pelletizing problems encountered during the startup operations of new facilities built for expansion of production early in 1973.

Millions of dollars have been spent on reclamation and pollution control, and

[6] Chemical Week. A Good Deal for Both. V. 113, No. 14, October 3, 1973, p.18.
[7] Aluminum Co. of America. 1973 Annual Report. Pp. 4, 19.

progress was continuing to eliminate discharges by July 1975 when Environmental Protection Agency rules are enforced.[8]

A facility was built to produce copper powder at Greenback by Greenback Industries Inc., a major producer of nonferrous metal powders. The new facilities, which will increase copper production 25%, was scheduled to be completed in early 1974.[9]

Table 9.—Tennessee: Mine production (recoverable) of gold, silver, copper, and zinc

	1971	1972	1973
Mines producing: Lode	13	11	9
Material sold or treated:			
Ore, thousand short tons	5,948	5,285	3,458
Copper-zinc, do	1,704	1,762	1,323
Zinc, do	4,245	3,523	2,135
Production (recoverable):			
Quantity:			
Gold, troy ounces	192	176	68
Silver, do	131,349	83,466	73,104
Copper, short tons	13,916	11,310	8,500
Zinc, do	119,295	101,722	64,172
Value:			
Gold, thousands	$8	$10	$7
Silver, do	203	141	187
Copper, do	14,473	11,581	10,115
Zinc, do	38,413	36,111	26,516
Total, do	53,097	47,843	[1] 36,824

[1] Data do not add to total shown because of independent rounding.

Ferroalloys.—Tennessee ranked third in the Nation in ferroalloy production in 1973. Six companies produced ferroalloys in Marion, Maury, Roane, and Shelby Counties. Shipments were 274,111 tons valued at $49 million, an increase of 26% in tonnage and 45% in value over those of 1972.

The plants in Maury County produced ferrophosphorus as a byproduct of making phosphorus; the plant in Marion County produced ferrosilicon; the plant in Roane County produced ferromanganese, ferrosilicon, and silicomanganese; and the Shelby County plant produced ferrosilicon, ferrochromium, ferrochromiumsilicon, and special manganese alloys for foundry use.

Roane Electric Furnace Co. invested about $3.7 million in a filtering system to clean plant emission. When construction is complete, the baghouse will collect about 99.6% of the silicomanganese and calcium emissions.[10]

Gold.—Gold recovered at out-of-State refineries was 68 troy ounces in 1973, a decrease of 61% from that of 1972. Value of gold produced in 1973 was $6,651 compared with $10,314 in 1972. All the gold was a byproduct of refining copper from Cities Service Co., Copperhill operations.

Magnesium.—Tennessee Die Casting Corp. at Ripley continued producing magnesium die castings. Most of the magnesium metal was imported from Texas. The company also produces aluminum and zinc die castings.

Manganese.—Foote Mineral Co. continued production of manganese at its plant in New Johnsonville. Sales of electrolytic manganese increased in 1973 over those of 1972. The product was sold primarily to the steel industry in chip form and to the aluminum industry as manganese-aluminum briquets and as a manganese powder and flux mixture. Further improvements in operating methods and costs were made, and product prices increased in December following decontrol of some nonferrous metals by the Cost of Living Council.[11]

Rare-Earth Elements and Thorium.—Davidson Chemical Div. of W.R. Grace & Co. at Chattanooga, Tenn., processes monazite concentrates imported from out of

[8] Knoxville News Sentinel. Unhappy Prospector Overlooked Big Find. No. 26,716, Sept. 20, 1973, p. 29.

[9] Knoxville News Sentinel. Copper Powder Plant Expanding. No. 26,723, Sept. 27, 1973, p. 37.

[10] Knoxville News-Sentinel. Rockwood Skies are Getting Less Smoke. No. 26,722, Sept. 26, 1973, p. 43.

[11] Foote Mineral Co. 1973 Annual Report. P. 5.

State for rare-earth elements and thorium. Major uses for the processed material are polishing compounds and petroleum catalysts.

Silver.—Silver recovered at out-of-State refineries was a byproduct of refining copper from the Cities Service Co. The quantity produced was down 12%, but because of the substantial increase in the price of silver, the value was up 33%. The quantity of silver produced in 1973 was 73,104 troy ounces at a value of $187,000.

Titanium.—E. I. duPont de Nemours and Co., Inc., continued production of titanium dioxide pigments from Florida, Georgia, New Jersey, and Australia concentrates. Capacity of the New Johnsonville plant was reported to be 228,000 tons per year.

Kerr-McGee Corp. returned to western Tennessee and explored the heavy mineral sand deposits. No announcements were made regarding its findings.

Ethyl Corp. was reportedly operating a pilot plant to recover heavy sands from the McNairy formation in western Tennessee. Rutile, ilmenite, zircon, and monazite are present in the sands.

Zinc.—Tennessee dropped to third place, after ranking first among the zinc producing States for 15 years, with production of 64,172 tons valued at $26.5 million. The decline of 37% was due principally to the closure of three mines during an 8-month strike.

Three companies mined zinc ore from five mines in Jefferson and Knox Counties in eastern Tennessee. Cities Service Co. also produced zinc concentrate from its plant in Polk County.

The American Smelting & Refining Company (ASARCO) started construction on a new concentrator to replace the Mascot mill, which has been operating since 1913. The new mill will process about 8,500 tons of zinc ore per day, an increase of 20% over the capacity of the Mascot mill. The mill is on a new site at the nearby Young mine; in 1974 it is scheduled to process zinc ore from the Young, Coy, and Immel mines. The New Market mine has its own mill.[12]

The Jefferson City mine of the New Jersey Zinc Co. and Zinc Mine Works of United States Steel Corp. in east Tennessee operated throughout the year.

In the mid-1960's, drilling was initiated by the New Jersey Zinc Co., in the middle Tennessee area. As drilling expanded into new areas, intense mineralization was encountered in the vicinity of Elmwood, Tenn. Determination of the tonnage showed more than 20 million tons of ore grading from 4-½% to 5% zinc. To obtain additional information on the ore bodies, a decision was made to sink an exploration shaft. Following completion of the shaft and lateral development, it was decided to sink a second shaft to a depth of 1,550 feet, which would serve as a production shaft. Crushing, milling, and a sink-float plant will be at the surface with a capacity of 2,000 to 2,500 tons per day of ore.[13] The project is about on schedule, and production was scheduled to begin in 1974.[14] When in operation, the mine and plant will produce zinc and lead concentrates, agricultural limestone, and rock aggregates. All operations are being engineered to be essentially pollution-free and to have a minimal effect on the environment.

The New Jersey Zinc Co. was considering building an electrolytic zinc refinery and a zinc oxide plant near Clarksville. If undertaken, the refinery would begin production in 1977, and by 1979, the plant should have an annual capacity of 160,000 tons. The new plant would use zinc concentrate produced in the company mines in Tennessee and Virginia.[15]

Occidental Mineral Corporation (Oxymin), a subsidiary of Occidental Petroleum Corp., increased its leaseholdings in the vicinity of Carthage, to a total of 1,300 acres. Further exploration and development was being discussed with several mining companies.[16]

A major earth lineament across the middle of Tennessee that may aid future mineral and water exploration in the State was noted on space images by U.S. Geological Survey scientists. The 90-mile linea-

[12] American Smelting and Refining Company. 1973 Annual Report. P. 8.
Skillings Mining Review. ASARCO's Tennessee Zinc Mines. V. 62, No. 37, Sept. 15, 1973, p. 4.
[13] Winslow, K. R., and W. T. Hill. The Elmwood Project. Min. Cong. J., v. 59, No. 3, March 1973, pp. 19–24.
[14] Gulf & Western Industries, Inc. 1973 Annual Report. P. 31.
[15] American Metal Market. N.J. Zinc Planning 160,000-Ton Smelter. V. 81, No. 133, July 10, 1974, p. 1.
[16] Occidental Petroleum Corp. 1973 Annual Report. P. 17.

ment cuts generally north-south across the midsection of Tennessee between Carthage and Fayetteville. The major zinc mine at Carthage and four small zinc-bearing veins near Readyville are 30 miles apart, but both areas are within 2 miles of the lineament belt.[17]

MINERAL FUELS

Mineral fuels accounted for 25% of the total value of mineral production in 1973. Production value was down 18% from that of 1972 and coal accounted for most of the output.

Coal (Bituminous).—Production of coal was 8.2 million tons valued at $66.8 million, down 27% in quantity and 18% in value from those of 1972. Production was from 119 mines in 14 counties of east-central Tennessee. Strip mining accounted for 52% of the total production, underground 44%, and auger 4%.

Most of the coal produced was used by electrical utilities; the rest used by retail dealers and others. Permits were issued by the State of Tennessee allowing 3,116 acres of land to be disturbed for coal strip mining in 1973.

Unit cost of coal burned at TVA plants increased 15% during the fiscal year ending June 30, 1973. Nearly 80% of TVA's present power supply is generated at coal-burning plants, and fuel expense represents about 75% of the production cost at these plants.

The Bureau of Mines and the Division of Geology investigated the coal reserves in a five-county area in east-central Tennessee. Results of the investigation revealed that the net recoverable reserves of strippable coal total about 290 million tons, 114 million tons of which is in Campbell County.

[17] Engineering & Mining Journal. Satellite Images Reveal Tennessee Fracture Zone. V. 174, No. 6, June 1973, p. 32.

Table 10.—Tennessee: Bituminous coal production, by type of mine and county
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total[1]	
Anderson	18	10	4	32	767	930	177	1,874	$14,344
Bledsoe	--	1	--	1	--	20	--	20	W
Campbell	7	13	3	23	419	940	141	1,501	13,692
Claiborne	4	10	--	14	1,376	704	--	2,081	17,034
Cumberland	--	1	--	1	--	25	--	25	W
Fentress	1	2	--	3	14	48	--	62	443
Grundy	2	1	--	3	29	23	--	52	423
Marion	4	--	1	5	381	--	22	403	3,906
Morgan	--	7	1	8	--	450	8	458	3,269
Putnam	1	--	--	1	99	--	--	99	W
Roane	--	1	--	1	--	20	--	20	W
Scott	3	14	--	17	305	695	--	1,000	7,350
Sequatchie	6	2	--	8	245	161	--	406	3,222
Van Buren	--	2	--	2	--	218	--	218	W
Undistributed	--	--	--	--	--	--	--	--	3,143
Total[1]	46	64	9	119	3,636	4,236	348	8,219	66,827

W Withheld to avoid disclosing individual company confidential data.
[1] Data may not add to totals shown because of independent rounding.

Coke.—Chattannoga Coke and Chemicals Div. of Woodward Co., The Mead Corp., produced all the State's coke and breeze at its plant at Alton Park in Hamilton County. Other commodities produced were ammonium sulfate, crude coal tar, benzene, toluene, and xylene. The coal used for production of coke and byproducts was from Pennsylvania, Virginia, and West Virginia.

Natural Gas.—Pemberton Oil and Lumber Co., Inc., and Natural Gas Dehydrating Co. were the leading producers of natural gas in 1973. Natural gas sold in 1973 totaled 20 million cubic feet, all from Scott and Morgan Counties.

Four gasfields were discovered in 1973, and three extensions were completed on gas wells. Except for a small Ordovician gas discovery in Pickett County, all exploratory successes were in Scott, Morgan, and Fentress Counties, and all were produced in Mississippian carbonates.

Petroleum.—Crude oil production for 1973 was 201,000 barrels, up 1.5% from that of 1972. More than 85% of the crude oil produced was from two Ft. Payne pools in Scott County. The Oneida West field in Scott County produced 124,800 barrels from 35 wells during the year; cumulative production at yearend was 993,700 barrels.

Considerable development took place at Honey Creek South in Scott County in a Ft. Payne pool found in 1972. About 10 oil wells were completed during 1973, and another 9 wells were drilled but not completed or tested. Problems were encountered in obtaining sustained produciton, but by yearend the pool had produced about 65,000 barrels of oil.

Tennessee had a total of 98 oil and gas tests in 1973, up 4.3% from 1972. Exploratory tests were down 1.5% from 1972; development wells were up 18.5%.

Twelve counties reported one or more tests, but activity was concentrated in Scott, Morgan, and Fentress Counties. These counties reported a total of 82 wells, of which 52 were exploratory. Six tests were drilled west of the axis of the Nashville dome. Total for all tests was 141,950 feet, of which 97,282 feet were exploratory. Three new oil fields were discovered in 1973. In addition, two new oil pools and two extensions were completed during the year.

The trend of Ft. Payne production in Scott and Morgan Counties was extended southward by two 1973 discoveries. At Gum Branch there were three producers, several dry outposts, and several wells were being drilled or tested by yearend. At Indian Creek one well was completed and a second well was tested by yearend.

A deep test well in Macon County was abandoned during the year after reaching 4,875 feet with no significant findings. American Oil Company (Amoco) began a test in DeKalb County late in the year. A Copper Ridge test started in 1972 in Smith County was shut down at 3,380 feet.

Leasing activity increased markedly during the latter half of 1973. At least four major and several smaller companies were actively leasing in about 20 counties on the east flank of the Nashville dome. The area extends eastward into the folded and faulted valley and ridge province. Several geophysical crews were also active in this part of the State during the year.

Table 11.—Tennessee: Oil and gas well drilling completions, by county

	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Clay	--	--	1	--	--	--	1	714
Cumberland	--	--	--	--	--	1	1	1,975
Dickson	--	--	--	--	--	3	3	1,590
Fentress	--	1	2	--	1	5	9	9,288
McNairy	--	--	--	--	--	1	1	1,410
Macon	--	--	--	--	--	2	2	5,378
Morgan	1	--	2	3	4	11	21	31,388
Overton	--	--	1	--	--	3	4	4,325
Perry	--	--	--	--	--	1	1	700
Pickett	--	--	--	--	1	1	2	833
Scott	17	1	6	3	2	23	52	82,739
White	--	--	--	--	--	1	1	1,610
Total	18	2	12	6	8	52	98	141,950

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 12.—Principal producers

Commodity and company	Address	Type of activity	County
Aluminum smelters:			
Aluminum Co. of America	P.O. Box 158 Alcoa, Tenn. 37701	Plant	Blount.
Consolidated Aluminum Corp., New Johnsonville.	1102 Richmond St. Jackson, Tenn. 38301	do	Humphreys.
Barite:			
NL Industries, Inc. Baroid Division.	Box 187 Sweetwater, Tenn. 37874	2 open pit mines and plant.	Monroe.
B. C. Wood	Box 284 Sweetwater, Tenn. 37874	Open pit mine and plant.	Loudon.
Cement:			
General Portland Inc., Signal Mountain Division.	1300 American National Bank Bldg. Chattanooga, Tenn. 37402	Plant	Hamilton.
Ideal Cement Co	P.O. Box 6238 Knoxville, Tenn. 37914	do	Knox.
Marquette Cement Mfg. Co	P.O. Box 1242 Nashville, Tenn. 37202	do	Davidson.
	P.O. Box 157 Cowan, Tenn. 37318	Open pit mine and plant.	Franklin.
Penn-Dixie Cement Corp	Richard City, Tenn. 37371	Plant	Marion.
	Kingsport, Tenn. 37662	do	Sullivan.
Clay:			
Ball:			
Bell Clay Co	Gleason, Tenn. 38229	4 open pit mines and plant.	Weakley.
Kentucky-Tennessee Clay Co.	Box 449 Mayfield, Ky. 42066	13 open pit mines and plant.	Carroll, Gibson, Henry, Weakley.
H. C. Spinks Clay Co., Inc.	Box 820 Paris, Tenn. 38242	16 open pit mines and plants.	Carroll, Henry, Weakley.
United Sierra, a division of Cyprus Mines Corp.	P.O. Box 111 Gleason, Tenn. 38229	7 open pit mines and plant.	Carroll and Weakley.
Fuller's earth:			
Southern Clay, Inc., a subsidiary of Lowe's Inc.	Box 819 Paris, Tenn. 38242	Open pit mine and plant.	Henry.
Miscellaneous:			
General Portland Inc., Signal Mountain Div.	1300 American National Bank Bldg. Chattanooga, Tenn. 37402	do	Hamilton.
General Shale Products Corp.	Box 3547 C.R.S. Johnson City, Tenn. 37601	6 open pit mines and plants.	Hamilton, Knox, Sullivan, Washington.
Shalite Corp	Box 441 Knoxville, Tenn. 37901	Open pit mine and plant.	Knox.
Tennlite, Inc	Box 340 Greenbrier, Tenn. 37073	do	Davidson.
Coal:			
Consolidation Coal Co	Box 460 Middlesboro, Ky. 40965	1 underground mine and plant.	Claiborne.
Cumberland Coal Corp	P.O. Box 3187 Oak Ridge, Tenn. 37830	2 strip mines	Scott and Anderson.
Grundy Mining Co., Inc	P.O. Box 878 Jasper, Tenn. 37347	1 underground mine	Marion.
Long Pit Mining Co	Box 443 Harriman, Tenn. 37748	1 auger and 1 strip mine.	Campbell.
Royal Dean Coal Co., Inc	Box 428 Oneida, Tenn. 37841	Underground mine	Scott.
Shemco Inc	Route 1, Box 86–A Oliver Springs, Tenn. 37840	1 strip mine	Morgan.
Volunteer Mining Corp	Cody, Ky. 41808	Underground mine	Anderson.
Coke:			
Chattanooga Coke and Chemicals, Div. of Woodward Iron Co., The Mead Corp.	4800 Central Ave. Chattanooga, Tenn. 37410	Plant	Hamilton.
Copper:			
Cities Service Co., Copperhill Operations.	Copperhill, Tenn. 37317	4 underground mines, mill, smelter, chemical plant.	Polk.
Ferroalloys:			
Chromium Mining and Smelting Co.	P.O. Box 28538 Memphis, Tenn. 38128	Plant	Shelby.
Hooker Chemical Corp	P.O. Box 591 Columbia, Tenn. 38401	do	Maury.
Monsanto Co	Columbia, Tenn. 38401	do	Do.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Ferroalloys—Continued			
Roane Electric Furnace, Woodward Co., a division of The Mead Corp.	Box 298 Rockwood, Tenn. 37854	Plant	Roane.
Stauffer Chemical Co	P.O. Box 472 (Furnace Plant) Mt. Pleasant, Tenn. 38474	do	Maury.
Tennessee Metallurgical Corp.	818 Hamilton Bank Bldg. Chattanooga, Tenn. 37402	do	Marion.
Graphite, artificial:			
Union Carbide Corp	P.O. Box 513 Columbia, Tenn. 38401	do	Maury.
Lime, primary:			
Foote Mineral Co	Route 8, Asbury Rd. Knoxville, Tenn. 37914	Lime kiln	Knox.
Williams Lime Mfg. Co	Box 2286 Knoxville, Tenn. 37901	do	Do.
Perlite, expanded:			
Chemrock Corp	Osage St. Nashville, Tenn. 37208	Plant	Davidson.
Petroleum Refinery:			
Delta Refinery Co., a division of Earth Resources Co.	543 West Mallory Ave. Memphis, Tenn. 38106	Refinery	Shelby.
Phosphate rock:			
Hooker Chemical Corp	Box 591 Columbia, Tenn. 38401	Open pit mines and plant.	Hickman and Maury.
Monsanto Co	800 North Lindbergh Blvd. Columbia, Tenn. 38401	do	Giles, Maury, Williamson.
Stauffer Chemical Co	P.O. Box 89 Mt. Pleasant, Tenn. 38474	do	Giles and Maury.
Tennessee Valley Authority	P.O. Box 73 Columbia, Tenn. 38401	do	Maury and Williamson.
Pyrite:			
Cities Service Co., Copperhill Operations.	Copperhill, Tenn. 37317	*See* Copper	Polk.
Sand and gravel:			
Camden Gravel Co	P.O. Box 207 Camden, Tenn. 38320	Open pit	Benton.
Dixie Sand & Gravel Co	515 River St. Chattanooga, Tenn. 37402	Open pit and dredge	Hamilton.
Fischer Concrete Co., Inc	P.O. Box 37 Memphis, Tenn. 38126	3 open pits	Shelby.
Long Construction Co	4434 East Shelby Dr. Memphis, Tenn. 38118	Open pit mine	Do.
Memphis Stone & Gravel Co.	Box 269 Germantown, Tenn. 38138	2 open pits	Benton and Shelby.
Clyde Owen Sand and Gravel Inc.	10636 Shelton Rd. Collierville, Tenn. 38017	Open pit	Shelby.
Tennessee Valley Sand and Gravel Co.	Box 520 Sheffield, Ala. 35660	Dredge	Hardin.
Silver:			
Cities Service Co., Copperhill Operations.	Copperhill, Tenn. 37317	*See* Copper	Polk.
Stone:			
Dolomite:			
New Jersey Zinc Co. (Gulf & Western Industries, Inc.).	Jefferson City, Tenn. 37760	Underground mine	Jefferson.
Limestone, crushed:			
Dalton Rock Prod. Co	P.O. Box 1352 Cleveland, Tenn. 37311	Open quarry	Bradley.
Hoover Inc	Box 7201 Nashville, Tenn. 37210	5 quarries	Cumberland, Davidson, Franklin, Robertson, Rutherford.
Ralph Rogers & Co	720 Argyle Ave. Nashville, Tenn. 37203	2 open quarries and 1 underground mine.	Anderson, Coffee, Sumner.
The Stone Man, Inc	P.O. Box 2098 3814 Tennessee Ave. Chattanooga, Tenn. 37409	5 open quarries	Bedford, Hamilton, Moore, Rutherford, Warren.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Limestone, crushed—Continued			
Vulcan Materials Co	Box 7 Knoxville, Tenn. 37901	25 open quarries	Anderson, Benton, Blount, Davidson, Decatur, Hamblen, Hamilton, Hardin, Hawkins, Humphreys, Knox, Loudon, Marion, Roane, Rutherford, Sevier, Sullivan, Sumner, Wayne, Williamson.
Watanga Stone Co	Box 2389 Knoxville, Tenn. 37901	Quarry	Carter.
Marble:			
Georgia Marble Co	Riverside Drive Knoxville, Tenn. 37914	Open quarry	Knox and Union.
John J. Craig Co	681 Maryville Pike SW Knoxville, Tenn. 37920	2 open quarries	Blount, Loudon.
Imperial Black Marble Corp.	Thorn Hill, Tenn. 37881	do	Grainger.
Quartzite:			
Crab Orchard Stone Co., Inc.	P.O. Drawer J. Crossville, Tenn. 38555	do	Do.
Ross L. Brown Cut Stone Co., Inc.	Crab Orchard, Tenn. 37723	do	Cumberland.
Turner Bros. Stone Co.	P.O. Box 297 Crossville, Tenn. 38555	do	Do.
Sandstone:			
Turner Bros Stone Co., Inc.	P.O. Box 297 Crossville, Tenn. 38555	Open quarry	Do.
White Silica Sand Co., Inc.	Route 2 Caryville, Tenn. 37714	do	Campbell.
Vermiculite, exfoliated:			
W. R. Grace & Co., Construction Products Div.	4061 Powell Ave. Nashville, Tenn. 37204	Plant	Davidson.
Zinc:			
American Smelting & Refining Co.	Mascot, Tenn. 37806	4 underground mines and mill.	Jefferson and Knox.
Cities Service Co., Copperhill Operations.	Copperhill, Tenn. 37317	*See* Copper	Polk.
New Jersey Zinc Co., (Gulf & Western Industries, Inc.).	Jefferson City, Tenn. 37760	Underground mine and mill.	Jefferson.
United States Steel Corp	Jefferson City, Tenn. 37760	do	Do.

The Mineral Industry of Texas

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Bureau of Economic Geology, The University of Texas at Austin, for collecting information on all minerals except fuels.

By Charles J. Jirik [1] and Roselle Girard [2]

Total mineral output value increased 17.1% over that of 1972 to $8.4 billion, the highest ever, and for the 39th consecutive year, Texas was the Nation's leading mineral producer. The State ranked first in production of petroleum, natural gas, natural gas liquids, carbon black, magnesium chloride, natural graphite, and recovered sulfur. Significant quantities of aluminum metal, metallic sodium, uranium, helium, clays, sand and gravel, salt, and sodium sulfate were also produced. The Texas Railroad Commission promulgated a 100% statewide market demand factor (MDF) for petroleum allowable proration for the entire year, with the exception of a few large fields the production of which was restricted to prevent physical waste. Crude oil production was virtually at capacity. Crude petroleum was produced in 203 counties, natural gas in 207, nometallic minerals in 142, and metallic minerals in 4.

The varied metals industry of Texas consisted of numerous plants that produced aluminum, antimony, cadmium, copper, iron, lead, magnesium, manganese, sodium, tin, and zinc. Rare-earth metals were recovered in special units associated with existing smelting facilities. Several secondary recovery metal plants were operating throughout the State to process scrap and other materials to recover aluminum, lead, zinc, tin, and iron and steel.

Hydrocarbons continued to be the State's leading contributor to mineral production value and accounted for 93.2% of the total. Of the total hrdyocarbon output value, petroleum accounted for 65.6%, natural gas, 22.1%, and natural gas liquids, 11.9%.

[1] Petroleum engineer, Dallas Mineral Supply Field Office (now with the Federal Energy Administration).
[2] Geologist, Bureau of Economic Geology, The University of Texas at Austin, Austin, Tex.

Table 1.—Mineral production in Texas [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Cement:				
Masonry ---- thousand short tons	217	$5,812	234	$6,606
Portland ---- do	7,813	171,642	8,320	189,368
Clays ---- do	5,175	11,554	5,667	13,115
Coal (lignite) ---- do	4,045	W	6,944	W
Gem stones	NA	163	NA	163
Gypsum ---- thousand short tons	1,542	5,284	1,616	6,469
Helium, crude ---- million cubic feet	1,026	12,312	904	10,848
Lime ---- thousand short tons	1,631	22,181	1,677	26,887
Natural gas ---- million cubic feet	8,657,840	1,419,886	8,513,850	1,735,221
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels	92,437	294,163	92,743	347,393
LP gases ---- do	226,624	428,319	221,686	589,685
Perlite ---- short tons	2,391	24	602	W
Petroleum (crude) - thousand 42-gallon barrels	1,301,685	4,536,077	1,294,671	5,157,623
Pumicite ---- thousand short tons	W	W	--	--
Salt ---- do	9,744	36,544	10,354	45,350
Sand and gravel ---- do	35,151	56,328	38,546	60,706
Stone ---- do	49,314	[2] 66,573	62,574	91,379
Sulfur (Frasch) ---- thousand long tons	3,847	W	4,109	W
Talc and Soapstone ---- short tons	221,022	1,262	232,514	1,246
Value of items that cannot be disclosed: Asphalt, fluorspar, graphite, iron ore, magnesium chloride, magnesium compounds, mercury, sodium sulfate, uranium, and values indicated by symbol W ----	XX	143,427	XX	160,435
Total ----	XX	7,211,551	XX	8,442,494
Total 1967 constant dollars ----	XX	5,950,251	XX	[p] 6,198,478

[p] Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes value of dimension stone; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Texas, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Anderson	$47,132	$49,816	Petroleum, natural gas, natural gas liquids.
Andrews	246,718	261,884	Petroleum, natural gas liquids, natural gas.
Angelina	500	162	Clays, natural gas, petroleum.
Aransas	13,236	12,622	Natural gas, petroleum, natural gas liquids.
Archer	16,496	16,399	Petroleum, natural gas, sand and gravel, stone.
Armstrong	--	1,040	Sand and gravel.
Atascosa	21,954	23,477	Petroleum, natural gas, natural gas liquids, stone.
Austin	11,009	11,390	Petroleum, natural gas.
Bailey	W	W	Stone.
Bastrop	983	914	Petroleum, clays, natural gas.
Baylor	2,687	2,656	Petroleum, natural gas, stone.
Bee	17,571	18,937	Natural gas, petroleum, natural gas liquids, stone.
Bell	975	W	Sand and gravel, stone.
Bexar	33,347	39,504	Cement, stone, natural gas liquids, petroleum, lime, sand and gravel, clays, natural gas.
Blanco	1	18	Stone.
Borden	33,572	43,269	Petroleum, natural gas, sand and gravel, stone.
Bosque	1,956	W	Lime, stone.
Bowie	363	399	Petroleum, natural gas, clays.
Brazoria	243,048	276,766	Petroleum, natural gas, magnesium chloride, natural gas liquids, salt, magnesium compounds, lime.
Brazos	2,542	1,544	Sand and gravel, natural gas, petroleum.
Brewster	W	W	Fluorspar, sand and gravel.
Briscoe	--	2	Stone.
Brooks	56,358	61,845	Natural gas, petroleum, natural gas liquids.
Brown	2,477	4,029	Stone, petroleum, clays, natural gas.
Burleson	402	813	Petroleum, natural gas.
Burnet	W	W	Stone, graphite, sand and gravel.
Caldwell	9,710	9,401	Petroleum, natural gas.
Calhoun	23,759	24,701	Natural gas, stone, petroleum, natural gas liquids, lime.

See footnotes at end of table.

Table 2.—Value of mineral production in Texas, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Callahan	$3,560	$4,026	Petroleum, stone, natural gas, natural gas liquids.
Cameron	2,699	2,955	Natural gas, petroleum.
Camp	2,987	3,420	Petroleum, natural gas.
Carson	34,819	41,808	Natural gas, natural gas liquids, petroleum.
Cass	21,292	23,506	Natural gas liquids, petroleum, natural gas, iron ore.
Chambers	125,882	139,842	Petroleum, natural gas, natural gas liquids, salt, clays.
Cherokee	12,525	14,207	Petroleum, natural gas liquids, natural gas, clays.
Childress	246	212	Petroleum, natural gas.
Clay	10,621	10,445	Petroleum, natural gas, sand and gravel.
Cochran	40,118	47,692	Petroleum, natural gas, natural gas liquids.
Coke	23,978	24,526	Petroleum, natural gas liquids, natural gas, sand and gravel.
Coleman	3,244	3,462	Petroleum, natural gas, stone, clays.
Collin	W	W	Stone
Collingsworth	1,516	1,756	Natural gas, petroleum
Colorado	52,196	55,092	Natural gas liquids, natural gas, sand and gravel, petroleum.
Comal	W	W	Stone, lime.
Comanche	339	297	Natural gas, petroleum, stone, clays.
Concho	1,649	1,861	Petroleum, natural gas, natural gas liquids.
Cooke	36,556	42,067	Petroleum, natural gas liquids, natural gas.
Coryell	234	452	Stone.
Cottle	56	54	Petroleum, natural gas.
Crane	202,188	227,786	Petroleum, natural gas, natural gas liquids.
Crockett	53,964	61,878	Petroleum, natural gas, natural gas liquids.
Crosby	1,463	1,789	Sand and gravel, petroleum, natural gas.
Culberson	W	W	Sulfur, petroleum, talc, natural gas.
Dallam	W	W	Natural gas.
Dallas	16,102	14,982	Cement, sand and gravel, stone, clays.
Dawson	41,759	48,142	Petroleum, natural gas, natural gas liquids.
Deaf Smith	W	W	Stone, lime.
Denton	1,997	1,664	Sand and gravel, clays, natural gas, petroleum, stone.
De Witt	13,127	14,428	Natural gas, petroleum, natural gas liquids, sand and gravel.
Dickens	862	1,037	Petroleum, natural gas.
Dimmit	28,206	30,457	Petroleum, natural gas, natural gas liquids.
Donley	W	W	Stone, sand and gravel, natural gas.
Duval	36,858	40,489	Petroleum, natural gas, salt, natural gas liquids.
Eastland	2,758	3,976	Natural gas liquids, petroleum, clays, natural gas, stone.
Ector	344,228	395,879	Petroleum, natural gas liquids, natural gas, cement, stone.
Edwards	95	530	Natural gas, petroleum.
Ellis	41,202	51,540	Cement, stone, clays, petroleum.
El Paso	7,693	9,683	Cement, stone, sand and gravel.
Erath	780	501	Natural gas, petroleum.
Falls	377	301	Do.
Fayette	1,745	2,288	Clay, petroleum, sand and gravel, natural gas.
Fisher	36,989	41,262	Petroleum, natural gas, natural gas liquids, gypsum, clays, stone.
Floyd	8	W	Stone, petroleum.
Foard	1,068	1,129	Petroleum, natural gas.
Fort Bend	79,779	91,108	Petroleum, sulfur, natural gas, salt, natural gas liquids, clay.
Franklin	18,191	19,985	Petroleum, natural gas liquids, natural gas.
Freestone	7,541	16,314	Coal, natural gas, stone, petroleum, clays.
Frio	4,343	4,901	Petroleum, natural gas, natural gas liquids, stone.
Gaines	195,600	259,192	Petroleum, natural gas, natural gas liquids, sodium sulfate.
Galveston	50,343	57,723	Petroleum, natural gas, natural gas liquids, clays.
Garza	17,877	21,561	Petroleum, natural gas.
Gillespie	W	W	Gypsum, stone, sand and gravel.
Glasscock	8,447	8,942	Petroleum, natural gas.
Goliad	9,995	11,570	Natural gas, petroleum.
Gonzales	1,229	1,409	Natural gas, petroleum, clays.
Gray	37,772	41,950	Petroleum, natural gas, natural gas liquids, sand and gravel.
Grayson	30,757	33,202	Petroleum, natural gas, natural gas liquids, stone, sand and gravel.
Gregg	203,294	236,154	Petroleum, natural gas liquids, natural gas.
Grimes	52	71	Petroleum, natural gas.
Guadalupe	9,777	10,731	Petroleum, sand and gravel, clays, natural gas.
Hale	17,043	25,533	Petroleum, natural gas liquids, natural gas.
Hamilton	215	206	Natural gas, petroleum.
Hansford	23,052	23,750	Natural gas, helium, petroleum.
Hardeman	4,897	5,817	Petroleum, gypsum, natural gas liquids, natural gas.
Hardin	26,683	26,859	Petroleum, natural gas, natural gas liquids, sand and gravel.
Harris	184,074	217,896	Petroleum, cement, natural gas liquids, natural gas, salt, lime, sand and gravel, clays.

See footnotes at end of table.

Table 2.—Value of mineral production in Texas, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Harrison	$15,815	$16,006	Petroleum, natural gas, natural gas liquids, coal, clays.
Hartley	2,472	W	Natural gas.
Haskell	9,960	11,607	Petroleum, natural gas, stone.
Hays	--	W	Sand and gravel, stone.
Hemphill	31,403	46,787	Natural gas, petroleum, sand and gravel.
Henderson	52,076	64,885	Petroleum, natural gas, natural gas liquids, clays, sand and gravel.
Hidalgo	35,386	44,275	Natural gas, petroleum, natural gas liquids, stone, sand and gravel.
Hill	W	W	Lime, stone.
Hockley	163,411	211,420	Petroleum, natural gas liquids, natural gas.
Hood	W	W	Stone, natural gas.
Hopkins	11,239	12,215	Petroleum, natural gas liquids, natural gas.
Houston	7,240	9,427	Petroleum, natural gas, natural gas liquids.
Howard	62,528	76,377	Petroleum, natural gas liquids, natural gas, sand and gravel, stone.
Hudspeth	1,392	2,135	Talc, stone, gypsum.
Hunt	132	170	Natural gas, petroleum.
Hutchinson	73,045	92,029	Natural gas liquids, natural gas, petroleum, salt, sand and gravel.
Irion	6,517	11,697	Petroleum, natural gas liquids, natural gas.
Jack	13,690	14,771	Petroleum, natural gas, stone, natural gas liquids.
Jackson	102,096	104,646	Petroleum, natural gas, natural gas liquids.
Jasper	1,443	1,441	Petroleum, natural gas.
Jeff Davis	--	W	Stone.
Jefferson	65,169	67,364	Natural gas, petroleum, sulfur, natural gas liquids, salt, clays, sand and gravel.
Jim Hogg	11,047	11,503	Natural gas, petroleum, natural gas liquids, stone.
Jim Wells	83,076	94,330	Do.
Johnson	4,557	5,088	Lime, stone, sand and gravel.
Jones	8,306	8,693	Petroleum, sand and gravel, natural gas, stone.
Karnes	27,943	33,712	Natural gas, petroleum, uranium, natural gas liquids.
Kaufman	2,690	3,056	Petroleum, stone, natural gas.
Kenedy	23,992	26,207	Natural gas, natural gas liquids, petroleum.
Kent	69,598	72,821	Petroleum, natural gas.
Kerr	W	W	Stone, sand and gravel.
Kimble	314	620	Natural gas, sand and gravel, petroleum.
King	6,392	8,920	Petroleum, natural gas.
Kleberg	195,483	225,194	Natural gas, natural gas liquids, petroleum, stone.
Knox	3,453	3,129	Petroleum, natural gas.
Lamb	747	744	Petroleum, stone, natural gas.
Lampasas	54	W	Stone, sand and gravel.
La Salle	2,927	2,448	Natural gas, petroleum.
Lavaca	8,564	12,464	Natural gas, natural gas liquids, petroleum.
Lee	85	191	Petroleum, natural gas.
Leon	3,053	3,253	Natural gas, petroleum.
Liberty	34,673	39,526	Petroleum, sulfur, natural gas, natural gas liquids, sand and gravel.
Limestone	4,951	5,507	Clays, sand and gravel, natural gas, petroleum.
Lipscomb	13,123	14,880	Natural gas, petroleum.
Live Oak	19,329	20,506	Natural gas, petroleum, uranium, natural gas liquids.
Llano	703	574	Stone.
Loving	5,504	5,398	Petroleum, natural gas.
Lubbock	2,901	3,200	Petroleum, stone, natural gas.
Lynn	992	962	Petroleum, natural gas.
McCulloch	1,999	2,813	Sand and gravel, stone, natural gas.
McLennan	11,958	13,258	Cement, sand and gravel, stone, natural gas liquids, clays, petroleum, natural gas.
McMullen	10,973	12,791	Natural gas, petroleum, stone.
Madison	2,719	3,184	Natural gas, petroleum, sand and gravel.
Marion	5,573	4,950	Petroleum, natural gas, natural gas liquids, clays.
Martin	44,415	53,817	Petroleum, natural gas.
Matagorda	55,851	66,723	Natural gas, natural gas liquids, petroleum, stone, salt.
Maverick	4,392	4,516	Petroleum, natural gas liquids, natural gas.
Medina	616	949	Petroleum, sand and gravel, clays, natural gas, stone.
Menard	919	1,003	Petroleum, natural gas.
Midland	69,842	76,874	Petroleum, natural gas, natural gas liquids, stone.
Milam	W	6,110	Coal, petroleum, natural gas.
Mitchell	17,517	20,476	Petroleum, stone, natural gas, sand and gravel.
Montague	13,835	13,983	Petroleum, natural gas, natural gas liquids, stone, sand and gravel.
Montgomery	78,017	103,973	Petroleum, natural gas liquids, natural gas.
Moore	68,618	85,003	Natural gas, natural gas liquids, helium, petroleum.
Morris	W	W	Iron ore.
Motley	1,823	1,980	Petroleum, sand and gravel, natural gas.
Nacogdoches	4,631	4,698	Natural gas, iron ore, petroleum, clays.
Navarro	10,513	11,161	Petroleum, natural gas, clays, stone.
Newton	5,073	5,421	Petroleum, natural gas.

See footnotes at end of table.

Table 2.—Value of mineral production in Texas, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Nolan	$36,277	$39,946	Petroleum, cement, natural gas liquids, gypsum, natural gas, stone, sand and gravel
Nueces	93,262	107,450	Natural gas, petroleum, natural gas liquids, cement, lime, stone.
Ochiltree	34,197	34,911	Petroleum, natural gas, natural gas liquids.
Oldham	1,818	2,554	Sand and gravel, petroleum, natural gas.
Orange	11,516	12,707	Cement, petroleum, natural gas, clays.
Palo Pinto	5,883	6,996	Natural gas liquids, natural gas, petroleum, clays, sand and gravel, stone.
Panola	27,396	31,605	Natural gas, natural gas liquids, petroleum.
Parker	5,097	8,882	Natural gas liquids, natural gas, stone, sand and gravel, clays, petroleum.
Parmer	--	W	Stone.
Pecos	r 251,209	277,822	Natural gas, petroleum, natural gas liquids, sulfur, stone, sand and gravel.
Polk	6,226	7,358	Petroleum, natural gas.
Potter	24,321	30,000	Natural gas, natural gas liquids, cement, stone, petroleum, clays.
Presidio	W	W	Mercury, perlite.
Rains	W	1,384	Natural gas, petroleum.
Randall	689	W	Stone.
Reagan	43,583	54,093	Petroleum, natural gas liquids, natural gas.
Red River	67	67	Petroleum.
Reeves	41,394	48,453	Natural gas, petroleum, natural gas liquids, sand and gravel, stone.
Refugio	164,793	186,863	Petroleum, natural gas, natural gas liquids.
Roberts	10,774	13,129	Natural gas, petroleum.
Robertson	54	26	Stone, petroleum, natural gas.
Runnels	6,578	6,534	Petroleum, natural gas, natural gas liquids.
Rusk	88,990	96,848	Petroleum, natural gas liquids, natural gas, clays.
San Jacinto	1,212	1,604	Petroleum, natural gas.
San Patricio	36,552	37,946	Petroleum, natural gas, natural gas liquids, stone, clays.
Schleicher	11,218	11,331	Petroleum, natural gas, natural gas liquids.
Scurry	351,967	447,396	Petroleum, natural gas liquids, natural gas, stone.
Shackelford	14,422	14,453	Petroleum, natural gas, natural gas liquids.
Shelby	916	960	Natural gas, petroleum.
Sherman	11,714	13,800	Do.
Smith	17,399	19,863	Petroleum, natural gas, natural gas liquids, clays.
Somervell	W	W	Sand and gravel.
Starr	44,970	49,925	Petroleum, natural gas, natural gas liquids, clays.
Stephens	11,040	13,064	Petroleum, natural gas liquids, natural gas.
Sterling	5,346	5,011	Petroleum, natural gas, stone.
Stonewall	22,197	23,405	Petroleum, natural gas liquids, natural gas.
Sutton	3,211	10,459	Natural gas, stone, natural gas liquids, petroleum.
Tarrant	19,862	18,014	Cement, sand and gravel, stone, natural gas.
Taylor	13,072	14,081	Petroleum, stone, natural gas, sand and gravel, natural gas liquids, clays.
Terrell	5,476	7,061	Natural gas, petroleum.
Terry	41,378	48,961	Petroleum, sodium sulfate, natural gas, natural gas liquids.
Throckmorton	6,558	6,769	Petroleum, natural gas.
Titus	9,578	10,254	Do.
Tom Green	8,628	10,742	Petroleum, natural gas, natural gas liquids, stone, sand and gravel.
Travis	6,114	7,967	Lime, sand and gravel, stone, petroleum, natural gas.
Trinity	18	25	Petroleum, natural gas.
Tyler	3,906	3,224	Do.
Upshur	12,562	13,665	Petroleum, natural gas, sand and gravel.
Upton	59,665	68,418	Petroleum, natural gas, natural gas liquids.
Uvalde	9,227	11,003	Asphalt, stone, sand and gravel, natural gas.
Val Verde	479	760	Natural gas, petroleum.
Van Zandt	73,268	87,147	Petroleum, natural gas liquids, salt, natural gas, clays.
Victoria	24,727	27,125	Petroleum, natural gas, sand and gravel, natural gas liquids.
Walker	167	140	Clays, natural gas, petroleum.
Waller	89,264	126,823	Natural gas, natural gas liquids, petroleum.
Ward	108,282	135,338	Natural gas, petroleum, natural gas liquids, sand and gravel, salt.
Washington	704	741	Petroleum, natural gas.
Webb	10,840	12,363	Natural gas, petroleum, natural gas liquids, sand and gravel, clays, stone.
Wharton	56,565	60,473	Sulfur, petroleum, natural gas, natural gas liquids, clays.
Wheeler	8,403	9,846	Petroleum, natural gas, natural gas liquids.
Wichita	27,130	27,710	Petroleum, sand and gravel, natural gas liquids, natural gas, stone.
Wilbarger	15,470	16,154	Petroleum, natural gas liquids, sand and gravel, natural gas.
Willacy	12,796	13,443	Petroleum, natural gas.

See footnotes at end of table.

Table 2.—Value of mineral production in Texas, by county [1]—Continued

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Williamson	$4,583	$6,037	Stone, lime, petroleum, natural gas.
Wilson	2,424	2,502	Petroleum, clays, natural gas.
Winkler	102,638	115,916	Natural gas, petroleum, natural gas liquids.
Wise	47,444	57,275	Natural gas liquids, natural gas, stone, petroleum, sand and gravel, clays.
Wood	168,898	206,678	Petroleum, natural gas liquids, natural gas, clays, sand and gravel.
Yoakum	221,788	300,456	Petroleum, natural gas liquids, natural gas, salt.
Young	11,471	11,839	Petroleum, natural gas, natural gas liquids, stone, sand and gravel.
Zapata	4,210	4,616	Natural gas, petroleum.
Zavala	7,506	4,711	Petroleum, natural gas.
Undistributed [2]	r 105,665	149,619	
Total [3]	r 7,211,551	8,442,494	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Bandera, Castro, Delta, Fannin, Hall, Kendall, Kinney, Lamar, Mason, Mills, Real, Rockwall, Sabine, San Augustine, San Saba, and Swisher. Values for petroleum are based on an average price per barrel for the state.

[2] Includes some sand and gravel, stone (1972), petroleum, and natural gas liquids that cannot be assigned to specific counties, gem stones, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Texas business activity

	1972	1973 p	Change, percent
Annual average labor force and employment:			
Total labor force ---- thousands	4,879	4,952	+1.5
Unemployment ---- do	220	193	−12.3
Employment:			
Construction ---- do	248.0	275.4	+11.0
Mining ---- do	103.2	107.5	+4.2
Manufacturing ---- do	744.5	795.8	+6.9
Transportation and public utilities ---- do	264.0	279.4	+5.8
Wholesale and retail trade ---- do	954.5	1,023.4	+7.2
Finance, insurance, and real estate ---- do	217.4	236.2	+8.6
Services ---- do	644.4	688.1	+6.8
Government ---- do	714.2	745.2	+4.3
Personal income:			
Total ---- millions	$46,486	$51,144	+10.0
Per capita ---- do	$3,991	$4,336	+8.6
Construction activity:			
Value of authorized nonresidential construction millions	$1,149.0	$1,364.9	+18.8
Number of new building permits issued	130,142	103,562	−20.4
Highway construction contracts awarded ---- millions	e $360.0	$367.3	+2.0
Cement shipments to and within Texas thousand short tons	6,965	7,076	+1.6
Farm marketing receipts ---- millions	$4,599.6	$6,849.8	+48.9
Mineral production value ---- do	$7,211.6	$8,442.5	+17.1

p Preliminary. e Estimate.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; U.S. Bureau of Mines.

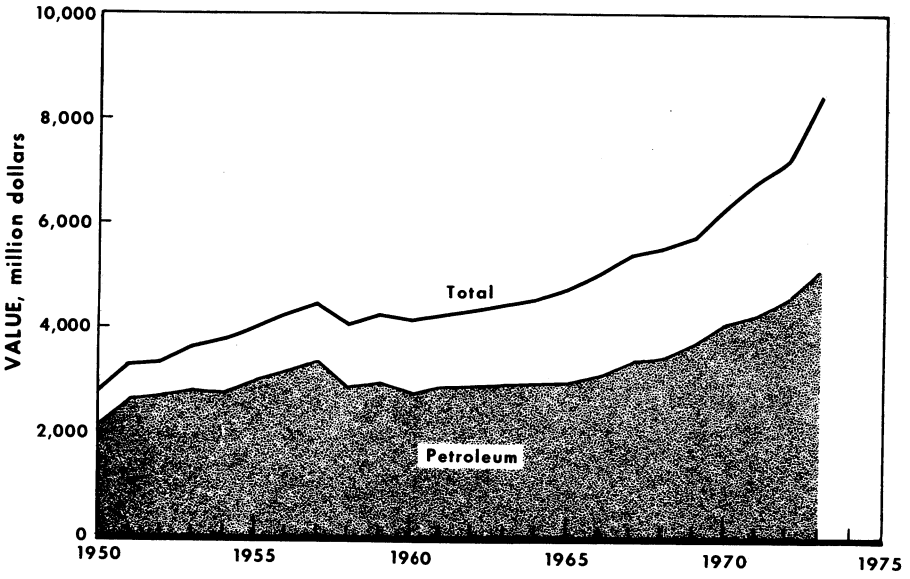

Figure 1.—Value of petroleum and total value of mineral production in Texas.

Trends and Developments.—The Texas Railroad Commission issued monthly orders during 1973, which allowed oil operators to produce at 100% of the MDF. The average daily production for 1973 amounted to approximately 3.55 million barrels compared with 3.57 million barrels for 1972. Increased prices for oil and gas initiated additional drilling activity; however, shortages of tubular goods prevented some wells from being drilled.

The Railroad Commission established guidelines, in the event of natural gas curtailments, that give priorities to the needs of homes, hospitals, schools, and churches in formulating a natural gas rationing plan for the State. Because of the almost certain possibility of gas curtailment, many generating and mineral processing plants constructed fuel oil storage facilities. These reserve fuel supplies should lessen the impact of gas curtailments, especially during the peak heating season.

Stating that an emergency situation existed for the company's customers, the Texas Railroad Commission, in an unprecedented move, granted the Lo-Vaca Gathering Co., a subsidiary of Coastal States Gas Corp., an interim rate increase for most of its contracted gas sales; revenue from the rate increase can be used only to purchase additional gas for the company's existing customers. This is the first case wherein a gas price contract has been modified by governmental action in the unregulated intrastate market.

In two State oil and gas tract lease sales in March and October, 219,015 acres in the offshore and submerged bay areas were leased for over $16 million. During the October sale, for the first time, the leases contained a stipulation allowing the State, if it so desired, to take its one-sixth share of the production as oil and gas.

The largest Federal Outer Continental Shelf (OCS) oil and gas lease sale in Texas was held June 19, 1973, when a total of 547,173 acres were leased. In this sale, the total bonus amounted to $1.6 billion; the highest bid per acre was $13,490.97 and the average per acre bonus bid accepted was $2,908.40. The previous OCS sale in May 1968, leased 541,304 acres with an average price of $1,097 per acre.

The State has filed suit against 15 oil and gas companies to recover full market value for the natural gas produced from State lands leased by the companies. The suit claims that each company owes the State in excess of $100,000 because the companies were selling gas for about $0.25 per thousand cubic feet below the then-present market price.

The controversial compulsory oil and gas unitization bill failed as the 63d legislature adjourned without taking action on the issue. The proposed legislation would have allowed the Railroad Commission to order compulsory unitization of an oilfield or gasfield when 75% or more of the operators and royalty interests requested such action. Proponents of the legislation maintained that it would allow the recovery of some 9 billion additional barrels of oil by 1985. Opponents criticized the bill because it would benefit big companies and hurt small operators.

"Seadock," a consortium of 11 oil companies and 1 chemical company, employed a consultant to prepare an environmental impact statement for a proposed monobuoy crude oil unloading facility about 25 miles off the Texas coast near Freeport. Plans are for the project to be in operation during 1976, providing the U.S. Congress passes enabling legislation, and the necessary State and Federal permits are obtained. The facility will be designed to handle tankers in the 300,000-deadweight-ton (dwt) class but can be expanded to accommodate 500,000-dwt vessels.

The Texas Air Control Board (TACB) permitted American Smelting and Refining Co. (Asarco) to continue operating its Amarillo zinc smelter until May 31, 1975. This action rescinded an earlier order that the smelter either be in full compliance with the Texas Clean Air Act by December 31, 1973, or be shut down. The company's request for relief from the initial order was based on the U.S. zinc supply problem, additional medical data pertaining to health problems related to cadmium emissions, and the economic problems that the closing would cause to the smelter workers, the city of Amarillo, and zinc miners in other States. Groundbreaking ceremonies for the new Amarillo copper refinery were held in late 1973.

Pollution fines paid to the State as of November exceeded $1 million. About two-thirds of the total has been deposited with the State treasury; the rest went to other government entities that were parties to the pollution suits, primarily Harris County.

The largest pollution fine in the State's history was paid by Armco Steel Corp. for polluting the Houston Ship Channel. In the out-of-court settlement, Armco paid a $125,000 fine and agreed to install about $300,000 worth of pollution control equipment in the near future.

Texasgulf, Inc., and Freeport Mineral Co. posted a $3.00-per-ton increase in the delivered price of sulfur. In announcing the price boost, the companies declared that over the past 4 years of depressed sulfur prices, there have been substantial increases in cost of fuel, transportation, materials, environmental protection measures, and labor.

Resource Recovery, Inc., operated by Browning-Ferris Industries, Inc., has started two units that can recover 100 million steel cans per year from refuse in Houston. The units use a magnetic reclamation process that results in a final product that can be remelted into steel.

The Howell Corp. is reopening its Corpus Christi refinery, which has a design capacity of 10,500 barrels of oil per day. Shortages in U.S. refinery capacity and product price increase were given as the reason for reopening the facility closed in 1970.

Effective January 1, 1973, the Governor has authorized a 100% increase in the price charged to commercial dredgers for sand and gravel taken from State lands. This increase also applies to the dredging of oyster shell from State lands in Texas coastal areas.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Although there was a decrease in output of the principal mineral fuels, overall value increased 17.3%, to $7,866 million. Crude oil contributed about 65.6% of the total fuels value; natural gas, 22.1%; natural gas liquids, 11.9%; and native asphalt, coal (lignite), and helium combined accounted for the remainder, or 0.5%.

Although the Railroad Commission allowed prorated wells to produce at 100% MDF for the entire year, compared with an average 94.1% MDF in 1972, output of crude petroleum decreased by 0.5% to 1,295 million barrels. For the second year, production did not parallel the increase in MDF percentage, indicating a further decline in producing capacity as allowables increased. Average daily production decreased 19,200 barrels per day during 1973 compared with that of 1972.

A total of 8,098 exploratory and development wells, including 72 offshore, were drilled during the year according to the American Pertoleum Institute (API). The increase in total wells drilled was 5.6%. The industry completed 5,161 ventures as oil and gas wells and abandoned 2,937 as dry holes. Of 2,325 exploratory wells, compared with 1,973 last year, 207 or 8.9% (6 offshore), were oil-productive and 410, or 17.6% (16 offshore), were gas-productive. Development drilling totaled 5,773 holes, compared with 5,693 in 1972, and resulted in 3,479 oil wells, 1,065 gas wells, and 1,229 dry holes. Success ratio of development wells was 78.7%.

Pipelines.—A total of 300 miles of natural gas lines and 440 miles of product lines were laid during 1973. The major projects were as folows: 250 miles of 4-, 6-, and 8-inch product lines from Brazosport to Stratton Ridge, Tex.; 365 miles of 30-, 24-, 12-, and 8-inch natural gas lines from Hemphill County, Tex., to Wilburton, Okla.; and 90 miles of 16-, 12-, 8-, and 6-inch natural gas lines in west-central Texas near Brownwood. Phillips Petroleum Co. increased the capacity of its 12-inch west Texas crude oil line by increasing the stationary pumping engines along the line by 7,500 horsepower. Exxon Pipe Line Co. assumed full operation of the Dixie Pipeline Co.'s 1,292-mile liquefied petroleum gas system that extends from Mont Belvieu, Tex., to Apex, N.C. Exxon has been partially operating the system under an agent-type agreement for the past 5 years. Explorer Pipeline Co. is adding 11,000 horsepower in pump capacity at three new main line stations. The products line capacity will be increased 90,000 barrels per day to 390,000 barrels per day. Stations at Huntsville and Greenville, Tex., are adding 3,500 and 4,000 horsepower, respectively. The 1,300-mile system extends from Louisiana through Texas to Indiana.

According to the Texas Railroad Commission, at the end of 1973, there were approximately 25,568 miles of crude oil trunklines, 26,787 miles of gathering lines, excluding lease flow lines, and 19,330 miles of product lines in operation throughout the State. There are now 46 common carrier pipelines in operation in Texas, and most of the carriers perform both gathering and trunk service. The rates for transportation of a barrel of oil to all gulf coast destinations range from 2.0 to 21.0 cents, depending on whether origin is in the gulf or west Texas areas.

Table 4.—Texas: Production and value of petroleum, natural gas, and natural gas liquids

Year	Crude petroleum		Natural gas [1]	
	Thousand 42-gallon barrels	Value (thousands)	Million cubic feet	Value (thousands)
1969	1,294,671	5,157,623	7,853,199	$1,075,888
1970	1,249,697	4,104,005	8,357,716	1,203,511
1971	1,222,926	4,261,775	8,550,705	1,376,664
1972	1,301,685	4,536,077	8,657,840	1,419,886
1973	1,294,671	5,157,623	8,513,850	1,735,221

Year	Natural gas liquids					
	Natural gasoline and cycle products		LP gases and ethane		Total	
	Thousand 42-gallon barrels	Value (thousands)	Thousand 42-gallon barrels	Value (thousands)	Thousand 42-gallon barrels	Value (thousands)
1969	96,628	$289,042	194,599	$237,411	291,227	$526,453
1970	97,511	284,871	204,177	334,850	301,688	619,721
1971	96,286	299,981	210,435	380,887	306,721	680,868
1972	92,437	294,163	226,624	428,319	319,061	722,482
1973	92,743	347,393	221,686	589,685	314,429	937,078

[1] Marketed production, gas either sold or consumed by producers including losses in transmission, amounts added to storage, and increases in gas pipelines.

Table 5.—Texas: Comparison of crude oil, natural gas, and natural gas liquids production in Texas and the United States

(Million barrels of crude oil equivalent)

Commodity	Production as oil equivalent[1]				Change from 1972 (percent)		Distribution percentage				Percent of Texas United States	
	Texas		United States				Texas		United States			
	1972	1973	1972	1973	Texas	United States	1972	1973[2]	1972	1973	1972	1973
Crude oil	1,302	1,295	3,455	3,361	−0.5	−2.7	42.3	42.5	43.5	42.7	37.7	38.5
Natural gas (marketed)	1,546	1,520	4,024	4,044	−1.7	.5	50.2	49.9	50.7	51.4	38.4	37.6
Natural gas liquids	233	229	465	463	−1.7	−.4	7.5	7.5	5.8	5.9	50.1	49.5
Total equivalent	3,081	3,044	7,944	7,868	−1.2	−1.0	100.0	99.9	100.0	100.0	38.8	38.7

[1] One barrel of crude oil equivalent to 5,600 cubic feet of natural gas or 57.6 gallons of natural gas liquids.
[2] Totals may not add due to independent rounding.

Table 6.—Texas: Crude oil, natural gas, and natural gas liquids reserves to production ratio in Texas and the United States[1]

(Million barrels of crude oil equivalent)

Commodity	Reserve				Reserve percentage				Reserve-production ratio			
	Texas		United States		Texas of United States		Change from 1972		Texas		United States	
	1972	1973	1972	1973	1972	1973	Texas	United States	1972	1973	1972	1973
Crude oil	12,144	11,757	36,339	35,300	33.4	33.3	−3.2	−2.9	9.7	9.3	11.1	11.1
Natural gas	16,972	15,167	47,515	44,634	35.7	34.0	−10.6	−6.1	11.5	10.3	11.8	11.1
Natural gas liquids	2,108	2,064	4,949	4,707	42.6	43.8	−2.1	−4.9	8.6	8.4	9.0	8.7
Total oil equivalent	31,224	28,988	88,803	84,641	35.2	34.2	−7.2	−4.7	10.5	9.7	11.3	10.9

[1] Estimated proved reserves and production from American Gas Association and American Petroleum Institute. One barrel of crude oil equivalent to 5,600 cubic feet of natural gas or 57.6 gallons of natural gas liquids.

Table 7.—Texas: Production trends of crude oil, natural gas, and natural gas liquids

(Million barrels of crude oil equivalent)

Year	Production[1]				Percentage of—						
					Annual total			Change from previous year			
	Oil	Gas[2]	Liquids	Total	Oil	Gas	Liquids	Oil	Gas	Liquids	Total
1969	1,152	1,402	211	2,765	41.7	50.7	7.6	1.7	4.8	1.4	3.2
1970	1,250	1,492	219	2,961	42.2	50.4	7.4	8.5	6.4	3.8	7.1
1971	1,223	1,527	224	2,974	41.1	51.3	7.5	−2.2	2.3	2.3	.4
1972	1,302	1,546	233	3,081	42.3	50.2	7.6	6.5	1.2	4.0	3.6
1973	1,295	1,520	229	3,044	42.5	49.9	7.5	−.5	−1.7	−1.7	−1.2

[1] One barrel of crude oil equivalent to 5,600 cubic feet of natural gas or 57.6 gallons of natural gas liquids.
[2] Marketed gas.

Table 8.—Texas: Estimated proved recoverable reserves of natural gas, natural gas liquids and crude oil, by district

Railroad commission district	Proved reserves Dec. 31, 1972	Extensions and revisions	New fields and new pools	Proved reserves Dec. 31, 1973	Change from Dec. 31, 1972
NATURAL GAS (MILLION CUBIC FEET)					
1	1,620,405	−28,772	21,352	1,473,201	−147,204
2	9,496,136	−643,178	111,881	8,449,920	−1,046,216
3	20,696,874	−1,029,612	443,273	18,526,171	−2,170,703
4	24,334,110	−3,562,955	259,006	19,416,215	−4,917,895
5	1,171,395	+82,147	4,330	1,149,781	−21,614
6	5,710,441	−7,515	38,832	5,432,193	−278,248
7B	663,560	+64,225	6,235	652,076	−11,484
7C	2,581,980	+96,214	19,008	2,430,873	−151,107
8	15,481,337	+988,512	337,009	14,796,454	−684,883
8A	2,366,951	−13,449	1,140	2,121,505	−245,446
9	1,559,594	+82,591	2,563	1,502,193	−57,401
10	9,359,260	+762,246	101,026	8,985,920	−373,340
Total	95,042,043	−3,209,546	1,345,655	84,936,502	−10,105,541
NATURAL GAS LIQUIDS (THOUSAND BARRELS)					
1	16,742	+12,773	138	26,510	+9,768
2	122,029	+31,639	1,807	144,318	+22,289
3	570,324	−54,968	3,075	464,794	−105,530
4	424,019	+123,254	3,628	490,561	+66,542
5	73,358	+5,776	184	73,261	−97
6	384,345	−1,854	1,576	355,689	−28,656
7B	52,921	+17,876	311	62,161	+9,240
7C	118,506	+18,862	7	120,608	+2,102
8	475,338	+38,229	268	453,718	−21,620
8A	258,147	+45,510	120	264,731	+6,584
9	68,280	+19,317	315	78,462	+10,182
10	327,574	+5,405	3,256	295,330	−32,244
Total	2,891,583	+261,819	14,685	2,830,143	−61,440
CRUDE OIL (THOUSAND BARRELS)					
1	147,324	+16,842	353	144,149	−3,175
2	636,768	+109,678	4,989	677,125	+40,357
3	1,536,426	+117,081	5,785	1,489,428	−46,998
4	343,752	+3,234	9,016	304,422	−39,330
5	98,963	+47,780	302	126,462	+27,499
6	2,208,438	+3,729	321	2,049,248	−159,190
7B	235,962	+32,174	3,233	235,870	−92
7C	239,270	−5,704	5,178	204,996	−34,274
8	3,402,358	+77,574	2,389	3,205,538	−196,820
8A	2,793,503	+332,752	4,860	2,785,308	−8,195
9	324,018	+81,961	3,700	363,708	+39,690
10	177,275	+13,030	603	170,359	−6,916
Total	12,144,057	+830,131	40,729	11,756,613	+387,444

Source: American Gas Association, Inc., and American Petroleum Institute.

Asphalt (Native).—Output and value increased 20.8% and 24.4%, respectively. Most of the output was used in highway maintenance, and Texas led the Nation in output of this commodity again. Two companies continued to quarry the native asphalt rock in Uvalde County.

Carbon Black.—Output increased by 6% to a total of 1,511 million pounds, which is 43.2% of the total U.S. production. Texas has 14 plants (2 channel and 12 furnace) of the Nation's 34 plants. The total daily capacity of the 14 plants is 5.2 million pounds, and the daily capacity of the United States is 11.6 million pounds. Statewide, a total of 23.1 billion cubic feet of natural gas was processed to produce 42.9 million pounds of carbon black. A total of 295 million gallons of liquid hydrocarbons were also processed to produce 1,468 million pounds of the commodity. Average price throughout the State for the year was 8.48 cents per pound, and total value was $128 million. The major users of carbon black were ink, paint, and plastic and rubber products manufacturers. The major portion of carbon black went into making automobile and truck tires.

J. M. Huber Corp. continued to expand its Texas carbon black plant. A 42-million-pound plant was completed at

Borger. Increased capacity was being built at the Borger and Baytown facilities. A 20-million-pound plant was being added to Phillips Petroleum Co.'s complex at Borger. Additional capacity wil be added at both the Borger and Orange plants.

Coal (Lignite).—In 1973 a total of 6,944,000 tons of lignite was produced. The 1972 output of lignite was about 4 million tons. Industrial Generating Co. mined lignite in Milam and Freestone Counties. This is the fuel source to generate electricity. Texas Power & Light Co., Dallas Power & Light Co., and Texas Electric Service Co. continue to work on two lignite-fired electric generating plants in east Texas; one near Mt. Pleasant in Titus County and the other near Tatum in Rusk County. The two new plants should be on-stream by 1975 and 1976. ICI America Inc. (formerly Atlas Chemical Industries, Inc.) continued to mine lignite in Harrison County for use in preparing activated carbon.

Helium.—Output and value of crude helium decreased 11.9% to 904 million cubic feet and $10.8 million. Unit value remained constant, and Texas output was 35.3% of the U.S. total crude helium quantity and value. Again, during 1973, high-purity helium was not produced in the State. During December, Phillips Petroleum Co. ceased delivery of helium to the U.S. Bureau of Mines conservation system. Extensive modernization planned for the Federal plant at Exell was still not complete by yearend owing to technical difficulties.

Natural Gas.—Texas continued to be the leading natural gas producing State and supplied 37.6% of the total domestic output. Marketed production of natural gas amounted to 8,514 billion cubic feet, a decrease of 1.7% from that of 1972. However, value increased significantly because of a higher unit price to $1.74 billion dollars. Overall value increased 22.2%, and unit value gained 24.3% to 20.4 cents per thousand cubic feet.

The Railroad Commission reported total natural gas production at 9,328 billion cubic feet, a 2.9% decrease from 1972. Gas well gas totaled 7,323 billion cubic feet for a 1.7% decrease. Likewise, casinghead gas production decreased 6.2% from 2,152 billion cubic feet in 1972 to 2,018 billion cubic feet in 1973. During December 1973, the total number of gas wells producing had increased by 1,121 over 1972 to 36,352, a 3.2% increase. Likewise, the number of gasfields reported increased by 2.4% to 9,636. Natural gas was produced in 207 of the State's 254 counties. Eleven counties produced more than 200 billion cubic feet each, and the leading 5 counties produced 31% of the State total. Production obtained from each of these five counties in billion cubic feet was as follows: Pecos 871, Kleberg 591, Waller 483, Ward 385, and Winkler 285.

According to the American Gas Association (AGA) annual report of the underground gas storage committee, over 6 trillion cubic feet of natural gas underground storage capacity is available in the United States. This storage permits the industry to maintain a reserve so that during cold weather, millions of gas customers can be supplied when demand exceeds pipeline capacity. As of December 31, 1973, total reservoir storage capacity in Texas was 186 billion cubic feet, or 3.0% of the U.S. total.

Annual statistics of the AGA show that natural gas reserves in the State continued the decline that had begun after 1967. Reserves have decreased from 125.4 trillion cubic feet as of December 31, 1967, to 84.9 trillion cubic feet at the end of 1973. Reserves decreased 10.6% during the year. The reserve in Texas was 34.0% of the U.S. total. Reserves found in new fields were 746 billion cubic feet, and in new reservoirs in old fields, 600 billion cubic feet. The majority, or 37.9 trillion cubic feet and 44.7% of the State's reserves, continued to be located in Railroad Commission districts 3 and 4 combined. Capacity for the State during the heating season immediately following the end of the year, as reported by the AGA, was 27.6 billion cubic feet per day, a decrease from the 31.2 billion reported at the end of the prior year.

The oil and gas industry increased its gas well exploratory efforts in 1973 to discover new reserves. The overall number of exploratory wells completed as gas producers was more than double the number reported in the previous year. According to the API, 410 exploratory wells were drilled in 1973 totaling 3.1 million feet drilled compared with 183 wells drilled in 1972 totaling 1.5 million feet. Rock units in west Texas receiving the most exploratory effort were the

Silurian, Fusselman, and Ellenburger. The most important Silurian discovery was the Chapman Deep field in Reeves County. An indicated important Fusselman discovery was the Apollo field in Winkler County along the west side of the Central Basin platform; in Loving County, combination Fusselman-Ellenburger discoveries that were important were in the Moore-Harper and Vermejo fields on the west side of the Delaware Basin.

In the Texas Panhandle area, the most significant new field discoveries were the North East Canadian Douglas and East Canadian Douglas in Hemphill County. These wells were completed in the Douglas sand of late Pennsylvania (Virgil) age, and they are in the most rapidly expanding area of the Anadarko Basin.

The rising demand and an increase in natural gas prices was anticipated throughout the State early in 1973. In north-central Texas, the Booneville gasfield and related areas were extended by 18 new gas discoveries in Wise County, 15 in Denton County, and 11 in Jack County. In addition, drilling resulted in 11 new gas discoveries in Hood County, 10 in Palo Pinto County, and 4 in Parker County. In south Texas, in the Paleozoic Trend, drilling for Pennsylvanian-age gas sands increased about fivefold. Real County was the site of a successful Pennsylvanian well with the discovery of the Lomas Piedras field, the first production in the country. Exploration in the Cretaceous sands of Dimmit County resulted in the discovery of two important new fields, the Catarina East and Wintergarden South fields.

One of the most significant discoveries of the year was the Clark Ranch field in Webb County, completed in the Lower Wilcox. The discovery well was about 10 miles from the nearest Wilcox production, with an offset that was successful. The Frio (Oligocene) was the most tested strata in district 2. New Frio discoveries reported were: North Alkek and Sitton in Goliad County; Northwest Ganado and North Carancahua Bay in Jackson County; Borcher and Vienna East in Lavaca County; and Adcock, Kyle, Garcitas Creek, and Southwest Coletto Creek in Victoria County. Another significant field discovery was the East Midway, productive from the lower Frio in San Patricio County. The discovery proved commercial reservoir formations below the Commonwealth sands and provided prospects that are expected to extend into other nearby counties. Offshore, in State waters off Willacy County, the Harena field, productive from the Miocene, was discovered.

Less exploration and development drilling was experienced in east Texas in 1973 than during 1972. However, nine new gasfield discoveries were reported in seven counties, primarily in the Travis Peak and Pettet formations, followed by the Rodessa and Smackover. In the upper gulf coast area, significant Miocene discoveries were offshore in the Brazos area, Federal Block A-1, and in High Island Federal Block 88-L. The most important Frio (Oligocene) gasfield discovered was the Martin Ranch field in Brazoria County.

Natural Gas Liquids.—Texas output for 1973 totaled 314 million barrels compared with 319 million barrels for 1972 and accounted for about 50% of the Nation's production and value of natural gas liquids. The components of the liquids produced in Texas were as follows: Ethane 11.4%, propane 19.4%, isobutane 2.4%, butane 8.3%, ethane and propane 2.6%, LP-gas mix 2.4%, NGL mix 39.4%, natural gas 9.8%, and others 4.3%.

The natural gas processing issue of the Oil and Gas Journal reported that there were 362 natural gas processing plants in Texas at the end of 1973 compared with 369 at yearend 1972. Total plant capacity was 29.9 billion cubic feet per day compared with 28.8 billion cubic feet in 1972.

The AGA estimated that proved natural gas liquid reserves in Texas totaled 2,830 million barrels as of December and accounted for 43.8% of U.S. reserves. In 1972, the State's reserves were reported as 2,892 million barrels. Revisions during 1973 amounted to 229,000 barrels; extensions, 33,000 barrels; and new field discoveries, 6,000 barrels, with new reservoirs in old fields amounting to 8,000 barrels; total increase was 276,000 barrels.

Amoco Production Co. will increase the capacity of its Hastings field (Brazoria County) gas processing plant by 73,000 gallons per day. Cities Service Oil Co. will expand its east Texas facility in Gregg County to handle an additional 7 million cubic feet of gas and about 33,000 gallons of products a day.

El Paso Natural Gas Co. will expand the capacity of their Shamrock gas processing plant in Wheeler County by 100 million cubic feet per day.

Getco Gas Co. has commenced operation

of its new natural gasoline plant near Shep in southwest Taylor County.

Lone Star Gas Co. will build a $3 million acid gas treating plant in the War-Wink field in Ward and Winkler Counties. Plant capacity will be 180 million cubic feet per day.

Mobil Oil Corp. expanded its Karon field (Live Oak County) gas processing plant by an additional 15 million cubic feet per day.

Natural Gas Pipeline Co. of America completed a $70 million plant at Ingleside (San Patricio County) to convert liquefied natural gas to a vapor.

Pioneer Natural Gas Co. is expanding its Briscoe gas processing facility in Wheeler County by 22.4 million cubic feet per day to a new capacity of 52.4 million cubic feet per day.

Shell Oil Co. expanded its Bryans Mill operation in Cass County by 20 million cubic feet per day.

Standard Oil Co. (Indiana) started a new cryogenic plant near Alvin in Brazoria County. The plant will process 70 million cubic feet of natural gas and 73,000 gallons of liquid per day, and will replace an adjacent absorption unit.

Sun Oil Co. increased the liquid production capacity at its Big Wells plant in Dimmitt by 120,000 gallons per day.

Texas Oil and Gas Corp. constructed a $3 million gas refinery 7 miles west of Krum in Denton County that can process 15 million cubic feet per day of raw gas. The company also expanded its plant at Avinger in Marion County in east Texas by 75 million cubic feet per day. Liquids output capacity is now 28,000 gallons per day of propane, 25,000 gallons per day of butane, and 25,000 gallons per day of gasoline. The construction was completed and operation of the new unit commenced in September.

Petroleum.—Crude oil production decreased slightly to 1.29 billion barrels, and total value increased substantially to $5.2 billion for a 13.7% value gain. Wellhead price increased $0.50 per barrel to $3.98. Value of Texas crude petroleum production, again setting an alltime high, was 39.5% of the U.S. total.

Crude oil production was reported from 203 counties. The five leading counties in descending order of output were as follows: Scurry, Ector, Yoakum, Gaines, and Andrews. All these counties were in Railroad Commission districts 8 and 8A in west Texas, and each was the source of over 60 million barrels during the year. Combined, the five counties accounted for about 352 million barrels, or 27.2% of the State total. At the end of the year, there were 159,090 productive crude oil wells with an average 22.3 barrels per day each, a 4.7% increase from that of the previous year.

In the south Texas area (Railroad Commission districts 1, 2, and 4 encompassing 58 counties) drilling activity decreased 2% from that in 1972. A total of 1,733 wells were drilled in 1973 (1,777 in 1972). Of the total 493 exploratory wells (516 in 1972) drilled, only 64 or 14% discovered hydrocarbons. Development wells totaled 1,050, compared with 1,261 in 1972, with 910 or 87% successful. Two important oil discoveries were reported in Kleberg and McMullen Counties. These were the North Padre Island and Freddy Hutt fields, respectively. In the east Texas area (Railroad Commission districts 5 and 6 composed of 46 counties), there were 295 wells drilled in 1973 compared with 367 in 1972. A total of 130 exploratory wells were drilled (161 in 1972) with a success ratio of 10%, and 165 development wells were drilled (206 in 1972) with 71% being successful. The American Association of Petroleum Geologists (AAPG) reported four important oil discoveries for 1973 in the area. These were the Girlie Caldwell field in Smith County; the Yantis field, Wood County, in which the discovery well potentialed 175 barrels of oil per day; Reilly Springs, southwest, in Hopkins County, a Smackover discovery that had a potential of 705 barrels per day reported for the discovery well; and the discovery of a 10-barrel-per-day well in the Whelan gasfield in Marion County.

Table 9.—Texas: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Anderson	51	1	3	--	--	7	62	118,387
Andrews	50	--	7	2	--	2	61	457,283
Angelina	--	--	--	--	--	1	1	9,460
Aransas	2	2	--	--	--	3	7	66,267
Archer	67	--	41	4	--	14	126	234,135
Armstrong	--	--	--	--	--	1	1	6,857
Atascosa	--	1	1	--	--	13	15	77,544
Austin	5	4	1	--	3	12	25	205,037
Bandera	--	--	--	--	--	1	1	10,370
Bastrop	--	--	3	--	--	6	9	36,855
Baylor	8	--	1	--	--	4	13	31,040
Bee	3	8	12	--	3	23	49	262,692
Bexar	5	--	5	--	--	1	11	11,736
Borden	14	--	5	1	--	6	26	198,645
Bosque	--	--	--	--	--	1	1	6,258
Bowie	--	--	--	--	--	3	3	24,544
Brazoria	34	4	10	1	4	23	76	540,702
Brazos	--	--	2	--	--	2	4	16,297
Brooks	3	6	6	--	3	5	23	166,179
Brown	36	10	20	2	1	2	71	133,391
Burleson	9	--	1	--	--	--	10	35,450
Caldwell	23	--	35	--	--	1	59	137,656
Calhoun	--	2	7	--	--	10	19	155,175
Callahan	32	--	36	1	--	16	85	109,549
Cameron	--	4	--	--	4	9	17	114,779
Camp	--	3	2	--	--	--	5	55,220
Carson	17	2	3	--	--	--	22	68,505
Cass	3	--	1	--	2	2	8	64,828
Chambers	8	2	4	8	1	15	38	325,486
Cherokee	--	--	3	--	2	9	14	91,733
Childress	--	--	--	--	--	2	2	5,550
Clay	13	--	7	2	--	15	37	156,104
Cochran	27	17	1	--	--	4	49	251,819
Coke	13	--	4	2	--	7	26	158,040
Coleman	3	5	11	2	1	6	28	61,976
Colorado	1	5	8	1	9	33	57	400,154
Comanche	4	--	5	2	2	3	16	34,949
Concho	--	--	4	--	2	5	11	33,386
Cooke	26	--	7	--	--	8	41	126,648
Cottle	--	--	--	--	1	3	4	21,023
Crane	114	5	7	3	1	6	136	571,693
Crockett	5	38	15	1	8	19	86	543,192
Crosby	1	--	--	--	--	1	2	13,212
Culberson	4	--	1	--	--	4	9	53,736
Dawson	36	--	6	1	--	13	56	444,171
Delta	--	--	--	--	--	1	1	4,759
Denton	--	6	1	--	15	15	37	264,448
De Witt	3	15	3	1	4	15	41	319,638
Dickens	4	--	3	2	--	4	13	75,405
Dimmit	74	5	19	--	3	30	131	490,840
Donley	--	--	--	--	--	1	1	6,500
Duval	28	19	17	1	6	26	97	374,261
Eastland	5	4	4	1	4	18	36	118,248
Ector	273	2	11	1	--	6	293	1,483,468
Edwards	--	14	4	--	10	19	47	271,458
Erath	--	--	--	--	--	2	2	8,590
Falls	--	--	2	--	--	--	2	6,926
Fayette	--	--	--	--	--	3	3	23,627
Fisher	28	--	6	2	--	6	42	231,069
Foard	--	--	1	1	--	3	5	21,388
Fort Bend	18	3	5	--	2	5	33	182,921
Franklin	7	1	1	--	--	1	10	54,694
Freestone	--	1	4	--	--	5	10	68,865
Frio	9	--	1	--	--	3	13	46,615
Gaines	21	--	6	3	--	10	40	336,989
Galveston	3	4	3	5	4	6	25	255,939
Garza	34	--	3	2	--	11	50	180,769
Glasscock	13	--	1	--	--	2	16	58,254
Goliad	6	16	10	--	4	12	48	277,319
Gonzales	--	--	--	--	--	6	6	20,013
Gray	17	1	--	--	--	--	18	56,323
Grayson	--	1	--	1	--	4	6	41,505
Gregg	5	7	3	--	--	1	16	106,033
Grimes	--	--	--	--	--	5	5	17,120
Guadalupe	49	--	2	--	--	1	52	129,276
Hale	42	--	--	--	--	--	42	258,187
Hamilton	--	--	--	--	--	2	2	6,871
Hansford	5	8	10	2	2	7	34	239,955

See footnotes at end of table.

Table 9.—Texas: Oil and gas well drilling completions, by county—Continued

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Hardeman	1	--	1	1	--	1	4	25,718
Hardin	55	1	16	2	3	7	84	288,668
Harris	16	2	8	1	6	6	39	258,995
Harrison	3	1	1	--	--	1	6	43,207
Hartley	--	2	--	--	--	2	4	13,913
Haskell	7	--	5	3	1	15	31	117,638
Hays	--	--	--	--	--	1	1	14,020
Hemphill	3	65	8	1	12	6	95	1,040,303
Henderson	1	5	--	--	--	--	6	59,876
Hidalgo	2	24	5	1	1	17	50	473,289
Hill	--	--	1	--	--	4	5	17,755
Hockley	164	5	3	--	--	10	182	968,142
Hood	--	--	--	--	11	3	14	41,027
Hopkins	--	--	--	--	1	5	6	52,642
Houston	3	6	2	--	1	2	14	132,690
Howard	42	--	10	2	--	4	58	237,858
Hudspeth	--	--	--	--	--	2	2	12,828
Hunt	--	--	--	--	--	2	2	19,946
Hutchinson	13	12	4	1	2	4	36	156,571
Irion	116	3	1	4	1	5	130	843,742
Jack	32	6	17	15	11	34	115	455,095
Jackson	16	21	14	5	9	16	81	499,326
Jasper	1	--	2	--	4	9	16	139,239
Jefferson	18	4	10	4	2	19	57	436,324
Jim Hogg	2	3	3	1	4	17	30	142,010
Jim Wells	9	22	11	--	3	12	57	336,165
Jones	9	--	8	4	--	19	40	107,479
Karnes	1	5	--	--	--	14	20	158,021
Kaufman	--	--	--	--	--	2	2	12,119
Kenedy	4	4	1	--	1	7	17	159,275
Kent	17	--	11	1	--	6	35	188,545
Kerr	--	--	--	--	--	3	3	12,409
Kimble	--	7	5	--	4	23	39	94,475
King	23	--	7	--	--	10	40	201,764
Kinney	--	--	--	--	--	3	3	8,687
Kleberg	28	10	13	1	2	12	66	500,488
Knox	2	--	2	--	--	10	14	42,064
Lamb	--	--	--	--	--	1	1	6,700
La Salle	--	--	4	--	1	11	16	96,554
Lavaca	5	21	4	2	16	19	67	366,923
Lee	--	--	--	1	--	2	3	15,629
Leon	--	4	--	--	--	5	9	79,831
Liberty	44	1	8	--	1	19	73	446,806
Limestone	--	--	1	--	1	7	9	67,754
Lipscomb	2	17	9	--	2	2	32	291,198
Live Oak	9	9	6	1	4	25	54	258,536
Loving	--	--	--	--	1	1	2	42,458
Lubbock	4	--	1	--	--	--	5	29,038
Lynn	--	--	2	--	--	1	3	26,834
McCulloch	--	13	17	--	--	1	31	45,400
McMullen	3	6	8	1	2	19	39	230,259
Madison	2	--	5	1	--	3	11	60,139
Marion	7	--	5	1	1	3	17	91,421
Martin	206	--	5	3	--	6	220	2,031,864
Matagorda	6	6	5	2	12	21	52	430,160
Maverick	6	2	19	--	1	19	47	137,217
Medina	--	--	1	--	--	--	1	1,086
Menard	1	--	1	1	--	6	9	26,632
Midland	59	3	4	3	--	--	69	610,848
Milam	2	--	5	--	1	2	10	28,122
Mitchell	71	--	2	--	--	9	82	251,377
Montague	5	--	12	2	--	18	37	171,118
Montgomery	6	3	4	--	1	5	19	152,907
Moore	18	7	1	--	--	1	27	76,803
Motley	--	--	1	--	--	2	3	10,030
Nacogdoches	1	1	2	--	--	6	10	85,260
Navarro	--	--	2	--	--	9	11	66,580
Newton	--	--	5	2	--	13	20	173,910
Nolan	15	3	5	2	--	8	33	202,408
Nueces	24	22	16	2	3	17	84	619,955
Ochiltree	5	9	5	2	--	6	27	225,819
Oldham	--	--	--	--	--	2	2	6,733
Orange	6	1	1	2	--	2	12	78,921
Palo Pinto	4	15	15	1	10	18	63	267,393
Panola	1	10	2	--	--	1	14	96,912
Parker	--	3	2	1	4	2	12	49,493
Pecos	69	33	25	6	13	16	162	1,056,305
Polk	6	--	7	2	2	4	21	158,830

See footnotes at end of table.

Table 9.—Texas: Oil and gas well drilling completions, by county—Continued

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Potter	18	17	7	--	1	--	43	105,430
Rains	--	--	--	--	--	1	1	13,870
Reagan	130	--	2	--	--	1	133	706,973
Real	--	--	--	--	--	1	1	6,500
Red River	--	--	1	--	--	3	4	16,928
Reeves	6	7	5	--	5	12	35	406,962
Refugio	22	10	1	1	3	8	45	283,308
Roberts	--	18	--	1	--	10	29	225,847
Robertson	--	--	--	--	--	4	4	45,730
Runnels	10	2	8	5	2	20	47	188,347
Rusk	7	4	4	--	--	9	24	155,394
Sabine	--	--	--	--	--	3	3	22,809
San Jacinto	--	--	1	--	1	1	3	20,511
San Patricio	9	20	12	--	4	13	58	441,966
Schleicher	--	5	6	--	8	21	40	255,637
Scurry	51	--	11	--	--	1	63	222,783
Shackleford	42	5	61	3	4	34	149	323,462
Shelby	1	2	1	--	--	6	10	50,770
Sherman	--	2	--	--	1	4	7	35,299
Smith	6	1	1	1	2	10	21	178,786
Starr	7	10	10	1	5	16	49	274,931
Stephens	19	10	6	3	--	8	46	153,577
Sterling	2	--	3	1	--	3	9	69,597
Stonewall	11	--	7	1	--	13	32	151,910
Sutton	--	150	24	1	20	17	212	1,389,874
Taylor	39	1	16	3	--	16	75	288,752
Terrell	--	2	1	--	--	3	6	45,339
Terry	24	1	6	--	--	3	34	198,423
Throckmorton	36	1	34	2	1	15	89	206,019
Titus	3	--	--	--	--	--	3	11,184
Tom Green	1	--	5	1	--	4	11	61,030
Trinity	--	--	--	--	1	2	3	30,575
Tyler	1	--	3	2	3	13	22	173,793
Upshur	--	7	1	--	1	1	10	118,756
Upton	64	--	6	2	--	3	75	446,036
Val Verde	--	2	--	--	--	3	5	42,696
Van Zandt	2	--	--	--	--	7	9	74,422
Victoria	4	18	10	--	8	15	55	293,238
Walker	--	--	--	--	--	3	3	36,805
Waller	--	2	--	1	--	4	7	56,696
Ward	31	15	15	4	4	8	77	737,394
Washington	5	--	1	--	--	2	8	21,684
Webb	2	56	13	1	25	38	135	896,665
Wharton	12	25	27	1	12	26	103	517,655
Wheeler	1	1	1	1	1	9	14	165,781
Wichita	172	--	52	1	--	2	227	370,955
Wilbarger	20	--	7	2	--	13	42	124,551
Willacy	3	3	1	1	--	5	13	103,125
Williamson	--	--	1	--	--	4	5	7,950
Wilson	3	--	3	1	--	5	12	32,553
Winkler	9	8	8	3	1	4	33	337,393
Wise	3	22	7	2	18	13	65	434,772
Wood	15	1	9	1	--	6	32	239,529
Yoakum	193	--	3	2	--	1	199	1,075,672
Young	41	--	25	12	1	22	101	235,781
Zapata	14	1	6	--	5	9	35	170,799
Zavala	3	9	5	--	1	10	28	97,407
Offshore 602	--	--	--	--	--	1	1	9,298
Offshore 604	--	--	--	--	2	1	3	25,609
Offshore 605	--	--	--	3	4	3	10	86,391
Offshore 703	--	--	--	--	--	5	5	31,499
Offshore 704	--	2	--	--	4	4	10	86,527
Offshore 705	--	--	--	--	--	1	1	10,218
Offshore 706	1	--	--	3	1	9	14	150,721
Offshore 708	--	2	1	--	4	4	11	110,219
Offshore 709	--	--	--	--	--	11	11	75,537
Offshore 710	--	--	--	--	1	1	2	18,355
Offshore 711	--	--	--	--	--	4	4	37,200
State total	3,479	1,065	1,229	207	410	1,708	8,098	44,212,567

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

The Upper Gulf Coast area (Railroad Commission district 3 composed of 29 counties) reported a 2% increase in drilling activity over that of 1972. There were 372 exploratory wells (335 in 1972) drilled with an overall success ratio of 29% compared with 27% the previous year. There were 460 development wells (487 in 1972) reported drilled, with 70% being successful, or 1% less than the year before. According to the AAPG, there were four important onshore oil discoveries reported during the year; these were along the Oligocene trend in the Frio formation. The discovery well in the Whites Bayou field in Chambers County was tested with a flow of 195 barrels of oil per day. For the discovery well in the South Hastings field in Galveston County, an initial potential of 323 barrels per day was reported. The Boise field was discovered in Orange County; in Matagorda County, the discovery well for Midfields field tested 252 barrels per day. Geophysical activity of 502 crew-weeks was reported for the onshore segment of the area, more than double that of 1972. In the offshore portion of the Upper Gulf Coast, primary areas of activity were High Island, Galveston, and Brazos. The objectives were mainly gas sands of the thick Miocene and Pleistocene sections. Geophysical activity tripled from 1972 with 141 crew-weeks. There were 60 offshore wildcats during the year with an overall success ratio of 35%.

In the west Texas area (Railroad Commission districts 7C, 8 and 8A composed of 55 counties), 435 exploratory wells were drilled compared with 423 in 1972; the success ratio for 1973 was about 29%. Development wells drilled increased to 2,532 (2,074 in 1972) with a success ratio of 89%. One important oil discovery was reported in the Ellenburger on the eastern shelf of the Midland basin; this was the Triple C field in Sterling County, and the discovery well potentialed 300 barrels of oil per day. The most active area in west Texas was the western side of the Delaware Basin; there was considerable leasing in that section with bonus prices on the increase. University of Texas lands leased in April brought an average of $65.99 per acre, and in the December sale, the average price paid was $134.43 per acre. In Martin and Andrews Counties, prices reached $1,280 per acre, and in Ward and Winkler Counties, the price per acre reached $2,030. Major blocks were assembled in Culberson, Reeves, Loving, Presidio, Pecos, and Terrell Counties. Geophysical activity increased to 996 crew-weeks, a 27% increase over that of 1972. Activity centered mainly in Culberson, Reeves, Loving, and Winkler Counties; the objective was the Silurian and Fusselman gas zones.

Table 10.—Texas: Crude petroleum production, indicated demand, and stocks in 1973, by month

(Thousand 42-gallon barrels)

Month	Production	Indicated demand	End of month stocks originating within Texas
January	108,336	113,839	87,617
February	99,619	101,127	86,109
March	111,160	107,164	90,105
April	107,371	107,097	90,379
May	110,321	105,165	95,535
June	105,668	108,096	93,107
July	109,807	114,879	88,035
August	109,949	106,883	91,101
September	106,120	107,271	89,950
October	110,377	110,517	89,810
November	106,510	105,251	91,069
December	109,433	107,503	92,999
Total:			
1973	1,294,671	1,294,792	XX
1972	1,301,685	1,301,869	XX

XX Not applicable.

Table 11.—Texas: Runs to stills and output of refineries in 1973, by month

(Thousand 42-gallon barrels)

Month	Runs		Output							
	Crude oil	Products	Lube oil	Gasoline	Kerosine	Fuel oil		Jet fuel	Petrochemical feedstocks	Miscellaneous products
						Distillate	Residual			
January	96,875	11,917	2,426	49,960	3,595	25,037	4,423	6,473	6,450	10,428
February	90,725	10,114	2,324	44,529	3,509	22,975	4,285	6,973	6,148	10,096
March	96,585	11,063	2,631	50,322	3,145	21,102	4,631	7,032	6,832	11,953
April	95,927	11,917	2,426	49,960	3,595	25,037	4,423	6,473	6,450	9,480
May	102,086	9,705	2,459	55,410	1,528	22,282	5,092	7,010	5,835	12,175
June	101,933	10,269	2,307	54,297	1,482	23,664	4,899	6,325	6,514	12,714
July	98,284	13,001	2,551	56,511	1,779	22,416	4,396	5,673	6,242	11,717
August	101,303	13,108	2,457	56,022	1,756	23,641	5,200	6,668	6,602	12,065
September	94,793	12,148	2,433	50,869	2,296	22,803	4,828	6,563	6,135	11,014
October	105,499	12,494	2,794	54,014	2,535	24,320	5,886	7,332	6,917	14,195
November	94,514	12,247	2,722	49,449	2,100	21,829	5,652	6,856	6,363	11,790
December	92,802	11,933	2,667	46,382	1,865	25,554	5,224	7,564	6,652	8,827
Total	1,171,326	139,916	30,197	617,725	29,185	280,660	58,939	80,942	77,140	136,454

Table 12.—Texas: Stocks of refined products held by refining and pipeline companies in 1973, by month

(Thousand 42-gallon barrels)

Month	Special naphthas	Gasoline	Kerosine	Fuel oil		Jet fuel	Miscellaneous products	Total refined products [1]
				Distillate	Residual			
January	2,162	38,250	1,797	16,172	4,802	5,019	32,313	100,516
February	1,984	33,984	1,527	13,070	4,088	4,618	32,891	92,162
March	1,954	32,945	1,925	11,655	4,083	4,935	33,578	91,075
April	2,157	32,200	2,399	13,360	4,901	4,906	37,504	97,427
May	1,875	33,265	3,019	16,539	4,566	4,799	38,097	102,160
June	1,833	36,620	3,004	19,457	4,954	4,814	38,658	109,340
July	1,935	39,127	3,120	23,359	5,309	4,015	36,829	113,694
August	1,843	37,534	3,078	25,954	4,975	3,298	35,279	111,961
September	1,862	36,749	2,977	25,529	4,140	3,956	34,460	109,673
October	1,969	34,833	2,803	24,374	4,683	4,005	36,853	109,520
November	1,893	33,787	2,419	23,472	4,633	4,756	38,170	109,130
December	1,800	29,861	2,178	22,690	4,267	5,609	35,639	102,044

[1] Data may not add to totals shown because of independent rounding.

Table 13.—Texas: Stocks of crude petroleum at refineries, tank farms, and gathering systems in 1973, as of the last day of each month

(Thousand 42-gallon barrels)

Month	Refineries	Tank farms and pipelines	Lease tanks	Total
January	14,024	50,621	4,740	69,385
February	14,561	55,186	4,721	74,468
March	15,709	56,292	4,762	76,763
April	15,770	56,167	4,800	76,737
May	16,955	60,006	4,681	81,642
June	15,591	58,861	4,618	79,070
July	17,886	56,088	4,626	78,600
August	17,350	57,831	4,550	79,731
September	16,743	55,730	4,623	77,096
October	14,676	56,016	4,549	75,241
November	17,768	56,522	4,494	78,784
December	16,314	58,476	4,598	79,388

There was a 3.7% decline in overall drilling activity in the north-central Texas area (Railroad Commission districts 7B and 9 encompassing 39 counties). During the year, a total of 542 exploratory wells (448 in 1972) were drilled with a success ratio of about 29%. Gas discoveries represented over one-half of the successful exploratory wells. There were 1,194 development wells (1,355 in 1972) completed with a success ratio of 65%. Jack County was the center of most activity with 26 discoveries and 60 exploratory wells. However, Wichita County led in development drilling completions with 699. Leasing activity was revived after a number of negative years. The area with most leasing reported was primarily along the western flank of the Fort Worth Basin, extending from Parker and Palo Pinto to Coryell Counties. Subsurface geology is the most important means of exploration in the north-central area.

In the panhandle area (Railroad Commission district 10 made up of 26 counties), a total of 384 wells were drilled throughout the year compared with 299 in 1972. In exploratory drilling, a total of 86 wells were drilled with 10 completed as oil discoveries. Development wells drilled accounted for 95 oil completions (119 in 1972). Most significant discoveries in the area were gas-productive.

Crude petroleum stocks at yearend totaled 79.4 million barrels, an increase of 1.3% over comparable stocks in 1972. Refinery stocks were 16.3 million barrels, 21.0% of the U.S. total. Stocks at tank farms and in pipelines were 58.5 million barrels, and on-lease stocks were 4.6 million barrels. Both tank farm and in-pipeline and on-lease stocks were down slightly from the year before.

Crude oil refinery receipts at Texas refineries were 1.17 billion barrels, an increase of 5.2% compared with that of 1972. Refinery receipts amounted to 25.8% of the U.S. total.

According to the Oil and Gas Journal annual survey, capacity of the State's 40 active oil refineries was 3.7 million barrels per calendar day. Capacity showed an increase of 7.0% over that of 1972, although the number of plants was unchanged. Over 26% of the U.S. capacity is located in Texas. The journal reports that five plants at various locations totaling about 39,000 barrels per day capacity are in the process of being reactivated.

The Adobe refinery at Midland is being refurbished for a planned reopening mid-1974 after a 12-year shutdown.

American Petrofina Inc. is increasing its output capacity from 50,000 to 80,000 barrels daily at its newly acquired refinery at Port Arthur, Tex. The extra capacity will be used initially to process imported "sweet" crude oil. The refinery was purchased from Standard Oil Co. (Ohio) in June for $100 million, including related crude oil pipelines and rights to certain marketing properties; facilities that have been shutdown since 1971 are being reactivated.

Atlantic Richfield Co. announced plans in November to begin a $150 million expansion at its Houston refinery. Crude oil capacity will be increased from 205,000 to 300,000 barrels per day. The addition of a crude unit, fluid feed pre-treater, and distillate hydrotreating section will increase the refinery's capacity to process sour crude oil.

Diamond Shamrock Oil & Gas Corp. completed a new 10,000-barrel-per-day Rheniformer process plant in Moore County, north of Amarillo. The new McKee facility was completed in late 1973 and was designed to use the catalytic reform process to handle 10,000 barrels per day of naphtha to make a product called "Reformate." The process converts part of the naphtha to aromatics for addition to gasoline to improve the octane rating. Exxon Co., U.S.A., will expand its Baytown refinery in Harris County. Capacity will be increased by 350,000 barrels to a total of 630,000 barrels per day, making it the largest in the nation.

The Longview Refining Co. refinery in Gregg County was being expanded to increase capacity to 10,000 barrels per day of crude oil. The company recently became a wholly owned subsidiary of Crystal Oil Co. of Shreveport, La.

Marathon Oil Co. began construction of a new 11,000-barrel-per-day hydrofluoric acid alkylation unit at Texas City. The system was scheduled for completion and operation by May 1974. Installation of the unit permits alkylation of propylene and butylene olefins to improve gasoline blending components manufactured and sold.

The Petroleum Refining Co. of Lueders, Jones County, was unable to meet pollution standards set by the Texas Water Quality Board and was ordered closed. The refinery was sold to Pride Refining, Inc., and was being dismantled. The company will use

some of the equipment at its Abilene refinery.

Tesoro Petroleum Corp. completed the first phase of a two-phase expansion program to increase crude throughput capacity at its Carrizo Springs facility. Throughput was increased to 13,000 barrels per day during the year, with plans to further increase throughput to 20,000 barrels per day in 1974. A new 3,000-barrel-per-day liquefied petroleum gas (LPG) unit was under construction during the year with completion scheduled for April 1974. The facility processes sweet crude supplied primarily from a five-county area surrounding Dimmit County. Further plans for expansion include the addition of a 3,000-barrel-per-day reformer hydrotreater to become operational in October 1974. Tankage, loading facilities, and pipelines are being added along with the above expansion projects, including capacity to produce no-lead gasoline.

Winston Refining Co. completed construction to increase crude oil throughput at its Fort Worth refinery to 15,000 barrels per day. Plans for early 1974 include yet another expansion to 20,500 barrels per day total capacity. Sweet crude is processed at the facility, and jet fuel, diesel, and fuel oil including various grades of gasoline are produced. Catalytic cracking capacity at the complex is 3,500 barrels per day.

E. I. du Pont de Nemours & Co., Inc., started expanding its Orange Texas facility to increase the annual output of high-density polyethylene by 50 million pounds. The company is expanding its Victoria complex with a new plant that will have an annual capacity of 225 million pounds of polyethylene resins. Completion date is scheduled for early 1976.

Gulf Oil Corp. plans to increase the yearly capacity of its high-density polyethane plant at Orange by 50 million pounds to 170 million pounds.

Gulf Oil Chemicals Co. has begun construction at its Cedar Bayou, Baytown unit, on a 1.2-billion-pound-per-year ethylene plant with a scheduled completion date for late 1975. Special design features will enable the use of a wide variety of feedsticks to produce ethylene.

At Beaumont, Mobil Chemical Co. is expanding its plant to produce 900 million pounds of ethylene per year by late 1974.

Hercules, Inc., started construction of a new 200-million-pound-per-year polypropylene plant a Bayport.

Phillips Petroleum Co. is adding about 160 million pounds of polyethylene capacity to its Adams terminal near Houston, and production is scheduled to begin late in 1974. At Borger, the company built a plant at its Philtex complex to manufacture 6 million pounds of polyphenylene-sulfide plastic resins a year.

Rohm & Haas Co. will expand its methyl methacrylate monomer production at Deer Park to 550 million pounds per year. This product is used in the production of acrylic plastics and in processing acids for rigid vinyl resins.

Shell Chemical Co. will increase the production of bisphenol-A at its Deer Park complex to more than 30 million pounds per year. The company will also increase the chlorine output to 90,000 tons per year.

Sinclair-Koppers Co. will double the low-density polyethylene production of its Port Arthur facility; new capacity will total 250 million pounds per year.

Tenneco Chemicals, Inc., is constructing a new 300-million-pound-per-year polyvinyl chloride plant at Pasadena and will be one of the largest producers of vinyl.

Petrochemicals.—Operators in the State continued to expand and build new petrochemical facilities. The following are some of the major projects that were started or completed throughout the year.

Amoco Chemicals Corp. planned to expand para-xylene production facilities at its Texas City petrochemical complex. The expansion will give the plant the capacity to produce 450 million pounds of para-xylene a year. Other products from the plant include styrene, secondary vinyl plasticizers, and methyl styrene. Para-xylene is a basic raw material used in the manufacture of terephthalic, an intermediate in the production of polyester fibers and film.

Diamond Shamrock Corp. planned a 200-million-pound-per-year polyvinyl chloride (PVC) resin plant at Deer Park. The compound is used in making plastic pipe and bottles, cable insulation, household goods, and other items. Completion is expected by late 1974. Also in the same area, the company plans to build a plant that will be able to produce 1,200 tons of chlorine and 300 tons of caustic soda per day.

Dow Chemical will expand production of propylene oxide at its Freeport plant In the same area, a plant to produce 100 million pounds of toluene diisocyanate was also being built by the company.

NONMETALS

Nonmetals produced in Texas during 1973 had a total value of $518 million, an increase of 16.0% for the year. Nonmetals accounted for 6.1% of the State's total mineral production value. The five principal nonmetals, in order of value, were cement, stone, Frasch sulfur, sand and gravel, and salt.

Increases in output of cement, common clay, ball clay, fuller's earth, kaolin, gypsum, lime, salt, sand and gravel, crushed or broken stone, Frasch sulfur, and talc and soapstone were registered in 1973. Declines in production of bentonite, fire clay, fluorspar, graphite, perlite, sodium sulfate, and dimension stone were reported.

The pumicite mine in Starr County was inactive during 1973, and the perlite mine in Presidio County was closed late in the year. Barite, mica, and vermiculite, mined out-of-State, were processed at plants in Texas.

Barite.—No barite mines operated in Texas during 1973, but four grinding plants—one in Brownsville, one in Corpus Christi, and two in Houston—processed crude barite that was brought into the State. Total output from these plants increased 32% over that of the previous year. The processed barite was used chiefly as a weighting agent in well-drilling muds. Other uses were as a filler or extender, and in the preparation of glass and other products.

Cement.—The portland cement industry in Texas surpassed its record output of the previous year. Shipments were up 6% with a gain of 10% in total value. Average value of the portland cement per short ton in 1973 was $22.76 compared with $21.97 in 1972 and $19.48 in 1971.

Thirteen companies prepared the cement at 18 plants located in Bexar (three plants), Dallas, Ector, Ellis (two plants), El Paso, Harris (four plants), McLennan, Nolan, Nueces, Orange, Potter, and Tarrant Counties. The plants had a total production capacity of 9.9 million short tons of portland cement at yearend 1973. Raw materials used to prepare the cement included limestone, shell, clay and shale, bauxite, fluorspar, gypsum, limonite, and sand. A total of 53.1 billion cubic feet of natural gas and 68,000 barrels of fuel oil were burned as fuel in films, powerplants, and dryers. The plants used a total of 955 million kilowatt hours of electricity.

Ready-mix concrete companies received 63% of the portland cement shipments during the year. Other shipments went to concrete product manufacturers, building material dealers, highway construction and other contractors, government agencies (Federal, State, and local), and other customers. Approximately 8.32 million short tons of portland cement were used in Texas in 1973.

Masonry cement was prepared at 12 plants in Bexar, Dallas, Ector, Ellis, El Paso, Harris, McLennan, Nolan, Nueces, Potter, and Tarrant Counties. Shipments of masonry cement increased 8%, and their total value was up 14%. Average value of masonry cement was $28.27 per short ton in 1973.

During the year, Kaiser Cement & Gypsum Corp. announced a $11.5 million expansion program for its Longhorn Cement Div. in San Antonio that would increase plant capacity to 785,000 tons of cement annually. The plans called for installation of a new dry-process kiln and air-pollution control equipment. Another cement producer, Capitol Cement, a Division of Capitol Aggregates, Inc., completed a $3 million expansion program that increased production capacity at its San Antonio plant to 18,000 tons of cement daily. In Houston, Gulf Coast Portland Cement Co., a division of McDonough Co., announced plans to construct a 4,800-square-foot cement-finishing mill at an estimated cost of $70,000.

General Portland, Inc., which operates cement plants in Dallas, Fort Worth, and Houston, as well as in cities in other States, contracted to purchase 275,000 tons of cement in 1973 from Cementos Anahuac del Golfo, S.A., Mexico. The contract calls for shipments to increase to more than 750,000 tons per year during 1976–79.

The cement plant of Texas Industries, Inc., at Midlothian, southwest of Dallas, was described in an article.[3]

[3] Pit & Quarry, TXI's Expanded Midlothian Plant Largest in Southwest. V. 66, No. 1, July 1973, pp. 164, 166.

Table 14.—Texas: Portland cement salient statistics
(Short tons)

	1972	1973
Number of active plants	18	18
Production	7,884,308	8,312,050
Shipments from mills:		
Quantity	7,813,290	8,320,477
Value	$171,641,532	$189,368,484
Stocks at mills, Dec. 31	494,154	464,584

Table 15.—Texas: Masonry cement salient statistics
(Short tons)

	1972	1973
Number of active plants	12	12
Production	240,657	250,140
Shipments from mills:		
Quantity	216,634	233,679
Value	$5,811,510	$6,606,121
Stocks at mills, Dec. 31	22,730	21,163

Clays.—Production of clays in Texas during 1973 topped by 9% the record set the previous year. Total value, also an alltime high, was up 13%. Production consisted of ball clay, bentonite, common clay, fire clay, fuller's earth, and kaolin.

Ball clay was mined in Cherokee County by Southern Clay Products, Inc., and in Rusk County by Major Brick Co., for use in making face brick, floor and wall tile, and other ceramic products. Output and total value were up for the year.

Bentonite was mined at 12 operations in Angelina, Fayette, Gonzales, and Walker Counties by four producers—Dresser Industries, Inc., Dresser Minerals Division; The Milwhite Co., Inc.; NL Industries, Baroid Div.; and Southern Clay Products, Inc. Tonnage was down 4%, and total value declined 29% in 1973. The bentonite was used as an additive in drilling muds, as a filtering and decolorizing agent, a foundry-sand bond, an animal-feed filler, and a grease absorbent.

Output of common clay, reported by 45 producers from 91 operations in 40 counties, increased 9% during 1973. Average value was $1.68 per short ton. Approximately 27% of the common clay was used as a raw material in the manufacture of portland cement, and 38% was expanded for use as lightweight aggregate. Other uses were in the manufacture of building brick, sewer pipe, floor and wall tile, structural and drainage tile, and other clay products.

Fire clay output was reported by three producers—Elgin-Butler Brick Co., General Refractories Co., and United States Gypsum Co., A.P. Green Refractories Co., Div.—at four operations in Bastrop, Cherokee, and Wood Counties. Production was down approximately 2%, but total value increased slightly. Almost all of the fire clay was used to make firebricks and block.

One company, Balcones Minerals Corp., mined fuller's earth (attapulgite type) in Fayette County. The output and total value registered gains for the year. The fuller's earth was used chiefly as an oil and grease absorbent.

Kaolin was obtained from surface mines at two operations in Limestone County, by Dresser Indutsries, Inc., Dresser Minerals Div. (Kosse pit) and Teague Brick and Tile Co. (Personville mine). Output and total value increased sharply in 1973. The kaolin was used in the preparation of portland cement, facing brick, fertilizers, rubber, paint, and other products.

Table 16.—Texas: Clays sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Year	Bentonite		Fire clay		Common clay and shale		Total[1]	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1969	100	655	635	1,669	3,593	5,402	4,407	8,664
1970	74	839	351	1,334	3,550	4,945	4,148	9,587
1971	W	W	W	W	4,374	7,098	4,615	10,432
1972	88	1,128	89	684	4,894	7,872	5,175	11,554
1973	85	802	87	689	5,330	8,951	5,667	13,115

W Withheld to avoid disclosing individual company confidential data; included in "Total."
[1] Includes ball, kaolin, fullers earth, and data indicated by symbol W.

Fluorspar.—D & F Minerals Co. produced metallurgical-grade fluorspar at the only active fluorspar operation in Texas. Output from the mine, which is located in the Christmas Mountains northwest of Big Bend National Park in Brewster County, was less than that of the previous year. Fluorspar mined in Mexico was processed at plants in Brownsville, Eagle Pass, and Marathon, Tex.

Gem Stones.—Dealers and hobbyists collected gem stones and rock and mineral specimens having an estimated value of $163,000. Agate, calcite, celestite, jasper, cinnabar, feldspar, fossiliferous limestone, opal, petrified wood, tektites, quartz, and

topaz were among the materials found. No actual gem stone mines operated in the State during 1973.

Graphite.—Production at the only active natural graphite mine in the nation increased slightly during 1973. Sales and total value, however, were down. The open pit, crystalline flake graphite mine, located in western Burnet County, is operated by Southwestern Graphite Co., a division of Joseph Dixon Crucible Co. The ore was processed at the company plant adjacent to the mine site. Natural crystalline flake graphite is used in crucibles, foundry facings, lubricants, and pencils.

Gypsum.—Production of crude gypsum in Texas, totaling 1,615,741 short tons, exceeded by 5% the record high output of the previous year. Total value of the mined gypsum was $6,469,267, an increase of 22% over that of 1972. Average value in 1973 was $4.00 per short ton compared with $3.43 in 1972 and $3.63 in 1965. Seven companies reported production of the gypsum from surface mines in Fisher, Gillespie, Hardeman, Hudspeth, and Nolan Counties. Texas was ranked third among the States in gypsum output in 1973.

Most of the crude gypsum was calcined before use. Seven plants—located at Irving in Dallas County, Hamlin and Rotan in Fisher County, Acme in Hardeman County, Galena Park in Harris County, and Sweetwater in Nolan County (two plants)—prepared over 1.3 million short tons of calcined gypsum in 1973. The calcined material was used to prepare products such as gypsum, wallboard, plasters, and joint compounds. Uncalcined gypsum was used as a retarder in portland cement and as a soil conditioner.

Lime.—Texas ranked third among the States in lime production during 1973. Output totaled 1,677,250 short tons, which was an increase of 3% for the year and a new record high. Twelve companies produced the lime at 14 plants located in Bexar, Bosque, Brazoria, Calhoun, Comal, Deaf Smith, Harris (three plants), Hill, Johnson, Nueces, Travis, and Williamson Counties. Plants in Comal, Johnson, Nueces, and Travis Counties (listed alphabetically) led in lime output. Texas lime producers used limestone or shell as the raw material.

The lime was marketed in Texas, Oklahoma, Louisiana, and other States as well as in other countries. Lime consumption in Texas totaled 1,648,000 short tons, an increase of 1% during 1973. Major uses of the lime were in soil stabilization and water purification, the manufacture of paper and pulp, and the preparation of aluminum and bauxite.

Table 17.—Texas: Lime sold or used by producers, by use
(Short tons)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Soil stabilization	548,000	$7,223,000	575,400	$8,230,000
Aluminum and bauxite	W	W	158,500	2,013,000
Water purification	124,800	r 1,733,000	136,700	1,599,000
Paper and pulp	60,020	r 833,700	133,900	1,848,000
Steel electric	W	W	79,130	1,162,000
Steel, open-hearth	W	W	35,320	377,500
Masons lime	17,210	226,800	18,250	260,900
Sewage	W	W	10,410	116,300
Petroleum refining	W	W	9,779	142,000
Oil well drilling	8,716	r 121,100	7,620	116,500
Other uses [1]	872,300	r 12,043,000	512,300	11,022,800
Total [2]	1,631,000	22,181,000	1,677,000	26,887,000

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes alkalies, petrochemicals, chrome (1973), magnesia (1972), sugar refining, magnesium metal, insecticides, food, agriculture, fertilizers (1972), B.O.F. steel furnaces (1972), plastics (1973), and items indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

Mica.—Mica mined outside of Texas was processed in Fort Worth at the grinding plant of Western Mica Co., a division of United States Gypsum Co. No mica mines operated in the State during 1973.

Perlite.—Production of crude perlite declined sharply during the year and ceased late in 1973 when the State's only perlite mine was abandoned. Texas American Sulphur Co., which operated the surface mine in the Pinto Canyon area of Presidio County, expanded the crude perlite at its Perlite Industries, Inc., plant near Midland, Tex.

Four other companies, with plants in Dallas, Harris (two plants), and Nolan Counties, expanded perlite that was mined outside of Texas. Output of expanded perlite declined 16% during the year, and sales were down 13%. The expanded material was used as filter aid, aggregate in concrete and plaster, low-temperature insulation, and in horticulture.

Pumicite (Volcanic Ash).—No production of pumicite was reported in the State in 1973. The open pit pumicite mine of Rio Clay Products near Rio Grande City in Starr County was inactive during the year.

Salt.—Production reached a new high in 1973, surpassing the previous record set in 1970. Texas ranked second among the States in salt output, and with Louisiana (the leading State), accounted for 54% of the Nation's total salt production. Texas output increased 6% over that of 1972, 21% over that of 1968, and 74% over that of 1963. Average value of all salt produced in the State during 1973 was $4.38 per short ton compared with $3.75 in 1972, $5.00 in 1968, and $3.75 in 1963.

Ten companies reported production from 12 operations in Brazoria, Chambers, Duval, Fort Bend, Harris (two operations), Hutchinson, Jefferson, Matagorda, Van Zandt, Ward, and Yoakum Counties. Most of the salt was produced as brine, which was pumped from wells drilled into salt domes of the Gulf Coastal Plain and into subsurface saline deposits of west Texas. In addition, Morton Salt Co. produced rock salt and evaporated salt at Grand Saline salt dome in Van Zandt County, and United Salt Corp. mined rock salt from the Hockley salt dome in Harris County and also recovered evaporated salt from well brines of the Blue Ridge salt dome in Fort Bend County.

Salt, an essential raw material in the State's chemical industry, was used to prepare chlorine, caustic soda (sodium hydroxide), soda ash (sodium carbonate), and other chemicals. It also was used in meat packing, and water softening, as table salt, and for numerous other purposes.

Table 18.—Texas: Salt sold or used by producers
(Thousand short tons and thousand dollars)

Year	Quantity	Value
1969	9,261	43,012
1970	10,184	45,000
1971	9,217	40,838
1972	9,744	36,544
1973	10,354	45,350

Sand and Gravel.—Output of sand and gravel in Texas climbed 10% in 1973, setting a new record high for the State. Total value was up 8%. Texas ranked sixth among the States in sand and gravel production during the year.

Commercial production, reported from 139 operations in 63 counties, accounted for 93% of the total output. Noncommercial (government and contractor) operations made up the remainder. Commercial tonnage was up 8% with a 6% increase in total value; noncommercial output increased 33% in tonnage and 56% in total value. Almost 89% of all the sand and gravel produced in the State during 1973 was used as building and paving material. Other uses were as fill, railroad ballast, etc.

Industrial sands, which include abrasives, chemical, enamel, filler, pottery, glass, filtration, oil hydrofracing, engine, foundry, and furnace sands, were produced in Colorado, Hardin, Harris, Limestone, McCulloch, Somervell, Wood, and Upshur Counties.

Approximately 96% of the commercially produced sand and gravel was washed or otherwise processed before use. Average value of the processed commercial material was $1.63 per short ton; pit-run material averaged $0.76.

A change in ownership for one of the industrial sand operations occurred in 1973. Chemical Express Co., of Dallas, purchased Texas Mining Corp. Inc. of Texas Oil & Gas Corp., a producer of blast sand, hydraulic-fracturing sand, pot-

tery sand, and pulverized sand and silica flour near Voca in McCulloch County.

A new producer, Witt & Sons Sand and Gravel Co., began operations at Glen Rose in Somervell County during 1973. The plant has a daily capacity of 1,500 yards.

Two plants in Texas are described in articles published in a national trade journal during the year. The Capital Silica Co. plant, located west of Cleburne, Tex., is the subject of one of the articles,[4] and the Briggs plant of the Fordyce Co. at Victoria, Tex., is the subject of another article.[5]

[4] Rock Products. Fluidized-Bed Dryer Steps Up Silica Sand Production. V. 76, No. 5, May 1973, pp. 65–67.

[5] Rock Products. Fordyce Co., Victoria, Texas—1.2 Million Tons Per Year. V. 76, No. 9, September 1973, pp. 58–59.

Table 19.—Texas: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	W	W	135	382
Building	10,108	13,932	10,868	16,154
Fill	2,897	3,381	1,279	861
Glass	W	W	438	W
Molding	104	345	119	427
Paving	3,068	4,419	5,465	6,647
Other uses [1]	1,539	4,310	515	3,976
Total [2]	17,719	26,385	18,821	28,447
Gravel:				
Building	9,506	17,588	9,669	17,863
Fill	2,023	2,885	332	195
Paving	3,497	7,464	5,884	10,553
Miscellaneous	128	114	708	531
Other uses [3]	165	222	326	507
Total [2]	15,317	28,272	16,918	29,651
Government-and-contractor operations:				
Sand:				
Building	11	11	(4)	(4)
Fill	2	4	5	16
Paving	1,045	664	373	195
Other uses	--	--	13	39
Total [2]	1,058	679	392	250
Gravel:				
Building	38	34	25	29
Fill	37	13	19	10
Paving	982	944	2,366	2,304
Other uses	--	--	5	15
Total [2]	1,057	991	2,415	2,358
Total sand and gravel [2]	35,151	56,328	38,546	60,706

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes railroad ballast, engine, filtration, fire or furnace (1973), grinding and polishing (1972), oil, abrasives, chemical, enamel, filler, foundry, ground glass (1972), pottery, and other industrial sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast.

[4] Less than ½ unit.

Table 20.—Texas: Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

	Commercial		Government and contractor		Total sand and gravel [1]	
	Quantity	Value	Quantity	Value	Quantity	Value
1969	24,226	33,123	5,746	6,633	29,972	39,756
1970	27,464	42,252	3,973	4,110	31,438	46,362
1971	29,607	48,831	3,181	2,983	32,788	51,814
1972	33,036	54,658	2,115	1,670	35,151	56,328
1973	35,739	58,098	2,807	2,608	38,546	60,706

[1] Data may not add to totals shown because of independent rounding.

Sodium Sulfate (Natural).—One producer, Ozark-Mahoning Co., extracted sodium sulfate from brines that were obtained through shallow wells drilled into alkali-lake beds in Gaines and Terry Counties. Output of salt cake at the two processing plants, located in the Brownfield and Seagraves areas, was down slightly from that of the previous year. Salt cake is used in the manufacture of kraft paper and pulp, detergents, glass, dyes, textiles, and other products.

Stone.—Commercial and noncommercial (government and contractor) operators reported production of 62.6 million short tons of stone from 234 quarries in 87 Texas counties during 1973. Both dimension stone and crushed or broken stone were produced. Total stone output increased 27% for the year. Slightly more than 57% of the stone was obtained from 23 quarries, each of which produced 900,000 or more short tons.

Dimension stone, consisting of granite and limestone, was quarried in Burnet (three granite operations), Gillespie (one granite and one limestone operation), Llano (one granite operation), and Williamson (one limestone operation) Counties. Output was down 12% for the year. The dimension stone was used as cutstone, housestone veneer, flagging, monuments, and rough blocks.

Production of crushed or broken stone, reported at 227 quarries, was up 27% in 1973. Some of the crushed or broken stone was used as road base material, bituminous and concrete aggregate, raw material in the manufacture of cement and lime, filter stone, railroad ballast, riprap and jetty stone, and flux stone.

Limestone and dolomite output, which accounted for 86% of the total crushed or broken stone production, was up 26% with a 30% increase in total value. The limestone was obtained from 164 quarries, and dolomite production was reported from two quarries (in Burnet and Ector Counties). Other crushed or broken stone quarried in the State included basalt (traprock), granite, marble, marl, quartzite, sandstone, and shell. Output of shell, which made up 10% of the crushed or broken stone production in 1973, increased 31%; total value of the shell was up 51%.

A possible new crushed limestone operation in Bell County was being considered by Dresser Industries, Inc. The company obtained options on several hundred acres of land in the Nolanville area during the year.

Table 21.—Texas: Crushed and broken stone sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	4,207	8,729	7,959	15,864
Concrete aggregate	5,918	8,974	6,696	10,807
Dense graded road base stone	14,638	11,862	20,837	20,019
Macadam aggregate	703	631	416	653
Surface treatment aggregate	3,005	6,436	3,655	8,795
Unspecified construction aggregate and roadstone	4,444	8,039	4,487	4,959
Agricultural purposes [1]	407	518	339	672
Cement manufacture	10,351	10,857	11,406	14,402
Lime manufacture	2,357	3,337	2,363	3,592
Filter stone	W	W	W	192
Manufactured fine aggregate (stone sand)	164	305	222	403
Railroad ballast	760	998	591	893
Riprap and jetty stone	738	1,376	805	1,375
Terrazzo and exposed aggregate	W	W	19	480
Flux stone	591	825	584	1,357
Asphalt filler	W	W	105	262
Other filler	--	--	28	W
Other uses [2]	1,009	3,685	2,042	4,328
Total [3]	49,290	66,573	62,554	89,054

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Data include agricultural limestone and poultry grit and mineral food.
[2] Includes roofing aggregates, sugar refining, waste material, whiting, and uses not specified. 1973 data include dead-burned dolomite, ferrosilicon, and paper manufacture.
[3] Data may not add to totals shown because of independent rounding.

Table 22.—Texas: Stone sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Kind of stone	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone ---------- total --	24	W	21	2,325
Crushed and broken stone:				
Limestone and dolomite ----------	42,559	55,799	53,733	72,816
Granite ----------	W	416	25	236
Sandstone and quartzite ----------	1,058	2,121	1,671	3,919
Shell ----------	4,864	7,298	6,380	11,009
Other stone [1] ----------	809	939	744	1,074
Total crushed stone [2] ----------	49,290	66,573	62,554	89,054

W Withheld to avoid disclosing individual company confidential data.
[1] Includes marble, marl, traprock, and data where symbol W appears for crushed and broken stone.
[2] Data may not add to totals shown because of independent rounding.

Sulfur.—An increase in demand for sulfuric acid by fertilizer manufacturers resulted in a moderate improvement in the sulfur market during 1973. Production of native sulfur from Frasch mines in Texas was up 14%, and shipments registered a gain of 7%. Several producers announced price increases during the year.

Four companies reported production of the native sulfur at seven Frasch operations in six counties. The sulfur was obtained on the Texas gulf coast from the caprock of Long Point salt dome at Fort Bend County, Fannett and Spindletop salt domes in Jefferson County, Moss Bluff salt dome in Liberty County, and Boling salt dome in Wharton County. Production also was reported from subsurface deposits in Culberson and Pecos Counties in West Texas.

Although not included in tables 1 and 2, elemental sulfur was recovered from sulfur-bearing natural gas and oil at 52 operations in 28 Texas counties. Production, sales, and value were greater than in the previous year. At a new operation in El Paso County, sulfur was recovered from smelter gas of the El Paso Smelting Works of American Smelting & Refining Co. (Asarco) and used to prepare sulfuric acid.

Table 23.—Texas: Sulfur produced and shipped from Frasch mines
(Thousand short tons and thousand dollars)

Year	Production	Shipments	
		Quantity	Value [1]
1969 ----------	3,289	2,616	67,676
1970 ----------	3,446	2,844	63,321
1971 ----------	3,408	3,092	W
1972 ----------	3,755	3,847	W
1973 ----------	4,294	4,109	W

W Withheld to avoid disclosing individual company confidential data.
[1] F.o.b. mine/plant.

Talc and Soapstone.—Mined production of talc and soapstone in Texas totaled 232,514 short tons, an increase of 5% for the year. Texas ranked third among the States in tonnage produced and fifth in value. Total value of the mined talc and soapstone was $1,246,000, a decrease of 1%. Average value was $5.36 per short ton in 1973, compared with $5.71 in 1972.

The talc and soapstone were obtained from surface mines in west Texas. Four producers—Pioneer Talc Co., Inc., Southern Clay Products, Inc., Texas Talc Co., and Westex Talc Co. (a subsidiary of Milwhite Co.) reported output in the Allamoore area of Hudspeth County. An additional talc mine was operated by Westex Talc Co. at Tumbledown Mountain in adjoining Culberson County; the company also operated a talc calcining and milling plant near Van Horn, Tex.

Most of the talc and soapstone mined in

the State was used in the manufacture of ceramic products. Some also was consumed in the preparation of insecticides, paint, roofing materials, and textiles.

Vermiculite.—No production was reported, but vermiculite, mined outside of Texas, was processed at the Dallas and San Antonio exfoliating plants of Texas Vermiculite Co. and at the Houston plant of Vermiculite Products, Inc. Output at the plants as well as sales and average value increased during the year. The exfoliated vermiculite was used as lightweight aggregate in concrete and plaster and as soil conditioner, loose-fill insulation, and fertilizer carrier. It also was used in fireproofing and for miscellaneous other purposes.

METALS

The metals sector contributed 0.7% of the State's total mineral value in 1973, down slightly from the 0.8% in 1972. However, actual value increased about 0.5% from $58.3 million in 1972 to $58.6 million during the year. Metal mining in Texas continued to be limited to iron ore, mercury, and uranium. Magnesium metal was processed from gulf seawater and brines by chemical methods. Although none of the following metallic minerals were mined in the State, aluminum, antimony, cadmium, copper, lead, manganese, tin-tungsten, and zinc were recovered as by-products at smelters, refineries, and reduction plants.

Table 24.—Texas: Smelters, refineries, and reduction plants in 1973

Product, company, and plant	Location (county)	Material treated
Aluminum:		
Aluminum Company of America:		
Point Comfort (alumina)	Calhoun	Bauxite.
Point Comfort (reduction)	do	Alumina.
Rockdale (reduction)	Milam	Do.
Reynolds Metal Co.:		
Sherwin Works (alumina)	San Patricio	Bauxite.
San Patricio (reduction)	do	Alumina.
Antimony:		
NL Industries, Inc.:		
Laredo smelter	Webb	Ore.
Cadmium:		
American Smelting & Refining Co.:		
Electrolytic	Nueces	Flue dust.
Copper:		
American Smelting & Refining Co.:		
El Paso smelter	El Paso	Ore and concentrates.
Phelps Dodge Refining Corp.:		
Nichols refinery	do	Blister and anode.
Iron:		
Lone Star Steel Co.:		
Daingerfield plant	Morris	Ore and scrap.
Armco Steel Corp.:		
Houston plant	Harris	Do.
United States Steel Corp.:		
Cedar Point plant	Chambers	Do.
Lead:		
American Smelting & Refining Co.:		
El Paso smelter	El Paso	Ore and concentrates.
Magnesium:		
The Dow Chemical Co.:		
Freeport plants, electrolytic	Brazoria	Sea water.
Manganese:		
Tenn-Tex Alloy Corp	Harris	Ore.
Sodium:		
Ethyl Corp	do	Brine.
Tin-tungsten:		
Gulf Chemical & Metallurgical Corp.:		
Texas City smelter	Galveston	Ore.
Zinc:		
American Smelting & Refining Co.:		
Amarillo retort smelter	Potter	Ore and concentrates.
Corpus Christi electrolytic	Nueces	Do.
El Paso fuming plant	El Paso	Dusts and residues.

Table 25.—Texas: Secondary metal recovery plants

County and company	Material	Products
Dallas:		
Abasco, Inc	Aluminum scrap	Aluminum ingots, dioxidizing bars and shot.
American Smelting & Refining Co	Lead and zinc scrap	Lead and zinc ingots, pigs, alloys.
Dixie Lead Co	Lead scrap	Lead pigs, alloys, chemicals.
NL Industries, Inc., Dallas Region	Battery plates	Lead products.
Southern Lead Co	do	Lead pigs, alloys.
El Paso:		
Border Steel Mills, Inc	Steel scrap	Steel shapes, reinforcing bars.
Gregg:		
R. C. LeTourneau, Inc	do	Heavy mobile equipment.
Guadalupe:		
Structural Metals, Inc	do	Structural steel reinforcing bars.
Harris:		
A & B Metal & Smelting Co	Aluminum, lead scrap	Lead pigs, ingots, aluminum ingots, alloys.
Federated Metals	Various metals	Lead products, alloys of copper, lead, zinc, magnesium, tin.
Gulf Reduction Corp	Aluminum, zinc scrap	Aluminum and zinc ingots, alloys.
Houston Fishing Tackle Co	Soft lead scrap	Lead products.
Houston Lead Co	Lead scrap	Lead pigs, ingots, alloys.
Lead Products Co., Inc	do	Do.
NL Industries, Inc., Magnus Metal Div.	Various metal scrap	Lead, brass, bronze bearing metal.
Southwest Saw Corp	Steel scrap	Steel alloys.
Sterling Type, Rule & Metals Co	Type metal	Type metal.
Vulcan Materials Co., Metals Div	Tinned scrap	Refined tin, baled detinned steel.
Tarrant:		
National Metal & Smelting Co.	Battery lead and aluminum scrap.	Lead pigs, ingots, battery metal, aluminum ingots.
Texas Steel Co	Steel scrap	Carbon and alloy steel bars and shapes, reinforcing bars.

Aluminum.—Output of primary aluminum metal increased 4.0%, but unit value decreased 4.8%. Texas ranked second nationally in output and value, following the State of Washington. U.S. production increased 9.9% compared with that of 1972, and Texas' share was 12.3%, down in percentage from 13.0% contribution the prior year.

The Rockdale smelting works of Aluminum Co. of America (Alcoa) was reported back in full operation in May. Two of eight potlines had been shut down during early December 1972 because the Texas Power and Light Co. had been forced to curtail electric power owing to shortages of natural gas during unseasonably cold weather. Annual capacity of the two potlines is 60,000 tons. Employment is about 1,600 when the 285,000-ton-per-year facility is in full production.

Alcoa announced in September that site preparation had begun for construction of a pilot primary aluminum smelter that will test its new aluminum smelting process. Situated near Palestine, Tex., in Anderson County, the plant will have an initial capacity of 15,000 tons per year, and ultimate design capacity of 30,000 tons per year. If the Alcoa smelting process (ASP) proves feasible, the company reports, the site's ultimate potential is 300,000 tons per year. Target date for completion of the pilot unit is 1975.

The major advantage expected for the ASP process is its potential ability to reduce by as much as 30%, electricity requirements to make aluminum in the most efficient Hall process units in operation. Important features of the ASP are that smaller plants can be built on smaller sites, with greater location flexibility. These are especially important where market accessibility and power availability have to be carefully studied.

Antimony.—Output of primary antimony metal decreased 28.1% during the year. The only producer in the State of the metal is NL Industries, Inc., at its Laredo smelter from ores obtained mainly from Mexico. Production was down partially because the smelter was closed down for 6 weeks during midyear as a result of a shortage of the ores imported from Mexico. The shortage and delay were caused by a buildup of rail cars in the Nuevo Laredo, Mexico, marshaling yard. Ore-carrying cars were side-tracked during the pileup and priorities of movement given cars containing perishables.

Cadmium.—Cadmium was recovered as a byproduct of zinc retort smelting from zinc dust and residues. These residues were shipped to other smelters having cadmium recovery facilities such as the Asarco electrolytic plant at Corpus Christi. Output decreased almost 15%, which followed the national trend. However, there was a substantial increase in unit value both in Texas and in the United States. Unit value in Texas increased about 39% during 1973; overall U.S. unit value increase was more than 50%.

Copper.—No commercial production has been reported from the State's deposits of copper minerals in recent years. Scrap copper and ores and concentrates from other States and foreign countries were processed at the El Paso smelters of Asarco and Phelps-Dodge Refining Co.

Groundbreaking for Asarco's major new copper refinery took place during the fall at a plant site about 4.5 miles northeast of Amarillo in Potter County. The new electrolytic refinery will have a capacity of 420,000 tons per year and will be one of the largest in the world. Startup is scheduled for September 1975, and about 700 people will be employed at the complex. The completely integrated $100 million facility will receive blister copper and anode copper from the smelters, and refine it to greater than 99.9% purity. Then it will be shipped as either copper cathodes or cast shapes, including wire bars, billets, and continuous cast rod or cake. Cast rod will be a new product for the company. Complete facilities will be installed to recover the byproducts of copper refining, including silver, gold, platinum, palladium, nickel salts, and compounds of selenium and tellurium. The plant will be capable of producing 60 million ounces of silver per year.

Asarco's largest volume of smelting and refining activity is in copper. One of its three U.S. smelters is at El Paso wherein copper ores and concentrates are processed into blister copper for refining at the company's out-of-State copper refineries.

Iron Ore.—Large deposits of iron ore (limonite and siderite) in the northeast Texas counties of Cass, Morris, and Nacogdoches were mined during the year. Output decreased 3.4% from 1972, but unit value increased about 3.7%, and overall value gained slightly.

Texas Foundries, Inc., at Lufkin is installing three additional 500-ton hydraulic straightening presses that will increase pressing capacity by about 10,000 tons per year. A new ductile treating facility is also being installed that will increase annual capacity by 5,000 tons. The company is planning an automatic pouring system on an existing 3,000-mold-per-hour conveyer; the unit will increase capacity by 2,000 tons. Chaparral Steel Co., a joint venture of Texas Industries, Inc., and Co-Steel International, Ltd., of Toronto, Canada, is scheduled to begin melting operations at its Midlothian, Ellis County, plant in early 1975. The new $35 million facility will produce about 250,000 tons per year of finished rolled steel products, with an ultimate potential annual capacity of 600,000 tons. The plant is a basic steel-making facility that utilizes scrap metal entirely for feedstock, with a complete mill set up to roll steel into the finished product. Prepared scrap iron materials are obtained from various manufacturing facilities, as well as from onsite preparation. The onsite preparation utilizes a shredder to process junk automobile bodies. Planned sales are projected at $50 million annually, and about 330 people will be employed by the operation.

Lead.—No production has been reported in the State since the closing of the Presidio mine. Lead minerals are known to occur in Brewster, Hudspeth, and Presidio Counties, and in the Central Mineral region. Lead ores and concentrates, principally from Mexico, were processed into base bullion at the El Paso lead smelter of Asarco. Several secondary lead smelters processed and refined lead scrap.

Magnesium.—Magnesium, the lightest of structural metals, was produced from Gulf of Mexico seawater. The Dow Chemical Co., using the seawater at its Freeport plant, continued to produce magnesium chloride, magnesium hydroxide, and caustic-calcined magnesia. Output and value were virtually unchanged from 1972. The company announced that process modifications and improvements have added 10 million pounds of annual rated capacity to its 240-million-pound production complex at Freeport. A. P. Green Refractories Co. used magnesium hydroxide obtained from Dow to make refractory magnesia. American Magnesium Co.'s electrolytic process plant at Snyder has been shut down since May; no production from the plant

was reported during 1973. The plant processed subsurface brines from the general area to produce magnesium metal. Environmental constraints were given as the reason for suspension of operations.

Magnesium oxide used in the manufacture of high-temperature nonclay refractory brick and mortar consumed by the steel and other metallurgical industries is the largest market for magnesium compounds. Other industries using the compounds are cement, chemical, petroleum, rayon, rubber, and others.

Manganese.—Tenn-Tex Alloy Corp. of Houston was the only producer of the metal during the year. Silicomanganese and ferromanganese were produced at the company's Harris County plant in electric furnaces from imported foreign ore feedstocks. The primary demand for this material is for use in the production of cast iron and steel to improve malleability during the forging process.

Mercury.—Mercury production for the year decreased slightly, but value increased owing to a 27.2% increase in unit value. Texas ranked fourth of five States in output. The only mine in operation during the year was the Anchor Co. of Whit-Roy facility in Presidio County. The principal uses for mercury are in manufacture of alkalies and chlorine and in electrical applications, including the mercury battery. Substantial quantities of mercury are consumed in paints and allied products, mechanical measuring devices, agricultural chemicals, and dental supplies.

Sodium.—Ethyl Corp produced metallic sodium from brine by the electrolytic process at its plant near Houston. Output decreased slightly but unit value increased 9.1% over that of 1972. The principal use of metallic sodium is in the production of compounds of tetraethyl and tetramethyl lead to improve antiknock qualities of motor fuels.

Tin.—The only tin smelter in the United States is the Texas City facility of Gulf Chemical and Metallurgical Corp. The bulk of the base load was received as tin-in-concentrates from Bolivia, although domestic tin concentrates and secondary tin-bearing materials were also utilized. The company initiated plans to boost production from the present level of about 4,500 tons per year to 8,000 tons per year by the end of 1974. Accordingly, Gulf Chemical and Bolivia negotiated a 10-year contract in which Bolivia guaranteed to deliver 6,000 tons of concrete to the company in each of the first 3 years of the contract. Details of the remaining 7 years of the contract were not available.

Uranium.—Although complete data were not available, apparently the value of production increased 2% during 1973, and output decreased slightly. According to the U.S. Atomic Energy Commission, uranium drilling activity declined again during the year to 2.75 million feet, a reduction of 17.5%. This was counter to total U.S. drilling, which increased 6.5%. Texas accounted for 16.8% of the U.S. uranium drilling footage. Acreage held for uranium mining and exploration was unchanged at 641,000 acres, which represented 3.4% of the U.S. total.

Susquehanna—Western, Inc., closed its Fall City mill and is phasing out all their uranium operations in south Texas. Economic factors were given as the reason for the shutdown. The company closed its Ray Point uranium mill near Three Rivers during 1972.

Two French companies, Total Compagnie Minière et Nucléaire and Pechiney Ugine Kuhlmann, have entered into an agreement with Continental Oil Co. to explore for uranium in east and north-central Texas. Continental Oil Co. is the major producer of uranium in Texas with a mill in Karnes County about 50 miles southwest of San Antonio.

Texas Eastern Transmission Corp. and Pioneer Natural Gas Co. have announced they will start a uranium exploration program in six States, including Texas. The joint venture will be conducted by Texas Eastern Nuclear, Inc., and Pioneer Nuclear, Inc., wholly owned subsidiaries of the two companies.

The principal commercial use for uranium is the generation of electric power, which was about 98% of the total domestic requirement for the commodity annually.

Zinc.—Recovery of zinc at smelters and refineries increased about 4% and accounted for over one-fourth of the U.S. total zinc production in 1973.

The major portion of zinc recovery operations in Texas are at Asarco's Amarillo horizontal retort smelter and Corpus Christi electrolytic process plant. Ores and concentrates are processed at these operations. The Amarillo facility has an annual

capacity of 52,500 tons; the Corpus Christi unit is rated at 100,00 tons per year. The company also processed dusts and residues to recover the commodity at its El Paso fuming plant.

In recent years, the transportation industry has become the largest consumer of zinc. The automobile industry uses zinc diecasting to produce carburetors, grilles, trim, and other hardware. In addition, zinc-covered splashguards are used. A major end-use is in construction applications where galvanizing is utilized to protect steel beams, girders, and fasteners in bridges and buildings, and roofing, siding, guardrails, and fencing. Electrical equipment and supplies, plumbing and heating, and other industries use the remainder.

Table 26.—Texas: Principal producers

Commodity and company	Address	Type of activity	County
Asphalt (native):			
Uvalde Rock Asphalt Co	P.O. Box 531 San Antonio, Tex. 78206	Mine	Uvalde.
White's Uvalde Mines, Inc	P.O. Box 499 San Antonio, Tex. 78206	do	Do.
Barite:			
Dresser Industries, Inc	P.O. Box 6504 Houston, Tex. 77005	Grinding plant	Cameron.
The Milwhite Co., Inc	P.O. Box 15038 Houston, Tex. 77020	do	Harris.
National Lead Co	P.O. Box 1675 Houston, Tex. 77001	do	Nueces.
Carbon black:			
Ashland Chemical Co	P.O. Box 1503 Houston, Tex. 77005	Furnace	Aransas and Wheeler.
Cabot Corp	125 High St. Boston, Mass. 02110	do	Gray and Howard.
Columbian Carbon Co	380 Madison Ave. New York, N.Y. 10017	do	Montgomery and Terry.
Continental Carbon Co	P.O. Box 22085 Houston, Tex. 77027	do	Moore.
J. M. Huber Corp	P.O. Box 831 Borger, Tex. 79006	do	Harris and Hutchinson.
Phillips Petroleum Co	Bartlesville, Okla. 74003	do	Hutchinson and Orange.
Sid Richardson Carbon & Gasoline Co.	1200 Fort Worth National Bank Bldg. Fort Worth, Tex. 76102	do	Howard.
Cement:			
Alpha Portland Cement Co	15 South Third St. Easton, Pa. 18042	Quarry and plant.	Orange.
Capitol Aggregates, Inc	Route 13, Box 412 San Antonio, Tex. 78209	Plant	Bexar.
Centex Cement Corp	P.O. Box 9294 Corpus Christi, Tex. 78408	Quarry and plant.	Nueces.
General Portland Cement Co	2800 Republic Bank Tower Dallas, Tex. 75201	do	Dallas, Harris, Tarrant.
Gifford-Hill Portland Cement Co	P.O. Box 520 Midlothian, Tex. 76065	do	Ellis.
Gulf Coast Portland Cement Co., Division of McDonough Co.	P.O. Box 262 Houston, Tex. 77001	do	Harris.
Ideal Cement Co., Division of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	do	Do.
Kaiser Cement & Gypsum Corp	Permanente Rd. Permanente, Calif. 95014	Plant	Bexar.
Lone Star Industries, Inc	P.O. Box 47327 Dallas, Tex. 75247	Quarry and plant.	Harris and Nolan.
San Antonio Portland Cement Co.	P.O. Box 6925 San Antonio, Tex. 78209	do	Bexar.
Southwestern Portland Cement Co.	P.O. Box 392 El Paso, Tex. 79943	do	Ector and El Paso.
Texas Industries, Inc	P.O. Box 146 Midlothian, Tex. 76065	do	Ellis.
Universal Atlas Cement Div., United States Steel Corp.	600 Grant St. U.S. Steel Bldg. Pittsburgh, Pa. 15230	do	McLennan.

Table 26.—Texas: Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clay and shale:			
Acme Brick Co., division of Justin Industries, Inc.	P.O. Box 425 Fort Worth, Tex. 76101	Mine and plant	Denton, Nacogdoches, Parker, Wise, Van Zandt.
Balcones Mineral Corp	P.O. Box B Flatonia, Tex. 78941	do	Fayette.
Dresser Industries, Inc	P.O. Box 6504 Houston, Tex. 77005	do	Angelina and Limestone.
Featherlite Corp	P.O. Box 141 Ranger, Tex. 76470	do	Bexar and Eastland.
General Refractories Co	1520 Locust St. Philadelphia, Pa. 19102	do	Cherokee.
Gulf Coast Portland Cement Co., division of McDonough Co.	P.O. Box 262 Houston, Tex. 77001	do	Chambers.
Henderson Clay Products Co	P.O. Box 1251 Henderson, Tex. 75652	do	Rusk.
Lone Star Industries, Inc	P.O. Box 47327 Dallas, Tex. 75247	do	Fisher and Harris.
The Milwhite Co., Inc	P.O. Box 15038 Houston, Tex. 77020	do	Fayette and Walker.
Southern Clay Products, Inc	P.O. Box 44 Gonzales, Tex. 78629	do	Angelina, Cherokee, Gonzales.
Texas Clay Industries, Inc	P.O. Box T Malakoff, Tex. 75148	do	Henderson.
Texas Industries, Inc	8100 Carpenter Freeway Dallas, Tex. 75247	do	Dallas, Marion, Comanche, Ellis, Fort Bend, Henderson, Van Zandt.
Coal (lignite):			
I.C.I. America Inc	P.O. Box 790 Marshall, Tex. 75670	Strip mine	Harrison.
Industrial Generating Co	P.O. Box 1111 Rockdale, Tex. 76567	do	Freestone and Milam.
Fluorspar:			
D & F Minerals Co	P.O. Box 75 Terlingua, Tex. 79852	Mine	Brewster.
Graphite:			
Southwestern Graphite Co	Burnet, Tex. 78611	do	Burnet.
Gypsum:			
The Celotex Corp	1500 North Dale Mabry Tampa, Fla. 33607	Open pit mine and calcining plant.	Fisher.
The Flintkote Co	480 Central Ave. East Rutherford, N.J. 07073	do	Nolan.
Georgia-Pacific Corp	P.O. Box 311 Portland, Oreg. 97207	do	Hardeman.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Fisher.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	do	Nolan.
Do	do	Plant	Harris.
Iron ore:			
Lone Star Steel Co	P.O. Box 35888 Dallas, Tex. 75235	Open pit	Cass and Morris.
Lime:			
Aluminum Co. of America	1028 Alcoa Bldg. Pittsburgh, Pa. 15219	Plant	Calhoun.
Armco Steel Corp	P.O. Box 1367 Houston, Tex. 77001	do	Harris.
Austin White Lime Co	General Delivery McNeil, Tex. 78651	do	Travis.
Champion Papers, Inc	P.O. Box 872 Pasadena, Tex. 77501	do	Harris.
The Dow Chemical Co	2020 Dow Center Midland, Mich. 48640	do	Brazoria.
Eastex, Inc	P.O. Box 816 Silsbee, Tex. 77656	do	Jasper.
McDonough Bros., Inc	Fredericksburg Rd. Route 8, Box 222 San Antonio, Tex. 78228	do	Bexar.
PPG Industries, Inc	P.O. Box 4026 Corpus Christi, Tex. 78408	do	Nueces.

Table 26.—Texas: Principal producers—Continued

Commodity and company	Address	Type of activity	County
Lime—Continued			
Round Rock Lime Co	P.O. Box 218 Round Rock, Tex. 78664	Plant	Hill and Williamson.
Texas Lime Co	P.O. Box 851 Cleburne, Tex. 76031	do	Johnson.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	do	Comal and Harris.
Magnesium compounds:			
The Dow Chemical Co	Midland, Mich. 48640	do	Brazoria.
Mercury:			
The Anchor Co	309 North Third St. Alpine, Tex. 79830	Mine	Presidio.
Perlite:			
Filter Media, Inc	P.O. Box 19156 Houston, Tex. 77024	Expanding plant.	Harris.
Perlite of Houston, Inc	P.O. Box 8386 Houston, Tex. 77004	do	Do.
Perlite Products Co	2651 Manila Dallas, Tex. 75212	do	Dallas.
Texas American Sulphur Co	1012 Midland Savings Bldg. Midland, Tex. 79071	Mine	Presidio.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	Expanding plant.	Nolan.
Roofing granules:			
H.B. Reed & Co., Inc	8149 Kennedy Ave. Highland, Ind. 46322	Plant	Milam.
Salt:			
Diamond Shamrock Corp	300 Union Commerce Bldg. Cleveland, Ohio 44115	Brine wells	Chambers.
The Dow Chemical Co	Midland, Mich. 48640	do	Brazoria.
Montex Chemical Co	104 East 3d Monahans, Tex. 79756	do	Ward.
Morton Salt Co	110 North Wacker Dr. Chicago, Ill. 60606	Underground mine and brine wells.	Van Zandt.
PPG Industries, Inc	P.O. Box 4026 Corpus Christi, Tex. 77704	Brine wells	Duval.
Phillips Petroleum Co	Bartlesville, Okla. 74003	do	Hutchinson.
Texas Brine Corp	4614 Montrose Blvd. Houston, Tex. 77006	do	Harris, Jefferson, Matagorda.
United Salt Corp	do	Underground mine and brine wells.	Fort Bend and Harris.
Vulcan Materials Co	P.O. Box 1060 Denver City, Tex. 79323	Brine wells	Yoakum.
Sand and gravel:			
Capitol Aggregates, Inc	Route 13, Box 412 San Antonio, Tex. 78209	Stationary	Guadalupe and Travis.
Centex Corp., Travis Div	P.O. Box 2252 Austin, Tex. 78767	Pit	Travis.
The Fordyce Co	P.O. Box 1981 San Antonio, Tex. 78206	Stationary	Hidalgo, San Patricio, Victoria.
Gifford-Hill & Co., Inc	P.O. Box 47127 Dallas, Tex. 75247	do	Brazos, Colorado, Dallas, McLennan, Tarrant, Wichita.
Horton & Horton	P.O. Box 1669 Houston, Tex. 77001	Portable and dredge.	Colorado, Harris, Victoria.
Lone Star Industries, Inc	P.O. Box 47327 Dallas, Tex. 75247	Stationary	Colorado, Denton, Nolan.
Parker Bros. & Co., Inc	P.O. Box 107 Houston, Tex. 77001	Stationary and dredge.	Colorado and Harris.
Superior Sand and Gravel Co	Box 273 Altair, Tex. 77412	Pit and mill	Colorado.
Texas Industries Inc	P.O. Box 400 Arlington, Tex. 76010	Pits and plants	Dallas, Palo Pinto, Parker.
Thorstenberg Materials Co	1435 Bank of the Southwest Bldg. Houston, Tex. 77002	Stationary and dredge.	Colorado and Harris.
Shell:			
General Dredging Corp	P.O. Box 9294 Corpus Christi, Tex. 78408	Dredge	Nueces.
Lone Star Industries, Inc	P.O. Box 86 Houston, Tex. 77001	do	Calhoun.
Parker Bros. & Co., Inc	P.O. Box 107 Houston, Tex. 77001	do	Do.

Table 26.—Texas: Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sodium (metallic):			
Ethyl Corp	P.O. Box 472 Pasadena, Tex. 77501	Plant	Harris.
Sodium sulfate (natural):			
Ozark-Mahoning Co	1870 South Boulder Tulsa, Okla. 74119	do	Gaines and Terry.
Stone:			
Gifford-Hill & Co., Inc	P.O. Box 47127 Dallas, Tex. 75247	Quarry	Wise.
Lone Star Industries, Inc	P.O. Box 47327 Dallas, Tex. 75247	do	Burnet, Calhoun, Ellis, Hudspeth, Nolan, Wise.
McDonough Bros. Inc	Box 222 San Antonio, Tex. 78228	do	Bexar.
Parker Bros. & Co., Inc	P.O. Box 107 Houston, Tex. 77001	do	Comal and Matagorda.
Texas Crushed Stone Co	P.O. Box 9345 Austin, Tex. 78717	do	Llano and Williamson.
Texas Industries, Inc	P.O. Box 146 Midlothian, Tex. 76065	do	Ellis and Wise.
Trinity Concrete Products Co	P.O. Box 47524 Dallas, Tex. 75247	do	Johnson and Wise.
Vulcan Materials Co., Olmos Rock.	P.O. Box 13010 San Antonio, Tex. 78213	2 quarries	Bexar.
White's Mines, Inc	P.O. Box 500 Brownwood, Tex. 76801	do	Brown, Taylor, Uvalde.
Sulfur (native):			
Atlantic Richfield Co	P.O. Box 2819 Dallas, Tex. 75221	Frasch process	Pecos.
Duval Corp	1906 First City National Bank Bldg. Houston, Tex. 77002	do	Culberson.
Texasgulf, Inc	200 Park Ave. New York, N.Y. 10017	do	Jefferson, Liberty, Wharton.
Sulfur (byproduct):			
Amoco Production Co	P.O. Box 591 Tulsa, Okla. 74102	Secondary recovery.	Andrews, Ector, Hockley, Van Zandt, Wood.
Cities Service Oil Co	P.O. Box 300 Tulsa, Okla. 74102	do	Cochran, Dawson, Gaines, Van Zandt.
Getty Oil Co	P.O. Box 8 Scroggins, Tex. 75480	do	Franklin and Freestone.
Gulf Oil Corp	P.O. Box 701 Port Arthur, Tex. 77640	do	Jefferson.
Phillips Petroleum Co	Bartlesville, Okla. 74003	do	Brazoria, Crane, Ector, Hutchinson.
Shell Oil Co	P.O. Box 2099 Houston, Tex. 77001	do	Cass, Karnes, Harris.
Warren Petroleum Corp	P.O. Box 1589 Tulsa, Okla. 74101	do	Crane, Hopkins, Karnes.
Talc and soapstone:			
Pioneer Talc Co., Inc	Chatsworth, Ga. 30705	Mine and plant	Hudspeth.
Southern Clay Products, Inc	Box 44 Gonzales, Tex. 78629	do	Do.
Texas Talc Co	Allamoore, Tex. 79829	do	Do.
The United Sierra Div., Cyprus Mines Corp.	P.O. Box 1201 Trenton, N.J. 08606	Mine	Do.
Westex Talc Co	P.O. Box 15038 Houston, Tex. 77020	Mine and plant	Hudspeth and Culberson.
Vermiculite:			
Texas Vermiculite Co	2651 Manila Rd. Dallas, Tex. 75200	Exfoliating plant.	Bexar and Dallas.
Vermiculite Products, Inc	P.O. Box 7327 Houston, Tex. 77008	do	Harris.

The Mineral Industry of Utah

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Utah Geological and Mineral Survey for collecting information on all minerals.

By Gertrude N. Greenspoon [1]

The value of mineral production in Utah totaled $674 million in 1973, a 24% increase over that in 1972 and a record high. Increases were recorded in all three commodity groups—mineral fuels, metals, and nonmetals; mineral fuels registered the largest gain.

Total value of the metals group rose 20% over that in 1972. Substantial gains in copper, gold, iron ore, molybdenum, and silver contributed to the higher value in the metals group. Copper accounted for 74% of the metals value and 45% of the total mineral production value in Utah.

Production of mineral fuels was 41% greater in total value than in 1972. Gains of 46% in value of petroleum and 22% in natural gas more than offset decreased values of asphalt and related bitumens.

Increased production values were recorded for eight commodities in the nonmetals group. Sand and gravel, cement, sodium sulfate, clays, and lime declined in value. Substantial increases in fluorspar, phosphate rock, potassium salts, and salt raised the nonmetals value 11% over that in 1972.

A total of 176 million tons of material was handled in the metals and nonmetals industries in 1973. Of the total, 63 million tons was ore and 113 million tons was waste material. Underground mining operations accounted for 793,000 tons of the total tonnage handled.

Construction of the first 430-megawatt unit at the Utah Power & Light Co. Huntington powerplant was virtually completed by yearend. The plant was expected to be operational by mid-1974.

The planned site on Nipple Bench for the Kaiparowits Plateau coal-burning powerplant was rejected for environmental reasons. In late 1973, Resources Co. was considering four alternate sites in Kane County for the powerplant. The new sites lie 4 to 17 miles further from Lake Powell than Nipple Bench.

Legislation and Government Programs.—Fluor Utah, Inc., a subsidiary of Fluor Corp., San Mateo, Calif., was granted a contract by the Office of Coal Research, U.S. Department of the Interior, for research on large-scale mining systems for deposits in Utah. The contract amount is $2,307,887 for 3½ years. Most of the research will be conducted at the Fluor facilities at San Mateo. The research will concentrate on quality and quantity of coal required for the large conversion complexes expected to be operational after 1980. The work will also involve a concept of planning for the best use of land, and the social and economic impacts, environmental factors, watershed and water table protection, land fertility increases, improvement in living standards, and creation of parks, lakes, and other recreational facilities through proper mining and utilization of the coal.

[1] Mineral specialist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in Utah [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Carbon dioxide, natural -- thousand cubic feet --	61,103	$4	80,490	$6
Clays [2] ---------- thousand short tons --	266	790	243	771
Coal (bituminous) ---------- do ----	4,802	42,868	5,500	61,566
Copper (recoverable content of ores, etc.) short tons --	259,507	265,735	256,589	305,341
Fluorspar ---------- do ----	2,977	84	4,778	144
Gem stones ----------	NA	95	NA	95
Gold (recoverable content of ores, etc.) troy ounces --	362,413	21,237	307,080	30,035
Gypsum ---------- thousand short tons --	W	W	231	1,134
Iron ore (usable) thousand long tons, gross weight --	1,788	W	1,986	13,581
Lead (recoverable content of ores, etc.) short tons --	20,706	6,224	13,733	4,474
Lime ---------- thousand short tons --	171	4,216	185	3,804
Natural gas ---------- million cubic feet --	39,474	6,711	42,715	8,159
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels --	458	1,406	W	W
LP gases ---------- do ----	1,742	2,787	W	W
Petroleum (crude) ---------- do ----	26,570	80,773	32,656	117,743
Pumice ---------- thousand short tons --	14	29	42	57
Salt ---------- do ----	660	4,955	717	6,913
Sand and gravel ---------- do ----	14,619	17,071	15,410	15,986
Silver (recoverable content of ores, etc.) thousand troy ounces --	4,300	7,245	3,619	9,257
Stone ---------- thousand short tons --	3,384	6,005	2,848	6,318
Uranium (recoverable content U_3O_8) thousand pounds --	1,496	9,425	1,940	12,610
Vanadium ---------- short tons --	188	W	142	W
Zinc (recoverable content of ores, etc.) -- do ----	21,853	7,758	16,800	6,942
Value of items that cannot be disclosed: Asphalt, beryllium, cement, clays (kaolin), magnesium chloride, magnesium compounds, molybdenum, phosphate rock, potassium salts, sodium sulfate, tungsten, and values indicated by symbol W ----------	XX	57,391	XX	69,274
Total ----------	XX	542,809	XX	674,210
Total 1967 constant dollars ----------	XX	447,872	XX	p 495,005

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Utah, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Beaver ----------	W	W	Copper, sand and gravel, pumice.
Box Elder -------	$1,782	$1,840	Stone, lime, sand and gravel, salt.
Cache ----------	W	W	Sand and gravel, stone.
Carbon ----------	W	W	Coal, natural gas, carbon dioxide, sand and gravel.
Daggett ---------	871	W	Sand and gravel, natural gas, petroleum.
Davis ----------	W	1,325	Sand and gravel, stone.
Duchesne --------	W	W	Petroleum, natural gas, natural gas liquids, sand and gravel.
Emery ----------	10,887	24,541	Coal, sand and gravel, natural gas, uranium, petroleum.
Garfield --------	7,980	7,806	Petroleum, sand and gravel, copper, uranium, silver.
Grand ----------	4,594	6,963	Potassium salts, natural gas, uranium, copper, petroleum, sand and gravel, silver, gold.
Iron ----------	13,195	14,265	Iron ore, sand and gravel, pumice.
Juab ----------	200	362	Clays, fluorspar, sand and gravel, stone.
Kane ----------	W	114	Sand and gravel.
Millard ---------	W	W	Pumice, beryllium, sand and gravel.
Morgan ---------	W	9,163	Cement, stone, sand and gravel.
Piute ----------	2	W	Clays, sand and gravel.
Rich ----------	W	W	Phosphate rock, stone.
Salt Lake ------	305,423	377,845	Copper, gold, molybdenum, silver, cement, sand and gravel, salt, stone, lime.

See footnotes at end of table.

Table 2.—Value of mineral production in Utah, by county [1]—Continued

(Thousands)

	1972	1973	Minerals produced in 1973 in order of value
San Juan	$56,187	$61,889	Petroleum, uranium, natural gas liquids, natural gas, copper, vanadium.
Sanpete	1,359	616	Sand and gravel, gypsum, salt, clays.
Sevier	2,468	3,390	Coal, gypsum, clays, salt.
Summit	6,564	5,970	Petroleum, sand and gravel, clays, natural gas, stone.
Tooele	8,174	9,716	Salt, lime, potassium salts, stone, sand and gravel, clays.
Uintah	25,733	23,522	Petroleum, phosphate rock, asphalt, natural gas, sand and gravel, natural gas liquids.
Utah	18,478	18,037	Zinc, lead, silver, stone, sand and gravel, gold, clays, copper, lime.
Wasatch	7,280	W	Sand and gravel, stone.
Washington	116	W	Sand and gravel, stone, pumice.
Wayne	W	W	Sand and gravel.
Weber	2,866	5,836	Potassium salts, salt, sodium sulfates, sand and gravel, magnesium compounds, clays, stone.
Undistributed [2]	68,657	101,015	
Total [3]	542,809	674,210	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Value of petroleum is based on an average price per barrel for the state. County data for uranium is estimated for 1973.

[2] Includes some sand and gravel that cannot be assigned to specific counties, gem stones, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Utah business activity

		1972	1973 [p]	Change, percent
Employment and labor force, annual average:				
Total labor force	thousands	449.5	471.5	+4.9
Unemployment	do	27.5	26.8	−2.5
Nonagricultural employment	do	395.4	416.9	+5.4
Mining	do	12.0	12.5	+4.2
Construction	do	20.7	21.7	+4.8
Manufacturing	do	59.5	64.2	+7.9
Government	do	105.5	106.6	+1.0
Other nonagricultural employment [1]	do	197.6	211.9	+7.2
Personal income:				
Total	millions	$4,197.0	$4,634.0	+10.4
Per capita		$3,728.0	$4,005.0	+7.4
Construction activity:				
Total construction valuation	millions	$509.2	$596.0	+17.0
Residential	do	$271.8	$279.9	+3.0
Nonresidential	do	$132.6	$218.2	+64.6
Highway construction contracts awarded	do	[e]$75.0	$45.0	−40.0
Cement shipments to and within the State	thousand short tons	653.0	691.0	+5.8
Farm marketing receipts	millions	$264.9	$340.3	+28.5
Mineral production value	do	$542.8	$674.2	+24.2
Electrical energy utilized	million kilowatt hours	8,295.3	9,073.7	+9.4

[e] Estimate. [p] Preliminary.

[1] Includes Transportation and Public Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; and Services.

Sources: Bureau of Economic and Business Review, University of Utah; Survey of Current Business; Employment and Earnings; Farm Income Situation; Area Trends in Employment and Unemployment; Roads and Streets; and the U.S. Bureau of Mines.

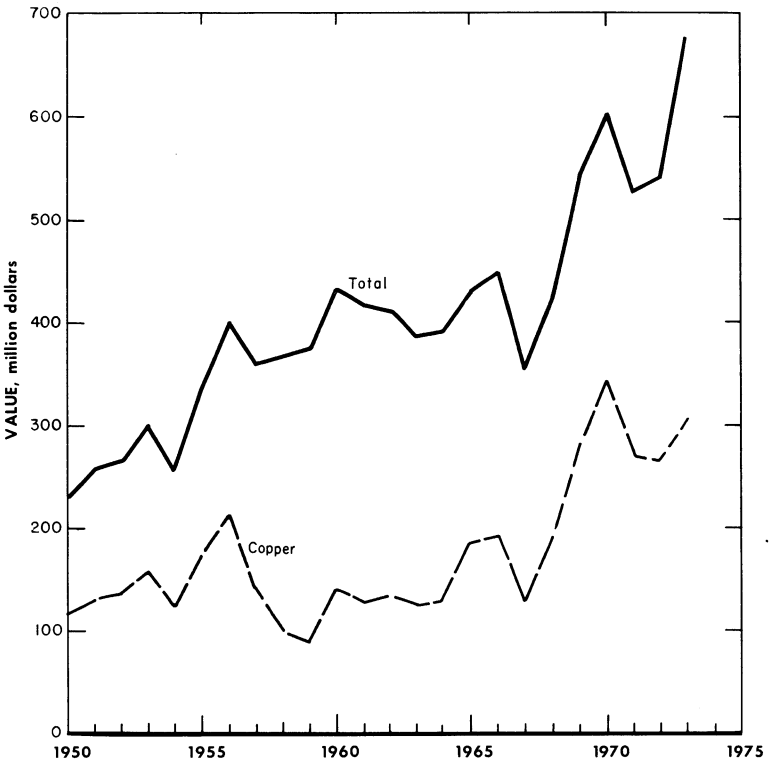

Figure 1.—Value of mine production of copper, and total value of mineral production in Utah.

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—The Spor Mountain bertrandite mine, 55 miles northwest of Delta, was the largest domestic source of beryllium ore in 1973. Output was greater than that in 1972, and Brush Wellman, Inc., mined sufficient ore to maintain a 2-year supply for its extraction plant at Delta.

Copper.—The quantity of copper produced fell 1% but the value rose 15% because of a higher average annual price in 1973. The Kennecott Copper Corp. open pit mine at Bingham was the largest copper-producing mine in the United States. Copper was produced from six operations in six counties.

Centennial Development Co., Salt Lake City, completed exploration drilling on sandstone copper deposits in the Lisbon Valley area, San Juan County. The deposits are 10 to 15 miles south and east of the Big Indian copper property and the uranium mine and mill operations of Rio Algom Corp. A large tonnage of ore averaging 0.9% copper was outlined by the exploration. Current plans call for an open pit mining operation if metallurgical tests demonstrate feasible recovery of the copper.

Table 4.—Utah: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing [1]	Material sold or treated	Gold		Silver	
	Lode	(short tons)	Troy ounces	Value	Troy ounces	Value
1971, total	14	36,303,529	368,996	$15,221,088	5,294,477	$8,185,260
1972, total	6	36,063,001	362,413	21,237,401	4,299,604	7,244,834
1973:						
Beaver	1	303,135	--	--	--	--
Garfield	1	31	--	--	5	13
Grand	--	--	W	W	W	W
Salt Lake	1	38,453,537	W	W	W	W
San Juan	1	252,000				
Utah	2	198,699	--	--	--	--
			[2] 307,080	[2] 30,035,495	[2] 3,619,033	[2] 9,257,486
Total	6	39,207,402	307,080	30,035,495	3,619,038	9,257,499

	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1971, total	263,451	$273,988,832	38,270	$10,562,422	25,701	$8,275,804	$316,233,406
1972, total	259,507	265,735,427	20,706	6,224,345	21,853	7,757,941	308,199,948
1973:							
Beaver	2,747	3,268,580	--	--	--	--	3,268,580
Garfield	5	5,562	--	--	--	--	5,575
Grand	264	314,376	--	--	--	--	314,376
Salt Lake	252,228	300,150,973	--	--	--	--	300,150,973
San Juan	1,233	1,466,675	--	--	--	--	1,466,675
Utah	113	134,720	13,733	4,474,325	16,800	6,941,787	50,843,813
Total	[3] 256,589	305,340,886	13,733	4,474,325	16,800	6,941,787	356,049,992

W Withheld to avoid disclosing individual company confidential data.
[1] Operations at old mill or miscellaneous cleanups not counted as producing mines, nor are various uranium mines counted from which byproducts were recovered.
[2] Grand, Salt Lake, and Utah Counties combined to avoid disclosing individual company confidential data.
[3] Data do not add to total shown because of independent rounding.

Table 5.—Utah: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1973, by class of ore or other source material

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Dry gold	1	131,458	789	6,843	399	--	--
Dry gold-silver	1	10,388	2,449	149,170	70	--	--
Total	2	141,846	3,238	156,013	469	--	--
Copper	3	38,822,766	303,614	2,619,504	211,880	--	--
Lead-zinc	1	188,311	226	840,211	43	13,733	16,800
Total	4	39,011,077	303,840	3,459,715	211,923	13,733	16,800
Other lode material:							
Copper precipitates	1	54,479	--	--	43,933	--	--
Uranium	--	([2])	2	3,310	264	--	--
Total	1	54,479	2	3,310	44,197	--	--
Grand total	6	39,207,402	307,080	3,619,038	256,589	13,733	16,800

[1] Detail will not add to total because some mines produce more than one class of material.
[2] Uranium ore tonnage not included.

Table 6.—Utah: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1973, by type of material processed and method of recovery

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Leaching	--	--	3,673	--	--
Smelting of concentrates	303,842	3,288,391	208,509	10,689	14,890
Direct smelting of:					
Ore	3,238	330,647	474	3,044	1,910
Copper precipitates	--	--	43,933	--	--
Total	307,080	3,619,038	256,589	13,733	16,800

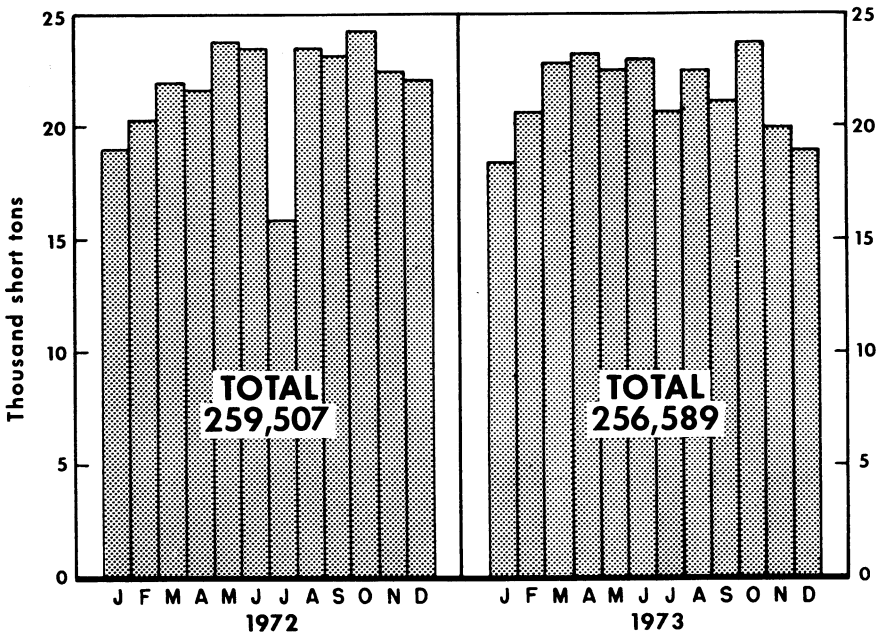

Figure 2.—Mine production of copper in Utah, by months in terms of recoverable metals.

A development program for The Anaconda Company Carr Fork copper property in the Bingham district was under consideration. Plans include a large-scale underground operation and metallurgical facilities. Exploratory drilling was scheduled for completion in mid-1974.

Gold.—Nearly all gold produced in Utah was a byproduct of base metal ores. Four mines in three counties produced 15% less gold than in 1972, but value of production rose 41% because of higher average market prices. Kennecott's open pit copper mine at Bingham was the leading producer.

Iron Ore.—Iron ore production was from three open pits, all in Iron County. The producing mines were the Comstock of CF&I Steel Corp., the Desert Mound of United States Steel Corp., and the Iron Springs of Utah International, Inc. Total output and value rose 11% and 12%, respectively.

Ore and concentrate shipped during 1973 contained an average of 55.55% iron. Most of the ore and concentrate shipped was utilized by the iron and steel industry, and a small quantity was used in making paint.

Lead.—Output of lead, all from Utah County, fell 34% and total value decreased 28% in 1973.

Park City Ventures, a joint venture of The Anaconda Company and the American Smelting and Refining Company, will operate the Ontario lead-zinc-silver mine at Park City, leased from United Park City Mines Co. New ore reserves were discovered and new mining facilities and a concentrator were under construction. Production is planned for early 1975 at an estimated annual rate of 15,000 tons of lead, 25,000 tons of zinc, and 1.2 million ounces of silver.

American Metal Climax, Inc. acquired the Tintic Standard Mining Co., a Salt Lake City based company active in Utah mining since 1907. Most of the mining property held by Tintic Standard is located in the East Tintic district, Utah County, and includes the Tintic Standard mine, a longtime producer of high-grade lead-silver ores, and other properties now part of the Kennecott Copper Corp. unitized area near the Burgin mine.

Magnesium Compounds.—Production of magnesium compounds, all from lake brines, was reported by Great Salt Lake Minerals & Chemical Corp. (GSL) at Ogden, NL Industries, Inc. (NL), at Rowley, and Kaiser Aluminum & Chemical Corp. at Wendover. GSL became a wholly owned subsidiary of Gulf Resources & Chemical Corp. in May. An expansion program was begun in July to increase the ponding area from 13,500 to 17,000 acres. The expansion program was scheduled for completion in 1974 with marketable products beginning in 1976.

The NL plant produced some magnesium metal in 1973 and was expected to produce magnesium at full-rated capacity by late 1974.

Molybdenum.—The quantity and value of molybdenum produced in Utah were more than double those in 1972. Total output was recovered as a byproduct from the concentration of copper ore mined by Kennecott Copper Corp. at Bingham.

Silver.—Production of silver declined 16% in quantity but value of output rose 28% because of increased average annual prices. Output was reported from five mines in four counties. The leading producer was the Kennecott Copper Corp. Utah Copper mine at Bingham.

Tungsten.—Tungsten properties in the House Range, Millard County, were under investigation by Kalium Chemical Corp. Ltd. of Canada. Drilling exploration was scheduled to begin if mapping results were sufficiently encouraging. A holding company, Notch Peak Corp., was formed to permit consolidation of several companies into one unit for easier administration.

Uranium.—Output at the Rio Algom Corp. mill in San Juan County increased following start of operations in October 1972. The mill was designed to treat 500 tons of ore per day but was operating efficiently on a daily feed of 600 tons.

Vanadium.—The quantity and value of vanadium recovered from Utah ores decreased 24% in 1973. Vanadium-bearing ores from three counties were processed at mills in Colorado.

Zinc.—Zinc production fell 23% in quantity and 11% in value in 1973. Output was reported from only one mine in Utah County.

MINERAL FUELS

Asphalt and Related Bitumens.—Output from two gilsonite-producing companies fell 69% in quantity and 53% in value from that in 1972. The Fruita, Colo., plant of American Gilsonite Co. was sold in December 1973.

Carbon Dioxide.—The one-well Farnham Dome field, Carbon County, continued to yield carbon dioxide; output gained 32% in quantity and 50% in value.

Coal (Bituminous).—Coal production rose 15% in quantity and 44% in value. The gain in value was due principally to an increase in the average price from $8.93 to $11.19 per ton. Carbon and Emery Counties continued to account for most of the output.

McCulloch Oil Corp. and American Electric Power Co. signed a letter of intent which will permit delivery of coal from Utah properties to powerplants in the midwest over the next 20 years. Prin-

cipal coal properties in Carbon County controlled by McCulloch include the Carbon Fuel Co. and Valley Camp properties, formerly held by North American Coal Corp. This low-sulfur coal would be blended with coal from other areas. Plans call for delivery by unit train beginning in 1974 with an annual tonnage of 1,250,000 tons. Subsequently, 4 million to 6 million tons may be shipped annually.

Table 7.—Utah: Coal (Bituminous) mine production in 1973, by county
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines	Production (thousand short tons)	Value (thousands)
Carbon	9	3,022	$35,109
Emery	6	2,138	24,351
Sevier	1	339	2,106
Total	16	[1] 5,500	61,566

[1] Data does not add to totals because of independent rounding.

Nevada Power Co. continued investigations of a proposal to construct a 500-megawatt coal-fired powerplant in the Warner Valley area, 12 miles east of St. George, Washington County. Coal for the proposed plant would be mined by Utah International, Inc., in the Alton field, Kane County, and transported to the plant by a 70-mile slurry pipeline. The plant would be constructed in two 250-megawatt units, the first to be operational by 1978 and the second in 1979.

Natural Gas.—Marketed natural gas rose 8% over the 39.5 billion cubic feet marketed in 1972. Because of an increase in the average wellhead price to 19 cents per thousand cubic feet (17 cents in 1972), the value of marketed gas was 22% more than that in 1972. The State Division of Oil and Gas Conservation [2] reported production of 76.8 billion cubic feet. San Juan County was the largest gas producer with 34.6 billion cubic feet, followed by Duchesne County with 14.5 billion cubic feet, and Uintah County with 12.8 billion cubic feet.

The American Petroleum Institute (API) and the American Gas Association, Inc. (AGA), estimated reserves at 1.025 trillion cubic feet. Extensions and new fields added 80 billion cubic feet; revisions, however, deducted 26.6 billion cubic feet.

Twenty-five gas wells were completed in 1973—19 in Grand County and two each in Daggett, San Juan, and Uintah Counties. A number of gas wells were completed in eastern Grand County, principally in the Cisco field. In San Juan County, Mountain Fuel Supply Co. and Merrion & Bayless each completed a gas discovery.

Gary Operating Co., Denver, Colo., constructed a natural gas processing plant in the Altamont-Bluebell oil producing area, Duchesne County. Propane, butane, and gasoline are gathered, compressed, and recovered from natural gas produced in the area. The plant is the third gas processing plant in the area and has the capacity to produce 20 million cubic feet of gas daily.

Natural Gas Liquids.—Production of natural gas liquids rose substantially in quantity and in value. Reserves of natural gas liquids estimated by API and AGA totaled 52.5 million barrels at yearend, 18.5 million barrels more than at the end of 1972.

Petroleum.—Output of crude oil in 1973 increased for the fourth consecutive year. Production of 32.7 million barrels was 22% more than in 1972 and value rose 46%. Duchesne County with output 2½ times that of 1972 and 43% of the State total displaced San Juan County as the leading producing county. San Juan County accounted for 33% of the total output, followed by Uintah County with 14% and Garfield County with 7%.

The Greater Aneth field, San Juan County, continued as the principal producing area with 7.9 million barrels of oil. Two fields in Duchesne County—

[2] Utah Department of Natural Resources, Division of Oil and Gas Conservation. Monthly Oil and Gas Production Report. December 1973.

Bluebell and Altamont which ranked third and sixth in 1972—rose to second and third places, respectively, in 1973. The Bluebell field produced 7.1 million barrels and the Altamont field 5.6 million barrels. The Upper Valley field in Garfield County was fourth, producing 2.2 million barrels; the Lisbon field, San Juan County, was fifth with 1.9 million barrels; and the Wonsits Valley (1.8 million barrels) and Red Wash Unit (1.7 million barrels) fields, both in Uintah County, ranked sixth and seventh, respectively. These seven fields accounted for 87% of the total output.

Table 8.—Utah: Crude oil production, by county
(Thousand 42-gallon barrels)

County	1972	1973	Principal fields in 1973, in order of production
Daggett	7	7	Clay Basin.
Duchesne	5,893	14,217	Bluebell-Wasatch, Altamont.
Emery	3	1	Grassy Trail, Ferron.
Garfield	2,614	2,152	Upper Valley.
Grand	97	73	Salt Wash, Long Canyon.
San Juan	11,346	10,677	Greater Aneth, Lisbon.
Summit	1,166	922	Bridger Lake.
Uintah	5,444	4,607	Wonsits Valley, Red Wash Area.
Total	26,570	32,656	

Source: Utah Oil & Gas Conservation Commission.

Table 9.—Utah: Oil and gas well drilling completions in 1973, by county

County	Proved field wells [1]			Exploratory			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Carbon	--	--	--	--	--	3	3	15,291
Daggett	--	2	1	--	--	--	3	17,462
Duchesne	87	--	--	4	--	2	93	1,270,694
Emery	--	--	--	--	--	1	1	4,530
Garfield	--	--	--	--	--	6	6	15,278
Grand	2	8	8	--	11	17	46	131,806
Iron	--	--	--	--	--	1	1	5,996
Millard	--	--	--	--	--	2	2	11,420
San Juan	10	--	2	--	2	7	21	113,178
Sevier	--	--	--	--	--	2	2	17,844
Uintah	1	2	2	--	--	7	12	61,518
Wayne	--	--	--	--	--	5	5	13,055
Total	100	12	13	4	13	53	195	1,678,072

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Proved crude oil reserves in the State at yearend 1973 were 264.5 million barrels, an increase of 20.1 million barrels. In addition, 44.1 million barrels are considered available by fluid injection. New fields and new reservoir discoveries in old fields added 125,000 barrels, and revisions and extensions added 52.1 million barrels.

Seven oil refineries in the State processed 42.2 million barrels of crude oil. About 16 million barrels came from Utah fields and 26.2 million barrels were received from other States. Colorado supplied 18.6 million barrels and Wyoming furnished 7.6 million barrels. Out-of-State shipments of Utah crude oil totaled 16.7 million barrels, of which 10.2 million went to California and 3.4 million to Texas.

Husky Oil Co. was modernizing and expanding its North Salt Lake City refinery to double crude oil handling capacity to 22,000 barrels per day. The plant began processing the high pour point Uinta Basin Tertiary oil exclusively in early

1973. The company was also using Uinta Basin crude as part of the feedstock for its Cheyenne, Wyo., refinery.

The Tertiary trend in Uinta Basin continued as the dominant factor in Utah activity. Drilling activity resulted in 195 completions, 35 more than that in 1972. Sixty-six percent of all wells were successful, giving the State 104 new oil producers and 25 new gas wells. Twelve counties reported drilling activity; in Duchesne County, the heart of the trend, 91 of 93 wells drilled produced.

Considerable interest was indicated in a new "hinge line" unitized area in Sanpete and Sevier Counties in central Utah. The area approved as a drilling unit by the U.S. Geological Survey covers approximately 170 square miles in parts of T. 18–23, R. 3–4 E., S. L. Meridian. Phillips Petroleum Co. is the operator of the unitized area. Shell Oil Co. and Quintana Oil & Gas Co. hold working interests in the area. One well, in the southern part of the unitized area near Salina Canyon, was being drilled by Brinkerhoff Drilling Co. under contract with Phillips.

The Utah State Land Board issued a lease to American Oil Co., Denver, Colo., to permit the company to conduct oil exploration over 606,000 acres of strata beneath Great Salt Lake. Geophysical exploration, including seismic methods, was begun with the objective of locating subsurface structures that may be favorable for petroleum drilling.

Chevron Pipe Line Co. nearly completed installation of heating stations along the company's oil pipeline extending from the Uinta Basin to Salt Lake City. The line is currently used to some extent in transporting crude oil but not the waxy crude from Uinta Basin wells. Heating stations were being established at Hanna, Woodland, and Kimball's Junction. The heated pipeline will permit moving the waxy crude without the necessity of mixing with the easier-flowing crude oil from the Rangely Field in northwestern Colorado.

NONMETALS

Barite.—No production of barite was reported in Utah in 1973. Crude barite prepared for use in well drilling by Custom Milling & Supply Co. and Eisenman Chemical Co. came from properties in Nevada.

Cement.—Output of portland cement decreased 6% in quantity and 2% in value. Output of masonry cement was virtually unchanged from that in 1972. The entire output was produced by Ideal Cement Co., Div. of Ideal Basic Industries, Inc., and Portland Cement Co. of Utah. Portland and masonry cement consumed in the State totaled 689,000 and 1,000 short tons, respectively. Seventy-four percent of the portland cement was purchased by ready-mix concrete companies, 9% by concrete product manufacturers, 7% by building material dealers, and 10% by contractors and other users. Raw materials used in making portland cement included limestone and cement rock, gypsum, iron-bearing materials, and sandstone.

Clays.—Output of clays (excluding kaolin) fell 9% in quantity and 2% in value. Twenty operations in eight counties contributed to total production. The major producing companies were Utelite Corp., Entrada Industries, Interpace Corp., and Western Clay Co. The materials listed as clays included common clay and shale, bentonite, fire clay, fuller's earth, and halloysite (a kaolin group mineral). Most of the clays were used as expanded material in making lightweight aggregates, in manufacturing building brick, and as catalysts in oil refining.

Fluorspar.—Production of fluorspar in 1973 was substantially greater than that in 1972; output rose 60% and value increased 71%. Producers in Juab County—Willden Fluorspar Co., U.S. Energy Corp., and Spor Bros.—accounted for the total output.

Gypsum.—Georgia-Pacific Corp., United States Gypsum Co., and Cox Enterprises, Inc., mined gypsum in Sanpete and Sevier Counties. Output was 231,000 tons. Georgia-Pacific Corp. and United States Gypsum Co. calcined gypsum in Sevier County. Output decreased 10%.

Lime.—Utah-Marblehead Lime Co., The Flintkote Co., Kennecott Copper Corp., Utah-Idaho Sugar Co., and Mountain States Lime Inc. produced lime in Box Elder, Salt Lake, Tooele, and Utah Counties. Output increased 8% but was 7% below the 1966 record. The lime was used for refractories, copper ore concentration, mason's lime, and other uses. The lime was consumed in Utah, New Mexico, Nevada, other States, and Canada. Total

lime consumption in Utah was 122,300 tons.

Perlite.—Acme Lite Wate Products, Inc., Salt Lake City, and Georgia-Pacific Corp., at Sigurd, expanded perlite from out-of-State sources. The expanded perlite was used as a plaster aggregate and in building.

Phosphate Rock.—Output of phosphate rock was 7% greater than that in 1972 and value increased 22%. The Stauffer Chemical Co., with mines in Rich and Uintah Counties, was the only producer of phosphate rock. Phosphate rock from the Crawford Mountains (formerly Cherokee) mine was processed in the company plant at Leefe, Wyo. The company announced that the phosphate rock mining and beneficiation plant, 10 miles north of Vernal, Uintah County, would be expanded to increase production by about 40% over current operations.

Potash.—Production of potash salts was reported by Texasgulf, Inc., near Moab, Grand County; Kaiser Aluminum & Chemical Corp., Bonneville, Ltd. Division, at Wendover, Tooele County; and Great Salt Lake Minerals & Chemicals Corp., Weber County. Output rose 39% in quantity and 71% in value.

Pumice.—Pumice and related volcanic materials was produced at five mines in four counties; most of the output was used in road construction. Total tonnage produced and value increased substantially.

Salt.—Salt production increased 9% over that of 1972; the value of output was 40% greater. Six companies operating ponds in four counties accounted for all the evaporated salt produced, and rock salt was produced at one mine each in Sanpete and Sevier Counties. The salt was sold for use in many industries, including the chemical and animal feed processing industries, but most of the output was sold for road salt.

Sand and Gravel.—Sand and gravel production from 100 operations (93 in 1972) rose 5% in quantity but fell 6% in value. The average value of sand and gravel produced decreased from $1.17 to $1.04 per ton. Two counties—Salt Lake and Utah—reported output from more than 10 operations. Sand and gravel continued to lead the nonmetallic group in total value of commodity production.

Table 10.—Utah: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Box Elder	4	637	472	3	321	W
Cache	7	501	590	7	788	895
Daggett	1	W	W	1	156	572
Davis	7	1,756	1,472	6	1,558	1,313
Duchesne	2	108	123	1	18	5
Emery	--	--	--	1	188	123
Garfield	1	W	W	1	30	39
Grand	3	29	W	3	42	35
Iron	5	812	W	5	507	655
Juab	1	47	31	1	47	30
Kane	2	W	W	2	W	114
Millard	--	--	--	1	6	4
Piute	1	1	2	1	W	\
Salt Lake	19	4,610	4,441	19	5,588	4,648
Tooele	2	W	W	2	W	42
Uintah	4	272	W	4	304	349
Utah	6	1,102	1,564	12	1,008	1,277
Washington	2	W	W	3	59	99
Weber	3	225	225	4	330	309
Undistributed [1]	r 23	4,521	8,153	23	4,461	5,477
Total [2]	93	14,619	17,071	100	15,410	15,986

r Revised.
W Withheld to avoid disclosing individual company confidential data; included in "Undistributed."
[1] Includes Beaver, Carbon (1973), Morgan, Sanpete, Sevier (1972), Summit, Wasatch, and Wayne Counties and some sand and gravel that cannot be assigned to specific counties.
[2] Data may not add to totals shown because of independent rounding.

Table 11.—Utah: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,853	2,341	1,546	1,901
Fill	114	78	895	286
Paving	379	348	446	514
Other uses [1]	301	357	312	405
Total [2]	2,647	3,125	3,200	3,106
Gravel:				
Building	2,314	2,512	2,311	2,371
Fill	459	251	502	269
Paving	5,231	7,259	5,575	6,412
Miscellaneous	W	W	73	79
Other uses [3]	1,000	842	627	566
Total [2]	9,006	10,864	9,087	9,698
Government-and-contractor operations:				
Sand:				
Fill	84	82	30	16
Paving	4	1	24	18
Other uses	12	6	--	--
Total	100	89	54	34
Gravel:				
Building	--	--	70	78
Fill	528	211	1,312	735
Paving	2,261	2,705	1,612	2,228
Other uses	78	78	75	108
Total [2]	2,867	2,993	3,070	3,149
Total sand and gravel [2]	14,619	17,071	15,410	15,986

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes blast, engine, foundry, molding (1973), and other sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast and other gravel.

Stone.—Production of stone from 26 quarries decreased 16% in quantity but rose 5% in total value. Three counties—Utah, Box Elder, and Morgan—accounted for 71% of the total output. Principal producing companies were United States Steel Corp., Southern Pacific Railroad Co., Ideal Cement Co. Div. of Ideal Basic Industries, Inc., and Portland Cement Co. of Utah.

Table 12.—Stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973			Kind of stone produced in 1973
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Box Elder	2	W	W	3	W	W	Limestone, quartzite, other stone.
Cache	3	W	W	4	W	W	Limestone, sandstone.
Davis	2	W	W	1	13	12	Quartz.
Juab	1	3	11	1	W	W	Quartzite.
Morgan	2	W	W	1	W	W	Limestone, sandstone.
Rich	1	1	1	1	10	8	Dolomite.
Salt Lake	3	W	W	3	W	W	Limestone, granite, sandstone, other stone.
Summit	3	W	W	2	W	W	Sandstone, other stone.
Tooele	6	W	729	3	W	807	Limestone, dolomite, marble.
Uintah	1	W	W	--	--	--	
Utah	4	W	W	3	W	W	Limestone, dolomite.
Wasatch	3	W	W	2	(1)	6	Limestone, sandstone.
Washington	1	W	W	1	W	W	Sandstone.
Weber	--	--	--	1	13	12	Quartz.
Undistributed	--	3,381	5,264	--	2,813	5,471	--
Total [2]	32	3,384	6,005	26	2,848	6,318	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Data may not add to totals shown because of independent rounding.

Table 13.—Stone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone total [1]	1	33	5	259
Crushed and broken stone:				
Dense graded road base stone	382	318	W	W
Lime and cement manufacture	948	1,670	903	1,883
Other uses [1]	2,054	3,984	1,941	4,177
Total [2]	3,383	5,972	2,844	6,059
Grand total [2]	3,384	6,005	2,848	6,318

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes stone used in agricultural lime, poultry, grit, riprap and jetty stone, terrazzo, flux stone, refractory stone, and mine dusting. Data for 1972 also include concrete aggregate, bituminous aggregate, surface treatment aggregate, roofing aggregates, ferrosilicon, whiting, other filler, and other uses not specified. 1973 data also include stone sand, dead-burned dolomite, and stone used in acid neutralization.

[2] Data may not add to totals shown because of independent rounding.

Table 14.—Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone total [1]	1	33	5	259
Crushed and broken:				
Limestone [2]	2,326	4,414	2,049	4,731
Sandstone	122	123		
Quartz	--	--	111	139
Quartzite	30	55		
Undistributed [3]	907	1,380	685	1,189
Crushed total [4]	3,383	5,972	2,844	6,059
Grand total [4]	3,384	6,005	2,848	6,318

[1] Includes marble, sandstone, and quartzite (1973).

[2] Limestone used generally to include dolomite.

[3] Includes marble, other stone and granite (1973).

[4] Data may not add to totals shown because of independent rounding.

Vermiculite.—Crude vermiculite was not produced in Utah in 1973, but out-of-State material was exfoliated by Vermiculite-Intermountain, Inc., Salt Lake City. The product was sold and used principally as loose fill insulation and plaster aggregate. Other uses included concrete aggregate, soil conditioning, and pipe covering.

Table 15.—Principal producers

Commodity and company	Address	Type of activity	County
Asphalt and related bitumens:			
American Gilsonite Co	Suite 1150, Kennecott Bldg. Salt Lake City, Utah 84110	Underground mine Refinery	Uintah. Mesa.
Beryllium: Brush Wellman, Inc.	67 W. 2950 S. Salt Lake City, Utah 84115	Open pit mine Chemical processing plant.	Juab. Millard.
Carbon dioxide (natural):			
Equity Oil Co	806 American Oil Bldg. Salt Lake City, Utah 84101	Well and plant, Farnham Dome field.	Carbon.
Cement:			
Ideal Cement Co., Div. of Ideal Basic Industries, Inc.[1]	420 Ideal Cement Bldg. Denver, Colo. 80202	Wet process, 2-rotary-kiln plant.	Morgan.
Portland Cement Co. of Utah	Box 1469 Salt Lake City, Utah 84110	Wet process	Salt Lake.
Clays:			
Entrada Industries, Interstate Brick Div.	Box 517 West Jordan, Utah 84084	Mine and plant	Summit, Sevier, Tooele, Utah.
Filtrol Corp	3250 E. Washington Blvd. Los Angeles, Calif. 90023	Open pit-underground mine.	Juab.
Interpace Corp	2901 Los Feliz Blvd. Los Angeles, Calif. 90039	Open pit mine	Sevier, Utah, Weber.
Utelite Corp	R.F.D. Coalville, Utah 84017	Open pit mine and expanding plant.	Summit.
Coal (bituminous):			
American Coal Co	190 N. Main Huntington, Utah 84528	Underground mine	Emery.
Kaiser Steel Corp	Sunnyside Coal Mines Sunnyside, Utah 84539	3 underground mines and cleaning plant.	Carbon.
Peabody Coal Co	301 N. Memorial Drive St. Louis, Mo. 36102	Underground mine	Emery.
United States Fuel Co	1910 University Club Bldg. Salt Lake City, Utah 84111	Underground mine Cleaning, crushing and oil treatment plant.	Carbon, Emery. Carbon.
United States Steel Corp., Western District.	Box 807 Dragerton, Utah 84520	Underground mine Cleaning, thermal drying, and crushing plant.	Carbon, Emery. Carbon.
Copper:			
Kennecott Copper Corp., Utah Copper Division.	Box 11299 Salt Lake City, Utah 84111	Open pit mine, crusher, 2 flotation mills, precipitation plant, smelter, and electrolytic refinery.	Salt Lake.
Fluorspar:			
Spor Bros	Box 276 Delta, Utah 84624	Open pit and underground mines.	Juab.
U.S. Energy Corp	625 East Madison Suite 1 Rivington, Wyoming 82501	Open pit mine	Do.
Willden Fluorspar Co	Box 536 Delta, Utah 84624	Underground mine	Do.
Gold:			
Kennecott Copper Corp., Utah Copper Division.	Box 11299 Salt Lake City, Utah 84111	*See* Copper	Salt Lake.
Gypsum:			
Georgia-Pacific Corp., Gypsum Division.	P.O. Box 311 Portland, Oreg. 97204	Open pit mine and calcining plant.	Sevier.
United States Gypsum Co	101 S. Wacker Dr. Chicago, Ill. 60606	do	Do.
Iron ore:			
CF&I Steel Corp	Box 1920 Pueblo, Colo. 80201	3 open pit mines	Iron.
United States Steel Corp., Western Ore Operations.	Lander, Wyo. 82520	Open pit mine	Do.

See footnote at end of table.

Table 15.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Iron ore—Continued			
Utah International, Inc	Box 649 Cedar City, Utah 84720	2 open pit mines, mobile crushing and screening plant, and beneficiation plant.	Iron.
Lead:			
Kennecott Copper Corp., Tintic Division.	Box 250 Eureka, Utah 84628	*See* Zinc	Utah.
Lime:			
The Flintkote Co., U.S. Lime Division.[1]	2244 Beverly Blvd. Los Angeles, Calif. 90057	2-shaft-kiln plant	Utah.
Kennecott Copper Corp	Box 11299 Salt Lake City, Utah 84111	Lime kiln	Salt Lake.
Utah-Marblehead Lime Co[1]	300 W. Washington St. Chicago, Ill. 60606	Rotary-kiln plant	Tooele.
Molybdenum: Kennecott Copper Corp., Utah Copper Division.	Box 11299 Salt Lake City, Utah 84111	*See* Copper	Salt Lake.
Petroleum:			
American Oil Co.	Box 898 Salt Lake City, Utah 84111	Refinery	Do.
Atlantic Richfield Co	717 Fifth Ave. New York, N.Y. 10022	Crude oil wells, Boundary Butte field.	San Juan.
Belco Petroleum Corp	630 Third Ave. New York, N.Y. 10017	Crude oil wells, White River field.	Uintah.
Chevron Oil Co, Western Division.	Box 599, 1700 Broadway Denver, Colo. 80201	Crude oil wells and gas processing plant, Red Wash field.	Do.
		Crude oil wells, Bluebell field.	Duchesne.
Exxon Co., U.S.A	2000 Classen Center N. Oklahoma City, Okla. 73106	Crude oil wells, Walker Hollow field.	Uintah.
		Refinery	Salt Lake.
Gulf Oil Corp	Gulf Bldg. Pittsburgh, Pa. 15230	Crude oil and natural gas wells, Wonsits Valley field.	Uintah.
		Indian Ridge field	Duchesne.
Husky Oil Co	Box 380 Cody, Wyo. 82414	Refinery	Salt Lake.
Monsanto Polymers & Petrochemicals Co., Hydrocarbons Division.	800 N. Lindbergh Blvd. St. Louis, Mo. 63166	Crude oil wells, McElmo Mesa field.	San Juan.
Phillips Petroleum Co	431 S. 3rd E. Salt Lake City, Utah 84111	Crude oil wells, Ratherford field.	Do.
		Bridger Lake field	Summit.
		Refinery	Davis.
Shell Oil Co	1 Shell Plaza Houston, Tex. 77001	Crude oil wells, Altamont field.	Duchesne.
Superior Oil Co	Box 1521 Houston, Tex. 77001	Crude oil wells, McElmo Creek field.	San Juan.
Texaco Inc	Box 2100 Denver, Colo. 80201	Crude oil wells, Aneth, Ismay and Flodine Park fields.	Do.
		Natural gas wells, Fence Canyon field.	Uintah.
Union Oil Company of California, Western Region.	Box 7600 Los Angeles, Calif. 90054	Crude oil wells and gas processing plant, Lisbon field.	San Juan.
Phosphate rock: Stauffer Chemical Co.	636 California St. San Francisco, Calif. 94119	Open pit-underground mine.	Rich.
		Open pit mine and beneficiation plant.	Uintah.
Potassium salts:			
Great Salt Lake Minerals & Chemicals Corp.	Box 1190 Ogden, Utah 84402	Brine processing plant	Weber.
Kaiser Aluminum & Chemical Corp.	300 Lakeside Dr. Oakland, Calif. 94604	do	Tooele.
Texasgulf, Inc	200 Park Ave. New York, N.Y. 10017	Underground mine and flotation refinery.	Grand.
Pumice: Thompson Block Co	620 N. 400 W. Cedar City, Utah 84720	Open pit mine and crushing and screening plant.	Beaver.
		do	Iron.
Salt:			
American Salt Co	3142 Broadway Kansas City, Mo. 64111	Lake brine processing plant.	Tooele.
Great Salt Lake Minerals & Chemicals Corp.	Box 1190 Ogden, Utah 84402	Solar evaporation	Weber.

See footnote at end of table.

Table 15.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Salt—Continued			
Morton Salt Co., a division of Morton International Inc.	110 N. Wacker Drive Chicago, Ill. 60606	Lake brine processing plant.	Salt Lake.
Sand and gravel:			
Breitling Brothers Construction Inc.	3645 S. 500 West Salt Lake City, Utah 84119	Pit	Do.
W.W. Clyde & Co	Box 232 Springville, Utah 84663	Portable plant	Various.
Cox Construction Co., Inc	270 N. First E. Manti, Utah 84642	do	Sanpete.
Gibbons & Reed Co., Concrete Products Co. Division.	41 W. Central Ave. Murray, Utah 84107	Pit and plant do do	Davis. Salt Lake. Weber.
Le Grand Johnson Corp	Box 248 Logan, Utah 84321	Pit	Cache.
Pioneer Sand and Gravel Co	3200 W. 5400 S. P.O. Box 18457 Salt Lake City, Utah 84118	Pit	Salt Lake.
South Weber Sand and Gravel Co.	5100 S. Washington Blvd. Ogden, Utah 84403	Pit	Davis.
Utah Sand and Gravel Products Corp.	Box 537 Salt Lake City, Utah 84110	3 pits and plants	Salt Lake.
L.A. Young & Sons Construction Co.	1135 S. West Temples Salt Lake City, Utah 84104	Portable plant	Summit.
Selenium:			
Kennecott Copper Corp.	161 East 42nd Street New York, N.Y. 10017	*See* Copper	Do.
Silver:			
Kennecott Copper Corp., Utah Copper Division.	Box 11299 Salt Lake City, Utah 84111	*See* Copper	Salt Lake.
Stone:			
Ideal Cement Co., Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Quarry	Morgan.
Portland Cement Co. of Utah	Box 1469 Salt Lake City, Utah 84110	Quarry and plant	Salt Lake.
Southern Pacific Railroad Co	65 Market St. San Francisco, Calif. 94105	Quarry	Box Elder.
United States Steel Corp., Western Ore Operations.	Lander, Wyo. 82520	Quarry and plant	Utah.
Uranium:			
Atlas Corp., Atlas Minerals Division.	Box 1207 Moab, Utah 84532	14 underground mines	San Juan.
Rio Algom Corp	Box 610 Moab, Utah 84532	Underground mine	Do.
Vanadium: *See* Uranium			
Zinc:			
Kennecott Copper Corp., Tintic Division.	Box 250 Eureka, Utah 84628	2 underground mines	Utah.

[1] Also stone.

The Mineral Industry of Vermont

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Vermont, for collecting information on all minerals except fuels.

By Frank B. Fulkerson [1]

Mineral production in Vermont in 1973 was valued at $29.4 million, a decline of $5.5 million (16%) from that of 1972. Stone continued as the principal mineral commodity and supplied two-thirds of the total value. Output of dimension stone dropped $5.5 million (34%), and output of crushed stone declined $1.2 million (12%). Production of asbestos, sand and gravel, and talc increased in 1973. A small quantity of peat was also produced. Vermont ranked among the top four States in the production of dimension granite, dimension marble, dimension slate, asbestos, and talc.

A book was published that analyzed the impact of the Vermont minerals industry on the economy of the State and described steps taken by the industry to protect the environment.[2]

Conwest Exploration Co., Ltd., Toronto, Canada, which already was active in the Vermont copper belt with an exploration project in Topsham, announced intention to drill for copper and zinc at West Corinth, Strafford, and Waits River. No copper has been produced in Vermont since 1958.

[1] Industry economist, Division of Nonmetallic Minerals—Mineral Supply.

[2] Tillman, D. A. Mining in Vermont. Tower Pub. Co., Portland, Maine, 1973, 102 pp.

Table 1.—Mineral production in Vermont [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Gem stones	NA	W	NA	$7
Peat thousand short tons	(2)	$1	(2)	2
Sand and gravel do	3,302	3,214	4,041	3,581
Stone do	3,300	26,170	1,871	19,523
Talc short tons	180,239	1,326	W	W
Value of items that cannot be disclosed: Asbestos and values indicated by symbol W	XX	4,157	XX	6,253
Total	XX	34,868	XX	29,366
Total 1967 constant dollars	XX	28,770	XX	p 21,561

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Less than ½ unit.

Table 2.—Value of mineral production in Vermont, by county
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Addison	$291	$2,609	Stone, sand and gravel.
Bennington	W	W	Sand and gravel, stone.
Caledonia	W	W	Stone, sand and gravel.
Chittenden	W	W	Do.
Essex	W	W	Sand and gravel.
Franklin	W	W	Stone, sand and gravel.
Grand Isle	--	W	Stone.
Lamoille	W	W	Talc, sand and gravel, stone.
Orange	W	W	Stone, sand and gravel.
Orleans	W	W	Asbestos, sand and gravel, stone.
Rutland	W	9,432	Stone, sand and gravel.
Washington	W	W	Do.
Windham	W	W	Stone, talc, sand and gravel.
Windsor	1,054	1,407	Talc, sand and gravel, stone, peat.
Undistributed [1]	33,524	15,919	
Total [2]	34,868	29,366	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Includes gem stones, some sand and gravel (1973) that cannot be assigned to specific counties, and values indicated by symbol W.
[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Vermont business activity

		1972	1973 [p]	Change, percent
Employment and labor force, annual average:				
Total labor force	thousands	194.5	200.5	+3.1
Unemployment	do	12.7	11.1	−12.6
Employment:				
Mining	do	.9	.9	--
Construction	do	9.8	10.7	+9.2
Manufacturing	do	38.5	41.3	+7.3
Government	do	28.2	28.8	+2.2
Other [1]	do	76.4	80.4	+5.2
Personal income:				
Total	millions	$1,703	$1,861	+9.3
Per capita		$3,686	$4,011	+8.8
Construction activity:				
Number of housing units authorized		3,129	2,371	−24.2
Value of nonresidential building construction	millions	$14.2	$14.0	−1.4
Portland cement shipments to and within Vermont	thousand short tons	154	143	−7.1
Mineral production value	millions	$34.9	$29.4	−15.8

[p] Preliminary.
[1] Includes transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; and services.

Sources: Survey of Current Business, Employment and Earnings, Construction Review, Area Trends in Employment and Unemployment, New England Economic Indicators, U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Asbestos.—GAF Corp. announced that it would close its Lowell asbestos mine and mill by March 15, 1975. The company said that to continue producing beyond that date would require spending $1 million for air pollution control equipment to meet U.S. Environmental Protection Agency standards. This expenditure would result in a marginally economic operation particularly in view of limited reserves. Production increased 16% in quantity and 15% in value in 1973.

Gem Stones.—The value of gem stones and mineral specimens collected was estimated at $7,000.

Mica, Reconstituted.—At Rutland, Samica Corp. processed delaminated scrap mica to manufacture reconstituted sheet mica for use in electrical insulation.

Sand and Gravel.—Sand and gravel pro-

duction increased 22% in quantity and 11% in value. Average value per ton was $0.89 ($0.97 in 1972). Commercial production by 24 sand and gravel companies totaled 2.47 million tons with an average value of $1.24. Government-and-contractor operations, through the Vermont Department of Highways, produced 1.57 million tons with an average value of $0.34. Leading counties were Bennington, Chittenden, Orange, Rutland, and Windsor. Leading commercial producers were J. P. Carrara & Sons, Inc., William E. Dailey, Inc., and S. T. Griswold, Inc., and Lawrence Sangravco, Inc.

Sand production was 2.25 million tons with a value of $1.90 million. By quantity, sand was used for the following purposes: Paving 71%, building 24%, fill 2%, and other uses 3%.

Gravel output totaled 1.79 million tons with a value of $1.68 million. By quantity, gravel was used as follows: Paving 59%, building 30%, fill 7%, and other uses 4%.

The Vermont Department of Highways purchased sand and gravel from commercial producers and contracted for production as part of the works projects. Its own crews produced sand for ice control and gravel for paving.

Table 4.—Vermont: Sand and gravel production by Government-and-contractor operations, by county
(Thousand short tons)

County	1972	1973
Addison	38	24
Bennington	9	625
Caledonia	10	39
Chittenden	37	45
Essex	16	12
Franklin	70	34
Lamoille	3	4
Orange	231	349
Orleans	79	40
Rutland	132	73
Washington	50	50
Windham	42	187
Windsor	109	90
Total[1]	825	1,573

[1] Data may not add to totals shown because of independent rounding.

Stone.—Compared with the 1972 figure, tonnage and value of stone production declined 43% and 25%, respectively, owing to decreased crushed stone requirements for highway construction and a lower unit value of dimension stone production.

Production of dimension stone rose from 144,330 tons to 158,910 tons, but value declined from $16.4 million to $10.9 million. Average value per ton dropped from $113.48 in 1972 to $68.47 in 1973, owing to a greater proportion of low-unit-value rubble.

Production and value of crushed stone decreased from 3.2 million tons and $9.8 million to 1.7 million tons and $8.6 million. Average value per ton increased from $3.10 in 1972 to $5.05 in 1973. A larger proportion of the crushed stone was relatively high-unit-value crushed limestone.

Leading producers were White Pigment Corp., Rock of Ages Corp., Vermont Marble Co., Wells-Lamson Quarry Co., Inc., and the State Highway Department, which contracted for crushed stone in all counties except Essex and Grand Isle. Dimension stone was produced at 27 quarries. Stone was crushed at 52 quarries. Leading counties were Rutland, Washington, and Addison. Principal kinds of stone were limestone, granite, marble, and slate.

Crushed limestone production declined 7% from the 1972 level. White Pigment Corp., a large producer of industrial fillers, expanded the capacity of its Florence mill by about 50% and planned a similar expansion of its New Haven mill. The company operated quarries at South Wallingford and New Haven. Vermarco Ground Products Division of Vermont Marble Co. operated a plant at Florence and produced industrial sands and fillers, specialty products, and agricultural limestone. The limestone was obtained from a quarry near the plant. Two companies crushed limestone for agricultural purposes, construction aggregate, papermill stone, and other uses.

Vermont Marble Co., the only marble producer in the State, operated the Imperial quarry at Danby and the Main quarry near Proctor. Small tonnages were obtained from quarries at Rochester and Isle La Motte. The principal dressed stone products from the company finishing plant at Proctor were cut and sawed marble for architectural work and monumental marble.

Rock of Ages Corp. operated four granite quarries and a finishing plant at Barre. By value, most of the quarry output was monumental stone; rubble for construction work also was produced from one quarry. Wells-Lamson Quarry Co., Inc., operated its quarry and finishing plant at Barre and

produced rough granite blocks and dressed sawed granite.

Dolomite, quartzite, and traprock were quarried for road surface treatment, road base stone, and construction aggregate.

Dimension slate production, exclusive to Rutland County, totaled 21,350 tons worth $1.6 million, compared with 21,900 tons with a value of $1.5 million in 1972. Fifteen quarries were active. Mill stock for flagging, the principal product, was worth an average of $30.60 per ton in 1973. Other products included mill stock for structural and sanitary uses ($185.60 per ton), roofing slate ($145.10 per ton), and flooring slate ($117.60 per ton). A quantity of crushed slate was expanded in a rotary kiln to produce lightweight concrete aggregate.

Talc.—The talc industry was to be expanded. Windsor Minerals, Inc., which operates two talc mines and a mill near Windsor, announced in August that it would build a new $3 million mill at Ludlow to process crude talc. The mill will use talc from the firm's deposits in the Ludlow and Chester areas. The complex will include a cosmetic products plant, an industrial products plant, an engineering and research facility, a byproducts plant, and an office structure. Three companies mined and ground talc in 1973. Quantity and value of production increased over that of 1972. The ground talc was sold and used for toilet preparations, plastics, rubber, paper, paint, insecticides, asphalt filler, refractories, foundry facings, and export.

MINERAL FUELS

Peat.—A small quantity of humus peat was produced from a bog near Barnard. The material was sold both in bulk and in bags for general soil improvement.

Table 5.—Principal producers

Commodity and company	Address	Type of activity	County
Asbestos: GAF Corp., Building & Industrial Floor Products Div.[1]	140 West 51st St. New York, N.Y. 10020	Pit	Orleans.
Peat: Kirks Green Mountain Peat	P.O. Box 456 Woodstock, Vt. 05091	Bog	Windsor.
Sand and gravel:			
Burgess Brothers Inc	RFD Burgess Road Bennington, Vt. 05201	Pit	Do.
Calkins Construction, Inc	Danville, Vt. 05828	Pit	Orleans.
J. P. Carrara & Sons, Inc	North Clarendon, Vt. 05759	Pit	Rutland.
William E. Dailey, Inc	North Bennington, Vt. 05257	Pit	Bennington.
S. T. Griswold, Inc	P.O. Box 8 Williston, Vt. 05495	Pit	Chittenden.
Hinesburg Sand & Gravel	Hinesburg, Vt. 05461	Pit	Do.
Lawrence Sangravco, Inc	138 Portland St. Johnsbury, Vt. 05819	Pit	Essex.
Tucker Construction Corp	Drawer C Ludlow, Vt. 05149	Pit	Bennington.
Twin States Sand & Gravel Co	P.O. Box 267 West Lebanon, N.H. 03784	Pit	Windsor.
Vermont Sand & Gravel Corp	Box 429 Bellows Falls, Vt. 05101	Pit	Rutland.
Stone:			
Granite (dimension):			
Rock of Ages Corp	Barre, Vt. 05641	Quarry	Orange, Washington, Windsor.
Wells-Lamson Quarry Co., Inc.	700 North Main St. Barre, Vt. 05641	do	Washington.
Granite (crushed) Wells-Lamson Quarry Co., Inc.		do	Do.
Limestone (crushed and broken):			
Swanton Lime Works, Inc	Swanton, Vt. 05488	Quarry	Franklin.
Vermarco Ground Products Division of Vermont Marble Co.	West Rutland, Vt. 05777	do	Rutland.
White Pigment Corp	Proctor, Vt. 05765	2 quarries	Addison and Rutland.
Marble (dimension):			
Vermont Marble Co.[2]	do	do	Rutland and Windsor.

See footnotes at end of table.

Table 5.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Slate (dimension):			
Green Mountain Slate Corp	Main Street Middle Granville, N.Y. 12849	2 quarries	Rutland.
John G. Hadeka	25 College St. Poultney, Vt. 05764	do	Do.
Hilltop Slate Co	Middle Granville, N.Y. 12849	do	Do.
Plasticrete Corp	1883 Dixwell Ave. Hamden, Conn. 06514	do	Do.
Taran Brothers, Inc	Poultney, Vt. 05764	do	Do.
Tatko Brothers Slate Co	Middle Granville, N.Y. 12849	do	Do.
Vermont Structural Slate Co., Inc.	Prospect St. Fair Haven, Vt. 05743	do	Do.
Talc:			
Eastern Magnesia Talc Co	Johnston, Vt. 05656	Underground mines.	Lamoille.
Vermont Talc Co	Chester, Vt. 05143	do	Windham.
Windsor Minerals, Inc	P.O. Box 680 Windsor, Vt. 05089	do	Windsor.

[1] Also miscellaneous stone.
[2] Also crushed marble.

The Mineral Industry of Virginia

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Virginia Division of Mineral Resources for collecting information on all minerals except fuels.

By Charles E. Vannoy [1]

Another record high in total value of mineral production was attained for the 11th consecutive year. Value of mineral production in 1973 reached $540.6 million, an increase of 10% over the $489.8 million reported the previous year. Value increases for three commodities, coal, stone, and sand and gravel, were primarily responsible for the gain. Eight commodities gained in output quantity, and 11 gained in output value. Of the total 1973 mineral production value, approximately 70% was contributed by fuels, 29% by nonmetals, and 1% by metals.

[1] Mining engineer, Division of Coal—Mineral Supply.

Table 1.—Mineral production in Virginia [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays ____ thousand short tons	1,634	$1,783	1,646	$1,886
Coal (bituminous) ____ do	34,028	344,061	33,961	377,679
Gem stones	NA	13	NA	13
Lead (recoverable content of ores, etc.) short tons	3,441	1,034	2,637	859
Lime ____ thousand short tons	758	11,739	782	12,205
Natural Gas ____ million cubic feet	2,787	892	5,101	1,688
Petroleum (crude) thousand 42-gallon barrels	(2)	(2)	--	--
Sand and gravel ____ thousand short tons	14,085	21,696	14,511	26,246
Soapstone ____ short tons	W	W	4,600	12
Stone ____ thousand short tons	39,987	74,090	43,895	82,719
Zinc (recoverable content of ores, etc.) short tons	16,789	5,960	16,683	6,894
Value of items that cannot be disclosed: Aplite, cement, gypsum, kyanite, salt (1972), and values indicated by symbol W	XX	28,523	XX	30,394
Total	XX	489,791	XX	540,595
Total 1967 constant dollars	XX	404,127	XX	p 396,905

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Less than ½ unit.

Table 2.—Value of mineral production in Virginia, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Accomack	$11	$116	Sand and gravel.
Albemarle	W	W	Stone, sand and gravel.
Alleghany	W	--	
Amherst	W	W	Stone, sand and gravel.
Appomattox	W	W	Stone.
Augusta	W	W	Stone, sand and gravel.
Bedford	--	W	Do.
Bland	W	482	Stone.
Botetourt	W	W	Cement, stone, clays.
Brunswick	W	W	Stone, clays.
Buchanan	159,315	174,611	Coal, natural gas, sand and gravel.
Buckingham	W	W	Kyanite, stone.
Campbell	W	W	Stone, sand and gravel.
Caroline	W	W	Sand and gravel.
Charles City	W	W	Do.
Charlottesville (city)	--	114	Do.
Chesapeake (city)	W	W	Cement, sand and gravel.
Chesterfield	7,623	5,642	Sand and gravel, stone, clays.
Clarke	W	W	Stone.
Craig	W	150	Sand and gravel.
Culpeper	W	W	Stone.
Dickenson	W	W	Coal, natural gas.
Dinwiddie	W	W	Stone.
Essex	--	W	Sand and gravel.
Fairfax	W	8,719	Stone, sand and gravel.
Fauquier	W	W	Stone, sand and gravel.
Floyd	17	10	Stone.
Franklin	W	12	Soapstone.
Frederick	6,885	7,890	Stone, lime, sand and gravel, clays.
Giles	W	W	Lime, stone.
Gloucester	W	W	Sand and gravel.
Goochland	2,945	4,430	Stone.
Grayson	401	467	Stone, sand and gravel.
Greensville	W	W	Stone, clays.
Halifax	W	W	Stone, sand and gravel.
Hampton (city)	W	W	Sand and gravel, stone.
Hanover	W	W	Stone, aplite, sand and gravel.
Henrico	2,823	3,993	Sand and gravel, stone.
Henry	W	W	Stone.
Highland	180	(2)	Stone.
Isle of Wight	W	W	Sand and gravel, lime, stone.
James City	--	55	Sand and gravel.
King and Queen	--	W	Do.
King George	W	W	Do.
King William	W	W	Do.
Lancaster	--	W	Do.
Lee	8,242	10,363	Coal, stone.
Loudoun	W	7,140	Stone, sand and gravel.
Louisa	W	--	
Madison	--	W	Sand and gravel.
Middlesex	W	W	Do.
Montgomery	W	W	Stone, clays.
Nansemond	W	W	Clays, sand and gravel.
Nelson	W	W	Stone, aplite.
New Kent	W	W	Sand and gravel.
Newport News (city)	W	W	Do.
Northampton	W	32	Sand and gravel.
Northumberland	W	43	Do.
Nottoway	W	W	Stone.
Orange	W	W	Clays.
Page	W	W	Stone, sand and gravel.
Pittsylvania	W	W	Do.
Powhatan	--	W	Stone.
Prince Edward	W	W	Kyanite, stone.
Prince George	W	W	Sand and gravel.
Prince William	W	W	Stone, clays.
Pulaski	W	W	Stone.
Rappahannock	W	W	Do.
Richmond	W	19	Sand and gravel.
Richmond (city)	W	W	Stone, clays.
Roanoke	W	W	Do.
Rockbridge	687	W	Stone, sand and gravel, clays.
Rockingham	W	W	Stone, sand and gravel.
Russell	28,803	30,009	Coal, stone, clays, natural gas.
Scott	W	1,475	Stone, coal.
Shenandoah	W	W	Lime, stone.
Smyth	434	469	Stone, clays, sand and gravel.
Spotsylvania	W	1,462	Stone, sand and gravel.
Stafford	141	W	Sand and gravel.
Surry	W	W	Do.
Sussex	--	W	Do.

See footnotes at end of table.

Table 2.—Value of mineral production in Virginia, by county[1]—Continued
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Tazewell	$18,959	$20,220	Coal, stone, natural gas, clays, lime.
Virginia Beach (city)	969	478	Sand and gravel.
Warren	W	W	Cement, stone, sand and gravel.
Washington	W	W	Stone, gypsum.
Westmoreland	W	W	Sand and gravel.
Wise	74,508	95,393	Coal, stone, sand and gravel, natural gas.
Wythe	8,477	9,177	Zinc, stone, lead.
York	28	W	Sand and gravel.
Undistributed[3]	r 168,346	157,620	
Total[4]	489,791	540,595	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Amelia, Arlington, Bath, Carroll, Charlotte, Cumberland, Fluvanna, Greene, Lunenburg, Lynchburg (city), Mathews, Mecklenburg, Patrick, and Southampton.

[2] Less than ½ unit.

[3] Includes sand and gravel that cannot be assigned to specific counties, gem stones, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Virginia business activity

		1972	1973 p	Percent, Change
Employment and labor force, annual average:				
Total labor force	thousands	2,013	2,081	+3.3
Unemployment	do	73	75	+2.7
Employment (Nonagricultural):				
Manufacturing	do	383.2	399.8	+4.3
Mining	do	16.1	16.2	+.6
Construction	do	109.7	121.1	+10.4
Transportation and public utilities	do	100.9	105.7	+4.8
Wholesale and retail trade	do	332.6	354.2	+6.5
Finance, insurance, and real estate	do	77.9	83.2	+6.8
Services	do	243.1	259.1	+6.6
Government	do	380.0	390.3	+2.7
Personal income:				
Total	millions	$20,478	$22,683	+10.8
Per capita		$4,298	$4,715	+9.7
Construction activity:				
Value of nonresidential construction	millions	$483.8	$656.0	+35.6
New housing units authorized		81,669	72,532	−11.2
Portland cement shipments to and within Virginia	thousand short tons	2,107	2,282	+8.3
Farm marketing receipts	millions	$685.2	$936.1	+36.6
Mineral production value	do	$489.8	$540.6	+10.4

p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; U.S. Bureau of Mines.

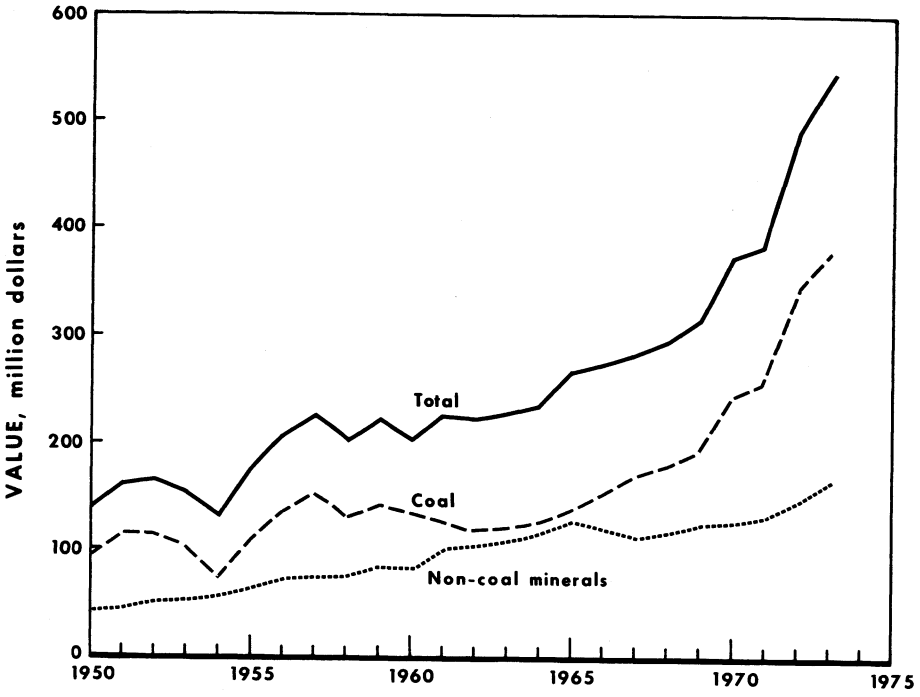

Figure 1.—Value of non-coal minerals, value of coal, and total value of all mineral production in Virginia.

Studies of the geology and mineral resources of Virginia included reports on the geology of a Virginia quadrangle,[2] of gravity,[3] of ground-water supplies,[4] of stratigraphy,[5] and of resource investigations.[6]

A directory of the mineral industry in Virginia is issued annually by the Virginia Division of Mineral Resources.[7] The 1973 edition of this publication lists 245 companies and individuals, exclusive of coal producers on record as of March 15, 1973. The listing includes portable crushing plants, some captive and intermittent operations, and some processors of out-of-State or imported materials. The names of producers and processors are arranged by county or city under the appropriate raw material or commodity. The locations of the various operations are given with respect to a nearby city or town. An alphabetical listing of the names of companies and individuals is provided as a reference index.

Trends and Developments.—Washington Gas Light Co. announced plans for a $20 million synthetic gas plant in Prince William County. Construction of the 50-

[2] Conley, J. F., and W. S. Henika. Geology of the Snow Creek, Martinsville East, Price, and Spray Quandrangles, Virginia. Va. Div. Miner. Res. (Charlottesville, Va.), RI 33, 1973, 71 pp.

[3] Johnson, S. S. Bouguer Gravity, Northeastern Virginia and the Eastern Shore Peninsula. Va. Div. Miner. Res. (Charlottesville, Va.), RI 32, 1973, 48 pp.

[4] DeKay, R. H. Development of Ground-Water Supplies in Shenandoah National Park, Virginia. Va. Div. Miner. Res. (Charlottesville, Va.), Miner. Res. Rept. 10, 1973, 158 pp.

[5] Oaks, R. Q., Jr., and N. K. Coch. Post-Miocene Stratigraphy and Morphology, Southeastern Virginia. Va. Div. Miner. Res. (Charlottesville, Va.), Bull. 82, 1973, 135 pp.

[6] Harris, W. B. High-Silica Resources of Clarke, Frederick, Page, Rockingham, Shenandoah, and Warren Counties, Virginia. Va. Div. Miner. Res. (Charlottesville, Va.), Miner. Res. Rept. 11, 1973, 42 pp.

Good, R. S., and G. C. Allen. Geochemical Reconnaissance for Zinc, Lead, and Copper in the Staunton Quadrangle, Virginia. Va. Div. Miner. Res. (Charlottesville, Va.), RI 31, 1973, 47 pp.

Sweet, P. C. Analyses of Clay, Shale, and Related Materials–Southern counties, Va. Div. Miner. Res. (Charlottesville, Va.), Miner. Res. Rept. 12, 1973, 183 pp

[7] Levan, D. C. Directory of the Mineral Industry in Virginia. Va. Div. Miner. Res. (Charlottesville, Va.), 1973, 51 pp.

million-cubic-foot-per-day plant will be completed by the spring of 1975. Once on line, the plant on an annual basis will provide about 8% of Washington Gas Light's total gas requirements. The plant will manufacture gas from naphtha, a petroleum derivative. Operating at full capacity, the facility will use 10,000 barrels of naphtha per day. The naphtha will be supplied by Atlantic Richfield Co. and transported by barge from Philadelphia to an existing dock at the plant site at Cockpit Point, 5 miles north of Quantico on the Potomac River.

The Motor Gas Oil and Refining Corp. plans to build a $33 million, 100,000-barrel-per-day fuels refinery in Chesapeake. The plant will be situated on a 50-acre site in the Money Point section of the city on the Southern Branch of the Elizabeth River. The refinery will produce such distillates as diesel fuel, kerosine, and light and heavy heating oil.

Cox Enterprises, Inc., purchased an 823-acre proposed refinery site in the West Norfolk section of Portsmouth. Cox is the principal backer of the Hampton Roads Energy Co., which is based in Suffolk and plans to build a refinery in the Hampton Roads area. The property was bought from Virginia Holding Corp., a subsidiary of the Norfolk and Western Railway.

A new cement company capitalized at $125 million is to be formed in the United States by Lone Star Industries, Inc., and Ciments Lafarge S. Pr. of France. The concern will be owned in equal amounts by the two partners. Initial assets of the venture will include Lone Star's existing plants in Roanoke, Va. and Birmingham, Ala. About $35 million is to be spent to double the Roanoke plant's capacity to 1.2 million tons of cement per year. Work on expansion is to start immediately. Lafarge and Lone Star are already associated in the field of high-alumina cement in the United States and in cement research and development.

Johns-Manville Corp. started building a multi-million dollar roof insulation plant in Shenandoah County. The facility will produce a homogenous impregnated roof insulation that is formed of expanded perlite particles, mineral binders, and fibers. Completion is slated for the first half of 1975.

Virginia Electric and Power Co. (VEPCO) filed an application for a license to build and operate a 2,100-megawatt pumped storage hydroelectric power project in Bath County. The project would be located on Back Creek and Little Back Creek, with transmission lines crossing portions of Highland, Augusta, and Rockbridge Counties. Major project facilities include an upper reservoir with surface area of 265 acres, created by a 2,400-foot-long, 425-foot-high dam across Little Back Creek; a powerhouse containing six 350-megawatt reversible units; a lower reservoir with surface area of 555 acres, created by a 2,400-foot-long, 155-foot-high dam across Back Creek; and two 500-kilovolt transmission lines. VEPCO also announced filing an application with the Atomic Energy Commission for a license to construct two additional nuclear units at its Surry Power Station. The new units are rated at 882 megawatts each and are scheduled for commercial operation in the early 1980's. Fuel shortages in Virginia, particularly in the Tidewater area, led VEPCO to convert two of its powerplants from fuel oil to coal. The two plants affected are the Reeves Avenue plant in Norfolk and the 12th Street plant in Richmond.

Reynolds Metals Co. started construction in Williamsburg of an aluminum recycling center. The center will use an elaborate collection system to obtain aluminum cans from many sites.

Wheelabrator-Frye started excavation for a 20,000-ton-per-year abrasives plant near Bedford. The plant will have facilities for melting, shot making, heat treating, crushing, packaging, screening, and shipping all sizes of hardened steel shot and grit.

Employment and Injuries.—The 1973 annual report of the Virginia Department of Labor and Industry reported 18 fatalities in the coal industry, compared with 15 fatalities the previous year. The cause of the 18 fatalities were as follows: six by fall of face or roof, five by machinery, three by haulage, two by gas ignition, one by electricity, and one by surface machinery. The fatality rate per ton of coal produced was 0.53, compared with the all-time low of 0.32 attained in 1968. The number of workers employed by coal mines averaged 11,334 for the year, a slight decrease from the 11,569 employed in 1972. The 1973 employment included 8,553 underground workers, 2,337 surface workers, and 444 office personnel.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Coal, the most important mineral commodity produced in Virginia, accounted for 70% of the value of the Commonwealth's mineral production in 1973, the same portion as in 1972. Mine output remained essentially stable, but the output value increased 10%. The average value of a short ton was $11.12, compared with $10.11 in 1972. Production data include coal produced from deposits within Virginia, whether the mine opening is or is not inside the State boundary, and exclude operations producing less than 1,000 tons per year. Consequently, production data published by the Federal Bureau of Mines differ somewhat from data published by the State.

Both high- and low-volatile bituminous coals were produced for electric power generation, coke manufacture, industrial uses, and export. No production of semianthracite coal was reported in 1973.

Three of the seven southwestern counties in which coal was mined accounted for 85% of the State's total output. These counties were Buchanan (40%), Wise (31%), and Dickenson (14%). Buchanan County was the leading producer in both underground and auger mining, and Wise County led in strip mine output. Of the total coal production, 69% was from underground mines, 26% from strip mines, and 5% from auger mines. Beds mined included the Blair, Clintwood, Eagle, Hagy, High Splint. Imboden, Jawbone, Jewell, Kelly, Lyons, Parsons, Pocahontas No. 3, Splash Dam, Taggart, Tiller, Upper and Lower Banner, and Widow Kennedy.

The total underground output from 300 mines was 23.4 million tons compared with 24 million tons produced by 327 mines in 1972. The average value received was $12.07 per ton, an increase of $1.14 over $11.56 per ton average value in 1972.

A total of 294 mobile loading machines produced 10.1 million tons, or 43% of the underground output. Continuous miners numbered 180 and produced 11.3 million tons, or 48%. Eleven plow-type longwall installations produced 1.7 million tons or 8%. The remaining 1% was loaded by all other methods.

Strip mine output increased 10% to 8.7 million tons with an average value of $7.66 per ton, compared with 7.9 million tons at $6.70 per ton in 1972. The number of strip mines decreased to 242 compared with 244 in 1972.

Auger mines produced 1.8 million tons having an average value of $7.33 per ton, compared with $6.46 per ton for the 2.1 million tons produced in 1972. This was a decrease of 13% from the output of the previous year. The number of auger mines decreased by 14, to a total of 108.

Equipment used in the 350 surface mines (242 strip and 108 auger), included 238 power shovels and draglines, 407 bulldozers, 201 front-end loaders, and 117 augers.

Thirty-two mechanical cleaning plants received 26.56 million tons of raw coal from which 8.86 million tons of refuse was removed and 17.70 million tons of salable coal (52% of the State's total production) was recovered. The coal cleaning methods employed were tables, 36%; dense medium, 35%; jigs, 13%; froth flotation, 12%; and all other methods, including pneumatic, 4%.

Twenty-one thermal drying units at 10 cleaning plants produced 4.42 million tons of dried coal, or 25% of the mechanically cleaned coal.

Transportation of coal to market was 32.67 million tons by rail (including 4.48 by unit-train) and 1.29 million tons by truck.

Table 4.—Virginia: Bituminous coal production, by type of mine and county, 1973
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total	
Buchanan	195	60	57	312	10,729	1,828	946	13,503	$173,554
Dickenson	36	32	11	79	3,758	902	135	4,795	54,512
Lee	12	10	6	28	805	239	92	1,136	9,703
Russell	4	15	9	28	1,686	627	172	2,485	28,005
Scott	1	1	--	2	7	2	--	9	78
Tazewell	9	5	1	15	1,320	328	3	1,651	17,089
Wise	43	119	24	186	5,132	4,774	476	10,382	94,738
Total	300	242	108	650	23,437	8,700	1,824	33,961	377,679

Coke.—Production of coke was discontinued at the Esserville plant in Wise County in June 1973. This was the last beehive oven plant in Virginia. The only currently operating plant is in Buchanan County and uses nonrecovery Mitchell-type ovens. Total coke production increased 29% in 1973, and average coke yield was 65%.

Natural Gas and Petroleum.—Natural gas production data in table 1 are reported to the Bureau of Mines by pipeline companies and are comparable with other State chapter data. Marketed natural gas showed a spectacular increase in 1973, output rose 83% to 5,101 million cubic feet and value rose 89%. According to the Virginia Department of Labor and Industry, Div. of Mines and Quarries, the total amount of natural gas produced in five southwestern counties was as follows: Buchanan (3,162 million cubic feet), Tazewell (1,252 million cubic feet), Dickenson (706 million cubic feet), Wise (5 million cubic feet), and Russell (5 million cubic feet). Reserves of natural gas at yearend were 37,273 million cubic feet, as reported by the American Gas Association.[8] This was 1,352 million cubic feet more than in 1971.

There were 22 new wells drilled in 1973 with a combined total footage of 104,268 feet by two companies, Columbia Gas Transmission Corp. (Columbia Gas) and Philadelphia Oil Co. Drilling was confined to Buchanan County (4 wells) and Dickenson County (18 wells). Eight wells drilled in 1972 were completed. Columbia Gas drilled 18 of the new wells for a combined total footage of 84,199 feet. Fourteen of these wells had a combined final openflow of 20,768,000 cubic feet. Of the remaining four wells, three were to be plugged and abandoned, and one is to be re-fractured. Philadelphia Oil Co. drilled four wells for a combined total footage of 20,069 feet. All of the walls were completed and shut in with a total final openflow of 4,030,000 cubic feet.

No oil production was reported from Lee County during 1973. A refinery was operated by the American Oil Co. at Yorktown, York County. Operating capacity was 52,900 barrels per day.

NONMETALS

Aplite.—Output of aplite increased 5% in 1973, but the value increased 61% over that of the previous year. Production of this commodity, chiefly for use in glassmaking with a minor amount used as brick flux, was from two operations, The Feldspar Corp. in Hanover County and Sobin Chemical Corp. in Nelson County.

Cement.—Shipments of portland cement decreased 8% but value increased 4%; masonry cement shipments decreased 3%, but value increased 5%. Of the portland cement shipments, 83% was Type I and II (general use and moderate heat), and the remainder was Type III (high early strength) and other white cement. Distribution of shipments by type of transportation was 48% by rail in bulk and 4% by rail in containers, 44% by truck in bulk and 4% by truck in containers. Disposition of cement by type of customer was ready mix concrete companies (60%),

[8] Oil and Gas Journal. Another Big Drop Logged for U.S. Oil and Gas Reserves. V. 72, No. 13. Apr. 1, 1974, pp. 42-43.

building material dealers (15%), concrete product manufacturers (12%), highway contractors (10%), and other users (3%).

Three cement plants were active in 1973. One plant in Botetourt County produced both types of cement, and one plant in Warren County produced masonry cement only. The third plant in the City of Chesapeake operated grinding mills on imported clinker. Raw materials used in making cement included limestone, gypsum, sand, iron ore, and clay and shale.

Clays.—Clay production remained stable in 1973, but its value was 6% greater because the average value increased 6 cents per short ton to $1.15. The principal use was in manufacturing face brick. Other major uses were lightweight aggregate and cement. Minor uses were for clay dummies (shot-hole tampers) and miscellaneous products.

Clay production was reported by 11 companies operating 21 mines in 14 counties and one independent city. In order of output and value the chief producing counties were Botetourt, Orange, Russell, Prince William, and Chesterfield. The five counties listed accounted for 70% of the State output and 71% of the output value. Four firms, Webster Brick Co., Inc., General Shale Products Corp., Lone Star Industries, Inc., and Clinchfield Coal Co., accounted for 70% of the output and 71% of the output value.

Table 5.—Virginia: Clays sold or used by producers
(Thousand short tons and thousand dollars)

Year	Quantity	Value
1969	1,677	1,504
1970	1,633	1,672
1971	1,710	1,800
1972	1,634	1,783
1973	1,646	1,886

Gem Stones.—Hobbyists and mineral fanciers collected a variety of semiprecious gems and mineral specimens in various areas in the State.

Gypsum.—The output of crude gypsum decreased 20%, and value decreased 9% in 1973. The raw gypsum, mined at Plasterco, Washington County, was calcined or otherwise processed and manufactured into plasterboard and other gypsum products by United States Gypsum Co. at its Plasterco plant. The company also calcined imported gypsum at its Berkeley plant in Norfolk. Output of calcined gypsum by the company increased 4%.

Kyanite.—Shipments and value of kyanite increased 9% over that of 1972. Shipments were principally to refractory and ceramic product manufacturers. The Kyanite Mining Corp. operated two mines and four processing plants in adjacent Buckingham and Prince Edward Counties.

Only a small portion of the beneficiated kyanite (Al_2SiO_5) is used in the raw state; the bulk of production is calcined to mullite, one of the most important refractory materials used in the ceramic industry. Quartzite sand, recovered during the milling of kyanite, was marketed for industrial and construction uses. Virginia is North America's leading producer of kyanite.

Lime.—The total lime production (quick and hydrated) increased 3% over that of the previous year but was 27% below the 1969 record. The principal use for Virginia lime production was as a metallurgical flux in the basic oxygen steelmaking process. Other major uses were in pulp and paper, electric furnaces for steel, and water purification.

Primary lime production was reported by seven companies operating seven plants in five counties. Giles and Shenandoah Counties accounted for 82% of the output and 81% of the output value. The major producing companies were National Gypsum Co., Chemstone Corp., and Virginia Lime Co.

Lime consumption in Virginia was 156,200 tons, equal to 20% of the State's production. The remaining output was shipped to Kentucky, Pennsylvania, Ohio, Maryland, and sixteen other states. The average value of all lime increased to $15.60 per ton from $15.48 per ton in 1972.

Processing equipment used in limemaking included pot, shaft, and rotary kilns and batch and continuous hydrators. Raw materials included high-calcium limestone (predominantly), dolomitic limestone, and oystershell. Fuel used included bituminous coal, coke, and natural gas.

Table 6.—Virginia: Lime sold or used by producers, by use
(Short tons)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Steel, basic oxygen furnace	382,500	$5,884,000	383,100	$5,893,000
Water purification	76,600	1,178,000	82,370	993,600
Paper and pulp	63,270	r 973,100	72,570	1,116,000
Steel, electric	62,120	955,400	67,500	1,038,000
Steel, open hearth	47,810	721,000	45,180	694,900
Sewage treatment	45,880	705,600	37,760	580,000
Construction	19,220	r 301,200	17,650	306,300
Agriculture	15,180	295,900	14,880	248,700
Other [1]	45,750	725,300	61,300	1,394,000
Total [2]	758,400	r 11,739,000	782,300	12,000,000

r Revised.
[1] Includes metallurgy (other), refractory dolomite, miscellaneous chemicals, tanning, sugar refining, acid mine water neutralization, and petroleum refining (1972).
[2] Data may not add to totals shown because of independent rounding.

Mica.—Mica was processed in two Newport News plants. Ashville Mica Co. operated a mica-fabricating plant, and Mica Co. of Canada, Inc. operated a plate-mica plant.

Nitrogen Compounds.—Allied Chemical Corp., Nitrogen Div., Hopewell, Prince George County, using reformed natural gas, produced ammonia, urea, ammonium nitrate, and ammonium sulfate for use chiefly as fertilizer ingredients. The capacity of the plant at Hopewell is rated at 350,000 short tons annually of ammonia.

Sand and Gravel.—Increased use by the building and highway construction industry in Virginia in 1973 raised the demand for aggregates; sand and gravel rose 3% in output and 21% in value. Commercial output comprised more than 99% of total production and value; the remainder was State and local Government output, primarily for use in highway maintenance. Of the commercial production, 77% was used as construction aggregates in building (40%) and paving (37%).

Sand comprised 62% of the commercial sand and gravel production and 51% of the total commercial value. The average price per ton of commercial sand increased 16 cents to $1.51, while the average price per ton of commercial gravel increased 48 cents to $2.34. Although only 5% of the sand output was for industrial uses, marketed for glass, engine, fire or furnace, abrasive, pottery, and other industrial sands, 13% of the value of sand output was attributed to these uses.

Production of sand and gravel was reported from 48 counties and 5 independent cities. In order of output the principal sand and gravel producing counties were Chesterfield, Henrico, Charles City, Fairfax, and Prince George. Transportation of commercial production to market was 63% by truck, 27% by waterway, and 10% by railroad.

Seventy-four of the 118 commercial sand and gravel operations had an annual output range of up to 50,000 tons and accounted for 8% of the total tonnage; 34 operations had an output range of from 50,000 to 500,000 tons and accounted for 38%; seven had an output range from 500,000 to 1,000,000 tons and accounted for 31%; and 3 had an output range over 1,000,000 tons and accounted for 23%. The bulk of the sand and gravel recovery was by open pit mining and dredging, a sizable tonnage of industrial silica sand was produced from crushed sandstone and quartzite, and a limited amount was obtained in the processing of kyanite.

Table 7.—Virginia: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,326	4,989	3,441	5,957
Engine	29	95	--	--
Fill	1,912	W	2,216	1,518
Glass	W	847	W	W
Paving	2,654	2,773	2,769	4,146
Other uses [1]	555	2,708	484	1,791
Total [2]	8,477	11,412	8,910	13,414
Gravel:				
Building	2,359	4,478	2,423	6,163
Fill	W	W	277	321
Paving	1,292	2,025	2,549	5,997
Miscellaneous	20	25	94	154
Other uses [3]	1,828	3,708	106	138
Total [2]	5,498	10,235	5,449	12,773
Government-and-contractor operations:				
Sand:				
Fill	51	18	108	35
Paving	27	3	35	20
Other uses	(4)	(4)	1	1
Total	78	21	144	56
Gravel:				
Fill	1	(4)	--	--
Paving	31	27	8	3
Total	32	27	8	3
Total sand and gravel [2]	14,085	21,696	14,511	26,246

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes railroad blast fire or furnace, molding (1972), abrasives (1973), filler (1972), ground glass (1973), pottery (1973), and other industrial sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast (1973).
[4] Less than ½ unit.

Soapstone and Talc.— Crushed and ground soapstone was produced by Blue Ridge Talc Co., Inc., near Henry, Franklin County, principally for use in insecticides and foundry facings. Output increased but value decreased compared with that of the previous year.

Dimension soapstone was produced by Alberene Stone Div., Georgia Marble Co., and is included in the Stone section of this chapter.

Stone.—Ranking second to coal in importance to the mineral economy of Virginia, stone accounted for 15% of the State's total value of mineral production in 1973. Total stone output increased 10% and value increased 12% over that reported in 1972. Both output and value totals exceeded all previous records. An increase in the output of crushed and broken stone and an increase of 4 cents in value per average ton were responsible for the rise to the new highs.

Varied types of stone were mined or quarried in the State; in order of output value they were limestone, granite, traprock, slate, sandstone, miscellaneous stone, quarzite, marble, and marl. Both crushed and broken stone and dimension stone were produced.

Crushed stone was produced from all the stone types and comprised virtually all of the stone output (99.9%) and the major portion of the total value (97.3%). Of the total crushed stone output, 80% was used for building purposes (concrete aggregate and roadstone), 7% for cement and lime, 3% for agricultural limestone, and the remainder as stone sand, railroad ballast, mine dust, flux stone, riprap and jetty stone, terrazzo, and miscellaneous and unspecified applications. Crushed stone increased 10% in output and gained 13% in value compared with that of 1972. The average value per ton for crushed stone rose to $1.83 from $1.79 in 1972.

Dimension stone was produced by eight companies in six counties. Although a

low-output commodity in terms of tonnage (0.1% of total stone production), it accounted for 2.7% of the total stone output value. The uses of dimension stone in decreasing order of quantities produced were structural, flagging, roof slate, rough blocks, irregular shapes, and cut or sawed.

Commercial stone was produced at 144 operations in 53 counties and 2 independent cities. In terms of tonnage, the principal stone producing counties were Loudoun (traprock and granite), Goochland (granite), Fairfax (traprock and granite), Frederick (limestone and quartzite), and Botetourt (limestone). The five counties listed accounted for 29% of the total stone output. In terms of output value the most important counties were Loudoun, Fairfax, Goochland, Frederick, and Prince William. Thirty percent of the total stone output value was contributed by the five counties named. Nineteen counties produced more than 1 million tons each, and 29 counties had output value in excess of $1 million each.

Shipments of crushed stone in million short tons by method of transportation were as follows: 34.6 by truck, 7.1 by railroad, 0.1 by waterway, and 2.1 by unspecified methods.

Table 8.—Virginia: Stone sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone total	17	2,645	25	2,229
Crushed and broken stone:				
Bituminous aggregate	2,756	5,137	3,028	5,827
Concrete aggregate	4,180	6,888	7,832	14,715
Dense graded roadbase stone	16,310	29,047	12,610	21,541
Macadam aggregate	1,222	2,040	1,285	2,344
Surface treatment aggregate	1,484	2,530	2,847	5,446
Unspecified construction aggregate and roadstone	6,505	11,119	7,670	12,940
Agricultural [1]	1,098	2,080	1,167	2,359
Cement manufacture	W	1,556	3,247	4,860
Lime manufacture	1,432	2,382		
Flux stone	223	394	363	626
Manufactured fine aggregate (stone sand)	208	396	601	1,235
Mine dusting	W	W	307	702
Railroad ballast	496	665	533	786
Riprap and jetty stone	289	595	212	464
Terrazzo	W	W	W	117
Other uses [2]	3,767	6,615	2,168	6,528
Crushed total [3]	39,970	71,445	43,869	80,490
Grand total [3]	39,987	74,090	43,895	82,719

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Data include stone used in agricultural limestone and poultry grit and mineral feed.
[2] Includes stone used in asphalt and other fillers, chemical, drain fields, filter stone, glass, lightweight aggregate, paper manufacture, roofing aggregates, abrasives (1973), fill (1973), and other uses not specified.
[3] Data may not add to totals shown because of independent rounding.

Table 9.—Virginia: Stone sold or used by producers, by kind
(Thousand short tons and thousand dollars)

Kind of stone	1972		1973	
	Quantity	Value	Quantity	Value
Limestone [1]	W	W	19,985	W
Granite	14,257	25,990	16,186	30,170
Marble	W	W	W	220
Sandstone, quartz, quartzite	W	W	W	W
Shell	W	W	(2)	W
Slate	W	W	958	5,698
Traprock	4,561	9,877	4,872	10,460
Undistributed [3]	21,169	38,224	1,894	36,172
Total [4]	39,987	74,090	43,895	82,719

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Limestone used generally to include dolomite.
[2] Less than ½ unit.
[3] Includes marl and other stone.
[4] Data may not add to totals shown because of independent rounding.

Sulfur.—Hydrogen and sulfide, recovered from fuel gas, was converted to elemental sulfur by the American Oil Co. at its Yorktown refinery. Compared with 1972, sulfur production decreased 6%, but the sales value increased 25%. Production and sales were approximately equal.

METALS

Iron Ore (Pigment Material).—Natural iron-oxide pigments were produced by Hoover Color Corp., at Hiwassee, Pulaski County, from local deposits of earthy forms of hydrous and anhydrous iron oxides including ocher, sienna, and umber. Manufactured iron oxides for use in pigment manufacture and other purposes were produced at the company's Pulaski facilities. Natural iron-oxide pigments were also produced by Blue Ridge Talc Co., Inc., at Henry, Franklin County, from hematite obtained out of State. The finished iron-oxide pigments are used in cement manufacture, printing inks, paint manufacture, and other products.

Lead and Zinc.—Lead and zinc were recovered from two mines in Wythe County operated by the same company. The ratio of zinc recovery to that of lead was about 6.3 to 1. Lead production declined 23%, and value declined approximately 17%. Zinc production remained substantially the same, but the output value increased approximately 16%.

Table 10.—Virginia: Mine production of recoverable lead and zinc

Year	Lead		Zinc	
	Short tons	Value (thousands)	Short tons	Value (thousands) [1]
1969	3,358	$1,000	18,704	$5,462
1970	3,356	1,048	18,063	5,534
1971	3,386	934	16,829	5,419
1972	3,441	1,034	16,789	5,960
1973	2,637	859	16,683	6,894

[1] Recoverable zinc valued at the yearly average price of prime western-slab zinc, East St. Louis market. Value established after transportation, smelting, and manufacturing charges have been added to the value of the ore at the mine.

Magnetite.—Foote Mineral Co. operated a grinding plant at Kimballton, Giles County, to process out-of-State magnetite for use in coal preparation.

Manganese.—Imported ore was processed in a plant at Newport News by the Consumer Products Div. of Union Carbide Corp. for company use.

Pyrrhotite.—The Industrial Chemicals Div. of Allied Chemical Corp. operated a surface mining operation for pyrrhotite near Galax, Carroll County. The product is used in the company's plant at Pulaski.

Table 11.—Principal producers

Commodity and company	Address	Type of activity	County
Aplite (crude):			
The Feldspar Corp	Route 1, Box 23 Montpelier, Va. 23192	Quarry	Hanover.
Sobin Chemical Corp	Box 38 Piney River, Va. 22964	do	Nelson.
Cement:			
Lone Star Industries, Inc.[1]	3315 W. Broad St. Richmond, Va. 23230	Plant and quarry	Botetourt.
Lone Star Industries, Inc.[2]	do	Plant	Chesapeake (City).
Riverton Corp.[3]	Riverton, Va. 22651	Quarry and plant	Warren.
Clays (miscellaneous and shale):			
Brick and Tile Corp. of Lawrenceville	P.O. Box 45 Lawrenceville, Va. 23868	Pit and plant	Brunswick.
Do	do	Pit	Greensville.
Clinchfield Coal Company, Div. of the Pittston Co.[4]	Dante, Va. 24237	Plant	Russell.
General Shale Prod. Corp	Box 3547 Johnson City, Tenn. 37601	Pits and plants	Chesterfield, Smyth, Tazewell.

See footnotes at end of table.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clays (miscellaneous and shale)—Continued			
Old Virginia Brick Co., Inc	P.O. Box 508 Salem, Va. 24153	Pits	Roanoke.
Do	do	Pit	Montgomery.
Redford Brick Co	Box 4096 Richmond, Va. 23224	Pit and plant	Chesterfield (City of Richmond).
Weblite Corp	Box 780 Roanoke, Va. 24004	Pit and plant	Botetourt.
Webster Brick Co., Inc	do	Pit	Botetourt, Nansemond, Orange.
Woodbridge Clay Products Co	Rt. 3, Box 240 Manassas, Va. 22100	do	Prince William.
Coal (Bituminous):			
Clinchfield Coal Co.[5]	Dante, Va. 24237	Underground mines.	Buchanan.
Do	do	do	Dickenson.
Do	do	do	Russell.
Do	do	do[6]	Wise.
Do	do	Strip mine	Dickenson.
Do	do	Auger mine	Do.
Coal Processing Corp	Box 497 Norton, Va. 24273.	do	Wise.
General Trucking Corp	Box 389 Appalachia, Va. 24216	Strip mine	Do.
Harman Mining Corp.[6]	Harman, Va. 24618	do	Buchanan.
Island Creek Coal Co.[7]	Box 113 Keen Mountain, Va. 24624	do	Do.
Westmoreland Coal Co.[8]	P.O. Box 229 Big Stone Gap, Va. 24219	do	Wise.
Coke:			
Jewell Smokeless Coal Corp	Jewell Valley, Va. 24623	do	Buchanan.
Gypsum:			
United States Gypsum Co.[9]	101 S. Wacker Drive Chicago, Ill. 60606	do	Chesapeake (City).
United States Gypsum Co	do		Washington.
Iron-oxide pigments (crude):			
Hoover Color Corp.[10]	Hiwassee, Va. 24347	do	Pulaski.
Iron-oxide pigments (finished):			
Blue Ridge Talc Co., Inc	P.O. Box 7 Henry, Va. 24102	Plant	Franklin.
Kyanite:			
Kyanite Mining Corp.[11]	Dillwyn, Va. 23936	Mine and plants	Buckingham.
Do	do	do	Prince Edward.
Lime:			
Battery Park Fish & Oyster Co.[12]	Battery Park, Va. 22304	Plant	Isle of Wight.
Blue Grass Lime Co.[13]	Route 3 Tazewell, Va. 24651	do	Tazewell.
Chemstone Corp.[13]	Menlo Park Edison, N.J. 08817	do	Shenandoah.
Foote Mineral Co.[13]	Route 100 Exton, Pa. 193,41	do	Giles.
W. S. Frey Co., Inc.[13]	257 E. Market St. York, Pa. 17403	do	Frederick.
M. J. Grove Lime Co., Div. of The Flintkote Co.[13]	Lime Kiln, Md. 21763	do	Do.
National Gypsum Co.[13]	325 Delaware Ave. Buffalo, N.Y. 14202	do	Giles.
Sand and gravel:			
Chickohominy Inc	Route 1, Box 229B Williamsburg, Va. 23185	Pit	Charles City.
Fredericksburg Sand and Gravel Co.	P.O. Box 650 Culpepper, Va. 22701	Pit and mill	Stafford.
Friend Sand and Gravel Co	Box 388 209 River St. Petersburg, Va. 23801	Pit	Chesterfield.
Hitch Gravel Corp	P.O. Box 7542 Chesapeake, Va. 23324	Pit	Prince George.
Massaponax Sand & Gravel Corp.	P.O. Box 270 Fredericksburg, Va. 22401	Pit	Spotsylvania.
Solite Corp	P.O. Box 883 Fredericksburg, Va. 22401	Pit	King George.

See footnotes at end of table.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel—Continued			
Southern Materials Co., Inc	2125 Kimball Terrace Norfolk, Va. 23504	Pit and dredge	Chesterfield.
Do	do	Dredge	Henrico.
Do	do	Pits	Isle of Wight and Prince George.
Virginia Concrete Co., Inc	P.O. Box 666 Springfield, Va. 22150	Pit	Fairfax.
West Sand and Gravel Co	Box 6008 Richmond, Va. 23222	Pit	Henrico and Rockingham.
Williams Paving Co., Inc	do	Pit	Halifax.
Soapstone (talc): Blue Ridge Talc Co., Inc.[14]	P.O. Box 8 Henry, Va. 24102	Mine and plant	Franklin.
Stone:			
Blue Ridge Stone Corp	Box 2459 Roanoke, Va. 24010	Quarry	Botetourt.
Chantilly Crushed Stone Co	Box 12 Chantilly, Va. 22021	do	Loudoun.
Culpepper Stone Co., Inc	P.O. Box 650 Culpepper, Va. 22701	do	Culpepper.
Flintkote Co., Grove Mt	Frederick Md. 21701	do	Frederick.
General Crushed Stone Co	712 Drake Bldg. Easton, Pa. 18042	do	Hanover.
Luck Quarries Inc., Augusta Stone Corp.	Box 4682 Richmond, Va. 23229	do	Augusta.
Pounding Mill Quarry Corp	Box 2459 Roanoke, Va. 24010	do	Tazewell.
Rockydale Quarries Corp	Route 8, Box 635 Roanoke, Va. 24004	do	Roanoke.
Trego Stone Corp	Box 2459 Roanoke, Va. 24010	do	Greensville.
Vulcan Materials Co	P.O. Box 7506 Reynolds Sta. Winston-Salem, N.C. 27109	Quarries	Brunswick, Fairfax, Goochland, Halifax, Mecklenburg, Pittsylvania, Prince William, Buckingham.

[1] Portland and masonry cement; also captive production of limestone and shale.
[2] Portland cement only; also captive production of marl and clay in Nansemond County.
[3] Masonry cement only; also produce limestone.
[4] Shale obtained from coal preparation plant as a coproduct.
[5] 3 mines.
[6] 2 mines.
[7] 5 mines.
[8] 11 mines.
[9] Process imported gypsum.
[10] Also finished iron oxide pigments.
[11] Coproduct: quartz sand.
[12] Calcine oystershell.
[13] Also captive production of limestone.
[14] Also process out-of-State hematite at plant for pigment manufacture.

The Mineral Industry of Washington

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Washington Division of Mines and Geology for collecting information on all minerals.

By Benjamin Petkof [1]

The total value of mineral production increased during the year. Decreased production of portland cement, lead, silver, gold, and tungsten was offset by increased output of other mineral products such as clay, coal, sand and gravel, diatomite, olivine, and talc. The output of nonmetallic minerals greatly exceeded that of metallic minerals and fossil fuels.

The production of aluminum in Washington declined during 1973 because of an electrical power shortage in the Pacific Northwest, which resulted from low water conditions.

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in Washington [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Cement:				
Masonry ---thousand short tons--	6	$170	6	$169
Portland ---do----	1,239	26,848	1,194	26,651
Clays [2] ---do----	264	584	287	664
Coal, bituminous ---do----	2,635	17,424	3,270	21,440
Gem stones	NA	163	NA	160
Gypsum ---thousand short tons--	5	13	W	W
Lead (recoverable content of ores, etc.) ---short tons--	2,567	772	2,217	722
Peat ---thousand short tons--	18	89	21	110
Pumice ---do----	W	W	1	1
Sand and gravel ---do----	23,065	26,069	27,935	30,132
Silver (recoverable content of ores, etc.) thousand troy ounces--	221	372	W	W
Stone ---thousand short tons--	14,712	[3] 23,764	11,384	19,284
Zinc (recoverable content of ores, etc.) ----short tons--	6,483	2,301	6,378	2,635
Value of items that cannot be disclosed: Clays (fire clay), copper, diatomite, gold, lime, olivine, stone (dimension 1972), talc, tungsten, uranium, and values indicated by symbol W ----	XX	11,237	XX	12,361
Total ----	XX	109,806	XX	114,329
Total 1967 constant dollars ----	XX	90,601	XX	p 83,940

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes fire clay; included with "Value of items that cannot be disclosed."
[3] Excludes some dimension stone; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Washington, by county

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adams	$2,543	W	Stone, sand and gravel.
Asotin	20	$58	Sand and gravel.
Benton	W	W	Stone, sand and gravel.
Chelan	366	W	Stone, sand and gravel, copper, silver.
Clallam	1,028	W	Clays, stone, sand and gravel.
Clark	2,073	2,278	Stone, sand and gravel, clays.
Columbia	109	96	Stone.
Cowlitz	1,527	1,219	Stone, sand and gravel.
Douglas	W	62	Sand and gravel, clays.
Ferry	W	3,247	Gold, silver, stone, copper, zinc, lead.
Franklin	W	W	Sand and gravel, stone.
Garfield	W	138	Stone.
Grant	5,416	3,682	Diatomite, sand and gravel, lime, stone.
Grays Harbor	1,020	978	Sand and gravel, stone.
Island	W	305	Do.
Jefferson	W	W	Stone, sand and gravel.
King	22,881	24,502	Cement, sand and gravel, stone, coal, clays, peat.
Kitsap	674	W	Sand and gravel, stone, peat.
Kittitas	130	272	Stone, sand and gravel, clays, pumice.
Klickitat	291	299	Stone, sand and gravel.
Lewis	W	22,047	Coal, sand and gravel, stone, clays.
Lincoln	175	90	Stone.
Mason	W	W	Sand and gravel, stone.
Okanogan	W	W	Stone, sand and gravel, gypsum.
Pacific	419	520	Stone.
Pend Oreille	8,478	7,207	Cement, zinc, lead, stone, sand and gravel, silver, copper.
Pierce	6,307	8,696	Sand and gravel, stone, lime, clays.
San Juan	W	W	Sand and gravel, stone.
Skagit	2,051	2,912	Olivine, stone, sand and gravel, talc.
Skamania	249	359	Stone, gold, sand and gravel, copper, silver.
Snohomish	5,425	W	Sand and gravel, stone, clays, peat.
Spokane	3,260	3,532	Do.
Stevens	5,207	5,218	Uranium, stone, sand and gravel, clays, tungsten, lead, silver.
Thurston	686	983	Sand and gravel, stone, peat.
Wahkiakum	W	W	Stone.
Walla Walla	W	W	Sand and gravel.
Whatcom	W	W	Cement, stone, sand and gravel, clays.
Whitman	W	W	Stone, sand and gravel.
Yakima	1,735	1,449	Sand and gravel, stone, lime.
Undistributed [1]	37,732	24,180	
Total [2]	109,806	114,329	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

Legislation and Government Programs.—No legislative actions were implemented during the year that had any significant influence on the State's minerals industry.

Environment.—Increased demand and prices for copper and molybdenum have increased the economic viability of a large low-grade copper deposit on the Bren Mac property. The proximity of the water source for the city of Everett, Wash., to the Bren Mac property and the possibility of contamination of the water source by mining operations, caused the city to file suit in Snohomish Superior Court to stop additional development work on the property. In addition, an environmental impact statement must be prepared and the property rezoned prior to permitting mining operations. Future operation of the property will be dependent on the resolution of these issues.

The Puget Sound Air Pollution Control Agency approved regulations to limit arsenic emissions from nonferrous smelters. As a result, American Smelting and Refining Company (Asarco) announced plans to lower arsenic emissions from a high of 700 pounds per day to 50 pounds per day. Installation of a baghouse on the plant's mainstack was under consideration to remove 90% of the process sulfur.

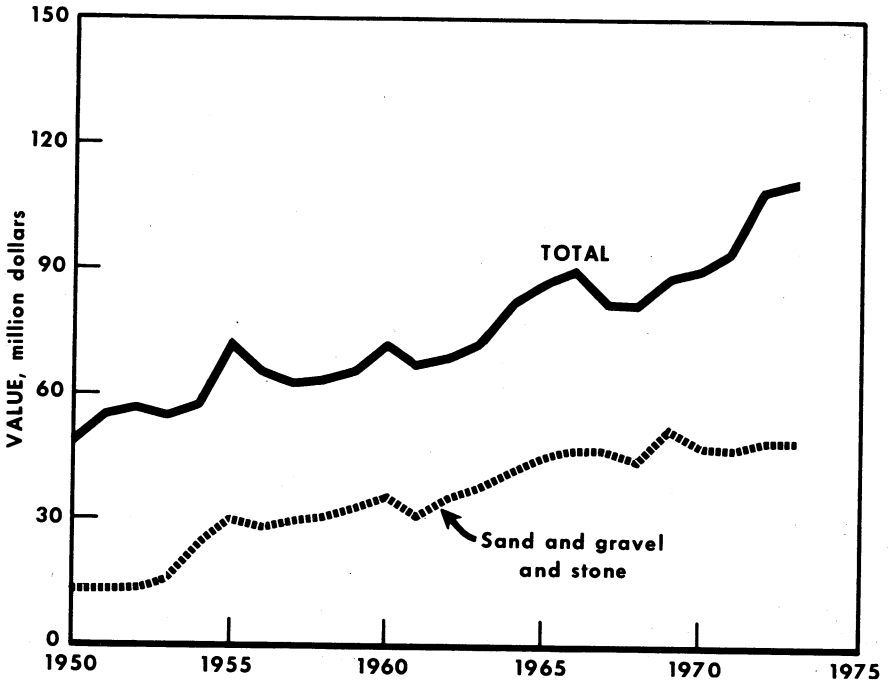

Figure 1.—Value of sand and gravel and stone, and total value of mineral production in Washington.

Table 3.—Indicators of Washington business activity

	1972	1973 p	Change, percent
Annual average labor force and employment:			
Total labor force ---thousands--	1,436	1,464	+1.9
Unemployment ---do---	137	113	—17.5
Employment:			
Construction ---do---	52.2	55.3	+5.9
Aerospace ---do---	41.4	50.5	+22.0
Lumber and wood products ---do---	47.3	50.1	+5.9
Food processing ---do---	27.7	28.4	+2.5
All manufacturing ---do---	224.1	244.8	+9.2
All industries ---do---	877.9	906.5	+3.3
Personal income:			
Total ---millions--	$15,399.0	$17,106.0	+11.1
Per capita	$4,472.0	$4,989.0	+11.6
Construction activity:			
Value of nonresidential construction ---millions--	$252.6	$352.7	+39.6
State highway commission: Value of contracts awarded millions--	$184.0	$116.0	—37.0
Cement shipments to and within Washington thousand short tons--	1,098.0	1,110.0	+1.1
Farm marketing receipts ---millions--	$1,128.8	$1,572.5	+39.3
Mineral production value ---do---	$109.8	$114.3	+4.1

p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Labor Force and Employment in Washington State; and the U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Shipments of portland cement in 1973 declined 4% in quantity and 1% in value from those of 1972 to 1.19 million short tons valued at $26.65 million. Shipments of 5,689 tons of prepared masonry cement valued at $169,415 represented only a slight decline from the quantity and value of material shipped in 1972. Output originated at four plants, (three wet and one dry process), each producing both portland and masonry cement. Shipments of portland cement included types I, II, and III (general use, moderate heat, high-early-strength) and white cement.

Ready-mix concrete, and concrete product manufacturers, building material dealers, and contractors were the major consumers.

Clays.—Production increased 9% in quantity and 14% in value over that of 1972. Clay was produced in 11 counties, but five counties accounted for 91% of total production. Fire clay was produced in only two counties.

Gypsum.—Argo Minerals, Inc., mined gypsum at the Poison Lake mine in Okanogan County. Kaiser Gypsum Co., Inc., calcined gypsum in King County.

Lime.—Domtar Chemicals, Inc., and Utah-Idaho Sugar Co. produced lime in Grant, Pierce, and Yakima Counties for sugar refining, paper and pulp processing, calcium carbide production, sewage treatment, and other uses. Output declined slightly in quantity and value from that of 1972. The lime was consumed in Washington, Oregon, and other nearby western States. Lime consumption in Washington declined from 164,000 tons in 1972 to 141,944 tons in 1973.

Sand and Gravel.—Production increased 21% in quantity and 16% in value from that of 1972 because of increased sand and gravel demand for end uses such as fill and paving. Commercial operations provided 81% of the total; the remainder was provided by local government contractors' crews. Production was reported from 33 counties but Grant, King, Pierce, Snohomish, and Spokane Counties accounted for 62% of the total.

The consumption pattern for sand and gravel in Washington for 1973 was as follows: Paving, 42%; building, 27%; fill, 25%; and other uses, 6%.

Stone.—The production of crushed and broken stone declined 23% in quantity from that of 1972; value also declined. There were 262 operating quarries in 36 counties, but 55 quarries in 5 counties produced 37% of the stone reported. There were seven counties whose production was valued in excess of $1 million. Four uses—riprap, road base, surface treatment, and aggregate—consumed 66% of the available crushed stone.

Traprock constituted 77% of the stone quarried and came from 183 quarries in 28 counties. About 75% was used for aggregate, road material, and riprap. Granite was produced in 18 quarries and accounted for 7% of the stone. Fifteen quarries produced limestone to furnish almost 9% of the total stone output. Almost three-fourths of total limestone production was used to make cement and lime.

METALS

Aluminum.—Primary aluminum production declined less than 1% in quantity and 4% in value from that of 1972. Washington's share of national production was 23%, a decline of 2% from that of 1972. The lack of growth in Washington's primary aluminum production in 1973 may be attributed to the shortage of electrical power in the Pacific Northwest due to low water conditions. Five firms, with a total of seven plants, produced aluminum from alumina, imported primarily from Australia.

Copper.—Bren Mac Mines, Ltd., planned to continue exploration on the Sunrise property to delineate the zone, in a large breccia pipe, that contains a copper-molybdenum mineralization. The deposit is located near the city of Everett's water supply in the Sultan Basin.

Silver Standard Mines, Ltd., Vancouver, British Columbia, planned a drilling program in the Danville area of northern Ferry County, an area of known mineralization that might be an extension of the boundary copper belt. Geochemical reconnaissance has indicated copper and molybdenum anomalies.

The Ram Mining Co. prospected at the Wayside mine near Granite Falls in Snohomish County. Construction of a small mill was planned to determine the capability of

Table 4.—Washington: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,228	4,721	3,029	4,270
Fill	892	640	2,495	1,811
Glass	53	480	W	95
Paving	1,249	1,723	1,190	1,431
Other uses [1]	28	54	205	385
Total [2]	5,451	7,619	6,919	7,993
Gravel:				
Building	4,353	6,156	4,339	6,217
Fill	1,579	958	2,977	1,821
Paving	5,939	7,491	6,795	8,129
Railroad ballast	189	178	107	136
Miscellaneous	464	594	855	1,143
Other uses	290	444	671	1,227
Total [2]	12,814	15,821	15,743	18,673
Government-and-contractor operations:				
Sand:				
Fill	W	W	--	--
Paving	W	W	26	58
Other uses	387	385	74	53
Total [2]	387	385	101	111
Gravel:				
Building	35	59	35	17
Fill	1,380	301	1,335	272
Paving	2,948	1,883	3,691	3,015
Other uses	52	([3])	111	50
Total [2]	4,414	2,243	5,173	3,355
Total sand and gravel [2]	23,065	26,069	27,935	30,132

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes ground and unground sand (1972), railroad ballast (1973), and other sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Included with paving gravel.

Table 5.—Washington: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension stone total	3	W	6	346
Crushed and broken:				
Bituminous aggregate	517	926	580	1,123
Concrete aggregate	408	W	292	572
Dense graded roadbase stone	1,712	2,810	1,357	2,126
Macadam aggregate	W	375	114	200
Surface treatment aggregate	2,654	4,079	1,800	2,635
Unspecified construction aggregate and roadstone	5,419	7,443	2,135	2,598
Agricultural limestone	15	W	14	67
Asphalt filler	W	W	69	W
Cement and lime manufacture	W	W	833	1,295
Fill	184	132	746	W
Manufactured fine aggregate (stone sand)	W	W	24	50
Metallurgical purposes [1]	72	215	49	120
Railroad ballast	321	543	559	872
Riprap and jetty stone	1,489	2,037	2,240	3,955
Other uses [2]	1,918	5,204	565	3,327
Crushed total [3]	14,708	23,764	11,377	18,938
Grand total [3]	14,712	W	11,384	19,284

W Withheld to avoid disclosing individual company data; included with "Other uses."
[1] Includes ferrosilicon and flux stone.
[2] Includes acid neutralization, abrasives, drain fields, glass, paper manufacture, roofing aggregates, sugar refining, terrazzo, uses not specified, and waste material. The 1972 data include building products, filter stone, and refractory stone.
[3] Data may not add to totals shown because of independent rounding.

Table 6.—Washington: Primary aluminum plant production data

Year	Primary production		
	Quantity (thousand short tons)	Percent of national total	Value (thousands)
1968	775	24	$394,261
1969	1,003	26	541,834
1970	1,023	26	569,377
1971	934	24	516,407
1972	r 1,049	r 25	532,678
1973	1,048	23	513,732

r Revised.

separating the minerals from a complex chalcopyrite-sphalerite ore.

Gold-Silver.—Production of gold and silver declined during the year, but the value of production increased, following the upward trend in world prices for these precious metal commodities. The average value of gold and silver produced in 1973 was $97.81 and $2.56 per troy ounce, respectively. Increasing price and demand for gold and silver may stimulate exploration and production. Silver was produced in Chelan, Ferry, Pend Oreille, Skamania and Stevens Counties.

Lead-Zinc.—Directors of the Pend Oreille Mines & Metals Co. were reported to have approved in principle a proposal to merge with the Bunker Hill Co., a wholly owned subsidiary of Gulf Resources and Chemical Corp. Pend Oreille Mines has a lead-zinc operation near Metaline Falls, Wash.

Magnesium.—Northwest Alloys Inc., a subsidiary of the Aluminum Company of America (Alcoa), began site preparation for its $50 million magnesium plant at Addy, Wash. The State Department of Ecology and the company agreed on conditions for granting a construction permit. The plant was expected to have a capacity of 40,000 tons per year and to have begun production in late 1975.

MINERAL FUELS

Coal.—Bituminous coal production increased 24% from that of 1972. The bulk of production came from two strip mining operations in Lewis County. The remaining production came from one underground operation in King County.

Geothermal Energy.—The Department of Natural Resources, State of Washington, has issued a report entitled "The Search for Hot Rocks, Geothermal Exploration, Pacific Northwest" (Reprint 11), listing the requirements for the existence of a geothermal reservoir and discussing the dry-steam and hot-water thermal fields. Development of geothermal resources in the future could enhance the energy outlook for Washington and other States of the Pacific Northwest.

Peat.—Production was reported in five counties during the year. Thurston County as the largest producing county, followed by Spokane County. Production increased 17% over that of 1972; value increased 24%. The average value was $5.24 per ton. The material was sold in bulk for use in soil improvement.

Petroleum and Natural Gas.—Eight Canadian mining and oil companies planned to drill for oil and gas in Stevens County, north of Spokane, Wash. Several shallow wells had been drilled on the 14,000-acre site previously, and indications of oil and gas were observed.

Table 7.—Principal producers

Commodity and company	Address	Type of activity	County
NONMETALS			
Cement:			
Columbia Cement Co., a division of Filtrol Corp.	Marietta Road, P.O. Box 37 Bellingham, Wash. 98225	Plant	Whatcom.
Ideal Cement Co., a division of Ideal Basic Industries, Inc.[1]	420 Ideal Cement Bldg. Denver, Colo. 80202	----do----	King.
Lehigh Portland Cement Co.[1]	718 Hamilton Mall Allentown, Pa. 18105	----do----	Pend Oreille.
Lone Star Industries, Inc	P.O. Box 2047 Seattle, Wash. 98111	----do----	King.
Clays:			
Interpace Corp	2901 Los Feliz Blvd. Los Angeles, Calif. 90039	3 pits and plants.	Do.
		2 pits and plants.	Spokane.
		Pit and plant	Stevens.
Lowell Brick Co	Box 3005 Everett, Wash. 98203	----do----	Snohomish.
Mutual Materials Co	P.O. Box 3547 Seattle, Wash. 98124	----do----	King, Pierce.
Pacific Concrete Industries	P.O. Box J Bellingham, Wash. 98225	Pit	Whatcom.
Diatomite: Kenite Corp., a division of Witco Chem. Corp.	277 Park Ave. New York, N.Y. 10017	Mine and plant	Grant.
Gypsum: Agro Minerals, Inc	P.O. Box Call Tonasket, Wash. 98855	Plant	Okanogan.
Lime: Domtar Chemicals, Inc., Lime Div.	1220 Alexander Ave. Tacoma, Wash. 98421	Plant	Pierce.
Olivine: Northwest International	329 Kincaid Mount Vernon, Wash. 98273	Mine and plant	Skagit.
Pumice and pumicite:			
W. L. Marenakos Co	Route 1, Box 921 Issaquah, Wash. 98027	Plant	Kittitas.
Sand and gravel:			
Central Pre-Mix Concrete	805 North Division St. Spokane, Wash. 99202	Pit and plant	Spokane, Adams, Franklin.
N. Fiorito Co., Inc	844 NW 48th St. Seattle, Wash. 98107	Pits	Skagit.
Friday Harbor Sand and Gravel Co.	Box 1051 Main St. Vancouver, 4, British Columbia, Canada	Pit and plant	San Juan.
Glacier Sand & Gravel Co	5975 E. Marginal Way Seattle, Wash. 98134	----do----	King, Pierce.
Lone Star Industries, Inc	P.O. Box 1020 Seattle, Wash. 98111	Pit	Pierce.
Materne Bros	Box O, Rosewood Station Spokane, Wash. 99208	Pits	Various.
Reid Sand and Gravel Inc	Box 922 Bellevue, Wash. 98009	Pit and plant	King.
Stoneway Concrete, Inc	Box 509 Renton, Wash. 98055	----do----	Do.
S & S Sand & Gravel Co[2]	Box 1211 Ephrata, Wash. 98823	----do----	Various.
Woodworth & Co., Inc	1200 East D St. Tacoma, Wash. 98421	----do----	Pierce.
Silicon carbide: The Carborundum Co.	P.O. Box 423 Niagara Falls, N.Y. 14302	Plant	Clark.
Stone:			
Black River Quarry, Inc	6808 South 140th Seattle, Wash. 98178	Quarry	King.
Bohemia Inc	2280 Oakmont Way Eugene, Oreg. 97401	----do----	Clark.
Columbia Cement Co	P.O. Box 37 Bellingham, Wash. 98225	----do----	Whatcom.
Degerstrom, N.A	Box 425 Spokane, Wash. 99210	----do----	Various.
Friend & Rikals, Inc	Box 3 Aberdeen, Wash. 98520	----do----	Grays Harbor.
General Construction Co	Box 3845 Seattle, Wash. 98124	Quarry and plant.	Jefferson.
Interstate Asphalt Co., Inc	Box 208 Aberdeen, Wash. 98520	----do----	Kitsap.
Lehigh Portland Cement Co.	718 Hamilton Mall Allentown, Pa. 18105	----do----	Pend Oreille.
Monroe Quarry	Box 488 Monroe, Wash. 98272	----do----	Snohomish.
Woodworth & Co., Inc	1200 East D St. Tacoma, Wash. 98421	Quarry	Pierce.
Sulfuric acid: American Smelting and Refining Co.	Box 1605 Tacoma, Wash. 98401	Smelter	Do.

See footnotes at end of table.

Table 7.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
NONMETALS—Continued			
Talc and soapstone:			
Skagit Talc Co	220 Reed St. Sedro Wooley, Wash. 98284	Quarry	Skagit.
Western Minerals, Inc	3314 Harbor Ave. S.W. Seattle, Wash. 98126	do	Do.
Vermiculite (exfoliated): Vermiculite-Northwest, Inc.	P.O. Box A Auburn, Wash. 98002	Plant	Spokane.
METALS			
Aluminum:			
Aluminum Company of America.	Vancouver, Wash. 98600	Reduction plant	Clark.
	Wenatchee, Wash. 98801	do	Chelan.
Intalco Aluminum Corp	Bellingham, Wash. 98225	do	Whatcom.
Kaiser Aluminum & Chemical Corp.	Spokane, Wash. 99200	do	Spokane.
	Tacoma, Wash. 98400	do	Pierce.
Martin Marietta Aluminum Inc.	Goldendale, Wash. 98620	do	Klickitat.
Reynolds Metals Co	Longview, Wash. 98620	do	Cowlitz.
Ferroalloys:			
Foote Mineral Co	Wenatchee, Wash. 98801	Plant	Douglas.
Ohio Ferro-Alloys Corp	Tacoma, Wash. 98400	do	Pierce.
Gold and silver: Knob Hill Mines, Inc.	160 Sansome St. San Fransisco, Calif. 94104	Mine and mill	Ferry.
Lead-zinc: Pend Oreille Mines & Metals Co.	923 Old National Bank Bldg. Spokane, Wash. 99201	do	Pend Oreille.
Steel:			
Bethlehem Steel Co., Pacific Coast Div.	Seattle, Wash. 98124	Plant	King.
Northwest Steel Rolling Mills, Inc.	Seattle, Wash. 98107	do	Do.
Uranium: Dawn Mining Co	Box 25 Ford, Wash. 99013	Mine and mill	Stevens.
MINERAL FUELS			
Coal: Washington Irrigation and Development Co.	R.R. 2, Box 41 Centralia, Wash. 98531	Strip mine	Lewis.
Peat:			
Asbury Fuel Co	2424 Hilltop Dr. Bremerton, Wash. 98313	Bog	Kitsap.
Cunningham Sand & Gravel Co., Inc	North 6315 Cedar St. Spokane, Wash. 99208	Bog	Spokane.
Kildow Bros., Inc	Route 15, Box 550 Olympia, Wash. 98502	Bog	Thurston.
Maple Valley Humus	18805 SE 170th St. Renton, Wash. 98055	Bog	King.
Plant Food Co	14515 35th Ave. Bothell, Wash. 98011	Bog	Snohomish.
Petroleum refining:			
Atlantic Richfield Co	Ferndale, Wash. 98248	Refinery	Whatcom.
Mobile Oil Corp	do	do	Do.
Shell Oil Co	Anacortes, Wash. 98221	do	Skagit.
Sound Refining, Inc	Tacoma, Wash. 98400	do	Pierce.
Texaco, Inc	Anacortes, Wash. 98221	do	Skagit.
U.S. Oil & Refining Co	Tacoma, Wash. 98400	do	Pierce.

[1] Also rock.
[2] Also traprock.

The Mineral Industry of West Virginia

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the West Virginia Geological and Economic Survey for collecting information on all minerals except fuels.

By R. E. Harris [1]

In 1973 West Virginia ranked second in the Nation in the production of bituminous coal. Coal remained the greatest source of the State's mineral output value, supplying 89.1% of the total. Coal production was 115 million tons compared with 124 million tons in 1972. The value of the total mineral output in the State rose $73 million, an increase of 5.1%.

[1] Mining engineer, Division of Fossil Fuels—Mineral Supply.

Table 1.—Mineral production in West Virginia [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays [2] ---- thousand short tons --	274	$403	348	$516
Coal (bituminous) ---- do ----	123,743	1,275,813	115,448	1,340,338
Gem stones ----	NA	2	NA	2
Natural gas ---- million cubic feet --	214,951	64,485	208,676	64,481
Petroleum (crude) ---- thousand 42-gallon barrels --	2,677	12,047	2,385	11,965
Salt ---- thousand short tons --	1,232	5,963	1,217	6,082
Sand and gravel ---- do ----	5,765	15,031	5,893	16,257
Stone [3] ---- do ----	11,649	21,293	11,732	22,821
Value of items that cannot be disclosed: Cement, clays (fire clay), natural gas liquids, stone (dimension), and lime ----	XX	35,595	XX	40,583
Total ----	XX	1,430,632	XX	1,503,045
Total 1967 constant dollars ----	XX	1,180,414	XX	p 1,103,916

p Preliminary. NA Not available. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes fire clay; included with "Value of items that cannot be disclosed."
[3] Excludes dimension stone; included with "Value of items that cannot be disclosed."

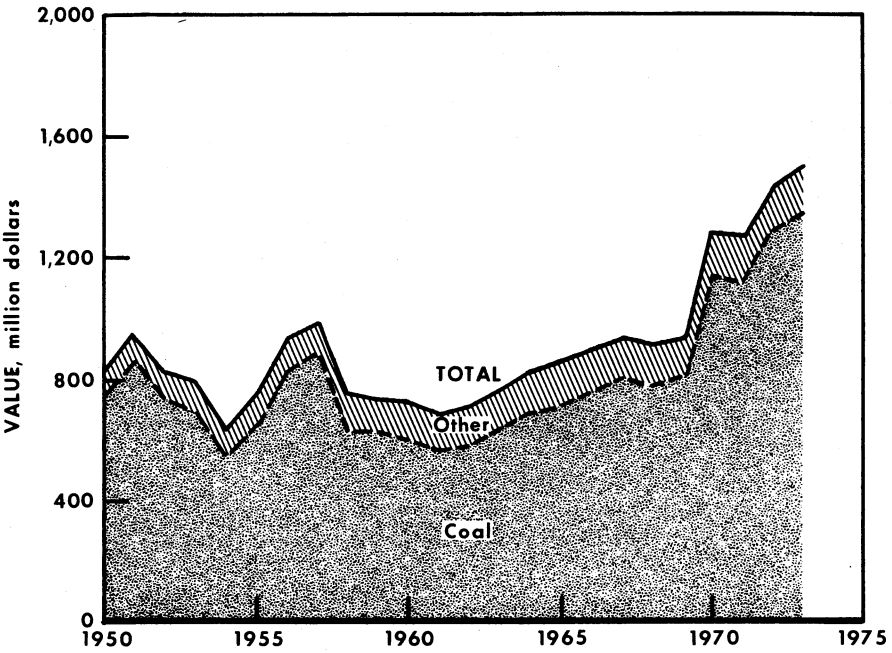

Figure. 1.—Value of coal and total value of mineral production in West Virginia.

Table 2.—Value of mineral production in West Virginia, by county [1]
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Barbour	$33,673	$40,771	Coal.
Berkeley	W	W	Cement, stone, lime, clays.
Boone	W	W	Coal, natural gas liquids.
Braxton	W	W	Stone.
Brooke	W	W	Coal, sand and gravel.
Cabell	W	W	Clays.
Clay	209	300	Coal.
Fayette	38,186	50,812	Coal, stone.
Gilmer	297	--	
Grant	W	W	Coal, stone.
Greenbrier	10,772	9,530	Do.
Hancock	W	8,224	Sand and gravel, clays.
Hardy	W	27	Stone.
Harrison	W	32,952	Coal, stone.
Jackson	30	--	
Jefferson	W	W	Stone.
Kanawha	W	W	Coal, stone.
Lewis	W	W	Coal, natural gas liquids, stone.
Lincoln	W	4	Clays.
Logan	110,883	105,815	Coal.
McDowell	216,122	212,596	Coal.
Marion	62,920	W	Coal, stone.
Marshall	48,560	W	Coal, salt.
Mason	1,491	3,386	Coal.
Mercer	16,318	W	Coal, stone.
Mineral	W	W	Do.
Mingo	34,348	W	Do.
Monongalia	W	W	Do.
Monroe	W	--	
Morgan	W	W	Sand and gravel.
Nicholas	60,959	78,573	Coal.
Ohio	19,988	W	Coal, sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in West Virginia, by county [1]—Continued
(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Pendleton	W	W	Stone, lime.
Pleasants	W	W	Sand and gravel.
Pocahontas	W	W	Stone.
Preston	W	W	Coal, stone.
Raleigh	$95,535	W	Do.
Randolph	W	$9,557	Do.
Roane	W	19	Stone.
Taylor	W	1,475	Coal.
Tucker	W	W	Coal, stone.
Tyler	W	W	Salt, sand and gravel.
Upshur	6,539	9,997	Coal.
Wayne	6,992	10,435	Coal, natural gas liquids, stone.
Webster	1,025	2,717	Coal.
Wetzel	W	W	Natural gas liquids, sand and gravel.
Wood	W	--	
Wyoming	W	W	Coal, sand and gravel.
Undistributed [2]	665,787	925,855	
Total [3]	1,430,632	1,503,045	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Calhoun, Doddridge, Hampshire, Putnam, Ritchie, Summers, and Wirt Counties are not listed because no production was reported.
[2] Includes gem stones, petroleum, natural gas, and values indicated by symbol W.
[3] Data may not add to totals shown due to independent rounding.

Trends and Developments.—The first United States application of a "shortwall" mining system was developed and installed at the Eastern Associated Coal Corp. Federal No. 1 mine at Grant Town, Marion County.

The Republic Steel Company announced plans to open a new mine in Barbour County that would have an estimated annual production of 2½ million tons of metallurgical coal. The American Electric Power System announced plans to open a new mine in Marion County that would have an estimated annual production of 2 million tons of steam coal.

In Preston County, 2 beehive coke oven plants, operating 36 ovens and 140 ovens respectively, announced the start of a cleanup of coke oven emissions by modifying these ovens with a scrubbing water system to remove smoke particles from the air as the smoke exhausts from the ovens. Tentative target dates for completion of modifications to all ovens are February 1974 and June 1975, respectively.

The first aid team of the Consolidation Coal Company Williams mine in Harrison County became national champions when they captured first place in the 1973 National First-Aid and Mine Rescue Contest.

Employment and Injuries.—According to the West Virginia Department of Mines in a report on production and accidents, coal mining in 1973 employed a daily average of 40,216 men (37,497 men in underground mines and 2,719 men in auger and strip mines). This was a decrease of 1,436 men from the 1972 average. The loss was caused mostly by mine closures and reductions in mine operating staffs. During 1973 each underground mine worked an average of 222 days while each strip and auger mine worked an average of 213 days. This represented an increase of 3 days for underground mines and 7 days for strip and auger mines over the 1972 average days worked. In 1973 there were 41 mine fatalities, a decrease of seven fatalities from the 1972 total. The rate of coal mine fatalities continued to drop with the 1973 ratio being 0.52 fatal accidents per million man-hours worked.

Legislation and Government Programs.—At the Bureau of Mines Morgantown Energy Research Center, research was completed, continued, and started on a number of projects. Among the completed projects were the influence of coal minerals on energy production; subsurface management of waste liquids; and underground pneumatic transport. Among the projects being continued were formcoke; underground gasification of coal; producer gas cleanup; reactivity between limestone and hydrogen sulfide in producer gas; corrosion of fireside surfaces in coal-fired boilers; sulfur dioxide removal from stack gases; utilization of

solid wastes from combustion and mining of coal; use of heat pipes in fluid-bed coal gasification; factors affecting new oil recovery; increasing oil recovery from oilfields by reservoir stimulation; and monitoring the plugging of wells for mining through safely. Among the newly started projects were synthoil pilot plant design; hydrogen generation from synthoil and hydrane residues; liquid fuels from coal; removal of solids from liquid fuels; and gas cleanup by precipitating cyclones.

The training program for West Virginia state mine inspectors was continued both at West Virginia University and in the field. The training of Federal mine inspectors was continued at the Federal Mine Health Safety Academy in Raleigh County.

The moratorium on strip mining in 22 counties was extended an additional 2 years by the West Virginia State Legislature. The Department of Natural Resources, Division of Reclamation, put into effect a new regulation that precludes any uncontrolled spoil being placed on slopes that exceed 65%.

Two studies, funded by Bureau of Mines grants, on the problems of methane gas in underground mines were continued. One study involved a computerized system of monitoring conditions within coal mines and the other involved methods of draining methane gas through special drainage wells.

The West Virginia Surface Mining and Reclamation Association was awarded a federal grant by the Environmental Protection Agency (EPA) to study a new longwall surface mining technique that would minimize environmental disturbance.

A research project on the possibility of using two coal byproducts, coal mine refuse and fly ash, as highway base material, was started at the EPA mine drainage control field in Monongalia County.

At the Pond Fork mine in Boone County, the Island Creek Coal Co., the NUS Corp., and the EPA undertook a cooperative project involving a feasibility study on mining without oxygen and operating all types of mining machinery while wearing space suits.

The West Virginia Geological and Economic Survey continued their cooperative programs with the U.S. Geological Survey. An additional 23 new 7.5 minute topographic quadrangle maps were published and these brought the total number of topographic maps, issued since this cooperative program began, to 386. The West Virginia Geological and Economic Survey continued their study on coal reserves and coal mining practices.

Table 3.—Indicators of West Virginia business activity

	1972	1973 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ---- thousands	655.8	668.0	+1.9
Unemployment ---- do	42.5	39.3	−7.5
Employment:			
Manufacturing ---- do	123.5	128.0	+3.6
Transportation and public utilities ---- do	40.2	40.7	+1.2
Wholesale and retail trade ---- do	102.3	107.1	+4.7
Finance, insurance, and real estate ---- do	16.7	17.8	+6.6
Mining ---- do	53.6	52.2	−2.6
Services ---- do	70.9	74.2	+4.7
Contract construction ---- do	34.0	35.1	+3.2
Government ---- do	99.4	103.4	+4.0
Payroll average weekly earnings: Manufacturing	$154.80	$165.60	+7.0
Personal income:			
Total ---- millions	$6,402	$6,867	+7.3
Per capita	$3,594	$3,828	+6.5
Construction activity: Cement shipments to and within West Virginia ---- thousand short tons	593	749	+26.3
Mineral production value ---- millions	$1,430.6	$1,503.0	+5.1

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Area Trends in Employment and Unemployment; U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Carbon Black.—Carbon black was produced by two furnace process plants; one located in Marshall County and the other in Pleasants County. When compared with 1972 production, 1973 output increased by 17.2%. The total value of the 1973 production increased by 23.2%, when compared with 1972. Carbon black was used by the rubber industry and also was used in the manufacture of ink.

Coal (Bituminous).—West Virginia, after regaining its position in 1972 as the leading coal-producing State in the Nation, lost the top spot in 1973, once again to Kentucky. The 1973 production was approximately 115 million tons, a decrease of slightly more than 8 million tons or 6.7% when compared with the approximate 124 million tons produced in 1972. When compared with the total value of 1972 production, the total value of the 1973 production increased by approximately $64.5 million or 5.1%.

Only four counties individually produced 10 million tons or more in 1973. These counties, listed in descending order by amount of coal produced, were McDowell, Monongalia, Boone, and Wyoming. The four leading counties in production from underground mines were McDowell, Monongalia, Wyoming, and Boone. The four leading counties in production from strip mines were Barbour, Boone, Fayette, and Nicholas. The four leading counties in production from auger mines were Kanawha, Boone, Logan, and Mingo. There were 19 mines, 18 underground and 1 strip, that had individual productions of over 1 million tons. Four of these mines, all underground, had individual productions of over 2 million tons. The largest coal-producing mine in the State continued to be the Humphrey No. 7 mine in Monongalia County.

Only four counties had coal productions that were valued at more than $100 million each. These counties, listed in descending order by amount of total value, were McDowell, Wyoming, Boone, and Logan.

The production of open-market coal totaled 103.2 million tons, a decrease of 13.3 million tons or 11.4% when compared with the open-market production of 1972. The total value of this open-market coal was $1,149 million, a decrease of $30 million or 2.5% when compared with the open-market value of 1972. The production of captive coal totaled 12.2 million tons, an increase of 5 million tons or 69.4% when compared with captive production in 1972. The total value of this captive coal was $191 million, an increase of $94 million or 96.9% when compared with the 1972 captive value. When compared with the 1972 averages, the average value per ton for open-market coal increased by $1.01 or 10% while the average value per ton for captive coal increased by $2.18 or 16%. The average value per ton for all coal increased from $10.31 in 1972 to $11.61, a rise of 12.6%.

There were 932 active mines in 1973 with each of these mines producing at least 1,000 tons. This was a decrease of only 3 mines from the 1972 count of 935 active mines. There was a decrease of 26 mines in the underground mines total but the total of strip mines and the total of auger mines increased respectively by 16 mines and by 7 mines. Total production by each of the methods of mining decreased. These production losses were 6% for underground mining, 7.3% for strip mining, and 25.2% for auger mining. Of the number of mines, 522 or 56% were underground, 304 or 32.6% were strip, and 106 or 11.4% were auger: Of the total output, 95.5 million tons or 82.8% was produced from underground mines, 17.7 million tons or 15.3% was produced from strip mines, and 2.2 million tons or 1.9% was produced from auger mines. The value of the coal produced from underground mines was $1,169 million, an increase of 5.5% when compared with that of 1972. The value of coal produced from strip mines was $152 million, an increase of 5.6% when compared with the 1972 strip value. Value of coal produced from auger mines was $19 million, a decrease of 20.8% when compared with that of 1972.

Table 4.—West Virginia: Coal (bituminous) production
(Thousand short tons and thousand dollars)

Year	Quantity	Value
1969	141,011	807,811
1970	144,072	1,142,245
1971	118,258	1,128,282
1972	123,743	1,275,813
1973	115,448	1,340,338

Equipment used at underground mines in 1973 included the following: 462 cutting machines, 89 fewer than in 1972; 225 hand-held and/or postmounted coal drills, 105 fewer than in 1972; 272 mobile coal drills, 44 less than in 1972; 717 rotary rock drills, 72 fewer than in 1972; and 201 percussion rock drills, 16 more than in 1972. Over 28 million tons was cut by these 462 cutting machines while 321,000 tons was cut by hand or shot from the solid. Of the total amount of coal drilled underground, 9 million tons was drilled by hand-held or postmounted drills and 20 million tons was drilled by mobile drills.

Equipment used at strip mines in 1973 included the following: 198 power shovels, 106 fewer than in 1972; 21 draglines, 12 fewer than in 1972; 25 carryall scrapers, 5 more than in 1972; 504 bulldozers, 9 fewer than in 1972; 37 horizontal power drills, 11 fewer than in 1972; 145 vertical power drills, 14 more than in 1972; 338 front-end loaders, 28 more than in 1972; 6 wheel excavators, 4 more than in 1972; 16 power brooms, 7 fewer than in 1972; 84 motor graders, 6 more than in 1972; and 25 coal drills, 4 fewer than in 1972.

Equipment used at auger mines in 1973 included the following: 93 augers, 4 more than in 1972; 1 power shovel, no change from 1972; 53 bulldozers, 24 fewer than in 1972; 4 power drills, 2 fewer than in 1972; 14 front-end loaders, 14 fewer than in 1972; and 3 motor graders, 3 fewer than in 1972.

Of the total underground production, approximately 99.5% was mechanically loaded. When compared with the 1972 percentage for mechanically loaded coal, this amount represented little change. Continuous mining machines produced 63.1 million tons or 66.4% of the coal mechanically loaded. When compared with 1972 production, the 1973 production by continuous mining machines decreased by 2.2 million tons or 3.4%. Mobile loading machines produced 28.5 million tons or 30% of the coal mechanically loaded. When compared with that of 1972, the 1973 production by mobile loading machines decreased by 3.8 million tons or 11.8%. The remainder of the coal mechanically loaded, 3.5 million tons or 3.6%, was produced by longwall machines. When compared with the 1972 production, the 1973 production by longwall machines increased by 0.4 million tons or 12.9%.

The 673 continuous mining machines, 12 fewer than were in use in 1972, were reportedly used as follows: 437 loaded into shuttle cars or rubber-tired mine cars; 67 loaded onto conveyors or into mine cars; and 169 deposited coal directly onto the mine bottom. The 697 mobile loading machines, 56 fewer than were in use in 1972, were reportedly used as follows: 462 loaded into shuttle cars or rubber-tired mine cars; 66 loaded onto conveyors or into mine cars; and 169 were used in conjunction with continuous mining machines for loading that coal deposited directly onto the mine bottom. Of the 18 longwall machines in operation, 3 more than in 1972, 10 were typed as planers and 8 were typed as shearers. Of the total longwall production, the planers produced 61.5% and the remaining 38.5% was produced by the shearers.

In 1973, 124 cleaning plants, 12 fewer than in 1972, produced 75.7 million tons of cleaned coal. This was 65.5% of the total coal production and represented a drop of 1.8% from the percentage cleaned in 1972. Of the total amount of cleaned coal produced, 24.7% was produced by jigs; 43.8% was produced by dense-medium processes; 20% was produced by concentrating tables; 7.5% was produced by froth flotation; 3.3% was produced by pneumatic methods; and the remaining 0.7% was produced by classifiers. The cleaned coal, recovered from these cleaning devices, totaled 70.4% of the raw coal input into these same devices. In 1973 the average recovery percentages, by method of cleaning for the State as a whole were as follows: jigs averaged 75.6%; dense-medium processes averaged 68.2%; concentrating tables averaged 69.8%; froth flotation averaged 66%; pneumatic methods averaged 77.6%; and classifiers averaged 76%. Of the total amount cleaned, 28.4% was dried in 45 thermal drying plants. These plants operated 68 thermal drying units.

Of the total production, 91.1% was shipped by rail or water with the remainder being shipped by truck or other methods. Of the total production, 29.6% was shipped by unit train.

As of yearend 1973 the demonstrated coal reserve base of West Virginia was 39,590 million tons. Of this total, 34,378 million tons were classed as the demonstrated underground reserve base and 5,212

millions tons as the demonstrated strippable reserve base. When classified according to sulfur content, 12,700 million tons of the underground reserve base and 3,256 million tons of the strippable reserve base can be placed in the low sulfur (1.0% or less) category. When classified according to thickness of the coalbed, 23,173 million tons of the total can be placed in the greater than 42-inch category. When ranked by their amounts of demonstrated underground reserve base, the five leading counties, listed in descending order of magnitude are Logan, Marshall, Monongalia, Marion, and Mingo. When ranked by their amounts of demonstrated strippable reserve base, the five leading counties, listed in descending order of magnitude, are Boone, Kanawha, Logan, Mingo, and Raleigh.

In 1973, according to the West Virginia Surface Mining and Reclamation Association, West Virginia once again was the leading State in the Nation in reclaiming lands that had been surface mined for coal, with 25,332 acres reclaimed. This acreage was a decrease of 2,000 acres or 7.2% when compared with the 1972 reclaimed acreage.

Table 5.—West Virginia: Bituminous coal production by type of mine and county, 1973

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total[1]	
Barbour	8	34	7	49	1,326	3,116	132	4,574	$40,771
Boone	46	22	11	79	8,901	1,992	310	11,203	118,429
Brooke	2	7	1	10	636	120	22	778	6,740
Clay	9	--	--	9	35	--	--	35	300
Fayette	21	20	7	48	2,580	1,798	118	4,496	50,544
Grant	3	7	--	10	1,410	201	--	1,611	12,627
Greenbrier	7	11	1	19	114	377	6	497	5,564
Harrison	4	13	2	19	3,206	729	63	3,997	32,347
Kanawha	36	25	23	84	6,597	1,034	541	8,171	93,661
Lewis	1	12	5	18	1	235	40	276	2,177
Logan	50	7	6	63	7,620	586	225	8,431	105,815
McDowell	89	17	4	110	12,020	640	64	12,724	212,596
Marion	7	1	--	8	6,199	20	--	6,220	59,854
Marshall	4	--	--	4	6,108	--	--	6,108	47,832
Mason	1	--	--	1	355	--	--	355	3,386
Mercer	4	--	4	8	1,100	--	38	1,138	18,165
Mineral	1	9	--	10	144	251	--	395	2,638
Mingo	31	7	5	43	2,776	323	187	3,286	36,083
Monongalia	16	9	2	27	10,572	888	31	11,492	94,974
Nicholas	38	23	7	68	4,779	1,208	61	6,049	78,573
Ohio	2	--	--	2	1,967	--	--	1,967	W
Preston	10	26	--	36	847	886	--	1,732	12,261
Raleigh	36	14	6	56	5,180	843	68	6,091	93,976
Randolph	7	13	2	22	158	726	6	889	7,411
Taylor	--	4	1	5	--	200	2	203	1,475
Tucker	--	2	--	2	--	180	--	180	W
Upshur	7	7	2	16	345	888	20	1,253	9,997
Wayne	2	--	--	2	582	--	--	582	W
Webster	8	3	1	12	123	64	108	296	2,717
Wyoming	72	11	9	92	9,834	399	185	10,418	157,257
Undistributed	--	--	--	--	--	--	--	--	32,168
Total[1]	522	304	106	932	95,516	17,704	2,228	115,448	1,340,338

W Withheld to avoid disclosing individual company confidential data.
[1] Data may not add to totals shown because of independent rounding.

Coke and Coal Chemicals.—The production of coke at three oven-coke plants, one plant each in Brooke, Hancock, and Marion Counties, was slightly more than 3.8 million tons, compared with slightly more than 3.5 million tons in 1972. The total value of the coke, when compared with 1972 values, increased by slightly more than $29.2 million. The average value per tons also increased over the 1972 average value.

At these three oven-coke plants, 5.4 million tons of coal (0.6 million tons more than the 1972 total) was carbonized with a coke-yield of 69.9% per ton. Of the total amount of coal supplied to these plants, 2.6 million tons or 49.2% was from Pennsylvania, 2.1 million tons or

39.0% was from West Virginia, and the remaining 0.7 million tons or 11.8% was from Kentucky and Virginia.

A total of 296 thousand tons of coke breeze was recovered at the oven-coke plants. Coal-chemical materials, exclusive of coke breeze, that were produced, included 44.8 million gallons of coke oven tar, 63.4 million cubic feet of coke oven gas, and 41 thousand tons of ammonium sulfate. Crude light oil, from which benzene, toluene, xylene, and solvent naphtha were recovered, was also produced.

Coke was also produced at two beehive coke oven plants in Preston County from a total of 176 beehive ovens. The coal source, for these beehive ovens, was mostly Preston County mines.

Natural Gas Liquids.—Natural gas liquids were produced in four counties in 1973, with Wetzel County ranking first in production. While the quantity of natural gas liquids produced showed a slight decrease of 0.4%, the total value of production showed an increase of 22%. The proved reserves of natural gas liquids at yearend were 82.8 million barrels, 671 thousand barrels more than the reserves at yearend 1972.[2]

Petroleum and Natural Gas.—Crude oil production in 1973 totaled slightly less than 2.4 million barrels. When compared with 1972 production, the 1973 production represented a decrease of almost 0.3 million barrels or 10.9%. The total value of this production was slightly less than $12 million. When compared with the 1972 value, the 1973 value represented a decrease of $82,000 or 0.7%. The average price paid for Penn-grade crude in West Virginia in 1973 was $5.02 per barrel. This represented an increase of $0.52 or 11.6% per barrel over the 1972 average price.

Natural gas production totaled 208,676 million cubic feet. When compared with 1972 production, this represented a decrease of slightly more than 6 million cubic feet or 2.9%. Total value of natural gas production was approximately $64.5 million. When compared with the 1972 value, the 1973 value revealed a decrease of $4,000 or a negligible percentage loss. The average wellhead value for natural gas (includes the value of natural gas liquids contained therein) was 30.9 cents per thousand cubic feet. When compared with the 1972 average value, the 1973 value showed an increase of 0.9 cents or 3% per thousand cubic feet.

The estimated number of producing wells in the State at yearend was 35,000. Of this total, there were an estimated 13,600 oil wells, an increase of 1,464 wells or 12.1% over the estimated number of oil wells at yearend 1972. To complete this total, there were an estimated 21,400 gas wells, an increase of 76 wells or 0.4% over the estimated number of gas wells at yearend 1972.

According to the American Petroleum Institute in 1973, there were 701 well completions of which 621 were development wells and 80 were exploratory wells. When compared with 1972 well completions, development well completions increased by 30, and exploratory well completions decreased by 3. In 1973, 543 or 87.4% of the development wells were successful and 43 or 53.8% of the exploratory wells were successful. Successful percentages in 1972 were 90.7% and 43.4%, respectively. Of the total number of development wells, there were 475 gas wells, 68 oil wells, and 78 dry wells. Of the total number of exploratory wells, there were 39 gas wells, 4 oil wells, and 37 dry wells.

The total footage drilled in completing these wells was 2,175,820 feet, an increase of slightly more than 78,000 feet or 3.7% when compared with that of 1972. Of the total footage, 86.2% was drilled in development wells and 13.8% in exploratory wells. Of the development wells footage, 79.9% was drilled in gas wells, 7.5% in oil wells, and 12.6% in dry wells. Of the exploratory footage, 52.2% was drilled in gas wells, 2.3% in oil wells, and 45.5% in dry wells. Well completions were reported in 36 counties. The three leading counties in descending order by number of wells, were Kanawha, Gilmer, and Upshur. On a footage drilled basis, the three leading counties, in descending order were Upshur, Kanawha, and Lewis. Kanawha County led the State in the number of development well completions while Raleigh County led the State in the number of exploratory well completions.

According to the West Virginia Geological and Economic Survey, the Oil and Gas Division of the West Virginia Department of Mines issued 1,073 permits (241

[2] Oil and Gas Journal. Another Big Drop Logged for U.S. Oil and Gas Reserves. V. 72, No. 13, Apr. 1, 1974, p. 44.

more permits than issued in 1972) to drill new wells or deepen old wells and 130 permits (1 less permit than issued in 1972) to fracture old wells. They also issued 403 permits to plug or abandon wells. Gilmer County led the State in the number of permits issued to drill new wells or deepen old wells. Roane County led the State in the number of permits issued to fracture old wells. Harrison County led the State in the number of wells plugged or abandoned. Walton remained the most active oilfield and Smithton-Flint-Sedalia became the most active gas field.

According to the West Virginia Geological and Economic Survey, exploratory wells included 29 wildcats, of which 13 were successful; 20 deeper pool wells, of which 6 were successful; 40 outpost wells, of which 26 were successful; and 1 unsuccessful shallow-pool well. Of the exploratory successes, 86.7% were in shallow formations. There were seven new-field discoveries in shallow formations and one new-field discovery in deep formations. The average footage per exploratory well was 3,921 feet, a decrease of 561 feet when compared with the 1972 average. Shallow wells accounted for 95% (3.7% more than in 1972) of all well completions reported. The Mississippian Big Injun interval continued to dominate shallow drilling with 342 well completions, an increase of 73 over the 1972 total. Other leading intervals were the Lower Mississippian Weir-Berea with 207 well completions, an increase of 47 over the 1972 total, and the Upper Devonian Benson-Riley with 175 well completions, a decrease of 4 well completions from the 1972 total. Deep drilling activity continued to decrease during 1973. The leading intervals for activity were the Huntersville Onondaga-Oriskany with 26 well completions and the Upper Silurian-Williamsport (Newburg) with 14 well completions.

According to the Oil and Gas Journal, estimated proved crude oil reserves at yearend were 32.1 million barrels, a decrease of slightly more than 1.9 million barrels or 6.5% from the proved reserves at yearend 1972. The estimated proved reserves of natural gas at yearend were 2,320 billion cubic feet, a decrease of slightly more than 26 billion cubic feet or 1.1% from the proved reserves at yearend 1972.[3]

According to the American Gas Association, at yearend the State had an underground gas storage capacity of 435,893 million cubic feet, a decrease of 849 million cubic feet or 0.2% from the 1972 gas storage capacity. At yearend there were 369,031 million cubic feet of gas in storage, an increase of 18,128 million cubic feet or 5.2% from the stored gas of 1972.[4] According to the West Virginia Geological and Economic Survey, 34 gas storage wells (an increase of 10 wells over the 1972 completions) were completed during 1973.

The deep test well, that was started in September 1971 by the Columbia Gas Transmission Corp. in Mingo County, and which became the deepest well drilled in the northeastern United States, was completed in the spring of 1973 with a total depth of 19,537 feet. This well was plugged and abandoned. Two deep test wells, one each in Calhoun and Lincoln Counties are currently being drilled and are expected to bottom out near the 20,000-foot level.

According to the West Virginia Geological and Economic Survey, the Big Injun waterflood in the Granny Creek-Stockly field in Clay County remained the only full-scale waterflood project in operation. Four pilot waterflood projects, one each in Calhoun, Clay, Lewis, and Roane Counties, remained active during 1973. These secondary recovery projects were estimated to have supplied 20% of the oil production in the State.

NONMETALS

Cement.—When compared with 1972, shipments of masonry cement increased by 26% and those of portland cement decreased by 1.6%. The total value of the masonry cement shipments increased by 29.9% over that of 1972. The total value of the portland cement shipments increased by 5.2% over the 1972 shipments value. When compared with the 1972 average prices per short ton, the average price per short ton for masonry cement increased 3.1% and the average price per short ton for portland cement increased 6.9%. Capitol Cement Co., a subsidiary of Martin Marietta Corp., at Martinsburg, Berkeley County, was the sole producer and oper-

[3] Oil and Gas Journal. Another Big Drop Logged for U.S. Oil and Gas Reserves. V. 72, No. 13, Apr. 1, 1974, pp. 42–43.

[4] American Gas Association. 1973 Annual report. Pp. 10, 13.

ated three coal-fired rotary kilns. Most of the portland cement was used in ready-mix concrete, concrete product manufacture, and building and highway construction.

Clays—The production of miscellaneous clays increased by 27% and the production of fire clays increased by 17.2% over their respective productions of 1972. The total value of the miscellaneous clays increased by 28% and that of fire clays increased by 25.3% over their respective 1972 values. The average value per ton for miscellaneous clays increased by 0.8% and the average value per ton for fire clays increased by 6.9% over their respective 1972 average values. These clays were produced in four counties at six operating mines (four strip mines and two deep mines). Berkeley County was once again the leading producer of miscellaneous clays while Hancock County continued to be the only producer of fire clays. Miscellaneous clays were mostly used in the manufacture of building brick and cement. Fire clays were chiefly used in the production of firebrick and block.

Lime.—Two lime plants, one in Berkeley County and one in Pendleton County, were in production in 1973. Lime output and its total value, when compared with those of 1972, increased respectively by 2.2% and 5%. The average price per ton showed an increase of 2.7%. This lime was used in steel furnaces, acid mine water neutralization, paper and pulp manufacturing, agriculture, and other uses. Consumption was mostly in Maryland, Ohio, Pennsylvania, and West Virginia. Total consumption of lime in West Virginia was 326,900 short tons, a decrease of 4.8% from 1972 consumption.

Salt.—The 1973 production of salt was 1,217,000 tons, a decrease of 15,000 tons or 1.2% from that of 1972. Total value increased by 2.0% while the average value per ton increased by $0.16 or 3.3%. The salt was used by the producers in the manufacture of chlorine and caustic soda. The salt was produced from brines that were obtained from three active deep well solution mining operations in two counties, Marshall and Tyler.

Sand and Gravel.—The output of sand was 3,846,000 tons, an increase of 208,000 tons or 5.7% over the 1972 output. Gravel output was 2,047,000 tons, a decrease of 79,000 tons or 3.7% from the 1972 output. The total value of the sand increased by $981,000 or 8.5% over the 1972 value and that of gravel increased by $246,000 or 7.0% over the 1972 gravel value. When compared with the average values per ton for 1972, that for sand increased by 2.6% and that for gravel increased by 11.2%. Of the total output, 65.3% was sand and 34.7% was gravel.

Production was reported from eight counties with the three top producing counties, in descending order by quantity produced, being Hancock, Morgan, and Pleasants. Production was reported from four stationary plants, five dredges, and two unreported types. Of the total output, 67.5% was shipped by barge with the balance being shipped by railroad or truck.

Table 6.—West Virginia: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,772	2,938	1,685	2,895
Paving	415	687	596	1,106
Other uses [1]	1,451	7,914	1,565	8,520
Total [2]	3,638	11,539	3,846	12,520
Gravel:				
Building	1,200	2,102	1,118	2,198
Paving	W	W	904	1,504
Other uses [3]	926	1,390	25	36
Total [2]	2,126	3,491	2,047	3,737
Total sand and gravel [2]	5,765	15,031	5,893	16,257

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes blast, engine, filtration, fire or furnace, glass, grinding and polishing, molding, abrasives, chemical, enamel, filler, foundry, pottery, porcelain tile, and other sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes fill, paving (1972), and railroad ballast (1972).

Slag.—Weirton Steel Division, National Steel Corp. produced crushed air-cooled blast furnace slag for aggregate use.

Stone.—Total crushed stone (limestone and sandstone) production was 11,732,000 tons, an increase of 83,000 tons or 0.7% over that of 1972. The total value of this production was $22.8 million, an increase of $1.5 million or 7.2% over the 1972 value. The average value per ton increased by $0.12 or 6.6% over the 1972 average value per ton. Crushed limestone output increased by 4.3% and crushed sandstone output decreased by 37.2% when compared with 1972 output.

Limestone production was reported from 15 counties and 37 quarries. The four leading limestone producing counties, in descending order by quantity produced were Monongalia, Greenbrier, Berkeley, and Jefferson. The major limestone uses were various aggregates, roadbase stone, cement manufacture, flux for iron and steel production, railroad ballast, mine dusting, and lime manufacture.

Sandstone production was reported from 13 counties and 17 quarries. The four leading sandstone producing counties, in descending order by quantity produced, are Raleigh, Braxton, Monongalia, and Lewis. The major sandstone uses were various aggregates and roadbase stone.

Table 7.—West Virginia: Crushed and broken stone sold or used by producers, by use
(Thousand short tons and thousand dollars)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Bituminous aggregate	170	351	200	453
Concrete aggregate	903	1,787	604	1,381
Dense graded roadbase stone	2,314	4,596	2,799	5,293
Macadam aggregate	--	--	161	400
Surface treatment aggregate	979	1,672	W	555
Unspecified aggregate and roadstone	1,843	3,240	3,325	6,244
Abrasives	27	73	--	--
Agricultural purposes	75	166	83	170
Flux stone	W	W	1,075	2,469
Lime manufacture	435	849	W	W
Mine dusting	206	826	173	873
Railroad ballast	644	816	504	627
Refractory stone	39	89	W	W
Riprap and jetty stone	W	W	52	117
Other uses [1]	4,012	6,829	2,756	4,241
Total [2]	11,649	21,293	11,732	22,821

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes manufactured fine aggregate (stone sand), chemical stone, stone used in cement manufacture, and uses not specified; 1972 data also include dam construction, dead-burned dolomite, and stone used in glass manufacture. 1973 data also include filter stone and roofing aggregates.
[2] Data may not add to totals shown because of independent rounding.

The production of dimension stone increased by 60.7% over that of 1972. The total value of this production decreased by 28.6% from the 1972 value. The principal uses of dimension stone were cut stone and curbing.

Of the total stone production, 58.8% was shipped by truck, 26.7% was shipped by railroad, and the remainder was shipped by either other means of transportation or shipment method was unspecified.

METALS

Aluminum.—Aluminum was produced from alumina at the Kaiser Aluminum and Chemical Corp. plant in Ravenswood, Jackson County. When compared with 1972, aluminum production increased by 17% and the value increased by 11.4%. Imported bauxite was processed into alumina at Baton Rouge and Gramercy, La., and transported by rail to Ravenswood.

Ferroalloys.—The total production of all types of ferroalloys was 226,424 tons. When compared with the 1972 production, the 1973 output increased by 31,381 tons or 16.1%. The total value of this production was $66,543,000. When compared with the 1972 value, the 1973 value increased by $16,460,000 or 32.9%.

Ferroalloys were produced by three companies. The Union Carbide Corp. operated a plant near Alloy, Fayette County, where ferroalloys were produced in electric

furnaces. The Foote Mineral Co., Inc., also used electric furnaces to produce ferroalloys at their plant at Graham Station, Mason County. The Chemetals Division, Diamond-Shamrock Corp., used electric furnaces in producing ferromanganese at their plant near Kingwood, Preston County. Most mineral raw materials either were obtained from other States or were imported.

Magnesium Compounds.—American Specialty Metals Division, American Metal Climax, Inc., produced anhydrous magnesium chloride as a byproduct during the production of zirconium sponge metal at their plant near Parkersburg, Wood County.

Nickel.—Huntington Alloy Products Division, International Nickel Products Co., Inc., produced nickel and various types of high-nickel alloys at their Huntington plant, Cabell and Wayne Counties. The 1973 production increased slightly. The principal products included nickel and high-nickel alloys in mill forms such as sheet, strip, plate, tube, wire rod, and bar and welding products, such as nickel and high-nickel bare welding filler wire, coated electrodes, and welding fluxes.

Zinc.—Zinc dust, zinc alloys, zinc oxides, and other zinc products were manufactured by the zinc smelting plant at Meadowbrook, Harrison County. This plant uses zinc drosses, zinc ashes, and various other zinc residues as raw materials.

Zirconium and Hafnium.—Amax Specialty Metals Corp. produced zirconium and hafnium sponge metal from zirconium tetrachloride at their plant near Parkersburg, Wood County. These metals were shipped to a company fabricating plant near Akron, N.Y. Corhart Refractories Co. made zircon brick at their plant near Buckhannon, Upshur County. Union Carbide Corp. produced zirconium metal powder and zirconium alloys at their plant near Alloy, Fayette County.

Table 8.—Principal producers

Commodity and company	Address	Type of activity	County
Cement (portland and masonry):			
Capitol Cement Co., a subsidiary of Martin-Marietta Corp.[1]	Box 5618 Baltimore, Md. 21210	Plant	Berkeley.
Clays:			
Fire Clay:			
Crescent Brick Co., Inc	Box 368 New Cumberland, W. Va. 26047	Underground	Hancock.
Globe Refractories, Inc	Box D Newell, W. Va. 26050	do	Do.
Common clay and shale:			
Barboursville Clay Manufacturing Co.	Box 1048 Charlestown, W. Va. 25324	Pit	Cabell.
Continental Clay Products Co.	931 Investment Bldg. 1511 K St. N.W. Washington, D.C. 20005	Pit	Berkeley.
Martin-Marietta Cement, Eastern Div.	Box 5618 Baltimore, Md. 21210	Quarry	Do.
Sanders Dummy Co	Midkiff, W. Va. 25540	Pit	Lincoln.
Coal (bituminous):			
Amherst Coal Co	Lundale, W. Va. 25631	Underground	Logan.
Bethlehem Mines Corp	701 East 3rd St. Bethlehem, Pa. 18015	do	Boone, Kanawha, Marion, Raleigh.
Buffalo Mining Co	Lyburn, W. Va. 25632	Underground, strip, and auger.	Logan.
Eastern Associated Coal Corp	Koppers Bldg. Pittsburgh, Pa. 15219	Underground	Boone, Marion, McDowell, Monongalia, Wyoming.
Island Creek Coal Co	Holden, W. Va. 25625	do	Boone, Grant, Logan, Marion, Monongalia, Nicholas, Raleigh, Wyoming.
King Knob Coal Co	Box 268 Clarksburg, W. Va. 26301	Strip	Barbour, Harrison, Marion, Monongalia.
Pocahontas Fuel Co., Div. of Consolidation Coal Co.	Pocahontas, Va. 24635	Underground	Mercer and Wyoming.

See footnotes at end of table.

Table 8.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Coal (bituminous)—Continued			
Pocahontas Fuel Co., Div. of Consolidation Coal Co.	Pocahontas, Va. 24635	Underground and strip.	McDowell.
Ranger Fuel Corp	Drawer Y Beckley, W. Va. 25801	Strip and auger	Boone.
Do	---- do ----	Underground and strip.	Raleigh and Wyoming.
Rowland Coal Co., Div. of Consolidation Coal Co.	Box 169 Beckley, W. Va. 25801	Underground, strip, and auger.	Raleigh.
Semet-Solvay Div. Allied Chemical Corp.	40 Rector St. New York, N.Y. 10006	Underground	Fayette, McDowell, Wyoming.
The Valley Camp Coal Co	Shrewsbury, W Va. 25184	Underground and strip.	Kanawha.
Do	Box 218 Triadelphia, W. Va. 26059	Underground	Ohio and Marshall.
The Youngstown Mines Corp	Box 900 Youngstown, Ohio 44501	---- do ----	Logan.
Union Carbide Corp., Ferroalloys.	Box 38 Mammoth, W. Va. 25132	---- do ----	Kanawha and Mason.
United States Steel Corp	525 William Penn Place Pittsburgh, Pa. 15219	Underground and strip.	McDowell, Mingo, Wyoming.
Westmoreland Coal Co	123 South Broad St. Philadelphia, Pa. 19109	Underground	Boone and Nicholas.
Lime:			
Germany Valley Limestone Co., Div. of Greer Limestone Co.	Riverton, W. Va. 26814	Plant	Pendleton.
Jones & Laughlin Steel Corp., Blair Limestone Div.[2]	R.D. 3 Martinsburg, W. Va. 25401	---- do	Berkeley.
Petroleum refineries:			
Pennzoil Co., Elk Refining Div	Falling Rock, W. Va. 25079	Plant	Kanawha.
Quaker State Oil Refining Corp	St. Marys, W. Va. 26170	---- do	Pleasants.
Quaker State Oil Refining Corp	Newell, W. Va. 26050	---- do	Hancock.
Salt:			
Industrial Chemicals Div. Allied Chemical Corp.	Box 70 Morristown, N.J. 07960	---- do	Marshall.
Inorganic Chemical Div. FMC Corp.	Box 8127 South Charleston, W. Va. 25303	Mine	Tyler.
PPG Industries, Inc., Chemical Div.	1 Gateway Center Pittsburgh, Pa. 15222	Plant	Marshall.
Sand and Gravel:			
Dravo Corp., Keystone Div	5th and Liberty Ave. Pittsburgh, Pa. 15222	Dredge	Hancock.
Duquesne Sand Co	East Beaver St. Glenfield, Pa. 15115	---- do	Brooke.
Ohio River Sand & Gravel Div. of McDonough Co.	Box 538 Parkersburg, W. Va. 26100	---- do	Pleasants, Tyler, Wetzel, Wood.
Pennsylvania Glass Sand Corp	Berkeley Springs, W. Va. 25411	Pit	Morgan.
Shippingport Sand and Gravel Co.	1200 Stambough Bldg. Youngstown Ohio 44501	Plant	Hancock.
Smelters:			
Kaiser Aluminum & Chemical Corp.	300 Lakeside Dr. Oakland, Calif. 94626	---- do	Jackson.
Stone:			
Limestone (crushed and broken):			
Acme Limestone Co	Fort Spring, W. Va. 24936	Mine and quarry	Greenbrier.
Appalachian Stone Div., Martin-Marietta Corp.	Box 120 Mercersburg, Pa. 17236	Quarry	Berkeley.
Elkins Limestone Co	Elkins, W. Va. 26241	Mine	Randolph.
The H. Frazier Co., Inc	Box 1377 Richmond, Va. 23211	Quarry	Greenbrier.
Green Bag Cement Co., Div. of Marquette Cement Manufacturing Co.	20 North Wacker Dr. Chicago, Ill. 60606	Mine	Monongalia.
Greer Limestone Co	Greer Building Morgantown, W. Va. 26505	Mine and quarry	Monongalia and Pendleton.
Jones & Laughlin Steel Corp., Blair Limestone Div.	R.D. 3 Martinsburg, W. Va. 25401	Quarry	Jefferson.
Sandstone (dimension):			
Rhine Creek Stone Co	Box 265 Eglon, W. Va. 26716	---- do	Preston.
Sandstone (crushed):			
Meadows Stone and Paving, Inc.	Box 518 Gassaway, W. Va.	---- do	Braxton.
Raleigh Stone Co. of Beckley, W. Va.	Box 1387 Roanoke, Va. 24001	---- do	Raleigh.

[1] Also limestone and shale.
[2] Also limestone.

The Mineral Industry of Wisconsin

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Geological and Natural History Survey of Wisconsin, under a memorandum of understanding for collecting information on all minerals except coal and liquid fuels.

By Grace N. Broderick [1]

The value of mineral production in Wisconsin in 1973, $114.3 million, showed a 28% increase over the record high of $89.4 million set in 1972. Sand and gravel and stone, $43.6 million and $36.9 million, respectively, accounted for 70.5% of the total.

Nonmetallic minerals continued to contribute the major part of total Wisconsin mineral value. Sand and gravel increased 10.5% in quantity and 39.3% in value, and represented 38.2% of the total State value. Production of stone, which increased 22.8% in quantity and 24.4% in value, accounted for an additional 32.3% of the State total. Other nonmetallic minerals produced were abrasive stone, cement, clays, gem stones, and lime. Expanded perlite and exfoliated vermiculite were produced from crude materials mined outside the State. Elemental sulfur was recovered at the new sulfur extraction plant completed at Murphy Oil Corp's Superior refinery.

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Mineral production in Wisconsin [1]

Mineral	1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays ---thousand short tons--	4	$7	2	$3
Gem stones	NA	1	NA	1
Iron ore (usable) thousand long tons, gross weight--	887	W	956	W
Lead (recoverable content of ores, etc.) short tons--	757	228	844	275
Lime ---thousand short tons--	263	5,009	310	6,004
Peat ---do---	2	179	2	208
Sand and gravel ---do---	36,430	31,324	40,250	43,647
Stone ---do---	19,394	29,681	23,818	36,917
Zinc (recoverable content of ores, etc.) short tons--	6,873	2,440	8,672	3,583
Value of items that cannot be disclosed: Abrasive stone, cement, and values indicated by symbol W	XX	20,484	XX	23,701
Total	XX	89,353	XX	114,339
Total 1967 constant dollars	XX	73,725	XX	p 83,948

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Wisconsin, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Adams	W	W	Sand and gravel.
Ashland	W	W	Do.
Barron	W	$1,491	Sand and gravel, stone.
Bayfield	$98	38	Do.
Brown	W	W	Sand and gravel, lime, stone.
Buffalo	W	512	Stone, sand and gravel.
Burnett	W	W	Sand and gravel, stone.
Calumet	W	283	Stone, sand and gravel.
Chippewa	335	751	Sand and gravel.
Clark	W	966	Sand and gravel, stone.
Columbia	2,519	3,104	Do.
Crawford	W	W	Stone, sand and gravel.
Dane	3,814	4,336	Sand and gravel, stone.
Dodge	W	W	Stone, lime, sand and gravel.
Door	W	W	Sand and gravel, stone.
Douglas	W	W	Lime, sand and gravel, stone.
Dunn	W	92	Sand and gravel, stone.
Eau Claire	W	2,716	Sand and gravel.
Florence	W	28	Do.
Fond du Lac	W	W	Stone, sand and gravel, lime, clays.
Forest	W	W	Sand and gravel.
Grant	W	W	Stone, sand and gravel.
Green	W	W	Do.
Green Lake	397	772	Sand and gravel, stone.
Iowa	418	494	Stone.
Iron	W	27	Sand and gravel.
Jackson	W	W	Iron ore, sand and gravel, stone.
Jefferson	W	W	Sand and gravel, stone.
Juneau	W	W	Stone, sand and gravel.
Kenosha	197	154	Sand and gravel.
Kewaunee	W	W	Do.
La Crosse	W	W	Stone, sand and gravel.
Lafayette	3,378	4,332	Zinc, stone, lead, sand and gravel.
Langlade	W	149	Sand and gravel.
Lincoln	477	565	Sand and gravel, peat.
Manitowoc	2,682	2,762	Cement, sand and gravel, lime, stone.
Marathon	3,967	5,581	Stone, sand and gravel.
Marinette	W	W	Do.
Marquette	322	W	Stone.
Milwaukee	6,839	10,727	Cement, stone, sand and gravel.
Monroe	215	W	Stone, sand and gravel.
Oconto	W	W	Sand and gravel, stone.
Oneida	458	761	Sand and gravel.
Outagamie	W	1,827	Sand and gravel, stone.
Ozaukee	W	W	Do.
Pepin	W	W	Stone, sand and gravel.
Pierce	W	834	Do.
Polk	1,535	W	Do.
Portage	691	1,816	Sand and gravel, stone.
Price	W	109	Sand and gravel.
Racine	3,240	3,573	Stone, sand and gravel.
Richland	381	W	Do.
Rock	2,544	2,736	Sand and gravel, stone.
Rusk	331	323	Sand and gravel.
St. Croix	W	W	Stone, sand and gravel.
Sauk	1,442	W	Stone, sand and gravel, abrasive stone.
Sawyer	W	W	Sand and gravel.
Shawano	373	W	Sand and gravel, stone.
Sheboygan	419	651	Do.
Taylor	257	377	Sand and gravel.
Trempealeau	W	W	Stone, sand and gravel.
Vernon	W	W	Do.
Vilas	170	W	Sand and gravel, stone.
Walworth	W	W	Do.
Washburn	1	W	Sand and gravel.
Washington	1,233	1,409	Sand and gravel, stone.
Waukesha	7,229	9,973	Sand and gravel, stone, peat.
Waupaca	186	429	Sand and gravel, stone.
Waushara	W	218	Sand and gravel.
Winnebago	2,242	1,896	Stone, sand and gravel.
Wood	198	331	Sand and gravel, stone.
Undistributed [2]	40,763	47,195	
Total [3]	89,353	114,339	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] No production reported for Menominee county.

[2] Includes gem stones, some sand and gravel and stone which cannot be assigned to specific counties, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

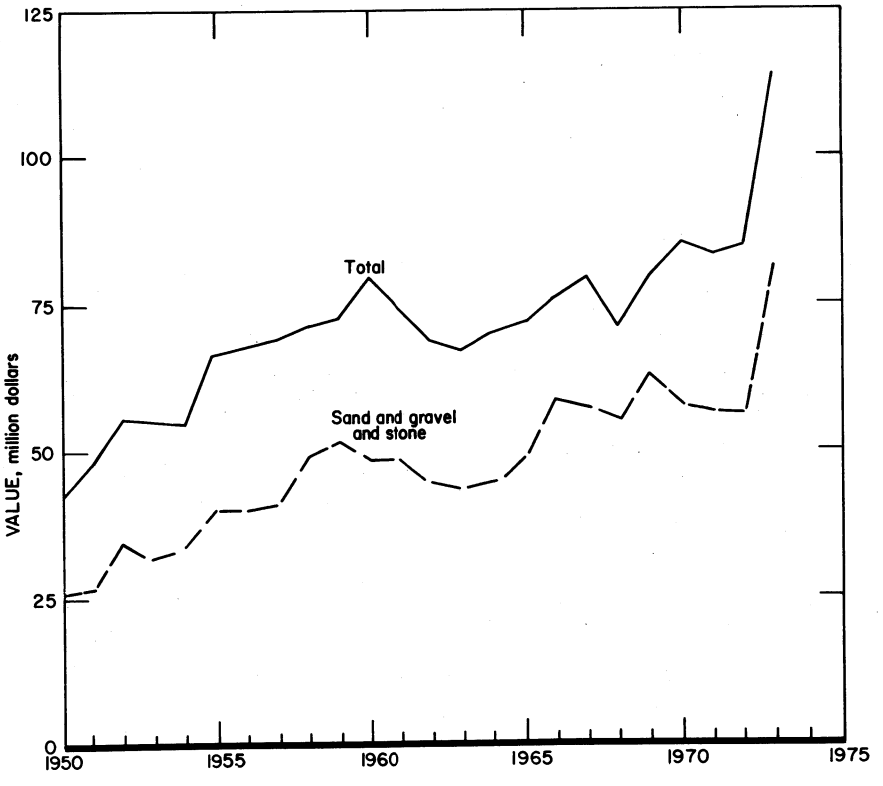

Figure 1.—Value of sand and gravel, stone and total value of mineral production in Wisconsin.

Table 3.—Indicators of Wisconsin business activity

	1972	1973 p	Change, percent
Employment and labor force, annual average:			
Total labor force ---thousands	1,908	2,063	+8.1
Unemployment ---do	81	84	+3.7
Employment:			
Manufacturing ---do	495.4	529.4	+6.9
Construction ---do	62.7	67.7	+8.0
Mining ---do	2.5	2.5	--
Transportation and public utilities ---do	81.9	83.9	+2.4
Wholesale and retail trade ---do	346.9	363.7	+4.8
Finance, insurance, and real estate ---do	64.2	68.3	+6.4
Services ---do	251.5	263.7	+4.9
Government ---do	275.8	276.4	+ .2
Personal income:			
Total ---do	$19,232	$21,173	+10.1
Per capita	$4,255	$4,634	+8.9
Construction activity:			
Value of authorized nonresidential construction ---millions	$288.0	$308.4	+7.1
Number of private and public residential units authorized	36,310	31,640	-12.9
State highway commission contracts awarded ---millions	e $154.0	$116.0	-24.7
Portland cement shipments to and within Wisconsin thousand short tons	1,619	1,837	+13.5
Farm marketing receipts ---millions	$1,913.2	$2,332.4	+21.9
Mineral production value ---do	$89.4	$114.3	+27.9
International trade: [1]			
Value of exports through Wisconsin ---do	$169.2	$209.4	+23.8
Value of imports through Wisconsin ---do	$161.7	$189.9	+17.4

e Estimated. p Preliminary. NA Not available.
[1] Includes Milwaukee Customs District.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; Highlights of U.S. Export and Import Trade; and the U.S. Bureau of Mines.

Output of taconite pellets increased from 887,000 long tons in 1972 to 956,000 long tons in 1973. Production of 844 short tons of lead and 8,672 short tons of zinc, in terms of recoverable metal, represented increases of 11.5% and 26.2%, respectively, over the 1972 figures. In terms of total value, lead production increased 20.6% and zinc production increased 46.8%.

Wisconsin continued to produce a small amount of peat, which was used principally for seed inoculant.

The intensity of interest in the base metal sulfide potential of Wisconsin remained at a high level in 1973. Companies seeking rights to mineral deposits on county-owned land in Eau Claire and Clark Counties included Superior Mining Co., Houston, Tex. (1,300 acres northeast of Fairchild); Exxon Co., Denver, Colo. (400 acres near Augusta); and North Central Mineral Ventures Co., Edina, Minn., a combined venture of Superior Oil Co., General Crude Oil Co., and Midwest Oil Corp. (a large tract east of Augusta). In Marathon County, Exxon Co. was negotiating a prospecting agreement on 540 acres; in Marinette County, Duval Corp., a subsidiary of Pennzoil Corp., has a prospecting agreement on 5,880 acres.

International Minerals & Chemical Corp. discontinued field work in Iron County. According to reports to the County Commissioners, the company drilled a total of 26 inclined holes for a total of 12,783 feet. The deepest was 550 feet. The company stated that it was recessing work due to a lack of significant economic finds.

Until January 1973, exploration and mine development activities of Kennecott Copper Corp. in Wisconsin were conducted by Great Lakes Exploration Co., Inc., a Wisconsin corporation (which has been dissolved). Subsequent exploration activities are being conducted by Bear Creek Mining Co., Kennecott's domestic exploration subsidiary, and future mining operations will be conducted by Flambeau Mining Corp., a mining subsidiary of Kennecott. Bear Creek Mining Co. terminated its agreement to prospect on 1,320 acres of county forest land in Rusk County. The company informed Florence County that it would discontinue ore exploration there and would terminate its prospecting agreement covering county land; it reported only pyrite mineralization had been found and that the pyrite constituted less than 5% of the rock in a 30-foot thickness. The decision of whether to mine the Flambeau deposit, near Ladysmith, in Rusk

County will depend on a study of potential environmental impacts, on granting of all permits and plan approvals required by the Wisconsin Department of Natural Resources, and on economic conditions affecting the deposit and the copper industry in general.

Noranda Exploration Co., in conjunction with Selco Mining Corp., Ltd., both Canadian companies, has been engaged in exploration for base metals in Wisconsin since 1972. Airborne geophysical work and some ground work has been conducted.

Plans to develop a large "energy center" were announced by five Wisconsin electric utilities. The companies are: Wisconsin Electric Power Co. and its subsidiary, Wisconsin-Michigan Power Co.; Wisconsin Power & Light Co.; Wisconsin Public Service Co.; and Madison Gas & Electric Co. The first generating unit, tentatively scheduled for construction in 1980 or 1981, would have a capacity of 800,000 to 1,050,000 kilowatts and would cost more than $250 million. Early studies indicate a nuclear unit would be feasible.

Wisconsin Power & Light Co., Wisconsin Public Service Co., and Madison Gas & Electric Co. announced plans to build a jointly owned 527,000-kilowatt coal-fired generating plant at a cost of $136.6 million. The unit is to be built at the site of Wisconsin Power's Columbia plant near Portage.

The Wisconsin Electric Power Co. has plans for a proposed plant on Lake Michigan in southeastern Wisconsin. The facility could consist of one, two, or three coal-fired generators with a total capacity of 550,000 kilowatts.

The Burlington Northern Inc. ore docks at Allouez loaded 13,000 tons of Montana low-sulfur coal on a lake freighter. The coal was destined for Detroit Edison Co. for a test to determine the feasibility of using this source of coal in an existing utility plant. This is the third shipment of Montana coal from the port; the other two were 5,000 tons to Taconite, Minn., and 5,000 tons to Scotland.

Final agreement was reached on construction of a $25 million Great Lakes shipping facility in Superior to handle low-sulfur coal destined primarily for powerplants of the Detroit Edison Co. Loading facilities, with an annual capacity of 10 million tons, will consist of a circular spur track capable of handling two 110-car unit trains simultaneously. Low-sulfur coal from Montana and Wyoming will be hauled by Burlington Northern, Inc., to Superior. Construction was to begin in 1974 with completion scheduled for 1976.

Lakehead Pipe Line Co., Inc., Superior, announced plans to expand its crude oil terminal facilities to include a refined petroleum products terminal. Products to be shipped include gasoline, diesel fuel, and home heating oils. An extensive remodeling of the Lakehead marine terminal, necessitated by present-day shipping practices, also has been proposed. New pipes would be laid from the terminal site to the marine loading facility.

Michigan Wisconsin Pipe Line Co. expanded its agreement with North American Coal Corp. to include an additional 1.2 billion tons of lignite for future conversion into synthetic gas. Terms of the agreement were extended to Dec. 1, 1993. The reserves, now totaling 2.7 billion tons, could feed 12 gasification plants, each producing 250 million cubic feet per day, for 25 years.

Legislation and Government Programs.—The Upper Great Lakes Regional Commission provided a grant of $40,279 to develop informational materials on prospecting, mining, leases, and zoning to assist citizens, landowners, and local officials. The Wisconsin Geological and Natural History Survey has in process information circulars on mining and prospecting that will discuss for the layman the advantages and disadvantages of controlling mining by zoning, the legal aspects of leasing, and the various types of leases. In addition, the Survey operated a "mining hot line" designed to answer questions about prospecting, mining, and minerals in Wisconsin.

Under a $15,000 grant from the Federal Bureau of Mines, two nuclear engineers at the University of Wisconsin have begun work on a process that could permit mining of weakly magnetic taconite. The new technique involves a separator with powerful superconducting electromagnets that can separate taconites having 100 times weaker magnetic force than those previously separable. Using ore from the Jackson County Iron Co. mine at Black River Falls, the superconducting magnetic separator has been developed and tested on a small scale, and there are plans to produce a practical full-scale model of the separator within the next 2 years.

A mineral industry related bill, Assembly Bill 128 dealing with pollution discharge elimination, was passed by the State Legislature in 1973. This bill gives the Department of Natural Resources authority to issue permits required by the Federal Water Pollution Control Act. It will require, by July 1, 1977, that all point sources conform to the level of treatment attainable through the application of the best practicable control technology.

A new state pollution monitoring program requires persons and corporations to make regular reports of industrial wastes or hazardous substances they discharge into the air and water. A directory of pollution sources is being compiled from the reports and from monitoring by the Department of Natural Resources. The program is part of an antipollution law that requires payment of an annual $50 administrative charge when firms report discharges, plus fees up to $10,000 per year based on the amount of discharges.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Materials.—Baraboo Quartzite Co., Inc., produced deburring media from its quartzite deposit in Sauk County. Quantity and value of production increased over that of 1972.

Cement.—Shipments of portland cement increased 20.8% in quantity and 26.6% in value over those of 1972. Shipments of masonry cement, however, decreased 3.7% in quantity but increased 22.4% in value. As in 1972, Medusa Cement Co., a division of Medusa Corp., continued to produce portland white cement at its Manitowoc plant, and Marquette Cement Manufacturing Co. produced Types I and II (general use and moderate heat) and Type III (high-early-strength) portland cement and masonry cement at its Milwaukee plant. Universal Atlas Cement Div. of United States Steel Corp. and Huron Cement Div. of National Gypsum Co. continued operating their grinding facilities at Milwaukee, Milwaukee County, and at Superior, Douglas County, respectively.

Most of the cement shipments were to points in Wisconsin, with lesser amounts to other States. Ready-mix concrete companies were the major users of Wisconsin portland cement; lesser amounts were consumed by concrete product manufacturers, building material dealers, and highway contractors.

Clays.—Output of clay and shale in Wisconsin decreased for the seventh consecutive year. Only the Oakfield Shale Brick & Tile Co. in Fond du Lac County, which produced shale for its own use in making brick, had production in 1973.

Gem Stones.—Small quantities of semiprecious gem stones and mineral specimens continued to be collected from old mines, quarries, slag piles, and dumps. Estimated value of the materials found remained the same as in 1972.

Lime.—Wisconsin's 1973 lime output was 310,000 tons, a 17.9% increase over the previous record high set in 1972. CLM Corp. (formerly titled Cutler-LaLiberte-McDougall Corp.), Western Lime & Cement Co., and Rockwell Lime Co. produced lime in Brown, Dodge, Douglas, Fond du Lac, and Manitowoc Counties. Mayville White Lime Works discontinued use of its lime kiln in Dodge County early in 1973.

The lime was used for paper and pulp, mason's lime, basic oxygen furnaces, soil stabilization, food and food byproducts, agricultural lime, paint, water purification, sewage treatment, and other uses. It was consumed in Wisconsin, Minnesota, Illinois, other states, and Canada. Total consumption of lime in Wisconsin was 169,000 tons.

Perlite.—Expanded perlite was produced at Milwaukee and Appleton from crude material mined outside the State. Material was used for plaster aggregate, concrete aggregate, horticultural aggregates, masonry and cavity fill insulation, and perlite granules and fines. Sales decreased both in quantity and value from those of 1972.

Sand and Gravel.—Sand and gravel continued to be the largest mining industry in Wisconsin, representing 38.2% of the State's total mineral output value. Of the State's 72 counties, all but Iowa, Marquette, and Menominee Counties reported production. Counties with production of more than 1 million tons of sand and gravel, in descending order of quantity, were Waukesha, Eau Claire, Brown, Rock, Portage, Washington, Marathon, Dane, Sauk, Barron, Manitowoc, and Clark. Nationally, Wisconsin ranked 5th in quantity and 7th in value of sand and gravel produced.

Stone.—Stone production (consisting of basalt, granite, limestone and dolomite, sandstone, and quartzite) was 23.8 million tons valued at $36.9 million, exceeding the previous tonnage and value record set in 1972 by 22.8% and 24.4%, respectively. Among all mineral commodities produced in Wisconsin, stone ranked second in value, representing 32.3% of the State's mineral value. Production was reported from 53 of the State's 72 counties. Counties that produced more than 1 million tons, in descending order of quantity, were Waukesha, Marathon, Racine, and Dane.

Table 4.—Wisconsin: Lime sold or used by producers, by use

Use	1972		1973	
	Quantity (Short tons)	Value (Thousands)	Quantity (Short tons)	Value (Thousands)
Paper and pulp	105,200	$1,900	112,300	$2,130
Mason's lime	53,540	1,200	59,520	1,240
Basic oxygen furnace	6,460	117	10,380	196
Soil stabilization	6,630	149	9,339	194
Food and food byproducts	3,094	56	4,870	91
Agricultural lime	2,657	48	1,925	39
Paint	30	1	1,369	26
Other [1]	84,890	1,539	110,400	2,088
Total	262,501	[2] 5,009	310,103	6,004

[1] Includes water treatment, sewage treatment, copper ore concentration, electric steel furnaces, finishing lime, tanning, plastics, calcium carbide (1973), oil well drilling, sulfur removal from stack gases, other ore concentration, other metallurgy, insecticides, rubber (1973), petroleum refining, other chemical uses, fertilizer (1972), open-hearth steel furnaces (1972), and wire drawing (1972).
[2] Data do not add to total shown because of independent rounding.

Table 5.—Wisconsin: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	4,518	4,758	3,986	5,043
Fill	1,391	832	1,726	1,066
Foundry	38	157	155	536
Paving	2,241	2,184	2,059	1,875
Other uses [1]	1,213	3,183	1,502	4,177
Total [2]	9,403	11,115	9,430	12,696
Gravel:				
Building	4,822	5,300	5,242	6,524
Fill	1,513	1,018	1,158	633
Paving	7,421	6,172	11,366	12,002
Railroad ballast	121	105	W	W
Miscellaneous	456	431	942	984
Other uses	682	740	1,513	1,524
Total [2]	15,015	13,765	20,221	21,667
Government-and-contractor operations:				
Sand:				
Building	2,747	1,001	8	2
Fill	348	97	248	74
Paving	1,629	712	1,718	1,611
Other uses	483	179	665	372
Total [2]	5,206	1,989	2,639	2,058
Gravel:				
Building	1,205	632	92	47
Fill	355	59	320	93
Paving	5,240	3,761	7,531	7,079
Other uses	6	3	18	7
Total	6,806	4,455	7,961	7,226
Total sand and gravel [2]	36,430	31,324	40,250	43,647

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes railroad ballast (1972), blast, engine, filtration (1973), glass, molding, and other sands.
[2] Data may not add to totals shown because of independent rounding.

Table 6.—Wisconsin: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Barron	9	W	W	11	1,179	1,473
Bayfield	3	116	98	1	48	38
Brown	6	567	406	8	2,021	1,842
Buffalo	1	52	48	1	62	24
Burnett	2	W	W	1	174	143
Chippewa	5	500	335	6	772	751
Clark	3	887	731	5	1,053	965
Columbia	4	913	W	5	W	W
Crawford	2	W	W	3	252	W
Dane	19	1,388	1,778	18	1,303	2,364
Dodge	12	834	667	9	402	266
Door	6	450	536	5	433	W
Douglas	8	82	67	6	W	W
Dunn	2	W	W	1	66	48
Eau Claire	2	W	W	5	2,186	2,716
Florence	1	W	W	1	62	28
Fond du Lac	11	424	322	9	346	276
Grant	2	W	W	2	31	W
Green	4	W	W	3	60	57
Green Lake	4	221	361	7	409	691
Iron	2	W	W	2	W	27
Jackson	4	168	138	4	184	223
Jefferson	5	292	201	8	415	341
Juneau	1	W	W	1	35	3
Kenosha	6	237	197	5	217	154
Kewaunee	5	542	W	4	565	W
Lafayette	1	164	W	1	1	1
Langlade	2	W	W	2	173	149
Lincoln	5	489	477	5	613	564
Manitowoc	9	925	646	11	1,119	857
Marathon	9	395	407	12	1,329	1,512
Marinette	3	W	312	4	398	477
Marquette	6	118	W	--	--	--
Oconto	7	550	489	7	599	500
Oneida	8	536	458	9	630	761
Outagamie	3	W	385	3	W	W
Ozaukee	8	544	541	8	550	605
Pierce	7	124	257	6	233	394
Polk	7	W	W	7	417	491
Portage	3	653	691	6	1,576	1,813
Price	2	W	W	1	98	109
Racine	7	765	1,125	5	668	587
Richland	2	W	W	2	48	63
Rock	9	1,572	1,908	13	1,640	2,258
Rusk	3	420	331	3	W	323
St. Croix	1	233	97	2	W	W
Sauk	9	438	W	9	1,218	1,391
Sawyer	2	W	W	2	118	W
Shawano	7	321	286	7	499	438
Sheboygan	7	439	394	7	551	627
Taylor	3	262	257	5	408	377
Trempealeau	1	W	3	1	53	26
Vernon	2	78	46	2	W	91
Vilas	4	136	170	5	166	215
Walworth	15	914	680	12	W	W
Washburn	1	4	1	2	W	W
Washington	14	1,689	1,200	11	1,476	1,373
Waukesha	33	4,550	3,631	35	5,929	5,347
Waupaca	6	W	150	5	443	347
Waushara	3	W	W	3	213	218
Winnebago	8	W	W	8	W	744
Wood	2	333	81	1	342	188
Undistributed [1]	r 20	12,106	10,416	22	6,471	8,371
Total [2]	368	36,430	31,324	375	40,250	43,647

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Adams, Ashland, Calumet, Forest, La Crosse, Milwaukee, Monroe, Pepin, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 7.—Wisconsin: Limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousand dollars unless otherwise specified)

Use	1972		1973	
	Quantity	Value	Quantity	Value
Dimension:				
Rough architectural ____thousand cubic feet__	46	39	W	W
Irregular-shaped stone ____	11	178	11	166
Rubble ____	18	168	20	245
Cut stone ____thousand cubic feet__	31	67	9	W
House stone veneer ____do____	176	467	161	466
Sawed stone ____do____	24	83	15	53
Construction ____do____	94	127	80	135
Flagging ____do____	107	129	97	137
Other uses [1] ____do____	--	--	31	145
Total (thousand short tons) ____	68	1,260	63	1,347
Crushed and broken:				
Bituminous aggregate ____	1,044	1,268	1,366	1,843
Concrete aggregate ____	865	1,264	1,097	1,675
Dense graded road base stone ____	6,372	7,616	8,835	11,711
Macadam aggregate ____	945	1,300	668	969
Surface treatment aggregate ____	2,612	3,399	1,376	1,895
Unspecified construction aggregate and roadstone	2,614	3,872	4,708	6,304
Agricultural purposes [2] ____	670	1,349	625	1,277
Filter stone ____	17	39	W	W
Railroad ballast ____	W	W	172	231
Riprap and jetty stone ____	211	337	297	683
Other uses [3] ____	449	749	422	765
Total [4] ____	15,799	21,194	19,565	27,351
Grand total ____	15,867	22,454	19,628	28,699

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes monumental (1972) and rough blocks, and other rough stone.

[2] Includes agricultural limestone, and other soil conditioners.

[3] Includes stone used in manufactured fine aggregate (stone sand) terrazzo (1973), lime manufacture, flux, bedding material (1973), disinfectant and animal sanitation, fill, and other uses not specified. 1972 data also include stone used in acid neutralization, and drain fields.

[4] Data may not add to totals shown because of independent rounding.

Ivey Construction Co., headquartered in Mineral Point, Wis., continued to supply aggregate to southern Wisconsin. In 1973, the company operated quarries in Iowa and Lafayette Counties. Its main product is crushed stone in the minus ¾- to plus ½-inch range, but it also produces 1½-inch size, breaker run (3- to 4-inch size), and filter bed stone, which ranges from 2- to ½-inch sizes with the "fines" removed. In addition to road construction stone, the company supplies aggregate to hot-mix asphalt and ready-mix concrete plants.[2]

Sulfur (Recovered Elemental).—Murphy Oil Corp. completed a $1 million sulfur extraction plant at its Superior refinery in Douglas County. In late September, the first 100 tons of liquid sulfur was shipped by railroad tank car to a consumer in central Minnesota. The plant eliminates 95% of the sulfur from the firm's fuel gas supply; it reportedly[3] removes about 7 tons of sulfur per day. Costs of operating the extraction plant, according to the company, exceed the price received for the liquid sulfur.

Vermiculite.—Exfoliated vermiculite was produced by Construction Products Div. of W. R. Grace & Co. at Milwaukee, and by Koos, Inc., at Kenosha from crude material mined outside the State. The exfoliated material was used for loose fill insulation, fertilizer, horticulture, concrete aggregate, plaster aggregate, fireproofing, and other purposes.

METALS

Aluminum.—Vulcan Materials Co., Metals Div., continued to operate its secondary aluminum smelter in Milwaukee County. This smelter, located near Oak Creek, began operation in April 1969.

Copper.—Kennecott Copper Corp.'s decision to mine the Flambeau deposit in Rusk County will depend on the evaluation of the environmental impacts of the possible operation, on granting of all permits and

[2] Robertson, J. L. Portable Plant Serves 10-Quarry Operation. Rock Products, v. 76, No. 8, August 1973, pp. 36–37.

[3] The Evening Telegram, (Superior, Wis.). Refinery Sulphur Extraction Plant Now in Operation Here. Sept. 25, 1973, p. 2.

Table 8.—Wisconsin: Stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1972			1973			Kind of stone produced in 1973 [1]
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Barron	--	--	--	1	9	18	Limestone.
Bayfield	--	--	--	1	(2)	(2)	Do.
Brown	10	670	970	9	898	1,135	Do.
Buffalo	8	W	W	12	340	W	Do.
Burnett	1	W	W	1	W	W	Other stone.
Calumet	3	W	155	3	36	W	Limestone.
Clark	1	W	W	1	1	1	Granite.
Columbia	4	W	W	5	337	W	Limestone.
Crawford	9	252	252	13	404	504	Do.
Dane	23	1,255	2,036	26	1,388	1,972	Do.
Dodge	8	535	723	9	655	940	Do.
Door	4	W	W	3	64	62	Do.
Douglas	1	3	W	1	7	12	Traprock.
Dunn	3	43	58	1	50	44	Limestone.
Fond du Lac	13	347	912	13	580	1,360	Do.
Grant	18	714	927	34	980	1,177	Limestone, other stone.
Green	24	515	521	20	W	W	Limestone.
Green Lake	3	25	36	2	54	81	Do.
Iowa	19	443	418	17	532	494	Do.
Jackson	1	W	W	2	45	W	Do.
Jefferson	1	W	W	1	W	W	Do.
Juneau	2	W	W	2	W	W	Do.
Kewaunee	1	W	W	--	--	--	
La Crosse	2	W	W	7	439	541	Do.
Lafayette	20	573	509	19	524	473	Do.
Manitowoc	3	W	550	2	W	W	Do.
Marathon	16	1,767	3,560	19	2,527	4,069	Granite, quartzite, sandstone.
Marinette	1	W	W	2	W	W	Traprock.
Marquette	2	W	W	2	W	W	Granite, limestone.
Milwaukee	2	W	W	2	W	W	Limestone.
Monroe	8	W	W	7	W	W	Do.
Oconto	3	W	W	1	W	W	Do.
Outagamie	3	W	W	5	W	W	Do.
Ozaukee	2	W	W	1	W	W	Do.
Pepin	6	146	169	2	39	W	Do.
Pierce	12	W	W	10	351	440	Do.
Polk	2	W	W	2	W	W	Limestone, traprock.
Portage	--	--	--	1	(2)	3	Sandstone.
Racine	6	1,220	W	3	W	W	Limestone.
Richland	3	W	W	9	227	W	Do.
Rock	14	489	636	12	319	478	Do.
St. Croix	7	W	W	9	374	476	Do.
Sauk	9	709	923	12	W	W	Limestone, quartzite, sandstone.
Shawano	2	W	87	4	W	W	Limestone.
Sheboygan	1	4	25	1	3	24	Do.
Trempealeau	5	W	W	9	298	W	Do.
Vernon	12	W	W	27	W	W	Do.
Vilas	--	--	--	1	25	W	Granite.
Walworth	1	24	W	3	W	62	Limestone.
Washington	1	34	33	1	32	36	Sandstone.
Waukesha	23	2,270	3,419	29	2,726	4,419	Limestone.
Waupaca	2	21	36	2	38	82	Do.
Winnebago	15	W	W	3	744	1,152	Do.
Wood	2	79	117	3	104	143	Granite, sandstone.
Various	1	W	W	28	W	W	Limestone.
Undistributed	--	7,257	12,605	--	8,669	16,719	
Total [3]	343	19,394	29,681	415	23,818	36,917	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] "Limestone" used generally to include dolomite.

[2] Less than ½ unit.

[3] Data may not add to totals shown because of independent rounding.

plan approvals required by the State Department of Natural Resources, and on the economics of the deposit and the copper industry in general.

Iron Ore.—Jackson County Iron Co.'s mine and mill near Black River Falls continued to be the only iron ore mining operation in Wisconsin. The Precambrian iron formation at the mine site outcropped as an erosional remnant that formerly rose 150 feet above the surrounding plain. However, mining since 1969 has removed the mound and created a pit about 100 feet deep. The taconite consists primarily of quartz and magnetite that has been metamorphosed to the garnet-actinolite grade; it dips about 70° and ranges from 100 to 300 feet in thickness. Three tons of ore yields 1 ton of magnetite concentrate, which is pelletized to a product of 63.5% iron and 7% silica. Shipments of taconite pellets from the Black River Falls plant increased to 955,575 long tons in 1973. The pellets were shipped by rail to Inland Steel Co.'s Indiana Harbor Works in East Chicago, Ind.

Foundries.—Kohler Co., Kohler, Wis., planned to replace its entire iron foundry melting facilities with a $6.6 million system of electric induction furnaces. The 9,000-kilowatt furnaces replace cupolas. Both 30-ton melting furnaces and 60-ton holding furnaces were being installed. An automated control system employing closed-circuit television scanners is included in the project.

The Budd Co. planned to build a $4 million foundry plant at Marinette. The new 66,000-square-foot plant, which was scheduled to be in production by May 1974, would use electrical energy rather than coke for smelting. It would employ an isocure permanent mold process, a technically new procedure in high-volume molding of medium-sized castings. The foundry, when in full production, will be capable of producing 2 million disk brake rotor castings annually. The facility will provide an additonal source of disk brake castings for the company's disk brake plant at Clinton, Mich.

The Brillion Iron Works, Inc., Brillion, Wis., was nearing completion of a $4.3 million expansion that will increase its output 40%. Brillion produces about 500 tons per day, mostly gray iron castings, but its new 60,000-square-foot unit will add 200 tons per day of ductile iron castings. Equipment includes a 300-mold-per-hour blower unit; the molds are 18 inches square with a 6-inch drag and a 7-inch cope. It is a high-pressure green sand system. Melting is in two new 23-ton electric furnaces; they are backed up with a preheater designed to run on natural gas, fuel oil, or propane. The new unit also includes a mold conveyor and a shot-blaster. The preheater and furnaces are hooked up to an extensive air-exchanging and dust-collecting system. A baghouse will collect the dust. The new unit is situated near Brillion's Farm Equipment division and its other foundry units.

Two relatively small foundries that were planning new operations were Badger Iron Works in Menomonie (with a present capacity of 80 tons per month) and John Torrance & Son in La Crosse (125 tons per month). The latter firm was converting to all electric melting.

Grede Foundries, Inc., of Milwaukee, which in a program to eliminate air pollution, installed electric melting facilities about 4 years ago, questioned whether the resulting substantial increase in electric power consumption was to the best advantage of the total environment considering the energy crisis. According to the company, to increase dust and fume removal from 95% to 99% required a change from a 325-horsepower blower to a 650-horsepower blower, which increased power consumption nearly 100%. According to a survey by the Wisconsin Power & Light Co., increased demand in Wisconsin for electric energy was due largely to such environmental control efforts.

Iron Oxide Pigments.—Delta Oil Co., the only producer of finished iron oxide pigments in Wisconsin, continued production at its Milwaukee Plant in Milwaukee County. Output (as indicated by sales) declined substantially in 1973.

Lead and Zinc.—Output of 844 short tons of lead and 8,672 short tons of zinc (in terms of recoverable metal), compared with 757 short tons of lead and 6,873 short tons of zinc in 1972, represented increases of 11.5% and 26.2%, respectively. In terms of total value, lead production increased 20.6% and zinc production increased 46.8%. Average yearly weighted prices, used in calculating 1973 values in table 1, were 16.29 cents per pound for lead and 20.66 cents per pound for zinc, compared with 1972 average prices of 15.03 cents per pound for lead and 17.75 cents per pound for zinc.

Eagle-Picher Industries, Inc., reopened

the Bear Hole mine in Lafayette County in May 1973. This is essentially a group of properties west of Shullsburg, previously held by the American Zinc Co. (now Azcon Corp.). The latter company had dewatered the mine late in 1968 and operated it until September 10, 1970.

MINERAL FUELS

Coke.—Milwaukee Solvay Coke Co., a division of Pickands Mather & Co., continued to be the only coke producer in Wisconsin. Foundries were the principal consumers of coke in the State.

Peat.—Two companies were active during the year, Demilco, Inc., which produced humus peat in Waukesha County, and Superior Brand Peats, which produced moss and humus peat in Lincoln County. Total production in Wisconsin in 1973 was reported as 2,261 short tons. Sales totaled 1,959 short tons, an increase of 7.9% over the 1972 figure of 1,815 short tons; 98.4% of the peat sold was used for seed inoculant; the remainder was used for general soil improvement and for packing flowers, plants, and shrubs. Most of the peat was sold in packaged form.

Pipeline Construction.—Koch Industries, Inc., announced plans for a 160-mile, 10-inch pipeline from Superior to another Koch facility in the Twin Cities. The new 50,000-barrel-per-day line will carry butane and propane gases; it will replace present truck and rail shipments. Input to the line will be from Interprovincial Pipe Line Co., Edmonton, Canada, and its U.S. subsidiary, Lakehead Pipe Line Co., Inc.

Table 9.—Wisconsin: Mine production of lead and zinc

	1971	1972	1973
Mines producing: Lode	3	1	2
Material sold or traded: Zinc ore, thousand short tons	414	293	379
Production (recoverable):			
Lead, short tons	752	757	844
Zinc, do.	10,645	6,873	8,672
Value:			
Lead, thousands	$207	$228	$275
Zinc, do.	3,428	2,440	3,583
Total, do.	3,635	2,668	3,858

Table 10.—Principal producers

Commodity and Company	Address	Type of activity	County
Abrasive stone:			
Baraboo Quartzite Co., Inc.	Box 123 Baraboo, Wis. 53913	Quarry; stationary plant.	Sauk.
Aluminum smelter:			
Vulcan Materials Co., Metals Div.	9100 South Fifth Ave. Oak Creek, Wis. 53135	Plant	Milwaukee.
Cement:			
Marquette Cement Manufacturing Co.	20 N. Wacker Dr. Chicago, Ill. 60606	Portland and masonry, dry process.	Do.
Medusa Cement Co., division of Medusa Corp.	Box 5668 Cleveland, Ohio 44101	White, dry process	Manitowoc.
Clays and shale:			
Oakfield Shale Brick & Tile Co.	Oakfield, Wis. 53065	Pit and plant	Fond du Lac.
Coke:			
Milwaukee Solvay Coke Co., division of Picklands Mather & Co.	311 E. Greenfield Ave. Milwaukee, Wis. 53204	Coke ovens	Milwaukee.
Iron ore:			
Jackson County Iron Co., subsidiary of Inland Steel Co.: Black River Falls	30 W. Monroe St. Chicago, Ill. 60603	Mine, concentrator, agglomerator.	Jackson.
Iron-oxide pigments, finished:			
Delta Oil Co	6263 Teutonia North Milwaukee, Wis. 53209	Plant	Milwaukee.
Lead and zinc:			
Eagle-Picher Industries, Inc.:			
Bear Hole	Box 406 Galena, Ill. 61036	Mine	Lafayette.
Shullsburg		Mine and mill	Do.

Table 10.—Principal producers—Continued

Commodity and Company	Address	Type of activity	County
Lime:			
C L M Corp	12th Ave. & Waterfront Duluth, Minn. 55802	Quick and hydrated, 2 rotary kilns, 1 continuous hydrator.	Douglas.
Rockwell Lime Co	Route 4 Manitowoc, Wis. 54220	Quick and hydrated, 1 rotary kiln, 1 continuous hydrator.	Manitowoc.
The Western Lime & Cement Co.:			
Green Bay plant	Box 2076 Milwaukee, Wis. 53201	Quick and hydrated, 5 shaft kilns, 1 batch hydrator.	Brown.
Knowles plant	----------	Hydrated, 5 shaft kilns, 1 continuous hydrator.	Dodge.
Eden plant	----------	Quick and hydrated, 5 shaft kilns, 1 batch hydrator.	Fond du Lac.
Peat:			
Demilco, Inc., division of Nitragin Sales Corp.	3101 W. Custer Ave. Milwaukee, Wis. 53209	Bog, processing plant	Waukesha.
Perlite, expanded:			
Midwest Perlite Co	912 College Ave. Appleton, Wis. 54911	Processing plant	Outagamie.
Zonolite Division, W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	----do----------	Milwaukee.
Petroleum refinery:			
Murphy Oil Corp	200 Jefferson Ave. El Dorado, Ark. 71730	Refinery	Douglas.
Sand and Gravel:			
American Materials Corp.	104 Gibson St. Eau Claire, Wis. 54701	Pit; dredge, portable and stationary plants.	Dunn, Eau Claire.
Janesville Sand & Gravel Co.	1110 Harding St. Janesville, Wis. 53545	Pit; stationary plant	Rock.
J. William Kennedy & Son.	P.O. Box 813 Janesville, Wis. 53545	Pits; portable plants	Green, Rock. Walworth.
Edward Kraemer & Sons, Inc.	Plain, Wis. 53577	Pits; portable plants	Barron, Bayfield, Brown, Chippewa, Dane, Douglas, Eau Claire, Jackson, Kenosha, Lincoln, Oconto, Oneida, Ozaukee, Polk, Racine, Sauk, Sawyer, Sheboygan, Walworth, Washington, Waukesha, Waushara.
C. C. Linck, Inc	1226 N. Center St. Beaver Dam, Wis. 53916	----do----------	Dodge, Fond du Lac, Marquette, Oneida, Sheboygan.
Manley Sand Div., Martin Marietta Corp.	Rockton, Ill. 61072	Pit; stationary plants; industrial sand.	Columbia.
Plautz Brothers, Inc	Route 1 Willard, Wis. 54493	Pit; stationary plant	Clark.
A. Overgaard Inc	Box 87 Elroy, Wis. 53929	Pits; portable and stationary plants.	Various.
Schuster Constr. Co	300 Elizabeth St. Green Bay, Wis. 54302	Pits; stationary plants	Brown, Kewaunee.
Stone:			
Granite:			
Anderson Bros. & Johnson Co.	Box 26 E. Mason St. Wausau, Wis. 54401	Quarries; stationary plant.	Marathon.
Ben Gottschalk, Inc.	Route 2 Edgar, Wis. 54426	Quarries; portable plant.	Do.
Lawrence Ladick, Inc.	Route 1 Vesper, Wis. 54489	Quarry	Do.
Lake Wausau Granite Co.	Box 397 Wausau, Wis. 54401	Quarry; stationary plant	Do.

Table 10.—Principal producers—Continued

Commodity and Company	Address	Type of activity	County
Stone:—Continued			
Limestone and dolomite:			
Courtney & Plummer, Inc.	Box 351 Neenah, Wis. 54956	Quarries; stationary and portable plants.	Calumet, Winnebago.
Daanen & Janssen	124 S. Huron St. De Pere, Wis. 54115	Quarries; portable plants.	Brown.
Franklin Stone Products, Inc.	7220 S. 68th St. Hales Corners, Wis. 53130	Quarry; stationary plant.	Milwaukee.
Halquist Lannon Stone Co.	Sussex, Wis. 53089	Quarries; stationary plant.	Waukesha.
Edward Kaemer & Sons, Inc.	Plain, Wis. 53577	Quarries; portable plants.	Buffalo, Columbia, Crawford, Jackson, Juneau, La Crosse, Marquette, Pepin, Pierce, Richland, St. Croix, Sauk, Trempealeau, Vernon.
Arthur Overgaard, Inc.	Box 87 Elroy, Wis. 53929	Quarries; stationary and portable plants.	Juneau, La Crosse, various counties.
Vulcan Materials Co., Midwest Division.	P.O. Box 6 Countryside, Ill. 60525	Quarries; stationary plants.	Milwaukee, Racine, Waukesha, Winnebago.
Waukesha Lime & Stone Co.	Box 708 Waukesha, Wis. 53186	Quarry; stationary and portable plants.	Waukesha.
Wingra Stone Co. Inc. Steward Watson Construction Co.	Route 2, Box 4284 Madison, Wis. 53711	Portable plants	Dane.
Quartzite:			
Foley Bros., Inc	450 Endicott Bldg. on 4th St. Paul, Minn. 55101	Quarry; stationary plant.	Sauk.
Minnesota Mining & Manufacturing Co.	2501 Hudson Rd. St. Paul, Minn. 55119	Quarries; stationary plant.	Marathon.
Sandstone:			
Ellis Quarries, Inc	Stevens Point, Wis. 55481	----do----	Marathon, Portage, Wood.
Traprock (basalt):			
Bryan Dresser Trap Rock, Inc.	Box 215 Chaska, Minn. 55318	Quarry; stationary and portable.	Polk.
GAF Corp	Pembine, Wis. 54156	Quarry; stationary plant.	Marinette.
McLean Construction Co.	314 Ogden Ave. Superior, Wis. 54880	Quarry; portable plant	Douglas.
Sulfur, recovered elemental:			
Murphy Oil Corp	200 Jefferson Ave. El Dorado, Ark. 71730	Byproduct sulfur recovery.	Do.
Vermiculite, exfoliated:			
Koos Inc	4500 13th Court Kenosha, Wis. 53140	Processing plant	Kenosha.
Construction Products Div., W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	----do----	Milwaukee.

The Mineral Industry of Wyoming

By Roger A. Diedrich [1]

Wyoming's mineral industry upheld its previous position as a significant factor in the economy of the State in 1973. The total value of mineral production during the year rose to $928 million compared with $747 million in 1972, a 24% increase. This placed the per capita value of production at about $2,795. The principal minerals, according to value, were crude oil, sodium carbonate, uranium, natural gas, and coal. Mineral fuels, including natural gas liquids and uranium, were valued at about $766 million or 83% of the total value.

Crude oil production in Wyoming was again ranked fifth in the Nation and first in the Rocky Mountain Region, with total production and value increasing over the previous year. However, natural gas liquids declined slightly in production, but increased in value.

The Wyoming coal industry is going through a dramatic revival, with value of output increasing nearly 50% over that of 1972. New production records were set, placing the State ninth in national ranking. Almost all of the coal is produced from strip mining operations. The low-sulfur quality of the coal is causing greater amounts of it to be shipped eastward where it is used for generation of electric power. Up to 17 new operations by existing and new companies are being studied, planned, or constructed, all involving the increased production and/or consumption of coal.

Uranium production and value increased for the year making Wyoming the Nation's primary source of recoverable U_3O_8. The State continued to rank second in reserves in the Nation. It's sodium carbonate production and reserves ranked first nationally and internationally with production and value increasing. Existing companies are continuing expansion activities and one new company is making plans for a plant.

[1] General engineer, Division of Fossil Fuels—Mineral Supply.

Acknowledgment is made for contributions by the late Walter E. Burleson, Bureau of Mines, State Liaison Officer, Cheyenne, Wyo.

Table 1.—Mineral production in Wyoming [1]

Mineral		1972 Quantity	1972 Value (thousands)	1973 Quantity	1973 Value (thousands)
Clays	thousand short tons	1,873	$18,509	2,343	$24,043
Coal (bituminous)	do	10,928	40,898	14,886	60,939
Feldspar	short tons	W	W	2,588	56
Gem Stones		NA	142	NA	142
Gypsum	thousand short tons	W	W	312	1,348
Iron ore (usable)	gross weight, thousand long tons	2,030	W	2,070	W
Lime	thousand short tons	W	W	30	548
Natural gas	million cubic feet	375,059	60,760	357,731	64,749
Natural gas liquids:					
Natural gas and cycle products	thousand 42-gallon barrels	3,015	8,951	3,351	10,647
LP gases	do	7,691	15,536	7,237	22,507
Petroleum (crude)	do	140,011	432,071	141,914	541,820
Sand and gravel	thousand short tons	9,098	14,916	6,201	11,635
Stone	do	3,549	5,768	3,191	6,716
Uranium (recoverable)	thousand pounds	8,544	53,827	10,060	65,390
Value of items that cannot be disclosed: Cement, phosphate rock, pumice, sodium carbonates, and sulfates, and values indicated by symbol W		XX	95,365	XX	117,565
Total		XX	746,743	XX	928,105
Total 1967 constant dollars		XX	616,138	XX	p 681,415

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Wyoming, by county [1]

(Thousands)

County	1972	1973	Minerals produced in 1973 in order of value
Albany	$6,722	$6,542	Cement, petroleum, clays, stone, sand and gravel, gypsum, iron ore.
Big Horn	26,462	21,849	Petroleum, clays, natural gas, gypsum, lime, sand and gravel.
Campbell	131,300	160,493	Petroleum, natural gas, natural gas liquids, coal, sand and gravel, pumice.
Carbon	52,584	67,024	Uranium, coal, natural gas liquids, natural gas, petroleum, sand and gravel.
Converse	26,493	36,433	Petroleum, coal, natural gas liquids, uranium, natural gas, sand and gravel.
Crook	19,642	23,882	Petroleum, clays, natural gas liquids, stone, natural gas, sand and gravel.
Fremont	88,360	99,804	Petroleum, uranium, iron ore, natural gas, natural gas liquids, sand and gravel, stone, feldspar.
Goshen	381	359	Lime, sand and gravel, petroleum.
Hot Springs	28,729	37,942	Petroleum, natural gas, coal, sand, and gravel.
Johnson	15,513	17,416	Petroleum, clays, natural gas, natural gas liquids, sand and gravel.
Laramie	3,661	3,660	Stone, petroleum, sand and gravel, natural gas.
Lincoln	16,130	21,824	Coal, natural gas liquids, phosphate rock, natural gas, sand and gravel, petroleum.
Natrona	53,294	75,204	Petroleum, uranium, natural gas, natural gas liquids, sand and gravel, clays, stone.
Niobrara	2,434	1,829	Petroleum, natural gas, sand and gravel.
Park	94,030	115,489	Petroleum, natural gas, natural gas liquids, gypsum, sand and gravel, stone.
Platte	5,014	5,636	Iron ore, stone, sand and gravel.
Sheridan	4,671	3,253	Coal, petroleum, stone, sand and gravel, natural gas.
Sublette	25,217	24,327	Petroleum, natural gas, sand and gravel, natural gas liquids.
Sweetwater	109,718	129,631	Sodium carbonate, petroleum, natural gas, coal, sand and gravel, natural gas liquids, pumice.
Teton	W	W	Stone, sand and gravel.
Uinta	1,425	1,521	Natural gas, natural gas liquids, clays, sand and gravel, stone, petroleum.
Washakie	10,850	12,606	Petroleum, natural gas, natural gas liquids, lime, sand and gravel, stone.
Weston	13,806	13,766	Petroleum, clays, natural gas, sand and gravel.
Undistributed [2]	10,306	47,620	
Total [3]	746,743	928,105	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Value of petroleum is based on an average price per barrel for the State. County data for uranium is estimated for 1973.

[2] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Wyoming business activity

		1972	1973 [p]	Change, percent
Employment and labor force, annual average:				
Total labor force	thousands	NA	155.9	NA
Unemployment	do	NA	5.2	NA
Nonagricultural employment:				
Mining	do	11.8	12.1	+2.5
Contract construction	do	9.8	12.3	+25.5
Manufacturing	do	7.6	7.6	--
Government	do	34.4	32.2	−6.4
Services	do	17.7	19.3	+9.0
Wholesale and retail trade	do	25.5	26.9	+5.5
Transportation and public utilities	do	11.1	11.5	+3.6
Finance, insurance, and real estate	do	3.7	3.7	--
Personal income:				
Total	millions	$1,494	$1,699	+13.7
Per capita		$4,330	$4,813	+11.2
Construction activity:				
Number of new residential units authorized		2,078	2,501	+20.4
Value of authorized nonresidential construction	millions	$14.8	$15.1	+2.0
Highway construction contracts awarded	do	[e] $46.0	$39.4	−14.3
Cement shipments to and within Wyoming	thousand short tons	196	206	+5.1
Farm marketing receipts	millions	$356.2	$402.1	+12.9
Mineral production value	do	$746.7	$928.1	+24.3

[p] Preliminary. [e] Estimated. NA Not available.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; U.S. Bureau of Mines.

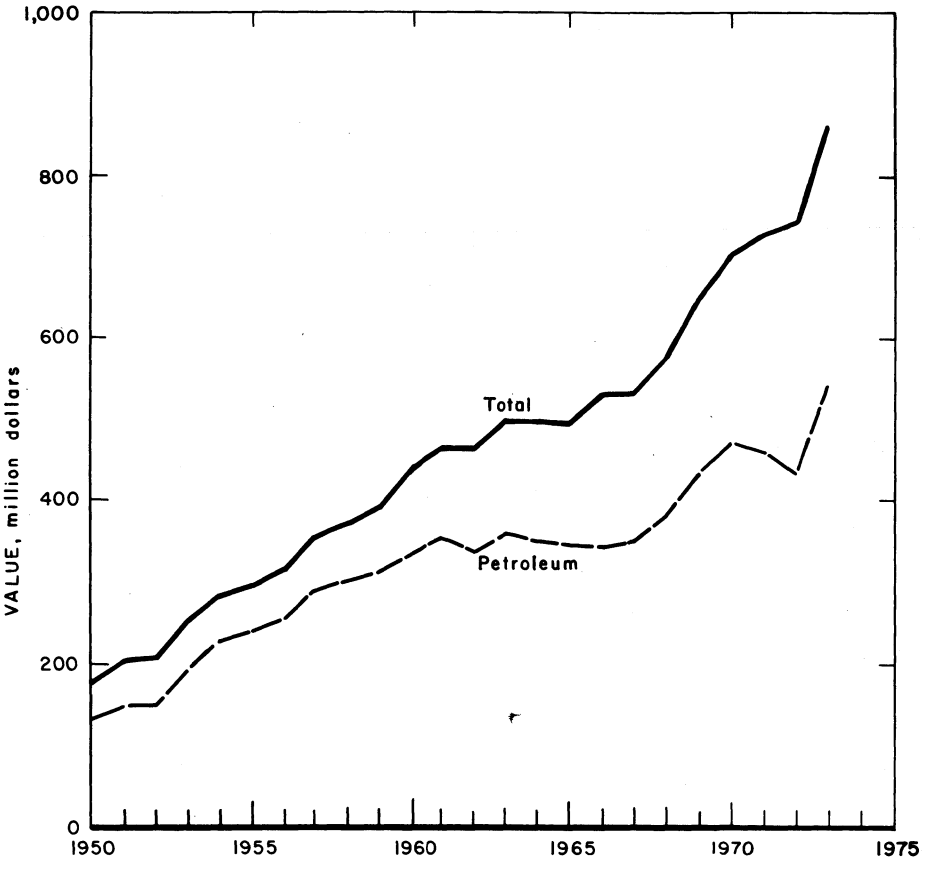

Figure 1.—Value of petroleum and total value of mineral production in Wyoming.

Reclamation of surface-mined and waste-covered areas was continued by the mining industry. During 1972, the most recent year for which information was available, 3,201 acres were affected by surface mining. This was 17% more acreage than that mined in 1971. During the same year, 1,685 acres were reclaimed, a 10% decline from the acreage reclaimed in 1971. Normally about 1 year lapses between mining and reclamation. The coal sector comprised about 36% of the land surface mined and 33% of the reclamation for the year. In addition, an estimated 21,142 acres were utilized for storage of mineral and solid fuel wastes generated during the year. Coal mining was responsible for 4,544 of these acres. During the same period, 6,570 acres of mineral waste areas were reclaimed, of which 1,698 were by the coal sector.

Table 4.—Wyoming: Estimated acreage of surface mined and reclaimed land

Commodity	1971		1972	
	Surface mined	Reclaimed	Surface mined	Reclaimed
Clay	434	305	608	380
Coal	1,016	728	1,142	555
Gypsum	4	--	9	--
Iron ore	120	97	1	14
Phosphate	30	8	12	--
Sand and gravel	133	45	188	73
Stone	16	--	19	4
Other and unknown	984	692	1,222	659
Total	2,737	1,875	3,201	1,685

Source: Wyoming Department of Environmental Quality Land Division.

Data on fuel and energy consumption by States, indicated Wyoming's 1972 consumption was 4.8 million tons of coal, 17.5 million barrels of petroleum products, 121.2 billion cubic feet of natural gas, and 1.2 billion kilowatt-hours of hydrogenerated electricity.[2] The total amount of electricity produced was 8.2 billion kilowatt-hours. For each fuel the major consumption sectors and comparable energy values were as follows: Coal—electric power generation, 4.5 million tons (101.7 trillion Btu); petroleum products—transportation, 11 million barrels (59.4 trillion Btu), household and commercial, 3.8 million barrels (20.2 trillion Btu); natural gas—industrial, 74.3 billion cubic feet (76.6 trillion Btu), household and commercial, 38 billion cubic feet (39.2 trillion Btu). Gross energy consumption totaled 340.7 trillion Btu and net energy consumption was 236.5 trillion Btu, equivalent to 684 million Btu per capita.

Legislation and Government Programs.—The 42d Legislature which met in January and February acted on numerous bills affecting the mineral industry. A major effort was placed on passing the Environmental Quality Act which included air, water, and land quality divisions.[3] A director, appointed by the Governor, appointed an administrator for each division. The Governor, with the advice of the Senate, has appointed a seven-member Environmental Quality Council and also has appointed a five-member advisory board for each of the three divisions. The council and advisory boards each meet four times per year. The director of the act, in addition to duties related to the three major divisions, is designated the coordinator of all State agencies concerned with solid waste management and disposal. The act became effective on July 1, and all other air, water, and land acts were revoked on that date. Under actions taken so far by the Environmental Quality Council, new mining permits are to be issued which will make it mandatory that areas to be mined be approved to avoid disturbance of historical, archaeological, and natural sites. Also, current mining operations have 1 year to submit mining reclamation plans to the land division of the council.

In other actions by the Legislature, the Wyoming Land Use and Conservation Commission was created. This commission is to recommend land use planning legislation for consideration by the 1975 Legislature. Other bills which passed were one which permitted approved internal combustion engines in underground mines and an occupational health and safety bill. Bills which were killed during the 1973 session included those which dealt with the 1973 water code, joint planning by private and public power companies for construction of generation facilities, radiation control, prohibition of mining under cities and towns, and increasing the mineral severance tax. Also, three mined land reclamation bills were temporarily shelved.

The Wyoming Public Service Commission has approved applications for the issuance of air pollution control bonds in Sweetwater County, with the proceeds to be used for control equipment at the Jim Bridger Power Plant. The companies constructing the plant, Pacific Power and Light Co. and Idaho Power Co., will in-

[2] Crump, L. H. and Readling, C. L. Fuel and Energy Data, United States by States and Regions, 1972. BuMines I.C. 8647, 1974, 82 pp.

[3] Wyoming Senate. Wyoming Environmental Quality Act, Enrolled Act No. 107. Original Senate File No. 135, secs. 35–502.1 through 35–502.56, 1973, 105 pp.

stall the equipment and then lease it to the county and the county will sublease it back to the companies. The director of the Air Quality Division has reported that due to a manpower shortage, the Federal Government will have to retain the permit program for potential air pollution sources in Wyoming.

The Atomic Energy Commission (AEC) responded to public inquiries concerning a mill tailing pile near Riverton with a survey and determined that the blowing of tailings does not present a hazard. However, the Federal Environmental Protection Administration (EPA) has recommended that the pile be stabilized and it is being leveled and seeded.

The Wyoming Air Resources Council has submitted proposed compliance schedules to the EPA for about 200 air pollution point sources throughout the State. The schedules are for particulate emissions only with the sources categorized as construction and affiliated industries, mining and minerals, municipalities, refineries, powerplants, and miscellaneous.

The Interdepartmental Water Conference, which was formalized by the 1973 legislature, decided to continue a priority study of northeast Wyoming under the State water planning program. That study, released later in the year by the State Engineer's Office, indicated that extensive development will be needed to meet future water requirements, especially for the coal industry.

The Department of Watershed Management in the College of Agriculture of the University of Arizona is conducting a research project on the hydrology of mined areas in Wyoming. Preliminary results indicate that chemically and physically the soil material of the mined areas compares favorably with that of the natural areas.

The Dow Chemical Co. was awarded a $721,771 contract by the U.S. Bureau of Mines for backfilling an abandoned coal mine which extends under much of the city of Rock Springs in Sweetwater County. The operation, which is classified as a research and demonstration program, involves pumping existing water out, mixing it with sand to form a slurry, and reinjecting it into the seam. The work is to be completed by winter.

A $10,000 grant financed by the Federal Environmental Education Act was awarded to two Kelly Walsh High School teachers at Casper. The money will be used by students in conducting an environmental impact study of the Dave Johnston Power Plant, east of Casper.

Researchers at the University of Wyoming's Natural Resources Research Institute have reported the successful conversion of solid wastes into natural gas. The reaction, consisting of combining steam with waste materials in the presence of catalysts, produced about 6 cubic feet of synthetic natural gas with a heating value in excess of 900 Btu per cubic foot.

A preliminary draft of a report on population growth in the Powder River Basin was released by the Department of Economic Planning and Development (DEPAD).[4] The report indicates that very rapid growth can be anticipated in the northeast part of the State. The population of the eight counties studied is expected to double in 20 years from their 1970 level of 107,000. Four counties, Campbell, Converse, Johnson, and Sheridan, are expected to absorb most of the impact of mineral development. The Division of Business and Economic Research at the University of Wyoming is conducting a DEPAD sponsored survey to gather information on the desires, intentions, and present social and economic characteristics of the people of Wyoming. The data will be used in planning for optimum use of manpower and educational resources in areas of development. Other areas of Wyoming are feeling the effects of rapid growth, such as Rock Springs, which is undergoing a serious housing shortage.

The joint Mines Minerals and Industrial Development Committee is exploring ways to provide communities with relief from the impact of major industry and the influx of a large work force. Legislation which is being explored includes payment of industry taxes before starting production, permitting the transfer of tax money across county lines, allowing municipalities to issue revenue bonds to be purchased by the incoming industry, and requiring companies to furnish employment and housing forecasts.

According to the State Mine Inspector, employment in the Wyoming mining industry rose from 6,116 persons in 1972 to 6,908 in 1973, a 13% increase. An ad-

[4] Ellis, D. L., and others. Powder River Basin Report. Wyoming Department of Economic Planning and Development, Mineral and Planning Divisions, preliminary draft 1973, p. 19.

ditional estimated 500 people work solely in mineral exploration. These figures do not include employment in crude oil and natural gas production and services. The industry-wide frequency of disabling injuries improved for 1973 along with the severity of coal-related injuries. However, the severity of noncoal injuries increased, pushing the total slightly higher.

The University of Wyoming has reestablished a mineral engineering department after being without one for 40 years.[5] The department was formed by combining the petroleum and chemical engineering programs with the coal conversion project of the Natural Resources Research Institute. The old core of mathematics, chemistry, physics, and geology was retained.

Several pertinent publications, articles, and maps were released during the year.[6] Reports pertaining to specific minerals are listed in the various reviews by mineral commodities.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—The State's coal mining industry continued to set new records in 1973 with production of 14.9 million tons compared with 10.9 million tons in 1972, an increase of 36%. The value of the coal produced rose from $40.9 million to $60.9 million, a 49% increase over that of 1972 and more than two times the value in 1971.

Wyoming moved up one position to ninth place in the national ranking, replacing Tennessee. In 1971, 98% of Wyoming's production was from strip mining compared with 96% in 1972. The increases in total production and percent of strip-mined coal both occurred in conjunction with a reduction in strip mine operations from 13 to 12. The number of underground mines held constant at five. The rapid growth in strip mine production was due primarily to increases in output from Carbon, Campbell, and Lincoln Counties. According to the Annual Report of the State Inspector of Mines of Wyoming, Carbon County production rose from 4.2 million tons to 6.8 million tons, while Campbell County production rose from about 656,000 tons to 1.6 million tons. Lincoln County production rose from 2.1 to 2.9 million tons. In contrast, production in Sheridan and Sweetwater Counties dropped to less than half of 1972 output. Sweetwater County had been the location of Rocky Mountain Associated Coal Company, which ceased operations, thereby reducing the total number of coal producing companies to 14.

[5] Riverton Ranger. V. 67, No. 76, June 14, 1973, p. 7-C.

[6] Goodier, J. T., M. E. Loomis, and R. E. Harris. 1973 Wyoming Mineral Yearbook. State Dept. Economic Planning and Development, 1973, 72 pp.

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Table 5.—Wyoming: Bituminous coal production in 1973, by type of mine and county
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines			Production (thousand short tons)			Value (thousands)
	Underground	Strip	Total	Underground	Strip	Total	
Campbell	--	2	2	--	W	W	W
Carbon	1	4	5	315	6,530	6,845	$28,808
Converse	--	2	2	--	2,899	2,899	11,155
Hot Springs	2	--	2	7	--	7	W
Lincoln	--	2	2	--	W	W	W
Sheridan	--	2	2	--	463	463	1,853
Sweetwater	2	--	2	103	--	103	1,646
Undistributed	--	--	--	--	4,570	4,570	17,479
Total [1]	5	12	17	425	14,461	14,886	60,939

W Withheld to avoid disclosing individual company confidential data.
[1] Data may not add to totals shown because of independent rounding.

The distribution of Wyoming coal was widespread, with nearly 60% of the output going to markets in 16 States and Canada.[7] About 92% of the total production was used in powerplants, with other uses, in descending order, being coke manufacture, beet sugar processing, and space heating. Currently, five to six unit trains per week serve markets in Chicago, Sioux City, Kansas City, and Pueblo, Colo. Several more unit trains are planned to operate within Wyoming and to such points as Cason, Tex.; Milwaukee, Wis.; East St. Louis, Ill.; Sullivan, Ind.; Wheatfield, Ind.; San Antonio, Tex.; St. Clair, Mich.; Muskogee, Okla.; Hammond, Ind.; Siloan Springs, Ark.; Sutherland, Neb.; Amarillo, Tex. and Redfield, Ark.

Four out of 14 companies produced 79% of Wyoming's total annual coal output. These companies, as reported by the State Inspector of Mines, were Arch Mineral Corp., which produced 4.4 million tons from the Seminoe Number 1 and Number 2 mines; Kemmerer Coal Co., which produced 2.9 million tons from the Elkol and Sorensen mines; Pacific Power and Light Co., which was responsible for 2.9 million tons from their Dave Johnston mine; and Rosebud Coal Sales Co., which produced 1.5 million tons at the Rosebud 4A mine.

Arch is joining with the Rosebud Coal Co. in building a 7-mile railroad loop which will serve mines operated by the companies. Rosebud is also constructing a new loadout system.

Pacific Power and Light Co. continued production from the Dave Johnston mine, a captive producer for the Dave Johnston steam electric plant in Converse County. Progress continues on the new Jim Bridger electric power plant, now nearly one-third complete. Over 2,500 workers are striving to complete the three 500-megawatt units, one each year starting in 1974 through 1976. Discussions have begun on a possible fourth unit to be completed in 1978. Feedwater for the plant will be supplied from the Fontenelle Reservoir at the rate of 35,000 acre-feet per year and a cost of $6.50 per acre-foot.

During the year, the Public Service Commission announced its approval of the 330-megawatt coal-fired air-cooled powerplant near Wyodak in Campbell County. The plant, owned 40% by Black Hills Power and Light Co. and 60% by Pacific Power and Light Co., will consume up to 200 tons of coal per hour at capacity. The AEC has entered into an agreement with the power companies for operation of a dry-cooling-tower test facility as part of their applied technology in the energy program. The AEC will pay the estimated $3 million for construction and operation for 5 years of the dry-cooling tower. Three monitoring programs at the plant will analyze the quality of air, water, and animal and vegetable life. Construction will begin in 1974 and will be completed by 1977. In addition to these plants in the construction or advanced planning stages, there are additional plants in early conceptual stages. A 1,200-megawatt station is under consideration by the Midwest Electric Consumers Association. It probably will be located near Wheatland in Platte County and will obtain coal by rail from the Gillette area and water from either the Laramie or Platte River. The Tipperary Coal Company is also planning

[7] Mining Record. Second Annual Western Coal Edition. V. 84, No. 13, Mar. 28, 1973, p. 3.

a 1,200-megawatt plant which will be located in Johnson County. The company has applied for permits to drill water wells on State land. Finally, the Utah Power and Light Co. has filed an application with the Public Service Commission to construct an additional 830-megawatt capacity at its Naughton plant at Kemmerer. The total amount of capacity which is planned or under construction in Wyoming is approximately 5,500 megawatts, or three times the installed capacity at the end of 1973.

Amax Coal Co. in Campbell County began regular shipments by unit train to the Comanche Powerplant in Pueblo, Colo. in July. Loading at the Belle Ayr mine is accomplished at one of two silos, requiring about 3 hours for a 110-car train. A second-unit train operation, to begin in 1974, will operate between Gillette and East St. Louis, Ill., for transshipment by barge over the Ohio system to powerplants in Indiana and possibly West Virginia. The mine produced nearly 0.9 million tons for the year, according to the State Mine Inspector. Amax has been granted a 9-month drilling option for evaluation of a 30-square-mile (19,305-acre) section of coal holdings by Titan Wells, Inc. If Amax exercises the option and develops the reserves on the Powder River Basin property, the firm would have one of the largest strip mining operations in the world. Meadowlark Farms, a subsidiary of Amax, contracts for agricultural use of the mining property before operations begin and is also responsible for a major part of the reclamation. By the end of 1973, about 130 acres had been reseeded.

Besides the new activities of established companies, there are a number of newly established and existing companies which are planning and preparing for first ventures into coal development operations in Wyoming.

Atlantic Richfield Co. has announced plans to operate a strip mine in Campbell County, about 40 miles south of Gillette. The first shipment from the 7,000-acre Black Thunder mine is scheduled to go to Southwest Public Service Co. in Amarillo. Tex., in the fall of 1975. Additional contracts are held with Nebraska Public Power District in Wallace, Nebraska and Oklahoma Gas and Electric Co. in Muskogee, Okla. Fluor Utah, Inc. has been retained to do an engineering and design study. An extensive environmental program with researchers from the University of Wyoming is being conducted. The mine will eventually employ up to 250 persons.

Texaco, Inc. made an initial leap into the coal industry with their purchase of coal deposits and water rights from Reynolds Aluminum Co. In exchange for an estimated 2 billion tons of reserves, Texaco agreed to pay an initial $25 million plus $12 million annually for the first 10 years. The seams lie up to 250 feet below the surface, range from 50 to 250 feet in thickness and are 95% recoverable by surface mining methods, according to Texaco officials. Plans have not been officially announced but the operation will likely involve coal gasification or coal liquefaction. The operations, located on properties covering 37,000 acres in Johnson and Sheridan Counties near Lake DeSmet Reservoir, will be capital intensive, using only a small work force.

Kerr-McGee Corp. has scheduled mine construction to commence in 1975 for its strip mine in Converse County. The company will supply steam coal to several utilities. Arkansas Power and Light Co. will purchase up to 5 million tons annually for 20 years and a 10-year optional extension. The cost to the plant to be built near Redfield will be up to $300 million. Also purchasing coal from Kerr McGee is central Louisiana Electric Company, Inc. They will spend up to $100 million to supply their proposed 550-megawatt plant to be operating by late 1978 or 1979. The company has an additional contract with Gulf States Utilities to purchase 50 million tons over 20 years starting in 1977.

Carter Oil Company, an affiliate of Exxon Corp., which holds extensive coal leases in northern Wyoming, has announced plans for a coal mine north of Gillette. The company holds a contract to deliver 150 million tons of coal, over a period of 30 years, to Indiana and Michigan Electric Co., a subsidiary of American Electric Power Co. Development would begin in 1974 and deliveries in 1976. Carter is also considering a coal gasification plant in the same general area. Such a project would require about 10,000 acre-feet of water annually and Carter has authorization to use water from

the Yellowtail Dam. Pending a feasibility and siting study, the plant would be completed in 1978 or 1979 and would employ about 1,000 during and after construction.

During the year, the Bureau of Mines Laramie Energy Research Center conducted experiments on in situ coal gasification near Hanna. A 16-well pattern was drilled into a 30-foot-thick, 400-foot-deep coal seam owned by Rocky Mountain Energy Company. The coal was ignited and kept burning by air injection. The injection rate varied from 50 to 800 standard cubic feet per minute while the pressure remained near 240 pounds per square inch guage. Later procedures included switching air intake wells and using varying rates and pressures, comparable to "huff and puff" methods used in oil recovery. Gas is produced with a heating value of about 140 Btu per cubic foot at rates between 1 and 2.4 million cubic feet per day. It is estimated that about 15 tons of dry coal are consumed each day and that from 50% to 90% of the energy of the affected coal is being recovered. Future plans include the drilling of horizontal holes in the coalbed and also injecting oxygen in order to raise the heating value of the product gas.

Another gasification project which would employ up to 1,000 persons is one being planned by Panhandle Eastern Pipe Line Company. The $400 million plant would have a 90 billion cubic foot annual capacity and would process about 25,000 tons of coal per day. It would be located in Converse or Campbell County with the possibility of a new town being constructed.

A 250-million-cubic-foot-per-day gasification plant is undergoing study by Transcontinental Gas Pipe Line, a Transco subsidiary. The company recently made an agreement with Tipperary Corp. and Stoltz, Wagner & Brown to jointly develop 20,000 acres of coal in northeastern Wyoming.

In other gasification activity, two natural gas companies, Northern Natural Gas Co. and Cities Service Gas Co., are studying the possibilities of a joint project. Their agreement provides for eventual construction of four plants, with the likely locations being two each in southeastern Montana and northeastern Wyoming. Each plant would be capable of producing 250 million cubic feet daily of pipeline quality gas. A 700-mile pipeline would carry the product to two separate distribution systems. The first Lurgi type plant would be in operation by 1979. Peabody Coal Co. has committed 500 million tons of coal from Montana and negotiations are underway for another 500 million tons from the Powder River Basin.

A Bureau report investigated the directional properties of fractured coalbeds and their effect on underground gasification technology.[8] The study utilized core samples taken from the Hanna coalfield.

Rocky Mountain Energy Corporation, a subsidiary of Union Pacific Corporation, formed a joint venture company with Arch Mineral Corp. to strip mine Union's coal reserves near Hanna. The joint company is the Medicine Bow Coal Company, which expects to be mining 3 million tons of coal annually by the end of 1975. Rocky Mountain Energy formed another joint venture with Ideal Basic Industries Inc. for the reopening of the now inactive Stansbury underground coal mine near Rock Springs. Ideal Basic will manage and operate the mine and will also purchase much of the coal produced for its own cement operations. Production is expected to be in excess of a million tons per year.

The Muddy Creek Mines Corporation reopened an old underground mine in Fremont County as an open pit mine. Depth of the 17-foot-thick vein is about 115 feet. Several improvements have been made at the mine and mine mouth sales and deliveries are being made, mostly for local domestic use. Expected output for the next year is 20,000 tons.

Peabody Coal Co. bought leases on more than 19,000 acres in the Powder River Basin from the Nuclear Exploration and Development Company. A geologist's report estimates the deposits exceeded 240 million tons with 40% at strippable depths.

A Casper lease broker has recently incorporated a new company, American Coal Company, which has several thousand acres of coal leases in the Powder River Basin.

A New Jersey based consortium called Energy Transportation System, which includes Peabody Coal Co., Inc., is planning a $204 million coal slurry pipeline

[8] Komar, C. A., W. K. Overbey and J. Pasini, III. Directional Properties of Coal and Their Utilization in Underground Gasification Experiments. BuMines TPR 73, 1973, p. 11.

project. The pipeline would transport coal from Campbell County in Wyoming to Arkansas, using deep underground water from Niobrara County. Mayors and citizens in the Black Hills area of South Dakota are forming a group to protest construction of the pipeline which was approved by the Wyoming Legislature. The group fears that the 1,000-mile pipeline will reduce the water level in the Madison formation which is the only water source in that area. The project would produce a permanent annual payroll of $1.2 million.

Following a vigorous debate, two railroads reached an agreement to jointly construct a new railroad section in Converse and Campbell Counties. Burlington Northern, Inc., and the Chicago and Northwestern Railroads will cooperate in construction, ownership, and operation of the 128-mile Douglas to Gillette line. Ranchers and environmentalists are strongly opposed to the building of the railroad. The matter is still before the Interstate Commerce Commission and awaits completion of an environmental impact statement.

Labor disputes flared briefly at the Jim Bridger powerplant and at the Big Horn and Rosebud mines. In no case did stoppages last beyond the third day although negotiations continued.

The State Mine Inspector reported that safety in the coal industry improved from 26 disabling injuries per million man-hours in 1972 to 25.43 in 1973. There were no fatalities in the coal industry during the year. It is believed that the predominance of strip mining is largely responsible for the improvement.

A Montana environmental organization, the Northern Plains Resource Council, filed suit in Washington, D.C., to delay development of coal in the Dakotas, Montana, and Wyoming until a comprehensive environmental impact statement has been prepared. The plaintiffs, which include the League of Women Voters of Montana and South Dakota, the Montana League of Conservation Voters, the Montana Wilderness Association, the National Wildlife Federation, and the Sierra Club, contend that none of numerous leases, prospecting permits, and water options have been accompanied by impact statements. The Wyoming Attorney General has filed a motion to remove the suit to the U.S. District Court in the District of Montana.

The Wheatland irrigation district has been asked to consider an agreement to supply water for a powerplant proposed by a North Dakota based cooperative. Bonnor and Associates, an architectural firm, made a study which indicates that unused water in the Lower Laramie River and additional water from wells would be sufficient to supply the plant's needs.

A report from the State Engineer's Office forecasts that industrial water consumption would increase from the present 78,700 acre-feet per year to 845,000 acre-feet per year by 2020. The report said that in some areas, notably northeastern Wyoming, water is not available in amounts to permit projected coal developments under present technology. There were various other publications which relate to the Wyoming coal industry issued during the year.[9]

[9] Cassady, J. M., and H. Hazelwood. Access to Western Coal. Western Coal Development Inst. Manual, Rocky Mountain Mineral Law Foundation, 1973, 24 pp.

Denson, N. M. Low-Sulfur Coal in the Powder River Basin Wyoming and Montana. U.S. Geol. Survey, Misc. Inv. 848C and 848D, 1973.

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Leo Kramer, Inc. Coal Manpower Projections, 1970–80. Bulletins Open File Rept. 21–73, 1972, 70 pp; available for reference only at all Coal Mine Health and Safety District Offices, at the Pittsburgh, Pa., and Denver, Colo., Technical Support Centers, the Health and Safety Analysis Center in Denver, Colo., and in the Office of Mineral Information and the Department of the Interior Library, both in Washington, D.C.; and from National Technical Information Service, Springfield, Va.; PB 219 375.

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Salem, L. J., D. L. Mutten, and E. J. Hoffman. A Two-Phased Coal Strip-Mining Pilot Study. Federation of Rocky Mountain States, Tech. Paper No. 19, 1973, 13 pp.

Sandoval, F. M., and Others. Lignite Mine Spoils in the Northern Great Plains—Characteristics and Potential for Reclamation. Nat. Coal Assoc., 1973, pp. 117–133.

Natural Gas.—Previous trends in marketed production and value of natural gas continued in 1973. Marketed production dropped to 358 billion cubic feet compared with 375 billion cubic feet in 1972 while value increased to $64.7 million from $60.8 million in 1972. Field production decreased significantly from 384.2 billion cubic feet in 1972 to 369.6 cubic feet in 1973. The percentage of production from public lands was up to nearly 53% from 46% in the previous year. The major gas producing counties and their production percentage according to the Wyoming Ad Valorem Tax Division were Sweetwater, 25%; Campbell, 20%; Sublette, 18%; and Fremont, 16%.

Although down from its 45.1 billion cubic feet in 1972, the Hilight Field in Campbell County was again the State's most productive with an output of 33 billion cubic feet.

The Salt Creek Field in Washakie County, the oldest field still producing, is also the State's greatest cumulative producer. According to the Wyoming Oil and Gas Commission, the field has yielded 711.2 billion cubic feet of gas since 1889. The Church Buttes Field retains the depth record at 18,050 to 18,200 feet production range.

Wyoming's natural gas reserves, as reported by the American Gas Association (AGA), was 4.11 trillion cubic feet at the end of 1973, slightly increased from the 1972 figure of 4.09 trillion cubic feet. The AGA also reported that Wyoming's productive capacity at the end of 1973 was 1.2 million cubic feet per day.

Mountain Fuel Supply Co. was very active in 1973 with continuing development from its Brady series in southwestern Wyoming. Brady unit well no. 7, about a mile southwest of the no. 1 discovery well, produced 8.3 million cubic feet per day of natural gas from between 11,000 and 11,034 feet in the Dakota formation. Mountain Fuel's No. 2 Butcher Knife Springs Well produced at a far greater gage than is usually found in the Church Buttes Field. The well flowed at a maximum rate of 43.7 million cubic feet per day on a drillstream test of 54 feet in the Dakota sand below 12,912 feet.

Increased gas prices and improved technology apparently are encouraging operators to rework oil wells to produce gas. Consequently, Terra Resources, Inc., a subsidiary of Farmland Industries, Inc., continued drilling at its Pacific Creek prospect in Sublette County.

Coastal States Gas Corp. and Burlington Northern Inc. signed an exploration agreement covering 7 million acres in five States. Coastal will spend at least 15 million in the first 3 years while Burlington retains 25% of the rights, a production royalty, and some lands.

Westrans Industries Inc. made an agreement with FMC Corporation for the sale of an undetermined amount of gas from Westrans' Wyoming reserves for 38 cents per 1,000 cubic feet, with escalations to 70 cents per 1,000 cubic feet. FMC will advance development funds and build a pipeline to deliver the gas to its Green River plant.

Colorado Interstate Gas Co. announced a $60 million exploration and development program for new gas reserves in Colorado, Wyoming, Montana, Kansas, and Texas. The 5-year program will be conducted by its subsidiary CIG Exploration which will also control the companies proved reserves. CIG also proposes to build a 216-mile, 20-inch pipeline from its existing system to the proposed Bearpaw Mountain supply area in Montana. They also would build about 73 miles of a 20-inch pipeline to parallel an existing line in Wyoming. Finally, the company is seeking FPC authority to build over 31 miles of 24-inch pipeline in segments of its main line to expand peak capacity by 21.9 million cubic feet. Stauffer Chemical Company has arranged construction of its own 10-inch, 35-mile gasline. The $2 million line will run from its Green River soda ash plant to wells in the Baxter Basin and is to prevent interruption of service.

According to the AGA, Wyoming had 6,518 miles of gasline at the beginning of 1973. This total included 1,134 miles of field and gathering line, 3,447 miles of transmission line, and 1,937 miles of distribution line.

There has been no change in the status of Project Wagon Wheel, the test of nuclear stimulation of natural gas production for which El Paso Natural Gas Co. is conducting studies. A discussion of this project in relation to other projects in the United States and the U.S.S.R. has been

Table 6.—Wyoming: Field production of natural gas, by major field
(Million cubic feet)

Field	County	1972	1973
Beaver Creek	Fremont	19,496	20,030
Canyon Creek	Sweetwater	15,524	11,838
Desert Springs	Sweetwater	12,916	15,411
Elk Basin	Park	18,961	27,924
Hilight	Campbell	45,102	32,953
Hogsback	Sublette	16,968	16,562
Table Rock	Sweetwater	9,299	9,113
Tip Top	Sublette	13,458	14,781
West Side Canal	Carbon	10,133	9,225
Worland	Washakie	14,233	12,182
Other Fields		208,063	199,571
Total		384,153	369,590

Source: Wyoming Oil and Gas Conservation Commission.

published in the American Association of Petroleum Geologists Bulletin.[10]

Natural Gas Liquids.—There was a slight decline in the State's production of natural gas liquids from 10.7 million barrels in 1972 to 10.6 million barrels in 1973. The value rose from $24.5 million to $33.1 million, a 35% increase. The total decline in production was due to a decline in LPG and ethane output from 7.7 million to 7.2 million barrels while natural gas, isopropane, and condensation output increased from 3.0 million to 3.4 million barrels. There were 31 plants operating in 1973. The AGA reported that the Wyoming productive capacity during the heating season was 36,000 barrels per day, down from 39,000 in 1972.

Proved reserves of natural gas liquids in Wyoming at the end of 1973 were estimated by AGA to be 83.7 million barrels, a decline from the 91.2 million barrels in 1972 and 97.6 million barrels in 1971. This total consisted of 42.1 million barrels of nonassociated reserves, 41.6 million barrels of associated dissolved reserves, 4.7 million barrels from revisions and extensions, and 31,000 barrels from new fields.

Oil Shale.—The Bureau of Mines continued work on an in situ oil shale retorting experiment West of Rock Springs, The project, conducted by the Laramie Energy Research Center, is attempting to develop a process for shale oil recovery which is more economically and environmentally attractive than conventional above-ground methods. With this process, holes are drilled into the shale to permit fracturing, first hydraulically, then with liquid explosives. The shale is then heated to approximately 900° F by burning residue which releases the oil to be pumped to the surface. The current project has nine test holes about 190 feet deep within a 50-foot diameter.

It was reported that the two Wyoming tracts designated under the Bureau's prototype oil shale leasing program were scheduled to be opened for bids in May and June of 1974 in Cheyenne. The two tracts are located near Kinney Rim, Washakie Basin, Southeast of Rock Springs. Several publications concerning oil shale deposits in Wyoming were leased during the year.[11]

Petroleum.—Crude oil production increased in 1973 to 142 million barrels, reversing a declining trend in 1971 and 1972 which had productions of 148 million and 140 million barrels, respectively. Wyoming again ranked fifth in the Nation and first in the Rocky Mountain

[10] Termon, M. J. Nuclear-Explosion Petroleum Stimulation Projects, United States and U.S.S.R. Am. Assoc. of Petrol. Geol. Bull., V. 57, No. 6, June 1973, pp. 990–1026.

[11] Bradley, W. H. Oil Shale Formed in Desert Environment: Green River Formation, Wyoming. Geol. Soc. of America Bull., v. 84, April 1973, pp. 1121–1124.

Burnwell, E. L., T. E. Sterner, and H. C. Carpenter. In Situ Retorting of Oil Shale—Results of Two Field Experiments. BuMines RI 7783, 1973, 41 pp.

Dana, G. F., and J. W. Smith. Artesion Aquifier, New Fork Tonque of the Wasatch Formation, Northern Green River Basin. Wyoming Geol. Assoc. Guidebook, 25th Ann. Field Conf., 1973, pp. 201–206; BuMines. OP 145–73, 1973, pp. 201–206.

Eugster, H. P., and R. C. Surdam. Depositional Environment of the Green River Formation of Wyoming: A Preliminary Report. Geol. Soc. of America Bull. V. 84, April 1973, pp. 1115–1120.

Robinson, W. E., and G. L. Cook. Compositional Variations of Organic Material From Green River Oil Shale. Wyoming No. 1 Core. BuMines RI 7820 1973, 32 pp.

Trundell, L. G., H. W. Roehler, and J. W. Smith. Geology of Eocene Rocks and Oil Yields of Green River Oil Shales on Part of Kinney Rim Washakie Basin, Wyoming. BuMines RI 7775, 1973, 151 pp.

region in petroleum production. Cumulative production reached 3.4 billion barrels through 1973. Counties providing the major share of oil production in Wyoming and the approximate percentages, according to the Ad Valorum Tax Division, were Campbell, 26%; Park, 21%; Natrona, 12%; Hot Springs, 7%; Fremont, 6%; and Sweetwater, 6%. Slightly over 56% of the production was from public lands.

Shipments of crude oil out of Wyoming in 1973 amounted to 104.2 million barrels compared with the 110.6 million barrels of 1972. States receiving shipments were Indiana, 23.5 million barrels; Montana, 19.8 million barrels; Kansas, 19.5 million barrels; Illinois, 9.8 million barrels; Colorado, 8.5 million barrels; Michigan 8.3 million barrels; and Utah, 7.6 million barrels. In addition, Kentucky, Tennessee, Missouri, Nebraska, and Ohio together received 7.1 million barrels. In the same period there were shipments into Wyoming of 1.8 million barrels of crude oil from Colorado, Montana, and Utah.

Four oilfields which produced 31% of the State production for the year were Salt Creek, Oregon Basin, Elk Basin, and Hilight. Three of these, Salt Creek, Elk Basin, and Oregon Basin, have produced 33% of the cumulative production in Wyoming, or 1.1 billion barrels.

There was a decrease in the number of exploratory and development wells drilled from 964 in 1972 to 885 in 1973. Drilling footage totaled 5.8 million feet, down from the 6.5 million feet in the previous year. Of 369 exploratory wells drilled, 50 or 13.6% were successful. There were 347 oil producers out of 516 development wells which were drilled, resulting in a 67% success ratio. As in previous years, Campbell County continued to be the most active in the State and in the Rocky Mountain region with 207 wells and 1.8 million feet of drilling. At the end of the year, there were 105 rigs operating in the State compared with 83 at the end of 1972.

Crude oil reserves in Wyoming at the end of 1973 totaled 916,763,000 barrels, down from 949,779,000 in 1972 as estimated by the American Petroleum Institute. This represents 2.6% of the U.S. reserves and retains the State's ranking of sixth in the Nation.

With the delivery by tank of the first oil from the Brady No. 1 discovery well to a Rock Springs pipeline terminal, the field began what may be "giant field" production. According to Petroleum Information, a giant oilfield is one which contains 100 million barrels or more of recoverable oil, and the Brady field may qualify. Presently the Sweetwater County unit has producing or producible gas zones in the Dakota, Lakota, and Phosphoria formations and oil and gas zones in the Nugget and Weber formations. Champlin Petroleum Corp., a subsidiary of Union Pacific Corp. is operator of the Brady field and shares interest with Mountain Fuel Supply Co. and Amoco Production Co. The initial production rate for the eight wells totaled nearly 9,000 barrels of oil and 30 million cubic feet of gas per day. The most productive well is the number two Brady unit which flowed 3,345 barrels of oil and 14 million cubic feet of gas daily. The crude, produced from Weber sand between 13,920 and 14,339 feet, has a gravity rating of 50.6. Plans are being made for an 8-inch-diameter pipeline which will connect the Brady field with the Wamsutter pipeline terminal at Bitter Creek, 13 miles away.

Amoco Production announced plans for a 22,600-foot-deep well in the Brady field, which will be the deepest in the Rocky Mountains.

Mountain Fuel drew attention to its wildcat strike, in the Frontier, at the 1 Andrako-Fox, now named the Spearhead Ranch field. The discovery, located in northeastern Converse County about 24 miles southeast of the prolific Salt Creek field, produced at high rates for several months through stuck drill pipe. A relief well has since been drilled to intercept the discovery bore below the pipe. The relief well indicated a potential of 1,000 barrels of oil and 2.9 million cubic feet of gas per day. Gas flows increased to 4 million cubic feet after the discovery was "killed."

Mountain Fuel was again in the news when a Sweetwater County wildcat blew out of control, creating a loss of 10 to 20 million cubic feet of gas. Although there was no fire, the Red Adair Firm of Houston, Tex., was called in to control the well. Another runaway well, this one on the Chaparrel Resources American Quasar Patterson Ranch, drew even greater attention. For reasons unknown, the blowout had ignited and caused flames to shoot 100 feet up, flaring the estimated 1.5 million cubic feet per hour of gas. The Red

Adair firm was called in here also and after removing metal scrap, attempted to control it with water and mud. An 8-inch pipeline was laid from the North Platte River to bring in up to 150,000 barrels of water which, along with 40,000 sacks of mud, would be needed for the effort. After 17 days and a 500-pound charge of nitroglycerine, the flame was extinguished, only to ignite again, requiring a second charge.

A private lease sale in Casper yielded high bids totaling nearly $2 million for an average of about $182 per acre. Nine of the 11 tracts located 20 miles south of the Chaparrel American Quasar well went to Midwest Oil Company of Denver. American Quasar Petroleum Co. of New Mexico-Fort Worth and the United Bank of Denver acquired the other two.

Toward the end of the year, output from old oilfields brought $4 and $5 per barrel. Marketers confirmed purchases in Wyoming of new oil of around $8.30 per barrel.

At least two pipeline projects were under construction or being planned in addition to the Brady Wamsetter line already mentioned. FMC Corporation received Public Service Commission approval for a 50-mile line from the Bird Canyon field to its Green River Trona facility. Belle Fourch Pipeline Company is extending its crude oil system to connect two newly discovered fields, the Spearhead Ranch field and the Steinle Ranch field, both in Converse County. The former will require 15 miles of line and the latter 5 miles. In addition, McCulloch Interstate Gas Corp. extended its system to the Spearhead Ranch for gas delivery to Colorado Interstate Gas Co.

The total crude oil-throughput capacity of the 12 operating refineries at the end of 1973 increased to 169,000 barrels from 139,000 barrels per calendar day in 1972. Crude oil, consisting of 51.5 million barrels and including 46.9 million barrels, produced in Wyoming was processed. Refinery processing of crude oil, unfinished oils, and natural gas liquids yielded about 56.8 million barrels of petroleum products compared with about 53.8 million barrels in the previous year. The fuels consumed for all purposes at Wyoming refineries during the year included 523,000 barrels of fuel oil, 32,000 barrels of liquefied petroleum gas, 14,561 million cubic feet of natural gas, 10,257 million cubic feet of refinery gas, and 212,000 short tons of petroleum coke. The refineries also consumed 136 million kilowatt-hours of purchased electricity. Following a refinery expansion at its Cheyenne facility, Husky Oil Company now plans to do similar work at its Cody refinery. Over a million dollars will be spent to permit production of low-lead gasoline.

Table 7.—Wyoming: Oil and gas well drilling completions in 1973, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Big Horn	15	1	3	--	1	11	31	160,126
Campbell	53	2	47	9	2	94	207	1,770,348
Carbon	1	4	1	--	1	4	11	49,179
Converse	79	--	6	9	--	29	123	815,416
Crook	15	--	16	2	--	27	60	302,153
Fremont	8	3	--	--	1	14	26	169,031
Goshen	--	--	--	--	--	4	4	17,734
Hot Springs	21	--	4	--	--	2	27	105,269
Johnson	8	--	--	1	--	11	20	168,984
Laramie	--	--	1	--	--	10	11	96,520
Lincoln	--	4	--	1	1	2	8	75,075
Natrona	75	1	3	1	--	21	101	406,942
Niobrara	5	--	2	--	--	10	17	94,656
Park	38	4	6	3	1	13	65	309,916
Sheridan	--	--	1	--	--	3	4	31,844
Sublette	--	4	1	--	1	4	10	87,631
Sweetwater	10	22	16	5	8	42	103	747,626
Uinta	--	--	1	--	--	5	6	44,071
Washakie	5	--	5	1	--	1	12	105,732
Weston	14	--	11	2	--	12	39	209,242
Total	347	45	124	34	16	319	885	5,767,495

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 8.—Wyoming: Production of crude petroleum, by major field
(Thousand 42-gallon barrels)

Field	County	1972	1973
Salt Creek	Natrona	11,722	14,929
Oregon Basin	Park	12,135	11,309
Elk Basin	---- do	9,952	10,255
Hilight	Campbell	6,631	7,875
Lost Soldier	Sweetwater	4,532	3,945
Hamilton Dome	Hot Springs	4,286	3,759
Garland	Big Horn & Park	4,225	3,755
Raven Creek	Campbell	2,025	3,453
Winkleman Dome	Fremont	3,335	3,189
Grass Creek	Hot Springs	3,406	3,101
Other Fields		77,762	76,344
Total		140,011	141,914

Source: Wyoming Oil and Gas Conservation Commission.

Table 9.—Wyoming: Principal oil and gas discoveries in 1973

County and field	Operator	Producing formation	Total depth (feet)
CRUDE OIL			
Campbell:			
Bethlehem	Jerry Chambers	Muddy	9,588
OK	Echo Oil Co	Minnelusa	8,168
Rourke Gap	W. A. Moncrief	---- do	10,360
Unnamed	Anschutz Corp. Inc	Muddy	7,377
Converse:			
Bower	Inexco Oil Co	Teckla and Teapot.	11,315
Piney Creek	Mountain Fuel Supply Co	Teapot	6,205
Spearhead Ranch	---- do	Frontier	12,850
Steinle Ranch	Inexco Oil Co	Muddy	10,371
Well Draw	---- do	Teapot	7,588
Crook:			
Deadman Creek	Burlington Northern, Inc	Minnelusa	6,418
Johnson:			
Heldt Draw	Davis Oil Co. & Phillips Petroleum Co.	Shannon	12,202
Natrona:			
Grieve N	Diamond Shamrock Corp & Grayrock Corp.	Muddy	9,595
Sweetwater:			
Desert Flats	Colorado Oil & Gas Corp	Almond	9,988
Tierney N	Amoco Production Co	Mesaverde	12,700
Unnamed	Trans Delta Oil & Gas Co	Frontier	3,830
NATURAL GAS			
Big Horn:			
Unnamed	Cardinal Petroleum Co	Frontier & Peay	4,324
Campbell:			
Spotted Horse	John F. Arens	Muddy	8,165
Sublette:			
Unnamed	Mountain Minerals Co. & Westrans Petroleum Co.	Bear River	9,550
Sweetwater:			
Barlett	True Oil Co	Morrison	6,700
Deadman Wash	---- do	2d Frontier	7,917
Unnamed	---- do	Frontier	8,538

Source: Petroleum Information Corp. 1973 Resume, Oil and Gas Operations in the Rocky Mountain Region.

NONMETALS

Cement.—Production of portland and masonry cement in Wyoming increased 1.6% from that of 1972. Portland cement production, constituting the bulk of the output, increased 1.5% while shipments and their value increased 8.0% and 8.75% respectively, thereby decreasing stocks at yearend 13.5%. The types of portland cement shipped included types I and II (general use and moderate heat); types III (high-early-strength); type V (high-sulfate resistance and oil well) and expansive. Portland cement consumed in the State totaled 204,000 tons compared with 194,000 tons in 1972. Primary customers were ready-mix concrete companies and concrete product manufacturers. Masonry

cement, while comprising much less than 1% of the total, rose in production 62%. Consumption within the State increased to 3,000 tons from about 2,300 tons the previous year. The total cement production of Wyoming originates at a single plant, the Monolith Portland Midwest Co., located south of Laramie.

Clays.—The amount of clays produced in Wyoming continued to rise from 1,873,000 tons in 1972 to 2,343,000 tons in 1973 which were valued at $24 million. Of this total, 2,106,000 tons were bentonite mined by eight companies and 236,000 tons were common clay and shale produced by four companies. The leading county was Crook with 41.7% of the production followed by Big Horn with 30.1%. Other clay-producing counties in order of rank were Johnson, Weston, Albany, Uinta, and Natrona. Wyoming remained the Nation's major source of bentonite with over two thirds of the U.S. production.

Black Hills Bentonite Co. is developing a new product, Econoseal. This dust-free, dry-crushed bentonite is used as a sealent for lagoons, dams, etc., and to control runoff from tailing piles. The Casper-based company has acquired deposits in the Ten Sleep area and has purchased an 8-acre tract in anticipation of constructing a processing plant near Worland. The plant will cost about a million dollars and employ 20 persons.

Reclamation of areas mined for bentonite will occur under an agreement signed between companies operating in Crook County and the Devils Tower Conservation District. While some companies have been restoring mined areas for several years, they now will be more equal in terms of reclamation costs. Under the agreement, the Soil Conservation Service will provide technical assistance and the companies will carry out reshaping and seeding procedures. After considerable testing of deposits, Double Eagle Petroleum and Mining Company was granted Federal permits to prospect for zeolites on 2,480 acres in Fremont County. Preliminary analyses indicate reserves of more than 100 million tons of high-purity clinoptilolite. This zeolite mineral removes 96% of dissolved ammonia from aqueous solution in a filtration process. It is anticipated that large quantities of the material will be needed for compliance with new Federal water-quality laws. Clinoptilolite also has potential for agricultural pollution control and as a soil conditioner.

Feldspar.—Modern Mining and Milling Company at Bonneville increased production slightly over that of 1972 with an output of 2,588 short tons valued at about $56,000. Their Quien Sabe mine, now under the new ownership of Brasel and Sims Construction Company of Lander, is the only feldspar producer in the State and processed 16,000 tons of crude ore.

A small hill consisting of high-grade ore was drilled and blasted to loosen an estimated 26,000 tons of rock. Most of the product was shipped to Faultless Starch Company in Kansas City, Mo., for producing soap and abrasives. A small amount was shipped to Colorado to be used in making glass. The operation, which includes a mill now producing 3 to 6 tons per hour, employs five. The State's production ranks seventh among eight States producing feldspar.

Gemstones.—The estimated value of gemstones produced in 1973 was $142,000, the same as in the previous year. The State ranked seventh in the Nation, down from sixth in 1972, out of 39 producing States.

Majestic Jade Company at Riverton, the only acknowledged commercial operator in the State, mined and cut a 10,000-pound jade boulder. It was rated as commercial grade with a vein of gem quality. Jade and other gems are regularly sought by weekend and part-time rockhounds.

Gypsum.—Wyoming Construction Co., Georgia Pacific Corp., and The Celotex Corp. mined gypsum in Albany, Big Horn, and Park Counties, respectively. Total production was 312,000 tons with a value of $1.3 million. This was 2.3% of the Nation's crude gypsum. Two companies, Georgia Pacific and Celotex, calcined gypsum, increasing output over that of 1972 by 13%. The State ranked 18 out of 30 States which produced calcined gypsum. Plans for a new gypsum plant at Thermopolis were upgraded from a $5 million to a $10 million plant and employment from 100 to 200 to 300 persons. Also, the company plans to construct a 1,200-unit housing development nearby. Markets have been developed for the wallboard which will be produced at the plant.

Lime.—Output of lime in Wyoming was 30,211 tons, up from that of 1972, while the value was $548,000, less than that of

the previous year. Two companies, Holly Sugar Corp. and Great Western Sugar Co., produced the total amount from three plants at Torrington, Worland, and Lovell. Holly will move a new lime kiln from Montana to their Worland plant as part of a general expansion. The total output was consumed in Wyoming for sugar refining.

Phosphate Rock.—Production of phosphate rock increased very slightly over that of 1972 while the value increased 15%. Stauffer Chemical Company's Leefe mine continued to be the only producer and processor. The Lincoln County plant and mine employs 107 persons.

Pumice.—Two mines produced pumice (often referred to as scoria or cinder) during the year for use in road construction. One mine was operated by Clyde Potter in Campbell County and the other by Basin Engineering Company in Sweetwater County. Big Horn Construction Company, which had been mining in Campbell County, is now inactive.

Sand and Gravel.—The number of operations, total production, and total value of sand and gravel all declined during 1973. Sand production declined from 3.25 million tons to 2.13 million tons, while value went from $6.34 million to $5.21 million. However, the average price rose from $1.95 per ton to $2.45 per ton, a 26% increase.

Gravel production dropped 30% from 5.8 million tons to 4.1 million tons. Value declined 26% from $8.6 million to $6.4 million in spite of an average price increase from $1.47 per ton to $1.58 per ton. Fifty-five percent of the sand and gravel was produced at commercial operations, bypassing government-and-contractor operations which dropped 49% from that of 1972. Most of the output was used in paving. Twenty of the 23 counties in the State produced sand and gravel and were lead by Natrona County.

Table 10.—Wyoming: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973		
	Number of Mines	Quantity	Value	Number of Mines	Quantity	Value
Albany	9	606	489	8	247	197
Big Horn	5	147	114	4	39	62
Campbell	1	160	96	1	106	136
Carbon	8	r 503	r 734	4	226	370
Converse	5	r 421	r 478	3	148	143
Crook	3	381	88	2	W	W
Fremont	10	291	273	8	W	W
Hot Springs	2	18	54	2	27	45
Johnson	6	386	258	3	124	W
Laramie	8	315	372	8	338	W
Lincoln	3	75	62	3	24	37
Natrona	7	589	316	9	701	941
Niobrara	3	194	289	1	131	156
Park	5	208	142	4	148	172
Platte	3	W	94	1	56	56
Sheridan	4	150	98	3	40	W
Sweetwater	10	354	532	7	485	1,015
Uinta	2	174	110	1	16	19
Washakie	4	70	67	3	41	64
Weston	5	W	W	3	64	59
Undistributed [1]	r 17	4,055	10,248	10	3,240	8,165
Total [2]	120	9,098	14,916	88	6,201	11,635

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Goshen, Sublette, Teton, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 11.—Wyoming: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1972		1973	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	427	607	437	811
Fill	43	W	26	12
Paving	W	W	371	546
Other uses	384	338	--	--
Total [1]	854	945	834	1,369
Gravel:				
Building	597	773	559	960
Fill	122	88	138	131
Paving	1,400	1,930	1,551	1,694
Railroad ballast	W	306	90	67
Miscellaneous	277	80	246	254
Other uses	429	20	(2)	(2)
Total [1]	2,824	3,197	2,585	3,106
Government-and-contractor operations:				
Sand:				
Building	2	3	11	20
Fill	2	(3)	69	207
Paving	2,391	5,386	1,214	3,618
Other uses	2	1	(3)	(3)
Total [1]	2,397	5,390	1,294	3,845
Gravel:				
Building	2	4	135	147
Fill	11	4	2	2
Paving	2,983	5,375	1,347	3,163
Other uses	27	2	6	3
Total [1]	3,022	5,384	1,489	3,315
Total sand and gravel [1]	9,098	14,916	6,201	11,635

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Data may not add to totals shown because of independent rounding.
[2] Included with miscellaneous gravel to avoid disclosing individual company confidential data.
[3] Less than ½ unit.

Sodium Carbonate.—Wyoming remained the Nation's principle producer of natural sodium carbonate in 1973. Production in the State rose 16.7% while value increased nearly 35% over that of 1972. The three companies which mine and process trona mined approximately 6.3 million tons of ore, according to the State Inspector of Mines. The companies, all located in Sweetwater County, are, according to rank, FMC Corp., Stauffer Chemical Company of Wyoming, and Allied Chemical Corp. They have a combined annual capacity of 4.35 million tons of sodium carbonate. Construction began on the new 750,000-ton expansion at FMC, including two new boilers, which can be fired by coal, oil, or natural gas. The company has contracted with Morrison Knudson Co., Inc. to work its coal mine, previously operated on a limited basis. A 50-mile gas pipeline was completed during the year to supplement the interruptable gas supply. Dravo Corp. began work for FMC on two 20-foot-diameter shafts, to be developed to a depth of 1,600 feet. FMC employs about 940 workers at its facilities.

Stauffer Chemical Company of Wyoming has been established as a separate operating division of Stauffer Chemical Company. Early in the year, the company completed work on a 34-mile natural gas pipeline to subsidize utility supplies. Studies are being conducted on a possible major expansion, which would follow five previous expansions in the last 10 years. The employment level at yearend was 445 persons. The company was one of two companies which received the State Mining Inspector's Safety Award for underground mines at the annual Mining Convention. Stauffer had only five disabling injuries which cost 498 man-hours per million man-hours out of over 900,000 man-hours worked during the year.

Work on expanding the Allied Chemi-

cal Corp. trona plant to 1.1 million tons annually was completed and a new expansion program was begun. The plan to double annual capacity to 2.2 million tons by late 1974 includes additions and improvements to the processing plant, boiler and power-generating facilities, and additions to the mine facilities. Fluor Utah, Inc., received the contract to engineer and construct the mine shaft and related facilities. Lummus Co., a subsidiary of Combustion Engineering, Inc., will be responsible for the design and construction of the processing plant expansion. Allied employed 560 persons at the end of 1973.

Discussions were held on a possible land exchange between the State and the Federal Bureau of Land Management (BLM) to facilitate the building of a soda ash plant by Texas Gulf Sulfur Company. Officials of the State Land Board say that the State owns the mineral rights but the Federal Government owns the surface rights at the site, located east of Granger, selected by the company. The BLM is interested in a 640-acre tract in the Boar Tusk area for a recreation area which may be exchanged. Meanwhile, Texas Gulf has announced its selections for engineering and construction of its proposed 1-million-ton, $75 million plant. Stearns-Roger, Inc., of Denver was named the general contractor for design and construction of a second mine shaft and related underground facilities while Cementation Company of America Inc. of Brampton, Ontario, Canada, will sink and line the shaft. Arthur McKee and Company of San Mateo, Calif., is to do engineering design of the processing plant and related surface facilities. Finally, Brown and Root, Inc., of Houston had been selected for construction of the facilities designed by McKee. The plant is expected to be in operation by 1976.

Church and Dwight Co., Inc., completed two major expansions within a year, the second placed in operation several months ahead of schedule, in December of 1972. The company produces baking soda and washing soda from sodium carbonate supplied by Allied Chemical.

The Wyoming Employment Security Commission office predicted there will be 1,000 new jobs in the trona industry in the next 2 years. The statement was verified by persons in the industry and was made in support of a bond issue to provide more vocational-technical educational space at Western Wyoming College. The rapid growth of the industry has created some serious housing and social problems. A report dealing with the original formation of trona beds was published during the year.[12] BLM and the Game and Fish Commission have approved a proposed study on the effects of stack emissions and fallout from the trona industries. The study would be conducted by the University of Wyoming and would determine the effects, if any, of the emissions on soils, vegetation, and wildlife. The initial phase would cover about 5 years of data gathering and analysis.

Sodium Sulfate.—Production of sodium sulfate as reported by the State Inspector of Mines, was about 2,500 tons in 1973. The total amount was produced by Pratt Sodium Co. in Natrona County from saline lakebed deposits.

Stone.—The 1973 stone production was 3.2 million tons, down 10% from the peak 1972 production level. However, unit value was up to $2.10 per ton from the previous $1.63 per ton. Granite made up the largest part of the total output and was produced at six quarries. Other stone by production rank and the number of quarries producing were limestone 6, dolomite 2, traprock 4, marble 1, and sandstone 5. Other stone was quarried at three locations. Twenty-six quarries produced crushed and broken stone and one produced dimension stone. Most stone was used for railroad ballast with bitumen aggregate and concrete aggregate also making up a substantial part of consumption. Shipment by truck was used for 52% of crushed and broken stone, and the remaining 48% was shipped by rail.

Union Pacific Railroad Co. was the largest producer out of 17 in the State. Basins Engineering Company, Inc., which operates the only marble quarry, accounted for 20% of the stone value in the State but only 2% of the quantity produced, which was a 61% increase over that of 1972 and the company projects another 50% increase by 1974. A second automatic bagger which fills and seals 50-pound bags at a rate of 24 bags per minute, will be installed shortly.

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[12] Eugster, H. P., and R. C. Surdam. Depositional Environment of the Green River Formation of Wyoming: A Preliminary Report. Geol. Soc. of America Bull. v. 84, April 1973, pp. 1115–1120.

Table 12.—Stone sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1972			1973			Kind of stone produced in 1973
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Albany	8	1,013	705	5	W	256	Limestone, granite, sandstone.
Big Horn	1	89	62	--	--	--	
Carbon	1	185	378	--	--	--	
Laramie	3	1,045	2,166	2	928	W	Limestone, granite.
Natrona	1	122	124	2	131	128	Granite.
Park	2	W	W	1	(1)	2	Do.
Uinta	1	W	14	1	W	18	Other stone.
Washakie	--	--	--	1	(1)	(1)	Granite.
Undistributed [2]	12	1,091	2,319	15	2,133	6,312	
Total [3]	29	3,549	5,768	27	3,191	6,716	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Less than ½ unit.
[2] Includes production for Crook, Fremont, Platte, Sheridan, and Teton Counties and for counties for which no breakdown is available.
[3] Data may not add to totals shown because of independent rounding.

Sulfur.—Four plants, down from five in 1972, shipped a total of 49,304 long tons of recovered sulfur, a coproduct of natural gas. This is an increase of nearly 25% from the previous year. Amoco Production Co. was the major producer along with two others. The operations were located in three counties which were by rank, Park, Fremont, and Carbon.

METALS

Copper.—American Metals Climax, Inc. released an eight-volume environmental impact study on its copper project at Kirwin, above Meeteetse. The 2-year study was conducted by the Rocky Mountain Center on the Environment in Denver and the Thorne Ecological Institute in Boulder. It reveals that the project could bring in 165 families to the area, in addition to employing local residents. Although it is not certain that the mine will be developed, crews have been busy collecting samples. The ore assays a fraction of 1% copper.

Iron Ore.—Shipments of iron ore remained constant at about 2 million long tons. The State also retained its fifth ranking among 20 States reporting shipments in 1973. The Atlantic City mine in Fremont County, operated by United States Steel Corp., shipped 1.6 million long tons of ore.[13] The company employs 550 persons in the operation which includes an open pit mine and beneficiation plant.

The second largest iron producer was CF & I Steel Corp. which operates the Sunrise underground mine and a beneficiation plant in Platte County. The company is developing access to a separate ore body by a decline with conveyor belt haulage and also is completing a new 9-foot-diameter fresh air shaft. Studies are being made in consideration of an open pit operation at an area 2 miles northeast of Sunrise, called the Chicago ore body. The firm employs about 225 persons. A third company was Maxwell Mining Company which produced iron ore from the Shanton open pit mine in Albany County.

A published report on Precambrian iron formations described those in the Lake Superior and Rocky Mountain regions.[14] The study points out that while Rocky Mountain formations are widespread, they are thinner and less extensive than those of the Lake Superior region, most being less than 100 feet thick. Detailed descriptions of specific formations throughout Wyoming are given.

Gold.—Early in the year, the State Department of Economic Planning and Development said that gold deposits in the State were not considered economically feasible because of the need to move large amounts of earth. The Wyoming Revenue Department said that no production had been reported for years. Only two leases are known to have any prospects and

[13] Skillings Mining Review. U.S. Steel Iron Ore Shipments From Western Ore Operations. V. 63, No. 8, Feb. 23, 1974, p. 15.
[14] Bayley, R. W., and H. L. James. Precambrian Iron Formation of the United States. Econ. Geol., V. 68, No. 7, November 1973, pp. 934–959.

these are in the Laramie and Tusk areas.

Teton National Forest officials report that assessment work has been performed on several claims in Teton and Fremont Counties; however, little, if any, mining has been done. By mid-year, higher prices promoted new interest in an old mining area around South Pass City. The BLM reported that The Anaconda Company has a crew staking claims in that area. About 2,000 acres are segregated to preserve the old townsite, but the bulk of the area is open to mining.

Uranium.—Wyoming moved into the lead position in the Nation in uranium production in 1973 with a total of more than 10 million pounds (recoverable content U_3O_8) compared with 8.5 million pounds in 1972. The States share of the national total increased from 33% in 1972 to 39% in 1973 for both production and value. The average grade of ore mined in the State was 0.18% U_3O_8.

Total drilling in Wyoming rose 26%, to 8.3 million from 6.6 million feet in 1972 according to the AEC. This amounted to over 50% of the drilling for uranium in the Nation, strengthening the States first ranked position. There were 8.6 million acres held for uranium mining and exploration in Wyoming at the end of the year, an increase over last year. This was about 46% of the total for the United States.

Wyoming's reserves at the end of 1973 totaled 55.7 million tons of ore containing 96,936 tons of recoverable U_3O_8. Of the Nation's reserves, 35% lie within the State, ranking it second behind New Mexico's 49%.

Wyoming's seven uranium ore processing mills had a total of 9,050 tons per day capacity or about 32% of the Nation's total capacity. The uranium industry was employing 1,660 persons at the end of the year as reported by the State Inspector of Mines.

Reynolds Metals Co. dropped its plan to build a $2.2 billion uranium enrichment plant at Lake DeSmet, near Buffalo. The company was not able to form a consortium of companies to provide financing. The company will sell its large coal reserves in Johnson and Sheridan Counties to Texaco Inc. and retain certain coal and water rights. These rights will be sufficient to provide power for possible future manufacturing, such as aluminum reduction.

The final environmental impact statement was released for Exxon's Highland uranium plant northwest of Douglas. A license can now be issued permitting the mining and processing of ore from 3,200 acres of prime grazing land, subject to certain conditions. These conditions include conducting an environmental monitoring system via soil sampling, controlling wastes and effluents, and restoration of the mine site. Exxon employs 117 in the operation while Mullen Mining Co., which has a contract for primary overburden removal and replacement, has 72 employees. Forgey Russell Construction Co. employs 24 persons for handling the operation's internal waste removal. The Exxon employees were all trained to do both mining and milling in a special 8-week program at Casper College. The company announced plans for two underground mines to be developed about 1½ miles north of the Highland mill. The cost will be between $10 million and $15 million and all ore will be processed at the Highland plant. A common production shaft, 670 feet in depth, will serve both mines. About 100 employment positions will be added when production begins early in 1977. Exxon has applied for a 10-year lease on land between Arapahoe and Kinnear. The application is awaiting an impact study by the EPA.

Western Nuclear, Inc. had a 50-man layoff as the company shifted emphasis from production to exploration. Plans are to resume full production in 1975. The company has announced plans to develop a new uranium mine in the Crooks Gap area south of Jeffrey City. An initial expenditure of $3 million has been authorized for development. Current exploration indicates reserves of about 11 million pounds of recoverable U_3O_8. The company is and plans to continue investing in the development of Jeffrey City. It is expected that this will help lower the employment turnover rate, especially in light of future expansion.

Western Nuclear reached a joint agreement with Double Eagle Petroleum and Mining Company for performing exploratory drilling in return for a 50% interest in 341 lode claims in the Red Desert area of Sweetwater County. The drilling by

Western Nuclear encountered uranium mineralization in seven zones. Gamma-ray logs indicated that the mineralization was associated with roll-fronts in sandstones of the Wasatch Formation. Western Nuclear has since relinquished its rights in the property to Double Eagle. Double Eagle owns 7,058 acres of claims and 1,320 acres of leases in the area.

Union Carbide Corp. started its own stripping operations in East Gas Hills early during the year. Five scrapers and four tractor-dozers move a half million yards of overburden per month. Later in the summer the crew will move to the West Gas Hills to begin stripping a new pit. Forty employees were added to man the operation. Mullen Mining Co. had previously been employed for the task.

Federal-American Partners announced an agreement with the Tennessee Valley Authority (TVA) for lease of uranium reserves and first call on use of the processing mill owned by the partners, which is located in the Gas Hills east of Riverton. This action followed an earlier decision by Carolina Power and Light Co. to not exercise its option to extend their agreement with the partners to 1984. In accordance with the agreement, TVA has paid the partners $4.5 million and will pay another $2.5 million in January 1979. Payments of up to $1.5 million may be paid on additional reserves identified after March 31, 1975. In addition, the partnership will receive a royalty from future production on a formula that is tied to anticipated increases in uranium prices and profitability of operations. The partnership, owned 60% by Federal Resources Corp. of Salt Lake City and 40% by American Nuclear Corp. of Laramie, was extended to 1990 to coincide with the length of the TVA agreement. Following settlement of the agreement, Federal American sold at auction most of their older heavy equipment string. Newer equipment will be acquired when they are ready to resume mining at TVA's request.

TVA has decided to exercise an option to acquire an additional 10% interest in American Nuclear uranium properties. For a cost of $1 million, TVA will increase its interest in properties in the Powder River Basin, Shirley Basin, Red Desert, and Green River Basin to 30%. The initial agreement of 20% for $2 million was signed in 1972.

Nuclear Exploration and Development Co. (NEDCO) of Lander has entered into an agreement with Denison Mines Ltd. for the exploration and possible development of NEDCO uranium mining claims and leases. Cash payments and completion of 510,000 feet of drilling by March 31, 1976, by Denison will earn that company a 50% interest in NEDCO's share of 64,000 acres in the Powder River Basin. Denison may earn similar participation in NEDCO's 50% interest in 18,000 acres in the same area on which Pioneer Nuclear Inc. is the operator under an agreement. Denison will manage the exploration and subsequent development mining and milling on the properties. Drilling done so far has indicated a number of roll-fronts, most of which have one or more ore grade drill intersections.

United Nuclear Corp. and the TVA have agreed to a joint exploration and development program for uranium. Under the agreement, TVA may acquire a 50% interest in properties owned by United Nuclear and its subsidiary, Teton Exploration Drilling Company of Casper. United Nuclear's operating properties and certain properties in New Mexico were excluded from the agreement. TVA's side of the agreement involves various options requiring a complexity of payments totaling in excess of $13.7 million by 1977. Teton will manage the exploration program, doing much of the drilling and hiring other companies as needed. In other action, Teton has filed for a mining permit to begin a pilot-type mining program on their Morton Ranch property in the Powder River Basin. The drilling company is a leader in large-diameter hole drilling, tripling its volume over the previous year.

Western Standard Corporation of Riverton and Chevron Oil Co. began the first phase of an exploration program for the Kaycee Uranium Project. Western Standard is general partner and Bessoiner Securities Corporation is the limited partner in a special partnership. Involved is more than 80,000 acres of leases and claims on the western flanks of the Powder River Basin. Under the new agreement, Chevron will earn up to 50% interest in the property in a staged program through 1976 for contributing up to $2 million in exploration and development funds. During 1973 and 1974 Western Standard and Chevron will be joint operators. In September, Chevron

exercised its option to continue into stage II of the program. Additional purchase options are available after 1976. Earlier, Western Standard had drilled more than 600,000 feet on the property, resulting in the location of numerous uranium targets and well-defined fronts. Mineralization has been found in both the Watsatch and Fort Union Formations at near-surface depths and as deep as 1,400 feet.

Union Pacific Mining Corporation has renewed a former agreement with Mono Power Company, the fuel procurement subsidiary of Southern California Edison Co. The agreement gives Mono Power an interest in Union Pacific's uranium reserves for inputs of $16 million in an 8-year program. The affected reserves are located in the southern Powder River Basin, northeast of Glenrock.

Texas Eastern Transmission Corp. and Pioneer Natural Gas Co. have announced that they will start a six-State uranium ore exploration program. The joint venture will concentrate the exploration in California, Colorado, New Mexico, Texas, Utah, and Wyoming.

Western States Mining has staked claims on 1,954 uranium leases totaling 39,000 acres in the Wind River Basin and acquired overriding royalties on 408 other claims on uranium prospects in the area.

Two uranium processing companies had difficulties with a propane shortage in November this year. The first, Petrotomics, was forced to stop processing yellow cake temporarily, and the second, Utah International, Inc., was able to stretch supplies by switching to electrical and diesel space heating. Appeals were made to the Federal authorities to obtain priority allocations for the mills, and arrangements were completed within a few days.

Several reports on the geology of Wyoming's uranium deposits were published during the year.[15]

[15] Armstrong, F. C. Estimation of Uranium Resources Ultimately Recoverable From Gas Hills District Central Wyoming. Bull. of the Soc. of Econ. Geol., v. 69, No. 1, January–February, 1974 (abstract).

Cheney, E. S., and J. W. Trammell. Isotopic Evidence for Inorganic Precipitation of Uranium Roll Ore Bodies. Am. Assoc. of Petrol. Geol. Bull., v. 57, No. 7, July 1973, pp. 1297–1304.

Haji-Wassiliou, A., and P. F. Kerr. Analytic Data on Nature of Urano-Organic Deposits. Am. Assoc. of Petrol. Geol. Bull., v. 57, No. 7, July 1973, pp. 1291–1296.

McKeel, B. K. Uranium in the Great Divide Basin, Wyoming. Wyoming Geol. Assoc. Guidebook, 25th Ann. Field Conf. Symp. and Core Seminar on the Geology and Mineral Resources of the Greater Green River Basin, 1973, pp. 131–138.

Nkomo, J. T., and J. N. Rosholt. Evidence of Uranium Migration in Precambrian Granitic Rocks From South-Central Wyoming. Ann. meeting, Geol. Soc. of Am., 1973 (abstract).

Table 13.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Monolith Portland Midwest Co	3326 San Fernando Road Los Angeles, Calif. 90065	Plant	Albany.
Clays:			
American Colliod Co	5100 Suffield Court Skokie, Ill. 60076	Open pit mine and plant.	Big Horn.
		Open pit mine	Crook.
		Open pit mine and plant.	Weston.
Dresser Minerals Division of Dresser Industries, Inc.	P.O. Box 6504 Houston, Tex. 77005	do	Big Horn.
International Minerals & Chemical Corp.	5401 Old Orchard Road Skokie, Ill. 60076	do	Crook.
Kaycee Bentonite Corp	Box 1 Mills, Wyo. 82644	Open pit mines	Johnson.
Monolith Portland Midwest Co	P.O. Box 40 Laramie, Wyo. 82070	do	Albany.
NL Industries, Inc., Bariod Division.	Box 1675 Houston, Tex. 77001	do	Crook and Weston.
Wyo-Ben Products, Inc	Box 1979 Billings, Mont. 59103	Open pit mine and plant.	Big Horn.
Federal Bentonite Co	4614 Prospect Ave. Cleveland, Ohio 44103	do	Crook.
Coal:			
Arch Mineral Corp	P.O. Box 459 Hanna, Wyo. 82327	Strip mines	Carbon.
Kemmerer Coal Co	Frontier, Wyo. 83121	2 strip mines, crushing and oil treatment plant.	Lincoln.
Pacific Power & Light Co	920 S.W. 6th Avenue Portland, Oreg. 97204	Strip mine	Converse.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Coal, bituminous—Continued			
Rosebud Coal Sales Co	P.O. Box 398 Hanna, Wyo. 82327	Strip mine	Carbon.
Gypsum:			
The Celotex Corp	1500 N. Dale Mabry Tampa, Fla. 33607	Mine and plant	Park.
Georgia-Pacific Corp	900 S.W. Fifth Ave. Portland, Oreg. 97204	do	Big Horn.
Wyoming Construction Co	Box 907 Laramie, Wyo. 82070	Mine	Albany.
Iron Ore:			
CF & I Steel Corp	Box 316 Pueblo, Colo. 81002	Underground mine and benficiation mill.	Platte.
United States Steel Corp., Western Ore Operations.	Lander, Wyo. 82520	Open pit mine and agglomerator.	Fremont.
Lime:			
The Great Western Sugar Co	Box 5308 Denver, Colo. 80217	Pot kiln at beet-sugar plant.	Big Horn.
Holly Sugar Corp	Holly Sugar Bldg. Colorado Springs, Colo. 80902	Shaft kiln at beet-sugar plant.	Goshen.
Natural gas and petroleum: [1]			
Phosphate rock:			
Stauffer Chemical Company of Wyoming.	636 California Street San Francisco, Calif. 94108	Open pit mine and beneficiation plant.	Lincoln.
Sand and gravel (commercial):			
Boatright-Smith	Box 1129 Casper, Wyo. 82602	Pits and plants	Natrona.
Gilpatrick Construction Co., Inc.	Box 973 Riverton, Wyo. 82501	Pit	Sublette.
P. Kiewit Sons Co	P.O. Box 1009 Sheridan, Wyo. 82801	Pits	Natrona and Sweetwater.
Rissler-McMurry Co., Inc	P.O. Box 2499 Casper Wyo. 82602	Pit Pits Pit Pit	Carbon. Fremont. Natrona. Niobrara.
Teton Construction Co	Box 3243 Cheyenne, Wyo. 82001	Pit	Laramie.
Sodium Carbonate:			
Allied Chemical Corp., Industrial Chemicals Division.	Box 70 Morristown, N.J. 07960	Underground mine and refinery.	Sweetwater.
FMC Corp. Inorganic Chemicals Division.	Box 872 Green River, Wyo. 82935	do	Do.
Stauffer Chemical Company of Wyoming.	Box 513 Green River, Wyo. 82935	do	Do.
Stone:			
Basin Engineering Co., Inc	Box 845 Wheatland, Wyo. 82201	Quarry	Platte.
The Great Western Sugar Co	Box 5308 Denver, Colo. 80217	Quarry and plant	Laramie.
Gilpatrick Construction Co., Inc.	Box 973 Riverton, Wyo. 82501	Quarry	Fremont.
Guernsey Stone Co	Box 337 Guernsey, Wyo. 82214	Quarry and plant	Platte.
Union Pacific Railroad Co	1416 Dodge Street Omaha, Nebr. 68102	do	Laramie.
Uranium:			
Exxon Co. U.S.A	P.O. Box 3020 Casper, Wyo. 82601	Open pit	Converse.
Getty Oil Co	P.O. Box 2459 Casper, Wyo. 82601	do	Carbon.
Union Carbide Corp	270 Park Ave. New York, N.Y. 10017	do	Natrona.
Utah International Inc	Box 831 Riverton, Wyo. 82501	2 open pit mines, leaching operation. 2 open pit mines, 2 underground mines, and mill.	Carbon. Fremont.

[1] Most of the major oil and gas companies and many smaller companies operate in Wyoming and several commercial directories contain complete lists of them.