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MINERAL INDUSTRIES OF THE MIDDLE EAST



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UNITED STATES DEPARTMENT OF THE INTERIOR • Manuel Lujan, Jr., Secretary

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

U.S. GOVERNMENT PRINTING OFFICE

WASHINGTON: 1992

Preface

This edition of the Minerals Yearbook records the performance of the worldwide minerals industry during 1990 and provides background information to assist in interpreting that performance. Content of the individual Yearbook volumes follows:

Volume I, Metals and Minerals, contains chapters on virtually all metallic and industrial mineral commodities important to the U.S. economy. In addition, a chapter on survey methods used in data collection with a statistical summary of nonfuel minerals and a chapter on trends in mining and quarrying in the metals and industrial mineral industries are included.

Volume II, Area Reports: Domestic, contains chapters on the minerals industry of each of the 50 States and Puerto Rico, Northern Marianas, Island Possessions, and Trust Territory. This volume also has a chapter on survey methods used in data collection, including a statistical summary of domestic nonfuel minerals.

Volume III, Area Reports: International, contains the latest available mineral data for the year of review on more than 160 foreign countries and discusses the importance of minerals to the economies of these nations. Volume III is presented as five area reports and one world overview: Mineral Industries of Africa, Mineral Industries of Asia and the Pacific, Mineral Industries of Latin America and Canada, Mineral Industries of Europe and Central Eurasia, Mineral Industries of the Middle East, and Minerals in the World Economy. This year's reports incorporate location maps, industry structure tables, and an outlook section previously incorporated in our Mineral Perspectives Series quinquennial regional books, which have been discontinued. The U.S. Bureau of Mines continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the Yearbook are welcomed.

T S Ary, *Director*

Acknowledgments

The U.S. Bureau of Mines, in preparing these Volume III Minerals Yearbook Reports, extensively utilized statistics and data on mineral production, consumption, and trade provided by various foreign government minerals and statistical agencies through various official publications. The cooperation and assistance of these organizations is gratefully acknowledged. Statistical and informational material was also obtained from reports of the U.S. Department of State, from United Nations publications, and from the domestic and foreign technical and trade press. Of particular assistance were the routine and special reports submitted by 10 Regional Resource Officers assigned to minerals and petroleum reporting and by economic and commercial officers and other officials of the U.S. Department of State in American Embassies worldwide. Their contributions are sincerely appreciated.

The text and production, structure of the mineral industry, and reserve tables of this volume were prepared by the respective country authors on the staff of the Division of International Minerals, Information and Analysis Directorate. The mineral export and import trade tables were prepared by the International Data Section of the Division of Statistics and Information Services, Information and Analysis Directorate.

The regimes of some countries reviewed in this volume may not be recognized by the U.S. Government. The information contained herein is technical and statistical in nature and is not to be construed as conflicting with or being contradictory of U.S. foreign policy.

George J. Coakley
Chief, Division of International Minerals

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MINERAL INDUSTRIES OF THE MIDDLE EAST

By George A. Morgan and Staff, Branch of Africa and the Middle East

INTRODUCTION¹

The production and processing of crude petroleum and natural gas are the dominant economic sectors of the Middle East. The 15 countries that constitute the region accounted for 28% of world crude petroleum output, 17.2% of world natural gas plant liquid production, and 5.3% of world dry natural gas production. Only Cyprus and Lebanon were not crude petroleum producers. About 66% of total world crude petroleum reserves and 31% of total world natural gas reserves are in the Middle East. Transportation and port facilities in the region are geared to expediting efficient and rapid shipment of these materials. Export sales of these fuels provide funding for further diversification of the mineral industry. Additional development of downstream facilities for producing energy-intensive metals such as aluminum and byproducts of the fuels such as petrochemicals and fertilizers can be expected. Earnings from the industry are also channeled by several Governments in the region to mineral industry projects in Africa and elsewhere. Several countries in the region own major petroleum refineries and distribution facilities worldwide.

Petroleum prices rose overall during the year owing to the invasion by Iraq of Kuwait in August 1990. Output from both countries, the fourth and fifth largest producers, respectively, in the Middle East, was negatively affected by the war. Kuwaiti crude oil wells and pipeline facilities suffered extensive war damage while exports of petroleum and petroleum refinery products by Iraq ceased owing to a U.N. embargo. The embargo also impacted Jordan, an exporter of phosphate and potash. Shipments of crude petroleum by pipeline from Iraq through Saudi Arabia and Turkey and by vessel through the Persian Gulf were terminated. However, the loss in production from Iraq and Kuwait was more than made up by accelerated output from other Middle East and world producers. Saudi Arabia, in particular, with its excess production capacity, accounted for the largest portion of the increase.

A fairly wide range of nonfuel minerals is produced in the region. The most significant are boron minerals, bromine, chromite, gypsum, phosphate rock, potash, strontium, and sulfur. However, the variety of minerals produced, output levels, and the size of the overall nonfuel mineral economy of the region is dominated by Iran and Turkey. Turkey, with a diverse mineral production and strategically situated between Europe and the Middle East, was first in world production of strontium, second in boron, and fourth in chromite and pumice. It was also a significant world producer of magnesium compounds, mercury, and sodium sulfate. Iran continued to expand output of most mineral commodities following almost 9 years of war with Iraq. It was second in world production of strontium and third in gypsum. Despite a very small domestic mineral industry, Israel was second in world production of bromine and a significant producer of phosphate rock and potash. Jordan ranked sixth in world production of phosphate rock. Iraq ranked about ninth and Saudi Arabia eighth in world production of sulfur, a commodity of major importance in the metallurgical, petrochemical, and fertilizer industries. Most sulfur output from Iraq was from the Frasch process, while Saudi Arabia's output was a byproduct of crude petroleum and natural gas processing. With its downstream processing program for chemicals, Iraq has the potential to expand its significance as a major exporter of fertilizers.

The dominance of the Middle East's liquid and gaseous hydrocarbon resources is a result of periodic marine inundations of a large inland basin within and adjacent to the existing Persian Gulf over a period of about 100 million years. Sediment accumulations of thousands of meters thickness exist in the region. Successive periods of evaporation and sea transgression also led to the formation of evaporite beds of borax, gypsum, and salt, the latter in places acting as traps for hydrocarbons. The shallow warm water bodies existing during the Cretaceous led to the formation of economic marine phosphate deposits. Cenozoic and Mesozoic cover of alluvium and volcanics

extends throughout much of the region, with economic deposits of barite, copper, lead, and zinc. Ultramafic rocks, including ophiolites, in Cyprus, Iran, Oman, and Turkey contain economic deposits of chromite, copper, and pyrite. Cambrian and Precambrian age granites and gneisses contain small minable deposits of iron and gold. The region north of the Arabian shield and Persian Gulf remains a highly active earthquake zone, as the Arabian plate continues to move north into the Eurasian plate, widening the Red Sea into a new ocean, with the contemporaneous formation of metal-bearing muds on its floor.

U.S. imports of mineral-based materials from the region were primarily energy products. U.S. net oil imports from the Middle East, which include crude petroleum, natural gas liquids, and petroleum refinery products, were about 27% of total U.S. net oil imports or about 716 million barrels in 1990. Nonfuel minerals, for which the Middle East was considered a significant supplier to the United States, were gemstones and potash from Israel and chromite from Turkey. U.S. exports to the region are primarily food, machinery, equipment, and computers.

Nonfuel mineral output from the Middle East supplied primarily local markets, India, and the European Community. Excluding production of boron, bromine, and strontium, for which the region accounted for 41%, 31%, and 49%, respectively, of world output, production of nonfuel minerals as shown in table 1 generally represented a small percentage of total world production. The most significant were chromite at 8.2%, gypsum at 9.9%, phosphate rock at 8.1%, and potash at 7.8% of world output. New mine development and exploration programs continued in Saudi Arabia and Turkey. Downstream mineral-based industries were expanding in the region primarily to make use of abundant associated natural gas. Aluminum production, currently underway in Bahrain, Iran, Turkey, and the United Arab Emirates, was to be expanded in Bahrain and the United Arab Emirates. Plans for constructing aluminum facilities in Qatar and Saudi Arabia continued. Fur-

ther advancement of Iraq's ability to build an aluminum refinery in that country was dependent upon resolution of U.N. demands and termination of a trade embargo. Realization of these plans could bring capacity to more than 1 million tons per year compared with output of about 505,000 tons in 1990. The higher value obtained from the sale of chemicals and plastics produced from hydrocarbon fuels is the motivation behind much of the expansion of petrochemical facilities in the region.

In comparison with the United States, the region covered about 6.2 million square kilometers or about 66% of the U.S. land region of 9.4 million square kilometers. Total population of the region was 197 million compared with 253 million for the United States, and total labor force was about 49 million compared with 124 million. Imported labor was an important factor in the work force of the countries of the Middle East. Perhaps 5 million people from Egypt, India, Pakistan, the Philippines, Republic of Korea, Taiwan, and other countries of Africa and Asia were employed in the Middle East. The estimated gross domestic product (GDP) for the Middle East was \$520 billion compared with a gross national product for the United States of \$5,465 billion. Per capita GDP ranged from \$525 for the Republic of Yemen to more than \$13,000 for Qatar. Average per capita GDP for the region was about

\$2,650 compared with about \$21,600 for the United States. All tons are metric in this report unless otherwise specified.

¹George A. Morgan, Chief, Branch of Africa and Middle East, Division of International Minerals.

SELECTED GENERAL SOURCES OF REGIONAL INFORMATION

- American Petroleum Institute, Washington, DC: Basic Petroleum Data Book, annual.
- Arab Petroleum Research Center, Paris: Arab Oil and Gas Directory, annual.
- British Sulphur Corp. Ltd., London: Nitrogen, bimonthly. Phosphorus and Potassium, bimonthly. Sulphur, bimonthly.
- Bureau de Recherches Geologiques et Minieres, Paris.
- International Lead and Zinc Study Group, London.
- International Monetary Fund, Washington, DC: International Financial Statistics, monthly and annual yearbook.
- Middle East Economic Digest, London.
- Miller Freeman Publications, San Francisco: World Mining, monthly. World Mining, yearbook.
- Mining Journal Ltd., London: Mining Magazine, monthly. Mining Journal, weekly. Mining Annual Review, July.
- Organization of Petroleum Exporting Coun-

- tries, Vienna, Austria: Annual Report.
- Annual Statistical Bulletin.
- Penn Well Publishing Co., Tulsa, OK: International Petroleum Encyclopedia.
- United Nations Statistical Office, New York: U.N. trade statistics.
- U.S. Department of Commerce: Bureau of the Census: trade statistics. International Trade Administration: Foreign Economic Trends and Their Implications for the U.S., International Marketing Information Series.
- U.S. Department of Energy, Office of International Affairs: Energy Industries Abroad, DOE/IA-0012. International Energy Annual, DOE/EIA-0219. Annual Energy Outlook, DOE/EIA-0383. Annual Energy Review, DOE/EIA-0384.
- U.S. Department of the Interior, Bureau of Mines: Mineral Commodity Summaries. Minerals Yearbook, v. I, Metals and Minerals; v. III, Area Reports: International.
- U.S. Department of State: Various economic and mineral industry reports from American Embassies in the region.
- U.S. Joint Publications Research Service, Arlington, VA: Foreign Broadcast Information Service Regional Publications, weekly.
- World Bank, Washington, DC: Bank news releases.
- World Bureau of Metal Statistics, London: World Metal Statistics, monthly.

TABLE 1

MIDDLE EAST: PRODUCTION OF SELECTED MINERALS COMMODITIES, 1990

(Thousand metric tons unless otherwise specified)

Country	Aluminum metal	Cement	Chromite	Gypsum	Natural gas plant liquids (thousand barrels)	Natural gas, dry (million cubic meters)	Nitrogen, N in ammonia	Petroleum crude (thousand barrels)	Phosphate rock (gross weight)	Potash, K ₂ O equivalent	Salt	Steel, crude	Sulfur
Bahrain	213	—	—	—	3,525	6,200	325	15,875	—	—	—	—	48
Cyprus	—	1,133	—	37	—	—	—	—	—	—	—	—	—
Iran	59	12,500	57	8,200	11,000	24,200	420	1,127,120	—	—	800	1,200	535
Iraq	—	13,000	—	470	1,155	2,300	400	732,920	1,100	—	300	—	1,050
Israel	—	2,868	—	38	—	33	58	79	3,516	1,379	426	95	15
Jordan	—	1,820	—	93	—	—	—	110	6,082	841	18	179	—
Kuwait	—	900	—	—	30,500	6,000	292	425,000	—	—	30	—	300
Lebanon	—	900	—	2	—	—	—	—	—	—	3	—	—
Oman	—	1,000	—	—	2,129	2,700	—	250,000	—	—	—	—	31
Qatar	—	267	—	—	13,200	7,400	760	140,000	—	—	—	580	52
Saudi Arabia	—	12,000	—	375	194,630	34,300	942	2,350,000	—	—	—	1,900	1,435
Syria	—	3,500	—	175	500	700	104	145,000	1,633	—	127	70	30
Turkey	61	24,408	1,000	230	—	212	405	26,880	87	—	1,600	9,454	179
United Arab Emirates	172	3,264	—	89	47,000	26,600	295	772,700	—	—	—	—	90
Yemen, Republic of	—	800	—	—	9	—	—	71,000	—	—	220	—	—
Total Middle East	505	77,560	1,057	9,709	303,639	110,645	4,001	5,985,684	12,418	2,220	3,304	13,478	3,765
Share of world total, percent	2.9	7	8.2	9.9	17.2	5.3	4.1	28	8.1	7.8	1.9	1.7	6.5
United States	4,048	71,310	—	14,883	569,035	499,000	12,646	2,664,000	46,343	1,713	35,291	89,726	11,560

TABLE 2

MIDDLE EAST: PRODUCTION OF SELECTED MINERALS COMMODITIES, 1989-REVISED

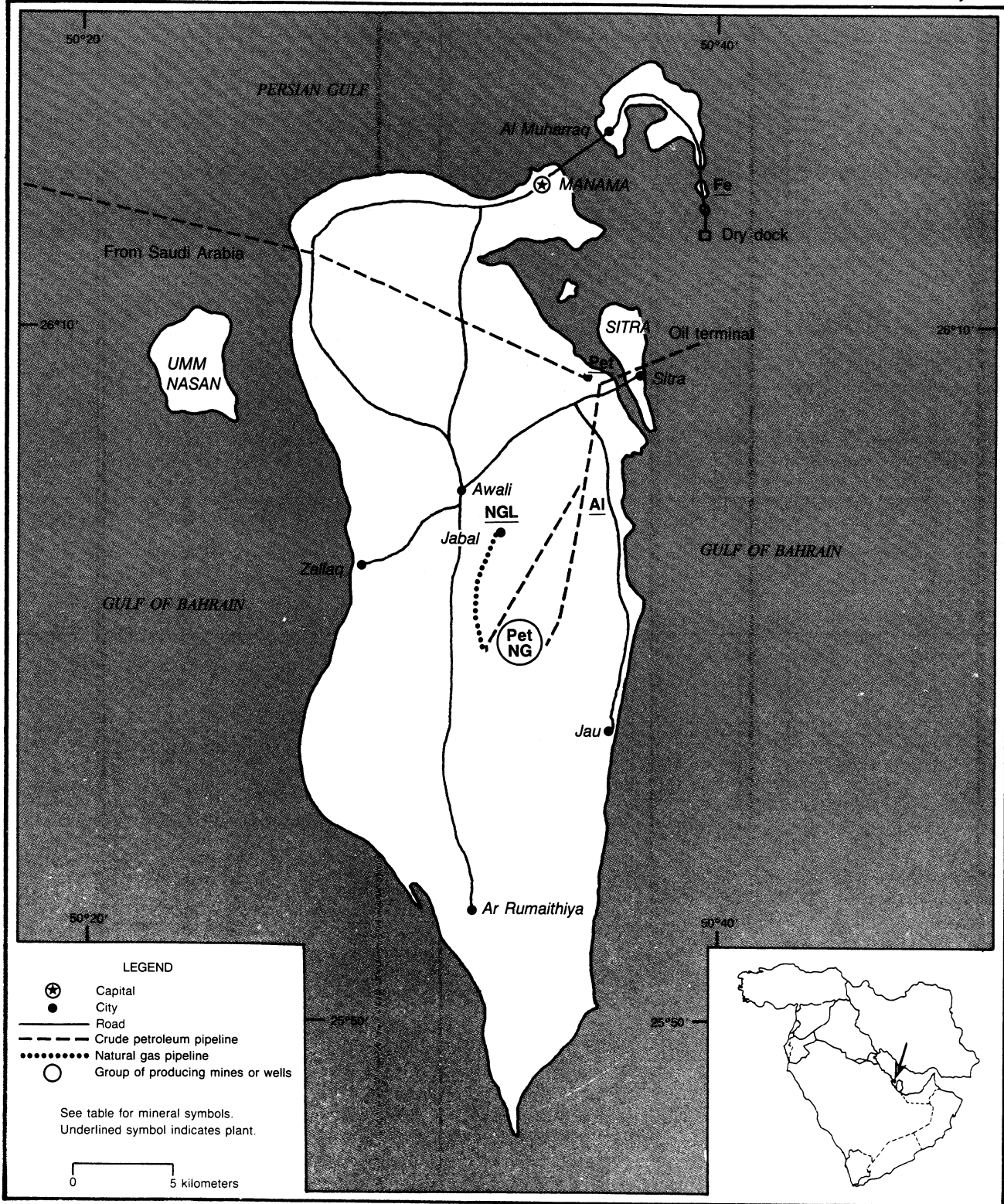
(Thousand metric tons unless otherwise specified)

Country	Aluminum metal	Cement	Chromite	Gypsum	Natural gas plant liquids (thousand barrels)	Natural gas, dry (million cubic meters)	Nitrogen, N in ammonia	Petroleum crude (thousand barrels)	Phosphate (gross weight)	Potash, K ₂ O equivalent	Salt	Steel, crude	Sulfur
Bahrain	187	—	—	—	2,911	5,947	319	15,595	—	—	—	—	48
Cyprus	—	1,042	—	11	—	—	—	—	—	—	—	—	26
Iran	45	12,500	62	8,000	9,900	22,200	336	1,025,650	—	—	800	1,081	510
Iraq	—	12,500	—	450	1,540	3,100	474	978,000	1,300	—	300	—	1,330
Israel	—	2,289	—	31	—	38	58	116	3,922	1,338	475	118	15
Jordan	—	1,930	—	132	—	—	—	110	6,900	792	18	177	—
Kuwait	—	1,110	—	—	38,500	8,160	665	657,700	—	—	32	—	375
Lebanon	—	900	—	2	—	—	—	—	—	—	3	—	—
Oman	—	948	13	—	2,135	2,682	—	233,800	—	—	—	—	32
Qatar	—	300	—	—	13,231	7,400	714	142,715	—	—	—	550	52
Saudi Arabia	—	11,442	—	375	153,645	29,900	863	1,848,500	—	—	—	1,800	1,423
Syria	—	3,501	—	180	500	695	123	140,000	2,256	—	138	70	40
Turkey	62	23,796	1,499	223	—	174	308	20,598	85	—	1,384	7,934	168
United Arab Emirates	168	3,387	—	87	46,355	19,256	324	715,400	—	—	—	—	80
Yemen, Republic of	—	700	—	63	4	—	—	66,500	—	—	230	—	—
Total Middle East	462	75,645	1,574	9,491	268,717	99,552	4,184	5,778,184	14,463	2,130	3,150	11,730	4,099
Share of world total, percent	2.6	6.8	13.2	9.7	15.5	4.9	4.2	26.9	8.9	7.2	1.8	1.5	7
United States	4,030	71,700	—	15,988	564,290	488,744	12,202	2,778,745	49,817	1,595	35,250	88,813	11,592

BAHRAIN

AREA 620 km²

POPULATION 520,186



THE MINERAL INDUSTRY OF BAHRAIN

By Bernadette Michalski

The nation's economy remained largely dependent on the mineral industry, which supplied almost 90% of export earnings and 30% of the GDP. The petroleum and natural gas industries alone accounted for more than 60% of Government revenues and 80% of export earnings. Capitalizing on the availability of natural gas for electric power generation, the aluminum smelting and fabrication industries experienced a constant growth pattern. Expansion plans project aluminum smelter capacity at 460,000 mt/a by 1992, making the Aluminum Bahrain (ALBA) smelter the largest in the Middle East. Other industry diversification efforts include iron ore pelletization, petrochemicals, and a major tanker repair shipyard.

GOVERNMENT POLICIES AND PROGRAMS

Although the Bahraini Government had encouraged limited privatization of industry, foreign firms were required to have a national partner or sponsor to bid on Government contracts. The Government, however, was taking under consideration the adoption of greater flexibility in this matter.

PRODUCTION

With the exception of aluminum, the production of the nation's mineral commodities has stabilized. Output of crude petroleum has been maintained at 15 Mbbbl/a or more with the aid of natural gas reinjection and is expected to continue at this level throughout the decade. While the addition of new cells at the ALBA aluminum smelter increased capacity by 20,000 mt/a to 225,000 mt/a in 1990, the full expansion to 460,000 mt/a capacity is not projected until 1992.

TRADE

Imports of alumina in 1990 increased by 35% over 1989 levels approaching almost

500,000 tons to accommodate the additional cells that came on-stream during the year and to create a stockpile in the event of a prolonged Gulf crisis. About 75% of the alumina supply is obtained from Alcoa of Australia. Data for other imported raw material used in the aluminum industry are available only for 1989 and include petroleum coke reported at 62,553 tons, fluoride at 7,368 tons, and cryolite at 206 tons.

Aluminum exports rose by 17% to 115,968 tons in 1990, accounting for about 10% of all exports. More than one-half of the exported aluminum was delivered to member countries of the Gulf Cooperation Council.

Refined petroleum product exports averaged 246,000 bbl/d in 1990, of which

about one-half was destined for Southeast Asia.

STRUCTURE OF THE MINERAL INDUSTRY

Bahrain's oil industry remained Government owned and controlled. The mineral policy permitted foreign investment up to 49% providing the remaining 51% is Bahraini held; however, the Government is considering adopting greater flexibility in this matter to the extent of allowing fully foreign-owned companies to register in Bahrain. This concept is prompted by the desire to increase foreign investment and promote rapid rebuilding of the economy, which suffered a \$2 billion loss in the 1990-91 Gulf crisis.

TABLE 1

BAHRAIN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^a	1990 ^a
Aluminum metal: Primary, smelter	178,188	180,344	182,804	186,889	² 212,505
Gas, natural:					
Gross million cubic meters	7,256	7,277	7,524	7,733	² 8,110
Dry do.	5,664	5,680	5,720	5,947	6,200
Natural gas liquids:					
Butane thousand 42-gallon barrels	894	775	897	917	975
Propane do.	889	1,133	880	890	1,150
Naphtha do.	1,169	1,361	1,349	1,104	1,400
Nitrogen N content of ammonia	275,780	308,440	296,400	319,400	325,000
Petroleum thousand 42-gallon barrels	15,484	15,377	15,671	15,595	² 15,875
Refinery products:					
Gasoline do.	7,520	6,157	5,449	6,931	7,500
Jet fuel do.	9,613	10,818	10,081	8,419	9,500
Kerosene do.	7,023	5,200	6,286	7,359	7,500
Distillate fuel oil do.	26,693	28,071	27,562	28,698	29,000
Residual fuel oil do.	22,611	22,225	22,268	21,983	21,500
Other do.	16,100	16,500	17,200	16,285	16,000
Total do.	89,560	88,971	88,846	89,675	91,000
Sulfur, byproduct of petroleum	46,000	47,500	48,000	48,000	48,000

^aEstimated. ^bPreliminary.

¹Table includes data available through July 1, 1991.

²Reported figure.

TABLE 2

BAHRAIN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Aluminum	Aluminum Bahrain Co. (ALBA)	Sitra	225.
Aluminum products	Bahrain Aluminum Extrusion Co.	do.	6.
Iron oxide pellets	Gulf Industrial Investment Co.	South Al Muharraq Island	4,000.
Natural gas	Bahrain National Gas Co.	Awali Field	1,500.
		Nonassociated Khuff gas	7,000.
Natural gas liquids		Jabal al-Dukhan	1,400 propane,
thousand 42-gallon barrels	do.		1,100 butane,
			1,500 naphtha.
Petroleum, crude	Bahrain National Oil Co.	South of Awali	16,000.
Petroleum products	Bapco BSC	Sitra	91,500.
Sulfur	do.	do.	75.

COMMODITY REVIEW**Metals**

The modernization and expansion activities at the nation's sole aluminum smelter were well underway, with 76 new cells on-stream by February 1990, raising its capacity to 225,000 mt/a. Aluminum production capacity is to be further expanded to 460,000 mt/a by 1992 at a cost of \$1.44 billion. Financing for the project had been secured by July 1990. Loans were secured through the Gulf Investment Corp. and the Arab Banking Corp. In addition, export credits in excess of \$550 million were secured. Upon completion of the expansion program, projected for 1993, but currently running ahead of schedule, the Aluminum Bahrain smelter will be the largest in the Middle East.

Mineral Fuels

Natural Gas.—Production of natural gas has maintained a constant growth pattern in the past decade, paralleling the growth in demand for electricity generation, as well as for reinjection into oil wells as a means of enhanced recovery. Nearly one-third of natural gas production was reinjected.

Petroleum.—Harken Bahrain Oil Co., a subsidiary of Harken Energy Corp. of the United States, concluded an exploration agreement with the Bahraini Government in January 1990. The agreement covered a hydrocarbon exploration program of 3 years' duration in the waters off al Muharraq and Umm an Nasan Island. Should com-

mercial fields be discovered, a 35-year production license would be granted.

Bahrain's crude oil production, stabilized at about 43,000 bbl/d largely by a gas injection program, was derived from the Awali Field in central Bahrain. Through a 1972 revenue-sharing agreement signed with Saudi Arabia, Bahrain receives a 50% share of revenues from the Abu Safah offshore field between the two countries.

The 250,000-bbl/d-capacity refinery at Sitra has consistently operated near capacity level and processed a record average of 251,000 bbl/d in 1990. More than 80% of the refinery's throughput was delivered by pipeline from the Abu Safah Field shared with Saudi Arabia and the remainder from the Awali Field. The implementation of a yield improvement program will eventually reduce the production of heavy fuel oil from 25% to 10% of refinery output and increase output of higher priced products such as gasoline, kerosene, and distillate oil. The Bahrain Petroleum Co. (Bapco) has under consideration a \$1 billion expansion program that includes the installation of a 140,000-bbl/d distillation unit and a hydrocracker to improve yields of higher value products. The Government announced in November 1990 that the petroleum refinery expansion would be postponed owing to expansion priorities awarded to the aluminum smelter and the instability resulting from the 1990-91 Gulf crisis.

Petrochemicals.—The Gulf Petrochemical Industries Co., a joint venture between Bahrain and Kuwait, operated an ammonia and methanol plant at Sitra. Non-

associated Khuff gas was used as feedstock. A \$20 million improvement project was completed in 1989, increasing plant capacity by 20% to 1,200 mt/d each of ammonia and methanol. Record production was achieved in 1990 exceeding 800,000 tons compared with 764,105 tons in 1989.

Reserves

The Organization of Arab Petroleum Exporting Countries estimated proven petroleum reserves at 98 Mbbbl and proven nonassociated natural gas reserves at 183 billion m³ in 1990.

INFRASTRUCTURE

The island nation's basic infrastructure is in place, including a network of petroleum pipelines and storage facilities to accommodate Sitra refinery receipts from the Awali Field and the Abu Safah Field shared with Saudi Arabia as well as product export facilities that include 16 product pipelines extending for 7 km from the Sitra refinery storage facilities to a deepwater terminal for export. Natural gas pipelines servicing Bahrain's power generation and industry complexes totaled 32 km in length.

The Arab Shipbuilding and Repair Yard (ASRY) was established on a 0.5 km² constructed island with all installations and support services necessary for a shipyard specializing in the repair of very large crude carriers (VLCC). Owned by Abu Dhabi, Bahrain, Kuwait, Qatar, and Saudi Arabia, each with 18.84% equity; Iraq, 4.7%; and Libya, 1.1%, the ASRY facility included four repair berths that can accommodate

sizes up to 500,000-dwt tankers. Occupancy of the dry dock averaged 95% prior to August 1990. The occupation of Kuwait by Iraq reduced interest in dry dock services in the Gulf area and prompted shipowners to delay or seek repairs and maintenance work elsewhere. The Gulf crisis also brought a halt to ASRY expansion plans, which included the construction of facilities to accommodate 40 to 50 ships of up to 180,000 dwt (maximum Suez Canal size).

OUTLOOK

Much of Bahrain's mineral industry operations are closely linked to Iraq, Kuwait, and Saudi Arabia. The tenuous position of the Gulf region after the August 2, 1990, invasion of Kuwait by Iraq placed

partnerships and trade agreements in jeopardy and brought the postponement of several major projects. These included the \$140 million expansion project for the Petrochemical Industries Co., a modernization plan for the Sitra Refinery, expansion of the ASRY operations, and a polypropylene-methyl tertiary butyl ether plant.

The major aluminum expansion program, however, has proceeded. When realized, the 460,000-mt/a-capacity ALBA aluminum smelter will foster new downstream industries and increase employment.

The lifting of restrictions limiting foreign company holdings to 49% in favor of allowing fully foreign-owned companies to register in Bahrain has strong support. If realized this would substantially increase foreign investment and promote rapid rebuilding of the postwar economy that suf-

fered a loss of nearly \$2 billion as a result of the Gulf war.

¹Where necessary, values have been converted from Bahraini dinars (BD) to U.S. dollars at the rate of BD0.37=\$US1.00.

OTHER SOURCES OF INFORMATION

Agency

Ministry of Industry and Development
Manama, Bahrain

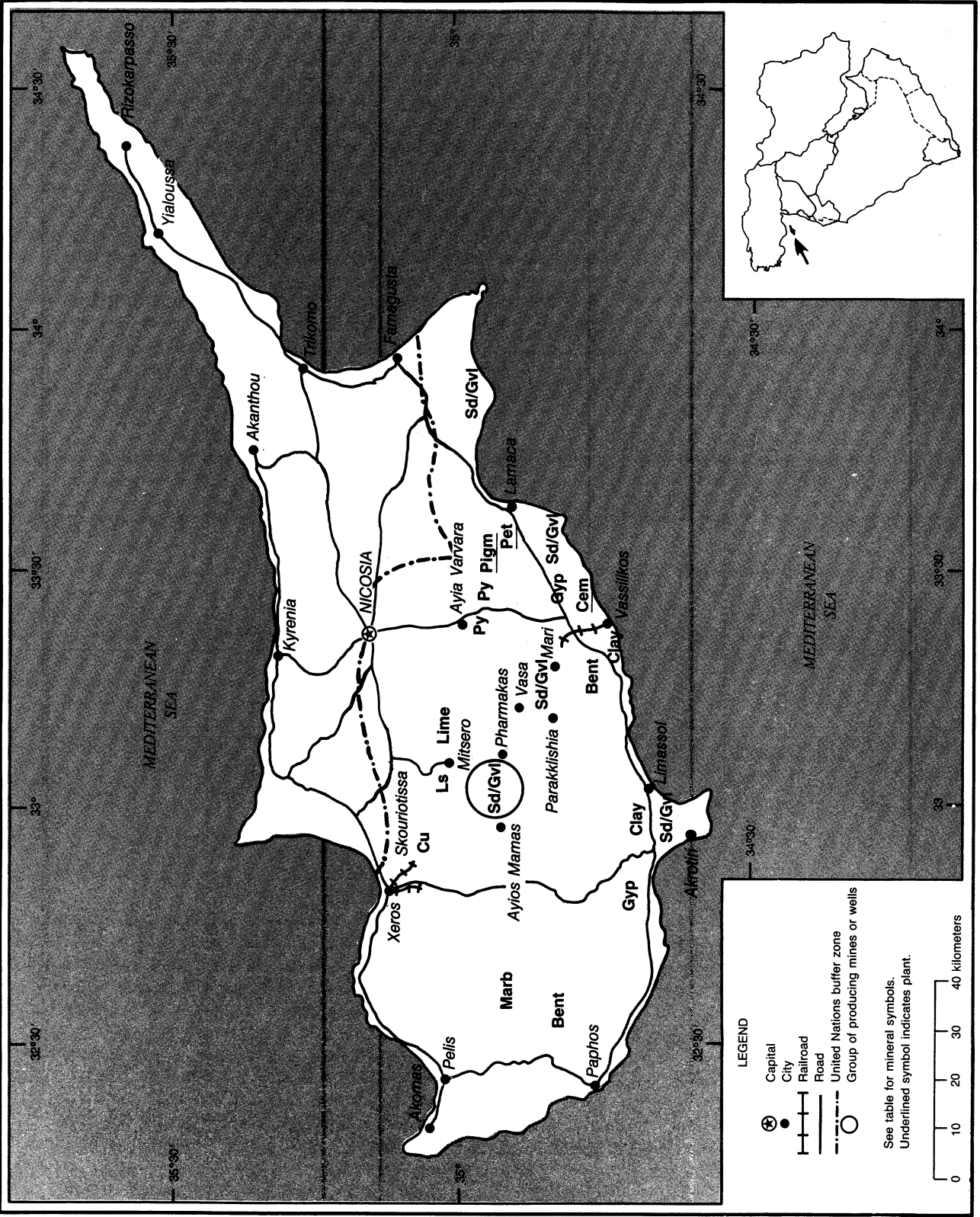
Publications

Bahrain National Oil Co. (BANOCO)
Annual Report.
Bahrain National Gas Co. (BANAGAS)
Annual Report.

CYPRUS

AREA 9,000 km²

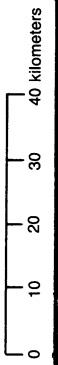
POPULATION 710,000



LEGEND

- ⊗ Capital
- City
- +— Railroad
- Road
- - - - - United Nations buffer zone
- Group of producing mines or wells

See table for mineral symbols.
Underlined symbol indicates plant.



THE MINERAL INDUSTRY OF CYPRUS¹

By Audie L. King

Despite a slight increase in the value of its output, the mining and quarrying sector of the Greek Cypriot economy decreased from 2.1% of the GDP in 1989 to 1.8% in 1990. Based on average exchange rates, the total value of the mineral industry's production, excluding the production of refined petroleum products, rose about 6.2% from \$97.7 million in 1989 to \$103.8 million in 1990.² An increase in the production of sand and gravel and other building materials accounted for most of the sector's growth. Once again, industrial minerals increased in relative importance to the mining and quarrying sector. Mineral exports dropped by about 5% in 1990 to \$4.7 million, about 0.5% of Cyprus' total domestic exports.

Cyprus has been geopolitically divided since 1974, when Turkish troops took control of 37% of the land area in the northern region of the island. The southern Greek-administered area was separated from the northern Turkish-administered area by a narrow UN buffer zone. Despite political uncertainty and a steady decline in mineral production, Cyprus' economy continued to expand rapidly and diversify. Cyprus had recently seen exceptional success in the expansion of its offshore sector by aggressively promoting the island's location as ideally situated between Europe and the Middle East. It offers reduced tax rates to companies in Cyprus with business exclusively offshore. Both the northern and southern areas of the island continued to progress. Although the per capita GDP of the Turkish section was barely one-third of the Greek section, its economy was rapidly expanding. In current market prices, the GDP of the Turkish-occupied territory increased by 6.6% in 1987, 7.5% in 1988, and 8.6% to \$423 million in 1989, the latest year that data were available. The economy of the Greek-controlled area continued to grow rapidly. It expanded by an estimated 9.8% in 1990 to about \$5.7 billion compared with a 14.5% increase the previous year.

Cyprus introduced a set of fiscal reforms that was to take effect in 1991. They include a new tax package and liberalized financial measures to stimulate the economy

and harmonize practices with the EC. A new value added tax would switch taxation from direct to indirect. The resulting tax structure would be simpler, with a maximum rate of 40%. The corporate tax rate would fall to 20% from the current 40%.

In general, production of those mineral commodities for use in the domestic construction industry fared better than those destined for export. Most of 1990's moderate gain in mineral production could be attributed to significant increases in the output of Cyprus' cement, sand and gravel, and aggregate operations. Slightly more than 30,000 tons of iron pyrite was exported from existing stockpiles in 1990. Iron pyrite mining ceased following the closure of Cyprus' fertilizer plant in 1989. Hellenic Mining Co. suspended cupreous pyrite concentrate processing following 1 year of production in 1989 after an 8-year hiatus.

Mining accounted for about 0.3% of the Turkish-occupied area's GDP. The total value of minerals extracted in the northern area in 1989, the latest year that these data were available, increased by 21.8% to about \$3.4 million. Information on amounts and specific types of minerals produced was not available. The bulk of the mineral production was likely in support of the construction industry, which expanded by 7.7% in 1989.

Trade was very important to the Cypriot economy. Its merchant marine fleet, consisting of 2,300 ships, was the seventh largest in the world and was expanding rapidly. A favorable cost structure enticed the U.S.S.R. to place 120 of its trading vessels under the Cypriot flag in 1990. The ports at Larnaca and Limassol were being deepened by dredging. The improvements are necessary to permit deeper draft vessels to use the ports. Cyprus lost an important customer in 1990 when Scan-Dutch, Limassol Port's biggest user, withdrew its container trade because the 10.5-m draft at the port was inadequate for its fleet's new vessels. The merchandise trade deficit increased 12.3%, from \$1.49 billion in 1989 to \$1.67 billion in 1990. Strong domestic demand resulted in an 11% rise in imports to \$2.5 billion, while exports increased only 8.4% to \$861 million.

Trade with the EC had become increasingly important to Cyprus' economy in recent years while the country's volume of trade with the Middle East had steadily declined. In January 1988, Cyprus began a 15-year program to abolish all trade barriers with the EC. As part of a customs union agreement, the existing import duties would decrease by 9% per year.

Cyprus' trade deficit with the United States widened to \$160 million in 1989. Exports to the United States, which accounted for 1.9% of Cyprus' exports, included clothing, footwear, iron oxide pigments, steel tubes and pipes, carob, dairy products, and miscellaneous food items. The United States exported cereals, office equipment, paper and paper products, commercial vehicles, and electrical equipment to Cyprus. These products accounted for 7.3% of Cyprus' total imports.

Mining operations on the island were privately owned and operate under leases and licenses issued by the Cyprus Mines Service since 1958. Royalties on extracted mineral commodities ranged from 1% to 5%. The Economic Geology Section of the Geological Survey Department was responsible for mineral exploration programs and the evaluation of the country's resources. Prospecting was also carried out by foreign and domestic mining companies and by the research agencies of foreign countries.

Mining sector employment continued its downward trend. Only 700 people were employed in 1989, the latest year that data were available, compared with 1,735 in 1980. The Hellenic Mining Co. was Cyprus' most significant company, with output from diverse operations. Production was mainly by small companies working small deposits.

During 1990, Hellenic Mining Co. pursued an exploration program that included drilling and laboratory tests on the Skouriotissa copper ore to determine its amenability to solvent extraction. The Hellenic Mining Co. still had plans to revive operations at the Troodos chromite mine. Operations ended in 1982 owing to poor world market conditions. Hellenic Gold Mining Co., a joint venture between Hellenic Mining Co. and Cyprus Mining Investors Ltd. of the United Kingdom,

TABLE 1
CYPRUS: PRODUCTION OF MINERAL COMMODITIES^{1 2}

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^p	1990 ^a
METALS					
Copper:					
Cupreous pyrite concentrate:					
Gross weight	—	—	—	1,752	—
Cu content	—	—	—	251	—
Cement copper:					
Gross weight	1,188	193	765	1,080	³ 1,032
Cu content	606	80	315	465	³ 472
INDUSTRIAL MINERALS					
Asbestos, fiber produced	13,011	18,070	14,585	—	—
Cement, hydraulic	864	854	868	1,042	³ 1,133
Clays, crude:					
Bentonite	<u>55,000</u>	<u>79,600</u>	<u>90,300</u>	<u>59,744</u>	<u>³82,000</u>
Other:					
For brick and tile manufacture	220	300	357	390	³ 400
For cement manufacture ^c	250	250	250	330	³ 300
Total	470	550	607	720	700
Gypsum:					
Crude	30,000	45,700	32,710	10,980	³ 37,000
Calcined	5,500	4,960	3,975	^a 4,000	³ 4,600
Lime, hydrated	7,452	6,890	6,810	7,060	³ 7,326
Pigments, mineral: Umber	10,000	12,500	10,060	8,534	³ 7,700
Salt, marine	6,051	—	—	—	—
Stone, sand and gravel:					
Limestone, crushed (Havara)	2,500	2,360	2,450	2,580	³ 2,700
Marble	75	80	78	96	³ 82
Marl, for cement production	568	567	^e 565	692	700
Sand and gravel ^d	4,370	4,200	4,400	4,850	³ 5,250
Unspecified building stone	280	285	300	166	200
Strontium: Celestite concentrate	7,365	6,300	—	—	—
Sulfur:					
Pyrite, gross weight	56,672	91,380	113,145	57,455	—
S content	<u>24,936</u>	<u>41,121</u>	<u>50,916</u>	<u>25,855</u>	—
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Liquefied petroleum gas	239	250	342	301	300
Gasoline	993	1,088	1,224	1,191	1,100
Kerosene and jet fuel	272	281	375	232	300
Distillate fuel oil	1,220	1,299	1,489	1,451	1,500
Residual fuel oil	1,069	1,288	1,506	1,268	1,300
Asphalt	165	191	246	266	300
Refinery fuel and losses	152	158	222	198	200
Total	<u>4,110</u>	<u>4,555</u>	<u>5,404</u>	<u>4,907</u>	<u>5,000</u>

^aEstimated. ^pPreliminary.

¹Table includes data available through Dec. 12, 1991.

²Mineral production data from the northern Turkish-occupied section of the country are not included in this table, as available information is inadequate to make reliable estimates of output levels.

³Reported figure.

⁴Includes crushed aggregate.

TABLE 2
CYPRUS: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Scrap	19	1,967	—	Netherlands 876; Greece 526; United Kingdom 137.
Semimanufactures	220	187	—	United Kingdom 88; Netherlands 70; Saudi Arabia 18.
Copper:				
Ore and concentrate value, thousands	\$45	\$415	—	All to West Germany.
Matte and speiss including cement copper	600	955	—	Do.
Metal including alloys: Scrap	29,900	63,795	—	All to Greece.
Iron and steel:				
Iron ore and concentrate including roasted pyrite	260	—		
Metal:				
Scrap	—	33,822	—	Greece 30,191; Italy 3,576.
Semimanufactures:				
Flat-rolled products:				
Of iron or nonalloy steel:				
Not clad, plated, coated	122	1,336	—	Greece 1,326.
Clad, plated, coated	—	1,007	—	All to Syria.
Bars, rods, angles, shapes, sections	2,532	993	—	Algeria 990.
Wire	—	5	—	All to Lebanon.
Tubes, pipes, fittings	3,303	1,308	1,287	United Arab Emirates 9.
Lead: Metal including alloys, scrap	—	490	—	Republic of Korea 326; Greece 164.
Manganese: Ore and concentrate, metallurgical-grade	3,750	—		
Titanium: Oxides	—	1	—	All to Lebanon.
Zinc: Metal including alloys:				
Scrap	—	51	—	United Kingdom 27; Netherlands 21.
Semimanufactures value, thousands	—	\$13	—	All to Italy.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	—	54	—	All to Israel.
Grinding and polishing wheels and stones value, thousands	\$40	—		
Asbestos, crude	14,595	56	—	United Kingdom 36; Lebanon 20.
Cement	462,420	487,760	—	Italy 195,341; Spain 134,292; Cameroon 124,895.
Clays, crude:				
Bentonite	—	5,936	—	United Kingdom 5,916.
Kaolin	328	126	—	All to United Kingdom.
Unspecified	153	22	—	All to Oman.
Diatomite and other infusorial earth	9	3	—	All to Lebanon.
Fertilizer materials: Manufactured:				
Ammonia	NA	1,300	—	All to Greece.
Nitrogenous	NA	40	—	All to United Arab Emirates.
Potassic	NA	1,380	—	All to Greece.
Unspecified and mixed	57,822	50,273	—	Italy 16,325; Panama 8,135; Greece 7,513.
Gypsum and plaster	11,728	2,901	—	Lebanon 2,850.
Lime value, thousands	—	\$18	—	All to Saudi Arabia.

See footnotes at end of table.

TABLE 2—Continued

CYPRUS: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Precious and semiprecious stones other than diamond: Synthetic value, thousands	\$64	—		
Pyrite, unroasted	6,610	—		
Salt and brine	—	3	—	Mainly to Ireland.
Sodium compounds, n.e.s.: Soda ash, manufactured	—	106	—	Syria 88; Lebanon 18.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	488	266	—	Italy 138; Israel 60; Greece 40.
Worked value, thousands	\$2	\$26	—	Bahrain \$17; United Kingdom \$8.
Gravel and crushed rock	6,018	—		
Limestone other than dimension	—	750	—	All to Lebanon.
Sand other than metal-bearing	—	20	—	All to Libya.
Sulfur:				
Elemental: Colloidal, precipitated, sublimed	—	36	—	All to Tanzania.
Sulfuric acid	5,000	—		
Other: Crude	(²)	2,096	3	Greece 2,080.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2	430	—	All to Greece.
Peat including briquets and litter	15	—		
Petroleum:				
Crude 42-gallon barrels	(³)	101	—	All to Algeria.
Refinery products: Mineral jelly and wax do.	3,305	4,108	—	All to Saudi Arabia.

NA Not available.

¹Table prepared by Virginia A. Woodson.²Unreported quantity valued at \$253,965.³Unreported quantity valued at \$29,597.

TABLE 3

CYPRUS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS				
Alkali and alkaline-earth metals kilograms	89	—		
Aluminum:				
Oxides and hydroxides	2	1	—	Mainly from Austria.
Metal including alloys:				
Unwrought	3,587	3,794	—	Greece 2,417; Canada 993.
Semimanufactures	3,852	1,635	1	Greece 796; United Kingdom 253.
Antimony: Metal including alloys, all forms	—	12	—	China 10; Japan 2.
Bismuth: Metal including alloys, all forms value, thousands	—	\$2	—	All from United Kingdom.
Chromium:				
Oxides and hydroxides kilograms	411	—		
Metal including alloys, all forms—value, thousands	—	\$4	—	Mainly from West Germany.

See footnotes at end of table.

TABLE 3—Continued

CYPRUS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS—Continued				
Cobalt: Metal including alloys, all forms value, thousands	—	\$7	\$7	
Copper: Metal including alloys:				
Scrap	—	9	—	All from United Kingdom.
Unwrought	73	12,048	—	United Kingdom 12,047.
Semimanufactures	1,356	1,612	111	United Kingdom 542; Belgium-Luxembourg 207; Italy 180.
Gold: Metal including alloys, unwrought and partly wrought kilograms	1,661	—		
Iron and steel: Metal:				
Scrap	16	216	—	All from Egypt.
Pig iron, cast iron, related materials	697	1,968	—	Poland 1,908; Czechoslovakia 28.
Ferroalloys:				
Ferromanganese	NA	26	—	All from France.
Ferrosilicon	NA	3	—	Do.
Unspecified	32	—		
Steel, primary forms	(²)	37	—	Sweden 26; Spain 10.
Semimanufactures:				
Flat-rolled products:				
Of iron or nonalloy steel:				
Not clad, plated, coated	13,223	18,190	3	Italy 3,978; Greece 3,604; Hungary 2,976.
Clad, plated, coated	12,884	19,761	98	Greece 8,987; West Germany 3,610; Czechoslovakia 1,413.
Of alloy steel	1,766	869	—	France 227; Spain 220; Hungary 186.
Bars, rods, angles, shapes, sections	145,173	138,889	112	Poland 49,268; Hungary 22,272; Romania 12,526.
Rails and accessories	4	27	—	West Germany 14; Italy 13.
Wire	1,875	2,770	—	Hungary 917; United Kingdom 691; Greece 153.
Tubes, pipes, fittings	12,097	15,303	316	Greece 3,811; Hungary 1,799; Republic of Korea 1,562.
Lead:				
Oxides	262	—		
Metal including alloys:				
Scrap	—	62	—	All from Sweden.
Unwrought	1,087	1,134	—	Italy 648; United Kingdom 359.
Semimanufactures	27	26	—	United Kingdom 18; Belgium-Luxembourg 8.
Manganese: Oxides	22	—		
Molybdenum: Ore and concentrate	20	—		
Nickel:				
Ore and concentrate	10	—		
Matte and speiss	1	1	—	Mainly from Norway.
Metal including alloys:				
Unwrought value, thousands	\$1	\$3	—	Yugoslavia \$2; Greece \$1.
Semimanufactures	5	12	—	France 4; Greece 3; West Germany 1.
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	\$41	\$230	\$23	West Germany \$185; United Kingdom \$19.
Silver: Metal including alloys, unwrought and partly wrought do.	\$436	\$2,393	\$55	West Germany \$1,410; United Kingdom \$710.

See footnotes at end of table.

TABLE 3—Continued

CYPRUS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
METALS—Continued					
Tin: Metal including alloys:					
Unwrought	value, thousands	\$1	\$2	—	Mainly from United Kingdom.
Semimanufactures		5	3	—	United Kingdom 2; Belgium-Luxembourg 1.
Titanium:					
Ore and concentrate		18	—		
Oxides		349	—		
Zinc:					
Ore and concentrate	value, thousands	(²)	\$1	—	All from United Kingdom.
Oxides		33	—		
Metal including alloys:					
Scrap	kilograms	1	—		
Unwrought		171	129	—	Belgium-Luxembourg 112; United Kingdom 7.
Semimanufactures		2	10	—	Norway 8; United Kingdom 1.
Other:					
Ore and concentrates		2	—		
Ashes and residues		25	—		
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		468	402	—	Greece 376; United Kingdom 24.
Grinding and polishing wheels and stones	value, thousands	\$97	\$662	\$2	Italy \$343; West Germany \$93; Israel \$62.
Asbestos, crude		—	17	—	All from Canada.
Barite and witherite		9	6	—	All from West Germany.
Crude natural borates	kilograms	100	—		
Oxides and acids		(²)	1	—	All from West Germany.
Cement		2,807	678	39	Greece 578; United Kingdom 61.
Chalk		813	567	—	France 299; United Kingdom 249.
Clays, crude:					
Bentonite		NA	101	—	United Kingdom 73; France 28.
Kaolin		17,558	16,317	—	Greece 16,161.
Unspecified		585	489	—	Greece 272; United Kingdom 129.
Cryolite and chiolite		—	3	—	All from France.
Diamond, natural:					
Gem, not set or strung	value, thousands	\$466	\$2,561	—	Belgium-Luxembourg \$878; Israel \$735; United Kingdom \$460.
Industrial stones	do.	—	\$17	—	All from Israel.
Diatomite and other infusorial earth		210	360	149	Italy 129; West Germany 51.
Feldspar, fluorspar, related materials:					
Fluorspar		—	20	—	All from West Germany.
Unspecified		18	—		
Fertilizer materials: Manufactured:					
Ammonia		17,032	11,029	—	U.S.S.R. 10,990.
Nitrogenous		13,886	17,729	—	Romania 10,830; Bulgaria 5,502; France 1,000.
Phosphatic		1,725	1,140	—	Lebanon 700; Romania 392.
Potassic		1,106	115	—	West Germany 100; Italy 8.
Unspecified and mixed		3,846	36,085	24	Romania 28,187; United Kingdom 2,270.

See footnotes at end of table.

TABLE 3—Continued

CYPRUS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Graphite, natural value, thousands	(²)	\$1	—	All from United Kingdom.
Gypsum and plaster	(²)	100	7	United Kingdom 42; Belgium-Luxembourg 41.
Lime	4	—	—	—
Magnesium compounds: Oxides and hydroxides	74	144	—	United Kingdom 61; West Germany 51; Netherlands 32.
Mica:				
Crude including splittings and waste	23	9	—	United Kingdom 6; Norway 3.
Worked including agglomerated splittings value, thousands	\$138	—	—	—
Phosphates, crude	22	22	—	All from Greece.
Pigments, mineral: Iron oxides and hydroxides processed	37	—	—	—
Precious and semiprecious stones other than diamond:				
Natural value, thousands	\$156	\$544	\$1	United Kingdom \$145; Thailand \$110; West Germany \$94.
Synthetic do.	\$59	\$306	\$8	Switzerland \$131; Czechoslovakia \$40; Hong Kong \$29.
Salt and brine	3,354	4,352	—	Israel 2,118; Tunisia 1,050; United Kingdom 85.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	2,968	13,723	1	Greece 7,568; Italy 5,993.
Worked value, thousands	\$164	\$1,106	—	Italy \$716; Greece \$318.
Dolomite, chiefly refractory-grade	45	164	—	Greece 119; Norway 43.
Gravel and crushed rock	1,555	3,588	—	Italy 2,189; Greece 1,032.
Limestone other than dimension	29,800	9,149	—	All from Greece.
Quartz and quartzite	34	3	—	NA.
Sand other than metal-bearing	831	1,056	—	Netherlands 239; Belgium-Luxembourg 225; United Kingdom 213.
Sulfur:				
Elemental:				
Crude including native and byproduct	51,552	2,298	—	Greece 1,150; Lebanon 567.
Colloidal, precipitated, sublimed kilograms	173	—	—	—
Sulfuric acid	13,028	7,678	16	Algeria 7,209; Greece 423.
Talc, steatite, soapstone, pyrophyllite	454	368	—	Greece 126; Norway 99; Belgium-Luxembourg 83.
Other:				
Crude	100	327	301	Italy 15.
Slag and dross, not metal-bearing	—	2	—	All from United Kingdom.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	36	56	—	Greece 37; United Kingdom 19.
Carbon black	3	—	—	—
Coal:				
Anthracite	58,370	102,415	102,395	Belgium-Luxembourg 20.
Briquets of anthracite and bituminous coal	—	33	—	Australia 17; Belgium-Luxembourg 16.
Lignite including briquets kilograms	311	—	—	—
Coke and semicoke	266	633	—	France 358; Italy 100; Belgium-Luxembourg 99.
Peat including briquets and litter	2,916	3,890	—	West Germany 2,685; United Kingdom 578.
Petroleum refinery products:				
Liquefied petroleum gas thousand 42-gallon barrels	—	210	(²)	Greece 119; Saudi Arabia 26; Bulgaria 20.
Mineral jelly and wax do.	5	4	—	Hungary 2; West Germany 1.
Bitumen and other residues do.	—	70	—	Italy 43; Greece 27.
Bituminous mixtures do.	3	4	(²)	United Kingdom 2; Syria 1.

NA Not available.

¹Table prepared by Virginia A. Woodson.²Less than 1/2 unit.³Unreported quantity valued at \$26,826.

continued to explore for precious metals. The two companies signed a 3-year agreement, begun in late 1989, to explore for gold on all mining leases and prospecting permits held by Hellenic Mining Co. Efforts also were underway in the private sector to reopen the Amiantos asbestos mine.

The Geological Survey Department of Cyprus proceeded with efforts to map all amber and gypsum deposits. This was consistent with the department's recent shift in emphasis to locating economic deposits of industrial minerals.

The Cypriot mining industry, which has

been in a steady decline for more than a decade, appears to have bottomed out. Most of the country's traditional mineral enterprises were either shut down or were operating at a small fraction of past production levels. The domestic copper industry was suffering from the depletion of its richer copper ores. Because of the country's experience in copper processing, it may continue producing minor quantities of cement copper from waste drainage and concentrates from lower grade ore. Any significant drop in world copper prices would, however, hurt the mining of these low-grade reserves.

Some commodities, such as asbestos, bentonite, celestite, chromite iron oxide pigments, pyrite, and salt, had experienced production declines or mine closures in recent years but remain in abundant supply. The producers of these commodities could resume operations or step up production if economic conditions turned more favorable and international markets could be secured.

Industrial mineral mining and cement production for the domestic construction industry, which in recent years emerged as the most economical sector in the mineral industry, will continue to grow in importance to the nation's economy. An economic decline in Europe, however, would hurt the country's fortunes, which are tied to tourism and foreign trade.

¹Unless specifically stated, all data in this chapter are concerned with the southern Greek-administered area because data related to the Turkish Cypriot area are sparse or unavailable.

²Where necessary, values have been converted from Cypriot pounds (CP) to U.S. dollars at the rate of CP0.46=US\$1.00.

TABLE 4

CYPRUS: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Bentonite	Peletico Plasters Ltd.	10 kilometers west of Vassilikos	55. ^e
Do.	Bentex Minerals Co. Ltd.	Vassilikos area	5.5. ^e
Do.	D. Mitides Import-Export	Paphos area	10. ^e
Cement	Vassiliko Cement Works Ltd.	Vassilikos	800.
Do.	Cyprus Cement Co. Ltd.	do.	400.
Clay	Vassiliko Cement Works Ltd.	do.	600. ^e
Do.	Peletico Plasters Ltd.	West of Limassol	120. ^e
Copper	Hellenic Mining Co. Ltd.	Skouriotissa	2 concentrate. ^e 1.1 cement copper. ^e
Gypsum	Gypsum and Plasterboard Co. Ltd.	Vassilikos	22. ^e
Do.	United Gypsum Ltd.	do.	22. ^e
Do.	Peletico Plasters Ltd.	West of Larnaca	10.
Lime	Hellenic Mining Co. Ltd.	Mitsero	8 hydrated lime. ^e
Limestone	do.	do.	280. ^e
Do.	Vassiliko Cement Works Ltd.	Vassilikos	1,500. ^e
Marble	Chrisostomos Peppos Ltd.	Paphos area	20. ^e
Do.	Elepem Ltd.	do.	12. ^e
Do.	D. Mitides Import-Export	do.	8. ^e
Do.	Takis Marble Enterprises Co. Ltd.	do.	7.5. ^e
Do.	Nearchos Eliades and Sons Ltd.	do.	1.5. ^e
Do.	Evagoras Andreou	do.	3.8. ^e
Marl	Cyprus Cement Co. Ltd.	Vassilikos	700. ^e
Petroleum, refined thousand barrels	Cyprus Petroleum Refinery Ltd.	Larnaca	5,850.
Pyrite	Hellenic Mining Co. Ltd.	2 mines 20 kilometers south of Nicosia	146.
Sand	do.	Mitsero	160. ^e
		Mari	24. ^e
Sand and aggregates	Hellenic Mining Co. Ltd.	Vasa	200. ^e
Do.	Skyra Lima Ltd.	Ayia Varvara	600. ^e
Do.	K.M.G. Quarries Ltd.	Pharmakas	220. ^e
Do.	Mosphiloti Quarries Ltd.	do.	196. ^e
Do.	Costas Kythreotis and Son Ltd.	do.	250. ^e
Do.	General Construction Co. Ltd.	Parakklisia	270. ^e
Do.	Eskal Ltd.	Ayios Mamas	175. ^e
Do.	Skyropiia "Leonik" Ltd.	Mitsero area	135. ^e
Sand and gravel	Neeffa Ltd.	Akrotiri	150. ^e
Do.	Geomichanikai and Ergoliptikai Epichirisis Merra Ltd.	do.	65. ^e
Umber	Umber Corp. of Larnaca Ltd.	20 kilometers northwest of Larnaca	13. ^e

^eEstimated.

OTHER SOURCES OF INFORMATION

Agencies

Department of Statistics and Research
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Publications

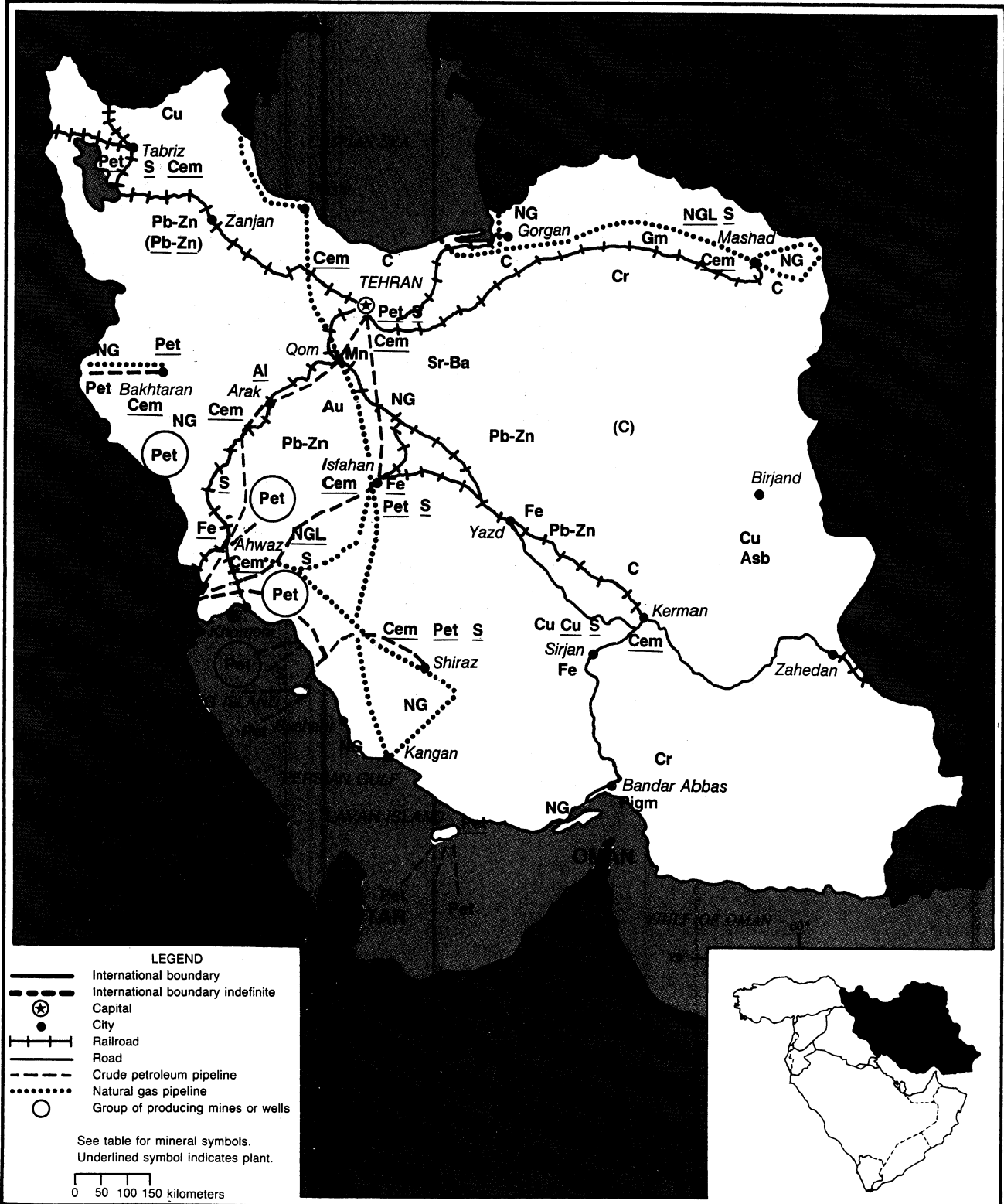
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IRAN

AREA 1.6 million km²

POPULATION 54.8 million



THE MINERAL INDUSTRY OF IRAN

By Lloyd E. Antonides and George A Morgan

The mineral industry, led by the oil and gas sector, remained the key factor in Iran's economy in 1990. Iran was among the world's five top producers of petroleum. Its petroleum reserves were also among the top five. It was among the top 10 producers of natural gas, with reserves second only to the U.S.S.R. Steel and copper were also major domestic industries. And a large number of metallic and industrial minerals, as well as coal, were produced by more than 800 operating mines.

The economy continued to stabilize after almost 10 years of war with Iraq. Although shortages of foreign exchange and problems with exchange rates remained, the Government was working on their resolution. A new 5-year development plan went into effect in March. An increased growth rate of 8% per year and a lowered inflation rate of less than 10% per year were targets of the plan.

GOVERNMENT POLICIES AND PROGRAMS

The Government continued to emphasize a free market economy and privatization of industry. This included all mining operations except the Sar Cheshmeh copper complex, the new Golgohar and Chadarmalu iron mines, and the Angouran lead-zinc deposits. The iron mines were near startup and metal extraction plants were under construction at the lead-zinc operations.

Foreign financial participation in petroleum processing was being seriously discussed and participation in exploration and production was being considered. Foreign investment was invited in most sectors of the economy, especially mining. Although foreign ownership was limited to 49%, management contracts were being offered to enable effective operating control by minority owners.

PRODUCTION

Output of mineral commodities continued to grow overall, although available sta-

tistics lacked specifics and were frequently inconsistent and often unclear. A variety of metallic and industrial minerals were produced but, in general, individual outputs were still relatively small. However, there were expansion plans throughout the industry. Metal production was being increased, especially aluminum, copper and steel. Lead and zinc metal production was to start in the next year. Cement output was also being expanded. And rehabilitation and expansion projects were underway in oil and gas production and refining, as well as in petrochemicals.

TRADE

A number of trade agreements relating to mineral commodities were concluded during 1990. However, their significance remained to be determined by future performance. Natural gas exports to Europe and the U.S.S.R. continued to be of major interest. Resumption of crude oil sales to U.S. firms were awaiting U.S. Government approval.

STRUCTURE OF THE MINERAL INDUSTRY

Most of the principal mineral commodity production facilities were still under Government control. This control was usually by subsidiary companies through the Ministry of Mines and Metals and the Ministry of Petroleum. However, the privatization program included in the new 5-year development plan was expected to lead to many changes. Foreign equity participation was a goal of the Government.

COMMODITY REVIEW

Metals

Metal production increases were high on the Government's agenda for postwar reconstruction as well as expansion of the economy and increased exports. The Ministry of Mines and Metals announced plans

for steel production rates to almost double in 3 years. Output would increase from about 3.0 Mmt/a in March 1991 to 5.5 Mmt/a by 1994 and to 7 Mmt/a a few years later. Output rates in nonferrous metals were also to grow. Copper was to increase from 94,000 mt/a in March 1991 to 120,000 mt/a 12 months later and to 200,000 mt/a by 1995. Aluminum was to increase from 70,000 mt/a in March 1991 to 120,000 mt/a soon thereafter and to more than 300,000 mt/a by 1995. Additionally, the first lead and zinc metal production plants were slated to come on-stream in 1992, with capacities of 40,000 and 60,000 mt/a, respectively.

Aluminum.—Companies under control of the Ministry of Mines and Metals reached agreement early in the year with the International Development Corp. (IDC) to establish the Almahdi Aluminum Corp. The IDC was a consortium of multinational investors-traders-constructors based in Dubai. Almahdi, owned 60% by the Government and 40% by IDC, was formed to build a new 220,000-mt/a aluminum smelter at Bandar Abbas. Technology was to be furnished by Dubai Aluminum Co. Ltd. (Dubai), which uses the pot cell technology of Kaiser Aluminum & Chemical Co. In January 1991, the parties apparently signed additional agreements to further confirm the venture. Start of production was planned for 1994. Source of alumina for the plant was not announced.

The 70,000-mt/a Government-owned Iranian Aluminum Co. smelter at Arak continued with an expansion to 120,000 mt/a or more. It reportedly received alumina mostly from India.

Early in 1990, press reports mentioned talks between the Iranian Government and several foreign firms regarding construction of a 150,000-mt/a alumina plant to be located in the southern part of the country to treat local bauxite for supplying both the Arak and Bandar Abbas smelters. However, since about 2 tons of alumina is needed per ton of aluminum, additional supplies would still be required for operating both smelters. Later in the year, the importation of bauxite from Guinea was discussed by representatives of Iran and Guinea. However, the

TABLE 1

IRAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^a	1990 ^a
METALS					
Aluminum, metal, primary ingot ^c	40,000	45,000	40,000	45,000	59,400
Chromium: Chromite, mine output (42%-52% Cr ₂ O ₃), gross weight	54,000	55,000	57,000	62,000	³ 57,400
Copper:					
Mine output, concentrate (30%-32% Cu), Cu content Metal: ⁴	⁵ 50,000	⁴ 40,000	51,000	68,000	³ 60,255
Smelter output, blister/anode	^r 50,000	^r 40,000	⁵ 52,000	^r 76,000	³ 54,756
Refinery output, cathode	^r 26,000	^r 25,000	^r 32,000	^r 40,000	³ 43,255
Gold, mine output, Au content ^c kilograms	200	400	400	400	500
Iron and steel:					
Iron ore, mine output, gross weight (^c 50% Fe) thousand tons	^r 2,130	^r 1,692	^r 2,005	2,296	2,300
Pig iron (including direct reduced/sponge iron) ^c do.	250	250	250	250	250
Steel, crude (ingots and castings) do.	850	875	^r 978	^r 1,081	1,200
Lead, mine output, concentrate (55% to 60%Pb):					
Gross weight	22,000	20,000	17,000	10,500	³ 16,000
Pb content ^c	13,200	12,000	10,200	6,300	9,600
Manganese, mine output, gross weight (^c 25%-35% Mn)	34,000	30,000	31,000	35,000	^c 25,000
Molybdenum, mine output (^c 55-60% Mo), Mo content ^c	500	500	500	500	500
Silver: Mine output, Ag content	^r 25	28	30	41	38
Zinc, mine output, concentrate (50% to 55% Zn):					
Gross weight	29,000	36,000	25,000	25,000	³ 28,000
Zn content ^c	15,950	19,800	13,750	13,750	15,400
INDUSTRIAL MINERALS					
Asbestos, marketable fiber ^c	3,000	3,300	^r 3,400	3,500	3,500
Barite ^c	^r 41,000	43,000	44,000	45,000	46,000
Boron: Borax ^c	1,200	1,500	1,700	1,500	1,500
Cement, hydraulic thousand tons	12,273	12,729	12,202	12,500	12,700
Clays:					
Bentonite ^c	27,000	27,000	^r 37,000	35,000	35,000
Kaolin and fire clay ^{c 5}	430,000	460,000	^r 493,000	500,000	500,000
Feldspar ^c	32,000	32,000	32,000	32,000	35,000
Fluorspar: Fluorite ^c	3,300	3,300	3,300	3,300	3,500
Gem stones: Turquoise ^c kilograms	35,000	35,000	^c 24,000	25,000	25,000
Gypsum ^c thousand tons	8,400	8,400	^r 7,600	8,000	8,200
Lime ^c do.	650	650	650	650	650
Magnesium compounds: Magnesite ^c	2,240	2,500	^r 2,800	2,800	3,000
Mica ^c	820	1,000	^r 1,200	1,200	1,200
Nitrogen: Ammonia, N content ^c	65,900	119,200	^r 145,500	336,000	420,000
Pigments, mineral, natural iron oxide ^c	4,300	4,300	4,300	4,300	4,500
Salt, rock ^c thousand tons	700	750	^r 815	800	800
Sodium compound: Caustic soda ^c	12,000	12,000	12,000	12,000	15,000
Stone, sand and gravel: ^c					
Crushed: Limestone thousand tons	16,000	16,000	^r 17,400	18,000	18,300
Dimension: Marble, granite, and travertine do.	3,300	3,300	3,300	3,500	3,700
Strontium: Celestite ^c	22,000	22,000	22,000	22,000	25,000

See footnotes at end of table.

TABLE 1—Continued

IRAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ³	1990 ⁴
INDUSTRIAL MINERALS—Continued					
Sulfates, natural:⁵					
Aluminum potassium sulfate (alum)	12,000	12,000	12,000	12,000	12,000
Sodium sulfate	¹ 123,000	¹ 170,000	¹ 214,000	¹ 200,000	¹ 220,000
Sulfur:⁶					
Native	¹ 10,000	10,000	10,000	10,000	10,000
Byproduct of petroleum and natural gas	¹ 180,000	240,000	206,000	460,000	480,000
Acid from smelter gas, S content	25,000	20,000	25,000	40,000	45,000
Total	² 215,000	² 270,000	241,000	510,000	535,000
Sulfuric acid	200,000	200,000	200,000	200,000	220,000
Talc	31,000	31,000	29,000	30,000	30,000
MINERAL FUELS AND RELATED MATERIALS					
Coal thousand tons	1,262	1,239	⁴ 1,600	1,500	1,500
Coke ⁶ do.	349	400	400	400	400
Gas, natural:					
Gross million cubic meters	33,350	36,700	40,500	43,600	48,000
Dry ⁶ million cubic meters	15,200	16,000	20,000	22,200	24,200
Natural gas plant liquids thousand 42-gallon barrels	5,500	7,300	7,300	9,900	11,000
Petroleum:					
Crude do.	⁷ 742,775	⁸ 838,770	⁸ 824,535	¹ 1,025,650	¹ 1,127,120
Refinery products:					
Liquefied petroleum gas do.	6,250	6,570	6,935	7,000	7,100
Motor gasoline do.	25,915	33,215	33,580	35,000	36,000
Jet fuel do.	2,555	2,555	2,555	3,000	3,500
Kerosene do.	22,630	22,630	22,995	25,000	26,000
Distillate fuel oil do.	80,300	58,400	62,050	75,000	76,000
Residual fuel oil do.	74,095	67,525	76,650	80,000	82,000
Other ⁷ do.	28,835	18,980	14,235	15,000	16,000
Total do.	240,580	209,875	219,000	240,000	246,600

¹Estimated. ²Preliminary. ³Revised.⁴Data are for Iranian years beginning Mar. 21 of that stated, except data for natural gas, plant liquids, petroleum, and all metals other than iron ore and pig iron, which are for Gregorian calendar years. Table includes data available through Jan. 22, 1992.⁵In addition to the commodities listed, other types of crude construction materials, such as common clays, sand and gravel, other varieties of stone, and miscellaneous other minerals are produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.⁶Reported figure.⁷Apparently includes output of copper smelted and refined from copper scrap, estimated at about 3% of total output.⁸Kaolin estimated to be about 17% of figures shown.⁹Excludes natural gas used for reinjection, flaring, venting, or consumed in the extraction of liquids.

details on plans for the processing into alumina were unclear. Australia was also mentioned as a source of alumina. UN and U.S.S.R. studies on making alumina from nepheline syenite in the northwest at Sarab, 125 km east of Tabriz, were due for completion toward yearend. Although results were not publicized, some trade sources believed the economics were bad. Large deposits of alunite were previously reported in the northwest region also. Periodically, bauxitic clays, mostly in central Iran, have been considered as a source of alumina.

Early in 1991, the Hungarian Aluminum Planning and Research Institute (ALUTERV) announced they expected to be involved in a \$360 million, 250,000-mt/a alumina production project in Iran but no location was indicated. Later, a firm from Czechoslovakia was also reported involved in an alumina project. Still later, a Czechoslovakian firm was mentioned in regard to a bauxite project in the northeast at Jajarm, about 350 km west-northwest of Mashad.

Chromium.—Expansion of chrome ore production and possible startup of high-

carbon ferrochrome production was considered likely in the next few years according to trade sources in Europe. Work on the ferrochrome plant was said to have started in 1987 but no location or subsequent announcements on progress were publicized. Two ferrosilicon projects, reported a few years ago as starting about the same time, also have not had progress reports released publicly.

Copper.—The Sar Cheshmeh copper mine-concentrator-smelter-refinery complex of the National Iranian Copper In-

dustries Co. (NICICO), about 150 km southwest of Kerman, was scheduled for continued expansion. Production rates reported for 1990 ranged from about 45,000 to more than 90,000 mt/a of anode-blister copper. Refined cathode output was apparently somewhat lower, and some blister was sold as finished product. Expansion plans called for a rate of 140,000 mt/a of finished product by 1992. The complex also produced molybdenum concentrate, some gold and silver, and possibly high-selenium slimes. During the year more than 20,000 tons blister, 10,000 tons refined, all molybdenum concentrate, and any selenium slimes were reportedly trucked about 500 km south to the Port of Bandar Abbas for export. Rail transport was expected to start in 1992-93 when the line from Kerman to Bandar Abbas is completed.

A small underground copper mine and concentrator about 500 km northeast of Sar Cheshmeh, south of Birjand, was also operated by the company. Concentrates containing good gold and silver values were trucked to Sar Cheshmeh.

A new mine at Meyduk, 100 km northwest of Sar Cheshmeh, was being planned for early development by NICICO. Foreign participation was being considered. A large porphyry deposit in the far northwest was also being explored.

Qaleh Zari, a copper mine and concentrator about 100 km south of Birjand, was operated by a privately owned company. The last specific output data, in the spring of 1986, stated about 12,000 mt/a of concentrate grading 22% copper with 550 g/mt silver and 12 g/mt gold. Ore production was reported as more than 120,000 tons at 2%-3% copper. Product was believed to be normally exported.

Gold.—Broken Hill Pty. Ltd. (BHP) of Australia was awarded a consultancy contract for investigating expansion of gold production in the Mouteh area, about 150 km northwest of Isfahan.

Iron and Steel.—Two iron ore projects were progressing toward meeting the scheduled needs of Iran's expanding steel industry. The Golgothar complex, about 25 km southwest of Sirjan, consisted of six open pit mines with concentrator, railroad, and other infrastructure. It was expected to produce more than 2.5 mt/a of magnetic concentrates from about 5 Mmt of ore. It was scheduled to start operation in 1992 to supply the new 2.5 Mmt/a Mobarakeh steel mill in Isfahan due for initial startup in 1992.

Reports indicated \$0.7 to 1.0 billion will have been invested upon completion in 1993. The new Chadarmalu open pit was another major project also for supplying Mobarakeh as well as other consumers. It was 125 km northeast of Yazd and about 50 km north of Choghart, which produced most of the iron ore in 1990.

An iron ore project consultancy was also awarded to BHP. Location was in the northeast.

Direct-reduced-iron (DRI) production at the Ahwaz steel complex was planned to commence early in 1992 from the first HYL module, according to the Mexican supplier of the process. Three additional modules will be completed a year later. Installation started in 1978 but ceased in 1981 owing to the Iran-Iraq war. Capacity of the four modules, as modified, was expected to be more than 1 Mmt/a. In the 1970's, plans also included construction of three 400,000-mt/a Midrex DRI units, of which two were reportedly installed. In 1988, completion of the third unit was on the Government's high-priority list. Kobe Steel of Japan acquired rights to supply Midrex units and may have been awarded supply of the third unit as part of its 1990 contract for management and technical services to rehabilitate the Ahwaz plant. In 1990, Ahwaz was producing at a 200,000 - 300,000-mt/a rate although original design was for 2.5 million mt/a.

At the Mobarakeh plant, Kobe was installing five Midrex units. The company also was selected to build a DRI facility on Qeshm Island offshore Bandar Abbas. The island was being developed as a free trade zone. A \$770 million iron ore handling facility and jetty was announced for the Port of Bandar Abbas. It was to be used to transfer shipments to the Iranian steel plants.

A new alloy and specialty steels plant at Yazd was being planned by the National Iranian Steel Co. Initial capacity was to be 140,000-mt/a capacity and more than double that within 3 years later. It was to be fed DRI from the Mobarakeh and Ahwaz plants. Ore from the Chardamalu Mine may also be used. A request for bids was expected by mid-1991.

Lead and Zinc.—The status of the lead and zinc plants reportedly under construction at Zanjan and due to come on-stream in 1992 was unclear. The lead plant was proceeding in early 1990, but the zinc plant was to be retendered because the ore was found to require a different technology.

Industrial Minerals

Cement.—Increased production of cement was a major Government goal. According to statements by officials, an increase of more than 15% was expected in 1990, and special incentives were offered for further increases. A number of contracts were awarded for new plants and additions to existing plants.

Dimension Stone.—The Government made efforts to promote expansion of the production of decorative stone from the extensive deposits in Iran. An international exhibition of mineral products and production machinery was planned for early 1991.

Mineral Fuels

With oil and gas being so important to Iran's economy, developments occurred at a rapid pace in 1990. The new 5-year plan allocated more than \$10 billion for oil and gas activities. First priority was continuing repair of Iran-Iraq war damage. Second was development of gas reserves and expansion of domestic distribution. The latter would substitute for oil, which could then be exported.

In natural gas, actual activity was mostly related to exports. Early in the year, Iran proposed a \$12 billion gas pipeline from the Gulf to Pakistan and on to India. After an 11-year suspension, gas exports were resumed from southern gasfields to the U.S.S.R. Iran and Qatar planned development of the offshore Pars Gasfield for export to Europe by pipeline through Turkey. At the Nar-Kangan gas refinery, an expansion to double output to 80 billion m³/a was started. The refinery was designed to serve domestic needs as well as provide for exports to the U.S.S.R.

In petroleum exploration, a Caspian Sea hole was drilled below 5,000 m by mid-March 1991, and more drilling was planned. Early in 1991, discussions were reported on inviting foreign oil firms to help increase production with financing and technical assistance and to possibly assist exploration also.

Petroleum production was slated to rise to more than 4 Mbbl/d by 1992 from an estimated 3.5 Mbbl/d at the end of 1990. By 1994 capacity was planned to be 5 Mbbl/d. The export terminal at war-damaged Kharg Island was to be expanded as reconstruction continued.

Refining reached a 10-year peak output of 920,000 bbl/d at yearend. Projects for

reconstruction of the Adaban refinery and construction of a new refineries at Arak and Bandar Abbas were continuing.

The petrochemical complex of Bandar Imam at Bandar Khomeini, originally recommended to be scrapped owing to war damage, was being rebuilt.

Reserves

Information was too inconsistent and unreliable to develop reserve data.

INFRASTRUCTURE

Major efforts were being made to rehabilitate and/or improve transportation facilities throughout the country. Ports were an important focus. A rail link from Kerman to Bandar Abbas was a high priority. It was

needed for imports and exports as well as internal movements. An extension from Kerman to Zahedan was a longer range project that would open trade to Pakistan and India as well as aid development of the southeast. Another rail line extension was also planned in the northeast from Mashad into the U.S.S.R. A very ambitious electric power generation and distribution program was underway that extended throughout the country. The natural gas distribution network was continuing to be expanded.

OUTLOOK

Expansion of the mineral industry can be expected to continue. The resource base was estimated to be large, and the trends toward privatization and foreign investment were

strong. This should result in expansion of the industry and the economy in general.

¹Where necessary, values have been converted from Iran rials (RIs) to U.S. dollars at the rate of RIs68.096=US\$1.00 for 1990 values and RIs72.015=US\$1.00 for 1989 values. These were official rates but free market rates were about RIs 1400=US\$1.00.

OTHER SOURCES OF INFORMATION

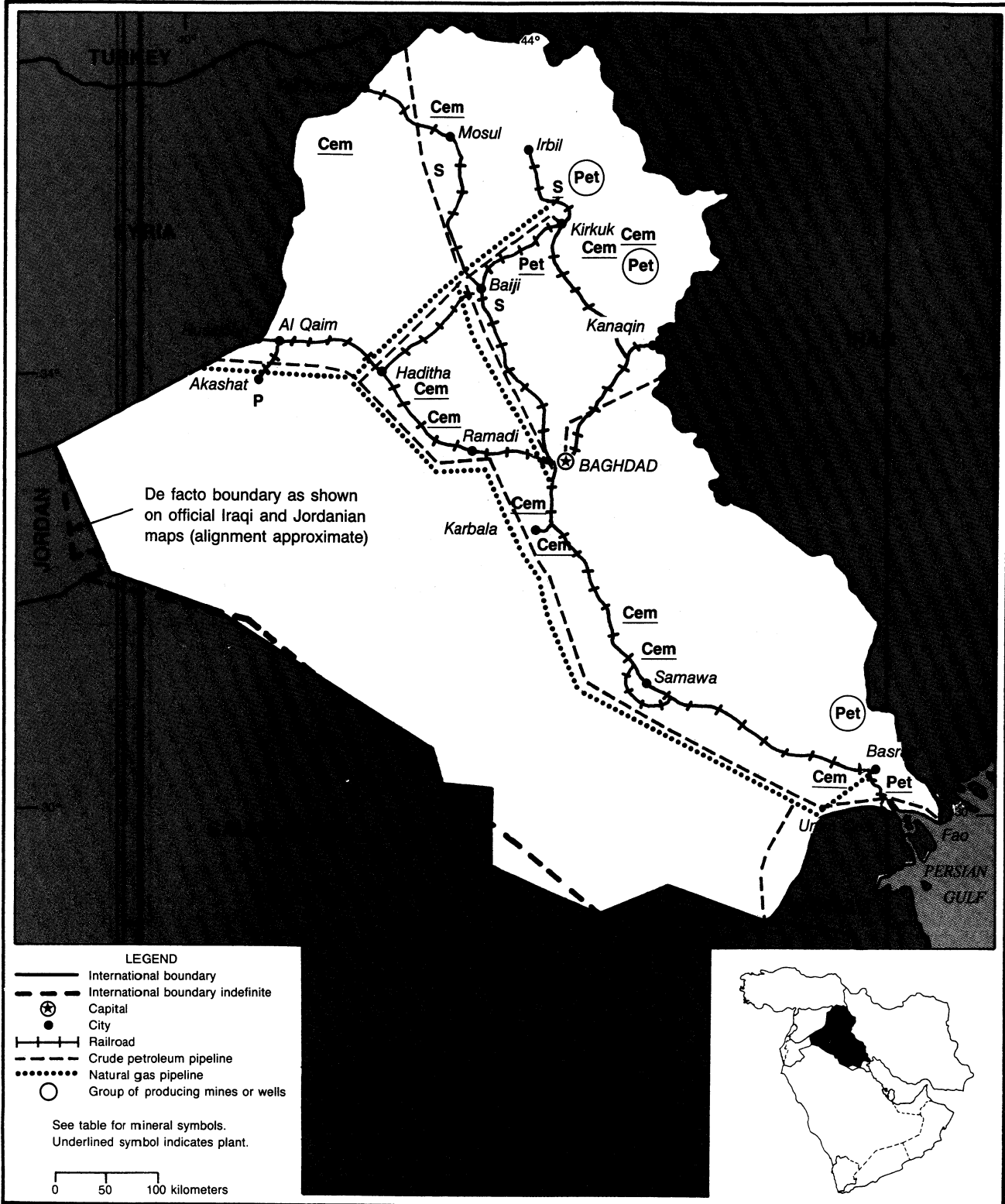
Ministry of Mines and Metals
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Ministry of Petroleum
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IRAQ

AREA 434,920 km²

POPULATION 18.8 million



THE MINERAL INDUSTRY OF IRAQ

By George A. Morgan

Output of most major mineral commodities declined sharply in 1990. Iraq suffered a UN imposed trade embargo on August 6 owing to its August 2 invasion of Kuwait. Crude petroleum, natural gas, and natural gas liquids were the major commodities produced. They remained the principal sources of income for the Government and were estimated to account for more than 90% of foreign exchange earnings. Iraq had been expanding its phosphate rock, sulfur, and downstream fertilizer industries, but all suffered a sharp setback.

In an effort to protect Iraqi interests from the UN embargo, the Government passed law 57 on September 16, retroactive to August 6, 1990. The purpose of the new law was to protect Iraqi property, interests, and legal rights, both inside and outside of

Iraq. Included in the law were references to contractual obligations, funds, and assets.

By yearend 1990, crude petroleum output was estimated to be 350,000 barrels per day compared with 3.1 million barrels per day in early August. Loss of export markets led to the decline in output. An estimated \$28 billion in sales of crude petroleum alone were to have been received in 1990. However, the decline in exports is estimated to have resulted in the loss of about 25%, or \$7 billion.

The southern gas-gathering complex was opened in July. It had the capacity to process and export liquefied petroleum gas from the Khor al-Zubair terminal. Capacity was about 46.4 million barrels per year of propane, butane, and benzene. Most of this was to be used locally as fuel, with the surplus exported.

Projects to develop the North Rumaila Oilfield for output of 300,000 barrels per day and the West Qurna Oilfield for output of 200,000 barrels per day in the first phase and 500,000 barrels per day in the second phase were suspended.

Iraq had been a significant exporter in the Middle East of nitrogen-base fertilizers, sulfur derived from Frasch recovery and petroleum, and granular triple superphosphate. World markets for these materials were reportedly affected and price increases occurred with imposition of the embargo. Exports of crude oil and refinery products by pipeline through Saudi Arabia and Turkey and via the Arabian Gulf were also terminated.

Official Iraqi trade statistics are not published. However, based on trading partners' trade data, in 1989, the latest year for which

TABLE 1

IRAQ: PRODUCTION OF MINERAL COMMODITIES FOR 1990¹

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e
INDUSTRIAL MINERALS					
Cement, hydraulic ^e thousand metric tons	8,000	10,000	10,500	12,500	13,000
Gypsum ^e do.	300	350	350	450	470
Nitrogen: N content of ammonia ^e do.	60	60	313	474	400
Phosphate rock ^e do.	1,000	1,500	1,273	1,300	1,100
Salt ^e do.	70	70	300	300	300
Sulfur, elemental: ^e					
Native, Frasch do.	600	707	958	960	800
Byproduct do.	200	250	227	370	250
Total do.	800	957	1,050	1,330	1,050
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural: ^e					
Gross million cubic meters	12,750	14,160	14,160	14,400	11,000
Dry do.	2,270	2,800	2,800	3,100	2,300
Natural gas liquids: ^e					
Natural gasoline thousand 42-gallon barrels	400	400	400	440	330
Propane and butane do.	1,000	1,000	1,000	1,100	825
Petroleum:					
Crude do.	617,000	792,050	981,000	978,000	³ 732,920
Refinery products ^e do.	110,000	110,000	120,000	150,000	100,000

^eEstimated. ^pPreliminary.

¹Includes data available through Apr. 10, 1991.

²In addition to the commodities listed, lime and a variety of crude construction materials (clays, sand and gravel, and stone) were also produced, but output was not reported, and available information is inadequate to make reliable estimates of output levels.

³Reported figure.

information was available, the leading exporters to Iraq in order of importance were the United States, Turkey, the U.S.S.R., and Japan. The leading importers in order of importance were the United States, the Federal Republic of Germany, the United Kingdom, and Japan. Imports during the first 6 months of 1990 were estimated at \$9.7 billion. Japan, which exported about 44,000 tons of steel to Iraq in the first half of 1990, and more than 65,000 tons in 1989, had an additional 20,000 tons of pipe steel to deliver when the embargo was imposed.

An estimated 1.3 million foreign work-

ers were employed in Iraq in 1990. The embargo led to the exodus of many of these laborers.

Work underway to expand the country's metalmaking capability and capacity through the Nasr State Enterprise for Mechanical Industries in Iraq was terminated or suspended with the embargo. Included in these programs were a \$50 million contract, begun in 1987, to build a 4,500-mt/a foundry by Kloeckner Industrieanlagen Ltd. of the Federal Republic of Germany; a \$77 million contract, begun in 1989, to construct a specialty steel rolling mill by

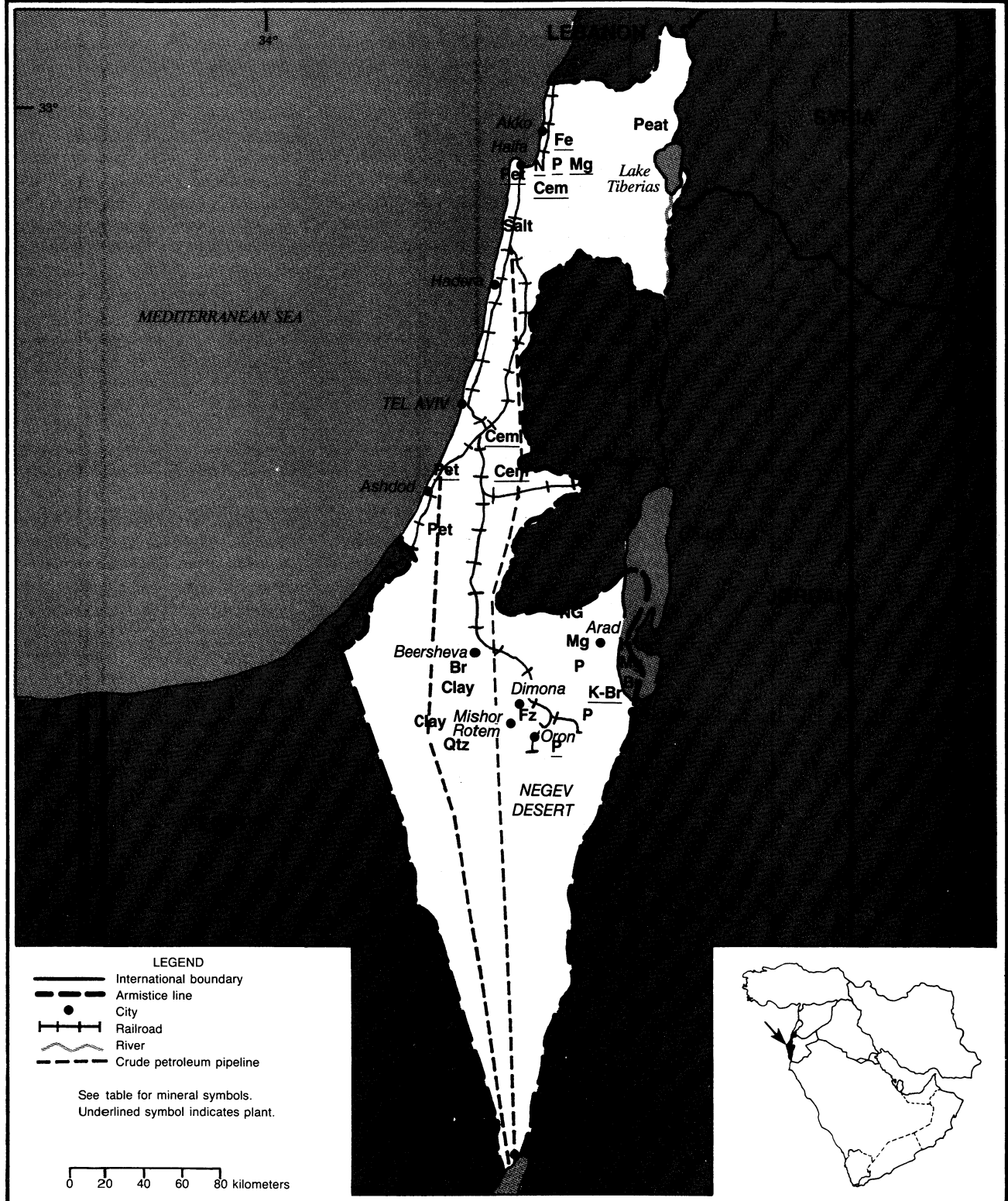
Danieli Ltd. of Italy; and a \$79 million contract to install a hammer forge to produce 30,000 mt/a of steel and aluminum products, by Ferrostaal Ltd. and SMS Hasenclever Ltd., both of the Federal Republic of Germany.

The Iraqi economy was expected to continue to deteriorate in the face of the international embargo and trade blockade. With loss of its principal sources of revenue, the sale of crude petroleum and petroleum refinery products, the mining and quarrying sectors of the economy would be brought to a virtual standstill.

ISRAEL

AREA 21,000 km²

POPULATION 4.4 million



THE MINERAL INDUSTRY OF ISRAEL

By Audie L. King

Israel's principal mining activities were phosphate production in the Negev Desert and the extraction of bromine, magnesium, and potassium from the Dead Sea. The country was the world's seventh largest producer of phosphate rock and accounted for 2% of world production. It continued to be the world's second largest producer of bromine and bromine compounds, accounting for about 30% of total world production in 1990. Potash production continued to be Israel's most lucrative mineral industry, although earnings fell to about \$50 million in 1990 from \$65 million in 1989. Israel supplied about 6% of the potash sold on the world market and accounted for about 5% of the world's potash production, making it the fifth largest producing nation. More than 1% of the world's refractory-grade magnesia was also recovered from Dead Sea brine.

The mineral industry played a relatively minor role in Israel's overall economy. Revenues were equivalent to about 2.3% of GDP in 1990. In that more than 90% of the country's mineral production was exported in 1990, the mineral industry was particularly important to Israel's balance of trade. Exports of mineral products from mining and quarrying and manufactured mineral products, excluding cut diamonds, were about \$1.2 billion in 1990 or about 9.7% of all exports.

Israel is also a significant consumer of mineral products. It has a relatively high per capita consumption rate and a well-developed industrial capacity to process imported raw materials for reexport. If reexports of processed mineral imports, such as diamond, primary metal products, fertilizer, refined petroleum products, and inorganic chemicals, are considered, mineral commodity exports would account for more than 42% of the value of total exports. The diamond cutting and polishing trade alone accounted for about 20% of the value of total imports and about 27% of the value of total exports.

GOVERNMENT POLICIES AND PROGRAMS

In September 1990, Israel adopted a new economic plan. The new program was de-

veloped to meet Israel's pressing need to create new jobs for the more than 150,000 immigrants that entered the country in 1991 and for the more than 1 million immigrants that were expected to arrive within 3 to 5 years. These new Israelis are very well educated and considered a very important asset. Fully employing the skills of the nation's unemployed was considered the key to Israel's future economic growth. Although Israel's leaders acknowledged that direct and indirect Government intervention would be necessary to rapidly create large numbers of jobs, the new economic plan had not abandoned the nation's transition to a market economy. It was hoped that new incentives would entice global high-tech companies to establish branches in Israel. The plan would reduce the cost of maintaining employees by reducing the taxation factor in labor costs. It also reduces governmental constraints on the capital and labor markets.

By the end of 1990, most of the plan's new measures had not yet been approved. In September, however, the Knesset enacted a measure granting loan guarantees for up to twice the capital invested in new enterprises, provided the investment amounted to at least \$75,000 and occurred in an approved location. It was hoped that loan guarantees, when combined with other financial incentives, will be attractive enough to investors to overcome any perceived security threats caused by civil unrest. Israel offers foreign companies relatively low cost capital, about 5% when adjusted for inflation, and wide variety of tax incentives.

Because it felt that the private sector was not meeting the housing needs of the new immigrants, the Government decided to intervene heavily in the building sector. Public-sector housing starts increased from 4,000 in 1989 to about 22,000 in 1990. During the same time period, private-sector housing starts increased by only 50% to about 23,000.

PRODUCTION

The production of mineral products whose end use was in the building sector, such as cement, clay, crushed stone, sand,

and steel, increased in 1990 owing to a surge in new home construction. Even though an estimated 45,000 residential dwellings were constructed in 1990, Israel failed to meet its demand for new housing that was estimated to be about 100,000 units per year.

A slowdown in world markets caused the production of minerals extracted primarily for export to decline or remain flat. Bromine and phosphate rock production fell from peak production levels in 1989, while fertilizer and magnesia production remained level. Potash was the only major export commodity to experience a slight production increase.

TRADE

Israel's economy is very reliant on trade. Its foreign trade, valued at almost \$27 billion in 1990, was equal to more than 52% of the country's GDP. This is an unusual situation, making Israel one of the most trade-dependent countries in the world. Israel exported an estimated \$11.6 billion worth of merchandise in 1989 and imported about \$15.1 billion. Israel's trade deficit widened slightly during 1990 to about \$3.5 billion from about \$2.4 billion in 1989.

Israel had negotiated trade agreements with the United States and the EC. From the standpoint of the diversity and abundance of its tradable merchandise, Israel could consider itself part of the Western market. The importance of Israel's trade with the United States decreased in recent years as European trade, particularly with Eastern Europe, increased. The United States accounted for about 28.8% of Israeli exports and 17.8% of Israeli imports in 1990, making it Israel's single most important trading partner. In 1989, Israel sold 31% of its exports to the United States and imported 17.9% of its foreign goods from the United States. The U.S. trade deficit with Israel was \$752.4 million in 1990, about \$204 million smaller than in 1989. U.S. exports to Israel in 1990 were about \$2.7 billion, a 15.5% increase from 1989, and U.S. imports from Israel increased 4.9% to about \$3.5 billion. The United States exported mainly machinery and military equipment, agricultural products, vehicles

TABLE 1
ISRAEL: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e	
METALS						
Iron and steel: Steel, crude	110,000	116,000	¹ 120,000	¹ 118,000	144,000	
INDUSTRIAL MINERALS						
Bromine: ^c						
Elemental	105,000	110,000	³ 118,000	³ 135,000	³ 130,000	
Compounds	73,000	78,000	³ 99,000	³ 120,000	³ 120,000	
Cement, hydraulic (from domestic clinker)						
thousand tons	2,059	2,226	2,326	2,289	³ 2,868	
Clays: ^c						
Bentonite	5,000	4,500	3,000	3,500	3,500	
Flint clays	6,000	6,000	³ 6,020	³ 6,130	³ 13,955	
Kaolin	28,000	29,000	³ 30,600	³ 33,280	³ 42,212	
Other	14,000	12,000	³ 11,739	14,000	14,000	
Gypsum ^c	³ 45,999	35,000	³ 31,181	31,000	38,000	
Lime ^c	¹ 130,000	¹ 130,000	³ 130,000	¹ 180,000	³ 230,000	
Magnesia, Mg content ^c	20,000	20,000	30,000	39,000	44,000	
Nitrogen: N content of ammonia	60,000	60,000	¹ 57,500	¹ 57,500	57,500	
Phosphate rock:						
Beneficiated	thousand tons	3,673	3,798	3,479	3,922	3,516
P ₂ O ₅ content	do.	1,107	1,214	1,092	1,223	1,104
Potash, K ₂ O equivalent	do.	1,253	1,244	1,240	1,338	1,379
Salt, marketed (mainly marine) ^c	350,000	350,000	³ 361,000	³ 475,000	³ 426,000	
Sand: ^c						
Glass sand	60,000	60,000	³ 59,520	³ 65,300	³ 84,759	
Other	thousand tons	4,300	4,500	4,500	³ 4,616	
Sodium and potassium compounds: Caustic soda	27,000	29,717	29,727	¹ 30,897	³ 31,575	
Stone: ^c						
Crushed	thousand metric tons	¹ 12,000	¹ 13,000	13,000	13,000	³ 16,372
Dimension, marble		13,000	10,000	10,000	10,000	³ 8,000
Sulfur:						
Byproduct from petroleum ^c	thousand tons	15	15	15	15	
Sulfuric acid	do.	182	142	163	161	150
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural, marketed	thousand cubic meters	39,400	45,100	41,400	38,400	³ 33,200
Peat ^c	thousand tons	20	20	20	20	20
Petroleum:						
Crude	thousand 42-gallon barrels	<u>74</u>	<u>85</u>	<u>107</u>	<u>¹116</u>	<u>79</u>
Refinery products:						
Gasoline	do.	10,700	11,400	10,950	11,600	12,200
Kerosene and jet fuel	do.	5,100	5,450	5,500	5,800	6,100
Distillate fuel oil	do.	11,315	14,650	14,700	15,600	16,400
Residual fuel oil	do.	14,920	13,440	13,500	13,700	14,400
Other	do.	7,900	5,200	5,200	4,400	4,600
Refinery fuel and losses ^c	do.	1,800	1,800	1,800	1,800	1,900
Total	do.	51,735	51,940	51,650	52,900	55,600

^eEstimated. ^pPreliminary. ^rRevised.

¹Table includes data available through Nov. 8, 1991.

²In addition to the commodities listed, a variety of other crude construction materials are produced, but available information is inadequate to make reliable estimates of output levels.

³Reported figure.

and transport equipment, optical and measuring instruments, chemicals, rough diamonds and precious stones, cardboard, and paper to Israel. The United States' main imports from Israel included polished diamonds and gemstones; machinery and mechanical instruments; medical, optical, and measuring instruments; vehicles and transport equipment; chemicals; textiles and clothing; and metals.

STRUCTURE OF THE MINERAL INDUSTRY

The Government was still the principal owner of most of the country's mineral-related industries. The diamond cutting and polishing industry was privately owned as

were the cement and potassium nitrate manufactures.

COMMODITY REVIEW

Industrial Minerals

Bromine.—Dead Sea Bromine, a member of the Israel Chemicals Ltd. (ICL) group, was the largest producer of elemental bromine in the world, accounting for about 25% of world production and about 60% of world trade. It also produced bromine compounds and chlorine from virtually unlimited Dead Sea brine reserves. Its main bromine products included bulk inorganic and organic compounds, flame-retardants, and agricultural specialty products. Production facilities are in Israel and in the Netherlands.

Cement.—Nesher Israel Cement Enterprises Ltd., Israel's only cement producer, was accessing plans to expand its production capacity by another 800,000 metric tons per year. The plans called for the construction of another dry kiln that would probably be at the Tel Aviv plant. The new scheme, if approved, would not likely be operational until the mid-1990's.

Diamond.—The cutting and polishing of imported rough diamonds continued to grow in importance to Israel's economy. In 1990, the diamond trade employed about 11,300 workers and accounted for about 20% of the total value of Israel's imports and about 27% of the value of total exports. Despite a worldwide recession and the negative effects of the Gulf crisis, which

TABLE 2

ISRAEL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Bromine	Dead Sea Bromine Co. Ltd.	Sdom	200 bromine and bromine compounds.
Do.	Bromine Compounds Ltd.	Romat industrial park: two plants near Beersheva	60 bromine compounds.
Cement	Nesher Israel Cement Enterprises Ltd.	Near Haifa	*850.
Do.	do.	Near Jerusalem	700.
Do.	do.	Near Tel Aviv	*750.
Chlorine	Dead Sea Bromine Co. Ltd.	Sdom	75.
Fertilizer	Rotem Fertilizer Ltd.	Mishor Rotem	*600 mixed fertilizers.
Magnesia	Dead Sea Periclase Ltd.	Haifa	70.
Magnesium chloride	Dead Sea Works Ltd.	Sdom	75.
Nitrogen	Fertilizers and Chemicals Ltd.	Mishor Rotem	180 ammonium sulfate.
Petroleum, refined million barrels	Oil Refineries Ltd.	Haifa	43.8.
Do.	do.	Ashdod	25.5.
Phosphate rock	Negev Phosphates Ltd.	Arad, Zin, Oron southwest of Sdom	4,000.
Phosphoric acid	Rotem Fertilizer Ltd.	Mishor Rotem	200.
Do.	Negev Phosphates Ltd.	Near Oron	30.
Potash	Dead Sea Works Ltd.	Sdom	2,200.
Potassium nitrate	Haifa Chemicals Ltd.	Haifa	300.
Iron	United Steel Mills Ltd.	Near Haifa	130.
Sulfuric acid	Rotem Fertilizer Ltd.	Mishor Rotem	500.
Do.	Fertilizers and Chemicals Ltd.	Haifa	220.

*Estimated.

caused a 500,000-carat drop in production, the diamond industry achieved a 0.9% growth in the value of diamond exports. Diamond exports in 1990 were valued at \$3.0545 billion, according to Israel's Central Bureau of Statistics. This record level of sales was achieved by increases in the price of polished stones sold through the Central Selling Organization. Israel processed 3.4 million carats in 1990, down from 3.9 million carats in 1989.

Periclase.—The Dead Sea Periclase Ltd., a company in the ICL group, had the capacity to manufacture about 70,000 mt/a of magnesium oxide. Most of the company's output was used for the manufacture of heat-resistant bricks for the steel industry. A small amount of magnesium oxide was used in the chemical, pharmaceutical, rubber, and plastics industries. During the past few years, the company had been concentrating on technically advanced products such as fused high-purity magnesium oxide for the nuclear industry and single magnesia crystals that are cut and polished for use as substrates in high-temperature superconductors.

Phosphate.—Negev Phosphates' plans to exploit the new Zohar phosphate field near Arad were still pending approval. In 1990, there were three active quarries, which together produced 2.1 Mmt of phosphate rock that was shipped to the Port of Ashdod for export. Zin, the largest producer, about 20 km east by northeast of Oron, had a rail capacity of 2.2 Mmt/a. The two smaller producers, Oron and Arad, about 30 km northeast of Oron, had rail capacities of 550,000 mt/a and 250,000 mt/a, respectively.

The Rotem-Amfert Group was formed in 1990 from the merger of Rotem Fertilizers Ltd. and its European subsidiary, Amfert BV. It processed about 1.4 Mmt of phosphate rock to produce about 200,000 tons of phosphoric acid and 600,000 tons of various fertilizers. The plant is in the Negev Desert at Mishor Rotem, close to its source of raw materials. Phosphoric acid production capacity at Rotem's plant increased to 200,000 mt/a owing to improvements in the processing facilities that were completed in 1990. Plans were to ultimately double capacity in an expansion project known as Rotem II. The sister plant that was to be built next to the older one would need additional raw materials, which would possibly come from the proposed Zohar deposit. The expansion project was

not yet approved and likely would not be completed until the mid-1990's.

Potash.—Production at the Dead Sea Works (DSW) increased 4% over 1989 levels to 2.2 Mmt in 1990. Lower world prices for its crude ore and fertilizer products, however, caused 1990's net profits to fall from 1989's record of \$65 million to \$50 million. DSW proceeded with plans to increase its capacity by 200,000 to 300,000 mt/a by increasing the number of evaporation ponds. Production could reach 2.5 Mmt/a by 1991, when the expansion is completed.

As part of its drive to diversify its product line, DSW proceeded with plans to build a potassium sulfate plant adjacent to its existing facilities. When completed, the \$5 million plant would have a capacity of 300,000 mt/a. Potash would come from the Dead Sea, and gypsum would be processed from waste generated in phosphoric acid production. DSW also planned to increase its loading capacity at the Port of Ashdod by installing a new shiploader.

Haifa Chemicals Ltd. expanded the capacity of its potassium nitrate plant from 250,000 mt/a to 300,000 mt/a. The capacity to produce technical-grade potassium nitrate increased from 30,000 mt/a to 45,000 mt/a. Initial plans for the construction of another 100,000-mt/a potassium nitrate production facility were being considered.

Sulfur.—Israel Chemicals Ltd. and the Israeli American Oil Co. (Isramco) were conducting an exploration program for sulfur in the Negev Desert. The exploration project was conceived after Freeport Egyptian Sulfur Co. located a 43-m-thick sulfur bed at a depth of about 130 m in the nearby Sinai Desert.

Mineral Fuels

Coal.—Israel imported 3.5 Mmt of coal in 1989, the last year that data were available. Its suppliers were, in descending order of importance, the Republic of South Africa, the United States, Australia, Colombia, Venezuela, the U.S.S.R., and Poland.

It was predicted that Israel will need to import more than 7 Mmt/a of coal by 1995 if it were to meet its growing demand for electricity. The Rutenberg power station, which was scheduled to open in 1991, will add 2.5 Mmt/a to Israel's coal imports. In April 1990, the existing powerplant at Hadera received authorization to expand capacity from 1,400 MW to 2,500 MW,

which will require an additional 1.5 Mmt/a of imported coal.

A new coal reception and handling facility became operational at the new Rutenberg coal powerplant in June 1989, and another one is due to open in 1991. Additionally, two new reception and handling units were authorized to be built at the Hadera plant.

Coal imports to industrial users, which have been minimal, were expected to increase to an estimated 1 Mmt/a by 1995. The cement industry already had the capacity to use 250,000 tons of coal; however, it had been less expensive to use oil in recent years.

Oil Shale.—Energy Resources Development Ltd. (PAMA) continued research on methods to exploit Israel's 12 billion tons of lean oil shale resources. Investigations centered around an oil-shale-fueled cogeneration pilot plant at Mishor Rotem. The plant cost \$30 million to construct and was designed to produce 50 tons of steam and 4.4 MW of electricity per hour.

Reserves

The supply of bromine, chlorine, potash, and magnesium salts from Dead Sea brine is virtually unlimited. Reliable information on Israel's phosphate reserve base was not available.

INFRASTRUCTURE

Israel had 4,500 km of roads, the majority of which was paved. There were three ports at Haifa, Ashdod, and Elat. A total of 708 km of pipelines carried crude oil from the Port of Elat, on the gulf of Aqaba, to the Haifa and Ashdod oil refineries. There were also 89 km of natural gas pipelines and 290 km of pipeline carrying refined petroleum products. About 85% of the traffic on Israel's 594-km rail system was involved in the transport of potash and phosphate materials from the Dead Sea and the Negev Desert to the Ports of Ashdod and Haifa.

OUTLOOK

The Israeli economy will likely improve as the nation moves ahead with plans to privatize a majority of its parastatal corporations. It will also benefit from the wide variety of skills and high level of education of the large number of new immigrants from the U.S.S.R. that were being assimilated into

the labor force. The key to Israel's economic success lies in its ability to utilize its most important natural resource — its people's abilities. Israel's population is far better educated, on average, than that of any other country, and statistics show that new Soviet immigrants have obtained even higher levels of education than the veteran population. Economic growth would increase the domestic consumption of Israel's mineral

commodities, but its mining industry will continue to be primarily export-orientated. The health of Israel's mining industry, therefore, will continue to fluctuate with world commodity prices. Trends to export higher valued mineral products such as custom fertilizers, technical-grade chemicals, and other high-tech specialty items will continue.

¹Where necessary, values have been converted from new Is-

raeli shekels (NIS) to U.S. dollars at the rate of NIS2.0162=US\$1.00.

OTHER SOURCES OF INFORMATION

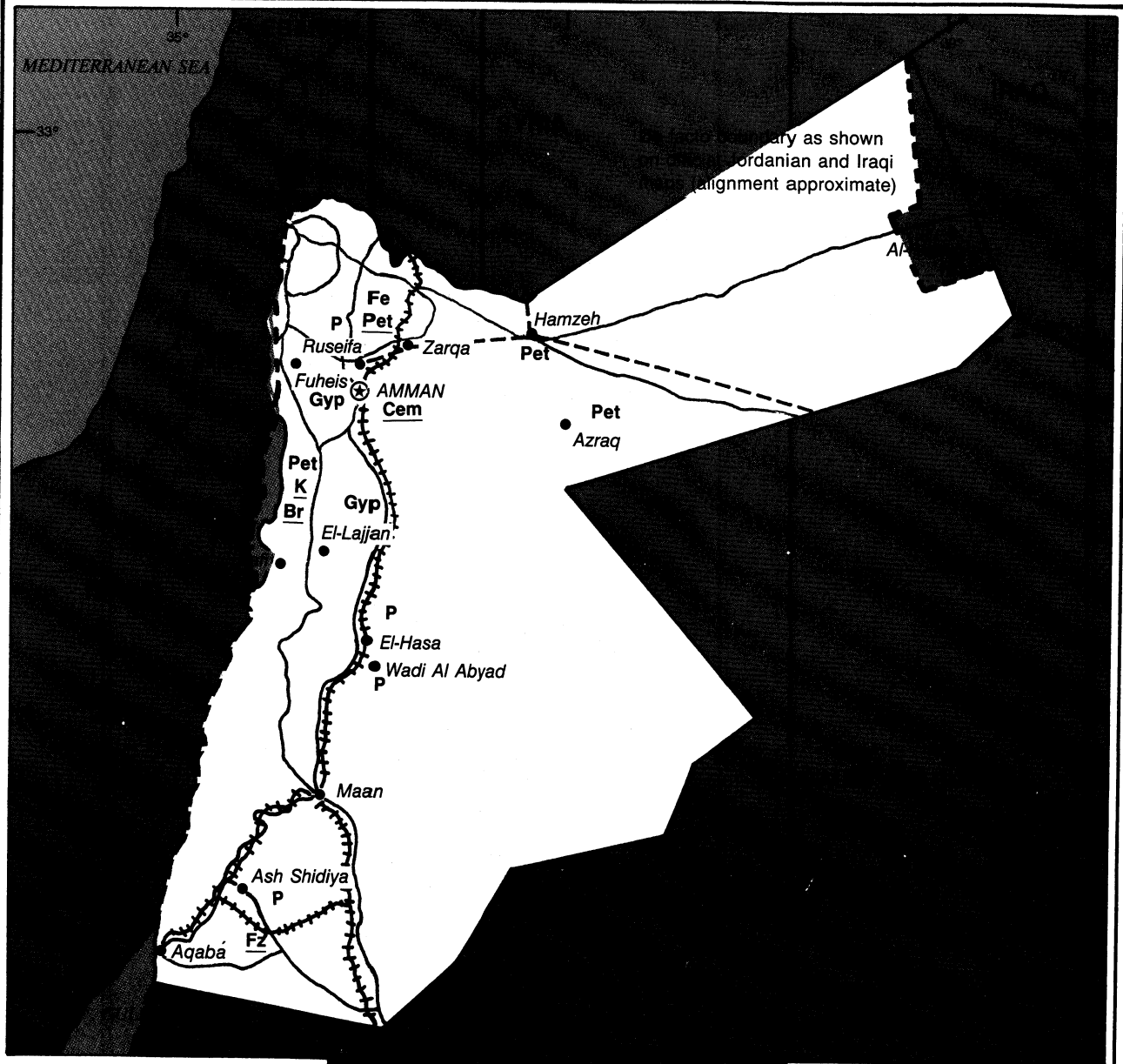
Central Bureau of Statistics, Tel Aviv:
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JORDAN

AREA 91,880 km²

POPULATION 3,064,508

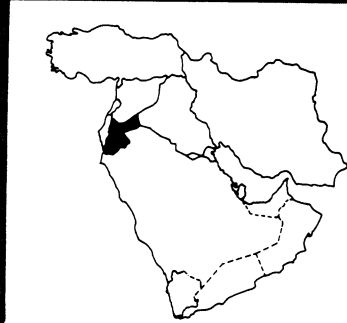


LEGEND

- International boundary
- International boundary disputed
- Capital
- City
- Railroad
- Road
- River
- Crude petroleum pipeline
- Group of producing mines or wells

See table for mineral symbols.
Underlined symbol indicates plant.

0 25 50 kilometers



THE MINERAL INDUSTRY OF JORDAN

By Thomas P. Dolley

With the exception of Iraq and Kuwait, the Hashemite Kingdom of Jordan was the nation most damaged economically by the Persian Gulf crisis and trade embargo in 1990. The mineral industry of Jordan, particularly its export markets, was not spared the economic downturn. The high insurance premiums for shipping and the shipping blockade had a negative effect on the overall economy. The central bank of Jordan estimated that the loss of exports, remittances of 289,000 expatriated Gulf workers, tourist flight, and other earnings in 1990 was \$2 billion.¹ The GDP for 1990 was estimated at about \$4 billion.

Potash production increased over that of the previous year, but this remained the only positive note in an overall decrease in mineral industry production. Phosphate rock production and exports decreased. Receipts for both domestic sales and exported phosphate rock produced in Jordan totaled about \$281 million in 1990. Domestic potash sales and exported potash mined in Jordan in 1990 generated approximately \$154 million.

Jordan's economic woes in 1990 were evident before Iraq's invasion of Kuwait in August. The rescheduling of \$650 million in external debt owed to international creditors occurred in both 1989 and 1990.

GOVERNMENT POLICIES AND PROGRAMS

The Provisional Law of Natural Resources 37 of 1966, amended, is the basic mining law of Jordan. The law allows for private Jordanian or foreign national ownership of a mine or quarry with the provision that mine management be conducted by a Jordanian operator.

In 1990, the Government sought further support from the International Monetary Fund (IMF) and other sources. In order to encourage IMF aid, the Government substantially cut investment spending and submitted its ongoing structural adjustment program, later canceled, to critical review. Thus, substantial tranches of a \$100 million

standby credit were then released, along with loans and contributions from the Federal Republic of Germany, Japan, and the World Bank totaling close to \$175 million.

The Government signed an agreement with the EC in 1990. The EC was to provide approximately \$700,000 in funding for economic geology projects. The projects include the mining of ornamental stone, assessment of the mineral potential of granites, and a feasibility study of the Wadi Araba copper prospect.

PRODUCTION

Phosphate and potash remained the most significant mineral commodities exploited in Jordan. The mining sector in 1990 survived the economic turmoil caused by the Gulf crisis, with moderate decreases overall in production and revenue. Shortfalls in some mineral commodities within the Jordanian mineral industry were offset by gains in other mineral commodities. Some positive developments were exemplified by the record exports of the Jordan Cement Factories Co. (JCFC) and the subsequent registering of about \$6 million in profits for 1990. JCFC had previously registered a net loss in 1989. Additionally, the Arab Potash Co. (APC) registered another profitable year, paying its first dividend to shareholders since the company's inception in 1983. Conversely, the Jordan Phosphate Mines Co. (JPMC) was dealt a net loss in 1990. Certain mineral industry infrastructure projects have either been introduced or resurrected from fiscal cuts to such projects. However, long-term mining industry improvements will require funding by international donors.

TRADE

A trade deficit occurred in 1990 following a positive trade balance in 1989. The trade deficit was \$1.5 billion in 1990. The deficit was primarily due to the rise in the

oil import bill for domestic energy needs following Iraq's invasion of Kuwait. Normally valued at about \$1 billion, export revenues dropped 4% compared with those of 1989.

According to Jordan Refinery Co. figures, Iraq supplied 86% of Jordan's crude petroleum requirements in 1990. This percentage is equivalent to 17.1 Mbbl. Saudi Arabia accounted for the balance of Jordan's crude requirements or about 2.6 Mbbl. Approximately 5.8 Mbbl of petroleum products was imported by Jordan from Iraq in 1990, with an additional 1.8 Mbbl of products supplied by Kuwait. The primary mode of transport for crude petroleum from Iraq to Jordan is by tanker truck. The biggest Jordanian transporter is Naber and Sons Co. (Nabresco). Though Nabresco does not transport all of the crude petroleum to Jordan and shares this operation with other transporters, it is one of the largest transporters in the Middle East. By yearend 1990, Jordan had implemented the UN embargo against Iraq, resulting in only 360 trucks out of the 1,000 trucks in Nabresco's fleet remaining active. Of the 360 tanker trucks operating, 200 trucks transported Iraqi crude oil to the Zarqa refinery, and the remaining 160 trucks transported Jordanian phosphate from the mines to the Port of Aqaba. Nabresco employs about 2,000 people and, owing to the embargo, was operating at its lowest recorded capacity level.

STRUCTURE OF THE MINERAL INDUSTRY

The Jordanian Natural Resources Authority (NRA) is the governmental agency responsible for all activities relating to exploration and development of minerals and mineral fuels. The exploitation of the major mineral commodities of Jordan—cement, kaolin, phosphates, potash, and rock wool—are all controlled by parastatals that are public shareholding mining companies. Aggregates, basalt, calcium carbonate, dimensional stone, glass sand, and natural sand are produced by private-sector firms.

TABLE 1
JORDAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^p	1990 ^e
Cement, hydraulic thousand tons	1,795	2,373	1,828	1,930	² 1,820
Clays	14,144	14,000	23,452	38,600	² 38,800
Gypsum	70,083	114,560	84,866	132,400	² 92,700
Iron and steel: Steel, crude	^e 136,000	217,000	^r 200,000	176,500	² 179,100
Lime	4,338	3,906	2,461	3,100	² 5,400
Petroleum:					
Crude ^e thousand 42-gallon barrels	110	153	200	110	110
Refinery products:					
Gasoline do.	4,517	2,975	2,368	2,514	2,500
Jet fuel do.	1,456	1,496	100	85	80
Kerosene do.	1,793	1,581	1,398	1,179	1,100
Distillate fuel oil do.	4,602	5,431	5,104	4,845	4,800
Residual fuel oil do.	4,543	4,735	4,462	4,887	4,800
Liquefied petroleum gas do.	1,012	1,032	640	670	670
Other do.	791	1,158	^e 800	2,500	2,500
Total do.	18,714	18,408	14,872	16,680	16,450
Phosphate:					
Mine output:					
Gross weight thousand tons	6,250	6,800	6,611	6,900	² 6,082
P ₂ O ₅ content ^e do.	2,063	2,260	2,182	2,277	2,007
Phosphatic fertilizers	550,880	565,066	615,000	602,000	² 596,000
Potash:					
Crude salts	1,103,716	1,200,000	1,309,000	1,320,000	² 1,402,700
K ₂ O equivalent	660,000	720,000	785,000	792,000	841,000
Salt ^e	32,000	18,000	18,000	18,000	18,000
Stone:					
Limestone ^e	7,000	³ 13,484	³ 3,642	3,600	3,600
Marble	⁴ 4,600	⁴ 4,600	322,800	333,560	² 484,200

^eEstimated. ^pPreliminary. ^rRevised.

¹Table includes data available through May 23, 1991.

²Reported figure.

COMMODITY REVIEW

Industrial Minerals

Phosphate Rock.—In 1990, Jordan dropped to fourth place in tonnage of phosphate rock mined globally. State-owned JPMC suffered a difficult year in 1990, with profits totaling \$63 million compared with a loss of almost \$100 million from the previous year. Decreased demand due to political upheaval led to lower phosphate exports to Eastern Europe. The naval blockade of the Port of Aqaba raised the cost of shipping and insurance for purchasers of phosphate rock.

In 1990, the newly opened Ash Shidiya Mine had its first full year of operation. This

mine is the southernmost operation in a north-south trending belt of phosphate deposits exploited by JPMC. Initially costing \$100 million, the Shidiya Mine was planned to have a capacity of 1.5 Mmt/a. However, output was terminated in 1990 due to decreased demand.

By late 1990, JPMC and APC terminated discussions with four Japanese companies on a joint-venture project to construct a 300-kmt/a fertilizer plant in Aqaba, primarily owing to Iraq's invasion of Kuwait. The consortium of Japanese companies was represented by Mitsubishi Corp., Kasei, Asahi, and Zen Noh. Plant construction costs were estimated at \$58 million to \$70 million. The Japanese consortium was to contribute \$24 million to the project or 60% of the equity.

By yearend 1990, Iraqi occupation of Kuwait caused JPMC to transfer its long-term ammonia contract with Kuwait's Petrochemical Industries Co. to Bahrain's Gulf Petrochemical Industries Co. A cooperative arrangement between the three parties, Kuwait would resume ammonia supplies as soon as it was able. JPMC annually requires 100 to 140 kmt/a of ammonia for the production of diammonium phosphate. Additionally, JPMC signed a contract valued at \$18.5 million and financed by the International Development Association for the supply of 72.5 kmt of fertilizer for the Ethiopian Agriculture Ministry.

Potash.—Jordan ranks eighth in world potash production. APC recovers the potash from Dead Sea brines. Despite the troubled

TABLE 2

JORDAN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Jordan Cement Factories Co.	Fuheis	1,300
Fertilizer	Jordan Fertilizer Industry Co.	Aqaba	1,500
Petroleum, crude million barrels	Natural Resources Authority	Northeast of Azraq, Azraq	NA
Petroleum, products do.	Jordan Petroleum Refinery Inc.	Zarqa	21
Phosphate, crude rock	Jordan Phosphate Mines Co.	El Hasa	3,000
Do.	do.	Wadi El Abyad	*3,000
Do.	do.	Ash Shadiya	*1,500
Potash K ₂ O equivalent	Arab Potash Co.	Safi, Dead Sea	1,500
Iron and steel, crude steel	Jordan Iron and Steel Co.	Zarqa	180

*Estimated. NA Not available.

economics of some sectors in Jordan, APC registered a \$60 million profit in 1990 and paid a dividend of 20%. This represented the first dividend payment since the company began operations in 1983. APC's favorable geographical location for its operation allows it to service markets in Africa, Asia, and Europe. Approximately 22 countries are customers of Jordanian potash. India alone purchases 60% of APC's product and another 20% is sold to the ever burgeoning Asian market.

Processed potash is stored at the company's Ghor Safi plant at warehouses of 60-kmt storage capacity or bulk shipping bins. Forty trucks per day then transport the potash to the Port of Aqaba. Each truck has a 50-ton capacity.

APC's future plans call for an increase in production capacity at the Dead Sea operation to 1.7 Mmt/a by 1993-94, with an additional increase of 2.2 Mmt/a by the turn of the century. Also involved in collateral expansion projects, the Jordan Industrial Consortium Engineering Co. (Jiceco), which is partly owned by both APC and JPMC, is interested in exploiting residual brines that are returned to the Dead Sea following potash extraction. Jiceco is predominantly involved in chemical projects downstream of the mineral industry.

Mineral Fuels.—Jordan does not have significant oil production. For its petroleum requirements, Jordan remained dependent on imports of crude oil primarily from Iraq and Saudi Arabia. In early 1991, Jordan arranged to import crude oil and refined petroleum products from Syria and Yemen. This action

was predicated by the aerial bombing of the Baghdad-Amman highway and concomitant loss of oil supplies. Jordan will purchase approximately 700 kbbl of crude petroleum from Yemen to be shipped by oil tanker. Jordan's sole refinery is the Zarqa refinery, processing about 20 Mmbl of crude petroleum in 1990, an increase of about 11% over the 1989 figure. Total throughput refining capacity is 100,000 bbl/d.

Reserves

The NRA estimated Jordanian phosphate reserves at 1 billion tons. Potash was obtained primarily from Dead Sea brines. Geological surveys had shown that Jordan had additional untapped mineral resources of bromine, dolomite, gypsum, glass sands, iron, lead, oil shale, pyrite, tin, travertine, and tripoli.

INFRASTRUCTURE

Railroads within Jordan consisted of 619 km of 1.05-m-gauge single track. Highways totaled 7,500 km, of which 5,500 km was asphalt paved, with the remaining 2,000 km composed of crushed stone and gravel. Crude oil pipelines within the country totaled 209 km. Electrical generation capacity within the country was estimated at 981,000 kW.

Jordan's Port of Aqaba experienced a marked decline in ships calling in 1990 owing primarily to the UN trade embargo in response to the Persian Gulf crisis. After the initiation of the naval blockade, fewer than 3 ships per day arrived at Aqaba, down

from about 20 ships per day. The Port of Aqaba contains two petroleum tanker berths. One berth was for the management of imported oil products through a pipeline to a tank farm. The remaining tanker berth was the 120-m Moshterek berth utilized for crude petroleum exports. Additionally, the Government purchased the tanker vessel Dafni from Greece's Mayamar Marine Enterprises for \$7.5 million. APC owns a terminal at the port with one jetty and two loading berths. Potash storage capacity is about 160 kmt.

OUTLOOK

Jordan's lack of domestic energy sources, mainly hydrocarbons, will continue to place stress on the nation's balance of trade owing to fuel importation costs. The loss of expatriate employment due to the war will have a deleterious effect on the economy. Substantial fiscal aid from the international community will certainly be needed in the foreseeable future.

OTHER SOURCES OF INFORMATION

Agency

Jordan Natural Resources Authority
P.O. Box 220
7 Amman, Jordan

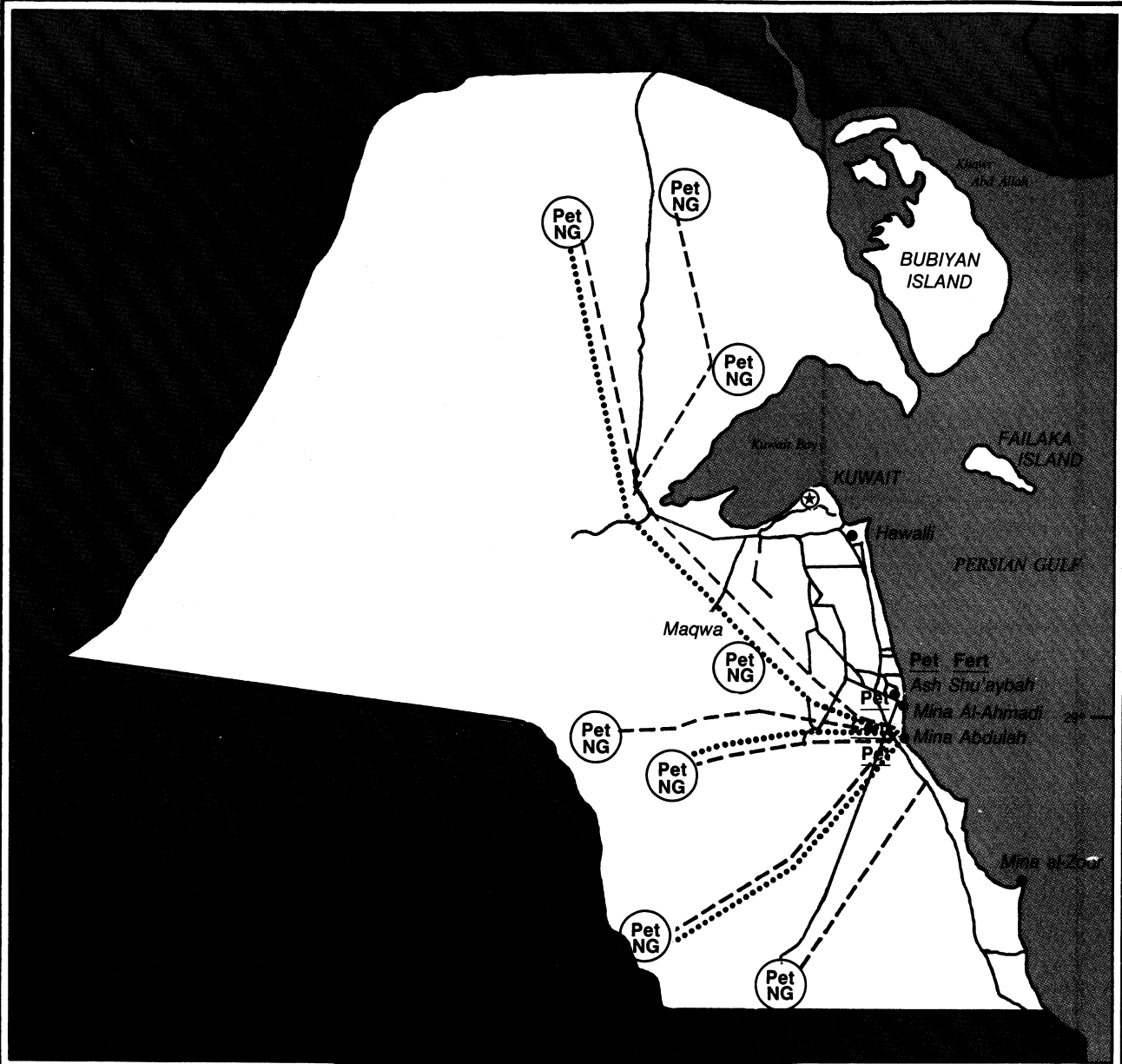
Publication

Natural Resources In Jordan, published by the Jordan Natural Resources Authority, December 1988.

KUWAIT

AREA 17,820 km²

POPULATION 2.12 million

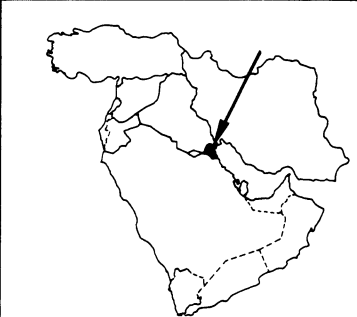


LEGEND

- International boundary
- International boundary indefinite
- Capital
- City
- Crude petroleum pipeline
- Natural gas pipeline
- Group of producing mines or wells

See table for mineral symbols.
Underlined symbol indicates plant.

0 5 10 15 20 25 kilometers



THE MINERAL INDUSTRY OF KUWAIT

By Bernadette Michalski

The production and refining of crude oil and natural gas, together with the output from the downstream industries manufacturing fertilizers and petrochemicals, contributed 90% of export revenues as well as about 40% of the GDP until the Iraqi invasion of August 2, 1990. During the Iraqi occupation, which lasted almost 7 months, Kuwait's oilfields were damaged, flowing uncontrolled, and in most cases set ablaze, causing immeasurable environmental damage. Industrial facilities were rendered inoperative, and the infrastructure was destroyed.

Kuwait's many overseas investments, including the participation in foreign petroleum exploration, the acquisition of foreign petroleum refining, distribution networks, and petrochemical facilities, have aided Kuwait in developing an economy that accumulated more assets than debts. Kuwait was able to continue running its foreign operations during the Iraqi occupation of the country. At the close of 1990, the most promising position of Kuwait's economy was the estimated \$100 billion in foreign assets available to sustain the Government and populace in exile and to finance reconstruction once liberation was achieved in early 1991.

GOVERNMENT POLICIES AND PROGRAMS

The London-based Kuwaiti Government in exile became the trustee of all property owned by Kuwaitis or non-Kuwaitis living in Kuwait according to Decree Law No. 3/A/1990 circulated in the UN on October 22, 1990. The law enabled the state of Kuwait to "take all necessary measures to protect property belonging to Kuwaitis or residents of Kuwait, and to establish the right of lawful government to have recourse to foreign administrative and judicial authorities for the purpose of protecting such property." The law, backdated to August 2, 1990, also gave the Kuwaiti Government the right "to order the provisional attachment and restraint of property belonging to the Iraqi Government or its public bodies or enterprises situated abroad."

PRODUCTION

Mineral production continued to be predominantly centered on hydrocarbon extraction and processing. In the past decade, Kuwait's oil production levels have varied between 2 Mbb/d and less than 800,000 bbl/d, reflecting market opportunities and to some extent OPEC policy. During the first 7 months of 1990 and prior to the Iraqi invasion, Kuwait production, including the Kuwaiti share of the Divided Zone fields, averaged 1.9 Mbb/d.

Output of construction materials, Kuwait's principal nonhydrocarbon minerals, has remained relatively stable as sustained by constant Government construction programs. Postoccupation reconstruction demand is expected to require early restoration of these facilities.

TRADE

The volume of higher priced petroleum product exports nearly matched that of crude oil exports in preoccupation 1990. The surge in higher valued petroleum product exports was attributable to the more than \$5 billion refinery modernization and expansion program implemented between 1982 and 1989 resulting in a combined capacity of 770,000 bbl/d for the nation's three refineries. The modernization program also increased the proportion of light products capacity from 50% to 70% to support the consumer shift to unleaded gasoline.

Crude oil shipments from Kuwait averaged approximately 775,000 bbl/d in 1989. Exports averaged 875,000 bbl/d in the pre-embargo period of 1990, including 385,000 bbl/d delivered to the Far East; 370,000 bbl/d delivered to Europe, of which 300,000 bbl/d supplied the Kuwait Petroleum Corp.'s European refineries; and 80,000 bbl/d was shipped to the United States. In January 1990, Kuwaiti 31° API gravity blend crude sold at \$17.35 per barrel, in July, the price dropped to \$15.00, and just before the invasion the price was \$16.10 on the spot market. The United Nations Security Council Resolution 661 of August 6, 1990, imposed worldwide economic

sanctions, including a trade embargo on both nations with the objective of pressuring Iraq to abandon the Kuwait takeover while preserving those Kuwait assets then under Iraqi control. Kuwait crude oil spot market price jumped to \$22.75 in mid-August on crude oil available prior to the embargo. Shortly after the invasion, OPEC suspended the July quotas totaling 22.5 Mbb/d in order to make up the shortfall resulting from the UN embargo.

After the Iraqi retreat in March 1991, an extensive amount of military hardware, including unexploded ordnances, contributed to the difficulty of controlling wells that were often ablaze after explosives caused casinghead damage. Of the 980 active wells in Kuwait, 550 were ablaze. Including the fields in the Wafra area of the Divided Zone, the total number of wells involved was 1,330, of which 732 wells were ablaze. Kuwait was unable to resume even limited oil shipments until July 27, 1991.

Petroleum product exports totaled 700,000 bbl/d in 1989. Western Europe, which hosts the Kuwait Petroleum Corp.'s extensive retail network, was the major outlet market importing about 300,000 bbl/d from Kuwait in 1989. Exports to the Far East were more than 200,000 bbl/d, with Japan absorbing about 125,000 bbl/d. Product exports to the United States were minimal, averaging 8,200 bbl/d in 1989 and 6,250 bbl/d during the preembargo period of 1990.

STRUCTURE OF THE MINERAL INDUSTRY

The Government of Kuwait imposed few restrictions on trade or financial flows and placed considerable emphasis on the private sector to develop the economy. The petroleum and natural gas extraction and processing industries, however, were under Government control. Total control of the Kuwait Oil Co. (KOC) and the Kuwait National Petroleum Co. (KNPC) was in effect since 1975. In 1980, the Government established a state umbrella company for hydrocarbon operations known as the Ku-

wait Petroleum Corp. This organization oversees all the state hydrocarbon companies and also manages Government shareholdings in various oil ventures including those operations in the Kuwait-Saudi Arabia Divided Zone and the acquired interests in foreign operations.

COMMODITY REVIEW

Industrial Minerals

Cement.—Prior to the occupation of Kuwait, the Saudi-Kuwaiti Cement Co. took the lead in coordinating efforts with other cement companies to improve marketing operations and promote exports. However, plant and infrastructure damage caused by retreating Iraqi troops combined with the nation's own heavy reconstruction demands obliterated any export plans for the near future.

Fertilizers.—The Petrochemical Industries Co. (PIC) operated the Shuaiba Fertilizer Complex which had the capacity to produce almost 1 Mmt of ammonia and 800,000 mt of urea annually. Urea production attained a record 852,000 mt in 1989, about 8% above design capacity. This complex, particularly the urea plant, was severely damaged by Iraq, inhibiting any production for the foreseeable future. Domestic production facilities have been severely damaged or destroyed; however, PIC has acquired interests in fertilizer manufacturing operations in other Gulf countries, North Africa, Europe, and China.

Mineral Fuels

Natural Gas.—As no commercial deposits of nonassociated natural gas have been as yet discovered in Kuwait, the nation remained dependent upon natural gas associated with crude oil production for domestic power stations and petrochemical plants. The inadequate domestic supply was supplemented with daily imports of 12 Mm³ by pipeline from Iraq. Kuwait's domestic supply of associated natural gas from the fields of Raudhatain and Sabiriya near the northern Iraqi border was processed in northern Kuwait, and a mixed liquids stream was delivered by pipeline to the fractionator at Shuaiba. Associated natural gas from the Minagish, Umm Gudair, and South Umm Gudair Fields near the western border with Saudi Arabia flowed as wet gas to the processing plant at Shuaiba. Associated gas

from the Burgan and Magwa-Ahmadi Fields was processed at two field recovery plants. The recovered liquids were then delivered by pipeline to Shuaiba for fractionation. The natural gas liquids plant at Shuaiba had an annual capacity of 4.6 Mmt. However, it would be necessary for Kuwait to nearly double its preoccupation crude oil production level to supply sufficient quantities of associated natural gas to attain this capacity level. The serious damage inflicted to Kuwait's hydrocarbon reservoirs, production, processing, storage, and transportation facilities increases the impetus for establishing a regional natural gas grid linking the six member states of the Gulf Cooperation Council. The main source of natural gas would be Qatar's North Field.

Petroleum.—Production.—Kuwait's production, including output from its share in the Divided Zone, averaged 1.9 Mbb/d just before the Iraqi invasion in August 1990. The Kuwait Oil Co., the operating company for the KPC, had increased production of light crude oil to maintain the export crude blend at 31.5° API gravity. Additional reservoirs of light crude were brought into production by mid-1990 with the oil flow from the deep Marat formation under the Burgan, Magwa, Umm Gudair, and Minagish Fields in south-central Kuwait yielding crude oil of 36° to 38° API gravity. The first shipments of light Marat crude oil were sent to KPC's European refineries for testing.

Refining.—After completion of an 8-year multibillion dollar refinery expansion and modernization program, combined refining capacity was reported by the KNPC at 770,000 bbl/d before the Iraqi invasion. One of the goals of the modernization project was to increase the proportion of light products from 50% to 70% of total product output. The integration of all three refineries was achieved through a complex pipeline network that provided for flexibility and greater efficiency by enabling the interchange of feedstocks between refineries for further processing. All three refineries in Kuwait and the two smaller refineries in the Partitioned Zone (70,000 bbl/d capacity Mina Saud and 30,000 bbl/d capacity Khafji) were stripped of process control equipment and other spare parts and were further damaged by deliberate explosive detonation. Only one refinery remained operating after the invasion. The Mina al-Ahmadi, the largest refinery at 270,000 bbl/d capacity, operated at 80,000

bbl/d for most of the last quarter, with production increased to 200,000 bbl/d in late December. With the boycott in effect, the refinery operated only to satisfy local consumption, but was rendered inoperable as the Iraqi forces retreated in March 1991.

Petrochemicals.—The nation's principal petrochemical complex was in Shuaiba and was operated by PIC, a wholly owned subsidiary of KPC. Initially commissioned in 1966, the complex has steadily expanded, including a fertilizer complex and salt and chlorine plants.

In March 1990, KPC announced approval for the construction of a \$3 billion ethylene-based petrochemicals complex at Shuaiba. The complex was to have a 750,000-mt/a-capacity ethylene cracker that was to supply 500,000 mt/a of ethylene to feed downstream units and 250,000 mt/a of ethylene for export. The complex was to include at least eight main units with the following capacities: high- and low-density products at 250,000 mt/a, monoethylene glycol at 263,000 mt/a, triethylene glycol at 27,000 mt/a, benzene at 300,000 mt/a, styrene monomer at 385,000 mt/a, polystyrene at 150,000 mt/a, paraxylene at 400,000 mt/a, and orthoxylene at 150,000 mt/a. With reconstruction efforts centered on restoring crude oil production and processing and in view of the extensive damage suffered at the existing Shuaiba Industrial Complex, the proposed \$3 billion petrochemical complex has been put on hold.

Reserves

After reassessments of the potential of known fields, Kuwait's proven reserves of crude oil were officially listed at 97.1 billion bbl prior to the invasion, an increase from the 94.5 billion bbl listed a year earlier. The extent of reservoir damage due to blowouts and fires has not as yet been assessed.

Natural gas reserves were estimated at 1,400 billion m³ prior to the invasion. As most of the reserve base was associated gas produced in conjunction with petroleum, a reassessment of the natural gas reserve base after the occupation will prove appreciably lower.

INFRASTRUCTURE

Prior to the invasion, Kuwait's highway system totaled 3,000 km, most of which was

bituminous surfaced, and traversed the country from north to south with a greater concentration of highways between Kuwait City and the port cities of Shuaiba and Mina al-Ahmadi to the south. The petroleum and natural gas industry was serviced by a network of pipelines operated by KOC. These pipelines connected major fields to the export terminals or to the refineries, which themselves were interconnected to permit more efficient use of feedstocks.

Not only were the mineral production and processing facilities damaged or destroyed during the Iraqi occupation but most of the supporting infrastructure as well. The highway network was heavily damaged by military action but repairs are further complicated by the necessity of removal of damaged, stripped, and abandoned military and private vehicles strewn all along the highway system as well as unexploded ordnance. The pipeline network and storage facilities supporting hydrocarbon production, processing, and transportation suffered serious damage. Most of the water supply and electric power infrastructure was destroyed. Of the four power and desalination complexes at Shuwaikh, Doha East, Doha West, and Ras az Zawr, only the 2,400 MW-capacity and 48 million gallons per day Ras az Zawr plant was not seriously damaged.

OUTLOOK

The mineral industry, particularly the oil sector, was a prime target for the Iraqi military forces. The scale of damage to the Arabian Gulf ecosystem and the petroleum and natural gas reservoirs has yet to be adequately assessed.

Long before the Kuwaiti liberation began, Kuwaiti officials planned a massive postwar reconstruction program. The prime contract for a detailed damage survey of the production, export, and refining facilities was awarded to Bechtel Corp. The organization and financing of Kuwait's reconstruction remains a tremendous task. Restoration priority will be given to the wealth-creating sectors of the economy, petroleum production and downstream processing. Until these industries begin generating revenues once again, the financing of daily existence, financial commitments, and the reconstruction program will be obtained from loans or through liquidation of assets. Under Article 16 of the UN Resolution 687 that outlines the terms of the cease-fire, a compensation fund is to be created and financed by a percentage of Iraq's future petroleum revenues. When petroleum production is resumed,

Kuwait will undoubtedly produce at the optimum rate to finance reconstruction. This may eventually require higher quotas from OPEC which prior to the invasion was 1.5 Mbb/d.

While the invasion impact on Kuwait's economy was profound, it also focused the attention of Kuwaiti exiles on the restoration of a democratic parliament in Kuwait. Strong support for parliamentary elections in a restored Kuwait was evident. In addition to emergency reconstruction work, previous Government policies are under reassessment and could involve privatization of utilities.

In spite of the liquidation of several billions of dollars in stocks and bonds in several industrialized countries in late 1990 and early 1991, Kuwait retained substantial worldwide industrial and financial investments. Without the strategic accumulation of these foreign assets, the consequence of the Iraqi occupation would have even more serious results.

OTHER SOURCES OF INFORMATION

Kuwait Petroleum Corporation (KPC)
P.O. Box 26565
Safat, 13126, Kuwait
Telephone: 245.54.55 and 245.26.86

TABLE 1
KUWAIT: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^p	1990 ^e
Chlorine	9,000	22,000	24,700	23,610	19,000
Cement thousand metric tons	1,014	1,000	888	1,110	900
Clay products, nonrefractory:					
Sand lime bricks cubic meters	336,000	336,000	300,100	354,800	300,000
Gas, natural: ²					
Gross million cubic meters	7,440	6,960	8,980	11,100	8,000
Dry do.	5,730	4,780	6,490	8,160	6,000
Lime: Hydrated and quicklime	57,198	62,700	65,000	65,000	50,000
Natural gas liquids thousand 42-gallon barrels	27,375	29,200	34,000	38,500	30,500
Nitrogen: N content of ammonia	450,600	577,500	497,500	664,600	292,100
Petroleum:					
Crude ² thousand 42-gallon barrels	<u>518,600</u>	<u>496,770</u>	<u>546,000</u>	<u>657,700</u>	<u>425,000</u>
Refinery products: ^e					
Gasoline, motor do.	11,300	11,500	16,425	20,000	18,000
Jet fuel do.	9,800	9,500	12,775	12,800	11,000
Kerosene do.	13,100	13,000	14,600	15,000	12,000
Distillate fuel oil do.	45,600	45,000	60,225	60,000	45,000
Residual fuel oil do.	95,000	90,000	93,075	95,000	75,000
Refinery fuel and loss do.	8,400	8,000	9,000	9,000	7,500

See footnotes at end of table.

TABLE 1—Continued

KUWAIT: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity		1986	1987	1988	1989 ^P	1990 ^E
Refinery products: ^E —Continued						
Other	thousand 42-gallon barrels	46,000	45,000	41,610	42,000	30,000
Total		229,200	222,000	247,710	253,800	198,500
Salt		21,000	21,000	39,500	31,950	30,000
Sodium and potassium compounds: Caustic soda		10,000	12,000	16,100	15,700	12,000
Sulfur:						
Elemental, petroleum byproduct		260,000	310,000	360,000	375,000	300,000
Sulfuric acid		4,600	4,600	4,500	5,000	4,000

^EEstimated. ^PPreliminary. ^RRevised.¹Table includes data available through June 30, 1991.²Includes Kuwait's share of production in the Kuwait-Saudi Arabia Divided Zone.

TABLE 2

KUWAIT: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990¹

(Thousand metric tons unless otherwise specified)

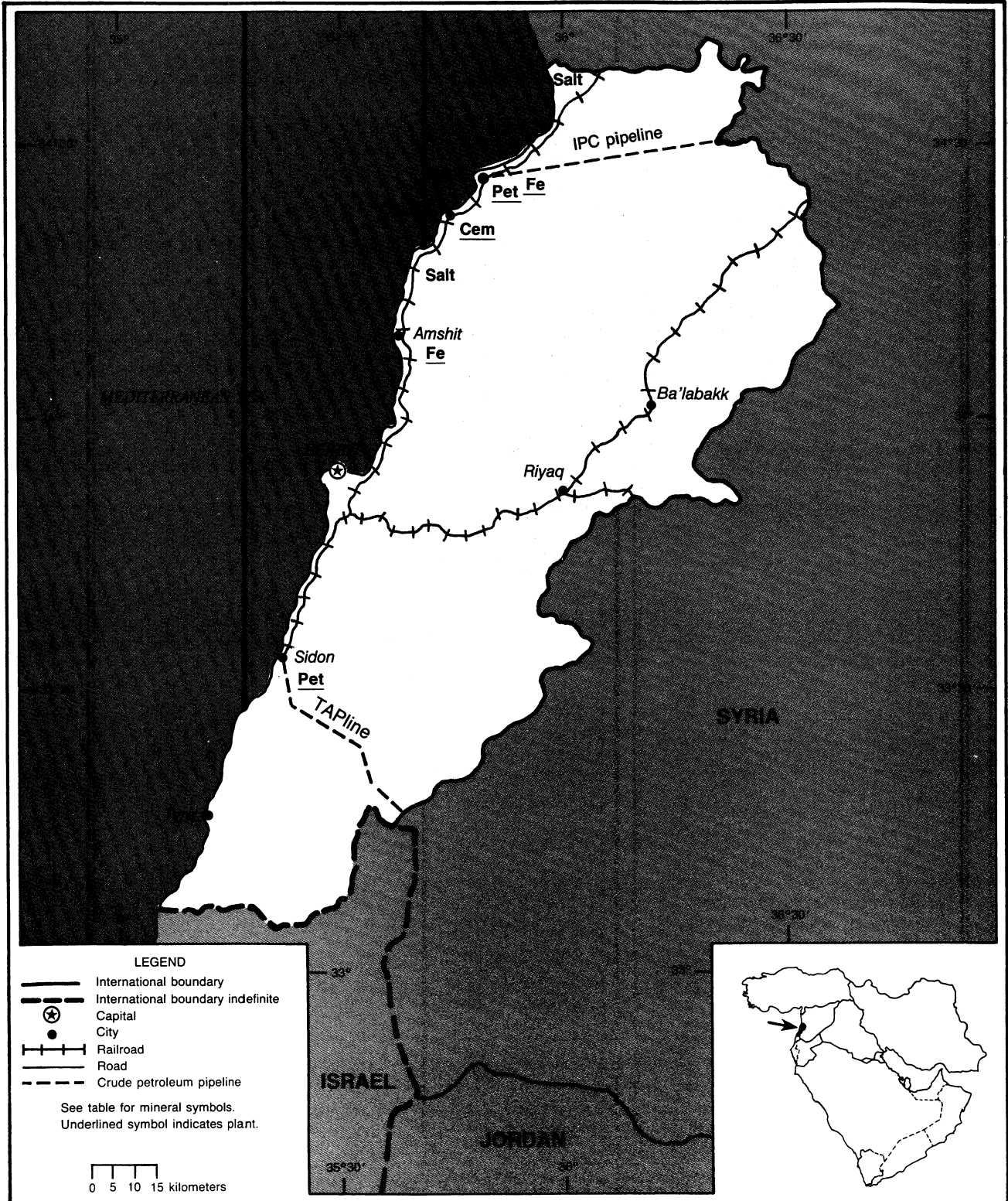
Commodity		Major operating companies	Location of main facilities	Annual capacity
Caustic soda		Petrochemical Industries Co.	Shuaiba	70
Cement		Kuwait Cement Co.	do.	1,500
Chlorine		Petrochemical Industries Co.	do.	58
Natural gas	million cubic meters	Kuwait Oil Co.	All oilfields	10,000
Natural gas liquids	million 42-gallon barrels	Kuwait National Petroleum Co.	Shuaiba	57
Nitrogen:				
Ammonia		Petrochemical Industries Co.	do.	990
Urea		do.	do.	792
Sulfuric acid		do.	do.	5
Petroleum, crude	million 42-gallon barrels	Kuwait Oil Co.	Burgan Raudhatain Sabriya Minagish Others	1,095
Petroleum, products	million 42-gallon barrels	Kuwait National Petroleum Co.	Mina al-Ahmadi	99
Do.	do.	do.	Shuaiba	73
Do.	do.	do.	Mina Abdullah	91
Salt		Petrochemical Industries Co.	Shuaiba	125

¹Annual capacities are reported as existing prior to the Iraqi invasion of Aug. 2, 1990. During the occupation, industrial installations were dismantled and transported to Iraq, rendering the cement, petroleum, and petrochemical facilities inoperative. Crude oil production facilities were destroyed, and virtually all wells were flowing uncontrolled and ignited.

LEBANON

AREA 10,400 km²

POPULATION 3.3 million



THE MINERAL INDUSTRY OF LEBANON

By Bernadette Michalski

Lebanon's industrial enterprises, including those of its minerals sector, continued in a state of disrepair after having been seriously damaged or disrupted during the course of the civil war that began in 1975. Most seriously affected was the fuel supply network and, consequently, electric power generation. Dependent upon imports of crude oil and petroleum products for most of its energy requirements, the nation suffered serious shortages as tankers withdrew from Lebanon's besieged ports.

Lebanese law permits private ownership of subsoil resources, but Government licenses are required for the exploitation of minerals. Domestic fuels sales are for the most part controlled, subsidized, and priced by the Government; however, limited private imports of gasoline were permitted since 1988.

The Lebanese Reconstruction and Development Council engaged the Bechtel Group Inc. of the United States to assess damages and propose means of financing the reconstruction of the infrastructure. United Nations authorities have estimated civil war damage at \$18 billion. The rebuilding of the infrastructure was estimated at \$5 billion.

The Ministry of Electricity and Water Resources reported the nation's 1990 electric power capacity at approximately 1,000 MW.

Mineral production entirely from indigenous deposits was limited to the production of salt and the quarrying of raw materials for the construction industry. The petroleum refineries were totally dependent upon imported crude oil. The steel industry utilized domestic and imported scrap as raw material. Actual production data have not been reported in recent years. Data reported in this chapter are estimates based upon best available information.

Mineral commodity trade remained limited in 1990. Petroleum imports were estimated at 7.5 million barrels of crude oil, 4.5 million barrels of residual fuel oil, 3 million barrels of gasoline, 1.5 million barrels of distillate fuel oil, and 1.0 million barrels of liquefied petroleum gas. The Arab States were

Lebanon's principal trading partners. Iraqi crude oil supplied the refineries, and petroleum products were imported from Romania and Syria, as well as Iraq.

Lebanon was basically a free-enterprise-oriented economy. Most mineral operations in Lebanon remained privately owned, including all cement plants, steel mills, and building material quarries. Most petroleum imports as well as the nation's refineries near Tripoli and Sidon are controlled by the Lebanon Ministry of Petroleum.

The bulk of cement manufacturing was centered in the north coastal region of Chekka; however, a single cement plant near the Port of Sidon in the south may still be in operation. Production in recent years has been curtailed for lack of electric power, supplies, and equipment, as well as myriad other problems associated with the civil war and world market conditions.

Lebanon did not produce any indigenous hydrocarbons and remained totally dependent upon imported crude oil to supply its two refineries. Operations at both refineries

improved in spite of periodic breaches of the cease-fire accord. Product output from these refineries has supplied from 30% to 45% of the nation's requirements, with the remainder satisfied by petroleum product imports. About 85% of all electricity produced in Lebanon was derived from powerplants operating on fuel oil; the remainder was supplied by hydroelectric power.

The nation's only known commercial minerals were salt and quarried building materials. No information about reserves has been reported.

Lebanon's principal port, Beirut, had undergone repeated shelling, resulting in chronic disrepair and intermittent serviceability during the long civil war. The Ports of Sidon and Tripoli have enjoyed increased activity after the closure of the Port of Beirut. The Port of Beirut was scheduled to reopen in early 1991.

The nation's 378-km railroad, most of which is 1.435-meter gauge, was virtually inoperable because it primarily paralleled

TABLE 1

LEBANON: PRODUCTION OF MINERAL COMMODITIES¹

	1986	1987	1988	1989	1990 ^e
Cement, hydraulic ^c thousand tons	'900	'900	'900	900	900
Gypsum ^c tons	3,000	2,000	2,000	2,000	2,000
Iron and steel: Metal, semimanufactures ^c do.	80,000	80,000	80,000	75,000	75,000
Lime ^c do.	<u>'10,000</u>	<u>10,000</u>	<u>10,000</u>	<u>10,000</u>	<u>10,000</u>
Petroleum refinery products:					
Liquefied petroleum gas thousand 42 gallon barrels	194	141	140	125	145
Gasoline do.	2,566	2,015	2,000	1,800	2,000
Jet fuel do.	218	92	100	90	100
Kerosene do.	129	151	150	130	135
Distillate fuel oil do.	2,234	1,723	1,725	1,600	2,000
Residual fuel oil do.	2,264	3,388	3,400	3,200	3,300
Other do.	153	35	40	35	40
Refinery fuel and losses do.	735	510	500	450	500
Total do.	8,493	8,055	8,055	7,430	8,220
Salt ^c thousand tons	3	3	3	3	3

^cEstimated. ^eRevised.

¹Table includes data available through July 31, 1991.

TABLE 2

LEBANON: STRUCTURE OF THE MINERAL INDUSTRY IN 1990

(Thousand metric tons unless otherwise specified)

Major commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Cimenterie Nationale S.A.L.	Chekka	1,300
Do.	Societe Libanaise des Ciments Blancs	65 kilometers north of Beirut	1,900
Do.	Societe des Ciments Libanais	70 kilometers north of Beirut	150
Do.	Ciment de Sibline	Sidon	150
Petroleum, refined million 42-gallon barrels	Tripoli Refining Co.	Refinery at Tripoli	7
Do.	Mediterranean Refining Co.	Refinery at Zahrani	6
Steel	Lebanon Steel Mill Co.	Mill at Tripoli	100
Do.	Consolidated Steel Lebanon S.A.L.	Mill at Amshit	240

TABLE 3

LEBANON: ELECTRIC POWER CONSTRUCTION PROGRAM

Location	Capacity	Completion
Bekaa	Two 100-MW gas turbine	1992
Zahrani	do.	1993
Zouk	150-to 180-MW steam turbine	1994
Jiyyeh	150-MW steam turbine	1994
Do.	do.	1995
Zahrani	100-MW steam turbine	1995
Harisha	do.	1996
Batroun	250-MW steam turbine	1996

NOTE.—The gas turbine plants at Bekaa and Zahrani will consume natural gas piped from Syria.

the coastal area where most of the hostilities took place.

By the close of 1990, Lebanon's regional conflicts had diminished, and the increased stability should lead to expansion of the construction industry and an improved outlook for the industrial minerals sector. Any firming of the Government's financial position should reflect in increased value of the Lebanese Pound.

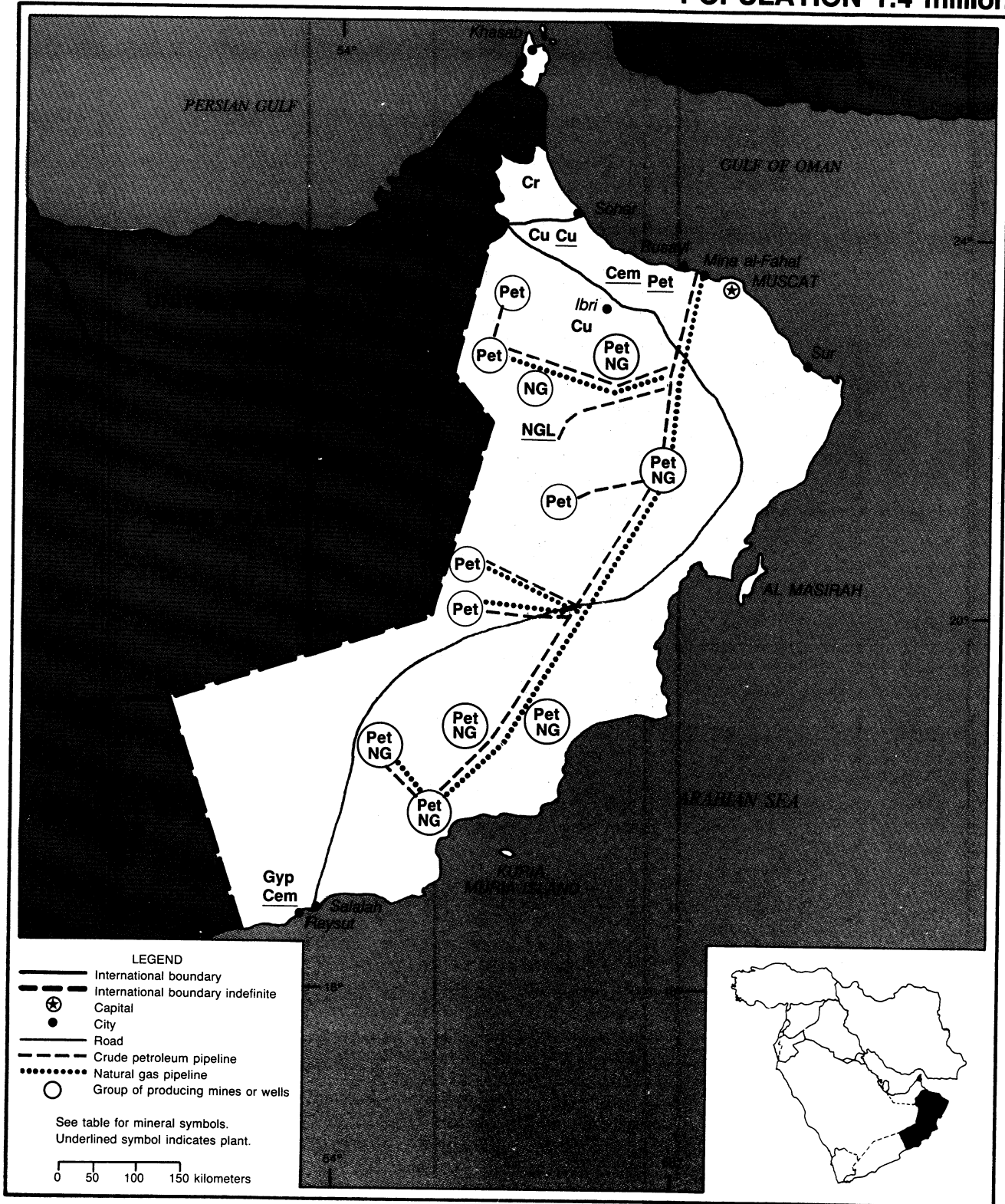
OTHER SOURCES OF INFORMATION

United States Embassy
P.O. Box 70-840
Beirut, Lebanon
Phone: (961) 41-77-74

OMAN

AREA 212,460 km²

POPULATION 1.4 million



THE MINERAL INDUSTRY OF OMAN

By Bernadette Michalski

Hydrocarbons continue to underwrite Oman's developing economy. Other commercial mineral industries include copper mining and refining with gold and silver as byproducts, the manufacture of cement, as well as dimension and crushed stone operations. The main industrial facilities include a petroleum refinery, gas processing plants, a copper smelter and refinery, and two cement works. All but the copper operations produce primarily for the domestic market.

Oman's Development Council reported a 9.4% increase in the gross domestic product valued at \$9.3 billion compared to \$8.5 billion in 1989.¹ The hydrocarbon industry accounted for 44% of the gross domestic product or \$4.1 billion in 1990. Revenues from the industry serve as the principal support for other sectors of the economy, which are largely dependent on Government spending.

GOVERNMENT POLICIES AND PROGRAMS

While not a member of the Organization of Petroleum Exporting Countries (OPEC), Oman plays a prominent role in the Independent Petroleum Exporting Countries group and has often acted as a liaison between that group and OPEC. Oman has on several occasions announced oil production cuts in support of OPEC; however, actual cutbacks have been minimal. As a relatively small producer with pressing development needs, Oman seeks to produce as close to the maximum sustainable level as possible.

Greater economic diversification continues to be an Omani Government objective. In support of this goal, an extensive mineral exploration and mapping contract was awarded to Bureau de Recherches Géologiques et Minières (France) in 1990.

PRODUCTION

Crude oil production continued to increase as the number of producing fields

reached 64 in 1990. Omani crude oil production averaged 650,000 bbl/d for most of 1990 but was increased to 700,000 bbl/d in September and 770,000 bbl/d in November and December. Production increases were intended to offset the loss of Kuwaiti and Iraqi crude and stabilizing market prices.

Because of complex geology, relatively small fields, low pressure, and the need for enhanced recovery techniques in many fields, production costs of Omani crude were \$3 to \$5 per barrel, high relative to those of other Gulf States which are often as low as 50 cents per barrel.

Chromite production was entirely dependent on export contracts. Although production was reported for 1989, by yearend, it was discontinued pending a decision to construct a ferrochrome plant.

TRADE

Over 91% of all export earnings in 1990 was derived from petroleum. More than 235 Mbbl was exported in 1990. The Far East accounted for nearly 90% of Oman's crude oil exports. United States' imports of Omani crude were nearly 14 Mbbl in 1990, doubling the previous year's level.

Copper exports were reported at 13,500 tons in 1990, about 10% below the previous year's export level due to lower ore grades and complex mineralization of the Aarja deposit.

STRUCTURE OF THE MINERAL INDUSTRY

The Government maintains a majority interest in most companies; however, foreign partnerships are encouraged.

COMMODITY REVIEW

Metals

Copper.—Almost half of Oman's copper production was extracted from the Lasail Mine, with much of the remaining output

derived from the Aarja surface mine that commenced operation in 1989. A minor amount was produced from the Bayda Mine, where reserves are near exhaustion. The blended ore from the three mines was beneficiated to yield a concentrate that was processed at the adjacent smelter and refinery. Copper cathodes are exported under a contract with Amalgamated Metals Corp. of the United Kingdom. Copper output for 1990 was projected at 13,500 tons owing to lower ore grade and the complex mineralization of the Aarja deposit. Additionally, about 20 kg of combined silver and gold are recovered annually as byproducts in the anode slime.

The Sohar copper deposits were nearing exhaustion; however, commercial deposits of copper with a relatively high gold content were discovered at Hajl al-Safi and Raka in Ibbi about 150 km south of the Oman Mining Co.'s smelter at Sohar. Early studies conducted on behalf of the Sultanate indicate the deposits may contain 8 to 12 million tons of ore.

Chromite.—The Rajmi chromite mine near Sohar yielded about 2,000 tons of ore annually between 1985 and 1988. The mines in the Sohar region generally yield refractory-grade and metallurgical-grade chromite. All output was destined for the export market.

A joint committee of the Ministries of Commerce and Industry and Petroleum and Minerals was considering the construction of a ferroalloy plant having a proposed annual capacity of 25,000 to 50,000 tons of product. Exports and, consequently, mining operations were suspended pending final decision.

Industrial Minerals

Cement.—The manufacture of cement was conducted at Rusayl and at Salalah. The Oman Cement Co.'s Rusayl plant accounts for about 85% of the nation's output. The company was engaged in a market feasibility study to determine the merits of increasing clinker production or installing a second kiln.

TABLE 1
OMAN: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Country and commodity	1986	1987	1988	1989 ^a	1990 ^a
Cement, hydraulic	^a 700,000	839,796	864,915	947,672	² 999,887
Chromite, gross weight	4,820	—	—	12,810	—
Copper:					
Mine output, Cu content	18,200	18,121	17,065	¹ 16,600	16,000
Metal:					
Smelter	19,601	^a 19,500	16,500	15,200	12,100
Refinery	14,561	15,490	16,473	15,080	² 12,010
Gas, natural:					
Gross million cubic meters	4,589	4,650	6,088	4,850	4,850
Dry do.	2,152	2,265	2,449	2,682	2,700
Natural gas liquids: Butane and propane thousand 42-gallon barrels	1,460	2,120	2,130	2,135	2,129
Petroleum:					
Crude do.	<u>204,100</u>	<u>212,430</u>	<u>226,600</u>	<u>233,800</u>	<u>250,000</u>
Refinery products:					
Gasoline do.	3,585	2,864	3,431	3,848	3,850
Jet fuel do.	1,476	928	948	1,116	1,120
Kerosene do.	70	77	80	80	80
Distillate fuel oil do.	3,880	3,565	4,459	4,406	4,400
Residual fuel oil do.	9,363	7,373	7,800	9,174	9,175
Other do.	938	900	1,000	780	800
Total do.	19,312	15,707	17,718	19,404	19,425
Sand and gravel thousand tons	7,514	7,590	4,719	5,539	² 5,899
Stone:					
Marble do.	44	39	41	33	² 35
Other do.	2,875	248	1,335	1,396	² 1,973
Sulfur, pyrites, S content	31,000	30,000	30,000	32,000	31,000

^aEstimated. ^bPreliminary.

¹Table includes data available through July 30, 1991.

²Reported figure.

TABLE 2
OMAN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise noted)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Oman Cement Co.	Rusayl	700.
Do.	Salalah Cement Works	Salalah	210.
Chromite	Oman Mining Co.	30 kilometers northwest of Sohar	20.
Copper	Oman Mining Co.	Mine at Sohar	1,500 ore. 20 metal.
Natural gas billion cubic meters	Petroleum Development Oman	Yibal Field and others	7.
Natural gas liquids million barrels	do.	Yibal	2.5.
Petroleum:			
Crude millions barrels	do.	Yibal-Shuaiba, Fahud, and others	250.
Do.	Occidental Group.	Sahfah Field	9.
Do.	Elf-Aquitaine Oman Ltd.	Sahmah Field	2.2.
Products million barrels	Oman Refinery Co.	Mina al-Fahal	29.

Mineral Fuels

Coal.—The United Nations Department of Technical Cooperation and Development conducted a feasibility study on the exploitation of 22 million tons of recoverable coal reserves in the Sultanate. Utilization of the coal at Al-Kamil, near Sur, to replace fuel oil in electricity generation was under consideration.

Natural Gas.—About 85% of all natural gas production is utilized. Field operations including reinjection absorbed about one-half of the natural gas produced. More than one-third of production is distributed by the Government Gas System network.

About 7 Mm³ of natural gas was produced daily from the Yibal field while the Fahud and Sayh Nuhaidah Fields each account for almost a Mm³/d. In early 1991, the Petroleum Ministry announced discovery of a gas field at Saih Rawl, in Central Oman.

The collection and processing of natural gas in Oman is centered at three plants: the Fahud gas processing plant, the 2.2-Mm³/d-capacity Sayh Nuhaidah gas treatment plant, and the Yibal gas processing plant now under expansion with capacity projected at 16.6 Mm³/d by 1992.

Oman hopes to replace as much as possible the domestic use of petroleum products with natural gas in order to make available more petroleum for export. Natural gas is currently used as fuel for the Government Power System. It is also piped to the copper refinery, the Sultan Qaboos University, and the cement plant. A pipeline carries gas from Yibal to the Ghubrah deslinization and power plant on the coast near Muscat and to the Rusayl Industrial Estate. Connecting lines extend up the Batinah Coast to Sohar at the site of the copper refinery and south from Sayh Nuhaidah to Zufar. The latter transports gas for use in the southern oil fields.

A contract was signed in November 1990 for a \$74 million expansion of the Government gas system treatment plant at Yibal. The project will raise throughput from 8.5 Mm³/d to 16.5 Mm³/d by yearend 1992.

The Omani Government originally considered assembling a methanol plant on a tanker floating off the Omani town of Khasab. However, the offshore Bukha Field

natural gas reserve (4.5 billion m³) was considered insufficient to justify construction of the floating plant. Revised plans call for the construction of a 35-km pipeline to deliver the Bukha natural gas and condensate to Ras al-Khaimah, United Arab Emirates, where it will be processed at the Khor Khwair plant. Bukha dry gas will be sold to Ras Al Khaimah households, and the natural gas liquids will be trucked to Dubai. Initial production from the Bukha Field was projected to be 5,000 bbl/d of condensate, 800 bbl/d of natural gas liquids, and over 1 million m³/d of dry gas.

Petroleum.—An intense decade of exploration resulted in crude oil reserves reported at 4.8 billion bbl as of Dec. 31, 1990.

Production over the past decade maintained a constant growth spiral attaining an average of 675,000 bbl/d in 1990 from a total of 64 fields. The Petroleum Development Oman Co. accounted for 96% of production. The company has approved a \$500 million waterflood project to increase production from the Lekhwair Field in northwest Oman from current levels of 24,000 bbl/d to over 100,000 bbl/d by 1994.

Occidental Oman drilled 30 development wells in 1990 following 29 development wells drilled the previous year. Production from its Safah Field averaged 23,500 bbl/d in 1990, 19,000 bbl/d in 1989, and 10,000 bbl/d in 1988.

Oman projects a sustained level of production at 700,000 bbl/d for the remainder of the decade. The bulk of crude oil output is exported. Less than 10% is refined domestically.

Japan, recognizing the strategic importance of a supply source independent of the Strait of Hormus, has been a traditional market for Omani crude oil, purchasing 40% to 50% of all exports for the past decade.

Oman's sole refinery, the Mina al-Fahal, was designed to meet domestic product demand and the bulk of its output is consumed in the Sultanate. Refinery throughput in 1990 was reported at 62,000 bbl/d yielding a product mix of gasoline, jet fuel, diesel oil, and bunker fuel.

Reserves

The Ministry of Petroleum and Minerals has announced proven copper ore reserves

at 8 million tons and proven chromite reserves at 1.6 million tons. Petroleum reserves are reported at 4.8 billion barrels. Natural gas is reported at 290 billion m³. Coal resources in the Misaw Valley are reported at 36 Mmt.

INFRASTRUCTURE

The Omani highway system totals 22,800 km of which only 18% is bituminous surfaced.

Petroleum and natural gas pipelines total 1,300 km and 1,030 km, respectively. The bulk of crude oil production is serviced by the central pipeline running from the Dhiab Field in the south to Mina al-Fahal near Muscat. The petroleum terminal at Mina al-Fahal can accommodate tankers up to 550,000 dwt tons. The port has eight storage tanks with a combined capacity of 3.6 Mbbl.

OUTLOOK

The Sultanate of Oman has enjoyed a stable economy sustained by hydrocarbon revenues for more than a decade, and the economy should continue in this vein. Although petroleum and natural gas output is modest, reserves continue to outpace reservoir withdrawals, affording a substantial economic base for at least the next 15 years at the current rate of production.

The mining of copper and chromite offers a basis for some diversification and the potential for increased export earnings.

¹Values were converted from Omani Rial (RO) to U.S. dollars at the rate of RO 0.3845=US\$1.00, a fixed rate since 1986.

OTHER SOURCES OF INFORMATION

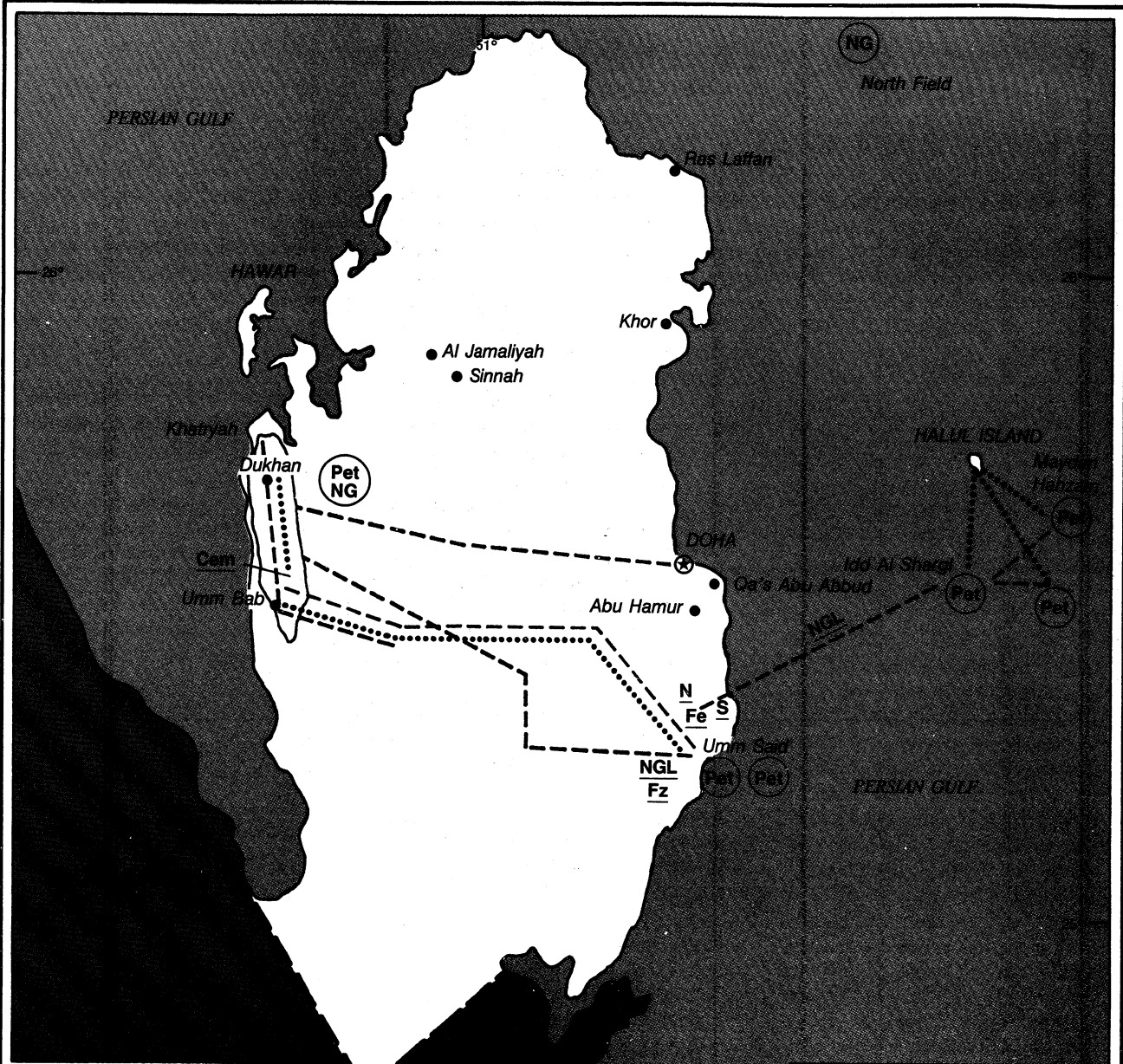
Ministry of Petroleum and Minerals
P.O. Box 551
Muscat, Oman
Phones: 603333/603341/603563
Fax: 696972

Petroleum Development Oman
P.O. Box 81
Muscat, Oman
Phone: 678111
Fax: 677106

QATAR

AREA 11,000 km²

POPULATION 0.49 million



LEGEND

- International boundary indefinite
- Capital
- City
- Crude petroleum pipeline
- Natural gas pipeline
- Group of producing mines or wells

See table for mineral symbols.
Underlined symbol indicates plant.

0 5 10 15 kilometers



THE MINERAL INDUSTRY OF QATAR

By David Izon

Qatar, one of the smaller members of the OPEC, relied mainly on oil and natural gas as its primary mineral resources in 1990. Qatar did not play a significant role in world production of crude oil, producing less than 1% of world output. However, Qatar's North Field is reported to be the largest nonassociated gas reserve in the world. Due to the existing abundant supply of natural gas in the North Field, the Government planned to expand its industries to include an aluminum smelter with a production capacity of 193,000 mt/a. Also, plans were underway for the construction of a \$300 million¹ ferroalloy smelter in Umm Said. Other efforts to diversify the mineral industry included construction of a petrochemical plant, a fertilizer plant, and a steel plant.

Although Qatar has continued to diversify its industrial base, the economy still depended mainly on oil exports, which accounted for about 90% of the country's revenues. Qatar traded mainly with the United Kingdom and Japan. In addition to oil, Qatar also exported natural gas liquids in the form of butane, propane, and natural gasoline, mainly to Japan and east Asia. Fertilizer was marketed by Norsk Hydro AS, the foreign partner in the fertilizer plant. Steel was exported to neighboring Arab states. The United States received approximately 1% of Qatar's crude petroleum exports in 1990. Imports from the United States included chemical compounds and semimanufactured metals.

The Government actively sought foreign and local investors for its natural gas projects. Current Qatari laws and regulations require that foreign firms should have local agents to be able to conduct business in Qatar. Investment patterns remained unchanged with the Government adopting a cautious approach to large-scale investments during 1990.

GOVERNMENT POLICIES AND PROGRAMS

Major Government policy emphasized the importance of developing a new industrial site dependent on gas as the main energy source and feedstock. The Government of

Qatar owned major shares and participated in all mining operations, plants, and refineries in the country. The state-owned Qatar General Petroleum Corp. (QGPC) was preparing for the establishment of a liquefied natural gas plant that was scheduled to come on-stream in 1997. To this end, QGPC signed an agreement with Total/Compagnie Francaise des Petroles (CFP) of France for the production of 800 Mm³ of natural gas per day from the North Field in the second phase of the project. The first phase was scheduled to be commissioned in June of 1991.

Several downstream industries were also planned. The Government has requested bids from four international banks to act as financial adviser to Qatar Electricity and Water Co. for its Al-Wusail 1,500-MW powerplant and a 100-million-gallons-per-day water project. Banks competing for the contract were Chemical Bank and Bankers Trust of the United States, Kuwait-based Gulf Investment Corp., the United Kingdom's S.G. Warburg, and a group consisting of Qatar National Bank and Morgan Grenfell of the United Kingdom. The project was estimated to cost about \$950 million. First phase downstream projects included a new \$500 million methanol plant and expansion of the petrochemical plant, which would double its capacity.

In an effort to attract foreign investor participation in Qatar industries, the visa system was liberalized to smooth the way for business visitors.

PRODUCTION

The Government planned to expand its fertilizer and petrochemical complexes to cope with demand. The petrochemical, fertilizer, and steel plants maintained levels of production that were comparable to those of 1989. Petroleum and natural gas production improved, and the refinery was working at full capacity.

TRADE

Qatar's main trading partners in 1990 were Japan, the United Kingdom, the United States,

and neighboring Arab states. Qatar's total imports for 1990 were about the same as the previous year. Total exports amounted to more than \$2 billion in 1990 and oil accounted for the major part of the country's export trade volume. Major commodities imported were iron ore and raw materials for the steel and construction industries.

STRUCTURE OF THE MINERAL INDUSTRY

The Qatari mineral industry was dominated by oil and gas. The Government has a controlling interest in almost all of Qatar's mineral industry. Qatar's labor force increased to about 110,000 people, 90% of whom were noncitizens and an estimated 25,000 of whom worked in the petroleum and natural gas sectors. The increase in the labor force was attributed to the Gulf situation.

COMMODITY REVIEW

Metals

Aluminum.—The Government of Qatar, under its newly formed aluminum company Doha Aluminum, started construction of a new primary aluminum smelter in 1990. The initial phase of the plan will require building a 193,000-ton capacity plant to be completed by October 1992. Final capacity was planned to be expanded to 300,000 tons about 5 years after startup. The project, which is sited at Doha, was planned to generate power using natural gas from the North Field gas reservoir. The total cost of the project is estimated at \$1.2 billion. The Government envisaged 100% financing of the project by Davy McKee of the United Kingdom, with Qatar taking royalties and being given the option of acquiring 30% equity in the plant in the first 10 years. Final negotiations were not settled by yearend 1990.

Iron and Steel.—Qatar Steel Co. (QASCO) continued to maximize its production to 560,000 mt/a in 1990, which was

TABLE 1

QATAR: PRODUCTION OF MINERAL COMMODITIES FOR 1990¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^P	1990 ^e
Cement, hydraulic	308,000	303,000	*300,000	300,000	³ 267,000
Gas, natural:					
Gross million cubic meters	6,487	6,439	7,405	8,500	8,500
Marketed ^d do.	5,600	5,600	6,400	7,400	7,400
Iron and steel: Metal:					
Steel, crude thousand tons	507	492	527	550	³ 580
Semimanufactures do.	493	503	505	530	540
Natural gas liquids:					
thousand 42-gallon barrels ^e	13,600	13,500	15,000	³ 13,231	13,200
Nitrogen: N content of ammonia	544,100	560,800	605,665	714,000	³ 760,000
Petroleum:					
Crude thousand 42-gallon barrels	<u>102,000</u>	<u>106,945</u>	<u>124,445</u>	<u>142,715</u>	<u>140,000</u>
Refinery products:					
Gasoline do.	2,130	2,125	*2,150	3,794	3,800
Jet fuel do.	710	608	*625	2,827	3,800
Kerosene do.	32	35	*35	23	30
Distillate fuel oil do.	3,148	2,685	*2,700	4,906	4,900
Residual fuel oil do.	4,162	3,929	*4,000	5,579	3,600
Other ^d do.	696	*800	*900	1,771	1,800
Total do.	10,878	*10,182	*10,410	18,900	17,930
Stone: Limestone ^e thousand tons	900	900	900	900	³ 810
Sulfur	48,500	53,300	*55,000	52,000	52,000

^eEstimated. ^PPreliminary.¹Table includes data available through Aug. 12, 1991.²In addition to the listed commodities, Qatar produced clays, sand, gypsum, and gravel for construction purposes.³Reported figure.^dIncludes refinery fuel and losses.

TABLE 2

QATAR: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Qatar National Cement Co.	Umm Bab	550.
Fertilizer	Qatar Fertilizer Co. (QAFCO)	Umm Said	540, N content of ammonia. 350, N content of urea.
Natural gas, liquefied thousand barrels	Qatar General Petroleum Co. (QGPC)	do.	685.
Petroleum, crude do.	do.	Dukhan	400.
Petroleum, refinery products do.	QGPC; National Oil Distribution Co.	Umm Said	60.
Iron and steel	Qatar Steel Co. (QASCO)	do.	400.
Sulfur	Qatar Petrochemical Co. (QAPCO)	do.	25.

slightly above its 1989 level and also above the design capacity of 350,000 mt/a. It sold 90% of the output to neighboring Gulf Cooperation Council States. The Government has continued its search for other markets. Qatar was particularly focusing on the regional market, but financing constraints may prevent QASCO from developing these new outlets.

Ferroalloys.—The Government was committed to the agreement signed with an Australian company, Pennant Holding Co., to build a 230,000-mt/a ferroalloy complex at Umm Said. The planned products were 70,000 mt/a of silicomanganese, 60,000 mt/a of ferrochrome, and 110,000 mt/a of ferromanganese. Raw materials for the plant, other than gas, were to be imported from the Pennant mines in Australia. Pennant owns coal, iron ore, and manganese mines in Australia. The complex will be run by Qatar Ferro Alloy Smelter, which held a 30% interest in the joint venture. A 120-MW power station was to be built at the site by Vitkovice of Czechoslovakia.

Industrial Minerals

Fertilizer.—Qatar Fertilizer Co. (QAFCO) was the country's sole fertilizer producer. Production rose in 1990 to 760,000 tons of ammonia and 780,000 tons of urea, compared with 714,000 tons of ammonia and 778,561 tons of urea in 1989. Exports reached 240,000 tons of ammonia and 854,000 tons of urea. Plans were underway to expand the fertilizer plant. The estimated \$400 to \$500 million expansion project is expected to be completed in 3 to 4 years. Davy McKee of the United Kingdom and Flour Daniel of the United States were frontrunners for the work. On completion, the plant's production capacity will increase by 2,000 mt/d of urea and 1,500 mt/d of ammonia. The new plant will also increase QAFCO's consumption of natural gas by 60 Mm³/d to a total of 160 Mm³/d. QAFCO intended to use the increased output to develop new markets in Europe and the United States.

Mineral Fuels

Natural Gas.—Natural gas was produced as associated gas from crude oil production and amounted to about 100 Mm³/d. Phase 1 of the North Field development plan was in final stages of completion at the end of 1990. The plant will process 800 Mm³/d of gas as planned, producing about 12.375 Mbbbl/a of liquefied petroleum gas and condensate for export. The startup of gas production from the phase

I project scheduled for early 1991 was delayed due to uncertainties caused by the Gulf situation. Negotiations for construction of the second phase of the North Field project were nearing completion by yearend 1990. The principal company involved in this phase of the project was France's CFP.

Petroleum.—In 1990, Qatar's oil production averaged about 390,000 bbl/d, slightly less than its 1989 output. The country was keen to continue its exploration program in an effort to increase production capacity. To this end, two new exploration contracts were signed by the Government with Elf Aquitaine of France and Amoco Corp. of the United States. QGPC proceeded with several projects designed to improve onshore and offshore production.

Reserves

Qatar was estimated to have the world's largest nonassociated gas reserves in the North Field. The North Field's recoverable gas reserves were put at 4.25 trillion m³. The country's recoverable oil reserves were believed to be about 2.5 billion barrels.

INFRASTRUCTURE

Qatar has continued to develop its infrastructure, although the petroleum and natural gas transportation facilities were already

quite modern. There were 235 km of petroleum and 400,000 m of natural gas pipelines, running east to west from Doha to Dukhan, and from Umm Said through Umm Bab to Dukhan. Other pipelines also link offshore fields in the Persian Gulf to Umm Said. Crude oil and gas were exported from four terminals: Halul Island, which serves the offshore fields; Umm Said, which services the onshore fields; and Ras Abu Abbud and Abu Hamur, which are used for refined products. Qatar also has a total of 1,500 km of highways, with 1,000 km of it paved and 500 km of gravel or natural surface; an international airport at Doha; and major cargo ports at Doha, formerly known as Ad Dawhah, and Umm Said, formerly Musayid.

OUTLOOK

The Government expects to continue to give top priority to the North Field gas project. The development of the gasfields to full capacity by 2010 is an urgent program that will guarantee its economic well-being into the next century. Industrial developments are focused on three key areas: first and second phase developments of the North Field, incorporation of the first and second phase of the North Field, and downstream projects, requiring the estab-

lishment of new industries and expansion of existing ones. This will increase job opportunities for Qatar's 35,000 citizens and its foreign residents. Natural gas will continue to provide abundant cheap energy for Qatar's domestic industries, including fertilizer, petrochemicals, aluminum, ferroalloys, and steel. This in turn should provide a substantial cost benefit for exporting goods produced in these industries.

Factors that may limit Qatar's economic development are its dependence on foreign labor and the Government's overcautious attitude toward implementation of capital projects. The completion of several natural gas projects with their long-term subcontracts for liquefied natural gas may provide additional economic stability.

¹Where necessary, values have been converted from Qatari Riyals (QRS) to U.S. dollars at the rate of QRS 3.64=US\$1.00 in 1990.

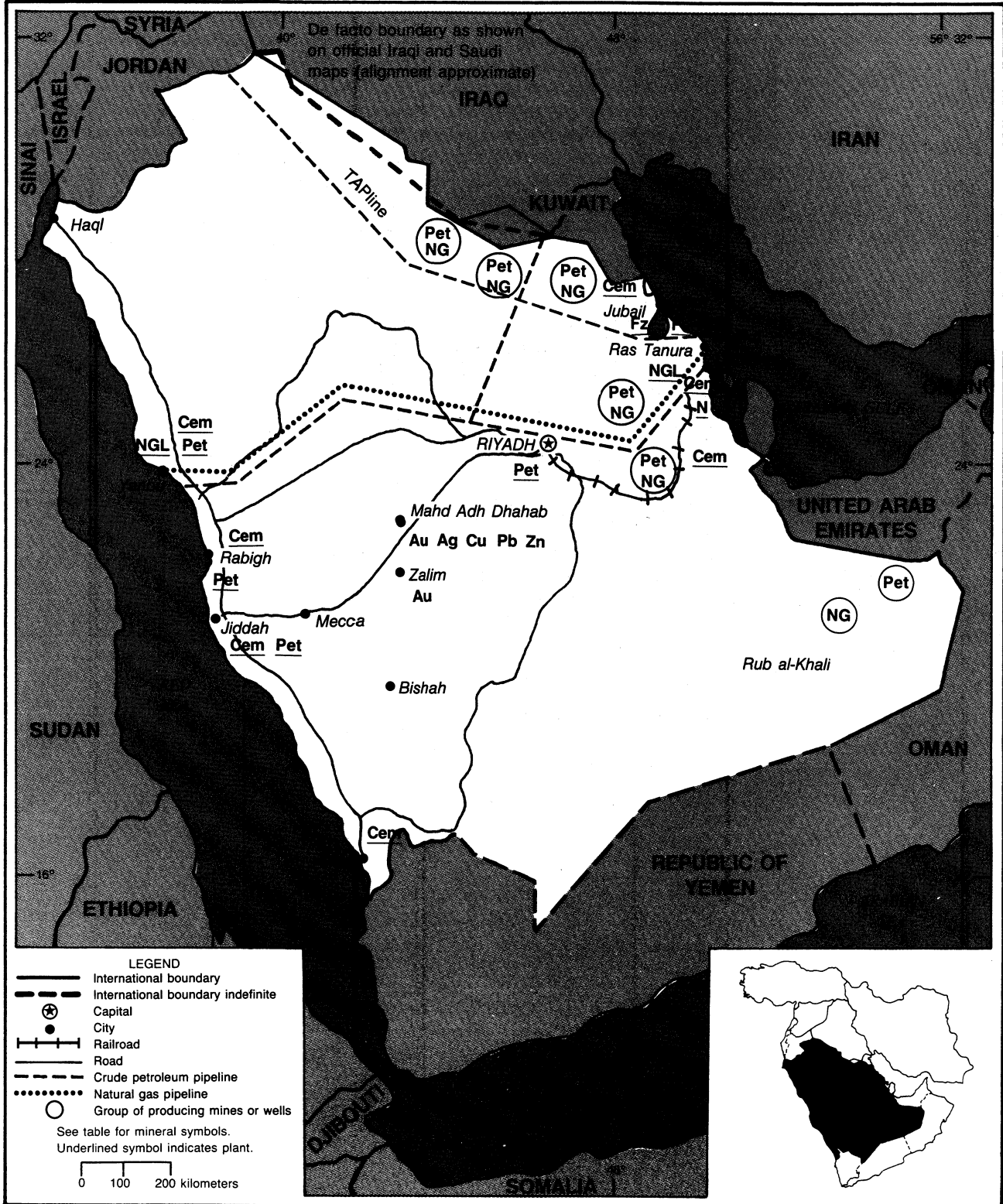
OTHER SOURCES OF INFORMATION

Qatar General Petroleum Corp.
P. O. Box 3212
Doha, Qatar
National Oil Distribution Co.
P. O. Box 2244
Doha, Qatar

SAUDI ARABIA

AREA 2.2 million km²

POPULATION 17.1 million



THE MINERAL INDUSTRY OF SAUDI ARABIA

By Bernadette Michalski

Although Saudi Arabia has achieved a significant diversity in mineral production, it remained dependent upon the hydrocarbon industry to generate finances for public expenditures and social and economic development. This dependence was exacerbated by the massive expenditures incurred when the Kingdom offered to bear much of the cost of the UN forces deployment during the 1990-91 Gulf crisis. The surge in export earnings during the early months of the crisis resulted in a modest rise of oil revenues for the year to \$32 billion as compared with almost \$28 billion the previous year. Petroleum accounted for two-thirds of Government revenue and 90% of total export earnings in 1990. Additional outlays between August and December 1990 have been estimated at \$25 billion. Successive budget deficits between 1983 and 1988 depleted the Kingdom's financial reserves. To help underwrite the liberation of Kuwait, Saudi Arabia elected to borrow \$3.5 billion from an international bank.

GOVERNMENT POLICIES AND PROGRAMS

As did its predecessor, the Economic Development Plan for 1990-95 continued to emphasize economic diversification, development of an industrial base not dependent on hydrocarbons, promotion of export and import substitution industries, and job opportunities for nationals. However, additional emphasis was placed on expanding the revenue base, ensuring the maintenance of national economic stability through careful management of Government expenditure, and consolidating the national economy's reliance on broadening private resources and activities. The plan calls for the construction of 300 factories and proposed industrial investments of \$5 billion, with about \$3.5 billion in capital and commercial financing from the private sector. Local industry continued to enjoy up to 20% tariffs on imported goods.

The Government encouraged private capital to participate in economic development, a key element in the 1990-95 economic plan. In support of this program, the Minis-

try of Petroleum and Mineral Resources was authorized by the Saudi Cabinet in January 1990 to start negotiating for the award of mineral prospecting and mining licenses with foreign companies.

PRODUCTION

Crude oil production, the Kingdom's principal mineral commodity, averaged 5.1 Mbbl/d in 1989. For the first 7 months of 1990, production averaged 5.6 Mbbl/d. Additional capacity was activated after the Iraqi invasion of Kuwait, bringing the average August production up to 5.8 Mbbl/d increasing to 7.7 Mbbl/d for September, 7.8 Mbbl/d for October, 8.3 Mbbl/d for November, and 8.5 Mbbl/d for December.

The commercial production of copper, gold, silver, and zinc commenced in 1988 with the opening of the Mahd Adh Dhahab Mine. A full year at capacity operation was experienced in 1990 in spite of the Gulf crisis.

Output of cement showed signs of recovery by 1989 when new construction projects were awarded, including university and public building expansions as well as civilian and military airport expansions. Cement manufacturers enjoyed a 20% duty on cement imports.

TRADE

Most imports were subject to customs duties at rates ranging from 12% to 20%. Imports from members of the Cooperation Council for the Arab States of the Gulf (GCC) were exempted, provided that at least 40% of the value added was affected in GCC countries and at least 51% of the capital of the producing firm was owned by citizens of GCC member countries.

The monetary authorities and all other residents, including private persons, could freely and without license purchase, hold, and sell gold in any form, at home or abroad. They could also without license and without payment of any customs duty or tax import or export gold in any form with the exception of gold of 14 carats or less, the import of which was prohibited.

The United States and Japan were the leading suppliers of imported goods, ac-

counting for 17% and 16%, respectively. U.S. exports in 1989 were largely passenger automobiles, telecommunications equipment, and industrial machinery.

Hydrocarbons generated more than 90% of total export earnings in 1990. Saudi Arabian crude oil exports averaged 4.8 Mbbl/d, and petroleum product exports averaged 1.3 Mbbl/d. The principal markets for Saudi Arabian crude petroleum and products were, by volume, Japan, Western Europe, and the United States. Each of these markets imported well over 1 Mbbl/d. The United States imported 1.2 Mbbl/d of crude oil from Saudi Arabia in 1990. Petroleum product imports, mostly unfinished oils and gasoline, from Saudi Arabia averaged 144,000 bbl/d in 1990.

Strategic refined product exports were curtailed in the last quarter of 1990, and the import of jet fuel and distillate oil was required to stockpile supplies in preparation for the pending offensive.

STRUCTURE OF THE MINERAL INDUSTRY

All minerals, including the vast petroleum and natural gas reserves, were owned by the Government. Their exploitation was predominantly controlled by Government organizations.

COMMODITY REVIEW

Metals

Aluminum.—The 220,000-ton capacity aluminum smelter planned for Yanbu remains scheduled to come on-stream in 1992 in spite of the 1990-91 Gulf crisis. Saudi Arabian interests held 60% equity in the smelter, and foreign investors were offered the remaining equity. Companies that were already involved by contracts had further committed to capital investment. These include the project consultant, Bechtel of the United States; the process technology license holder, Pechiney of France; and the engineering and construction contractor, Alumix of Italy.

TABLE 1
SAUDI ARABIA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^P	1990 ^F
Copper: Cu content of concentrate and bullion ²	—	—	^e 300	765	³ 895
Cement, hydraulic thousand tons	9,332	8,595	¹ 10,951	¹ 11,442	12,000
Gold:					
Mine output, gross weight:					
Ore	—	—	^e 40,000	100,000	146,000
Concentrate ²	—	—	2,800	6,977	7,000
Bullion, crude, gross weight kilograms	—	—	^e 1,500	3,642	³ 5,630
Au content of concentrate and bullion do.	—	—	^e 1,000	2,900	³ 3,536
Gas, natural: ⁴					
Gross million cubic meters	40,500	39,070	41,050	¹ 46,400	51,265
Dry do.	24,000	² 26,700	² 29,150	² 29,900	34,300
Gypsum ^e	373,000	373,000	375,000	375,000	375,000
Iron and steel: Metal, steel, crude thousand tons	^e 1,100	1,365	1,614	1,800	1,900
Lead: Pb content of concentrate ²	—	—	65	205	250
Natural gas liquids, all forms thousand 42-gallon barrels	149,650	125,896	149,145	¹ 153,645	194,630
Nitrogen: N content of ammonia thousand tons	467	637	867	863	³ 942
Petroleum: ⁴					
Crude thousand 42-gallon barrels	<u>1,841,425</u>	<u>1,535,555</u>	<u>¹1,890,100</u>	<u>¹1,848,500</u>	<u>2,350,000</u>
Refinery products:					
Liquefied petroleum gas do.	55,050	7,949	9,559	7,909	8,000
Gasoline and naphtha do.	¹ 109,711	¹ 130,102	¹ 130,539	¹ 124,104	138,700
Jet fuel do.	¹ 11,807	² 20,572	¹ 15,822	¹ 18,214	25,000
Kerosene do.	¹ 18,901	² 26,913	³ 30,917	² 29,918	44,000
Distillate fuel oil do.	¹ 109,290	¹ 149,129	¹ 161,590	¹ 145,670	158,700
Residual fuel oil do.	¹ 138,325	¹ 152,577	¹ 164,282	¹ 148,348	179,500
Unspecified do.	⁵ 53,152	¹ 14,442	¹ 13,084	¹ 13,437	13,000
Total do.	⁴ 96,236	⁵ 501,684	⁵ 525,793	⁴ 487,600	566,900
Silver: Ag content of concentrate and bullion ² kilograms	—	—	^e 3,600	13,321	³ 16,237
Sulfur: Byproduct, hydrocarbons thousand tons	1,446	1,432	1,378	¹ 1,423	³ 1,435
Zinc: Zn content of concentrate ²	—	—	^e 700	2,580	³ 2,472

^eEstimated. ^PPreliminary. ^RRevised.

¹Table includes data available through Sept. 1, 1991.

²Mahd Adh Dhahab final products include a bulk flotation concentrate containing gold, silver, copper, lead, and zinc and a crude bullion containing gold, silver, and copper.

³Reported figure.

⁴Includes Saudi Arabian one-half share of production in the Kuwait-Saudi Arabia Divided Zone.

Copper.—The Directorate General of Mineral Resources (DGMR) issued a tender for prospecting licenses near the Jabal Sayid copper mines, 315 km north of Jiddah. The DGMR had already conducted preliminary studies in the area, including the drilling of bore holes totaling 46,000 m, which revealed deposits estimated at 16.9 Mmt of ore containing 2.6% copper.

Ferrosilicon.—The Bahraini-based United Gulf Industries Corp. has proposed the construction of a 25,000-mt/a capacity ferrosilicon plant at Jubail.

Gold.—Several commercially significant gold deposits have been discovered in the Arabian Shield. The Mahd Adh Dhahab deposit, 275 km northeast of Jiddah, offered the most favorable recovery level at 27 g/mt and a reserve of 1.1 Mmt. In 1990, the mine's first year of operation at full capacity, output reached 3,536 kg of gold and 16,237 kg of silver.

The Saudi Co. for Precious Metals, a joint venture between Petromin and Boliden of Sweden, was established in 1989 to develop the Sukhaybarat gold deposit, about 65 km southeast of Zalim, where reserves were

reported at 8.4 Mmt of ore yielding an average of 2.5 grams of gold per metric ton. Mine development activity began in March 1989 and continued through the Gulf crisis. Initial production, which was originally scheduled to begin by April 1991, was anticipated to be on schedule. Eventual capacity was anticipated to be 600,000 mt/a of ore yielding 1,500 kg/a of gold. Precious metals recovered from the mine were to be sold by competitive tendering to refineries in Europe and the Far East. Other gold deposits are under consideration for commercial exploitation. These include Hiajar,

TABLE 2

SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Saudi-Bahraini Cement Co.	Ayn Dar, 75 kilometers southwest of Dammam	1,800.
Do.	Saudi Cement Co.	Al-Hufuf	1,352.
Do.	Saudi-Kuwait Cement Co.	Al-Kharsaniyah, 64 kilometers northwest of Jubail	3,000.
Do.	Arabian Cement Co. Ltd.	Jiddah	650.
		Rabigh	1,320.
Do.	Southern Province Cement Co.	Suq al-Ahad, 10 kilometers northeast of Jizan	1,500.
Do.	Yanbu Cement Co.	Yanbu	1,460.
Fertilizer	Al-Jubail Fertilizer Co.	Jubail	632 urea. 300 ammonia.
Do.	National Chemical Fertilizer Co.	do.	500 ammonia. 500 urea. 500 NPK. 200 TSP. 100 DAP. 10 liquid fertilizer.
Do.	Saudi Arabian Fertilizer Co.	Dammam	330 urea. 200 ammonia. 100 sulfuric acid. 20 melamine.
Gold	General Petroleum and Mineral Organization	Mahd Adh Dhahab, 270 kilometers northeast of Jiddah	150 ore.
Natural gas million cubic meters	Saudi Aramco	All oilfields	30,000.
Do.	do.	Khuff Zone	17,500.
Do.	do.	Abqaiq Gas Cap	4,600.
Natural gas liquids million 42-gallon barrels	Saudi Arabian Refining and Marketing Co.	Ju'aymah, 33 kilometers northwest of Ras Tanura	145,000.
Do.	do.	Yanbu	100,000.
Do.	Saudi Aramco	Ras Tanura	60,000.
Petrochemicals	Saudi Petrochemical Co.	Jubail	760 ethylene. 560 ethylene chloride. 60 styrene. 300 industrial ethanol. 375 caustic soda.
Do.	National Methanol Co.	do.	770 methanol.
Do.	Saudi Methanol Co.	do.	630 methanol.
Do.	Arabian Petrochemical Co.	do.	650 ethylene. 100 polystyrene.
Do.	Saudi European Petrochemical Co.	do.	500 methyl-tertiary-butyl-ether.
Petroleum, crude million 42-gallon barrels	Saudi Aramco	Eastern Province	2,920.
Do.	Arabian Oil Co.	Khafji	164.
Do.	do.	Al Hout	18.
	Texaco (former Getty Oil Co.) (Neutral Zone production shared by Saudi Arabia and Kuwait)	Wafra	37.
Do.	do.	South Fawaris	2.
Do.	do.	South Umm Gudair	15.
Petroleum products million 42-gallon barrels	Saudi Aramco	Ras Tanura	183.
Do.	Rabigh Petroleum Refining Co.	Rabigh	120.
Do.	Jubail Petroleum Refining Co.	Jubail	92.
Do.	Yanbu Petroleum Refining Co.	Yanbu	92.
Do.	Riyadh Oil Refinery Co.	Riyadh	50.
Steel	Saudi Iron and Steel Co.	Jubail	1,220.

80 km northwest of Bishah; Bir Tawilah, 50 km east of Zalim; Al-Amar, 650 km northeast of Jiddah; and Al-Shukhtaliat, 50 km west of Zalim. Combined, these properties contain more than 10 Mmt of ore with gold content ranging from 3 to 25 g/mt.

Iron Ore.—In late 1990, the DGMR awarded a contract to British Steel Consultants Ltd. with the objective of determining the technical feasibility of producing high-grade (67.5% Fe content with less than 2.2% total acid gangue) direct reduction pellets from the Wadi Sawawin iron ore deposit near the northern Red Sea coast. The assessment will include the conceptual design of a full-scale beneficiation and pelletizing plant.

Iron and Steel.—Production at the Saudi Iron and Steel Co. (Hadeed), a Sabic subsidiary, was reported at 1.5 Mmt in 1990, substantially above capacity of 1.22 Mmt/a. In March of 1990, a \$100 million contract was awarded to Voest-Alpine of Austria to virtually double the plant's annual capacity to 2 Mmt. The project, including modification of the existing electric arc furnaces and the installation of two ladle furnaces, was estimated to require 2 years to complete. A third direct-reduction iron module was under construction at the Jubail complex with the capacity to produce 650,000 mt/a of sponge iron, reducing the scrap intake from 30% to 20% for the complex.

Industrial Minerals

Cement.—With the massing of the UN military troops on the Saudi Arabian border with Kuwait in the last 5 months of 1990, cement production was pushed to capacity level to support the requirements of the military.

The Yanbu Cement Co. produced at full capacity, 4,000 mt/d, in 1990. Plans have been announced to increase capacity by 15% by modifying the existing three kilns.

The merger of the Saudi Cement Co. and the Saudi-Bahraini Cement Co. was proposed, which would result in a combined production capacity of almost 4 Mmt/a.

Phosphate.—Phosphate reserves of 4 billion tons have been discovered in the Tareif area. Phosphate deposits averaging 21% to 24% of P_2O_5 had been discovered near Al-Jalamid. The deposits were estimated to contain 120 Mmt of readily minable ore. Exploitation rate was projected at 6 Mmt/a of run of mine ore yielding 3 Mmt of concentrate averaging 30% to 35% P_2O_5

for a 20-year period. The concentrate would be transported 1,090 km to Jubail for use in the manufacture of diammonium phosphate, thus maximizing the utilization of natural gas and sulfur.

Potash.—Expansion plans for the National Chemical Fertilizer Co.'s Jubail plant include the capacity to produce 800,000 mt/a by 1991 of nitrogen-phosphate-potassium fertilizer.

Soda ash.—A 250,000-mt/a-capacity soda ash plant is being considered for construction at Jubail by the International Chemical Industries and Trading Co. Ltd. Financing will include company equity capital and loans from the Saudi Industrial Development Fund and commercial banks. The results of a market survey conducted by Tecnon of the United Kingdom place the current domestic market at 60,000 mt/a, rising to 116,000 mt/a by 1995. The glass industry and water treatment industry are projected to be the principal consumers. The remaining production is slated for export to other Gulf nations.

Sulfur.—The production of sulfur of 99.8% purity approached 1.5 Mmt/a and was derived from the processing of hydrocarbons. While the domestic requirements continued to grow, most of the sulfur output was exported with markets among members of the GCC, India, Pakistan, Bangladesh, Tunisia, and Morocco.

Titanium Dioxide.—Cristal, the National Titanium Dioxide Co., has announced the construction of a 51,500-mt/a-capacity TiO_2 plant at Yanbu. The \$200 million plant is scheduled to come on-stream by mid-1991.

Mineral Fuels

Natural Gas.—Most of the Kingdom's natural gas was produced in association with crude petroleum. Until the development of the Master Gas System (MGS), a network for recovering, processing, and distributing natural gas, Saudi Arabia flared much of the gas it produced. The MGS consists of 60 gas-oil separation plants set in the Khurais, Safaniyah, Ghawar, and Juluf Fields; three gas processing plants at Berri, Shedgun, and Uthmaniyah; the East-West natural gas liquids pipeline; and two gas fractionation plants at Yanbu and Ju'aymah. The system has a raw gas gathering capacity of 170 Mm^3/d and a processing capacity of

115 Mm^3/d . With the decline in oil production during the 1980's, it was necessary to supplement the system's gas feed by developing the Kingdom's nonassociated gas resources. By 1990, Saudi Aramco had added about 60 Mm^3/d of nonassociated gas-gathering capacity to the MGS. The system's overall capacity has some limitations. The gas-gathering systems were not in place at all fields. Consequently, Saudi Aramco flared or reinjected substantial quantities of gas during periods of peak production in the last quarter of 1990.

Petroleum.—Exploration.—Four new oilfields yielding light low-sulfur crude oil were discovered in the Central Province outside the traditional concession areas during 1990: Ragheeb, 123 km southeast of Riyadh; Na'eem; Ghinah; and Hazmiya, 205 km south of Riyadh. A natural gasfield yielding low-sulfur natural gas and condensate was also discovered in 1990 at Al-Hilwah, 137 km south of Riyadh. The discoveries had been made within a 4,000- km^2 area at depths ranging from 1,800 to 2,800 m. Crude oil ranged from 44° to 52.9° API gravity. Reserve delineation and development planning was underway.

Production.—Government-owned Saudi Aramco retained its position as the world's largest oil company based on oil and gas reserves, production, product sales, and refining capacity. Actual production averaged almost 5.7 Mbbl/d in the first half of 1990, but averaged almost 6.3 Mbbl/d for the year after output was accelerated to supply the UN coalition forces as well as counteract the loss to world oil supplies of embargoed Iraqi and Kuwaiti oil.

The recommissioning of facilities mothballed in the early 1980's activated production capacity of almost 3 Mbbl/d by the close of 1990. Saudi Aramco reported the recommissioning of 146 oil wells and 12 gas-oil separation plants at the Ghawar, Harmaliyah, and Khurais Fields. Five offshore gas-oil separation plants were activated in the Safaniya, Zuluf, and Marjan Fields. It also put into operation onshore gas-oil separator plants in the Khursaniyah, Qatif, and Aby Hadriya Fields and installed three new offshore production platforms at the Berri Field to maintain production levels. The Gulf crisis prompted Saudi Aramco to accelerate the timetable and increase the scope of its longer term oil capacity expansion program, which projects maximum capacity of 10 Mbbl/d by 1993 and sustainable capacity of 10 Mbbl/d by 1995.

Refining.—Refining capacity rose by 325,000 bbl/d with the January 1990 commissioning of the topping and hydrodesulfurization plant at Rabigh, thus bringing the Kingdom's total refining capacity to more than 1.8 Mbb/d. The Kingdom's refineries operated at 80% capacity during the first 7 months of 1990.

In an effort to meet the requirements of the multinational forces deployed in Saudi Arabia without disturbing world markets, Saudi Arabia raised its refinery throughput by more than 300,000 bbl/d during the months following the Iraqi invasion of Kuwait. In September, Saudi Arabian refineries processed well over 1.7 Mbb/d of crude oil as compared with 1.4 Mbb/d in the precrisis period. Production at the Ras Tanura refinery suffered a decline from an output level of 502,000 bbl/d when fire damaged two kerosene-diesel fractionating columns on November 30, 1990. The fire destroyed one-half of the jet fuel production capacity. Limited production was resumed in late December.

The 50,000-bbl/d capacity refinery at Mina Saud in the Kuwaiti-Saudi Arabian Neutral Zone was shut down in August 1990.

A letter of intent was signed on November 27, 1990, between Saudi Aramco and the third largest refiner of South Korea, the Ssangyong Oil Refining Co. Saudi Aramco will acquire 50% equity in two refineries through Saudi Han Oil Refining Co. Saudi Arabia will provide all crude requirements (175,000 bbl/d) under a long-term agreement. Direct investment in foreign refining, marketing, and distribution operations establishes for Saudi Arabia a guaranteed market for crude oil and provides stability in the face of market fluctuations.

Reserves

The reevaluation of existing reserves and the recent successful exploration activities outside the traditional concession area confirmed by a wide margin Saudi Arabia's strategic position as the world leader in crude oil reserves. At the present rate of output, Saudi Arabia enjoys a reserve-production ratio sufficient to last 112 years.

INFRASTRUCTURE

Construction activities of the mid-1970's through the 1980's have created a basic

TABLE 3

SAUDI ARABIA: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1990

(million metric tons unless otherwise specified)

Commodity	Reserves
Gold:	
20 to 30 grams per metric ton	2.1 ore.
1 to 7 grams per metric ton	18.0 ore.
Petroleum million 42-gallon barrels	257,500.
Natural gas billion cubic meters	5,125.

Source: Ministry of Petroleum and Mineral Resources.

infrastructure. Highways totaled 74,000 km, of which 35,000 km was bituminous surfaced and 39,000 km was gravel and improved earth. Railroad lines totaled 886 km of 1.435-m standard gauge.

Further expansion of the East-West pipeline was underway. The maximum throughput on Petroline, which runs from Abqaiq in the Arabian Gulf to Yanbu on the Red Sea, was being raised to 4.8 Mbb/d through the installation of additional pumps and turbines at the 11 pumping stations now in operation along the line. Originally, the pipeline operated at 1.8 Mbb/d and was expanded to 3.6 Mbb/d with the construction of a parallel pipeline.

The completion of the second phase of Iraq's oil pipeline transiting the Arabian Peninsula from the Gulf to the Red Sea at Yanbu was reported in January 1990. The 1,600-km pipeline had a reported capacity of 1.5 Mbb/d but did not operate after the Iraqi invasion of Kuwait in August.

OUTLOOK

The Gulf crisis enabled Saudi Arabia to reassert itself as the world's leading oil exporter as it had the mothballed capacity available to take advantage of the suspension of the OPEC production quota system. The petroleum expansion program calling for a sustainable production level at 10 Mbb/d will place the Kingdom in a position to take advantage of the expected growth in world oil demand during the 1990's.

The Gulf crisis also stimulated the domestic refining industry, which operated at full capacity in the last quarter of 1990 to accommodate demands of the UN forces.

Another byproduct of the Gulf crisis was spillage of large volumes of crude oil from

damaged Kuwaiti coastal facilities.

The reliance on foreign expertise and foreign labor particularly in the advanced industries continues as the transfer of modern industrial and management techniques to the national population progresses at a slow but steady pace.

Most of the national income is dependent upon markets outside the Kingdom; consequently, the economy will remain vulnerable to sudden changes in volume and pattern of worldwide trade in crude and refined petroleum and petrochemicals. Purchasing equity in refining, marketing, and distribution companies in the United States and most recently in Korea eases the vulnerability.

Soliciting the military intervention of the UN coalition forces to liberate Kuwait strengthened the Kingdom's political position but weakened the nation's economy in the short term. The financial burden of supplying a major share of troop deployment costs as well as the cost of compensating the countries most seriously affected by the application of the UN embargo against Iraq will affect the economy for several years to come. The Government is most anxious for the private capital to play a greater role in the country's economic development.

¹Where necessary, values have been converted from Saudi riyals (SRIs) to U.S. dollars at the rate of SRIs3.7450=US\$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Ministry of Petroleum and Mineral Resources
Jiddah, Saudi Arabia
Saudi Aramco
Dhahran, Saudi Arabia
Directorate General of Mineral Resources
Jiddah, Saudi Arabia

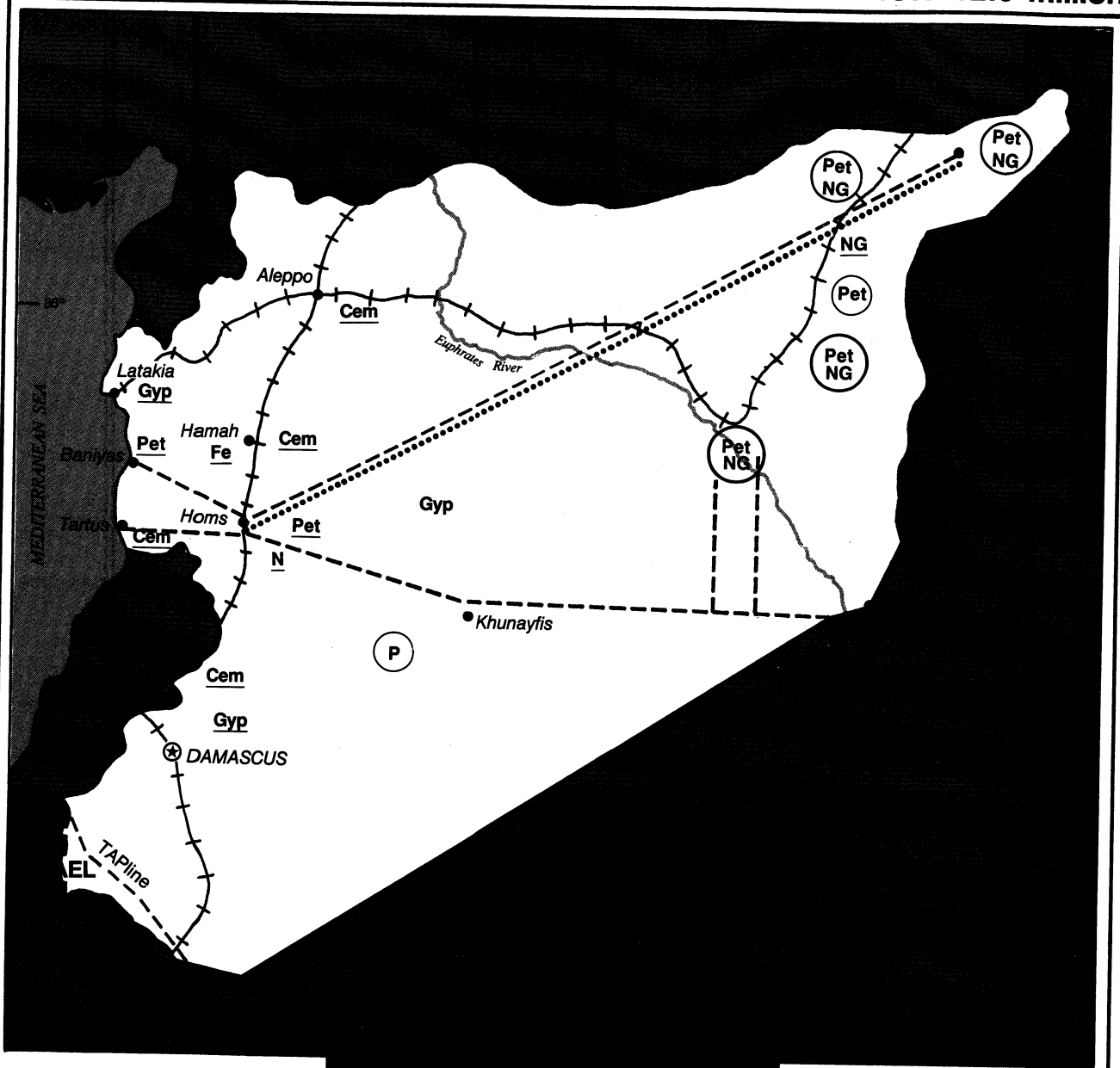
Publications

Kingdom of Saudi Arabia,
Ministry of Finance and National Economy, Central Department of Statistics, Statistical Yearbook, annual.
Saudi Arabian Monetary Agency,
Research and Statistics Department,
Statistical Summary, annual.

SYRIA

AREA 185,180 km²

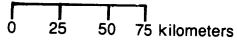
POPULATION 12.0 million



LEGEND

- International boundary
- International boundary indefinite
- Capital
- City
- Railroad
- River
- Crude petroleum pipeline
- Natural gas pipeline
- Group of producing mines or wells

See table for mineral symbols.
Underlined symbol indicates plant.



THE MINERAL INDUSTRY OF SYRIA

By Bernadette Michalski

While Syria remained principally an agrarian economy, the mineral industry continued to grow in 1990, contributing about 20% to the GNP. The discovery and development of petroleum fields yielding low-sulfur, light crude oils have improved the nation's trade balance. Associated natural gas flaring was reduced and the utilization rate was improved to approximately 40% as compared to 15% in 1983. The development of nonassociated natural gas deposits in the north and northeast should replace fuel oil for the electric power industry, provide a feedstock for the production of ammonia, and eventually provide exports via pipeline to neighboring Jordan, Lebanon, and Turkey.

Other significant mineral industries included gypsum and phosphate rock mining, the manufacture of fertilizers and cement, and the manufacture of steel from domestic and imported scrap.

GOVERNMENT POLICIES AND PROGRAMS

The Government controls all mineral exploration and production in Syria. Several non-Syrian companies conducted mineral exploration activities on behalf of the Syrian Government. The Syrian Government's General Petroleum Authority issued a decree in 1964 prohibiting the granting of concessions to foreign firms and vesting sole authority for exploration and development of Syrian hydrocarbon resources with the General Petroleum Authority. By 1974, the Government made a major policy shift reversing the earlier policy and awarded oil exploration concessions to foreign firms. The first companies to enter into exploration agreements under the new policy were U.S. Shell Pecten with a concession in the Dayr az-Zawr area and Marathon Oil Co. with a concession in the Palmyra/Homs area. By the close of 1990, 14 foreign companies entered into hydrocarbon exploration agreements with the Syrian Government, placing nearly 72,500 km² under license.

A major policy shift was effected in early 1990 when Syria restored diplomatic relations with Egypt after a 10-year-long breach. The stability achieved by improved relationships between Syria and Egypt had a favorable effect on the investment climate. Furthermore, Syria's support of the United Nations' coalition during the Iraqi occupation of Kuwait placed Syria in a position to receive aid from the coalition nations.

The Government drafted a new investment law designed to stimulate domestic and foreign private investment by lifting the current restrictions on foreign exchange transactions and also by providing tax and customs concessions. The law was expected to be passed by the People's Assembly in the spring of 1991.

PRODUCTION

Syria attained self-sufficiency in crude petroleum in 1989 with output from the Dayr az-Zawr region supplying crudes of 36° to 41° API gravity to blend with the 18° to 25° API gravity crudes from the northeastern fields. Domestic production of lighter crudes negated the requirement for imported blending crudes, favorably affecting the nation's foreign exchange position.

Production of the nonhydrocarbon minerals remained for the most part below capacity levels. Lack of investment capital has precluded mineral exploration, deposit development, or equipment repair, replacement, or improvement.

TRADE

Syria reported a trade surplus of nearly \$1 billion in 1989, the first surplus in three decades. In the first 6 months of 1990, the latest period for which data were available, the positive trade balance continued, approaching \$410 million. Government import restrictions combined with the increased production and price of petroleum were the principal reasons for the surplus. Crude oil exports for the first 6 months of 1990 netted \$282 million. The rise in pro-

duction and improved prices during the second half of 1990 should substantially increase total export earnings. Although Europe was the principal market for Syria's petroleum, shipments to the United States in 1990 were 2.2 Mbbl of crude oil and products, including nearly 1 Mbbl of residual fuel oil of greater than 1% sulfur content.

Exports of Syria's other significant mineral, phosphate rock, declined from 1.7 Mmt in 1989 to 1.4 Mmt in 1990. The principal export market for Syrian phosphates was Europe, accounting for nearly 80% of all phosphate rock exports in 1990. The political-economic changes in Eastern Europe were reflected in a market shift from Eastern to Western Europe between 1989 and 1990. The most pronounced market decline occurred in Romania, the German Democratic Republic, and Yugoslavia. France increased Syrian phosphate rock purchases by 34,000 tons, and new markets were opened in Denmark, the Netherlands, and Belgium.

STRUCTURE OF THE MINERAL INDUSTRY

The mineral industry remained owned and controlled by the Syrian Government. All mining, processing, and distribution companies are Government-operated firms. Hydrocarbon exploration concessions, however, have been granted to foreign companies operating on behalf of the Syrian Government. When commercial hydrocarbons are discovered and developed, the Government-owned Syrian Petroleum Co. activates a production-sharing agreement.

COMMODITY REVIEW

Metals

Iron and Steel.—The General Organization of Engineering Industries is considering the construction of an integrated iron and steel plant at Al-Zara near Hamah in east-central Syria. The plant will include a

TABLE 1

SYRIA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Country and commodity	1986	1987	1988	1989 ^P	1990 ^e
Cement, hydraulic thousand tons	4,200	3,870	3,330	3,501	3,500
Gas, natural: ^c					
Gross million cubic feet	² 28,000	² 43,000	45,000	48,000	50,000
Dry do.	² 9,000	² 22,000	23,000	24,500	26,000
Gypsum	160,000	248,000	179,000	180,000	² 175,451
Iron and steel: Steel, crude ^e	69,000	69,000	70,000	70,000	70,000
Natural gas liquids ^c thousand 42-gallon barrels	500	500	500	500	500
Nitrogen: N content of ammonia	136,984	92,533	78,700	² 122,500	² 103,600
Petroleum:					
Crude thousand 42-gallon barrels	<u>68,000</u>	<u>84,570</u>	<u>100,000</u>	<u>140,000</u>	<u>145,000</u>
Refinery products:					
Liquefied petroleum gas do.	2,030	1,763	1,750	1,900	1,900
Gasoline do.	8,453	7,242	8,570	8,700	8,700
Naphtha do.	5,355	5,124	5,000	5,000	5,000
Jet fuel do.	2,352	2,624	3,125	3,300	3,300
Kerosene do.	1,705	1,565	1,460	1,500	1,500
Distillate fuel oil do.	19,709	21,750	21,535	21,600	21,600
Residual fuel oil do.	32,514	34,500	38,490	38,700	38,700
Asphalt do.	1,654	1,357	1,400	1,400	1,400
Other do.	1,880	1,900	1,800	1,700	1,700
Total do.	<u>75,652</u>	<u>77,825</u>	<u>83,130</u>	<u>83,800</u>	<u>83,800</u>
Phosphate rock thousand tons	1,606	1,986	2,186	² 2,256	² 1,633
Salt	² 87,000	81,000	127,000	137,950	² 127,172
Stone, sand and gravel:					
Stone: Dimension, marble cubic meters	² 71,000	15,062	17,804	18,000	18,000
Sand and gravel thousand tons	⁶ 6,000	⁶ 6,000	8,000	8,000	8,000
Sulfur, byproduct of petroleum and natural gas	² 40,000	² 40,000	² 40,000	40,000	² 29,652

^eEstimated. ^PPreliminary. ^rRevised.¹Table includes data available through June 1, 1990.²Reported figure.

TABLE 2

SYRIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	General Organization for Cement and Building Materials	Tartus	1,655
Do.	do.	Hamah	405
Do.	do.	Musslemieh	300
Do.	do.	Al-Rastan	123
Gypsum	General Organization for Marble and Gypsum	Mine near Damascus Mine near Latakia	250 100
Natural gas million cubic meters	Syrian Petroleum Co.	Suwaydiyah processing plant	240
Do.	do.	Jubaisseh processing plant	640
Petroleum, crude million 42-gallon barrels	Syrian Petroleum Co.	Northeastern fields (including Suwaydiyah, Jabisah, Gbebeh, Tichrine, Karatchuk, and Rumaylah)	58

TABLE 2—Continued

SYRIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Petroleum, crude million 42-gallon barrels Continued	Al-Furat Petroleum Co.	Al-Thayyim (including Ash Shola and Al-Kharrata) 10 kilometers south of Dayr az-Zawr	36
Do.	do.	Umar northeast of Al-Thayyim	36
Do.	do.	Al-Ward (including Al-Asharah, Jido, Tanak and Tavyani East)	36
Petroleum, refined	Baniyas Refining Co.	Refinery at Baniyas	46
Do.	Homs Refining Co.	Refinery at Homs	43
Phosphate rock	General Co. for Phosphates and Mines	Khunayfis	400
Do.	do.	Al-Sharqiye Eastern A 20 kilometers south of Khunayfis	600
Do.	do.	Al-Sharqiye Eastern B 26 kilometers southeast of Khunayfis	400
Salt	General Co. for Phosphates and Mines	Mine near Dayr az-Zawr	60
Do.	do.	Mine 35 kilometers southeast of Aleppo	100
Steel	General Co. for Iron and Steel Products	Plant 8 kilometers north of Hamah	120
Sulfur	Baniyas Refining Co.	Refinery at Baniyas	85
Do.	Homs Refining Co.	Refinery at Homs	87
Do.	Syrian Petroleum Co.	Suwaydiyah processing plant	7
Do.	do.	Jubaisseh processing plant	14

direct reduction unit, electric arc furnaces, and a mill to produce reinforced steel bars and wire rods. Output is planned at 750 Mmt/a. Cost is projected at \$750 million. Saudi Arabia has pledged \$500 million in support of the project.

Industrial Minerals

Cement.—The General Organization for Cement and Building Materials has invited bids for contracts to build an extension to the Hamah Cement Works.

Fertilizers.—A phosphatic fertilizer complex is planned at Palmyra. The complex will comprise a 500,000-mt/a-capacity triple superphosphate plant as well as phosphoric acid and sulfuric acid plants.

Phosphate Rock.—Phosphate rock production was reduced by 25% to 1.7 Mmt as a result of reduced foreign and domestic sales in 1990. At least 200,000 tons was added to stocks during the year. Tenders

have been offered for the construction of a new phosphate mine and upgrading plant to produce 2 Mmt of washed and dried phosphate concentrate annually. The deepwater resources discovered in 1989-90 allow washing to produce a superior phosphate concentrate to that currently being sold.

Mineral Fuels

Natural Gas.—The Government has put a high priority on increasing gas production so that gas can be used more widely as a fuel for power generation and as an industrial raw material, for example, in direct iron ore reduction at the proposed integrated iron and steel plant. The Al-Furat Petroleum Company development plans included construction of a natural gas-gathering system and processing plant. Forerunners for the pipeline construction contract were Saipem of Italy, Hak Pijpleidingen of the Netherlands, and Technoexport of Czechoslovakia.

Petroleum.—Encouraged by the discovery of commercial quantities of light crude oils with low sulfur content, 14 foreign firms were engaged in hydrocarbon exploration activities in Syria in 1990. While most of the new exploration activity was centered in east-central Syria near Dayr az-Zawr, concessions were also awarded in the Palmyra area, in a region south of Damascus, and in the extreme northeast region near the Syrian Petroleum Co.'s producing fields.

Total Compagnie Française de Pétrole's P's holdings in the 9,330-km² Al-Bishri concession were reduced to 51% with the Indonesia Petroleum (Inpex) purchase of 9%. Other shareholdings in the concession remain the same with Fina Exploration Syria and Lasmo-Oil Syria each holding 20%.

Production from the Umar Field 440 km northwest of Damascus near Dayr az-Zawr was realized in January 1989. However, the field was found to be fractured, necessitating the drilling of additional wells and the adoption of enhanced recovery techniques.

TABLE 3

SYRIA: PHOSPHATE ROCK EXPORTS

Country of destination	1989	1990
Austria	174,000	139,000
China	53,000	52,000
France	311,000	345,000
German Democratic Republic	254,000	61,000
Italy	55,000	32,000
Lebanon	85,000	134,000
Portugal	85,000	66,000
Romania	369,000	122,000
Spain	65,000	50,000
Yugoslavia	196,000	79,000
Other	474,000	472,000
Total	1,729,000	1,394,000

Production is expected to be restored to 100,000-bbl/d levels by 1991. Total crude oil production for Syria including the heavier crudes from the northeastern fields averaged about 390,000 bbl/d in 1990. Crude oil production from the Shell Oil concession along the eastern border near Dayr az-Zawr averaged about 275,000 bbl/d. Nearly 100,000 bbl/d of light crude was supplied to the Homs refinery from this concession satisfying domestic consumption requirements for blending crudes. At least six term purchase contracts were obtained for Syrian 37° API blend crude oil. The price was established at \$0.40 below the price of North Sea Brent crude oil which was priced at \$21.00 bbl in January 1990 and \$27.20 bbl in January 1991.

Reserves

The Syrian Ministry of Oil, Electricity and Natural Resources has announced in early 1990 reevaluated hydrocarbon mineral reserves, which substantially increased recoverable natural gas reserves from the 113 billion m³ announced in 1989 to 181 billion

m³. Proven petroleum reserves were virtually unchanged at 1.7 billion bbl. Much of the nation's oil and gas reserves are in seven major fields, the largest of which is Suwaydiyah in the extreme northeast section of the country. This field covers an area 72 km² with a 260-m-thick oil layer. Proven reserves of this field alone are reported at 1 billion bbl.

INFRASTRUCTURE

Railway transportation is available in northern and western Syria servicing the major cities and the three principal ports of Tartus, Latakia, and Baniyas. The existing pipelines include the Iraq Petroleum Co. (IPC) pipeline traversing Syria from east to west, the Syrian Petroleum Co. (SPC) pipelines carrying crude petroleum and natural gas from the northeastern fields to the refineries, powerplants, and port facilities in the west, and the long-closed trans-Arabian pipeline (TAPline) that crosses Southern Syria into Lebanon. The IPC pipeline was originally intended as Iraq's conduit to the Mediterranean while also supplying light blending crudes to the Homs refinery. With the onset of production from the Dayr az-Zawr area, two spur lines were constructed connecting the Al-Thayyim Field along with its smaller satellite fields and the Umar Field to the IPC pipeline at the T-2 pumping station.

In a wet year, Syria can depend on hydroelectric power generation from dams on the Euphrates River. However, dam construction upstream in Turkey will reduce flow rates through the mid-1990's, requiring thermal generating plants to provide a higher percentage of electric power. A 90-megawatt electric powerplant using associated gas from the Thayyim Field came on-stream in mid-1990. Construction continued on the 800-megawatt plant at Tichrine, also to be fueled by associated gas.

OUTLOOK

The private sector should continue to benefit from a series of reforms including an expansion of the list of items the private sector may import, increased use of the free market rate for the Syrian pound in pricing, incentives for manufacturing for export and for exporting, and industrial investment incentives. The restoration of diplomatic relations with Egypt should improve stability and regional trade relationships. The discovery of nonassociated natural gas fields and the increased utilization of associated natural gas has prompted the Government to target this fuel as the source for 30% of Syria's energy consumption by the year 2000, thus reducing the demand for fuel oil and increasing petroleum export potential.

Recent developments in the nation's petroleum and natural gas industry have resulted in heightened foreign capital investment and a more favorable trade balance.

The Gulf conflict may lead to new financing arrangements for Syria. Kuwait and Saudi Arabia renewed pledges of aid prompting the Syrian Government to review investment projects such as a new iron and steel complex and a new fertilizer factory to absorb expansion of local phosphate rock production.

OTHER SOURCES OF INFORMATION

General Organization for Engineering Industries

Damascus, Syria

Banias Refining Co.

P.O. Box 26 Banias, Syria

Telephone: 238/307 Telex BANREF 470000 SY

General Company of Homs Refinery

P.O. Box 352 Homs, Syria

Telephone: 22771/22768 Telex HRC 441004 SY

THE MINERAL INDUSTRY OF TURKEY

By Hendrik G. van Oss

Turkey's mineral industry was relatively stagnant in 1990, especially by comparison with significant growth in several other sectors of the economy during the year and with the strong performance registered by the mineral industry in 1989. The mineral industry remained, however, a very important sector of the Turkish economy; sales of Turkish primary and secondary mineral commodities in 1990 were equivalent to about 14.5% of GDP. Turkey's GDP was about \$109 billion¹ in 1990, a significant increase over the revised 1989 figure of about \$79 billion. Mineral commodity exports in 1990 were worth about \$2.5 billion, or about 19.3% of Turkey's total exports. Mineral commodity imports, worth about \$10.7 billion, made up about 48% of the country's total imports.

Turkey's mineral industry is, in general, characterized by a large number of rather small producers—not uncommonly, however, having significant cumulative production. The country has more than 800 mining establishments, and a wide variety of deposits are exploited. Turkey is a major producer of industrial minerals, being among the top two producers in the world in 1990 for boron, emery, and strontium (celestite); and among the top three in perlite, pumice, and soda ash (trona). The country was also a significant world producer of barite, magnesite, and marble. Turkey was 4th in the world in chromite production, 6th in mercury, 10th in lignite, 12th in cement, and 19th in iron and steel.

In general terms, 1990 production levels of mineral commodities were mixed and export levels were lower by comparison with those of 1989. A number of factors appear to have been responsible for this performance. Exports were adversely affected by the worldwide recession and by a major disruption of trade with the Middle East occasioned by Iraq's invasion of Kuwait in August. Further, the competitiveness of some Turkish mineral commodities on the international market was adversely affected

by increasing labor costs and the elimination of export and electricity subsidies. A reduction in export and domestic demand for mineral products meant that prices could not be increased sufficiently to offset the production cost increases fueled by the country's 60% inflation rate. Profits suffered accordingly, and most facilities operated below capacity, negatively impacting new capacity increases planned or underway in the mining sector during the year.

The total value of sales of Turkish primary minerals, including crude petroleum, on the domestic and export markets is estimated at about \$1.9 billion in 1990; exports amounted to almost \$600 million of this amount. However, these estimates do not include the manufactured mineral commodity component of total sales, a major factor in a diversified economy such as Turkey's. If the estimated domestic and export sales value of manufactured mineral commodities is included, the total sales value of mineral commodities would be an estimated \$15.5 billion, of which exports make up about \$2.5 billion. This includes petroleum and gas shipping revenues, but not other mineral commodity shipping and loading fees owing to the unavailability of data. The sales value of mineral commodities represents a modest increase from that of 1989; much of this increase, however, merely reflected higher petroleum prices realized as a result of instability in the Persian Gulf, as well as a return to full production levels by a major public-sector steel company. Mineral commodity sector wages in 1990 amounted to an estimated \$400 million.

Turkey's major trading partners in 1990 included the United States, various European countries, the U.S.S.R., and various countries in the Middle East. A significant portion of the trade with the Middle East normally includes the transshipment of mineral and other commodities, particularly crude oil, from the Persian Gulf region through Turkey. Much of this trade

was adversely affected by instability in the region. In honoring the UN sanctions against Iraq for its invasion of Kuwait, Turkey lost both its major supplier of crude oil and a number of other commodities, and significant revenues from transit services for Persian Gulf country exports. These losses have been estimated to total about \$5 billion, although some of these losses were expected to be made up in 1991 through various grants from other countries. In addition, Turkey felt itself well-positioned to supply goods and services toward the post-war reconstruction efforts in the Gulf region.

GOVERNMENT POLICIES AND PROGRAMS

The Turkish Government has been actively involved in mining since 1935, mostly through a number of large parastatals. In more recent years, the Government has encouraged increased mineral exports and both domestic and foreign private mining investment in Turkey. This encouragement has come through the 1985 Mining Law and various recent investment decrees. One of the most significant outcomes of this recent legislation is that foreign companies are now on the same legal footing as domestic companies in terms of such factors as taxes and access to exploration permits. A number of new incentives to mining were, reportedly, incorporated into a 1990 draft of a new mining law, enactment of which, however, had not taken place by yearend.

Export subsidies and import restrictions imposed by the Government in the early 1980's to encourage economic growth helped cause high inflation and debt during the latter part of the decade and in 1990. Steps taken to curb inflation slowed the growth of the economy during the period 1988-90. Under pressure from some of Turkey's European trading partners, the Government eliminated the system of

export subsidies in early 1989. Because this action was expected to reduce profits for a number of industries, import tariffs and restrictions on certain industrial inputs were reduced or eliminated in order to reduce domestic manufacturing costs. Further, reduced import restrictions were seen as a way to ensure supplies of inputs where the supply from domestic public-sector manufacturers was threatened by labor unrest. These actions resulted in a major increase in imports, to the detriment of some Turkish industrial producers, particularly in the private iron and steel sector. Turkish industries have also been hurt by the elimination of electricity subsidies and a general decline in domestic demand, particularly in the construction sector. Years of high inflation led to major strikes in the public industrial sector in 1989; high wage settlements resulting from these strikes affected industrial profitability, and augured poorly for a decrease in future inflation rates.

The Government has embarked on a major privatization program. A number of public-sector mineral commodity producers are destined to be privatized, including the petrochemical manufacturer Petrokimya Anonim Şirketi (Petkim), cement companies under Türkiye Çimento Sanayii T.A.Ş. (Çitosan), and the Government shares in the Ereğli Demir ve Çelik Fabrikalari T.A.Ş. (Erdemir) integrated steel plant. However, the fate of the privatization program is in doubt, at least regarding foreign investments, due to a successful lawsuit to block the sale of several Çitosan cement plants to a French cement company. The basis of the suit, brought in 1989, was that Turkish law required that shares in state enterprises should first be offered to the general public. Several lower court hearings in 1990 upheld the decision invalidating the principal of the sale, but further appeals were in progress at yearend. Public demand in 1990 was high for shares in public enterprises, but the availability of investment capital for the general public is perceived to be limited. The Government has expressed concern that the court rulings will make it difficult to attract foreign investment and that valuable opportunities for improvements in management and technology may thereby be lost.

The common use in Turkey of lignite coal as domestic heating fuel and in powerplants is a major cause of the severe air pollution in cities. The resulting health problems have led to legal opposition to

planned new coal-fired powerplants. In response, the Government has begun to impose environmental controls on industries, particularly new ones, and has accelerated plans for the expansion of the country's natural gas pipeline infrastructure, which will largely use imported gas. It is intended that, where possible, natural gas will be substituted for coal and lignite for domestic and industrial uses. The Government has embarked on a program to expand the country's electrical generation capacity, mainly through the construction of hydroelectric facilities. Some of these are part of a major regional program aimed at increasing both power and, through irrigation, agricultural production. The latter is expected to greatly increase the country's consumption of fertilizers.

Many of Turkey's trading practices are in line with the country's efforts to join the EC. Full membership in the EC, however, has so far not been offered to Turkey. As an outcome of political and economic changes in the U.S.S.R. and Eastern Europe, Turkey has begun to explore the setting up of a Black Sea Cooperation Zone to facilitate trade among countries bordering the Black Sea. Apart from geographic proximity to these countries (Bulgaria, Romania, and the U.S.S.R.), Turkey perceives them to be potentially large markets for low-to-moderate priced Turkish consumer goods, as well as for such things as construction services.

PRODUCTION

The production of mineral commodities was mixed in 1990, in sharp contrast to the generally strong increases in 1989. The latter was due in part to commissioning of new capacity, which, however, was largely unutilized in 1990. In general terms, the production of metallic minerals declined or was stagnant in 1990, that for industrial minerals was stagnant or showed modest increases, and that for energy minerals largely showed increases.

Most declines in production could be attributed directly to a reduction in domestic and/or export demand, although for some commodities, such as antimony and tungsten, the declines were also attributable to diminishing reserves. Work stoppages toward the end of the year caused a modest decline in the output of coal. Iron ore and steel output increased dramatically in 1990 as a result of the settlement of the labor

disputes that had plagued the public-sector industry in 1989. The notable increase in feldspar and silica sand production was attributable to steady growth in Turkey's glass and ceramic industry, which was one of the largest in the world. Petroleum shortages and price increases resulting from instability in the Persian Gulf was a significant stimulus to petroleum and natural gas production and exploration, and to petroleum refining.

TRADE

Turkey's total exports increased 11.5% to almost \$13 billion in 1990, in part owing to an improved level of agricultural output and exports over drought-plagued 1989. Although exports of many mineral commodity exports declined, the total value of crude and processed mineral exports in 1990 increased 4% to about \$2.5 billion, largely because of higher exports of certain major categories of manufactured mineral commodities, especially iron and steel. Exports of iron and steel increased 19.5% to \$1.6 billion. The value of crude oil exports increased almost 9% to about \$264 million as a result of world price increases; the tonnage of oil exported actually fell 5.5%. Cement exports increased 133% to \$77 million. Exports of ferrochrome increased 48% in tonnage, but because of low world prices, export revenues increased only 1.4% to \$46.9 million. Exports of polished dimension and other stone (other than marble) increased 46.5% to \$26 million. Copper ore and concentrate exports increased 166% to \$9.5 million. Exports of calcium and silicon carbide increased about 5% to \$8.4 million, although the quantity exported fell slightly.

Against these increases, however, were a large number of declines in mineral exports. The most important of these was boron: combined exports of boron minerals, refined boron chemicals, and boric acid fell 12.5% to about \$200 million. Chrome ore exports fell about 45% to about \$64 million, although a small part of this decline was due to an increased diversion of ore to domestic ferrochrome production. Barite exports fell 45% to \$10.5 million, but given only a slight decline in production, the export level may have reflected an increased demand for drilling mud by the domestic petroleum industry. Magnesite exports fell 19% to \$37 million. Alumina exports fell 40% to \$16 million,

TABLE 1
TURKEY: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	¹ 1989	² 1990	
METALS						
Aluminum:						
Bauxite	280,401	259,075	269,437	561,505	730,000	
Alumina:						
Gross weight	144,396	95,236	181,657	200,560	² 177,144	
Al content	75,274	49,647	94,699	104,552	² 92,746	
Metal, smelter	60,017	41,685	56,692	61,776	² 60,903	
Antimony:						
Ore, mine output:						
Gross weight	45,112	51,399	42,640	29,896	² 9,000	
Sb content	2,752	2,344	1,877	¹ 1,350	400	
Concentrates:						
Gross weight	2,117	2,591	2,303	1,801	613	
Sb content	1,376	1,674	1,370	¹ 1,165	466	
Regulus	252	204	62	5	—	
Cadmium	6	11	22	54	² 46	
Chromite:						
Gross weight (34% to 43% Cr ₂ O ₃)	1,040,130	1,048,927	1,157,075	1,498,995	² 1,000,000	
Salable product	617,652	762,071	851,425	¹ 1,000,000	850,000	
Copper:						
Mine output:						
Gross weight (exclusive of pyrite)	2,374,862	2,645,367	3,135,661	3,822,516	² 4,000,000	
Cu content of ore	26,085	31,531	37,746	¹ 45,900	48,000	
Cu content of pyrite	108	564	1,946	² 1,120	2,300	
Concentrates (exclusive of pyrite):						
Gross weight	119,184	136,729	167,701	¹ 204,500	215,000	
Cu content	21,130	25,778	28,509	¹ 35,000	36,550	
Metal:						
Smelter output	35,466	19,247	12,910	21,129	² 25,220	
Refined ^c	75,100	75,600	90,000	¹ 86,400	² 84,200	
Iron and steel:						
Iron ore:						
Gross weight	thousand tons	5,249	5,366	5,481	3,602	5,350
Fe content	do.	2,833	2,881	2,983	¹ 1,960	2,910
Metal:						
Pig iron and ferroalloys:						
Ferchromium	50,000	52,530	54,030	59,715	² 62,040	
Ferrosilicon	7,000	4,400	5,200	4,970	² 5,225	
Pig iron and other ferroalloys	thousand tons	3,666	4,438	4,916	³ 3,924	² 5,309
Steel, crude including castings	do.	5,928	7,044	7,982	7,934	² 9,454
Lead:						
Mine output, Pb and Pb-Zn ores:						
Gross weight	231,256	236,907	286,269	371,536	371,000	
Pb content	9,626	9,463	10,212	¹ 13,000	13,000	
Concentrates:						
Gross weight	32,234	31,447	37,332	¹ 48,000	48,000	
Pb content	7,516	7,274	9,396	¹ 12,100	12,100	
Metal, refined ^c	9,600	10,000	11,000	¹ 9,000	² 12,000	
Manganese ore, gross weight ³	7,770	¹ 7,000	¹ 10,000	¹ 10,000	¹ 10,000	

See footnotes at end of table.

TABLE 1—Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES¹
(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	¹ 1989	² 1990
METALS—Continued					
Mercury kilograms	261,649	210,519	97,359	197,364	² 59,650
Silver, mine output, Ag content ^c do.	6,800	8,800	22,500	28,500	42,000
Tungsten, W content of concentrate	¹ 206	163	125	^c 100	25
Zinc:					
Mine output, Zn and Pb-Zn ore:					
Gross weight	325,613	355,252	387,844	^c 440,000	480,000
Zn content	40,574	42,223	37,494	^c 38,600	46,000
Concentrates:					
Gross weight	37,770	40,273	44,639	^c 71,000	57,000
Zn content	11,979	13,517	14,418	^c 27,000	18,100
Metal, smelter, primary	¹ 15,434	² 22,160	² 22,476	24,170	² 20,063
INDUSTRIAL MINERALS					
Abrasives, natural: Emery	6,333	9,171	12,267	7,780	² 4,000
Asbestos:					
Run of mine	30,981	10,097	1,296	—	² —
Fiber	1,098	806	^c 50	—	² —
Barite, run of mine	330,758	291,913	405,017	434,664	430,000
Boron minerals:					
Run of mine	1,635,600	1,629,345	2,043,628	1,990,339	² 2,062,758
Concentrates	928,010	980,150	1,230,828	1,174,520	1,252,591
Cement, hydraulic thousand tons	20,004	21,980	22,675	23,796	² 24,408
Clays:					
Bentonite	62,367	89,262	80,218	90,336	² 100,000
Kaolin	91,893	126,119	204,478	257,389	² 230,000
Other	187,349	310,002	368,241	298,813	300,000
Diatomite	^c 6,000	5,149	—	—	—
Feldspar, run of mine	12,180	30,336	82,225	90,751	² 155,000
Fluorspar	1,604	^c 10,000	13,240	^c 13,000	13,000
Graphite	3,586	11,760	12,911	11,302	12,000
Gypsum	128,051	301,743	231,218	223,485	230,000
Lime ^c thousand tons	1,100	1,100	1,500	1,400	1,650
Magnesite, crude ore	1,306,645	1,189,667	1,125,844	1,238,123	² 850,000
Meerscham kilograms	9,600	8,300	6,450	9,450	3,800
Nitrogen: N content of ammonia	190,180	329,771	^c 308,600	^c 308,000	405,000
Perlite	103,129	143,958	154,231	142,890	² 150,000
Phosphate rock (salable product)	2,700	19,197	74,230	84,810	² 86,788
Pumice ^c ⁴	534,917	760,661	1,470,675	665,476	² 412,500
Pyrites, cuprous, gross weight	10,153	51,245	176,964	192,738	² 208,000
Salt, NaCl, all types thousand tons	1,172	1,218	1,358	1,384	² 1,600
Silica sand, washed product ⁵ do.	¹ 346	¹ 397	¹ 438	¹ 485	540
Sodium compounds, n.e.s.:					
Soda ash (trona) ^c	330,000	376,000	379,000	381,000	385,000
Sulfate, concentrates	58,603	82,628	79,427	^c 80,000	80,000
Stone:					
Dolomite	527,452	394,187	262,773	^c 250,000	250,000
Limestone, other than for cement ^c thousand tons	2,500	2,700	3,200	2,800	² 4,250
Marble ^c do.	460	490	515	540	405
Quartzite	490,310	541,226	885,059	563,480	² 650,000

See footnotes at end of table.

TABLE 1—Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES¹
(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	^P 1989	^e 1990
INDUSTRIAL MINERALS—Continued					
Strontium minerals: Celestite	40,000	49,000	54,000	^e 59,000	60,000
Sulfates, natural, n.e.s.: Aluminum sulfate (alunite)	<u>14,584</u>	<u>12,726</u>	<u>11,173</u>	<u>7,366</u>	<u>10,000</u>
Sulfur:					
Native, other than Frasch	40,051	39,325	30,030	22,960	19,550
S content of pyrites	4,152	22,035	75,387	^e 83,000	89,500
Byproduct:					
Petroleum	6,504	8,615	15,684	13,166	² 14,600
Other ^c	22,000	11,000	5,000	49,000	55,000
Total ^c	<u>72,707</u>	<u>80,975</u>	<u>126,101</u>	<u>168,126</u>	<u>178,650</u>
Talc	^e 35,000	^e 15,000	5,397	5,614	6,000
MINERAL FUELS AND RELATED MATERIALS					
Asphalt, natural	607,167	631,159	624,113	407,988	295,000
Carbon black ^c	20,000	² 33,141	² 31,955	32,000	35,000
Coal:					
Anthracite	7,015	7,084	6,688	6,259	² 5,604
Bituminous	607	630	626	408	400
Lignite	<u>45,470</u>	<u>46,481</u>	<u>39,025</u>	<u>51,981</u>	<u>46,500</u>
Coke and semicoke:					
Metallurgical	2,771	2,912	^e 3,035	^e 2,676	3,050
Gashouse	117	105	^e 109	^e 100	112
Breeze	247	259	^e 270	^e 260	270
Total	<u>3,135</u>	<u>3,276</u>	<u>3,414</u>	<u>3,036</u>	<u>²3,432</u>
Gas, natural:					
Gross ^c	850,000	850,000	850,000	850,000	900,000
Marketed	456,715	297,125	99,167	173,822	² 212,488
Petroleum:					
Crude ⁶	<u>17,138</u>	<u>18,830</u>	<u>18,360</u>	<u>²20,598</u>	<u>²26,880</u>
Refinery products:					
Liquefied petroleum gas	5,608	6,511	8,029	7,770	² 8,025
Gasoline	18,512	20,020	19,204	19,847	² 24,264
Naphtha	250	102	91	245	² 12,965
Jet fuel	3,459	3,561	4,505	4,373	² 7,489
Kerosene	2,272	3,043	3,902	2,691	² 1,293
Distillate fuel oil	^e 96,275	^e 111,892	^e 118,374	^e 107,674	130,000
Lubricants	1,360	^e 1,500	1,726	1,833	2,000
Residual fuel oil	47,353	56,517	62,471	53,326	² 61,490
Asphalt	3,955	5,517	3,993	2,583	² 4,368
Refinery fuel and losses	2,388	2,898	2,940	² 2,910	2,900
Unspecified	^e 9,763	^e 12,085	^e 14,455	^e 12,532	13,000
Total	<u>^e191,195</u>	<u>^e223,646</u>	<u>^e239,690</u>	<u>^e215,784</u>	<u>267,794</u>

^eEstimated. ^PPreliminary. ^rRevised.

¹Table includes data available through Oct. 31, 1991. Limestone quarried for cement manufacture is substantial; however, information is inadequate to make accurate estimates of output levels.

²Reported figure.

³Does not include manganese iron ore from the Devci Mine, production of which amounts to several hundred thousand tons annually, and which has a manganese content of 3% to 5%.

⁴Turkish pumice production is officially reported in cubic meters and has a density reported to range from 0.5 to 1.0 tons per cubic meter. Values in this table have been converted using 1 cubic meter=0.75 tons.

⁵Series changed from run of mine.

⁶Crude oil production converted from reported metric tons using conversion factor of 7.161 barrels per ton.

in line with a general decline in Turkey's aluminum industry during the year. Strontium (celestite) exports fell 15% to \$6.2 million.

Turkish imports totaled \$22.3 billion in 1990, a 41% increase. Mineral commodity imports increased 51% to \$10.7 billion. One-third of this increase was due to the higher cost of crude oil and petroleum products imports in 1990. Crude oil imports increased 42% to almost \$3.5 billion, and petroleum products imports increased in value 62.5% to about \$500 million. These increases were largely the outcome of Turkey's need to seek alternate, higher priced, sources of oil after the Government shut down the oil pipeline from Iraq, in accordance with UN sanctions. Instability in the Persian Gulf region also stimulated the purchase of gold on the Turkish gold exchange; imports of gold for the exchange increased 69% to almost \$1.8 billion. Natural gas imports were essentially unchanged and were worth about \$140 million.

Imports of ores and related manufactured products decreased 5% in 1990 to \$2.64 billion, reflecting in part a reduction of domestic and/or reexport demand. Fertilizer imports declined almost 9% in value to \$248 million owing to lower world fertilizer prices. Iron and steel imports declined 13% to \$1.9 billion, both because of increased domestic output, particularly of long products, and a reduction in scrap imports.

The bulk of Turkey's trade in 1990 was with the EC, the United States, the U.S.S.R., Japan, and various Middle Eastern countries. Trade with the U.S.S.R. mostly involved a long-term barter arrangement under which Turkey purchased Soviet natural gas for cash, and the U.S.S.R. was to use 70% of those proceeds to buy Turkish goods and services. The bilateral trade with the U.S.S.R. was worth about \$1.8 billion in 1990. Mineral commodity trade with the Middle East mainly involved petroleum, for which Turkey was 83% import-reliant in 1990, in exchange for cement, fertilizers, and iron and steel. Turkey also provided transit services for Middle East exports, notably petroleum. Trade with Iraq, particularly for Turkish steel, has declined significantly since 1988 owing to the Government's termination of export credits to Iraq, and, especially in 1990, general instability in the region. Turkey's compliance with UN trade sanctions against Iraq, which commenced in August 1990, caused major trade problems for

Turkey. In terms of mineral commodities, Turkey lost fees from the pipeline and tanker truck transit of Iraqi crude oil, estimated to be worth \$300 million and \$120 million, respectively, per year. In addition, the Persian Gulf region traditionally has supplied 55% to 65% of Turkey's crude oil imports and a large proportion of its sulfur imports. A number of countries responded to Turkey's search for new sources of these commodities; most notably, Saudi Arabia agreed to make up for the lost oil imports and some of the revenues.

The EC took about one-half of Turkey's total exports in 1990. The Federal Republic of Germany was Turkey's single biggest customer in 1990, taking an estimated 22% of all exports. Italy was second with about 8%, followed by the United States, 7%; the United Kingdom and France, about 6% each; the U.S.S.R., 4%; and Iran, 3%. Imports of Turkish goods by the United States were dominated by agricultural products, textiles, and steel. Exports to Iraq and Kuwait virtually ceased following the August 1990 imposition of UN sanctions against Iraq. Exports to Europe showed significant increase during the same period, apparently as an EC or NATO effort to partially compensate for Turkey's lost trade with the Persian Gulf region. Exports to the U.S.S.R. showed an almost 30% decline for the year, evidently reflecting foreign exchange shortages associated with the political changes in that country.

About 41% of Turkey's imports in 1990 were from the EC. Imports from the Federal Republic of Germany, Turkey's largest trading partner, were worth about \$3.4 billion, followed by Italy, \$1.7 billion; France, \$1.3 billion; and the United Kingdom, \$1 billion. Overall, the United States was Turkey's second largest source of imports. Turkish imports of U.S. goods were worth about \$2.2 billion in 1990, mostly machinery, iron and steel products and scrap (almost \$400 million, or 24% of total U.S. scrap exports), coal, and chemicals. Official data on U.S. exports to Turkey, however, are incomplete because they do not include sales of U.S. products through European subsidiaries of American companies. Imports from the Persian Gulf region totaled about \$2.5 billion during the year, and were dominated by imports from Iraq at \$1.15 billion. Imports from Iraq and Kuwait declined almost totally following the imposition of sanctions. Imports from Saudi Arabia, in contrast, increased 175% for the year to about \$550 million. Most

of this change came as a fiftyfold increase in the fourth quarter, and represented sales of crude oil and petroleum products. Imports from the U.S.S.R. almost doubled to \$1.25 billion, with much of the increase coming in the fourth quarter of the year. Part of this increase represented oil deliveries; Turkish imports of Soviet natural gas increased only slightly to 3.2 billion m³.

STRUCTURE OF THE MINERAL INDUSTRY

The Turkish mining industry is characterized by several large, state-owned conglomerates and a large number of private producers. Private-sector producers range from large concerns with several hundred employees or more to family-operated mines with only a few employees. More than 800 mining establishments were listed as in operation in 1988, the latest year for which such information was available. The state-owned enterprises are a major part of the mineral industry. The various subsidiaries of the Etibank group dominate or produce the country's entire output of aluminum, boron minerals and chemicals, blister copper, ferrochrome, mercury, and zinc. Etibank sales in 1990 accounted for 3.3% of all sales of Turkish mineral commodities and about 12% of all mineral commodity exports. Other parastatals dominate production of such commodities as cement, coal, fertilizers, iron ore and iron and steel, and petroleum and natural gas. State participation in Turkey's mineral industry is being gradually reduced by the implementation of the Government's privatization plans.

Maden Tetkik ve Arama Enstitüsü (MTA) is the state agency responsible for geologic exploration and research in Turkey. Apart from doing its own exploration, MTA can provide laboratory and field services for private-sector exploration efforts. Until recently, MTA had first refusal rights for all exploration concessions in Turkey, but it now must bid on such concessions on an equal basis with domestic and foreign exploration companies.

Approximately 200,000 workers were employed in the mineral commodities industries in 1990. The largest employers were the coal and lignite producers, with a total of about 80,000 employees; the iron and steel producers, with about 43,000 employees; and the cement producers, with

TABLE 2
TURKEY: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	79,997	101,875	61,775	France 40,100.
Oxides and hydroxides	66,430	77,483	—	U.S.S.R. 26,300; China 32,500; Iran 16,033.
Metal including alloys:				
Scrap	33	94	—	Italy 50; West Germany 44.
Unwrought	6,326	8,945	—	Italy 5,135; Netherlands 1,121; United Kingdom 1,042.
Semimanufactures	29,989	26,827	5,202	West Germany 6,636; Italy 2,749.
Antimony:				
Ore and concentrate	1,644	2,204	—	Austria 640; Belgium-Luxembourg 620; Yugoslavia 500.
Metal including alloys, all forms	12,383	494	—	West Germany 240; Netherlands 184.
Arsenic: Ore and concentrate	72	—	—	—
Bismuth: Metal including alloys, all forms	21	—	—	—
Cadmium: Metal including alloys, all forms	—	130	—	All to West Germany.
Cesium and rubidium: Metal including alloys, all forms	50	—	—	—
Chromium:				
Ore and concentrate	843,115	913,375	90,550	Yugoslavia 137,325; Norway 107,000; Sweden 95,552.
Oxides and hydroxides	(²)	3	—	All to Belgium-Luxembourg.
Metal including alloys, all forms	—	1	—	Mainly to Libya.
Cobalt:				
Oxides and hydroxides	200	—	—	—
Metal including alloys, all forms	kilograms 9	—	—	—
Columbium and tantalum: Metal including alloys, all forms, tantalum	do. 40	—	—	—
Copper:				
Ore and concentrate	47,908	17,669	—	Japan 10,450; Bulgaria 7,219.
Matte and speiss including cement copper	1	—	—	—
Sulfate	kilograms 400	—	—	—
Metal including alloys:				
Scrap	—	86	—	Greece 50; United Kingdom 36.
Unwrought	5,458	6,113	—	Greece 3,424; United Kingdom 1,217.
Semimanufactures	29,146	41,021	1,326	Algeria 12,902; Egypt 6,069; India 4,349.
Gold: Metal including alloys, unwrought and partly wrought	—	7	7	—
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	38,493	50	—	All to Iraq.
Pyrite, roasted	7,810	—	—	—
Metal:				
Scrap	7,407	4,431	20	West Germany 4,235.
Pig iron, cast iron, related materials	101,778	31,920	—	Italy 31,285; Yemen (Sanaa) 415.
Ferroalloys:				
Ferrochromium	59,451	46,238	39,250	Sweden 2,100; Netherlands 1,950.
Ferromanganese	—	10	—	All to Syria.
Ferrosilicon	20	3,001	—	Iran 3,000.
Steel, primary forms	thousand tons 1,418	1,124	1	Iran 331; Libya 43; Japan 32.

See footnotes at end of table.

TABLE 2—Continued
TURKEY: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹
(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989		
			United States	Other (principal)	
METALS—Continued					
Iron and Steel—Continued					
Metal—Continued					
Semimanufactures:					
Flat-rolled products:					
Of iron or non-alloy steel:					
Not clad, plated, coated		317,711	39	Iraq 86,698; Japan 76,159; Iran 63,419.	
Clad, plated, coated		159,574	1,000	China 30,272; Iraq 22,837; U.S.S.R. 18,711.	
Of alloy steel		1,530	—	Iraq 716; Iran 500; Kuwait 151.	
Bars, rods, angles, shapes, sections	849,998	1,401,772	146,930	Iraq 197,255; Algeria 166,358; Iran 92,436.	
Rails and accessories		251	—	Cyprus 222; Libya 29.	
Wire		29,067	54	Syria 14,894; Libya 3,441; Egypt 1,874.	
Tubes, pipes, fittings		309,498	12,067	U.S.S.R. 118,674; Italy 46,584; Iraq 34,766.	
Lead:					
Ore and concentrate ³	2,908	6,810	—	Italy 5,350; Bulgaria 1,460.	
Oxides	52	—			
Metal including alloys:					
Unwrought	37	430	—	United Kingdom 400; Cyprus 23.	
Semimanufactures	43	44	—	Libya 37; Cyprus 3.	
Magnesium: Metal including alloys:					
Semimanufactures	197	—			
Manganese:					
Ore and concentrate, metallurgical-grade	—	10,271	—	Greece 6,250; Yugoslavia 4,000.	
Oxides	737	—			
Mercury	183	306	—	Netherlands 265; Italy 40.	
Nickel: Metal including alloys, semimanufactures	158	(?)	—	All to Iraq.	
Silver: Metal including alloys, unwrought and partly wrought	value, thousands	\$38	\$675	—	United Kingdom \$332; West Germany \$328.
Tin: Metal including alloys:					
Scrap	kilograms	68	—		
Unwrought	value, thousands	(?)	\$1	—	All to Libya.
Semimanufactures		47	1	—	All to West Germany.
Titanium: Oxides		37	—		
Tungsten: Ore and concentrate		433	1,800	—	All to U.S.S.R.
Uranium and thorium: Ore and concentrate		1,000	—		
Zinc:					
Ore and concentrate		³ 31,451	11,524	—	Belgium-Luxembourg 5,324; Italy 1,900; Netherlands 1,800.
Oxides		874	840	—	Belgium-Luxembourg 650; West Germany 100; Netherlands 80.
Ash and residue containing zinc		489	2,000	—	Bulgaria 1,600; Netherlands 400.
Metal including alloys:					
Unwrought		922	—		
Semimanufactures		1,109	—		
Zirconium: Metal including alloys, unwrought		—	1	—	All to West Germany.
Other:					
Ores and concentrates		38,493	11,977	—	Bulgaria 3,750; France 2,500; Italy 2,325.
Oxides and hydroxides		3	—		
Ashes and residues		952	—		

See footnotes at end of table.

TABLE 2—Continued

TURKEY: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	123,212	123,319	24,539	Italy 30,049; France 23,499.
Artificial: Silicon carbide	380	547	—	Italy 527; Egypt 20.
Grinding and polishing wheels and stones	906	624	—	Iraq 212; Saudi Arabia 171; Israel 156.
Asbestos, crude kilograms	200	—	—	—
Barite and witherite	233,899	314,737	—	U.S.S.R. 162,000; Egypt 44,902; Syria 18,450.
Boron materials:				
Crude natural borates	852,517	820,791	166,686	France 94,500; Italy 129,498.
Oxides and acids	130,538	162,946	27,885	Belgium-Luxembourg 35,635; Italy 28,945.
Cement	244,505	1,093,167	48,040	Spain 284,211; Algeria 283,219.
Chalk	2,833	2,828	—	Libya 2,000; United Kingdom 682.
Clays, crude:				
Bentonite	26,227	40,248	—	West Germany 19,540; Iraq 5,246; Austria 4,200.
Chamotte earth	23,572	NA	—	—
Fire clay	60	—	—	—
Kaolin	12,113	57,077	—	United Arab Emirates 29,980; Tunisia 24,920.
Unspecified	286	42,085	—	Romania 38,082; United Kingdom 2,550.
Diamond, natural: Gem, not set or strung value, thousands	—	\$7	—	All to Israel.
Diatomite and other infusorial earth	513	314	—	France 250; Nigeria 54.
Feldspar	20,094	43,751	—	Italy 14,118; Egypt 13,404; United Arab Emirates 6,000.
Fertilizer materials:				
Crude, n.e.s.	—	2	—	All to Cyprus.
Manufactured:				
Ammonia	3	5,987	—	Spain 5,983.
Nitrogenous	308,364	366,363	—	—
Phosphatic	448,627	36,101	—	Iran 15,750; Bangladesh 14,250; Sudan 5,300.
Potassic	200	—	—	—
Unspecified and mixed	565,404	196,574	—	Iran 179,659; Cyprus 11,915.
Graphite, natural	4	—	—	—
Gypsum and plaster	14,227	882	—	Egypt 800; Cyprus 73.
Lime	10,699	26,176	—	Cyprus 14,238; Uganda 7,175; Israel 3,300.
Magnesium compounds:				
Magnesite, crude	80,806	296,030	—	Greece 96,965; Italy 22,693; Yugoslavia 87,126.
Oxides and hydroxides	133,913	141,682	1,131	Austria 27,517; West Germany 24,213; Yugoslavia 21,657.
Meerschaum, amber, jet	1	1	—	All to West Germany.
Mica:				
Crude including splittings and waste	34	118	—	Syria 62; Iraq 30; United Kingdom 20.
Worked including agglomerated splittings	4	5	—	United Kingdom 4; Libya 1.
Perlite	86,823	98,454	—	France 26,400; Belgium-Luxembourg 19,120; United Kingdom 17,170.
Phosphates, crude	525	66	—	All to United Kingdom.
Pigments, mineral:				
Natural, crude	391	NA	—	—
Iron oxides and hydroxides, processed	97	266	—	Algeria 250; Belgium-Luxembourg 15.

See footnotes at end of table.

TABLE 2—Continued
TURKEY: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989		
			United States	Other (principal)	
INDUSTRIAL MINERALS—Continued					
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	—	\$12	—	Spain \$11.
Synthetic	do.	—	\$65	\$65	
Salt and brine	20,312	4,368	—	—	Lebanon 2,401; Cyprus 1,805.
Sodium compounds, n.e.s.:					
Soda ash, natural and manufactured	129,190	107,217	—	—	Iran 24,807; Greece 14,291; France 11,855.
Sulfate, natural and manufactured	20,350	55,621	—	—	Iran 12,907; Algeria 6,700; Tunisia 5,556.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked	82,308	135,483	193	—	Israel 83,363; Italy 26,684; Switzerland 4,908.
Worked	48,061	61,957	6,534	—	West Germany 22,312; Netherlands 14,887.
Dolomite, chiefly refractory-grade	1,655	2,662	—	—	France 1,750; Cyprus 912.
Gravel and crushed rock	1,261	4,135	—	—	United Kingdom 2,668; France 800; Libya 385.
Limestone other than dimension	—	3,400	—	—	All to Israel.
Quartz and quartzite	165	151	—	—	Syria 58; Egypt 54; West Germany 17.
Sand other than metal-bearing	8,759	49	—	—	Jordan 25; Cyprus 12.
Strontium: Sulfate (celestite)	55,800	88,490	—	—	West Germany 77,390; Japan 6,000; France 4,000.
Sulfur:					
Dioxide	7	72	—	—	All to Iran.
Sulfuric acid	71	63	—	—	Cyprus 49; Iraq 13.
Talc, steatite, soapstone, pyrophyllite	651	135	—	—	Cyprus 50; Iraq 50; West Germany 20.
Other:					
Crude	—	138,828	—	—	West Germany 128,106; Japan 6,000.
Slag and dross, not metal-bearing	20,220	19,862	—	—	All to Cyprus.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural	56	964	—	—	Cyprus 495; Libya 468.
Carbon black	298	3,053	—	—	Egypt 1,592; Iraq 1,415.
Coal:					
Anthracite and bituminous	154	1,708	—	—	Iraq 1,703.
Lignite including briquets	3,364	2,900	—	—	All to Cyprus.
Coke and semicoke	220	561	—	—	Syria 386; Iraq 125; Saudi Arabia 50.
Peat including briquets and litter	200	8	—	—	All to Cyprus.
Petroleum refinery products:					
Liquefied petroleum gas	thousand 42-gallon barrels	—	1,098	779	Italy 135; Cyprus 37.
Gasoline	do.	2,727	20,384	232	Italy 14,880; Greece 1,595; Iran 1,057.
Mineral jelly and wax	do.	29	39	—	West Germany 24; Italy 7; Netherlands 5.
Kerosene and jet fuel	do.	2,398	—	—	
Distillate fuel oil	do.	24,553	NA	—	
Lubricants	do.	574	—	—	
Residual fuel oil	do.	26	—	—	
Asphalt	do.	250	—	—	
Bitumen and other residues	do.	—	133	—	Lebanon 41; Algeria 25; Cyprus 18.
Bituminous mixtures	do.	2	1	—	Mainly to Cyprus.
Petroleum coke	do.	5	—	—	

NA Not available.

¹Table prepared by Virginia A. Woodson.

²Less than 1/2 unit.

³Includes content of polymetallic ores.

TABLE 3
TURKEY: IMPORTS OF MINERAL COMMODITIES¹
(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	55,684	51,367	—	China 45,033; Republic of South Africa 4,789.
Oxides and hydroxides	2,293	848	6	West Germany 773; Austria 50.
Metal including alloys:				
Scrap	1,305	138	—	West Germany 100; Cyprus 24.
Unwrought	59,193	48,243	121	Canada 22,372; U.S.S.R. 3,048; Romania 2,905.
Semimanufactures	6,698	5,028	124	West Germany 1,995; Hungary 698; Norway 686.
Antimony:				
Ore and concentrate	kilograms	800	—	
Oxides		164	—	
Arsenic:				
Oxides and acids		171	—	
Metal including alloys, all forms		7	—	
Bismuth: Metal including alloys, all forms		3	3	(²) West Germany 2; Belgium-Luxembourg 1.
Cadmium:				
Oxides and hydroxides		9	—	
Metal including alloys, all forms		1	1	— Mainly from Belgium-Luxembourg 1.
Chromium:				
Ore and concentrate		—	15	— All from Belgium-Luxembourg.
Oxides and hydroxides		404	257	2 West Germany 115; Italy 86; United Kingdom 22.
Metal including alloys, all forms		8	4	(³) Italy 2; West Germany 1.
Cobalt:				
Oxides and hydroxides		49	55	— Finland 21; Belgium-Luxembourg 13; Canada 11.
Metal including alloys, all forms		24	13	(³) West Germany 9; Austria 1; Italy 1.
Columbium and tantalum: Metal including alloys, all forms: Tantalum				
	kilograms	17	—	
Copper:				
Ore and concentrate (excluding cupreous pyrite)		813	446	— Yugoslavia 357; Cyprus 89.
Matte and speiss including cement copper		1,237	—	
Oxides and hydroxides		71	—	
Sulfate		1,476	—	
Metal including alloys:				
Scrap		1,715	3,120	— Saudi Arabia 2,412; Iraq 339; India 144.
Unwrought		47,974	62,230	2 Republic of South Africa 22,329; Chile 11,389; Yugoslavia 6,242.
Semimanufactures		22,823	11,910	4 West Germany 8,186; United Kingdom 1,370; Italy 533.
Gold: Metal including alloys, unwrought and partly wrought⁴				
	kilograms	35	274	13 West Germany 186; France 60.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite	thousand tons	1,798	2,525	— Republic of South Africa 1,133; Venezuela 289; Brazil 256.
Metal:				
Scrap	do.	3,037	4,422	3,042 Netherlands 636; Belgium-Luxembourg 236.
Pig iron, cast iron, related materials		182,960	216,608	— Brazil 96,517; U.S.S.R. 52,278; Yugoslavia 29,033.

See footnotes at end of table.

TABLE 3—Continued
TURKEY: IMPORTS OF MINERAL COMMODITIES¹
(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
METALS—Continued					
Iron and steel—Continued					
Metal—Continued					
Ferroalloys:					
Ferroaluminum	40	—			
Ferrochromium	8	15	—	Sweden 10; Belgium-Luxembourg 3.	
Ferromanganese	35,965	51,081	—	Republic of South Africa 31,930; France 9,177; U.S.S.R. 2,897.	
Ferromolybdenum	200	—			
Ferronickel	—	8	—	All from Austria.	
Ferrosilicomanganese	31,892	27,975	—	Republic of South Africa 17,051; U.S.S.R. 7,177; Yugoslavia 3,747.	
Ferrosilicon	24,783	29,276	134	Yugoslavia 13,911; Italy 4,263; Brazil 2,779.	
Silicon metal	1,307	743	—	Brazil 500; Norway 102; France 100.	
Unspecified	1,038	5,443	629	Belgium-Luxembourg 2,458; West Germany 829.	
Steel, primary forms	thousand tons	1,155	1,005	15	Brazil 519; Republic of South Africa 114; U.S.S.R. 92.
Semimanufactures:					
Flat-rolled products:					
Of iron or non-alloy steel:					
Not clad, plated, coated		782,583	16,738	Belgium-Luxembourg 154,694; West Germany 122,146; Yugoslavia 106,289.	
Clad, plated, coated		62,245	3,074	West Germany 18,422; Netherlands 13,803; France 10,707.	
Of alloy steel		45,829	457	West Germany 14,211; Spain 5,881; Italy 4,279.	
Bars, rods, angles, shapes, sections	1,208,320	798,240	12,646	Yugoslavia 277,141; Romania 241,007; Italy 95,264.	
Rails and accessories		51,533	(²)	Italy 31,080; West Germany 12,369; Yugoslavia 6,116.	
Wire		7,806	2	Belgium-Luxembourg 3,329; West Germany 2,355; United Kingdom 707.	
Tubes, pipes, fittings		85,728	1,534	West Germany 42,132; Finland 12,315; Venezuela 5,086	
Lead:					
Oxides	718	275	2	Spain 252; West Germany 20.	
Metal including alloys:					
Scrap	2,036	2,345	—	Canada 1,904; United Kingdom 184.	
Unwrought	15,754	10,039	—	Italy 4,149; Spain 2,839; Yugoslavia 2,403.	
Semimanufactures	16	55	—	Greece 35; West Germany 19.	
Lithium:					
Oxides and hydroxides	76	—			
Metal including alloys, all forms	1	—			
Magnesium: Metal including alloys:					
Scrap	—	26	—	Yugoslavia 14; Norway 12.	
Unwrought	302	286	117	West Germany 60; France 39; Norway 29.	
Semimanufactures	27	—			
Manganese:					
Ore and concentrate, metallurgical-grade	1,496	1,107	—	Brazil 780; Belgium-Luxembourg 170.	
Oxides	1,311	532	—	Republic of South Africa 372; Japan 60; Greece 51.	
Metal including alloys, all forms	106	81	—	Netherlands 49; Belgium-Luxembourg 24.	
Mercury	value, thousands	\$1	\$1	—	All from West Germany.

See footnotes at end of table.

TABLE 3—Continued
TURKEY: IMPORTS OF MINERAL COMMODITIES¹
(Metric tons unless otherwise specified)

Commodity		1988	1989	Sources, 1989	
				United States	Other (principal)
METALS—Continued					
Molybdenum:					
Oxides and hydroxides	kilograms	1,143	—		
Metal including alloys:					
Unwrought	value, thousands	—	\$8	\$8	
Unspecified		9	—		
Nickel:					
Matte and speiss		—	3	—	All from Canada.
Oxides and hydroxides		17	—		
Metal including alloys:					
Unwrought		800	780	—	Canada 564; United Kingdom 68.
Semimanufactures		121	85	1	West Germany 23; Austria 14; Ireland 13.
Platinum-group metals: Metals including alloys, unwrought and partly wrought	value, thousands	\$2,396	\$1,445	\$40	West Germany \$1,077; United Kingdom \$263.
Selenium, elemental	kilograms	50	—		
Silver: Metal including alloys, unwrought and partly wrought ⁴	value, thousands	\$809	\$2,276	—	Switzerland \$1,048; West Germany \$774; United Kingdom \$398.
Tellurium, elemental	kilograms	50	—		
Tin:					
Oxides		75	—		
Metal including alloys:					
Scrap		1	—		
Unwrought		897	1,053	—	United Kingdom 585; Brazil 220; Indonesia 152.
Semimanufactures		11	21	2	West Germany 9; United Kingdom 7.
Titanium:					
Ore and concentrate		3,219	1,576	—	Republic of South Africa 964; Australia 375; Austria 100.
Oxides		2,445	2,643		
Metal including alloys: unwrought	value, thousands	—	\$2	\$1	United Kingdom \$1.
Tungsten:					
Oxides and hydroxides	kilograms	135	—		
Metal including alloys:					
Unwrought		—	2	—	Mainly from West Germany.
Unspecified		71	—		
Uranium and thorium: Oxides and other compounds	value, thousands	—	\$67	—	France \$43; United Kingdom \$19.
Vanadium: Oxides and hydroxides		109	—		
Zinc:					
Ore and concentrate		3,503	—		
Oxides		506	745	—	West Germany 569; Netherlands 133.
Ash and residue containing zinc		343	—		
Metal including alloys:					
Scrap		499	—		
Unwrought		19,071	16,152	153	Italy 9,639; Belgium-Luxembourg 3,850; Yugoslavia 1,116.
Semimanufactures		36	96	—	West Germany 86; Italy 3.
Zirconium:					
Ore and concentrate		620	371	—	Italy 315; West Germany 27.
Metal including alloys, unwrought	value, thousands	—	\$6	—	All from West Germany.

See footnotes at end of table.

TABLE 3—Continued
TURKEY: IMPORTS OF MINERAL COMMODITIES¹
(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS—Continued				
Other:				
Ores and concentrates of precious metals kilograms	—	500	—	All from West Germany.
Oxides and hydroxides	606	491	51	Belgium-Luxembourg 169; West Germany 103; China 100.
Base metals including alloys, all forms value, thousands	—	\$4	—	All from West Germany.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	12	13	—	Italy 11; Netherlands 2.
Artificial: Corundum	2,903	3,055	1	West Germany 903; Austria 820; Poland 443.
Dust and powder of precious and semiprecious stones including diamond value, thousands	\$2,570	\$3058	\$98	Ireland \$1,631; United Kingdom \$1,167.
Grinding and polishing wheels and stones	470	451	3	Italy 116; West Germany 79; Poland 74.
Asbestos, crude	38,058	35,581	130	Canada 12,833; Greece 9,144; Zimbabwe 3,950.
Barite and witherite	—	30	—	All from West Germany.
Boron materials:				
Crude natural borates	162	—	—	
Oxides and acids	179	18	2	United Kingdom 10; Italy 5.
Bromine	(²)	⁵ 14	—	Israel 5; Italy 3; Canada 2.
Cement thousand tons	1,816	360	(²)	Iraq 229; Syria 64; U.S.S.R. 62.
Chalk	34	33	—	Switzerland 22; France 6; West Germany 5.
Clays, crude:				
Bentonite	30	45	—	United Kingdom 41; West Germany 4.
Chamotte earth	913	NA		
Fire clay	124	NA		
Kaolin	9,433	15,387	1,917	United Kingdom 11,261; West Germany 1,405.
Unspecified	3,794	8,846	65	Republic of South Africa 3,451; China 3,104.
Cryolite and chiolite	2	3	—	Denmark 2; United Kingdom 1.
Diamond, natural:				
Gem, not set or strung carats	⁶ 30,000	(⁷)	—	Mainly from Belgium-Luxembourg.
Industrial stones value, thousands	\$226	\$416	—	Netherlands \$237; China \$50; France \$38.
Diatomite and other infusorial earth	131	232	49	United Kingdom 87; France 85.
Feldspar	22	33	—	Norway 24; Sweden 6; West Germany 3.
Fertilizer materials:				
Crude, n.e.s.	13,517	808,922	—	Jordan 527,436; Tunisia 168,766; Syria 60,666.
Manufactured:				
Ammonia	713,465	625,034	—	U.S.S.R. 613,741; Switzerland 6,000.
Nitrogenous thousand tons	1,193	1,425	75	Romania 409; U.S.S.R. 220; Yugoslavia 182.
Phosphatic	98,127	31,536	—	Romania 28,936; Panama 2,600.
Potassic	60,358	80,693	—	Israel 56,544; Jordan 14,760; Netherlands 3,200.
Unspecified and mixed	584,865	613,980	200,419	Romania 114,309; Yugoslavia 106,560.
Fluorspar	436	446	—	Mexico 396; United Kingdom 50.
Graphite, natural	453	725	(²)	West Germany 410; China 242.
Gypsum and plaster	35,890	35,873	56	Cyprus 35,250; France 320.
Iodine	4	—		
Kyanite and related materials: Andalusite	1,402	NA		
Lime	127	—		

See footnotes at end of table.

TABLE 3—Continued

TURKEY: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
INDUSTRIAL MINERALS—Continued					
Magnesium compounds:					
Magnesite, crude	kilograms	—	2	—	All from Italy.
Oxides and hydroxides		238	307	20	West Germany 165; Netherlands 41.
Mica:					
Crude including splittings and waste		7	7	—	Netherlands 4; Switzerland 1; United Kingdom 1.
Worked including agglomerated splittings		55	50	—	Belgium-Luxembourg 25; Spain 11; West Germany 4.
Nitrates, crude		—	823	—	Chile 265; Czechoslovakia 260; Bulgaria 226.
Phosphates, crude		995,330	808,922	—	Jordan 527,436; Tunisia 168,766; Syria 60,666.
Phosphorus, elemental		37	—		
Pigments, mineral: Iron oxides and hydroxides, processed		650	650	78	West Germany 490; Japan 36.
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	\$283	\$457	—	West Germany \$99; Belgium Luxembourg \$77; Thailand \$55.
Synthetic	do.	\$185	\$72	\$1	Switzerland \$17; West Germany \$16; Austria \$8.
Pyrite, unroasted:					
Cupreous		64,155	NA		
Other		30	38	—	Italy 25; West Germany 13.
Quartz crystal, piezoelectric	kilograms	1	—		
Salt and brine		12,126	9,265	—	Iran 8,763; West Germany 307.
Sodium compounds, n.e.s.:					
Soda ash, manufactured		46	6	—	All from West Germany.
Sulfate, manufactured		83,419	1,524	(²)	U.S.S.R. 1,431.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		179	43	(²)	Italy 38; West Germany 4.
Worked		169	473	—	Italy 434; Ecuador 32.
Dolomite, chiefly refractory-grade		2	38	—	Mainly from West Germany.
Gravel and crushed rock		305	338	(²)	France 200; West Germany 137.
Limestone other than dimension	kilograms	10	4,000	—	Mainly from West Germany.
Quartz and quartzite		334	497	—	Sweden 156; West Germany 155; Belgium-Luxembourg 119.
Sand other than metal-bearing		8,183	8,841	(²)	Belgium-Luxembourg 8,684; Austria 60.
Sulfur:					
Elemental:					
Crude including native and byproduct		139,115	126,749	—	Iraq 122,403; Albania 2,203.
Colloidal, precipitated, sublimed		46	6,746	—	Iraq 6,488; West Germany 176.
Dioxide		6	(²)	—	Mainly from West Germany.
Sulfuric acid		100,925	303,636	6,857	Italy 230,634; Spain 43,241; Algeria 10,020.
Talc, steatite, soapstone, pyrophyllite		689	608	—	West Germany 244; Austria 144; Norway 88.
Other:					
Crude		6,251	7,014	1	West Germany 2,452; Italy 1,791; United Kingdom 1,738.
Slag and dross, not metal-bearing		5,425	6	—	France 2; United Kingdom 2.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		42	99	9	Switzerland 61; West Germany 27.
Carbon black		16,700	14,312	26	Italy 11,411; Portugal 988; France 622.

See footnotes at end of table.

TABLE 3—Continued

TURKEY: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
MINERAL FUELS AND RELATED MATERIALS—Continued					
Coal:					
Anthracite and bituminous	thousand tons	4,460	4,044	1,944	Republic of South Africa 1,024; Australia 875.
Lignite including briquets		228,644	253,380	1	U.S.S.R. 253,284.
Coke and semicoke		85,414	102,366	27,292	West Germany 19,292; Spain 16,520.
Gas, natural: Gaseous	million cubic meters	^c 520	3,107	—	All from U.S.S.R.
Peat including briquets and litter		267	827	—	Netherlands 408; U.S.S.R. 244; West Germany 175.
Petroleum:					
Crude	thousand 42-gallon barrels	160,709	138,628	—	Iraq 87,863; Libya 14,019; Iran 12,969.
Refinery products:					
Liquefied petroleum gas	do.	7,229	8,641	—	Kuwait 6,427; Iraq 2,020; Algeria 101.
Gasoline	do.	5,679	9,651	246	U.S.S.R. 3,331; Italy 1,515; Iraq 1,245.
Mineral jelly and wax	do.	23	14	(²)	West Germany 6; United Kingdom 3; Republic of Korea 2.
Distillate fuel oil	do.	(²)	—	—	—
Lubricants	do.	225	—	—	—
Residual fuel oil	do.	25	—	—	—
Asphalt	do.	684	—	—	—
Bitumen and other residues	do.	—	134	—	Mainly from Spain.
Bituminous mixtures	do.	2	2	—	Belgium-Luxembourg 1; West Germany 1.
Petroleum coke	do.	2,718	1,894	894	Syria 414; Romania 400.

^cEstimated. NA Not available.¹Table prepared by Virginia A. Woodson.²Less than 1/2 unit.³Unreported quantity valued at \$7,000.⁴Nonmonetary.⁵May include fluorine and iodine.⁶May include industrial.⁷Value only reported at \$540,000.

about 22,000 workers. Total annual wages in the mineral sector exceeded \$400 million, a major increase from that of 1989 stemming from costly wage settlements reached in that year, particularly in the public steel sector. Additional strikes were experienced toward yearend 1990, with very large wage settlements again the outcome. It was expected that increasing labor costs, together with stagnant demand and output, would begin to lead to worker retrenchments in 1991 and 1992.

COMMODITY REVIEW

Metal

Aluminum.—In mid-1990, the Government held talks with the U.S.S.R. on a joint

project to build a new aluminum smelter in Turkey. Losses associated with the UN sanctions against Iraq and Kuwait, however, put this project on hold, although this did not immediately affect Etibank's plans to expand and modernize the company's existing smelter at Seydişehir. The smelter, which had originally been built by the U.S.S.R., was to have its capacity increased from the yearend 1990 capacity of 60,000 mt/a aluminum to 120,000 mt/a, and eventually to 200,000 mt/a. In addition, the plant was to be modernized to reduce its energy consumption; the company lost its electricity subsidy in early 1990 and, reportedly, lost almost \$8.5 million in 1990 as a result.

Antimony.—Turkish antimony production has declined since 1987, and plummeted in 1990, largely owing to low world

antimony prices and, to a degree, declining reserves. Of an estimated five private-sector producers remaining in the country, Özdemir Antimuan Madenleri Ltd. Şti. appears to have been a casualty of these low prices and closed down in early 1990.

Chromite.—About 20% of Turkey's chromite ores and concentrates was produced by Etibank, the only public-sector producer in the country and the largest single producer. In addition, all of Turkey's ferrochrome and related ferroalloys were produced by Etibank. In March and October 1989, respectively, Etibank brought on-line two new high-carbon ferrochrome furnaces at its plant at Elazığ. The first of these was reported to have experienced a number of technical problems, which were not solved until September 1990. The second new furnace was shut down pending

TABLE 4
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY
(thousand metric tons unless otherwise specified)

Major commodities	Major operating companies	Location of main facilities	Annual capacity
Aluminum	Etibank Milas Boksit İşletmeleri Müdürlüğü	Open pit mine at Milas, 127 kilometers southwest of Denizli	150 diaspore.
Do.	Etibank Seydişehir Alüminyum Tesisleri Müessesesi Müdürlüğü	Mortaş bauxite mine, at Akseki, 40 kilometers south of Seydişehir	400 bauxite.
Do.	do.	Alumina refinery and aluminum smelter at Seydişehir	200 alumina. 60 aluminum.
Barite	Barit Maden Türk A.Ş.	Mines near Sivas and Adana	220 ground barite.
Do.	Baser Maden Sanayi ve Ticaret A.Ş.	Mines at Isparta and Konya	90 ground barite.
Do.	Emas Endüstri Mineralleri A.Ş.	Mine at Muş	100 ground barite.
Do.	Etibank Beyşehir Barit İşletmesi	Mine at Beyşehir, 72 kilometers southwest of Konya	70 barite ore.
Do.	Etibank Antalya Elektrometalurji Sanayi İşletmesi Müessesesi Müdürlüğü	Grinding plant at Antalya	100 ground barite.
Do.	Polbar Barit Endüstrisi A.Ş.	Mine near Antalya	120 ground barite.
Boron minerals	Etibank Bigadiç Madencilik İşletmeleri	Bigadiç, 38 kilometers southeast of Balıkesir	200 colemanite concentrate, 115 ulexite concentrate.
Do.	Etibank Emet Kolemanit İşletmeleri	Emet, 62 kilometers west-southwest of Kütahya	500 colemanite concentrate.
Do.	Etibank Kestelek Kolemanit İşletmeleri	Kestelek, 80 kilometers west-southwest of Bursa	100 colemanite concentrate.
Do.	Etibank Kirka Boraks İşletmeleri Müessesesi Müdürlüğü	Kirka, 61 kilometers north of Afyon	500 tincal concentrate.
Cement	Akçimento Ticaret A.Ş.	Büyükçekmece, 30 kilometers west of Istanbul	3,000 cement.
Do.	Aslan Çimento A.Ş.	Darica, 40 kilometers southeast of Istanbul	2,000 cement.
Do.	Bati Anadolu Çimento Sanayii A.Ş.	Bornova, 10 kilometers northeast of Izmir	2,500 cement.
Do.	Çanakkale Çimento Sanayi A.Ş.	Çanakkale	1,400 cement.
Do.	ÇİMSA - Çimento Sanayi ve Ticaret A.Ş.	Mersin	1,800 cement.
Do.	Çitosan (General Directorate)	17 plants ¹	8,200 cement.
Do.	Çukurova Çimento Sanayi T.A.S.	Adana	1,800 cement.
Do.	Soc. des Ciments Français	6 plants ¹	2,600 cement.
Do.	Yibitas-Yozgat Çimento Fabrikası	Yozgat, 168 kilometers east of Ankara	2,400 cement.
Do.	Other private sector and mixed public-private sector companies.	11 plants	7,700 cement.
Chromium:			
Chromite ores and concentrates	Etibank Şark Kromları İşletmesi Müessesesi Müdürlüğü	Mines at Güleman, 80 kilometers southeast of Elazığ	150 lump ore, 70 concentrate.
Do.	Etibank Uçköprü Maden İşletmesi Müessesesi Müdürlüğü	Mines in Göcek District, near Fethiye	50 lump ore, 30 concentrate.
Do.	Birlik Madencilik Ticaret ve Sanayi A.Ş.	Kayseri	240 lump ore.
Do.	Akpaş Madencilik ve Paz. ve Ticaret A.Ş.	Mines at Erzurum, Erzincan, and Kayseri	200 lump ore, 70 concentrate.
Do.	Bilfer Madencilik A.Ş.	Mines at Kayseri and Sivas	100 lump ore, 45 concentrate.
Do.	Türk Maadin Şirketi (AŞ)	Mines at Köyceğiz, 56 kilometers northwest of Fethiye, and at Eskişehir	24 lump ore, 88 concentrate.
Do.	Dedeman Madencilik Turizm Sanayi ve Ticaret A.Ş.	Kayseri	56 lump ore.

See footnotes at end of table.

TABLE 4—Continued

TURKEY: STRUCTURE OF THE MINERAL INDUSTRY

(thousand metric tons unless otherwise specified)

Major commodities	Major operating companies	Location of main facilities	Annual capacity
Chromium—Cont.			
Chromite ores and concentrates—Cont.	Egemetal Madencilik A.Ş.	Mines at Bursa, Mersin, Eskişehir, and Erzurum	35 lump ore, 40 concentrate.
Do.	Pinar Madencilik ve Turizm A.Ş.	Mines at Kayseri and Adana	25 lump ore, 14 concentrate.
Do.	Akdeniz Madencilik Ticaret ve Sanayi A.Ş.	Adana	*25 lump ore.
Do.	Other (9) private producers.	Mines at Köyceğiz, Bursa, Adana, Iskenderun, Eskişehir	114 lump ore, 12 concentrate.
Ferrocchrome	Etibank Elazığ Ferrochrom İşletmesi	Ferrocchrome plant at Elazığ	150 high-carbon ferrochrome.
Do.	Etibank Antalya Elektrometalurji Sanayi İşletmesi Müessesesi Müdürlüğü	Ferrocchrome plant at Antalya	11 low-carbon ferrochrome.
Copper	Etibank Küre Bakirli Pirit İşletmesi Müessesesi Müdürlüğü	Open pit copper and pyrite mine at Küre, 14 kilometers south of Inebolu	90 copper concentrate, 460 pyrite concentrate.
Do.	Etibank Ergani Bakir İşletmesi Müessesesi Müdürlüğü	Open pit mine and smelter at Ergani, 59 kilometers southeast of Elazığ	16 blister copper.
Do.	Karadeniz Bakir İşletmeleri A.Ş.	Murgul, Damar, and Çakmakkaya mines and smelter near Artvin	*175 copper concentrate, *20 blister copper.
Do.	do.	Open pit Kutlular Mine near Trabzon	*15 copper concentrate.
Do.	do.	Underground mine near Küre	*95 ore.
Do.	do.	Smelter and acid plant at Samsun	38 blister copper.
Iron and steel:			
Iron ore	Türkiye Demir ve Çelik İşletmeleri Genel Müdürlüğü	Divriği Mines, 115 kilometers northwest of Elazığ	3,000 run of mine ore, 1,100 pellets, 600 concentrate, 500 lump ore.
Do.	do.	Deveci Mine at Hekimhan, 112 kilometers west of Elazığ	*750 ore.
Steel	Türkiye Demir ve Çelik İşletmeleri Genel Müdürlüğü	Iskenderun	2,200 crude steel.
Do.	do.	Karabük	600 crude steel.
Do.	Ereğli Demir ve Çelik Fabrikaları T.A.Ş. (Erdemir)	Ereğli	2,000 crude steel.
Do.	Makina ve Kimya Endüstrisi Kurumu (MKEK)	Kirikkale, 62 kilometers east of Ankara	60 crude steel.
Do.	Çolakoğlu Metalurji A.Ş.	Izmit	650 semifinished steel.
Do.	Çukurova Çelik Endüstrisi A.Ş.	Aliğa, 40 kilometers north-northeast of Izmir	2,000 semifinished steel.
Do.	Diler Demir Çelik Endüstri ve Ticaret A.Ş.	Near Istanbul	312 semifinished steel.
Do.	Ekinciler Demir ve Çelik Sanayi A.Ş.	Arc furnace and 1 rolling mill at Iskenderun. Also rolling mills at Adana, Karabük, and Payas	550 semifinished steel.
Do.	Habaş Sinai ve Tibbi Gazlar Istihsal Endüstrisi A.Ş.	Aliğa	600 semifinished steel.
Do.	Izmir Demir Çelik Sanayi A.Ş.	Izmir	500 semifinished steel.
Do.	Kroman Çelik Sanayii A.Ş.	Gebze, 40 kilometers southeast of Istanbul	360 semifinished steel.
Do.	Metaş Izmir Metalurji Fabrikasi T.A.Ş.	Izmir	450 special and semifinished steel.
Do.	Other private-sector companies.	8 plants	830 semifinished steel.

See footnotes at end of table.

TABLE 4—Continued

TURKEY: STRUCTURE OF THE MINERAL INDUSTRY

(thousand metric tons unless otherwise specified)

Major commodities	Major operating companies	Location of main facilities	Annual capacity
Magnesite	Çitosan Konya Krom Magnezit Tuğla Sanayii A.Ş.	Konya	40 dead-burned magnesite, 38 bricks, 12 mortar.
Do.	Comag Continental Madencilik Sanayii Tic. A.Ş.	Mines at Tavslani, 40 kilometers northwest of Kütahya, and near Bursa	40 calcined magnesite.
Do.	Kümas Kütahya Manyezit İşletmeleri A.Ş.	Kütahya	144 dead-burned magnesite, 46 bricks.
Do.	Magnesit A.Ş.	Mine at Margi, 50 kilometers northeast of Eskişehir	60 dead-burned magnesite.
Mercury metric tons	Etibank Haliköy Maden İşletmesi	Mine near Ödemiş, about 70 kilometers southeast of Izmir	190 mercury.
Do.	Etibank Konya Çıva İşletmesi	Mine at Sarayönü, 47 kilometers north of Konya	100 mercury.
Phosphate rock	Etibank Güneydogu Anadolu Fosfatları İşletmesi	Open pit mine at Mazıdağı, 30 kilometers northwest of Mardin	125 concentrate.
Strontium	Barit Maden Türk A.Ş.	Mine at Akkaya, 120 kilometers northeast of Sivas	85 celestite concentrate.

*Estimated.

¹Société des Ciments Français operates 5 cement plants that it purchased in 1989 from Çitosan. The sale, however, was ruled invalid by several Turkish courts, but the verdict was under appeal at yearend 1990. Pending a final ruling, these plants have been assigned in this table to Ciments Français. Annual capacities of these 5 plants total 2 million tons. Ciments Français also owns one other cement mill, purchased from the private sector; this sale is not in dispute.

resolution of the first furnace's problems, but was reported to have started up again, on a trial basis, in the fourth quarter. In addition to these problems, the early 1989 loss of electricity subsidies and poor world ferrochrome prices hurt the plant's financial performance. The new ferrochrome capacity was expected to eventually eliminate Etibank's exports of chromite and chromite concentrates, and was such that the company was expanding its local mining and concentrating capacity, particularly at the Kefdağ Mine, to feed the Elaziğ plant.

Virtually all of Turkey's ferrochrome production was exported. As in years past, the United States was by far the largest customer in 1990, taking 35,650 tons or 69% of the high-carbon ferrochrome production, and 9,670 tons or 91% of the low-carbon ferrochrome production. The latter represented a 182% increase in sales to the United States over 1989 levels. Turkish exports in 1990 of chromite ore and concentrates were reported to have totaled about 676,500 tons, down about 25%; the exports were worth about \$64 million.

In early 1990, private-sector company Egemetal Madencilik A.Ş. formed a 50-50 joint venture with three Korean firms to develop a chromite mine near Orhaneli, 266 km south of Istanbul. Development

work on the mine was expected to commence in April 1990, and the company had plans to erect a 40,000-mt/a ferrochrome plant on the site starting in 1991, to be in operation in 1993. The joint venture was to ship 20,000 mt/a of ferrochrome to Korea.

Copper and Zinc.—The production of copper ore, copper concentrates, and blister copper is dominated by Etibank and its wholly owned subsidiary Karadeniz Bakir İşletmeleri A.Ş. (KBI). The latter is responsible for about 75% of Turkey's copper output.

Etibank continued with its plans to commence underground mining at Aşıköy, close to the company's Küre establishment near Inebolu. Tenders for the construction contract were issued in 1990, and it was anticipated that the contract would go to a Turkish company. Etibank had planned to use its new cupreous pyrite concentrator at Küre, completed in late 1988, at full capacity in 1990, but evidently experienced problems with it. Etibank's pyrite concentrate production was only 60,429 tons, a 46% decline from that of 1989. The copper and pyrite concentrates are shipped to the nearby KBI smelter at Samsun for both copper smelting and sulfuric acid production. Etibank's own copper smelter

facilities are at its Ergani Mine complex southeast of Elaziğ. Total Etibank copper ore production (excluding pyrite) fell almost 19% to about 718,000 tons; concentrate production fell almost 42% to about 27,600 tons.

The newly rehabilitated and expanded KBI copper smelter was in full operation in 1990 but, nevertheless, produced well below capacity. At full capacity, the Samsun smelter will be capable of meeting about 50% of Turkey's annual needs. KBI also operates a small smelter at Artvin. Most of KBI's copper ore comes from mines near Artvin and a smaller mine near Trabzon. KBI also operates a small underground mine near Küre; output from this mine is sold to Etibank for concentration prior to smelting at Samsun. Production of copper concentrate appeared to be near capacity level in 1990.

Metall Mining Corp. of Canada continued surface and underground exploration of the Çayeli copper-zinc-silver deposit 23 km northeast of Rize. Permitting work was also done, based on a favorable conclusion of the project's feasibility study, which became available during the year. A final production decision was anticipated in early 1991. Reserves were reported to be adequate to support an 18-year operation, mining 600,000 mt/a to produce 110,000 mt/a

of concentrate grading 23% copper plus 70,000 mt/a of concentrate grading about 53% zinc. The operating company, Çayeli Bakir İşletmeleri A.Ş., is 49% owned by Metall; 45% by Etibank; and 6% by the Turkish company Gama Industri. No decision was made during the year as to the smelter destination of the concentrates, although a possible destination for at least part of the product was the 98% Etibank-owned Çinko Kurşun Metal Sanayii A.Ş. (ÇINKUR) zinc smelter at Kayseri. The ÇINKUR facility, the only zinc smelter in Turkey, was undergoing expansion from the present 30,000 mt/a of zinc and about 60,000 mt/a of lead, to 40,000-mt/a capacity for zinc and an additional 40,000 mt/a of lead. Zinc and lead-zinc ores for the complex are supplied largely by nearby private-sector mines.

Gold and Silver.—In an effort to stem a long-flourishing illegal gold trade, and in the hope of drawing out some of the 500,000 kg of gold believed to have been hoarded in the country, the Government opened a gold exchange in March 1989. By yearend 1989, the Central Bank, agents for the exchange, had imported and sold about 90,000 kg of gold, worth about \$1.06 billion, and in 1990, gold imports totaled 145,000 kg, worth about \$1.79 billion. These import levels can be compared with the legal imports in 1988, which were worth only \$32 million. The high level of legal sales in 1990 was, in part, spurred by unrest in the Persian Gulf area; a significant volume of gold sales was attributed to nationals from that region.

Both domestic and foreign exploration companies were actively engaged in gold exploration in Turkey during the year. As in 1989, most of this work was along the Black Sea coast in northeast Turkey, in western Anatolia, and in south-central Turkey. During the year, Cominco Resources International announced a number of high-grade gold intercepts in its advanced drilling program on two properties, south and southeast of Trabzon. The company indicated that encouraging drill results had also been obtained for a number of less-advanced properties in the area. No reserves were announced. In May 1990, Metall Mining Corp. of Canada announced that it had gotten several high-grade gold drill and trench intercepts on its Dikili property, about 70 km north of Izmir. Based upon additional drilling done during the year, the company concluded that the property contained two veins that were

potentially open pit-minable, and that one of the veins might also be minable underground. The yearend preliminary resource calculations indicated a geologic resource of about 14,000 kg of gold. Additional drilling and a feasibility study were planned for 1991. Metall has a one-third interest in the property, the remainder of which is held by ACM Gold of Australia.

In 1990, MTA completed a 10-month exploration program on the Arapdağı property near Izmir; the program included drilling 23 holes. Preliminary reserve estimates were 300,000 tons having a gold grade of 9 g/mt.

Turkish production of silver is from Etibank's silver mine at Gümüşköy, 60 km southwest of Kütahya, and as byproduct of base metals mining. Reported silver output in 1990 from the mine at Gümüşköy increased 22% to 26,460 kg.

Iron and Steel.—The Turkish iron and steel industry is characterized by state-owned integrated facilities and private-sector electric arc furnace plants. State-owned Türkiye Demir ve Çelik İşletmeleri (TDÇİ) produces about 75% of Turkey's iron ore, largely from the Divriği Mines northwest of Elazığ, and is the largest steel producer in the country. Another parastatal steel company, Erdemir, is almost as large. Together they produced 48% of the country's steel in 1990. Virtually all of the remainder was produced by private-sector companies.

The Turkish steel industry is one of the fastest growing in the world. Production in the 1980's was one of almost continuous increase; 1990 output was almost fourfold that of 1980. Much of the growth in output was stimulated by generous export incentives on the part of the Government, duties on imported steel, and by high domestic demand, particularly in the construction sector. Apart from the establishment of new companies, many companies have undertaken or have planned plant capacity expansion projects. Most of this growth has been in the private sector, which has led to a relative product imbalance, notably a surplus of long products and a shortage of flat products. Demand for flat products has increased dramatically, especially for automobiles and major appliances; the country's sole flat products producer (Erdemir) was involved in a major expansion program and several private-sector companies were planning to expand their product line to include flats. By comparison with the large public-sector integrated mills, steel production by the private sector is of

relatively high cost due to the high cost of electricity and the need to purchase some forms of semifinished products and ferrous scrap as feed.

Growth in the steel industry, which mirrored that in many other sectors of the economy, began to slow toward the end of the 1980's as the Government took steps to curb the country's very high inflation rate, and as some of the export incentives were removed in response to dumping accusations by some EC countries. An outcome of the high inflation in Turkey was the onset of major labor disputes in 1989 over wage increase demands commonly on the order of 500%. In 1989, public-sector production of iron ore and steel were adversely affected by a 127-day strike at TDÇİ; steel production by that company declined by almost 50%. Erdemir, however, suffered no work stoppages in 1989 and recorded an increase in output of 11%. Steel production by the private sector increased dramatically, largely owing to expansion projects at many of the facilities and the lack of competition from TDÇİ, and almost made up for the large decline in TDÇİ output. In 1990, the situation was partially reversed and the country's output was the highest to date. TDÇİ was at full production levels, recording an output almost double that of 1989, but Erdemir's output increased only slightly. The private sector suffered a major strike during December 1990, and despite capacity increases, output showed but a modest increase for the year of about 6.4%.

Iron and steel exports in 1990 increased 35% to about 4.7 Mmt, worth about \$1.6 billion. The increase was largely due to a return to full production by TDÇİ. Export revenues, however, suffered from low world steel prices and by the appreciation of the Turkish lira, in real terms, against the currencies of several of Turkey's customers. As a result, export revenues only increased 19% to \$1.6 billion. The major customers for Turkish steel were in the EC and in the Middle East, particularly in the Persian Gulf; the latter trade was adversely affected by the war in that region. Exports were also hurt by a general reduction in world demand and prices, and an increase in Turkish steel prices necessitated by rising costs, particularly for labor and power. The steel price increases were reported to have been particularly damaging to Turkish sales on the Asian market. In general, labor costs were the dominant factor in the public-sector steel plants' cost increases in 1990, whereas the private-sector

steel mills were more affected by the lack of electricity subsidies and the increasing cost of loans to finance their plant expansion projects.

Imports of steel in 1990 fell 24% to about 6.2 Mmt, worth about \$1.9 billion. This decline, however, was to approximately normal pre-1989 levels. Imports in 1989 were abnormally high because of the need to make up for the loss of long product output as a result of the TDCI strike, and the elimination of import duties on long products to make such imports possible. Much of the imported material, however, was inexpensive steel from Eastern Europe and was reported to have been of low quality. Once the strike at TDCI was resolved, these imports became a problem, both to the Turkish public- and private-sector producers. In 1990, complaints to the Government about this cheap steel led to the Government imposing, effective the end of January 1991, strict quality controls on steel imports. Importers were now required to obtain documents both prior to and after importing steel certifying that the material met international standards.

Typically, at least 50% (by mass) of iron and steel imports are of scrap, with much of the remainder being flat products. Ferrous scrap imports in 1990 were down about 20% to an estimated 3.7 Mmt, worth about \$520 million. This decline was reportedly largely due to an increased use of domestic scrap, but may also have reflected cash-flow problems on the part of a number of the private-sector electric arc furnace steelmakers. With the rapid expansion of the natural gas distribution in Turkey, it may become feasible to build a number of gas-fired sponge iron plants to provide electric arc furnace feed in lieu of scrap. This would, however, necessitate increasing the country's imports of iron ore.

TDCI operates the Karabük and Iskenderun integrated steel mills, both of which returned to almost full capacity utilization in 1990, following the 1989 strike. At Iskenderun, production increased 101% to 1,870,609 tons. Karabük steel production increased almost 88% to 605,244 tons. Despite this production, the company recorded accrued losses by midyear 1990 of about \$115 million because of the lost production in 1989, the costly wage settlements, and the overstocking of coal and iron ore. The UN sanctions against Iraq and Kuwait further hurt the company's sales in 1990; a large proportion of the company's exports typically go to these countries, particularly from Iskenderun.

Major expansion programs were in progress at both of TDCI's steel mills. At Iskenderun, TDCI plans to modernize and/or expand virtually every part of the old Soviet-designed facility. By the end of the 1990's, TDCI hopes to have increased the hot-metal capacity at Iskenderun to 3.5 Mmt/a (3.25 Mmt crude steel) and the rolling mill capacity to 2.6 Mmt/a. A thin slab continuous casting and cold-rolling plant is to be installed, with expected commissioning at yearend 1992. The new facility, to be privately financed, will help reduce Turkey's undercapacity in flat products. The capacity of the wire rod mill at Iskenderun is being expanded from 500,000 mt/a to 700,000 mt/a, with commissioning expected by mid-1991. A sponge iron plant is planned to be constructed at either Izmir or Sivas to reduce the company's need to import scrap; typically 500,000 to 600,000 mt/a of scrap is imported for Iskenderun alone.

At Karabük, TDCI completed the feasibility studies for the installation of a new casting machine and a new ladle furnace by 1991. A new KORF process energy-optimizing oxygen furnace was fired in February 1989; its use reportedly has reduced the energy consumption per heat by 65% to 370,000 kcal/mt. The first phase of blast furnace modernization, involving the installation of a fine-crushing and screening circuit, was completed in February 1990. Liquid metal capacity was to be increased to 1.1 Mmt/a by 1994. One of Karabük's major cost problems is with coal. The plant obtains 60% of its requirements from Zonguldak; this coal is of relatively poor quality and adds to the company's energy costs. The remainder of Karabük's coal is imported material, railed in at approximately \$23/mt from Iskenderun. A Black Sea coal port was planned for the company to reduce coal transport costs.

Erdemir is Turkey's single largest steel mill and the country's sole producer in 1990 of flat products. In contrast with TDCI, Erdemir recorded a profit in 1990, albeit 19% lower than that in 1989 because of lower world prices, increased costs, and reduced exports to the Persian Gulf region. Erdemir's production increased only about 1% to 2,031,399 tons. The Government also operates a small electric arc furnace plant, Makina ve Kimya Endüstrisi Kurumu (MKEK). The company, which in part produces military equipment, has had declining production in recent years; steel production fell 37% in 1990 to 25,224 tons.

In early 1990, the Government, as part of its privatization program, announced that it would begin selling its 51.5% stake in Erdemir, both as part of its general privatization program, and in the hopes of dramatically increasing the company's capital. The first offering, for 5.5% of the shares, was made in April, and public demand for the shares was high.

Given an ever-increasing level of long products production from the private sector and the country's chronic shortage of flat products, Erdemir expansion plans are entirely toward increasing its output of flats. Part of this effort involved a project to modernize the basic oxygen furnace. This work, expected to be completed in late 1993, will increase Erdemir's raw steel capacity to 3 Mmt/a. In early 1990, Voest Alpine of Austria was awarded a \$180 million contract for two new single-strand continuous casting machines. The new machines will give Erdemir a total increased annual capacity of 1.7 Mmt and are scheduled to come on-stream in 1992. Erdemir hopes to have an annual output capacity of 3 Mmt of flats by 1993. Erdemir has begun soliciting bids to build a new blast furnace and new pickling and galvanizing lines for one of the plant's cold mills. The company ultimately plans to increase molten steel capacity to 6.4 Mmt/a in order to have a flat products capacity of 6 Mmt/a.

Production from the country's private-sector mills increased 6.4% in 1990 to 4,921,473 tons; a modest performance by comparison with the 23% increase recorded in 1989. A number of factors were responsible for the low increase. The private-sector producers faced much greater competition in 1990 on the domestic market, both from TDCI, and from inexpensive imports of long products. Further, domestic demand was down, largely because of declines in the construction sector. Following the imposition of economic sanctions against Iraq and Kuwait, many of the world steel exporters dumped their exports on the world market, which aggravated the already low prices brought on by low world demand. The Persian Gulf was also a lost market to the Turkish private-sector producers. The private-sector producers continued to be hurt by the loss of export and, of great significance to electric arc furnace steelmakers, electricity subsidies. Private-sector steelworkers, noting the large wage settlements in 1989 in the public sector, began agitating for large wage increases,

commonly on the order of 500%. These demands culminated in a strike in mid-December, which affected almost all of the private-sector steelmakers, and lasted until the end of January 1991. The strike halted about 85% of the sector's steel production and, hence, more than 60% of Turkey's output of long products.

The rapid growth of the private-sector steel industry seen in the late 1980's was made possible by expansion projects at most of the facilities. Many companies were still involved in such efforts in 1990 and, despite the industry's modest performance during the year, continued to plan additional capacity increases for the future. The expansion projects, however, have been made possible by heavy borrowing, and the cost of servicing these large debts has been burdensome, especially in times of lackluster steel prices and demand. In May 1990, *Metaş Izmir Metalurji Fabrikası T.A.Ş.*, was forced into receivership as a result of financial problems from debt servicing and poor sales the previous year. The Government was negotiating a rescue package with the company's creditors, but production was not expected to resume until 1991.

Ground was broken in September 1990 for a new cold strip mill, which, when completed in 1993, will have a capacity of 300,000 mt/a and will be the only other producer of flats in Turkey besides Erdemir. The new mill will be at Gemlik, about 50 km north-northeast of Bursa, and will be operated by *Borçelik*, a joint venture of Turkish tubemaker *Borusan*, 34%; Erdemir, 17%; *Usinor Sacilor* of France, 24.5%; and *Ilva* of Italy, 24.5%. Hot coil for the plant will be supplied equally by Erdemir, *Usinor*, and *Ilva*. *Çolakoğlu Metalurji A.Ş.* was planning to establish a flat products mill having a capacity of 1.8 Mmt/a. In terms of long products capacity expansion, the company, in October, started operations on a trial basis of its second rolling mill, with the aim of reaching full operational levels by yearend 1991. The mill, near Istanbul, has a capacity of 500,000 mt/a.

Çukurova Çelik Endüstri A.Ş., as part of its own major expansion project, is also planning to get into the production of flat products and was negotiating with a Japanese company to buy a 1.5-Mmt/a thin slab continuous caster. This mill is in addition to the company's expanding its long products capacity; liquid metal capacity is to be increased to 2.2 Mmt/a by 1992, and the company's rolling mill capacity is being expanded to 500,000 mt/a.

Toward yearend 1990, *Çemtaş Çelik Makina Sanayi ve Ticaret A.Ş.* completed an expansion program that involved replacing its electric arc furnace and installing a new 25-ton-capacity ladle furnace and a vacuum degassing unit. These additions increased the company's production capacity to 110,000 mt/a. *Habaş Sinai ve Tibbi Gazlar İstihsal* is building a new rolling mill with a capacity of 450,000 mt/a. *Izmir Demir Çelik* increased its steel capacity to 500,000 mt/a in 1990. The company has been hard pressed to service its debts and has no further expansion plans. In early 1990, a new company, *Sivas Demir Çelik*, commissioned its wire rod and bar mill; the mill has a capacity of 400,000 mt/a but operated well below this in 1990 because of problems obtaining billet.

Mercury.—World mercury sales in 1990 were extremely sluggish, and prices were very low. Turkey's output of mercury fell dramatically, reaching the lowest level of production recorded since 1959.

Industrial Minerals

Boron.—The production of boron minerals is virtually all by *Etibank*, as is the production of boron chemicals. *Etibank's* production of boron chemicals is from its *Kirka* and *Bandırma* plants. The *Kirka* plant has the capacity to produce 160,000 mt/a of borax pentahydrate, known as *Etibor-46*; 17,000 mt/a of borax decahydrate; and 60,000 mt/a of anhydrous borax (*Etibor-65*). At the *Bandırma Boraks ve Asit Fabrikaları İşletmesi* plant, production capacities are 5,000 mt/a of borax pentahydrate, 50,000 mt/a of borax decahydrate, 20,000 mt/a of sodium perborate, and 35,000 mt/a of boric acid. Exports of boron minerals in 1990 fell about 15% to about 690,000 tons worth about \$145 million. Exports of boron chemicals fell almost 12% to about 145,600 tons, worth \$54.3 million.

Cement.—State-owned *Çitosan* suffered a strike by its 10,500 workers from late March to early May, at which time a wage settlement was reached giving the workers a 100% wage increase in 1990 and a further 60% increase in 1991, together with large supplements in both years. Despite the strike, the Turkish cement industry recorded a production increase for the year. Exports reportedly doubled to 1.7 Mmt, and domestic consumption increased almost 2% to 23.7 Mmt. This strong performance of the industry is the outcome of

expansion projects at many of the country's cement mills; the growth in exports, however, in part reflects a general slowdown in domestic demand, which cannot accommodate the production capacity increases.

Throughout the 1980's, *Çitosan* has had about one-half of Turkey's cement mills and about one-third of the country's cement production capacity. As part of its general privatization scheme, the Government signed an agreement in September 1989 to sell 5 of *Çitosan's* 22 cement plants to *Société des Ciments Français* of France for \$110 million. The cement plants involved had a combined capacity of 2 Mmt/a. Opposition parties in the Government filed suit to block this sale, however, citing Turkish legal requirements that all such divestitures be first offered to the public. In January 1990, a court issued a 90-day injunction on the sale, despite the fact that *Ciments Français* had already paid \$85 million of the purchase price. Both the company and the Government appealed the injunction, which, however, was upheld by a court decision in April 1990. The decision was appealed further but was upheld in July 1990 by the Turkish Council of State. In its annual report, *Ciments Français* reported that further appeals were in progress and that it was operating the plants as if it owned them.

As a further step in its privatization program, the Government began floating shares in *Çitosan* subsidiary *Konya Çimento* on the Istanbul Exchange. Reportedly, four other *Çitosan* cement mills were to be privatized starting in November 1990.

Ciments Français purchased 60% of *Anadolu Çimentoleri T.A.Ş.* in Istanbul. The French company had been negotiating to buy a controlling interest in *Çanakkale Çimento S.A.Ş.*, but negotiations broke down late in the year. In January 1990, it was reported that another French company, *Lafarge Coppée*, had agreed to purchase *Aslan Çimento*, which has about 25% of the Istanbul area cement market.

Soda Ash (Trona).—For a number of years, *Etibank* has been planning to develop an underground mine on the *Beyazari trona* deposit. Originally, *FMC Corp.* of the United States was to have been a partner in the operation, but the company pulled out in 1989. In 1990, *Etibank* solicited bids from several European countries for a joint venture in the project. Planned output for the mine is 750,000 mt/a.

Mineral Fuels

Public-sector companies dominate Turkey's production of mineral fuels. Türkiye Petrolleri Anonim Ortaklığı (TPAO) produces about one-half of Turkey's crude oil and all of its marketed gas and, through its subsidiaries, controls oil refining, oil and gas piping, and a significant proportion of the country's fertilizer production. Türkiye Kömür İşletmeleri (TKI) dominates Turkey's coal production.

Coal.—In early 1990, TKI announced that it would be seeking bids to construct an \$80 to \$100 million lignite washery at the Tunçbilek Mine about 50 km west-northwest of Kütahya. The new washery is to have a throughput capacity of 3 Mmt/a and will supplement an existing washery of similar capacity. The mine produces about 4.2 Mmt/a of lignite. A similar washery is to be set up at the Soma Mine 120 km west of Denizli, which already has a washery capacity of 800,000 mt/a. It is hoped that the new washeries will lead to a somewhat cleaner burning product from the mines.

In December, state-owned Türkiye Taşkömürü Kurumu Genel Müdürlüğü (TTK) suffered a miners' strike at the hard coalfields at Zonguldak. The workers were reportedly demanding wage increases of 900%. The loss of production impacted coal deliveries to the country's integrated steel plants, although, in general, the steel plants were able to weather the strike using their stockpiles and by increasing their imports of foreign coal.

Natural Gas.—The Government intends to increase the use of Soviet natural gas in Turkey and is planning a major expansion of the gas pipeline network. Talks were in progress during the year concerning building a new natural gas pipeline from the U.S.S.R. (Azerbaijan) into Turkey. Construction of a \$218 million LPG terminal and regassification plant at Marmaraerğlisi in Thrace continued during the year. The facility, to be completed in 1992, is to have a capacity of about 57 Mm³/a, and will feed Algerian and Libyan LPG into the existing natural gasline bringing Soviet natural gas to Istanbul and Ankara. Talks were also underway with Iran concerning building a pipeline through Turkey to transport Iranian natural gas to Western Europe.

Petroleum and Petrochemicals.—The Turkish oil production and refining industry was in a state of flux during the latter part of the year as a result of the Government's decision to shut off the crude oil pipelines from Iraq to the port at Dörtöyl, north of Iskenderun, in accord with the UN sanctions against Iraq. This action cut off Turkey's major source of crude oil imports, and forced the Government to negotiate alternate supplies. Saudi Arabia agreed to supply 170,000 bbl/d in 1991 toward this end.

TPAO was able to take advantage of the crisis in the Persian Gulf to obtain permission and funding for a higher level of exploration drilling and other work. TPAO made four oil discoveries in 1990, all in southeast Anatolia. Crude oil production by TPAO was 18.92 Mbbl—the highest in the company's 36-year history, and 46% above the production in 1989. Of this production, 5,279,373 bbl was from 43 wells put into production during the year. In addition, 35 old wells were put back into production; TPAO has dramatically increased production from some of its older wells by the injection of carbon dioxide. Increased production from the oilfields in southeast Anatolia has led to plans by TPAO pipeline subsidiary Botaş to expand the crude oil pipeline capacity between Batman and Dörtöyl to 113,000 bbl/d.

TPAO's refining subsidiary, Tüpraş, and its marketing subsidiary, POAŞ, were turned over to the Government in 1990, in line with the Government's privatization program.

Reserves

Turkey has large reserves of certain industrial minerals and of lignite, but the country's reserves for most metallic commodities are not large by world standards. Reserves of metallic commodities minable by large-scale methods are known for bauxite, chromite, copper and copper-zinc, iron ore, and silver. Early results from several recent gold exploration efforts indicate a likelihood that the country has minable gold resources; however, no proven reserves had been published as of yearend. In terms of industrial minerals, Turkey's most significant reserves are in barite, boron, limestone and marble, magnesite, perlite, and pumice. Turkey is a geologically and mineralogically diverse country and, with the exception of a few commodities, is characterized by a relatively large number of small deposits rather than a few

large ones. According to the State Institute of Statistics, there were 838 mining establishments in Turkey in 1988. There are also many closed or long-idle operations potentially having additional reserves, and many as yet unexploited deposits that might warrant exploitation on at least an artisanal level. Given the relatively low wage levels in Turkey, many deposits have traditionally been able to be mined at a scale that would not be economic in Europe or North America. Many of these deposits have not had their reserves well-delineated, and for many that have, reserves have only been outlined to relatively shallow depths—suitable for hand mining methods. Many of the "reserves" cited in the literature are given without grades, or are of uneconomic grades in terms of modern, large-scale mining standards. Consequently, many of the published "reserve" data would be considered "resources," by Western standards, but may very well be minable on an artisanal basis. This is especially true for most of Turkey's base metal and chromite deposits. Summaries of Turkey's mineral inventory can be found in an investment brochure put out by the Government² and in reports by MTA.^{3/}

There are a number of bauxite and diasporite deposits in Turkey, the best known of which are those mined by Etibank at Milas, southwest of Denizli, and at Mortaş, south of Seydişehir. According to Etibank, the Milas deposit has reserves of 23 Mmt grading 58% alumina, and the Mortaş area has 40 Mmt grading 50% to 69% alumina.

Chromite reserves are not well defined and are spread out over well in excess of 500 chromite deposits. Most of these are small. In 1988, there were 114 chromite mining establishments listed as in production. MTA estimates that total chromite reserves amount to about 31 Mmt of ore grading 30% to 48% Cr₂O₃ within a larger inventory of lower grade material. Given the economics of mining in Turkey, it is likely that many of the explored deposits will be mined and that Turkey will continue to be a significant producer of chromite for many years.

According to the would-be operator, the Çayeli copper-zinc massive sulfide ore body at yearend 1990 contained proven plus probable reserves of about 10.6 Mmt grading 4.7% copper, 7.3% zinc, 0.45% lead, 69 g/mt silver, and 1.2 g/mt gold. Etibank's Siirt Madenköy massive sulfide deposit is reported by MTA to have proven plus probable reserves of 25 Mmt grading

1.40% copper, within which is an inventory of 11.2 Mmt grading 2.24% copper and 0.9% zinc.

MTA lists Turkey's mercury reserves as 5.5 Mmt grading 0.15% to 0.30% mercury.

According to TDÇI, iron ore reserves at its Divrigi Mine amount to about 100 Mmt of mostly magnetite ore grading 54% to 58% iron. At the company's Hekhimhan (Deveci) mines, there are reserves of 86 Mmt of siderite ore grading 40% to 50% iron and 3% to 5% manganese, and about 5 Mmt of limonite ore reportedly of similar grade.

Metall Mining reported that, as of yearend 1990, the geological resource for its Dikili gold property stood at 710,000 tons grading 10.4 g/mt gold (open pit) plus 280,000 tons grading 24.0 g/mt gold (underground). Etibank's Gümüşköy silver mine reportedly originally contained reserves of 19.2 Mmt grading 193.7 g/mt silver per ton. Most of this inventory has yet to be mined.

Turkey has significant reserves of a number of industrial minerals. Although they are not well defined, Turkey's reserves of boron minerals (tincal, ulexite, colemanite) are believed to be the largest in the world. MTA lists estimated reserves of 2 billion tons.⁴ Etibank's proven and probable reserves at Bigadiç, Emet, and Kirka total in excess of 300 Mmt grading 27% to 40% B₂O₃. Turkey has immense deposits of marble; total reserves have not been defined for the country. Similarly, Turkey's limestone reserves are immense but not well defined. Perlite and pumice reserves have not been fully measured, but many millions of tons of each are known. Etibank's Mazıdaği phosphate deposit is reported to have proven reserves of 62 Mmt. The Beypazarı soda ash (trona) deposit, according to Etibank, has reserves of 178 Mmt grading 45.5% Na₂CO₃.

Turkey's reserves of petroleum and natural gas are not well known. TPAO speculates that the country's petroleum reserves may be about 2 billion bbl. Its Karakus Field is believed to have reserves of 112 Mbbl. Natural gas reserves have been reported to have been 24.5 billion m³ in 1988, but this likely underestimates the country's resources by a considerable margin. Turkey has large lignite reserves; MTA estimates that these total 8 billion tons. Hard coal reserves, most of which are near Zonguldak, are given by MTA as 1.4 billion tons. However, the geology in the Zonguldak Basin makes for very difficult, labor-intensive mining conditions, and it is

not clear what proportion of the reserves will be economic over the long term.

INFRASTRUCTURE

Turkey has a fairly well-developed road and railroad infrastructure, and both are heavily used for the transport of mineral commodities. Turkey has 8,401 km of railroad, all 1.435-m standard gauge, and 479 km of which are electrified. In 1990, the railroads carried about 13.2 Mmt of freight, the mineral commodity component of which comprised about 9.2 Mmt of ore and mine supplies, about 2.2 Mbbl of fuel oil, and 151,000 tons of fertilizers.

Turkey has about 50,000 km of roads, of which about 55% are paved. Most of the country's mineral production and imports, including a significant proportion of fuel imports, is transported by truck.

Turkey has 2,092 km of crude oil and 2,321 km of petroleum products pipelines. The longest stretch of pipeline is the 986-km line connecting Iraq with the Turkish oil-shipping facility at Dörtöyl, 28 km north of Iskenderun. Most of the other lines connect oil-receiving ports with the country's refineries. Turkey has 842 km of natural gas pipeline, which is used to import natural gas from the U.S.S.R. and extends from the Bulgarian border to Ankara. The Government plans to significantly extend the natural gas pipeline grid, including a direct connection from the U.S.S.R. into eastern Anatolia.

Turkey has many ports capable of handling mineral commodity shipments. Many are undergoing capacity expansion projects.

Turkey generated 57,514 GW·h of electricity in 1990, of which 60% was from thermal plants and virtually all of the rest from hydroelectric plants. The parastatal Türkiye Elektrik Kurumu produced 89% of the thermal output and about 96% of the hydroelectric output. Of the total thermal output, 57% was generated by lignite-burning plants, 2% by hard coal-burning plants, 11% by fuel oil plants, and the remainder by natural-gas-burning facilities. Hydroelectric output increased 30% owing to better rains and the construction of new hydroelectric facilities. In 1988, the latest year for which data are available, the major industrial electricity consumers were the iron and steel industry, which consumed 4,014 GW·h; the chemical industry, with 3,502 GW·h; and the non-ferrous

basic industries, with 2,560 GW·h. The coal and lignite mines consumed 780 GW·h, and the other mines consumed a total of 290 GW·h.

Total electrical generating capacity in 1989, the latest year for which data were available, was about 15,000 MW, of which thermal plants accounted for 8,160 MW and hydroelectric power plants 6,543 MW. Geothermal plants have a total capacity of 21 MW. Turkey is in the process of greatly expanding its electrical generating capacity, mostly through the construction of about 50 new plants, most of which will be hydroelectric installations. The largest of the projects is the Southeast Anatolian Project, which involves the construction of 21 dams and 17 hydroelectric stations, and which alone will have a capacity of 8,000 MW. The Atatürk Dam on the Euphrates River will provide 2,400 MW of this. The dam was inaugurated in August 1990 and is scheduled for completion in 1994.

OUTLOOK

Turkey's economic growth in the early 1990's will likely be lower than that experienced in the 1980's. Domestic demand, particularly in the construction sector, is likely to remain fairly stagnant, and this will hurt a number of producers of mineral commodities, particularly cement and steel. Such industries will be forced to increase their exports in order to utilize the increased capacity of their plants, and thereby service the debts incurred in expanding their production capacities. Increased production costs arising from the loss of electricity subsidies and inflation, particularly of wages, will force Turkish exporters to increase prices, which will make their products less competitive on a world market already weakened by recession. However, increased production of hydroelectricity, particularly from the Southeast Anatolian Project, may mitigate the country's high electricity costs somewhat. On the other hand, dramatic wage increases may force the closure of a number of Turkey's smaller mining operations and will likely lead to layoffs in some sectors of the minerals industry, notably cement and steel. It is likely that Turkey's recently tripled capacity expansion in ferrochrome will go underutilized for a number of years, owing to stagnant world demand and the major expansion of world production capacity in 1989 and 1990.

Turkey will, however, continue to be well-positioned to meet increases in short-term demand in many commodities, both because of the capacity increases at many of the country's facilities, and the structure of the minerals industry. Historically, many idle mines and plants have been reopened on short notice to take advantage of improvements in prices or to meet new orders. Turkey's strong trading ties to the U.S.S.R. are likely to increase, and both Turkish companies and the Turkish subsidiaries of foreign firms are well-positioned to take advantage to what is perceived to be a new major market in the U.S.S.R. for consumer goods and construction services. Reportedly, Turkish companies will be favored to supply cement, steel, and construction services toward the reconstruction of Kuwait. The Southeast Anatolian Project will significantly increase the country's demand for fertilizers, which will favor the expansion of the Mazidagi phosphate mine and the manufactured fertilizer industry. Turkish soda ash, from the Bepazari deposit, is seen as having the potential to be a major supplier to the EC and it is thus likely that the deposit will be developed. The favorable results of recent gold exploration projects indicate strongly that Turkey will become a significant gold producer by the mid-1990's.

¹Where necessary, values have been converted from Turkish lira (TL) to U.S. dollars at the rate of TL2608.7=US\$1.00.

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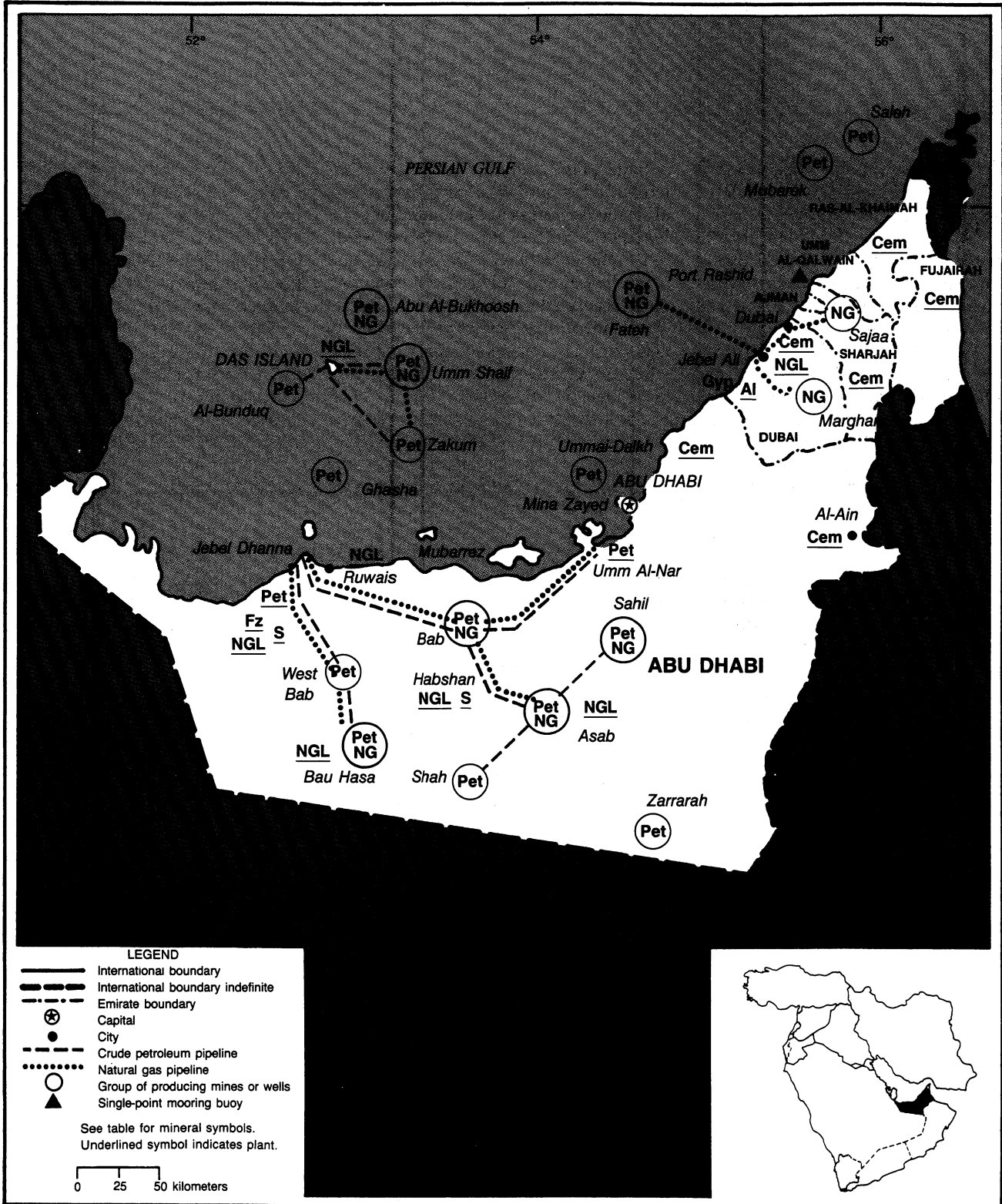
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UNITED ARAB EMIRATES

AREA 83,000 km²

POPULATION 2.3 million



THE MINERAL INDUSTRY OF THE UNITED ARAB EMIRATES

By Audie L. King

Although the nonfuel sector of the economy had expanded rapidly during 1989 and the first half of 1990, oil and gas still accounted for more than 75% of export revenues. Contributions from other mineral-based industries were small and generally related to the construction industry.

The Dubai Aluminum Co. (Dubal) was the only major metal producer in the United Arab Emirates (UAE). It produced about 172,000 tons of aluminum metal from imported alumina in 1990. An expansion project currently underway will increase Dubal's capacity by 40% to about 230,000 tons.

Cement manufacturing was the largest nonfuel mineral-based industry. There were plants in most of the Emirates, and limestone was mined in several localities to provide feedstock for the clinker. Production capacity continued to be higher than domestic demand, allowing for some exports.

Favorable conditions during an 18-month period of rapid growth had allowed the UAE to diversify its economy and the Government to initiate a large number of public works projects. The Government also proceeded with plans to greatly expand the production capacity of its oilfields and gasfields. The economy, however, was shocked severely following Iraq's August 2 invasion of Kuwait. The crisis had an immediate and negative effect on the availability of credit and the volume of both imports and exports. New contracts for road and sewerage improvements and new electrical generating facilities were delayed. Higher oil and gas revenues partially compensated for the declines in the rest of the economic sectors, allowing the nation's GDP to expand slightly during 1990.

GOVERNMENT POLICIES AND PROGRAMS

Since the early 1970's, when the Abu Dhabi National Oil Co. (Adnoc) was formed

with the purpose of giving the state an interest in all areas of the oil and gas industry, all of the Emirates have exercised increasing control over the nation's mineral wealth. All mineral resources were owned and controlled by the individual Emirates and only loosely administered by the Federal Government. The Ministry of Petroleum and Mineral Resources coordinated Federal United Arab Emirates activities in the international community.

The most common method of developing new deposits and establishing new processing plants was for Emirate-controlled companies to form partnerships with foreign companies. The Government retained a controlling interest in most recently formed companies. Agreements that gave foreign companies temporary rights to oil and gas deposits in exchange for development work were also common.

Under Abu Dhabi's new 4-year plan (1991-94), more than \$2.6 billion would be spent on the oil sector to raise crude oil production to 3 Mbbl/d, raise refining capacity to 250,000 to 300,000 bbl/d, and increase natural gas production to 3.4 billion m³ by 1994. In the crude oil sector, \$500 million would be spent to increase capacity from 2 to 3 Mbbl/d. The increase would come from further developing the onshore Bab Field and offshore Zakum Fields. A scheme to add a third liquefied natural gas (LNG) train at Das Island and four new 125,000-m³ tankers would cost \$1.6 billion.

Abu Dhabi also intends to spend \$4.827 billion on non-oil-related projects during the next 4 years; \$1.652 billion would be spent on increasing power generation and water desalination capacity. Sanitation, transportation, and communication projects would receive \$1.222 billion. Funding for these projects, many of which had been needed and anticipated for years, would come from oil revenues that rose by 25% in 1990 to more than \$15 billion. The Gulf War raised the UAE's defense-related costs and threatened to delay the timely completion of some of the public works projects.

PRODUCTION

After having grown by 14.0% in 1989, the GDP of the UAE stagnated in 1990. Losses in the non-oil sector of the economy were compensated for by increased value of the oil and gas sector's output, which surged by 13.5% in 1990. Increased demand for petroleum, following Iraq's invasion of Kuwait, allowed the UAE to step up production. Average crude oil production in 1990 was about 2.1 Mbbl/d compared with 1.7 Mbbl/d in 1989. Most of the crude oil production continued to come from Abu Dhabi; however, 430,000 bbl/d came from Dubai, 65,000 bbl/d of condensate came from Sharjah, and 1,000 bbl/d of condensate came from Ras Al-Khaimah. The UAE's crude oil production in the fourth quarter of 1990 averaged 2.4 Mbbl/d. Increased economic activity in the Persian Gulf following the cease-fire between Iran and Iraq benefited the nonfuel mineral industries. A boom in the construction industry that had increased demand for cement and other building materials was cut short during the latter half of the year.

TRADE

Revenues from oil and gas sales continued to increase faster than overall exports, reinforcing the importance of crude oil to the UAE's trade performance. A 25% rise in oil revenues during 1990 resulted in crude oil's share of total export earnings increasing from 77% in 1989 to 79% in 1990.

The first 7 months of 1990 saw greatly increased levels of economic activity. The economy, however, was shocked severely following Iraq's August 2 invasion of Kuwait when many expatriates left or transferred their money out of the country. This resulted in tight credit that slowed down the local market and trade. Imports and nonfuel exports fell because of apprehensiveness as to the safety of the shipping lanes, which caused steep rises in insurance

premiums. The negative effects of the situation in the Gulf were partially compensated for by increased oil exports and higher world crude oil prices. Despite high-risk premiums levied on goods, nonfuel trade increased later in the year as the UAE benefited from increased trade with neighboring Gulf countries, particularly with Iran. Overall exports for the year were up by more than 20% to about \$19 billion. Imports also increased by about 15% to about \$11.5 billion. Thus, the trade surplus was about \$7.5 billion. The United States received 4.4% of the UAE's exports and accounted for 13.5% of the country's imports. Petroleum products accounted for almost all of the UAE's exports to the United States. The UAE's imports from the United States consisted mainly of machinery and manufactured chemical and metal products.

The UAE remained Japan's largest supplier of crude oil in 1990. It supplied Japan with 11.7% more crude oil than in 1989, 823,500 bbl/d or 20.9% of Japan's total petroleum imports. The increase was because of Japan's reduced imports from Iraq and Kuwait. Almost 39% of the UAE's crude oil production went to Japan. Other important buyers of the country's crude oil include France, the Federal Republic of Germany, Oman, Singapore, South Korea, and the United States. Much of the natural gas produced in the UAE was for domestic consumption. It was used in the country's energy intensive industries that owe their existence to the availability of an inexpensive source of power, such as the aluminum smelter in Dubai, the fertilizer plant at Ruwais, and cement plants in nearly all of the Emirates. Japan was the most important destination for the UAE's LNG exports.

Refinery products were shipped mainly to the Far East and to other Middle Eastern countries.

Excluding crude oil exports, Saudi Arabia and other Gulf Cooperative Council (GCC) members had been the largest importers of goods. Iran is Dubai's largest reexport destination. It reexported \$429 million to Iran in 1989 and reported further increases in 1990. Reexports to the Far East and India continued to rise. Reexports and exports to neighboring Middle Eastern countries, which had been declining in recent years, improved in 1990.

Aluminum was an important export for the UAE. Japan, again, was the largest customer, taking 64% in 1988, the last year for which such data were available. Other important aluminum importers included the United States, Taiwan, and South Korea.

The local market absorbed less than 5% of the UAE's aluminum production. Bahrain, Bangladesh, Japan, Kuwait, South Yemen, and various African states were the UAE's most important cement customers.

STRUCTURE OF THE MINERAL INDUSTRY

During the past 20 years, the trend has been for the Governments of the various Emirates to increase their holdings in companies involved in all aspects of the minerals industry. Abu Dhabi, the Emirate richest in mineral wealth, passed a law in 1976 making the Government of Abu Dhabi the sole owner of all associated or nonassociated natural gas discovered in the Emirate. Adnoc managed these resources for the Government. It was authorized to form partnerships with foreign companies as long as it maintained at least a 51% interest.

COMMODITY REVIEW

Metals

Dubai planned to increase aluminum production capacity at its Jebel Ali smelter to take advantage of relatively high world aluminum prices and low production costs that, owing to the availability of inexpensive energy, averaged 43% lower than world averages. It would increase production capacity to 235,000 mt/a of hot metal by mid-1991 from a nominal capacity of 135,000 mt/a. The plans called for the installation of two new pot lines. The United Kingdom's Wimpey Major Products had the subcontract for the work, and Dubai's Al-Futtaim Wimpey was coordinating the project. It was estimated that the improvements would cost up to \$100 million and would require that 1,000 workers be brought in to work on the scheme.

Industrial Minerals

Cement.—Local cement manufacturers were able to make a profit for the first time in 4 years according to an Emirates National Bank report. This was because of a sharp rise in domestic construction and an upturn in the economy that allowed cement prices to rise to \$52 per ton in mid-1990 from \$26 per ton in 1989. Domestic demand had risen dramatically during the previous 5 years from 2.6 Mmt in 1985 to about 4.0 Mmt in

1989. The cancellation or postponement of various public works projects and the overall slowing of the economy associated with Iraq's invasion of Kuwait slowed domestic consumption during the last half of 1990; however, the UAE's cement industry stood to benefit from increased exports to Kuwait after the war.

Phosphate.—Plans to build an \$86 million phosphoric acid plant in the Jebel Ali Free Zone experienced delays because of debate on the approval of various aspects of the scheme by the Indian Government. When completed, the plant would have a capacity of about 150,000 mt/a of phosphoric acid. The scheme also includes a desalination plant and the construction of a bulk cargo handling unit. Emirates Narmanda Industries (ENI), a joint venture of India's Gujarat Narmanda Valley Fertilizer Co. (GNFC) and the Abu Dhabi-based Mozak International, was still arranging finance for the project. The Indian Government had agreed to purchase the entire output, worth an estimated \$60 million per year, under a 10-year contract. ENI says that the plant should begin operation sometime in 1991.

Sulfur.—Abu Dhabi Gas Liquefaction Co. (ADGAS) planned to install sulfur processing facilities at Ruwais where it planned to centralize solid sulfur production. Italy's Snamprogetti was awarded the project to engineer a sulfur terminal and facilities at Ruwais and to move sulfur production away from Das Island.

Mineral Fuels

Natural Gas.—In mid-1991, the Supreme Petroleum Council (SPC) approved ADGAS' plan to double LNG production at its Das Island plant to 4.6 Mmt/a by 1998 at a cost of \$1.6 billion. Liquefied petroleum gas (LPG) production would also rise from 750,000 mt/a to 1 Mmt/a. The project called for the construction of a third gas processing train and for the purchase of four new 125,000-m³-capacity LNG tankers. When finished, the new processing train would have a capacity of 2.3 Mmt/a of LNG and 250,000 mt/a of LPG. Under a 25-year contract that will come into effect in 1994, Japan's Tokyo Electric Power Co. (Tepco) agreed to purchase Das Island's increased output of LNG and LPG. The train's feedstock would be associated gas from the Umm Shaif, Lower Zakum, and Al-Bunduq offshore fields. In addition, Adnoc com-

TABLE 1

UNITED ARAB EMIRATES: PRODUCTION OF MINERAL COMMODITIES¹

Commodity ²		1986	1987	1988	1989 ^P	1990 ^Q
Aluminum, metal, primary ingot ³	metric tons	154,838	154,832	162,000	168,250	172,000
Cement, hydraulic ⁴	thousand metric tons	2,740	3,106	3,285	3,387	3,264
Gas, natural:						
Gross	million cubic meters	22,485	28,313	27,354	22,390	30,925
Dry, marketed	do.	15,292	19,256	18,604	19,256	26,600
Natural gas plant liquids ^c	thousand 42-gallon barrels	67,525	52,925	47,450	46,355	47,000
Fertilizer:						
Ammonia:						
Gross weight	metric tons	354,000	378,000	361,000	394,000	358,000
N content	do.	291,000	311,000	297,000	324,000	294,500
Urea:						
Gross weight	do.	495,000	529,600	524,000	579,000	496,000
N content	do.	231,000	247,000	244,000	270,000	231,000
Gypsum ^e	thousand metric tons	80	80	84	87	89
Lime ^e	do.	45	45	45	45	45
Petroleum:						
Crude ⁵	thousand 42-gallon barrels	485,450	562,465	571,225	715,400	772,700
Refinery products:						
Liquefied petroleum gas	do.	2,555	2,920	2,190	3,100	3,300
Gasoline	do.	9,125	9,855	9,855	10,300	10,800
Jet fuel	do.	8,395	8,395	8,395	8,700	9,100
Kerosene	do.	3,285	4,015	3,285	4,200	4,400
Distillate fuel oil	do.	16,425	17,895	18,250	18,700	19,700
Residual fuel oil	do.	14,965	16,425	17,155	17,200	18,100
Other	do.	8,750	9,855	5,475	10,700	11,300
Total	do.	63,500	69,360	64,605	72,900	76,700
Sulfur, byproduct: ^c						
From petroleum refining	metric tons	11,000	8,000	10,000	10,000	10,000
From natural gas processing	do.	104,000	97,000	100,000	70,000	80,000
Total	do.	115,000	105,000	110,000	80,000	90,000

^QEstimated. ^PPreliminary. ^RRevised.

¹Table includes data available through Aug. 26, 1991.

²In addition to the commodities listed, crude construction materials such as common clays, stone, and sand and gravel presumably are produced, but output is not reported quantitatively, and general information is inadequate to make reliable estimates of output levels.

³Reported figure.

⁴Includes white cement.

⁵Includes lease condensate.

TABLE 2

UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Aluminum	Dubai Aluminum Co. Ltd.	Jebel Ali, Dubai	140.
Cement	Al Ain Cement Co.	Al Ain, Abu Dhabi	800.
Do.	Fujairah Cement Industries	Dibba, Fujairah	750.
Do.	Gulf Cement Co.	Al-Nakheel, Ras al Khaimah	1,000.
Do.	Jebel Ali Cement Co.	Jebel Ali, Dubai	100.
Do.	National Cement Co. Ltd.	Dubai, Dubai	650.
Do.	Sharjah Cement and Industrial Development Co. Ltd.	Sharjah, Sharjah	1,100.

See footnote at end of table.

TABLE 2—Continued

UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement—Continued	Union Cement Co.	Union, Ras Al-Khaimah	1,100.
Do.	White Cement and Construction Co.	Khor Kuwair, Ras Al-Khaimah	300.
Diabase	Rockwool Co.	Fujairah and Ras Al-Khaimah	NA.
Fertilizer	Ruwais Fertilizer Industries	Ruwais, Abu Dhabi	400 ammonia.
Do.	do.	do.	580 urea.
Gypsum	General Gypsum Co.	Jebel Ali, Dubai	8
Natural gas million cubic meters	Abu Dhabi Co. for Onshore Oil Operations (ADCO)	Associated gas from the oilfields: Asab, Sahil, Bab, and Bau Hasa; onshore, Abu Dhabi	4,645 gross.
Do. do.	Abu Dhabi Marine Operating Co.(ADMA-OPCO)	Associated gas from the Umm Shaif oilfield; offshore, Abu Dhabi	6,200 gross.
Do. do.	Dubai Marine Areas Ltd.- Dubai Petroleum Co.	Associated gas from the oilfields: Fateh, Southwest Fateh, and Rashid; offshore, Dubai	7,000 gross.
Do. do.	Arco Oil and Gas Co.	Nonassociated gas from the Margham gasfield; onshore, Dubai	4,135 gross.
Do. do.	do.	do.	1,175 condensate.
Natural gas do.	Abu Dhabi National Oil Co. (Adnoc)	Two processing plants at Habshan, Abu Dhabi	7,300 dry.
Do. do.	Dubai National Gas (Dugas)	Processing plant at Jebel Ali, Dubai	1,345 dry.
Do. do.	do.	do.	915 liquefied petroleum gas.
Do. do.	do.	do.	425 condensate.
Do.	Ras Al Khaimah Gas Commission	Associated gas from the Saleh oilfield; offshore, Ras Al-Khaimah	570 dry.
Do. do.	do.	do.	60 liquefied petroleum gas.
Do. do.	do.	do.	20 condensate.
Do. do.	Sharjah Liquefaction Co.	Processing plant at Ash Shariqah, Sharjah, near the Sajaa gasfield	595 liquefied petroleum gas.
Do. do.	do.	do.	335 condensate.
Do.	Amoco Sharjah Oil Co.	Nonassociated gas from the Sajaa gasfield; onshore, Sharjah	1,800 dry.
Do. do.	do.	do.	410 liquefied petroleum gas.
Do. do.	do.	do.	1,695 condensate.
Do.	Abu Dhabi Gas Liquefaction Co. (ADGAS)	Processing plant at Das Island; offshore, Abu Dhabi	3,350 liquefied natural gas.
Do. do.	do.	do.	2,160 liquefied petroleum gas.
Do. do.	Abu Dhabi Gas Industries Ltd. (Gasco)	Liquefaction plants at the Bau Hasa, Bab, and Asab oilfields Fractionation plant at Ruwais, Abu Dhabi	7,475 liquefied petroleum gas.
Petroleum, crude thousand barrels	Abu Dhabi Co. for Onshore Operations (ADCO)	Asab, Bab, Bau Hasa, and Sahil oilfields; onshore, Abu Dhabi	365,000.
Do. do.	Abu Dhabi Marine Operating Co. (ADMA-OPCO)	Umm Shaif and Zakum oilfields; offshore, Abu Dhabi	208,000.

See footnote at end of table.

TABLE 2—Continued

UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Petroleum, crude		Zakum Development Co.	Upper Zakum oilfield; offshore, Abu Dhabi	113,000.
	thousand barrels			
Do.	do.	Total Abu Al Bukhoosh Oil Co. (TBK)	Al-Bukhoosh oilfield; offshore, Abu Dhabi	21,900.
Do.	do.	Umm Al Dalkh Development Co. (Udeco)	Umm Al Dalkh and Satah oilfields; offshore, Abu Dhabi	14,600.
Do.	do.	Al Bunduq Oil Co. Ltd. (BOC)	Al Bunduq oilfield; offshore, Abu Dhabi	11,000.
Do.	do.	Abu Dhabi National Oil Co. (Adnoc)	Mubarraz oilfield; offshore, Abu Dhabi	7,300.
Do.	do.	Mubarraz Oil Co. (Moco)	Umm Al-Anbar oilfield, near Mubarraz; offshore, Abu Dhabi	4,300.
Do.	do.	Dubai Marine Areas Ltd.-Dubai Petroleum Co.	Fateh, Southwest Fateh, and Rashid oilfields; offshore, Dubai	127,750.
Do.	do.	Crescent Petroleum Co. (CPC)	Mubarek oilfield; offshore, Sharjah	3,650.
Petroleum, refined				
	do.	Abu Dhabi National Oil Co. (Adnoc)	Ruwais and Umm Al-Nar, Abu Dhabi	71,200.
Sulfur	do.	Abu Dhabi National Oil Co. (Adnoc)	Habshan, Abu Dhabi Ruwais, Abu Dhabi	292. 10.

mitted to develop the Abu Al-Bukhoosh offshore nonassociated gasfield, 45 km northwest of the Das Island complex.

Petroleum, Crude.—Abu Dhabi Co. for Onshore Operations (ADCO) disclosed plans to expand its overall crude oil production capacity by 70% to 2.5 Mbbl/d by 1995. The main expansion projects were to be in the Upper Zakum Field and in the onshore Bab Field, which was reopened in 1989 after having been shut down since 1986. When finished, the \$500 million scheme would allow for expanded production at most of ADCO's onshore and offshore fields. ADCO planned to increase the capacity of the Bab Field from 60,000 bbl/d to 250,000 bbl/d over a 2-1/2-year period. Foster Wheeler, of the United Kingdom, was awarded the consulting contract for the \$150 million expansion project. ADCO also proposed to expand production capacity at the offshore Zakum Field.

Zakum Development Co. (ZADCO), the operator of the Zakum Field, planned to drill more than 100 production wells and build 5 new production platforms to increase crude oil production capacity from 350,000 bbl/d to 500,000 bbl/d. Mubarraz Oil Co. and ADCO planned to increase production at Umm Al-Anbar in the West Mubarraz Field, which began production in February 1989, from 8,000 bbl/d to 16,000 bbl/d. ADCO would also increase capacity at its four smaller onshore fields (Asab, Bau Hasa, Shah, and Shail) by putting into effect pressure support projects. To accommodate expanded production, three new 1-billion-bbl storage tanks are to be commissioned in 1992 at Jebel Dhanna, Abu Dhabi's principal onshore export terminal. ADCO is also reevaluating smaller discoveries made over the past decade.

Abu Dhabi Marine Operating Co. (ADMA-OPCO) plans to increase produc-

tion by drilling new production wells and undertaking a pressure support program at its Umm Shaif Field.

International Petroleum Corp. (IPC) brought in two companies to work its onshore concession in Ras Al-Khaimah. Hardy Oil and Gas is to take a 12.5% stake and Grauten Oil 5%. IPC's share in the 2,074-km² block is now 38.4%.

The American Oil Co. (Amoco) Sharjah Offshore Co., holder since 1978 of a 2,428-km² exploration area west of the Oman Mountains that contains the Sajaa Field, acquired a new 1,018-km² exploration concession offshore Sharjah.

Dubai Exploration Offshore (DEOL) began drilling in the offshore Al-Salem concession, 30 km south of Dubai. DEOL was a joint venture with the state-owned Dubai Petroleum Co. (DPC) and Conoco of the United States, which had a 30% interest in the concession. Dubai Marine

Areas held 50%. RWE-DEA Dubai, West Germany's Wintershall, and Dubai Sun Oil held the remainder.

DPC drilled 22 development wells and 2 exploration wells in 1990. Oil output was expected to rise in 1991 after a \$200 million project to increase gas pressure at the Fateh Field is completed.

Petroleum, Refined.—Adnoc planned to increase the capacity at its Ruwais and Umm Al-Nar refineries. The Ruwais oil refinery's capacity would increase from 120,000 bbl/d to between 250,000 to 300,000 bbl/d. The refinery's hydrocracker would double capacity to 55,000 bbl/d. Initial plans were to increase the capacity at the Umm Al-Nar refinery from 70,000 bbl/d to 85,000 bbl/d. Feasibility studies were done by Italy's Snamprogetti.

Abu Dhabi investigated the purchase of an additional 500,000 bbl/d in foreign refinery capacity as it held talks with United States and Japanese refineries. As of 1990, its overseas refinery holdings were considered very modest by Middle Eastern standards, accounting for less than 7% of the Gulf's overseas refinery capacity. It held minority stakes in Spain's Cepsa and France's Total. Abu Dhabi would likely restrict its foreign refinery holdings to minority equity shareholdings that provide an outlet for its crude exports while limiting its exposure to risk.

Adnoc announced plans to begin reducing the lead content of its gasoline to 0.4 g/L from 0.6 g/L and to produce lead-free gasoline by the year 2000.

The Jebel Ali Refinery Corp. (JARC), which is 100% owned by the Government of Dubai, planned to build and operate a 150,000-bbl/d refinery in the Jebel Ali Free Zone. Feasibility studies were to be carried out by Bechtel Corp. in early 1991. Progress had been slowed while JARC waited for India's Reliance Industries (RI), the lead investor, to get permission to proceed from its own Government. It was hoped that the State-owned Indian Oil Corp. would agree to purchase the refinery's output. RI planned to carry a 40% share of the \$225 million equity of the project, which would cost \$900 million to construct. The financing scheme called for the remainder of the funds to be raised by nonresident Indians living in the Middle East. Additional funds would be raised from syndicated loans. Major international oil companies had also shown interest in the project.

Reserves

In January 1990, Abu Dhabi's Minister of Petroleum and Minerals Resources announced that the UAE's proven petroleum reserves were estimated to be 116 billion bbl, enough to last 150 years at the average 1990 production level of 2,117,000 bbl/d. Proven natural gas reserves were estimated at 10,000 billion m³, which was far higher than previous industry estimates of 5,690 billion m³, and would put the UAE's gas reserves into third place behind the U.S.S.R. and Iran.

INFRASTRUCTURE

Firmer oil prices during 1989 and 1990 had allowed the UAE to release \$285 million in public works contracts. The crisis in the Gulf, however, temporarily slowed the flood of new road and sewerage projects. Several large construction projects that were expected to come up for bid in the late summer were postponed as the Government proceeded cautiously as it monitored events unfolding in the Gulf.

In an effort to keep up with its expanding population and growing industrial demand, the UAE planned to spend about \$1.7 billion in Abu Dhabi on increased power-generating capacity over the next 4 years. The bulk of the funds would go to expand the generating capacity of the Taweelah Power Complex, southeast of Abu Dhabi Island, from its present capacity of 250 MW to about 500 MW and for the construction of another 400-MW powerplant adjacent to the Taweelah Power Complex. A contractor was expected to be selected sometime in late 1991. In December 1990, \$305 million in contracts was awarded to international companies for power distribution improvements in the city of Al-Ain. Plans to triple the power-generating capacity in Al-Ain from 200 MW to 600 MW were put on hold after its funds were diverted to the Taweelah project. Work on a 150-km gas pipeline that would have supplied fuel for the Al-Ain powerplant had also been postponed. Dubai planned to spend about \$800 million over 3 years to construct the Jebel Ali G power station, a 440-MW power station that will supply electricity to the 100-km² industrial free zone at Jebel Ali. The Electricity and Water Ministry was expected to tender bids for a new 400-MW

power station that was expected to be built at Al-Rifa, between Umm Al-Qaiwain and Ras Al-Khaimah. Upgrades were also expected to be made at the Ajman, Dhaid, and Umm Al-Qaiwain power stations.

Dubai's two ports, Jebel Ali and Port Rashid, merged to form the Dubai Port Authority (DPA) to lower operating costs and streamline activities. The DPA was expected to handle 2 million 20-foot equivalent units by the year 2000.

A 300,000-m² air cargo village opened in July 1991 at Dubai International Airport. It was designed to handle 250,000 tons of cargo by the year 1997 but could expand to 450,000 tons if needed. It takes only 3 hours upon arrival at the port for merchandise to be unloaded, transported to the airport, and repacked into air containers and pallets ready for airlift. The container village has facilities to ship frozen and chilled goods and hazardous goods, including radioactive items.

According to Planning Ministry statistics, 1990's labor force consisted of 654,511 employees, with 226,000 in the service sector, 113,000 in construction, 62,000 in light industry, and 40,000 in agriculture.

OUTLOOK

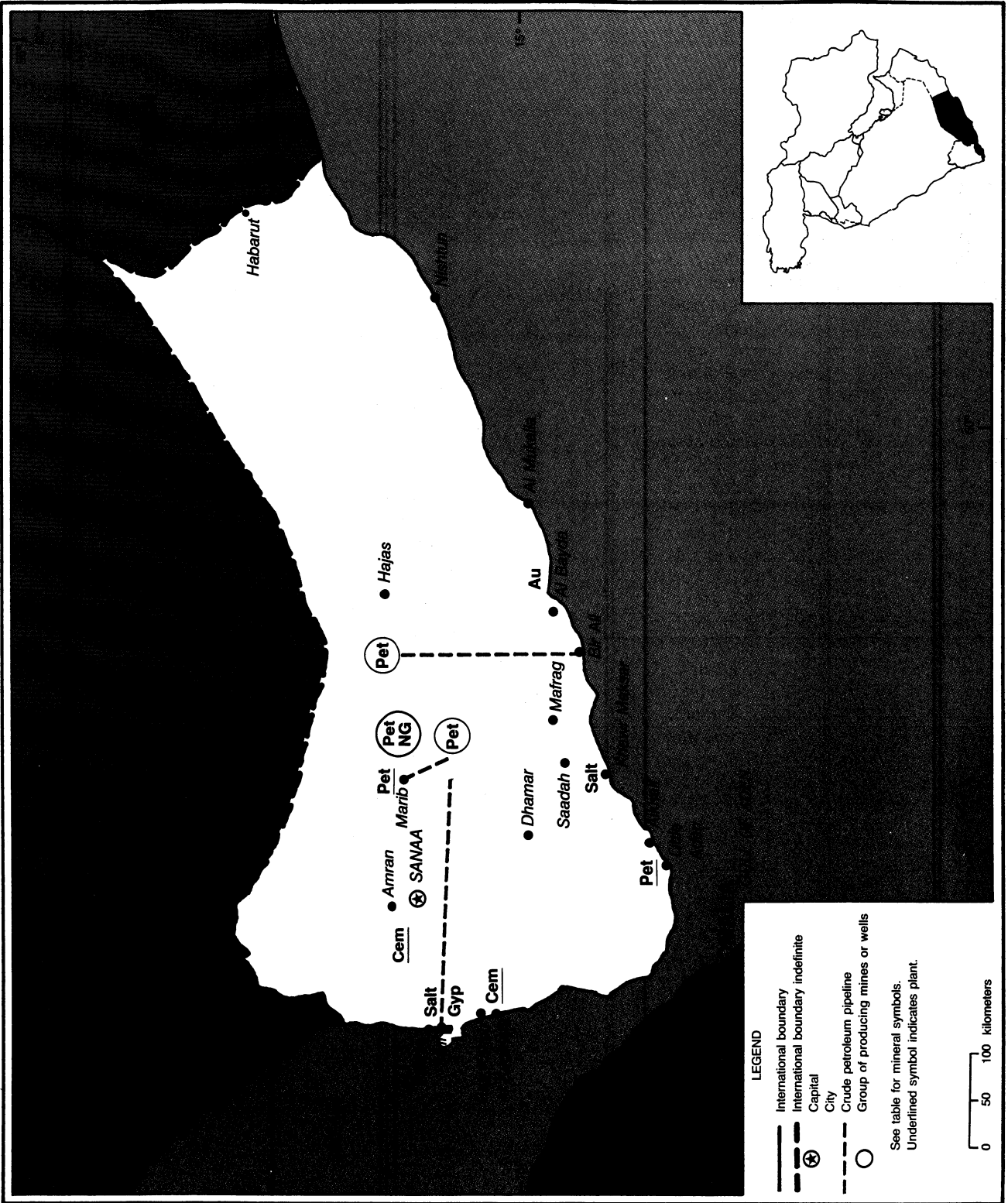
The UAE's economic prosperity will continue to fluctuate with world petroleum prices. The relative importance of petroleum to the UAE's economy will likely increase as more of the planned petroleum and natural gas production capacity comes on-line in coming years. The UAE's economy probably benefited more from the relative economic stability enjoyed in the Gulf region following the 1988 cease-fire between Iraq and Iran than any other country's. The current unrest in the Middle East may have slowed down the UAE's plans to increase the relative importance of its non-oil sector to its total economy. Higher oil prices and greater demand for crude oil will, however, more than compensate for any adverse effects that a regional conflict may have on business confidence. In the long run, the nonfuel sector may also benefit from increased trade with neighboring Gulf countries, particularly with Iran.

¹Where necessary, values have been converted from Emirian dirhams (Dh) to U.S. dollars at the rate of Dh3.70=US\$1.00.

REPUBLIC OF YEMEN

AREA 482,000 km²

POPULATION 13 million



THE MINERAL INDUSTRY OF THE REPUBLIC OF YEMEN

By Bernadette Michalski

Two sovereign nations, the People's Democratic Republic of Yemen and the Yemen Arab Republic, merged on May 22, 1990, forming the Republic of Yemen. The discovery of commercial quantities of crude oil straddling the undefined border area that divided the two former countries was a contributing factor in the merger. Possible challenges to ownership were avoided by unification, thus facilitating the influx of foreign capital for petroleum exploration and development. By the close of 1990, 12 exploration licenses were awarded or in negotiation. Particular interest was focused on the 2,200 km² in north-central Yemen between the Marib al Jawf region and the Shabwa region. Other promising acreage under exploration included the Masila block, north of the port of Ash Shihr on the Gulf of Aden and at Habarut near the Omani boundary. Historically an agrarian economy, the mineral industry activity in the Yemens had been confined to the refining of foreign crude oil and the production of cement, dimension stone, gypsum, and salt until the discovery of commercial petroleum deposits.

GOVERNMENT POLICIES AND PROGRAMS

The Republic of Yemen adopted a new investment law, which sanctioned limited private investment. It encouraged the infusion of capital by foreign and local enterprises for the purpose of elevating the national income and expanding the base of the economy.

Under the investment law, new projects would be entitled to a 3-year tax holiday, and provision was made for the remittance of profits and capital abroad. Investors would receive tax and customs exemptions on the importation of machinery, tools, equipment, and building materials. Tax and customs exemptions would also apply to imported raw materials for 3 years commencing from the date of actual operation.

In addition, 50% of dividends paid to shareholders or investors would be exempted from tax.

PRODUCTION

Mineral production was limited to the extraction and processing of crude oil, gypsum, rock and brine salt, and to the manufacture of cement. Despite recent discoveries of crude petroleum, their full development remains dependent upon pipeline construction, refinery modernization, and expanded port facilities and storage terminals. The underutilized refinery at Aden processes crude oil for domestic consumption and accepts contract processing for a few regional producers, particularly Iraq, Kuwait, and the United Arab Emirates, as well as for the U.S.S.R. Iraq made the first delivery to the newly expanded port facilities at Aden on November 19, 1989, with more than 1 million barrels of crude oil for contract processing. Payment for processing foreign crudes was usually a percentage of the refined output retained for Yemen's consumption. Deliveries from Iraq and Kuwait were curtailed by blockade after the August 1990 invasion of Kuwait by Iraq. Consequently, crude oil destined for the export market was diverted to the Aden refinery to satisfy domestic consumption requirements.

TRADE

Petroleum accounted for nearly 95% of total exports, according to the Central Bank of Yemen and the International Monetary Fund. Although favorable prices and increased export volumes throughout most of 1990 improved the new Republic's balance of payments position, the value of imported raw materials and consumer goods well exceeded export values. Remittances from over a million expatriate workers in Saudi Arabia and other Gulf countries helped to finance imports in previous years. However, the occupation of Kuwait by Iraq in August

of 1990 forced many workers to return to their homeland, severely curtailing these remittances.

More than 8 million bbl of crude and unfinished oils as well as a minor amount of residual fuel oil was exported to the United States in 1990.

STRUCTURE OF THE MINERAL INDUSTRY

Although the Republic of Yemen encourages private investment, the new Government had little time to implement any privatization program.

Crude oil, the nation's principal mineral commodity, was originally discovered and developed in the Marib al Jawf region by the Yemen Hunt Oil Co. of the United States on a production-sharing basis with the Government. The Government receives 70% of production of the first 100,000 bbl/d, with an additional 5% for each 100,000 bbl/d increment until capped at 90% for all production of 400,000 bbl/d and above. Production from the Shabwa region was developed by the U.S.S.R. under service contract for the Government. However, output from the region has been limited pending infrastructure development and resolution of technical problems. To facilitate development of the Shabwa region, the original 35,000-km² U.S.S.R. contract area has been divided into nine blocks. Of this total, at least six blocks were offered to commercial oil companies on a production-sharing basis.

COMMODITY REVIEW

Metals

Gold.—Renewed interest in gold mining was evidenced by the Government as it concluded an agreement with Jordan to establish a regional project for gold exploration. An agreement was also concluded with the U.S.S.R. calling for the renewal of

TABLE 1
REPUBLIC OF YEMEN: PRODUCTION OF MINERAL COMMODITIES¹

Commodity	1986	1987	1988	1989 ^a	1990 ^a
Cement thousand metric tons	1,160	760	646	700	² 800
Gypsum metric tons	53,000	50,000	60,000	63,000	—
Natural gas liquids thousand 42-gallon barrels	—	—	—	4	9
Petroleum:					
Crude do.	<u>2,700</u>	<u>7,800</u>	<u>60,390</u>	<u>66,500</u>	<u>71,000</u>
Refinery products:					
Gasoline do.	811	1,103	2,725	2,800	2,800
Kerosene do.	1,240	1,240	1,275	1,300	1,300
Distillate fuel oil do.	9,523	9,478	9,530	9,535	9,535
Residual fuel oil do.	8,919	10,113	10,135	10,140	10,140
Other ^a do.	900	1,000	2,000	2,350	2,350
Total do.	<u>21,393</u>	<u>22,934</u>	<u>25,665</u>	<u>26,125</u>	<u>26,125</u>
Salt ^a metric tons	375,000	238,000	225,000	230,000	² 220,000

^aEstimated. ^bPreliminary. ^cRevised.

¹Table includes data available through July 31, 1991.

²Reported figure.

TABLE 2
REPUBLIC OF YEMEN: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Yemen Corp. for Cement Industry and Marketing	Bajil (near Al Hudayda)	300
Do.	do.	Amran	500
Petroleum, crude	Yemen Exploration and Production Co.	Alif	65
million 42-gallon barrels	do.	Azal	8
Do.	do.	Asaad al-Kamil	9
Do.	Shabwa Petroleum	Western Ayyad	18
Do.	do.	Amal	18
Petroleum, refinery products	Yemen Exploration and Production Co.	Marib	4
million 42-gallon barrels	Aden Refining Co.	Little Aden	60
Do.	Yemen Salt Mining Corp.	Salif	200
Salt	Public Salt Organization	Khaw-Maksahr	80
Do.			

mine development at Wadi Medden, about 95 kilometers southwest of Al Mukalla on the Gulf of Aden coast. However, no information was available on the project.

Industrial Minerals

Cement.—The Yemen Corp. for the Production and Marketing of Cement awarded a design and construction supervision contract for the turnkey Al Buh cement works near Mafrag to Rendel Palmer and Tritton of the

United Kingdom. The 500,000-mt/a-capacity cement plant was financed by Japan's Overseas Economic Cooperation Fund at \$145 million. Completion of this project will elevate the nation's total annual cement production capacity to 1.25 Mmt. Existing plants, the Japanese-built 500,000-mt/a-capacity Amran plant and the 300,000-mt/a-capacity Bajil plant constructed by the U.S.S.R., were being considered for modernization and expansion.

Dimension Stone.—The Arab Mining Company (ARMICO) of Jordan recommended to the National Company for Industrial and Building Materials the establishment of a marble quarry at Hajaj to supply the domestic market. A granite quarry was recommended for Al Bayda with a processing plant at Sanaa to supply both block and finished granite for the export market. ARMICO projected the development cost at \$9.5 million.

Salt.—Present salt operations are centered at Salif where rock salt is mined and at Khawr Maksar where brine is evaporated. China has signed an agreement to provide a loan for the development of the salt industry.

Mineral Fuels

Petroleum.—Exploration.—The Government signed a production-sharing agreement with Petro-Canada for oil exploration in the 12,000 km Habarut region near the Oman border. Exploration will be in three main phases over a 6-year exploration period at an estimated cost of \$27 million.

Texaco Inc. acquired Exxon's relinquished holdings in a 22,000-km concession adjacent to the Marib al Jawf region in February 1989. After drilling two dry holes, Texaco announced it was relinquishing the concession in May 1990.

In February 1990, Phillips Petroleum of the United States acquired 67% interest in Canada's International Petroleum Corp.'s 4,300-km² concession in the Upper Wadi al Jawf area.

Société Nationale Elf Aquitaine (France), British Petroleum Co., and London and Scottish Marine Oil (United Kingdom) completed an offshore seismic survey in their 19,374-km² Aden-Abyan concession and initiated drilling.

Sun Oil Co. signed a production-sharing contract in the East Shabwa region.

A joint-venture exploration agreement covering a 14,000-km² block near the concession operated by Elf Aquitaine was entered into by Tullow Oil of Ireland, 33%, and the Bin Ham Group of the United Arab Emirates, 67%.

An agreement covering the 2,200-km² corridor between the oil-bearing zones of Marib al Jawf and Shabwa regions was awarded to a consortium representing companies from four nations, France, Kuwait, United States, and the U.S.S.R., for oil exploration and development rights in the area straddling the former border. The final agreement was signed on March 14, 1990. However, by the following June, the U.S.S.R. withdrew from the venture, having failed to meet its agreed share of investment amounting to approximately \$5 million.

Production.—The Yemen Exploration and Production Co. (YEPC), a joint venture between Yemen Hunt Oil Co. of the United States at 51% equity, and the Exxon Corp. of the United States at 49% equity, confirmed the start up of the Asaad al Kamil condensate and gasfield in the Marib al Jawf region about 16 kilometers north of the Azal Field. The field covered about 60 km² and contained an estimated 133 million bbl of crude and condensate as well as 76 billion m³ of associated gas in place. This represents the company's fifth commercial field. Sixteen wells were drilled, nine of which yielded crude oil of 40° to 43° API gravity crude with traces of sulfur at 0.02%. Seven wells yielded natural gas and condensate at the level of about 30 bbl of condensate per 28,000 m³. The field was scheduled to enter production following completion of a pipeline linkup with the existing 430-km pipeline network connecting production facilities to the export terminal at Ras Issa near Salif on the Red Sea. The terminal consists of a 9-km offshore pipeline linked to a 400,000-dwt storage tanker. The tanker will feed offtake vessels via a Single Point Mooring.

With the development of the Eastern Ayyad, Western Ayyad, and Amal Fields, output from the Shabwa region was projected to eventually attain levels of 150,000 bbl/d of low-sulfur crude oil ranging from 35° to 43° API gravity. A 190-km pipeline with three pumping stations to transport the crude oil from Shabwa to a floating storage facility at Bir Ali was completed. The Gulf of Aden terminal at Bir Ali will serve to load tankers for crude oil delivery to the domestic refinery at Aden or for delivery to international markets.

Refining.—The Aden refinery is scheduled to undergo a \$200 million modernization program including the installation of new processing units and storage facilities. The refinery now operates at less than 40% of its 160,000-bbl/d capacity. The 10,000-bbl/d-capacity refinery at Marib operated at full capacity, providing petroleum products for the domestic market.

A \$28 million contract involving the Federal Republic of Germany's Mannesmann Anlagenbau was awarded in mid-1990 to build a 135,000-mt/a-capacity plant for

bottling liquefied petroleum gas (LPG) in Sanaa. Also under consideration were LPG bottling plant sites at Dhamar, Marib, Amran, and Saada.

Reserves

The combined estimated and proven crude oil reserves of the newly formed Republic of Yemen were 4 billion bbl. Natural gas reserves were reported at 565 billion m³ of which 200 billion m³ is proven reserves in the Marib al Jawf region as announced in June 1989.

INFRASTRUCTURE

The Republic's road system totals 15,500 km of which only 4,000 is bituminous surfaced and the remainder is for the most part unsurfaced.

Seven ports are along the 1,906 km coastline. The Red Sea ports are Al Hudaydah, Mokha, Salif, and Ras Kathib. The ports in the Gulf of Aden are Aden, Al Khalf, and Nishtun.

OUTLOOK

The union of the People's Democratic Republic of Yemen and the Yemen Arab Republic will facilitate development of the petroleum reserves situated in the former border area. The prospect of a sustained rise in oil prices during the coming years should lead to a steady growth in export earnings. Liberal exploration laws have attracted foreign oil companies with development financing. However, pro Iraqi sympathy during the Kuwait occupation jeopardized Yemen's potential for foreign aid.

OTHER SOURCES OF INFORMATION

Agencies

- The Petroleum and Mineral Resource Ministry
- Sanaa, Republic of Yemen
- The Ministry of Economy, Supply, and Trade
- Sanaa, Republic of Yemen

MAP SYMBOLS

Commodity

Commodity	Symbol
Alunite	Alu
Alumina	<u>Al</u>
Aluminum	<u>AL</u>
Andalusite	And
Antimony	Sb
Arsenic	As
Asbestos	Asb
Asphalt	Asp
Barite	Ba
Bauxite	Bx
Bentonite	Bent
Beryllium	Be
Bismuth	Bi
Bitumen (natural)	Bit
Boron	B
Bromine	Br
Cadmium	Cd
Calcium	Ca
Carbon black	<u>CBl</u>
Cement	<u>Cem</u>
Cesium	Cs
Chromite	Cr
Clays	Clay
Coal	C
Cobalt	Co
Columbium (niobium)	Cb
Copper	Cu
Corundum	Cn
Cryolite	Cry
Diamond	Dm
Diatomite	Dia
Dolomite	Dol
Emerald	Em
Emery	E
Feldspar	Feld
Ferroalloys	<u>FA</u>
Ferrochrome	<u>FeCr</u>
Ferromanganese	<u>FeMn</u>
Ferronickel	<u>FeNi</u>
Ferrosilicon	<u>FeSi</u>
Fertilizer	<u>Fert</u>
Fluorspar	F
Gallium	Ga
Garnet	Gt
Gem stones	Gm
Germanium	Ge

Gold	Au
Graphite	Gr
Gypsum	Gyp
Indium	In
Iron and steel	<u>Fe</u>
Iron ore	Fe
Jade	J
Kaolin	Kao
Kyanite	Ky
Lapis lazuli	Laz
Lead	Pb
Lignite	Lig
Lime	<u>Lime</u>
Limestone	Ls
Liquefied natural gas	<u>LNG</u>
Liquefied petroleum gas	<u>LPG</u>
Lithium	Li
Magnesite	Mag
Magnesium	Mg
Manganese	Mn
Marble and alabaster	Marb
Marl	Ma
Mercury	Hg
Mica	M
Molybdenum	Mo
Natural gas	NG
Natural gas liquids	<u>NGL</u>
Nepheline syenite	Neph
Nickel	Ni
Nitrates	Nit
Nitrogen (ammonia plants)	N
Ochre	Oc
Oil sands	OSs
Oil shale	OSh
Olivine	OI
Opal	Opal
Peat	Peat
Perlite	Per
Petroleum, crude	Pet
Petroleum refinery products	<u>Pet</u>
Phosphate	P
Pig iron	<u>Pig</u>
Pigments, iron	Pigm
Platinum-group metals	PGM
Potash	K
Pozzolana	Pz
Pumice	Pum
Pyrite	Py
Pyrophyllite	Pyrp

Quartz or quartzite	Qtz
Rare earths	REE
Rhenium	Re
Salt	Salt
Sand and gravel	Sd/Gvl
Sandstone	Ss
Selenium	Ss
Sepiolite, meerschaum	Sep
Serpentine	Sep
Shale	Sh
Silicon	Si
Sillimanite	Slm
Silver	Ag
Soapstone	Soap
Soda ash, trona	NaAsh
Sodium Sulfate	NaSO ₄
Stone	Stone
Strontium	Sr
Sulfur	S
Talc	Talc
Tantalum	Ta
Tellurium	Te
Thorium	Th
Tin	Sn
Titanium (rutile or ilmenite)	Ti
Titanium dioxide (processed)	<u>TiO₂</u>
Tungsten	W
Umber	Um
Uranium	U
Vanadium	V
Vermiculite	Verm
Wollastonite	Wo
Yttrium	Y
Zinc	Zn
Zirconium	Zr

MAP LEGEND

Symbol = Mine, including beneficiation plants, well
 Circled Symbol = Group of producing mines or wells
 Underlined Symbol = Processing plant or oil refinery, including smelters and metal refineries
 (Symbol) = Undeveloped significant resource