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Printing Office, 1990

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LATIN AMERICA AND CANADA



U.S.
DEPARTMENT
OF THE
INTERIOR

Manuel Lujan, Jr.
Secretary



BUREAU
OF
MINES

T S Ary
Director

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

BUREAU OF MINES • T S Ary, Director

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 is as 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 is 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 on more than 160 foreign countries and discusses the importance of minerals to the economies of these nations. The 1990 review 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 U.S.S.R.*, *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 will be discontinued. The U.S. Bureau of Mines continually strives to improve the value of its publications to users. Comments and suggestions by readers of the Yearbook are welcomed.

T S Ary, *Director*

Acknowledgments

The 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 as well as from the annual reports of the mining companies. Of particular assistance were the routine and special reports submitted by the 10 Regional Resource Officers assigned to minerals and petroleum reporting and by economic and commercial officers and other officials of the Department of State located 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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Vitae

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LATIN AMERICA AND CANADA

By Staff, Branch of Latin America and Canada

INTRODUCTION¹

This regional report covers the mineral industries of Canada and 40 countries and areas in Latin America and the Caribbean Basin. Also included is a brief description of the mineral potential of Antarctica. The Latin American region encompasses an area twice that of the United States.

Latin America and Canada have a rich and diversified endowment of mineral fuels, metals, and industrial minerals. Tables 2 and 3 provide a summary view of the importance of Latin America and Canada's output of its major mineral commodities in world mineral supply in 1989 and 1990.

In terms of value, Latin America and Canada are both important in the world mineral economy as producers of crude oil, petroleum products, natural gas, and coal. With respect to a number of nonfuel minerals, the area contains several world class producers. In 1990, Canada was the world's leading producer of mine output of nickel, uranium, and zinc. In Latin America, Mexico was the world's leading producer of silver and strontium; Brazil led in columbium and tin, and Chile was the world leader in copper slightly ahead of the United States. In the next ranks, Canada was the world's second greatest producer of potash and was third in output of aluminum, copper, sulfur, and marketed natural gas. The second world rank included Brazil relative to iron ore output and Chile relative to iodine. After Brazil, the other significant iron ore producers in the hemisphere were Canada, Venezuela, Chile, and Mexico, in order of importance. Brazil was the world's leading exporter of iron ore accounting for about 29% of total world exports in 1990. The significant manganese producers were Brazil and Mexico. The area's leading steel producer was Brazil, which ranked seventh in the world followed by Canada and Mexico. Besides Canada, the other significant nickel producers included Cuba and the Dominican Republic.

Considering all the countries in Latin America, the most outstanding output from the region in terms of share of world output include silver, tin, copper, bauxite, iron ore, zinc, lead, gold, crude oil, and aluminum, in order of world percentage. Over the past decade, as a result of new discoveries and expanded productive facilities, Latin America has improved its relative world position as a supplier of aluminum, tin, gold, copper, and crude oil, in order of greatest change as shown in table 1.

It is a tribute to the resource base of the region that, after 450 years of mining operations, Latin America is still a key producer of silver and gold.

Latin America's proven oil reserves at the end of 1990, including condensates and natural gas liquids, amounted to about 122 billion barrels or 12.2% of the world total. As a region, Latin America ranks second to the Middle East in oil reserves. About 90% of these oil reserves is located in Venezuela and Mexico, with the remaining 10% distributed among Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, and Peru. In the past 25 years, about 150 billion barrels of new reserves have been discovered in the region. This volume represents an increase of 600%, the highest rate of the world in the considered period, which evidences the great effort put forth in exploration and production. The region's total oil production averaged 7.4 million barrels daily in 1990 or 11.4% of the world, with Mexico and Venezuela being responsible for more than two-thirds of this output. Projections indicate that Latin America's production may reach the 10-million-barrels-per-day level before the end of this decade. At the present production rate, Latin America oil reserves will last 50 years, more than the world average of 45 years. The refining capacity installed in the region is about 7.7 million barrels daily, 80% of which is operated directly by state oil companies, an ownership pattern that may change over time. As a region, Latin America is self-sufficient in refining. Regarding natural gas, Latin America holds

a relatively modest position in the world. The proven reserves are 7.3 trillion cubic meters, representing about 6% of the world total.

In addition to oil, gas, and coal, the region is significant as a source of geothermal power. Mexico ranks third after the United States and the Philippines in installed geothermal generating capacity, followed at much lower levels by El Salvador, Nicaragua, and Costa Rica in order of capacity.

Energy statistics on the region are compiled and disseminated by the Latin American Energy Organization OLADE established in November 1973 and headquartered in Quito, Ecuador. OLADE is made up of 26 member countries in Latin America. According to OLADE's statistical report of 1991, the OLADE group of countries produced 6.7% of the world's total energy output, but consumed only 5.4% of the world total. As a region, Latin America was a net exporter of energy. Electrical generation by the OLADE group was based on the following sources: hydroelectric, 64.7%; thermoelectric, 32.4%; nuclear 1.8%, and geothermal 1.0%. The OLADE group has 22% of the world's hydropower potential compared with the 6.8% share of North America.

Relative to growing domestic requirements, Latin America and Canada produce an important surplus of mineral commodities for international trade. In value terms, the most important mineral exports for the global economy include: crude oil, natural gas, silver, copper, gold, bauxite, zinc, and aluminum in order of value. Latin America is not a significant coal producer, but has a greater role as exporter of steam coal by Colombia. Coal exports from Colombia increased from less than 1 million tons in 1983 to 16.5 million tons in 1990 and were expected to increase to 35 million tons by the year 2000.

For most of the countries in the region, the United States is the major market for their mineral exports. As border countries, Canada and Mexico export the major part of their surplus mineral output to the

United States. In turn, the United States depends upon Canada and Mexico as the primary suppliers of a large variety of mineral commodities. Canada is the leading supplier to the U.S. economy of natural gas, asbestos, nickel, potash, cadmium, selenium, peat, zinc, gypsum, iron ore, nitrogen, sodium sulfate, salt, mica, copper, and lead, in order of U.S. net percentage dependency. On the other hand, Mexico is the leading supplier to the United States of cement, fluorspar, graphite, strontium, and sulfur.

In 1990, the United States imported crude oil from eight countries in Latin America as detailed in table 5: Mexico, Venezuela, Colombia, Trinidad and Tobago, Ecuador, Peru, Argentina, and Guatemala, in order of magnitude. But the bulk of oil imports came from the first three countries mentioned. If exports of petroleum products are taken into account, Venezuela becomes the most important supplier of oil to the U.S. market from Latin America. Total U.S. oil imports from Latin America in 1990 represented 25% of total U.S. oil imports of 2.1 billion barrels. Combined oil imports from both Latin America and Canada account for about 40% of total U.S. oil imports. In the Western Hemisphere, Venezuela surpassed Canada as the leading oil supplier to the United States in 1990. In sum, the United States relies heavily on the Western Hemisphere as a source of energy minerals. This dependency is more pronounced if U.S. imports of natural gas are included. In 1990, natural gas imports from Canada accounted for almost 10% of U.S. consumption. The good road, rail, and pipeline infrastructure between the United States and Canada and Mexico facilitates the importation of oil and natural gas.

The extensive mineral trade between the United States and Canada is expected to be enhanced and facilitated by the bilateral free trade agreement (FTA) that became effective on January 1, 1989. The FTA includes a schedule for the elimination of mineral and metal tariffs during varying periods not to exceed 10 years. In June 1990, the Presidents from Mexico and the United States endorsed the concept of a comprehensive free trade agreement between the United States of America and the United Mexican States. In February 1991, after preliminary trilateral discussions, Canada, Mexico, and the United States decided to proceed with trilateral negotiations to create a North America Free Trade Area (NAFTA). The NAFTA

negotiations will include trade and investment issues relating to energy and other mineral commodities. Canada is the most important trading partner of the United States and Mexico is third in importance after Japan. A NAFTA would create a formidable trading bloc with a population of 360 million and an economic output of \$6 trillion exceeding that of the European Community. Next in the region as a U.S. trading partner is Brazil, in 13th rank, followed by Venezuela in 17th rank.

Mineral trade in the Western Hemisphere is also expected to be enhanced by the new U.S. policy enunciated in June 1990, the "Enterprise for the Americas Initiative." This policy initiative is promoting the alleviation of foreign debt and the liberalization of trade and investment in Latin America, changes that would impact favorably on the region's mineral sector.

In line with this initiative, the United States signed framework agreements on trade and investment by mid-1991 with 16 Latin American countries. The framework agreements with Bolivia and Mexico actually predated the June 1990 initiative. Included in the 16 countries is a group of four countries, Argentina, Brazil, Paraguay, and Uruguay, which has agreed to form a Southern Cone Common Market (MERCOSUR) by the end of 1995. Also included is the Andean group formed by Bolivia, Colombia, Ecuador, Peru, and Venezuela, which has agreed to create an Andean Free Trade Zone by 1992 and a common market by 1996. The framework agreement with CARICOM (composed of 13 English-speaking Caribbean nations) was expected by late summer 1991.

The framework agreements create Trade and Investment Councils with Government and private-sector participation that will consult on trade and investment relations and work toward liberalizing trade and investment opportunities. In connection with these agreements, countries such as Bolivia, Chile, and Mexico have liberalized their foreign investment laws and mining codes to provide incentives for foreign capital. Increased foreign investment in the mining sector is seen as a way of diversifying and expanding exports, thereby gaining foreign exchange to confront the large foreign debts in most of the countries in Latin America.

Mineral development in Latin America was hampered by the large foreign debt—official and private—contracted by the individual countries. By yearend 1990, this debt for the region totaled \$422 billion.

Of the 15 highly indebted countries around the world, 10 are in Latin America: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Uruguay, and Venezuela. As a means of reducing the external debt, Chile and Mexico utilized debt-equity swaps. Chile was very successful as the pioneer of this mechanism. Particularly in the case of Chile, a number of mineral projects have benefited from this central bank mechanism either to finance direct foreign investments or to gain an equity position in a local company.

A review of the structure of the mineral industry in Latin America shows it to be dominated by oil companies, generally state-owned and of world class. The first Latin American company in Fortune Magazine's list of the 500 largest global companies is *Petróleos de Venezuela*, with 1990 sales of \$23.5 billion giving it a world rank of 43. It is followed by two other state-owned oil companies, *Petróleos Brasileiros (PETROBRAS)* of Brazil, with rank of 52, and *Petróleos Mexicanos (PEMEX)* of Mexico, with rank of 57. All the companies moved up in rank relative to 1989. *Petróleos de Venezuela* jumped to rank 43 from rank 76 in 1989 with a 72% sales increase, partly because of its acquisition of Citgo, an Oklahoma-based refiner, and 50-50 joint venture with Veba Oil of Germany. The largest mining companies in Latin America of world class are *Companhia Vale do Rio Doce (CVRD)* in Brazil and *Codelco* in Chile, both state-owned with ranks of 374 and 404, respectively, in the Fortune 500. The largest Canadian company, and also mineral-related, is *Alcan Aluminium* with 150 rank. *Codelco-Chile* was in eighth place in 1990 among 10 companies with the highest return on sales. In the global 500 list of the 10 companies with the highest returns on assets, *Petróleos de Venezuela* was listed in ninth place.

¹Orlando Martino, Chief, Branch of Latin America and Canada, Division of International Minerals.

SELECTED GENERAL SOURCES OF REGIONAL INFORMATION

American Petroleum Institute, Washington, DC: Basic Petroleum Data Book, annual.

Barclays Bank International, London: ABECOR Group Country Reports.

- British Sulphur Corp. Ltd., London:
Nitrogen, bimonthly.
Phosphorus and Potassium, bimonthly.
Sulphur, bimonthly.
- Bureau de Recherches Geologiques et
Minieres, Paris:
Chronique de la Recherche Miniere,
quarterly.
- Bureau de Documentation Miniere, Paris:
Annales des Mines, monthly.
- EMEP—Editorial Ltda. Sao Paul:
Minerios Extracao and Processamento,
monthly.
- G & T International (Chile):
Latinominería, quarterly.
- Instituto Latinoamericano del Fierro y el
Acero (ILAFA), Santiago:
Anuario Estadístico de la Siderurgia y
Minerá del Hierro de América Latina,
annual.
Siderurgia Latinoamericana, monthly.
- Inter-American Development Bank,
Washington, DC:
Economic and Social Progress in Latin
America, annual report.
IDB News, monthly.
- Intergovernment Council of Copper
Exporting Countries (CIPEC): Quarterly
Review.
- International Bauxite Association (IBA),
Kingston, Jamaica: Review, quarterly.
- Institution of Mining and Metallurgy, London:
Transactions, quarterly.
- International Lead and Zinc Study Group,
London.
- International Monetary Fund, Washington, DC:
International Financial Statistics,
monthly.
Annual Yearbook.
- Kal Wagenheim, Maplewood, NJ: Caribbean
Update, monthly.
- Latin American Energy Organization
(OLADE):
Energy Statistics, annual.
Energy Magazine, issued every 4 months.
- Latin American Mining Institute,
Washington, DC:
The South American Investment and
Mining Guide, annual.
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Weekly Report.
Commodities Report, biweekly.
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and Mining Journal, monthly.
- MILDA Limited, London: Latin American
Mining Letter, biweekly.
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World Mining, monthly.
World Mining, yearbook.
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Mining Magazine, monthly.
Mining Journal, weekly.
Mining Annual Review, July issue.
- Metallgesellschaft Aktiengesellschaft,
Frankfurt: Metal Statistics, annual.
- National Coal Association, Washington, DC:
International Coal, annual.
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Washington, DC: Trade News, monthly.
- Organization of Petroleum Exporting
Countries, Vienna, Austria:
Annual Report.
Annual Statistical Bulletin.
- PennWell Publishing Co., Tulsa, OK:
International Petroleum Encyclopedia.
- Samim, Rome: Metalli Non Ferrosi, annual
report.
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Latin America and the Caribbean:
Preliminary Economic Overview, annual.
CEPAL News, monthly.
Statistical Office, U.N. Trade Statistics.
- U.S. Central Intelligence Agency: World
Factbook, annual.
- U.S. Department of Commerce:
Bureau of the Census, trade statistics.
International Trade Administration:
Foreign Economic Trade and Their
Implications for the United States,
semiannual by country.
International Marketing Information Series.
- U.S. Department of Energy, Office of
International Affairs:
International Energy Annual, DOE/EIA-0219.
Petroleum Supply Annual Vol. 1 and 2.
DOW/EIA-0340.
- U.S. Department of the Interior, Bureau of
Mines:
Mineral Commodity Summaries, annual.
Minerals Yearbook, v. I, Metals and
Minerals.
Mineral Perspectives Series: Mineral
Industries of Latin America, July 1988.
- U.S. Joint Publications Research Service,
Arlington, VA: Foreign Broadcast
Information Service Regional Publications,
weekly.
- University of Miami, North-South Center
for Latin American Studies: North-South,
the Magazine of the Americas, bimonthly.
- World Bank, Washington, DC: Bank news
releases.
- World Bureau of Metals Statistics, London:
World Metal Statistics, monthly.
- World Mining, San Francisco: Yearbook.
- World Reports Limited, New York: The Latin
American Times, monthly.

LATIN AMERICA

AREA 19.5 million km²

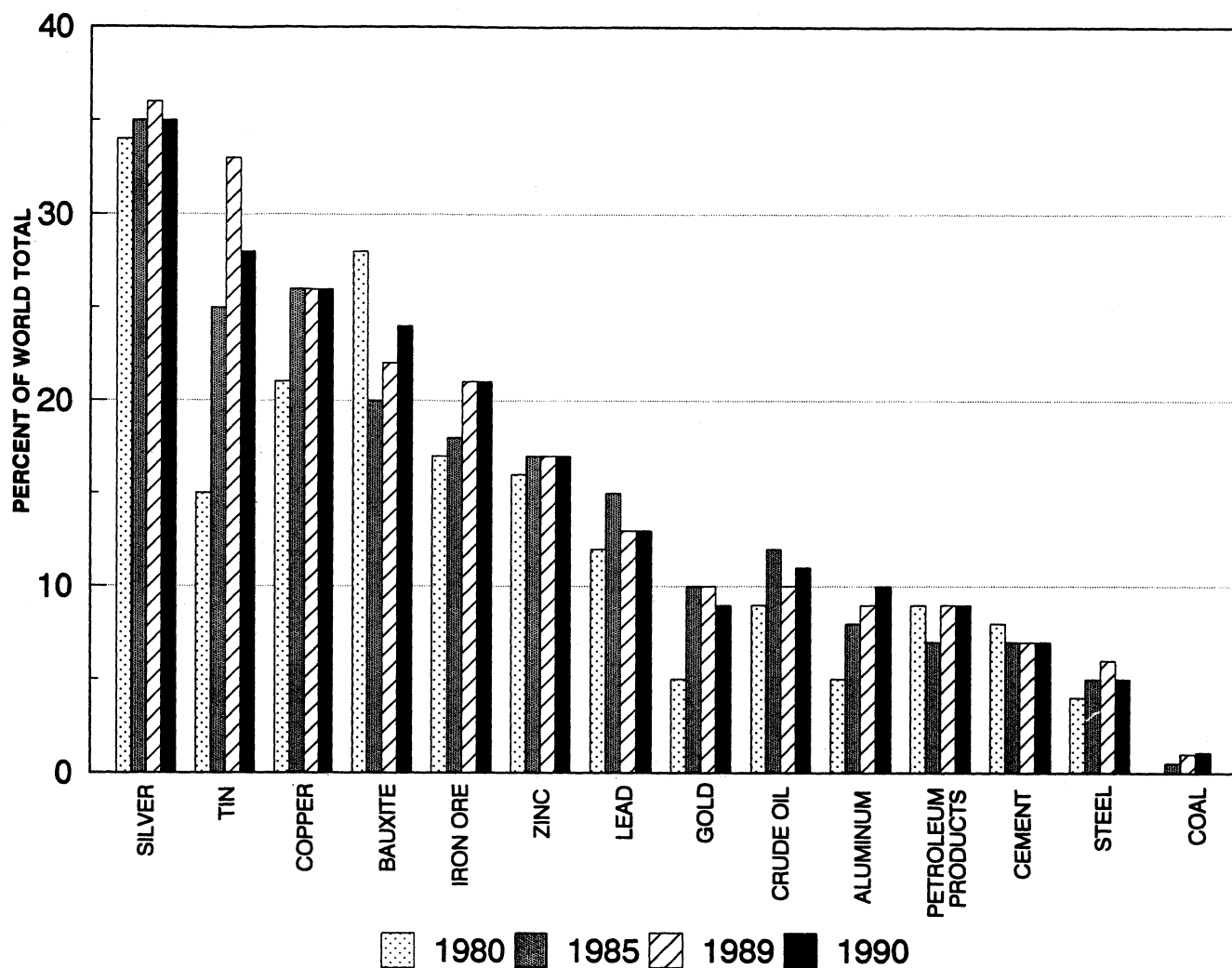
POPULATION 462 million



MAJOR MINERALS IN LATIN AMERICA

FIGURE 1

LATIN AMERICA: RELATIVE WORLD POSITION OF SELECTED MINERAL OUTPUT



SOURCE: U.S. Bureau of Mines

TABLE 1
**LATIN AMERICA: CHANGES
 IN RELATIVE WORLD POSITION
 OF SELECTED MINERAL OUTPUT**

(In percent share)

Mineral	1980	1990	Change
Aluminum	5	10	100%
Tin	15	28	86%
Gold	5	9	80%
Copper	21	26	24%
Crude oil	9	11	22%

Source: U.S. Bureau of Mines.

TABLE 2
PRODUCTION OF SELECTED MINERALS IN LATIN AMERICA, 1989
(Thousand metric tons unless otherwise specified)

	Metals									
	Aluminum, metal	Bauxite	Copper, mine output	Gold (tons)	Iron ore gross weight	Lead, mine output	Silver (tons)	Steel, crude	Tin, mine output	Zinc, mine output
Argentina	162	—	1	1	1,017	27	83	3,909	(¹)	43
Bolivia	—	—	(¹)	4	14	16	267	—	16	75
Brazil	890	8,442	44	100	153,700	16	124	25,055	50	176
Chile	—	—	1,628	23	9,030	1	545	800	—	18
Colombia	—	—	—	30	573	(¹)	7	706	—	(¹)
Cuba	—	—	2	—	—	—	—	336	—	—
Guyana	—	1,321	—	3	—	—	—	—	—	—
Jamaica	—	9,601	—	—	—	—	—	37	—	—
Mexico	72	—	254	9	8,141	163	2,306	7,851	(¹)	284
Peru	—	—	368	10	4,300	192	1,840	401	5	597
Suriname	28	3,530	—	—	—	—	—	—	—	—
Venezuela	702	540	—	4	18	—	—	2,941	—	—
Others	—	151	2	15	12	10	73	462	—	37
Total Latin America	1,854	23,585	2,299	110	176,805	425	5,246	42,561	71	1,230
Share of world percent	10	22	26	5	19	13	35	6	32	17
Canada	1,554	—	722	159	40,900	275	1,312	15,458	3	1,215
United States	4,030	W	1,498	266	59,032	419	2,007	88,852	W	288
Total Western Hemisphere ⁶	7,438	23,585	4,519	535	276,737	1,119	8,565	146,871	74	2,733
Share of world percent	42	22	51	26	30	33	57	19	34	37

	Industrial minerals						Fuels			
	Barite, crude	Cement, hydraulic	Gypsum, crude	Phosphate rock	Salt, all forms	Sulfur, all forms	Coal, all grades	Natural gas, gross (million cubic meters)	Petroleum (thousand barrels)	
								Crude	Products	
Argentina	58	4,470	402	(¹)	1,186	—	511	21,992	167,949	164,757
Bolivia	—	505	(¹)	—	(¹)	8	—	⁵ 5,291	7,274	⁸ 8,155
Brazil	64	25,883	799	3,655	3,646	301	7,186	6,091	217,971	460,650
Chile	60	¹ 1,700	277	14	904	¹ 436	2,404	4,236	8,063	42,425
Colombia	5	6,643	553	31	660	54	18,902	5,113	147,563	⁸ 82,410
Cuba	—	³ 3,700	¹ 130	—	² 200	⁵	—	³ 34	5,200	55,000
Dominican Republic	—	¹ 1,600	171	—	30	—	¹	—	—	9,236
Ecuador	—	2,250	48	—	—	14	5	180	105,000	43,100
Guatemala	4	1,613	57	—	63	—	—	⁹	1,328	4,249
Mexico	325	22,766	5,390	² 655	6,703	² 369	9,983	36,919	917,355	539,853
Netherlands Antilles	—	—	—	¹ 15	³ 350	³ 60	—	—	—	65,335
Peru	¹ 150	2,105	¹ 160	¹ 13	¹ 200	⁶ 66	¹ 150	1,125	47,597	55,570
Trinidad and Tobago	—	380	—	—	—	⁴ 5	—	7,146	56,189	28,225
Venezuela	(¹)	4,510	332	237	⁵ 500	¹ 125	2,113	38,097	696,407	³ 380,075
Others	—	4,591	220	—	962	2	—	32	1,831	47,348
Total Latin America	666	82,716	8,544	4,620	15,404	3,445	41,255	126,265	2,379,727	1,986,388
Share of world percent	12	7	9	3	8	6	1	6	11	9
Canada	39	11,832	⁸ 196	—	¹ 11,057	⁶ 6,692	71,000	114,661	⁵ 583,827	639,485
United States	290	72,700	15,988	49,817	35,250	11,592	889,948	488,185	2,778,745	5,538,875
Total Western Hemisphere ⁶	995	167,248	32,728	54,437	61,711	21,729	1,002,203	729,111	5,742,299	8,164,748
Share of world percent	17	15	33	33	32	37	21	36	26	35

¹Estimated. ²Revised. ³Withheld to avoid disclosing company proprietary data.

⁴Less than 1/2 unit.

⁵Includes only output used to manufacture fertilizers.

⁶Byproduct of petroleum.

⁷Byproduct of petroleum. Sulfur as a byproduct of natural gas may also be produced, but information is inadequate to make reliable output estimates.

⁸Including synthetic crude (from oil shale and/or tar sands).

⁹Excludes Greenland.

TABLE 3
PRODUCTION OF SELECTED MINERALS IN LATIN AMERICA, 1990

(Thousand metric tons unless otherwise specified)

	Metals									
	Aluminum, metal	Bauxite	Copper, mine output	Gold (tons)	Iron ore gross weight	Lead, mine output	Silver (tons)	Steel, crude	Tin, mine output	Zinc, mine output
Argentina	166	—	(¹)	1	992	27	80	3,636	(¹)	40
Bolivia	—	—	(¹)	5	125	20	311	—	17	104
Brazil	931	9,876	46	*80	150,000	14	125	20,567	39	132
Chile	—	—	1,603	28	8,248	1	633	800	—	25
Colombia	—	—	—	29	628	(¹)	7	703	—	(¹)
Cuba	—	—	3	—	—	—	—	270	—	—
Guyana	—	1,424	—	4	—	—	—	—	—	—
Jamaica	—	10,921	—	—	—	—	—	24	—	—
Mexico	68	—	294	8	8,073	180	2,346	8,705	(¹)	322
Peru	—	—	318	*10	3,246	189	1,728	284	5	577
Suriname	28	3,000	—	(¹)	—	—	—	—	—	—
Venezuela	590	771	—	8	20,365	—	—	2,677	—	—
Others	—	85	1	19	11	6	42	587	—	30
Total Latin America	1,783	26,077	2,265	192	191,688	437	5,272	38,253	61	1,230
Share of world percent	10	24	26	9	21	13	35	5	28	17
Canada	1,567	—	802	165	36,443	232	1,400	12,281	3	1,176
United States	4,048	W	1,587	290	56,400	495	2,170	89,720	W	543
Total Western Hemisphere ⁶	7,298	26,077	4,654	647	284,531	1,164	8,842	140,254	64	2,949
Share of world percent	42	24	53	32	31	35	59	18	29	40
	Industrial minerals						Fuels			
	Barite, crude	Cement, hydraulic	Gypsum, crude	Phosphate rock	Salt, all forms	Sulfur, all forms	Coal, all grades	Natural gas, gross (million cubic meters)	Petroleum (thousand barrels)	
								Crude	Products	
Argentina	*50	3,629	*400	(¹)	*1,201	—	278	21,800	175,836	169,104
Bolivia	(¹)	560	(¹)	—	(1/2)	2	—	5,276	7,635	8,500
Brazil	*55	25,900	875	*2,968	*3,800	*316	*7,200	6,280	231,045	468,700
Chile	3	*1,800	253	12	1,834	*449	2,695	4,198	*7,157	*42,570
Colombia	5	6,320	*500	37	687	*40	20,400	*5,600	*159,500	*83,715
Cuba	—	*2,600	*150	—	*200	*5	—	*34	5,738	*53,000
Dominican Republic	—	*1,060	*78	—	*11	—	*1	—	—	*7,916
Ecuador	—	2,250	40	—	—	14	3	150	106,006	39,231
Guatemala	(¹)	1,675	66	—	109	—	—	10	1,400	4,000
Mexico	305	23,824	5,434	*595	7,135	*2,432	10,014	37,741	930,023	572,226
Netherland Antilles	—	—	—	*15	*350	³ *60	—	—	—	*70,000
Peru	*150	*2,185	*150	*20	*200	*66	*175	1,100	47,050	54,080
Trinidad and Tobago	—	438	—	—	—	⁴ *5	—	7,000	56,000	28,130
Venezuela	—	5,230	201	165	430	106	2,190	40,516	770,133	377,270
Other	(¹)	*5,024	275	—	865	*2	—	33	454	50,233
Total Latin America	568	82,495	8,422	3,812	16,822	3,497	42,956	129,738	2,499,457	202,675
Share of world percent	10	7	9	2	9	6	1	6	12	9
Canada	48	1,300	8,202	—	11,097	*6,849	68,331	138,358	*381,362	637,376
United States	290	71,268	15,988	46,343	35,632	11,592	752,964	498,660	3,137,905	5,300,530
Total Western Hemisphere ⁶	906	165,063	32,612	50,155	63,551	21,938	864,251	766,756	6,018,724	7,966,581
Share of world percent	16	15	33	32	33	38	23	36	28	35

⁶Estimated. ⁷Revised. ^{**}Withheld to avoid disclosing company proprietary data.

¹Less than 1/2 unit.

²Includes only output used to manufacture fertilizers.

³Byproduct of petroleum.

⁴Byproduct of petroleum. Sulfur as a byproduct of natural gas may also be produced, but information is inadequate to make reliable output estimates.

⁵Including synthetic crude (from oil shale and/or tar sands).

⁶Excludes Greenland.

TABLE 4
U.S. DEPENDENCY ON IMPORTS OF PETROLEUM FROM LATIN AMERICA, 1989
 (Thousand 42-gallon barrels)

Country	Crude oil	Percent share	Petroleum products ¹	Percent share	Total petroleum	Percent share
Venezuela	180,598	32.7	137,947	54.0	318,545	39.5
Mexico	261,244	47.3	18,724	7.3	279,968	34.7
Colombia	49,615	9.0	² 13,018	5.1	62,633	7.8
Trinidad and Tobago	26,815	4.9	7,667	3.0	34,482	4.3
Ecuador	29,208	5.3	³ 3,425	1.3	32,633	4.0
Brazil	—	—	29,862	11.7	29,862	3.7
Netherlands Antilles	—	—	15,316	6.0	15,316	1.9
Bahamas	—	—	² 12,235	4.8	12,235	1.5
Peru	359	.1	² 10,590	4.1	10,949	1.4
Argentina	3,257	.6	5,808	2.3	9,065	1.1
Panama	—	—	² 673	.3	673	.1
Guatemala	655	.1	—	—	655	.1
Total	551,751	100	255,265	100	807,016	100
Total U.S. imports	2,132,761	100.0	809,338	100.0	2,942,099	100.0
From Latin America	551,751	25.9	255,265	31.5	807,016	27.4
From Canada	230,043	10.8	109,906	13.6	339,949	11.6
From Western Hemisphere	781,794	36.7	365,171	45.1	1,146,965	39.0

¹Composed of LPG, motor gasoline, jet fuel, residual fuel oil, kerosene, naphthas, asphalt, and other products.

²Mostly residual fuel oil.

Source: U.S. Department of Energy, Energy Information Administration, Petroleum Supply Annual 1989, Feb. 1991.

TABLE 5
U.S. DEPENDENCY ON IMPORTS OF PETROLEUM FROM LATIN AMERICA, 1990
 (Thousand 42-gallon barrels)

Country	Crude oil	Percent share	Petroleum products ¹	Percent share	Total petroleum	Percent share
Venezuela	242,910	41.0	131,079	54.7	373,989	45.0
Mexico	251,345	42.4	24,249	10.1	275,594	33.1
Colombia	51,041	8.6	² 15,443	6.4	66,484	8.0
Trinidad and Tobago	27,803	4.7	² 7,235	3.0	35,038	4.2
Brazil	—	—	17,874	7.5	17,874	2.1
Ecuador	13,886	2.3	³ 3,845	1.6	17,731	2.1
Argentina	3,363	.6	10,300	4.3	13,663	1.6
Bahamas	—	—	² 13,360	5.6	13,360	1.6
Netherlands Antilles	—	—	11,338	4.7	11,338	1.4
Peru	568	.1	⁴ 4,629	1.9	5197	.6
Guatemala	1,295	.2	—	—	1295	.2
Panama	—	—	² 181	.1	181	—
Total	592,211	99.9	239,533	99.9	831,744	99.9
Total U.S. imports	2,151,387	100.0	775,008	100.0	2,926,395	100.0
From Latin America	592,211	27.5	239,533	30.9	831,744	28.4
From Canada	234,516	10.9	106,342	13.7	340,858	11.6
From Western Hemisphere	826,727	38.4	345,875	44.6	1,172,602	40.1

¹Composed of LPG, motor gasoline, jet fuel, residual fuel oil, kerosene, naphthas, asphalt, and other products.

²Mostly residual fuel oil.

Source: U.S. Department of Energy, Energy Information Administration, Petroleum Supply Annual 1990, Jan. 1992.

TABLE 6

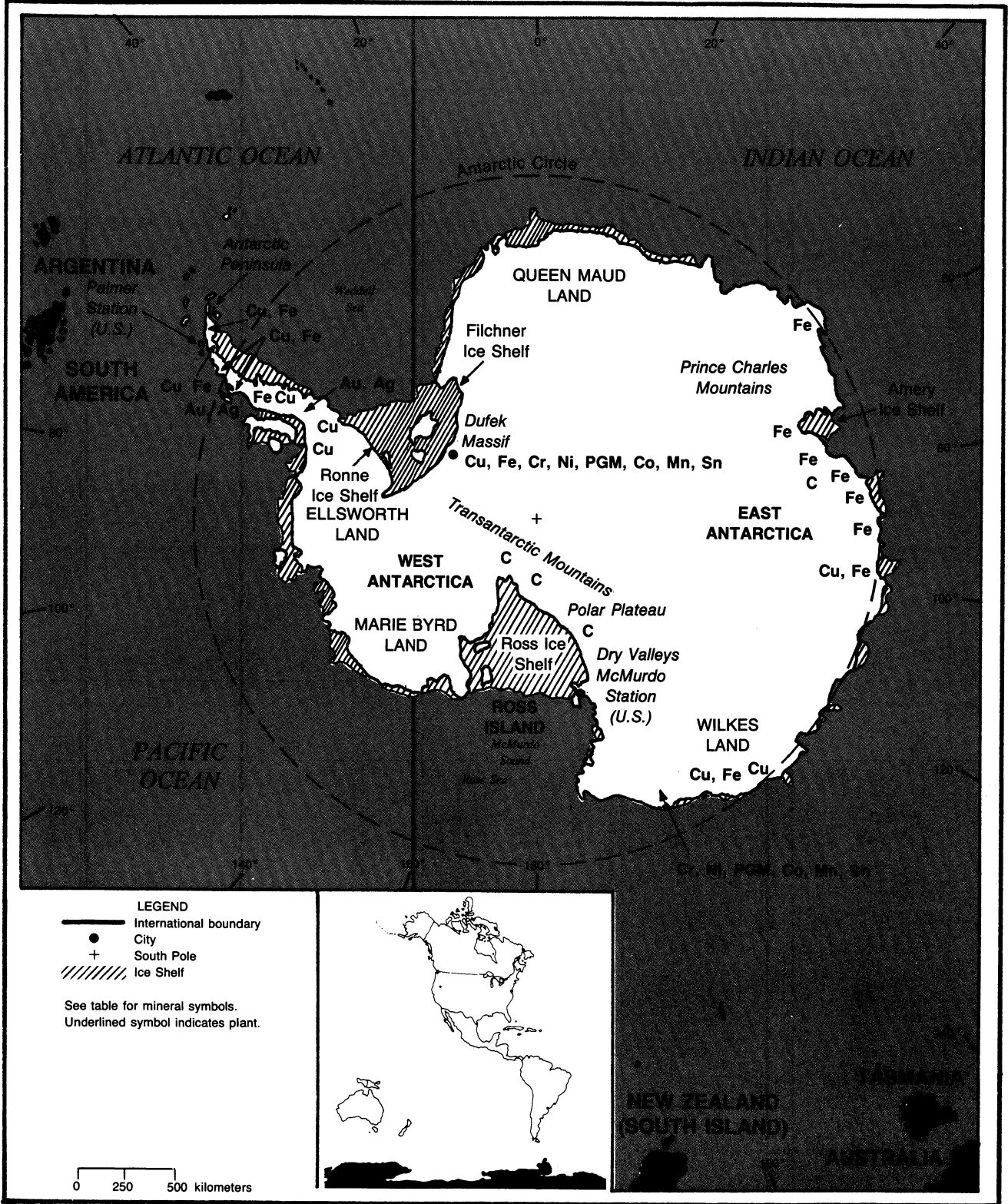
**LATIN AMERICA AND THE CARIBBEAN:
INTERNATIONAL ORGANIZATIONS**

ACP	African, Caribbean, and Pacific countries (associated with the EC).
ANCOM	Andean Common Market.
—	Andean Pact.
ARPEL	Latin American State Oil Companies Association.
CABEI	Central American Bank for Economic Integration.
CACM	Central American Common Market.
CARICOM	Caribbean Community and Common Market.
CARIFTA	Caribbean Free Trade Area.
CDB	Caribbean Development Bank.
CELAM	Conference of Latin American Bishops.
ECLAC	Economic Commission for Latin America and the Caribbean (UN).
IADB	Inter-American Defense Board.
IAIC	Inter-American Investment Corporation.
IDB	Inter-American Development Bank.
ILAFA	Latin American Iron and Steel Institute.
ILAI	Institute for Latin American Integration.
ILPES	Latin American Institute for Economic and Social Planning.
LAIA	Latin American Integration Association.
MERCOSUR	Southern Cone Common Market (Argentina, Brazil, Paraguay, and Uruguay).
NAFTA	North American Free Trade Agreement.
OAS	Organization of American States.
ODECA	Organization of Central American States.
OECS	Organization of Eastern Caribbean States.
OLADE	Latin American Energy Organization.
OLAMI	Latin American Mining Organization.
PAHO	Pan American Health Organization.
—	Rio Group.
SELA	Latin American Economic System.
TCA	Amazon Cooperation Treaty.

ANTARCTICA

AREA 14.3 million km²

POPULATION varies



ANTARCTICA

By H. Robert Ensminger

Antarctica, a huge continent of about 14 million square kilometers in area, lies almost entirely within the Antarctic Circle. It is almost entirely surrounded by deep ocean basins and contains a thick ice sheet varying from 1,500 meters to 3,900 meters in thickness. Recent geophysical studies have revealed a reasonably complete physiographic picture beneath the ice cover. West Antarctica is connected to the main part of the continent by a mountain chain that lies well above sea level, though largely masked by ice and snow. The mountains of Marie Byrd Land are a large island mass surrounded by ice that extends well below sea level. The bedrock of most of East Antarctica apparently lies above sea level, with the high ranges of the Transantarctic Mountains and Queen Maud Land lying far above sea level.

The Antarctic Treaty, signed on December 1, 1959, and entered into force on June 23, 1961, established for at least 30 years a legal framework for peaceful use, scientific research, and suspension of territorial claims. Administration is carried out through consultative member meetings; the 14th and last meeting was held in Rio de Janeiro (Brazil) in October 1987.

Consultative (voting) members include claimant nations, who claim portions of Antarctica as national territory (some claims overlap), and nonclaimant nations, who have made no claims to Antarctic territory, although the United States and U.S.S.R. have reserved the right to do so and do not recognize the claims of others.

Argentina and Chile are signatories of the 1961 Antarctica Treaty and are among the seven countries making claims on Antarctica territories. In October 1985, Uruguay achieved Consultative Party status within the treaty. Cuba and Peru are acceding (nonvoting) members. Argentina and Chile maintain research stations on Antarctica. Of all the claimant nations, Argentina has had the longest presence on Antarctica, dating back to 1904. Argentina

and Chile have signed the agreement called the Convention on the Regulation of Antarctic Mineral Resources Activities (CRAMRA) negotiated by the Antarctica Treaty nations during the period 1982-88.

In 1990, two concurrent resolutions were passed by the United States Congress: House of Representatives Concurrent Resolution 109 and Senate Concurrent Resolution 26, which declared that it is U.S. policy to pursue an indefinite or permanent ban on commercial mineral development activities in Antarctica. Both resolutions received widespread bipartisan support as well as the backing of major environmental groups.

It is highly improbable that Antarctica is the only continent on Earth wholly devoid of significant mineral deposits. Certain metalliferous fold belts in Africa, Australia, and South America appear to have continuations in Antarctica. This is based on the Gondwanaland concept.

Any technological and/or economic evaluation for a prospective mine can at best be based on circumstantial geologic evidence. However, there is a sound scientific basis for defining high-probability areas of ore-grade mineral concentrations in Antarctica. Some copper-bearing plutons on the Antarctic peninsula have distinct similarities to the Andean porphyry copper bodies. The Dufek Massif (intrusion), near the African end of the Transantarctic Mountains, bears a distinct resemblance to the Bushveld Complex in the Republic of South Africa. The two complexes are comparable in areal extent, although they are quite different in geologic age.

Based on geologic structure and geophysical evidence, there is a clear recognition by the scientific community that petroleum reserves are likely to be present, particularly offshore in the thick sedimentary basins of the Amery Ice Shelf, Filchner Ice Shelf, Ronne Ice Shelf, Ross Sea and Ice Shelf, and the Weddell Sea. Shows of petroleum and natural gas were encountered during Deep Sea Drilling Project Leg

28 in 1973 while drilling on the continental shelf in the Ross Sea area. The discovery of hydrocarbons along the Atlantic coasts of Africa and South America, the east coast of India, and the south coast of Australia underscores the possibility of similar accumulations along the coasts of Antarctica.

INFRASTRUCTURE

The infrastructure of Antarctica consists of permanent and temporary scientific stations that have been established by Argentina, Australia, Chile, France, the Federal Republic of Germany, Great Britain, India, Japan, New Zealand, the Republic of South Africa, the U.S.S.R., and the United States. These stations have been or are supplied by ship and planes using temporary airstrips totaling 39. There are no ports, only offshore anchorage. There are no indigenous inhabitants, and the total number of foreign inhabitants varies up to 4,000, depending on the time of year.

OUTLOOK

The Convention on the Regulation of Antarctic Mineral Resource Activities (Antarctic Minerals Treaty) was adopted in Wellington, New Zealand, on June 2, 1988. It seeks, among other things, to regulate a controlled, rational approach to future mineral exploration activities in the Antarctic. A special consultative meeting was being planned for yearend 1990 in Viña del Mar, Chile, to discuss a protocol to the Antarctic Treaty for the protection of the Antarctic environment and its associated ecosystems.

At present, there is no driving interest toward the economic feasibility of exploration and especially exploitation of onshore mineral wealth within the ensuing several decades. This is predicated on Antarctica's remoteness, its harsh climate, the amount of ice coverage (98%), the lack of suitable

mining related technology, the overabundance of minerals elsewhere, and the potential opposition of environmentalists and conservationists.

OTHER SOURCES OF INFORMATION

Agencies

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1800 G Street, NW
Washington, DC 20550

United States Geological Survey
12201 Sunrise Valley Drive
Reston, VA 22092

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ARGENTINA

AREA 2.8 million km²

POPULATION 31.9 million



ARGENTINA

By Pablo Velasco

Argentina, the second largest country in South America after Brazil, continued being a modest producer of minerals. Its mining activities, excluding hydrocarbons, accounted for an estimated 0.3% or less of the country's 1990 GDP of about \$102.5 billion¹ (in current dollars). In 1990, the real GDP declined by about 1.0%, thus making it the third year in a row of economic decline. Argentina's GDP was about equally divided between the production of goods and services. The small private sector was overshadowed by the public sector, which constituted about 60% of the GDP. The informal economy, or underground economy, was very large in Argentina; some economists estimated that it made up the equivalent of as much as 60% of the GDP. In 1990, Argentina continued its self-sufficiency in energy resources (coal, gas, petroleum, and uranium) and was a large producer of electricity. Argentina was the fourth largest producer of crude oil and natural gas in Latin America and ranked third in world production of boron minerals. Argentina had the most advanced nuclear energy program in Latin America, with two nuclear plants in operation and a third one under construction. Nuclear plants provided 5,039 megawatts of electric power to Argentina in 1989, or 11% of the total of 46,489 megawatts. Argentina's mineral production and trade remained almost negligible in terms of their contributions to the GDP and total exports. Total mineral sector exports, including hydrocarbons, amounted to an estimated \$844 million, 78% higher than those in 1989. Nonmineral exports represented 0.1% of the total mineral sector's exports figure. The state-owned entities included the petroleum company Yacimientos Petrolíferos Fiscales (YPF), Gas del Estado, Hierro Patagónico de Sierra Grande S.A. Minera (HIPASAM), Sociedad Mixta Siderúrgica Argentina (SOMISA), Yacimientos Carboníferos Fiscales (YCF), Dirección General de Fabricaciones Militares (DGF), and the

Altos Hornos Sapla smelter. The largest privately owned companies were Cía. Minera Aguilar S.A. (CMASA), producer of lead, silver, and zinc; the only aluminum smelter in Argentina, Aluminios Argentinos S.A.I.C. (ALUAR), which produced a record 166,000 tons in 1990; ACINDAR Industria Argentina de Aceros S.A. (ACINDAR), a steel producer and manufacturer; and Surfacid S.A., a producer of zinc metal.

GOVERNMENT POLICIES AND PROGRAMS

The Federal Government introduced several measures to promote foreign investment in 1990. The privatizations of several state-owned companies, which had begun in 1989, were completed in 1990. Some drastic austerity plans imposed on Argentina by the International Monetary Fund (IMF), such as the closure and/or merger of several state-owned banks, consolidation of Government agencies, and reduction in the number of public employees, were put into effect.

The exchange rate remained fairly constant throughout 1990, at about \$5,400 Australes to the U.S. dollar.

In the mining sector, the principal Government mining agency was downgraded from the Secretary of Mining within the Ministry of Economy to the National Directorate of Geology and Mining. This agency has continued to promote several mining areas and projects in the country for foreign investment and has consolidated a geological, ore reserve, and project information into a useful manual for initial research. Despite the aforementioned efforts, the performance in terms of economic growth, foreign and domestic investment, deficit reduction, and public opinion was dismal during 1990.

A special commission was set up by the Government of Argentina to prepare mining reform guidelines for proposed mining

legislation to be submitted to the Congress. The special commission was composed of miners and legislators. Before yearend, the Government submitted a draft of the proposed mining legislation to the Congress after consultations with potential investors from Australia, Canada, the Republic of South Africa, and the United States.

Leading mining companies such as Anglo-American, Broken Hill Proprietary, Río Tinto Zinc (RTZ), and Lithium Corp. of America had requested that the proposed mining legislation ensure legal stability for long-term investment. Under the new reformed mining code, private output of minerals, including metallic, industrial minerals, and fuel minerals, would not be taxed if exported. Companies could count uneconomic reserves as company assets for accounting purposes. Equipment could be imported tax free and Federal taxes on multinational companies would be maintained at existing levels. The Argentine Government wanted the private sector, not the state, to have the leading role in promoting mining development. With Argentina's economy in crisis, the only source of risk capital required to activate mineral and metals production was foreign companies. Foreign investors were most interested in developing Argentina's known deposits of nonferrous metals such as copper, lead, tin, zinc, and smaller precious-metal ore bodies. In 1990, Argentina had a \$520 million trade deficit in metals and minerals while exporting \$82 million. The mining sector has been a drain on the national treasury for decades. Since its reopening in 1989, the Overseas Private Investment Corp. (OPIC) has become increasingly active in Argentina. The recent bilateral agreement allowed for semiautomatic Government approval of OPIC-supported projects after 30 days.

Several provincial governments were very active in promoting exploration joint ventures. The governments of Mendoza, San Juan, and Catamarca Provinces arranged their mining structure into much

more flexible organizations that were at liberty to form joint ventures. BHP, Anglo-American, RTZ, and other foreign companies were carrying out exploration programs, but no details were available.

PRODUCTION

Argentina continued to be the world's third largest producer and exporter of boron minerals and byproducts following the United States and Turkey. It also produced modest quantities of base metals such as cadmium, copper, lead, silver, and zinc; industrial minerals such as asfaltite, barite, bentonite, clays, celestite, feldspar, fluorite, granite, gypsum, kaolin, marble, sodium carbonate, and vermiculite; and mineral fuels such as coal, coke, and crude oil.

Production of precious metals was limited; gold output reached 1,200 kilograms, about the same level as that of the previous year. Smelter and refinery production of most metals, including ferroalloys, generally remained at about the same level as that of 1989. Crude steel production in Argentina decreased in 1990 to 3.6 million tons from 3.9 million tons the preceding year, while domestic consumption fell to 1.5 million tons from 2 million tons in 1989. The biggest producers of steel in Argentina were SOMISA and ACINDAR. Production of crude oil increased 4.7% to 175,836,000 barrels in 1990 compared with that of the previous year.

TRADE

The National Customs Administration and the National Institute of Statistics and Census reported the value of exported nonfuel minerals, mineral related products, and metals to be approximately \$82 million, an increase of 58.3% compared with that of 1989. The export value of crude oil and refinery products increased 78.3% to \$762 million. The following principal nonfuel mineral exports were classified in six groups based on their export value: (1) borates, 27.4%, of which boron minerals were 16%, boric acid, 8.4%, and sodium borate, 3%; (2) metals, 26.3%, of which zinc was 22.8% and lead, 3%; (3) metallic minerals, 23.2%, of which lead minerals and concentrate were 18.8% and zinc minerals and concentrates, 4.3%; (4) granites, 8.1%, of which manufacture was 6.7%; (5) marble, 1.7%, of which manufacture was 1.2%; and (6) others, 13.5%, of which salt was 3.7%, bentonite, 1.2%, perlite, 1.2%, and gypsum,

0.5%. In 1990, 90.5% of total mineral products exported went to the following nine countries: Brazil, 42.4%; United States, 11.7%; Belgium, 10.1%, Netherlands, 7.8%; the Republic of South Africa, 4.6%; Japan, 4.1%; Chile, 3.4%; India, 3.3%; and Italy, 3.1%.

Brazil remained the single largest importer of Argentine minerals, accounting for approximately 42% of the total. According to Government import figures, the value of imports of minerals and basic manufactured products derived from mineral substances amounted to about \$822 million. Imports of natural gas from Bolivia increased 3.5% to 2.2 million cubic meters having an estimated value of \$224 million. Imports of metallurgical coal from the United States and other countries decreased 7.3% to an estimated 1.0 million tons.

STRUCTURE OF THE MINERAL INDUSTRY

Government participation in the mineral industry through the National Directorate of Geology and Mining accounted for approximately 60% of the major operating mining companies in the country. Included were such companies as DGFM and HIPASAM, which mined iron ore for its SOMISA pellet and steel plant and the Altos Hornos Zapla smelter. The state-owned Yacimientos Mineros de Agua de Dionisio (YMAD) controlled the exploration, exploitation, and development of the Farallón Negro Mine (gold-silver-manganese), Bajo la Alumbreira copper-gold-silver-molybdenum deposit, Alto de la Blenda (lead-silver-zinc), Bajo el Durazno (copper, gold, and molybdenum), Agua Tapada, La Josefa (copper and gold), and Bajo San Lucas copper deposits.

The Comisión Nacional de Energía Atómica (CNEA) controlled Empresa Nuclear Mendoza's uranium production from the Sierra Pintada Mine and provided the uranium needed for the Atucha I and the Embalse nuclear powerplants in Buenos Aires and Córdoba Provinces, respectively. Atucha II, still under construction, will also utilize the same source of uranium (U_3O_8) fuel for its power reactor when completed. In the hydrocarbon sector, the Government, through the Secretary of Energy, controlled YPF, Gas del Estado, and YCF enterprises, which conducted the exploration, exploitation, contracting, marketing, and transportation of all petroleum, natural gas and bituminous coal produced domestically. In

addition, YPF managed some oil ventures in foreign countries, signed contracts with private national and foreign companies, and called for bids on the exploration, development, and exploitation of new areas in the country. The mineral industry in the private sector was composed of several mining and manufacturing companies such as Aluminios Argentinos SAIC (ALUAR), Cementos Loma Negra CIASA, Boroquímica SAMICAF, Cía. Minera Aguilar S.A., Cía. Sulfacid SACIyF, and hundreds of small metallic and industrial mineral companies engaged in mining activities throughout Argentina.

At yearend, there were 10.9 million people employed in the country, of which 12% were employed in agriculture, 31% in industry, and 57% in services. Of the total labor force, approximately 3.0 million, or 28%, were organized in labor unions. Approximately 6.2% of the labor force was unemployed in 1990. Of the total labor force employed in industry, 7,000 were in the cement industry, 36,000 in the metallurgical plants, 24,000 in the mining sector, and 21,000 in the oil and gas industry.

COMMODITY REVIEW

Metals

Aluminum.—Primary aluminum in Argentina was produced by Aluminios Argentinos S.A.I.C. (ALUAR). ALUAR's refinery in Puerto Madryn, Chubut Province, has an installed production capacity of 172,000 tons of primary aluminum per year. ALUAR's continuing addition of modern technology to the plant has enabled the company to operate in recent years at approximately 98% of its maximum capacity. Of the total company's capital investment, about 52% was controlled by FATE S.A., an automobile tire manufacturing company. Meanwhile, ALUAR has maintained control of the entire capital investment of KICSA Co., which was engaged in the partial elaboration of primary aluminum at its plant at Abastos District in the Buenos Aires Province.

Among other manufacturers of aluminum products is CAMEA S.A., with one plant in the Capital Federal City and the second one in the Buenos Aires Province. Uboldi's aluminum refinery was mainly engaged in the manufacturing of aluminum alloys for export from two small plants in Buenos Aires Province and at Puerto Madryn in Chubut Province. Imports of aluminum

TABLE 1
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e
METALS					
Aluminum:					
Primary	147,600	¹ 152,529	154,203	^e 162,000	³ 165,608
Secondary	6,500	7,500	7,100	^e 5,300	6,000
Beryllium: Beryl concentrate:					
Gross weight	50	46	39	89	85
BeO content	5	5	4	10	9
Cadmium: Smelter					
	47	46	46	54	48
Columbium: Columbite concentrate:					
Gross weight kilograms	—	—	^e 88	116	100
Cb ₂ O ₅ content do.	—	—	51	87	75
Copper:					
Mine output, Cu content	317	379	492	653	500
Refined	11,000	13,000	12,500	^e 11,000	10,000
Gold: Mine output, Au content kilograms					
	944	990	962	1,150	1,200
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand tons	790	850	1,037	1,017	992
Fe content do.	419	451	550	539	526
Metal:					
Pig iron do.	1,625	1,752	1,596	2,062	1,883
Sponge iron (direct reduction) do.	935	1,034	1,067	1,166	1,034
Total do.	2,560	2,786	2,663	3,228	2,917
Ferrous alloys, electric-furnace:					
Ferromanganese	19,782	21,407	19,737	25,545	³ 23,787
Ferrosilicomanganese	12,977	11,746	11,610	16,857	³ 21,536
Ferrosilicon	22,979	23,998	30,539	28,381	³ 17,509
Other	5,149	6,362	5,744	5,603	³ 7,124
Total	60,887	63,513	67,630	76,386	³ 69,956
Steel, crude thousand tons	3,235	3,633	3,652	3,909	³ 3,636
Semimanufactures ⁴ do.	3,178	3,512	3,624	3,844	³ 2,794
Lead:					
Mine output, Pb content	26,868	26,069	28,549	26,650	27,000
Metal:					
Smelter, primary	15,700	16,200	14,000	^e 13,000	14,000
Refined:					
Primary	15,700	16,200	14,000	^e 13,000	14,000
Secondary	15,000	16,000	15,000	^e 13,000	13,000
Total	30,700	32,200	29,000	^e 26,000	27,000
Manganese ore and concentrate:					
Gross weight	9,886	6,393	9,339	5,532	5,000
Mn content 2,458	1,324	1,817	1,162	1,100	
Silver, mine output, Ag content kilograms					
	⁶ 66,371	⁵ 59,667	79,415	83,436	80,000
Tin:					
Mine output, Sn content	379	186	446	405	400
Metal, smelter	² 230	² 240	280	^e 280	200
Tungsten, mine output, W content					
	20	14	13	20	16
Uranium, mine output, U₃O₈ content kilograms					
	203,753	112,499	167,516	60,850	61,000

See footnotes at end of table.

TABLE 1—Continued

ARGENTINA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e	
METALS—Continued						
Zinc:						
Mine output, Zn content	39,540	35,648	36,849	43,155	40,000	
Metal: Smelter:						
Primary	29,123	31,900	30,500	^e 29,000	29,500	
Secondary	3,000	2,600	2,500	^e 2,500	2,500	
Total	32,123	34,500	33,000	^e 31,500	32,000	
INDUSTRIAL MINERALS						
Asbestos	1,697	332	2,328	225	300	
Barite	58,617	33,462	48,972	57,558	50,000	
Boron materials, crude	191,871	184,786	269,574	261,308	260,000	
Cement, hydraulic	thousand tons	5,553	6,302	6,048	4,470	³ 6,229
Clays:						
Ball clay (plastic clay), n.e.s.	do.	1,580	644	844	307	400
Bentonite	146,191	108,595	173,930	^e 150,000	150,000	
Foundry earth	102,551	107,000	100,000	100,000	100,000	
Fuller's earth (decolorizing clay) ^e	2,000	2,000	2,000	2,000	2,000	
Kaolin	117,378	128,455	125,195	185,075	150,000	
Laterite (aluminous)	38,816	44,548	65,651	67,200	65,000	
Refractory	72,185	47,834	49,287	32,111	30,000	
Other ⁵	1,596,852	2,275,826	2,819,031	2,889,468	2,900,000	
Diatomite	14,362	5,098	7,122	6,301	7,000	
Feldspar	24,087	29,282	39,469	23,688	24,000	
Fluorspar	39,076	54,975	18,052	23,317	20,000	
Graphite	40	216	24	100	100	
Gypsum, crude	462,195	618,817	520,153	402,399	400,000	
Lithium: Spodumene, amblygonite, gross weight	184	178	119	104	120	
Mica:						
Sheet	234	340	330	^e 400	400	
Waste and scrap	317	451	630	^e 500	500	
Nitrogen: N content of ammonia	62,879	80,600	78,100	74,000	³ 70,000	
Phosphates: Thomas slag ⁶	16	8	55	50	55	
Pigments, mineral, natural: Ocher	1,027	1,022	815	578	600	
Pumice and related volcanic materials	22,957	99,093	164,300	127,853	125,000	
Salt:						
Rock	thousand tons	1	1	1	1	
Solar	do.	1,218	950	1,246	1,185	1,200
Total	do.	1,219	951	1,247	1,186	1,201
Sand and gravel:						
Sand:						
Construction	do.	10,389	9,048	9,657	8,740	9,000
Silica sand (glass sand)	do.	292	283	294	344	300
Gravel	do.	5,552	3,574	4,657	3,700	3,700
Stone:						
Basalt	do.	2,802	2,542	2,627	1,900	2,000
Calcareous:						
Calcite, nonoptical	7,687	2,800	41,130	^e 40,000	35,000	
Calcium carbonate (chalk)	13,448	28,500	51,300	58,500	50,000	
Dolomite	254,966	372,173	488,204	^e 250,000	250,000	

See footnotes at end of table.

TABLE 1—Continued

ARGENTINA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e
INDUSTRIAL MINERALS—Continued					
Stone—Continued					
Calcareous—Continued					
Limestone thousand tons	10,166	13,911	11,896	9,190	9,000
Marble:					
Aragonite, broken	513	2,160	5,504	1,882	2,000
Onyx, in blocks and broken	9,351	9,020	8,256	4,809	5,000
Travertine, in blocks and broken	4,423	14,462	21,107	3,467	4,000
Unspecified, in blocks and broken	98,227	49,007	72,959	35,122	35,000
Flagstone	53,943	64,945	42,809	77,913	75,000
Granite:					
In blocks	30,424	31,331	50,398	39,347	40,000
Crushed thousand tons	3,747	3,693	5,425	4,168	4,000
Quartz, crushed	126,255	134,018	153,816	140,538	140,000
Quartzite, crushed thousand tons	580	2,128	1,287	691	700
Rhodochrosite do.	13	19	19	40	35
Gamestone (agate, amatist, apolo, turmalin, etc.)	—	40,200	2,000	5,000	4,000
Sandstone	346	608	120	³ 300	300
Serpentine, crushed	23,010	28,689	29,750	11,333	11,000
Shell, marl	320,898	830,325	383,363	285,630	300,000
Tuff and tasca thousand tons	1,306	12,146	8,966	2,006	2,000
Strontium minerals: Celestite	1,133	1,349	2,241	1,193	1,200
Sulfates, natural:					
Aluminum (alum)	30,489	60,291	71,985	66,844	65,000
Magnesium (epsomite)	762	2,500	12,140	⁷ 7,000	7,000
Sodium (mirabilite)	31,789	27,483	15,341	10,281	11,000
Talc and related materials:					
Pyrophyllite	2,812	1,260	671	1,310	1,300
Steatite ^e	300	300	250	250	250
Talc	22,353	27,103	26,108	26,658	26,000
Total	25,465	28,663	27,029	28,218	27,550
Vermiculite	5,207	18,612	19,300	⁴ 19,000	18,000
Water, mineral-containing	151,998	177,544	172,152	142,229	140,000
Zeolite ^e	³ 120	110	100	100	100
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural (asphaltite)	3,702	3,350	2,158	824	1,000
Coal, bituminous thousand tons	370	381	505	511	278
Coke, all types, including breeze do.	840	925	820	⁸ 800	800
Gas, natural:					
Gross million cubic meters	19,182	19,128	22,695	21,992	21,800
Marketed do.	14,333	14,769	17,831	⁷ 18,993	18,094
Natural gas liquids:					
Butane thousand 42-gallon barrels	3,170	3,306	3,887	4,3844,196	
Propane do.	3,030	4,967	5,283	⁵ 5,300	5,000
Total do.	6,200	8,273	9,170	9,684	9,196
Peat, agricultural (turba)	3,166	3,338	2,621	2,481	2,500
Petroleum:					
Crude thousand 42-gallon barrels	158,467	156,348	164,418	167,949	³ 175,836

See footnotes at end of table.

TABLE 1—Continued

ARGENTINA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e
MINERAL FUELS AND RELATED MATERIALS—Continued					
Petroleum—Continued					
Refinery products:					
Gasoline do.	31,351	31,246	28,041	40,311	³ 34,615
Kerosene do.	3,675	3,778	3,503	3,364	³ 3,634
Jet fuel do.	5,028	5,384	5,176	5,566	³ 6,123
Distillate fuel oil do.	51,429	54,172	53,997	56,108	³ 58,776
Residual fuel oil do.	21,447	25,734	27,790	30,232	³ 25,636
Lubricants do.	1,792	1,868	1,781	1,669	³ 1,354
Other do.	16,148	16,445	16,499	13,762	³ 13,185
Refinery fuel and losses do.	25,337	14,205	21,400	13,745	^e 25,781
Total do.	156,207	152,832	158,187	164,757	³169,104

^eEstimated. ^pPreliminary. ^rRevised.¹Table includes data available through June 30, 1991.²In addition to the commodities listed, bismuth, carbon black, columbite, lime, natural gasoline, perlite, and potassium sulfate (Kalinite) were believed to be produced, but output was not reported quantitatively, and available information was inadequate to make reliable estimates of output levels.³Reported figure.⁴Hot-rolled semimanufactures only; excludes castings and cold-rolled semimanufactures produced from imported hot-rolled semimanufactures.⁵Includes plastic, semiplastic, and/or ferruginous clays used totally in the manufacture of portland cement.⁶Thomas slag production was estimated from the Thomas crude steel reported in La Siderurgia Argentina annual published by the Instituto Argentino de Siderurgia.⁷Includes 2,186 million cubic meters of natural gas imported from Bolivia.

TABLE 2

ARGENTINA: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	1	2	—	Peru 1; Uruguay 1.
Metal including alloys:				
Unwrought	83,473	81,802	9,843	Japan 26,583; Netherlands 15,772; China 11,497.
Semimanufactures	25,186	17,894	5,730	Netherlands 7,358; Brazil 1,251.
Chromium: Oxides and hydroxides	274	307	—	West Germany 114; Finland 69; East Germany 577.
Copper: Metal including alloys:				
Unwrought	1	1	—	Mainly to Uruguay.
Semimanufactures	4,783	4,533	4,109	Uruguay 140; Canada 106.
Iron and steel: Metal:				
Scrap	—	33	—	All to Brazil.
Pig iron, cast iron, related materials	1,316	653	—	Brazil 362; Chile 245; Uruguay 46.
Ferroalloys:				
Ferromanganese	—	5	—	All to Uruguay.
Ferrosilicon	16,202	17,429	9,117	Iran 5,713; Chile 1,444.
Unspecified	5,414	5,902	2,569	Venezuela 852; United Kingdom 588.
Steel, primary forms	177,639	410,836	72	Australia 76,884; Philippines 38,438; Iran 24,502.
Semimanufactures:				
Bars, rods, angles, shapes, sections	357,045	436,490	78,117	Australia 63,023; Belgium-Luxembourg 54,170.
Universals, plates, sheets	591,821	881,188	43,847	Thailand 185,319; Japan 139,094; China 126,008.

See footnotes at end of table.

TABLE 2—Continued

ARGENTINA: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
METALS—Continued				
Iron and steel: Metal—Continued				
Semimanufactures—Continued				
Hoop and strip	4,677	7,758	1,420	Chile 5,866; Paraguay 269.
Rails and accessories	12,372	2,343	2,340	Ecuador 2; Peru 1.
Wire	6,739	18,854	13,711	Chile 2,146; Belgium-Luxembourg 740.
Tubes, pipes, fittings	383,291	496,750	97,932	China 122,786; U.S.S.R. 99,327.
Castings and forgings, rough	52	74	—	Colombia 33; Uruguay 16; Chile 15.
Lead:				
Ore and concentrate	9,812	19,635	—	Brazil 11,274; India 5,123; Belgium-Luxembourg 3,238.
Oxides	203	548	—	Spain 263; Brazil 96; Uruguay 87.
Metal including alloys:				
Unwrought	900	4,650	—	Brazil 1,702; Japan 1,602; Uruguay 926.
Semimanufactures	1	4	—	Paraguay 3; Brazil 1.
Magnesium: Metal including alloys:				
Unwrought value, thousands	\$1	—	—	
Semimanufactures	2	3	—	Mainly to Bolivia.
Manganese: Oxides				
	2	—	—	
Nickel: Metal including alloys, semi-manufactures value, thousands				
	\$18	\$11	—	All to Chile.
Silver: Metal including alloys, unwrought and partly wrought do.				
	\$3	—	—	
Tin:				
Ore and concentrate	721	135	—	Netherlands 127; Paraguay 8.
Metal including alloys:				
Unwrought value, thousands	\$1	—	—	
Semimanufactures do.	\$3	\$57	—	Uruguay \$55; Paraguay \$2.
Titanium: Oxides do.				
	—	\$2	—	All to Chile.
Tungsten: Metal including alloys, semimanufactures do.				
	\$29	—	—	
Zinc:				
Ore and concentrate	5,115	6,877	—	Brazil 3,879; Belgium-Luxembourg 2,998.
Oxides	100	570	—	Brazil 540; Uruguay 15; Chile 14.
Metal including alloys:				
Unwrought	3,254	11,263	3,517	Netherlands 3,015; Republic of South Africa 2,510.
Semimanufactures	1	2	—	All to Paraguay.
Other:				
Oxides and hydroxides	30	35	—	Brazil 31; Chile 4.
Ashes and residues	—	1	—	All to Uruguay.
Base metals including alloys, all forms	87	253	—	Brazil 249; Netherlands 3.
Precious metals, waste and scrap value	\$6,000	\$2,000	—	All to Italy.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	1,284	3,738	—	Brazil 2,310; Paraguay 903; Uruguay 524.
Artificial: Silicon carbide	2,862	3,511	128	Belgium-Luxembourg 1,249; Republic of South Africa 727; Brazil 661.
Dust and powder of precious and semi-precious stones value, thousands	\$1	\$3	—	Republic of South Africa \$2; Hong Kong \$1.
Grinding and polishing wheels and stones	14	18	—	Brazil 9; Chile 3; Paraguay 3.

See footnotes at end of table.

TABLE 2—Continued

ARGENTINA: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Barite and witherite	10	37	—	All to Uruguay.
Boron materials:				
Crude natural borates	26,563	20,431	—	Italy 10,067; Brazil 9,733; Uruguay 581.
Oxides and acids	10,824	12,519	—	Brazil 6,474; Netherlands 1,562; West Germany 1,547.
Cement	48,299	77,848	—	Chile 54,705; Brazil 16,102; Bolivia 6,806.
Chalk	5	—	—	—
Clays, crude	11,321	11,613	—	Brazil 6,963; Chile 3,705; Uruguay 929.
Diatomite and other infusorial earth	30	20	—	Mainly to Uruguay.
Feldspar, fluorspar, related materials	480	398	—	Chile 383; Uruguay 15.
Fertilizer materials: Manufactured:				
Ammonia	414	445	—	Uruguay 360; Paraguay 75; Bolivia 10.
Nitrogenous	119	121	—	Paraguay 96; Uruguay 20; Bolivia 5.
Phosphatic	78	—	—	—
Potassic	32	55	—	All to Bolivia.
Unspecified and mixed	3	1	1	—
Graphite, natural	3,000	14	—	Chile 11; Uruguay 3.
Gypsum and plaster	20,335	14,396	—	Paraguay 10,960; Uruguay 3,433.
Lime	6,526	2,816	—	Chile 1,915; Bolivia 826; Uruguay 75.
Magnesium compounds: Magnesite, crude	125	25	—	All to Chile.
Mica: Crude including splittings and waste	46	50	—	France 40; Chile 9.
Pigments, mineral: Iron oxides and hydroxides, processed	479	446	2	Uruguay 99; Singapore 96; Brazil 54.
Precious and semiprecious stones other than diamond, natural value, thousands	\$313	\$60	\$2	China \$25; Hong Kong \$13; Bangladesh \$12.
Salt and brine	24,340	172,646	3	Brazil 170,343; Uruguay 1,775; Paraguay 525.
Sodium compounds, n.e.s.: Sulfate, natural and manufactured	NA	3,522	—	All to Brazil.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	10,204	12,594	—	Japan 5,535; Spain 3,175; Italy 2,914.
Worked	4,032	8,531	4,252	Chile 817; Japan 802.
Dolomite, chiefly refractory-grade	361	5,210	—	Chile 5,087; Brazil 101; Uruguay 22.
Gravel and crushed rock	70	143	—	Brazil 125; Bolivia 18.
Quartz and quartzite	25	601	—	Ecuador 367; Uruguay 161; Bolivia 55.
Sand other than metal-bearing	58	2,171	—	Ecuador 2,141; Uruguay 24.
Sulfur:				
Elemental:				
Crude including native and byproduct	57	63	—	Uruguay 35; Paraguay 23; Chile 4.
Colloidal, precipitated, sublimed	4	—	—	—
Sulfuric acid	2,997	7,293	—	Brazil 7,071; Chile 200; Bolivia 20.
Talc, steatite, soapstone, pyrophyllite	71	58	—	Chile 55; Paraguay 3.
Other:				
Crude	8,377	9,268	—	Brazil 8,134; France 623; Spain 240.
Slag and dross, not metal-bearing	180	99	—	All to Chile.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,441	785	2	Brazil 781; Mexico 2.

See footnotes at end of table.

TABLE 2—Continued

ARGENTINA: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS—Continued				
Carbon black	144,295	154,347	—	Brazil 69,152; Netherlands 30,813; Belgium-Luxembourg 16,915.
Coal: All grades including briquets	505	149	—	All to Uruguay.
Coke and semicoke	52,932	99,842	—	Belgium-Luxembourg 50,576; Spain 49,067; Uruguay 187.
Gas, natural cubic meters	—	26,005	—	Paraguay 13,725; Brazil 12,280.
Peat including briquets and litter	14	19	—	All to Uruguay.
Petroleum:				
Crude thousand 42-gallon barrels	1,446	2,273	2,179	Chile 94.
Refinery products:				
Liquefied petroleum gas do.	559	1,242	—	Brazil 1,077; Uruguay 92; Paraguay 41.
Gasoline do.	2,933	7,798	3,989	Netherlands 2,055; Australia 437.
Mineral jelly and wax do.	51	62	(²)	Chile 29; Peru 24; Ecuador 5.
Kerosene and jet fuel do.	520	353	143	Brazil 210.
Distillate fuel oil do.	942	2,226	346	Paraguay 1,428; Brazil 234.
Lubricants do.	106	153	—	Uruguay 77; Brazil 35; Netherlands 32.
Residual fuel oil do.	2,081	4,099	2,963	Uruguay 366; Netherlands Antilles 352.
Bitumen and other residues do.	128	78	—	Paraguay 49; Chile 27; Uruguay 1.
Bituminous mixtures do.	1	2	—	Mainly to Bolivia.
Petroleum coke do.	301	1,390	109	Canada 695; Netherlands 581.

¹Revised. NA Not available.¹Table prepared by H.D. Willis.²Less than 1/2 unit.

TABLE 3

ARGENTINA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS				
Alkali and rare-earth metals	30	30	(²)	France 25; Canada 4; Brazil 1.
Aluminum:				
Ore and concentrate	20,457	25,696	102	China 17,793; Brazil 7,783.
Oxides and hydroxides	270,999	300,411	747	Australia 289,980; Brazil 8,859.
Metal including alloys:				
Scrap	2	—	—	—
Unwrought	55	7	(²)	Brazil 5; Belgium-Luxembourg 2.
Semimanufactures	9,207	6,112	60	Brazil 5,569; France 124; Uruguay 117.
Beryllium: Metal including alloys, all forms value, thousands	—	\$2	—	All from Switzerland.
Chromium:				
Ore and concentrate	14,776	20,393	—	Republic of South Africa 17,393; Philippines 2,000; Cuba 1,000.
Oxides and hydroxides value, thousands	\$8	\$4	\$3	Belgium-Luxembourg \$1.
Cobalt: Oxides and hydroxides	28	84	13	Republic of South Africa 49; Belgium-Luxembourg 16.

See footnotes at end of table.

TABLE 3—Continued

ARGENTINA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS—Continued				
Columbium and tantalum: Tantalum metal including alloys, all forms value, thousands	\$25	\$20	\$18	West Germany \$2.
Copper: Metal including alloys:				
Scrap	—	6	1	West Germany 3; Japan 1.
Unwrought	31,952	15,439	7	Chile 15,061; Peru 369.
Semimanufactures	1,154	1,083	56	Japan 272; Brazil 263; West Germany 211.
Gold: Metal including alloys, unwrought and partly wrought kilograms				
	2	—		
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite thousand tons	3,260	4,001	—	Brazil 3,887; Chile 53; Venezuela 38.
Metal:				
Scrap	2,507	10,950	26	Paraguay 4,930; Gabon 2,369; Bolivia 1,991.
Pig iron, cast iron, related materials	112,770	3,805	490	Paraguay 2,363; Netherlands 388.
Ferrous alloys:				
Ferromanganese	3,917	2,392	—	Brazil 1,740; Netherlands 445; Spain 134.
Ferrosilicon	204	50	10	West Germany 40.
Unspecified	2,941	2,765	195	Republic of South Africa 1,312; Chile 726; Brazil 276.
Steel, primary forms	744,456	294,859	50,937	Brazil 157,340; Japan 25,690.
Semimanufactures:				
Bars, rods, angles, shapes, sections	17,373	14,084	600	Brazil 4,816; Belgium-Luxembourg 2,867; West Germany 1,401.
Universals, plates, sheets	170,406	92,816	3,814	Brazil 40,539; Spain 15,527; Mexico 10,603.
Hoop and strip	4,128	3,578	463	Brazil 725; Belgium-Luxembourg 706; Japan 700.
Rails and accessories	377	128	52	France 37; Republic of South Africa 27.
Wire	5,209	2,970	37	Uruguay 1,723; Brazil 704; Sweden 146.
Tubes, pipes, fittings	45,016	13,260	1,334	Belgium-Luxembourg 3,802; Italy 3,232; West Germany 1,939.
Castings and forgings, rough	38	171	5	Chile 134; Brazil 26.
Lead:				
Oxides	16	—		
Metal including alloys:				
Scrap	40	—		
Unwrought value, thousands	\$2	\$4	—	All from France.
Semimanufactures	5	11	—	Bolivia 5; France 3; Brazil 1.
Magnesium: Metal including alloys:				
Unwrought	1,022	588	548	Norway 25; West Germany 15.
Semimanufactures	58	27	22	West Germany 5.
Manganese:				
Ore and concentrate	78,395	66,325	144	Brazil 65,874; Bolivia 221.
Oxides	425	267	36	Brazil 210; Belgium-Luxembourg 20.
Mercury	57	98	—	Mexico 56; Spain 34; Netherlands 6.
Molybdenum: Metal including alloys:				
Unwrought including waste and scrap	1	—		
Semimanufactures	5	4	1	Austria 1; France 1.
Nickel:				
Matte and speiss	30	35	—	All from Cuba.
Metal including alloys:				
Unwrought	322	262	78	Netherlands 93; Canada 41.

See footnotes at end of table.

TABLE 3—Continued

ARGENTINA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
METALS—Continued					
Nickel—Continued					
Metal including alloys—Continued					
Semimanufactures	201	268	33	Japan 135; West Germany 37.	
Platinum-group metals: Platinum metal including alloys, unwrought and partly wrought	value, thousands	\$242	\$197	\$39	West Germany \$114; Canada \$34.
Silver: Metal including alloys, unwrought and partly wrought	do.	\$111	\$295	\$151	Peru \$82; West Germany \$40.
Tin:					
Ore and concentrate	60	—			
Metal including alloys:					
Unwrought	550	696	10	Brazil 481; Bolivia 204.	
Semimanufactures	15	20	11	Brazil 7; Japan 1.	
Titanium: Oxides	486	272	3	Belgium-Luxembourg 212; West Germany 25; Italy 21.	
Tungsten:					
Ore and concentrate	105	58	—	Belgium-Luxembourg 32; Netherlands 20; Bolivia 6.	
Metal including alloys:					
Unwrought including waste and scrap	3	1	1		
Semimanufactures	8	11	7	Brazil 1; Netherlands 1.	
Uranium and Thorium: Oxides and other compounds	value, thousands	—	\$1	—	All from France.
Zinc:					
Oxides	8	62	20	Israel 21; West Germany 20.	
Metal including alloys:					
Scrap	247	269	—	Canada 193; Peru 76.	
Unwrought	1,880	1,000	—	Peru 500; Spain 500.	
Semimanufactures	value, thousands	\$39	\$5	\$2	West Germany \$3.
Other:					
Ores and concentrates	2,878	1,884	—	Republic of South Africa 1,117; Bolivia 555; Brazil 201.	
Oxides and hydroxides	1,543	1,610	709	Chile 631; Cuba 59.	
Ashes and residues	85	—			
Base metals including alloys, all forms	462	401	337	Netherlands 15; Peru 10.	
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.	164	130	130		
Artificial: Corundum	7,196	8,186	129	Brazil 7,656; China 300.	
Dust and powder of precious and semi-precious stones	value, thousands	\$564	\$227	\$87	Belgium-Luxembourg \$136; Brazil \$4.
Grinding and polishing wheels and stones	236	270	2	Italy 153; Brazil 69; West Germany 16.	
Asbestos, crude	8,109	7,093	88	Brazil 3,372; Canada 2,177; Republic of South Africa 1,436.	
Barite and witherite	212	52	25	Brazil 27.	
Boron materials: Oxides and acids	7	5	—	All from Belgium-Luxembourg.	
Bromine ³	33	35	—	Israel 18; Chile 16; Japan 1.	
Cement	2,314	1,503	214	France 715; Yugoslavia 315.	
Chalk	17	1	—	All from West Germany.	
Clays, crude	24,732	562,929	550,636	Brazil 11,874; West Germany 202.	
Cryolite and chiolite	22	23	—	Denmark 22; Belgium-Luxembourg 1.	

See footnotes at end of table.

TABLE 3—Continued

ARGENTINA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
INDUSTRIAL MINERALS—Continued					
Diamond, natural:					
Gem, not set or strung	value, thousands	\$39	\$46	—	Brazil \$45; Switzerland \$1.
Industrial stones	do.	\$353	\$257	\$64	Belgium-Luxembourg \$153; Sweden \$36.
Diatomite and other infusorial earth		2,037	1,739	302	Mexico 883; Chile 554.
Feldspar, fluorspar, related materials		—	18	—	All from Canada.
Fertilizer materials: Manufactured:					
Ammonia	value, thousands	—	\$1	\$1	
Nitrogenous		104,809	136,773	10,025	U.S.S.R. 27,590; Venezuela 26,792; Poland 21,449.
Phosphatic		30,508	9,391	4,779	Uruguay 3,459; Brazil 1,153.
Potassic		25,542	12,584	9,731	Israel 2,600; Brazil 250.
Unspecified and mixed		101,786	71,506	66,779	Chile 2,810; Brazil 1,107.
Graphite, natural		552	1,317	402	Brazil 818; Peru 36.
Gypsum and plaster		9	23	20	Japan 3.
Magnesium compounds: Magnesite, crude		24,487	20,766	38	Brazil 11,990; Mexico 7,915; Italy 500.
Mica:					
Crude including splittings and waste		24	6	(²)	Netherlands 3; India 2.
Worked including agglomerated splittings		11	10	2	Belgium-Luxembourg 4; West Germany 2.
Nitrates, crude		3,265	2,735	—	All from Chile.
Phosphates, crude		—	8	5	West Germany 3.
Pigments, mineral: Iron oxides and hydroxides, processed		59	66	47	West Germany 13; Italy 3.
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	\$14	\$33	—	Brazil \$28; Uruguay \$1.
Synthetic	do.	\$48	\$24	\$21	Brazil \$3.
Pyrite, unroasted		22	26	—	All from West Germany.
Salt and brine		52	46	9	West Germany 27; Belgium-Luxembourg 5.
Sodium compounds, n.e.s.:					
Soda ash, natural and manufactured		163,854	169,203	64,437	Belgium-Luxembourg 40,281; Romania 21,452.
Sulfate, natural and manufactured		NA	15	7	West Germany 7.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		1,831	1,568	1	Uruguay 633; Brazil 414; Italy 270.
Worked		825	1,167	—	Italy 569; Spain 399; Uruguay 168.
Dolomite, chiefly refractory-grade		300	393	—	All from Brazil.
Gravel and crushed rock		195,650	107,138	(²)	Paraguay 101,525; Uruguay 5,600.
Quartz and quartzite		134	26	5	Belgium-Luxembourg 11; Brazil 10.
Sand other than metal-bearing		182,470	109,536	2,720	Uruguay 106,204; Brazil 612.
Sulfur:					
Elemental:					
Crude including native and byproduct		53,882	50,663	3	Canada 50,562; Chile 78; France 20.
Colloidal, precipitated, sublimed		14	19	16	West Germany 3.
Sulfuric acid		4,163	3,495	(²)	Mainly from Uruguay.
Talc, steatite, soapstone, pyrophyllite		778	386	30	Uruguay 141; Brazil 112; China 83.
Other:					
Crude		8,047	5,752	470	Brazil 1,984; Republic of South Africa 1,198; Belgium-Luxembourg 991.

See footnotes at end of table.

TABLE 3—Continued

ARGENTINA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
INDUSTRIAL MINERALS—Continued					
Other—Continued					
Slag and dross, not metal-bearing	795	432	4	Uruguay 180; Brazil 150; Australia 77.	
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural	129	67	67		
Carbon black	732	512	285	Belgium-Luxembourg 98; East Germany 45.	
Coal:					
Anthracite	2,110	1,146	119	Brazil 1,027.	
Bituminous	thousand tons	¹ 1,250	1,032	567	Australia 284; Poland 180.
Lignite including briquets	(²)	—			
Coke and semicoke	96	30,773	30,773		
Gas, natural	million cubic meters	2,228	2,210	—	All from Bolivia.
Peat including briquets and litter	136	58	58		
Petroleum:					
Crude	value	\$3,000	\$2,000	\$2,000	
Refinery products:					
Liquefied petroleum gas	42-gallon barrels	546,615	11,624	12	Chile 11,612.
Gasoline	do.	11,118	1,615	1,334	West Germany 281.
Mineral jelly and wax	do.	5,777	4,872	1,401	Brazil 2,455; Spain 551.
Kerosene and jet fuel	do.	1,290,468	132	132	
Distillate fuel oil	do.	2,938,240	1,406,150	—	Bulgaria 526,370; Italy 321,384; Netherlands 261,085.
Lubricants	do.	439,705	189,406	11,928	Italy 136,654; Netherlands Antilles 28,343.
Residual fuel oil	do.	5,862,532	1,736,202	381,511	Venezuela 1,354,691.
Bituminous mixtures	do.	73	48	—	Mainly from Brazil.
Petroleum coke	do.	6	—		

¹Revised. NA Not available.²Table prepared by H. D. Willis.³Less than 1/2 unit.⁴Includes fluorine and iodine.

TABLE 4

ARGENTINA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity	
Aluminum	Aluminios Argentinos S.A.I.C. (ALUAR)	Puerto Madryn, Chubut Province	170	
Boron	Cía. Boroquímica S.A.M.I.C.A.F.	Mina El Porvenir, Jujuy Province; Tincalayu and Campo Quijano, Salta Province	300	
Cement	Loma Negra C.I.A.S.A.; Juan Minetti S.A.	Buenos Aires, Córdoba, Corrientes, Salta, San Juan, Mendoza, Jujuy, and other Provinces	12,000	
Coal	Yacimientos Carboníferos Fiscales (YCF)	Río Turbio, Santa Cruz Province	1,600	
Gold, silver	kilograms	Yacimientos Mineros de Agua de Dionisio (YMAD)	1,200	Gold
		Mina Angela, Mina Camila, Chubut Province	9,000	Silver
Iron ore	Hierro Patagónico de Sierra Grande S.A. Minera (HIPASAM)	Mina Sierra Grande, Río Negro Province	2,000	
Lead, silver, zinc	kilograms	Cía. Minera Aguilar S.A.	49,800	Silver
		Mina Aguilar, Estación Tres Cruces, Jujuy Province	24,000	Lead
			30,000	Zinc

TABLE 4—Continued

ARGENTINA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Natural gas million cubic meters per year	Yacimientos Petrolíferos Fiscales (YPF) and Gas del Estado	Neuquén Santa Cruz, Tierra del Fuego, Salta, and Río Negro Provinces	24,000
Petroleum million barrels per year	YPF	Chubut, Santa Cruz, Neuquén, Río Negro, Mendoza, Salta, Tierra del Fuego, and Jujuy,	168
Steel	Sociedad Mixta Siderúrgica Argentina (SOMISA)	La Pampa, and Formosa Provinces 7 kilometers from San Nicolás de los Arroyos Buenos Aires Province	2,850
Do.	ACINDAR-Industria Argentina de ACEROS S.A.	Plant Nos. 1. and 3 Buenos Aires Province; Plant No. 2. near Río Paraná, Santa Fe Province	1,500
Uranium (U ₃ O ₈)	Empresa Nuclear Mendoza, CNEA	Sierra Pintada, San Rafael, Mendoza Province Los Gigantes, Córdoba Province (Private)	205
Zinc, refinery	Cía. Sulfacid S.A.C.I. y F	Near Rosario on the Paraná River, Santa Fé Province.	35

products in all forms declined from 1,300 tons in 1989 to 1,000 tons. Exports of primary aluminum rose from 41,400 tons in 1989 to 121,000 tons in 1990, and semifinished products declined from 48,000 tons in 1989 to 29,700 tons. Apparent consumption of aluminum in 1990 decreased from 54,100 tons to 42,300 tons.

Copper.—YMAD continued exploration, development, and production of all minerals within its mining concession of about 344 square kilometers, northwest of Catamarca Province. The YMAD mining concession includes several deposits, of which the Farallón Negro Mine has been under development since 1978. Alto de la Blenda was under exploration and development through a cooperative agreement with the Japanese Government.

The Bajo de la Alumbrera, a porphyritic copper deposit also on YMAD's mining concession, approximately 9 kilometers from the Farallón Negro Mine, has minable reserves of approximately 350 million tons of ore assaying 0.75 gram of gold per ton and 0.55% copper. A series of studies and metallurgical tests were performed on this deposit by Argentina and foreign companies such as Outokumpu Oy of Finland, Humboldt Wedad-KHD of the Federal Republic of Germany, and BRGM Bureau de Recherches Géologiques et Minières of France. All the studies confirmed the technical feasibility of processing the minerals of Bajo de la Alumbrera using conventional methods.

Four additional feasibility studies were performed for this project. The first one was done by Kaiser Engineers & Co. from the United States in 1978, followed by DIGID

of Argentina, Seltrust Engineering Ltd. of the United Kingdom, and the National University of San Juan, also from Argentina.

By yearend, YMAD hoped to attract \$500 million in foreign investment to develop major copper reserves in the northwest portion of Catamarca Province, and after consultation with E.L. Bateman, a south African consultant company, decided to call for international bids on the Bajo de la Alumbrera porphyry copper deposit. The project, according to officials, represents a step forward, reviving long-dormant plans to develop potentially rich mineral deposits in the eastern area. Previous studies indicated that the Bajo de la Alumbrera deposit could produce about 60,000 tons of copper per year, along with 500 tons of molybdenum, 10 tons of silver, and 8 tons of gold. The bids were to be opened on February 15, 1991.

Gold and Silver.—The Government reported that gold production increased 4.3% and that silver production decreased 4.1%, respectively, in 1990 compared with those of 1989. Minera Valle del Cura, which in 1869 had commissioned part of a mine with the same name in San Juan (on the border with Chile just across from El Indio), decided to stop production and concentrate on the development of an overall project that was comprised of the Río Frío deposit and several other hydrothermal altered deposits in the area. At yearend, the parent company, Minera Río Frío, was seeking joint-venture partners.

Silver production decreased to about 9,000 kilograms at the Farallón Negro deposit in Catamarca Province. This mine is now apparently becoming depleted of its

ore reserves. Plans are underway to commission two other mines in the same area and use the existing milling facilities. Another option being examined at yearend was the formation of a joint-venture company, and a tender was being prepared.

Iron and Steel.—The Argentine steel industry's growing presence in world markets reflects the nation's chronic economic crisis. The industry, which was founded with Government assistance to meet the "strategic" requirements of the nation's military, was originally expected to displace foreign steel imports in the domestic market. Unfortunately, the increase in national steel-making capacity coincided with the collapse of the demand for steel in the domestic economy. Burdened by an overvalued currency, low productivity, and erratic Government policies, the industry was forced to retrench. Despite rationalization efforts, however, steel capacity continued to exceed consumption and utilization rates remained low.

The Government's steel program relied upon a combination of public and private enterprise. On the one hand, the Government created state-controlled companies that were directly involved in the production process. SOMISA, now the largest steel-maker in Argentina, was founded in 1947. Because self-sufficiency in steel was considered essential to the national defense, SOMISA was placed under the authority of the Dirección General de Fabricaciones Militares (DGFM). In addition to SOMISA, the Government created a second integrated producer, Altos Hornos Zapla, and an iron ore producer, HIPASAM, both of which were also placed under military control.

The military, one of Argentina's most powerful institutions, has continued to play a key role in the development of the Argentine steel industry. The Government also undertook to promote private investment in the steel sector. Toward this end, it eliminated tariffs on imported capital goods, provided loans and loan guarantees for the implementation of investment plans, and built a system of investment incentives into the tax system. As a result of these promotional activities, a significant private-sector steel industry soon emerged in Argentina. Although state producers dominated the production of raw steel and flat products, two private companies, ACINDAR and SIDERCA, became the leading producers of nonflat and tubular products, respectively. Both state and private producers benefited from tariffs and other import barriers designed to protect and stimulate domestic production and from export incentives designed to maintain production in times of slack in domestic demand. Crude steel production in Argentina decreased in 1990 to 3.6 million tons from 3.9 million tons the year before, while domestic consumption fell to 1.5 million tons from 2.0 million in 1989. The total tonnage imported reached 2.4 million tons. Altos Hornos Zapla produced 56,000 tons of pig iron and 81,000 tons of crude steel. The biggest steel producers in Argentina are SOMISA and ACINDAR.

Uranium.—Preliminary figures released by the Dirección de Economía Minera of Argentina indicate that the production of yellow cake (U_3O_8) in 1990 was maintained at the same level as that in the previous year. The Embalse nuclear powerplant in Córdoba Province returned to service on October 14, 1990, after being shut down for 5 weeks for maintenance and inspection. The Transitory Union of Firms (UTE), composed of eight small companies in different fields, will finance the continuation of construction of the Atucha II nuclear powerplant. The total investment required is about \$1.4 billion. The completion of the powerplant is envisioned by June 1994. As a result of the Atucha I nuclear reactor's problems, which caused it to be out of service since August 1988, some corrections in the design of Atucha II, to avoid similar problems, will be made.

On November 30, 1990, the Chairman of the U.S. Nuclear Regulatory Commission and representatives of the Argentine National Commission of Nuclear Energy (CNEA) signed a memorandum of under-

standing (MOU) for the interchange of technical information on the security of nuclear reactors for power generation and research. This represents the first agreement between the two countries for the peaceful use of nuclear energy. The MOU provides, among other things, the interchange of physical security data on the operation of reactors, technical training, and exchange of information on specific cases of emergency.

At yearend, Argentina publicly signed or announced intentions to sign a number of agreements for the export of Argentine nuclear technology with Romania, Turkey, and the U.S.S.R..

Turkey, on October 20, 1990, announced that CNEA has been given the green light to build two CAREM nuclear reactors with a capacity of 25 megawatts. The legal and administrative details were to be ready by yearend or early in 1991. Estimated cost of the reactors was between \$2 million and \$3 million per megawatt, with modular construction to allow increasing power requirements with the addition of more units at a later time.

Industrial Minerals

Boron.—According to estimates, Argentina was ranked fourth in the world as a boron producer after the United States, Turkey, and the U.S.S.R. Production of boron minerals was maintained at the same level as that of 1989. In terms of foreign exchange generated, this industry ranked first among all mining industries in the country. From the total of minerals and derivatives exported in 1990, borates accounted for 27.4% (boron minerals, 16%; boric acid, 8.4%; and sodium borate, 3%). The largest boron mineral producer in the country was Cía. Boroquímica S.A.M.I.C.A.F., owned by Río Tinto Zinc Corp. Ltd. and Industrias Químicas Boradero S.A., both in the Province of Salta.

Cement.—The Argentine production of cement continued its downward trend, which began in 1987 and reached 3.6 million tons in 1990. This was a 42.4% decline compared with 1987 output and 18.8% compared with that of 1989. For the year, the cement industry operated at 30% of its installed capacity. According to the Portland Cement Manufacturer's Association, the average consumption of cement per inhabitant declined from 198 tons in 1987 to about 109 tons in 1990. The decrease in production during the past 4 years was due

primarily to the stagnant demand in the construction industry and to the modernization, expansion, and installation of new plants in the country. In 1990, there were 19 cement plants operating in Argentina belonging to 7 companies. Of these, Cementos Loma Negra C.I.A.S.A., with 6 plants, had a total installed capacity share of 43.3% (5.2 million tons); Juan Minetti S.A., with 5 plants and a 19.8% share (2.4 million tons); Corporación Cementera Argentina S.A. (Corcemar), with 3 plants and a 17.9% share (2.2 million tons); Cía. Argentina de Cemento Portland S.A., with 2 plants and a 7.5% share (0.9 million tons); Calera Avellaneda S.A., with 1 plant and a 7.9% share (1.0 million tons); and Petroquímica Comodoro Rivadavia S.A. and Sandrin Hermanos S.A.C.I.C.F.I.A., with 1 plant each and a 2.5% and a 1.1% share, respectively (0.3 and 0.1 million, respectively).

Granite.—According to the Dirección de Minería of San Luis Province, the province ranked second in the production of granite after the Buenos Aires Province. The production of granite in blocks was from quarry operations in the District of Sierra Chica Olavarría, Buenos Aires Province. The number of quarries in the province was 42. Minera TEA-SAMICAF's quarry operation in La Huertita was in the exploration and development stage and was planning for the production of Dragon red granite for export at Potrerillos. Other companies producing granite in San Luis were Conevial S.A., José B. Godoy S.A., Mármoles y Granitos San Luis S.A., Kursoal S.A., Franzoni y Cía. S.A., Carlos Campolnghi S.A., and others. Approximately 90% of the crushed granite came from the Provinces of Buenos Aires, Córdoba, and Santiago del Estero. Exports of granite, generally in the form of blocks of about 3 by 1.2 by 0.8 meters, were mostly to Italy, Japan, France, Spain, Israel, and the Federal Republic of Germany.

Potassium.—The Río Colorado potash project was an important part of Minera TEA-SAMICAF's 1990 operations. Since 1976, Minera TEA has been carrying out exploration work to determine ore reserves. It has acquired the surface and mineral rights over the area containing the ore body. Some of its work was done with Texasgulf Minerals and Metals, Inc. of the United States, which proposed a 500,000 ton-per-year joint-venture project in 1983. Because of investment requirements, Minera TEA's ownership would have been diluted to a minority status.

The Grupo TEA is a group of interrelated Argentine companies, most significantly Minera TEA S.A., Excavaciones de Roca S.A. (ERSA), Boratos S.A., Pucara S.A., and Los Tilianis S.A. While each company is an independent operating entity, they operate in 10 of the 22 provinces. The companies' mining operations have been exploiting ballast, barite, dolomite, fluorite, granite, limestone, and industrial limes. Sales (\$16.9 million in the fiscal year ended January 31, 1990) were primarily to the domestic market, although exports of boric acid, calcium carbonate, and granite were of increasing importance.

The Río Colorado potash deposit was in the Provinces of Mendoza and Neuquén, approximately 960 kilometers southwest of Buenos Aires in an uninhabited region bordering the Río Colorado River. It has been an area of oil exploration since the early 1960's. The project will exploit the rich potash deposits of the Río Colorado sedimentary basin. Instead of using high-cost traditional underground mining methods, Minera Tea S.A. will apply solution mining technology. The project has been designed for the production of 250,000 tons per year of KCl over a period of 25 years.

Mineral Fuels

In 1988, Argentina's estimated production of commercial energy totaled about 64.2 million tons of standard coal equivalent, almost 0.7% above the 1987 level. Of the total, solid fuels accounted for only 8.7%, liquid fuels, 54%; gas fuel, 41.3%; and primary electricity, 4.0%.

Energy consumption data were not available for the years subsequent to 1988, when the total consumption was 62.2 million tons of standard coal equivalent. Solid fuels provided 2.5%, liquid fuels contributed 46.1%, gas fuels supplied 47.1%, and primary electricity accounted for 4.3%.

Of total installed electrical generating capacity of 16,600 megawatts in 1988, 54.1% was conventional thermal, 39.7% was hydroelectric, and 6.1% was nuclear. In that year, the latest for which complete data were available, a total of 53,062 kilowatt hours was produced, 59.3% by conventional thermal plants, 29.8% by hydroelectric plants, and 10.9% by nuclear plants. In 1989, total electric power output declined 1.5%, but its distribution by source was not available, and 1990 power output was not yet reported.

Coal.—Production of bituminous coal decreased 45.6% to 278,000 tons compared with that of 1989. YPF, the state-owned coal company, produced coal from the Río Turbio Mine in Santa Cruz Province. Under a 5-year project, planned in 1988, YCF was to increase its annual production to 650,000 tons by 1990, but instead production declined owing to lack of sufficient financial resources and a small contribution from the National Energy Fund, setting back production and investment in the industry. In addition to these problems, the Río Turbio coal mines developed some operating problems, reducing production. One of the biggest problems was the high level of methane gas encountered in the mines as a result of a poor ventilation system. Other problems were the slow process in clearing the contaminated areas and delays in the provision of needed operating supplies and transportation equipment. The new economic stabilization program did not help as it reduced the existing tariff figures no less than four times. Devaluation continued through the second half of the year.

Natural Gas.—Natural gas production in 1990 was maintained at the same level as in 1989. Recently, it became evident that Argentina's known natural gas proved reserves were about 25% less than officially estimated. However, it is quite possible that large, undiscovered natural gas reserves exist, which could be exploited at relatively low economic cost. As a result of this reassessment of natural gas reserves, future shortages of natural gas are likely to develop in certain regions of the country, depending on the availability of transport and distribution systems. Most natural gas produced in Argentina is controlled by the state oil company, YPF. About 81% of the gas is produced by YPF and the rest either imported from Bolivia or produced under service contracts with private production companies. Gas imports from Bolivia are paid directly by Gas del Estado. Realistic proved natural gas reserves as of January 1, 1988, were estimated to be only 554 billion cubic meters versus the YPF official estimate of 693 billion cubic meters, which at the current production rate puts the proved reserve/production ratio for natural gas equal to about 20 years of supply.

Petroleum.—Crude oil production increased 4.7% compared with that of 1987, reversing the recent downward trend. Argentina, although endowed with substantial and diversified energy resources, depends

heavily on crude oil and natural gas to meet its energy requirements. However, the country has rarely been in a position of having an adequate supply of hydrocarbon reserves, and in recent years, production rates have consistently exceeded the rate at which depleted reserves have been replaced by new discoveries, reducing its most essential energy resources to a critical level from which it will be difficult and costly to recover. New large investments are required to discover new hydrocarbon reserves. As a result of recent reassessments, proven crude oil reserves as of January 1, 1988, were estimated to be only 1.41 billion barrels—versus the previous estimate of 2.3 billion barrels, which at the current production rate of 440,287 barrels per day needed for present consumption requirements puts the proved reserve/production ratio for crude oil equal to 8 years' supply.

In 1985, the Houston Plan was devised to attract private-sector participation. The first three rounds of bidding resulted in the award of 36 contracts from the 116 blocks offered. A fourth round was completed, but two-thirds of the blocks did not have any bidders. A fifth round of 70 areas as offered in late 1989. Nevertheless, with the Houston Plan format, Argentina and YPF have finally been able to attract wide participation by international petroleum companies in searching for hydrocarbons in the country through cooperative ventures with local private oil companies. The main feature of the Houston Plan is a guarantee that payment of services would be made in exportable crude oil in the event that YPF is unable to make timely payments in foreign exchange.

INFRASTRUCTURE

The Argentine road network consists of about 208,350 kilometers of which 47,500 was paved, 39,500 was gravel, 101,000 was improved earth, and 12,500 was unimproved earth. Roads were one of the principal transport methods used to move mine production to processing plants in Buenos Aires and other shipping centers. Argentina had 11,000 kilometers of navigable inland waterways and an excellent navigable river system. River transport operates largely on the Río de la Plata estuary and its tributaries: the Paraná, Uruguay, Paraguay, and Alto Paraná Rivers.

Argentina had about 7,000 kilometers of pipeline for transport of crude oil and refined products and 10,900 kilometers of gas

pipelines from production centers to consumer centers. The system connected oilfields and refineries to the north, center, west, and southeast with main industrial centers. Natural gas was also imported from Bolivia by gas pipeline through Yacuiba-Pocitos at the border to the northern provinces and Buenos Aires. The existing Argentine railroad network covered approximately 34,000 kilometers. It transported about 19 million tons of freight and 300 million passengers per year. Of the total network, 164 kilometers was electrified. The network was owned and operated by the state enterprise Ferrocarriles Argentinos.

OUTLOOK

Argentina's energy resources are abundant and diverse. They include crude oil, natural gas, and hydropower, as well as fair amounts of coal and uranium, as well as its vast nonfuel mineral resources which remain almost untapped. There is optimism about the development of these mineral projects and the discovery of new onshore and offshore oilfields and gasfields as future sources of energy and mineral production. New investments in Argentina are being directed toward several promising areas such as crude oil and natural gas, telecommunications, petrochemicals, gas pipelines, hotels, and tourism-related projects and agro-industry. In the future, once a new mining code is enacted in Argentina, the country may also see new investments in the mining sector. The energy subsecretary announced on October 1 the results of the Government's first tender process for the "central areas" that contain the richest petroleum reserves. The Government found

the following bidders prequalified to proceed to the next stage of the tender: Amoco, Texaco, Texaco/Repsol, Texaco/Repsol/Astra, Texaco/Astra, Shell/Pérez Companc, Total, Sodeco Americana/Agip, Pluspetrol/Union Pacific International, Cadispa/British Gas, Ecopetrol/Santa Fe Energy Co., Pérez Companc/Repsol.

In the past year, the investment climate in Argentina has improved with the implementation of an economic plan directed at privatizing state-owned companies, lowering import tariffs, free and floating currency exchange rates, removing import bans on most products, a new foreign investment law granting national treatment to foreign investors, and allowing the private sector the opportunity to enter previously closed areas. For example, the Government of Argentina opened oilfields and gasfields to foreign exploration and development. As a result of these changes, there have been a large number of U.S. companies interested in investing in Argentina.

¹Where necessary, values have been converted from Argentine australes to U.S. dollars at the rate of Australes 4,887=US\$1.00, the average exchange rate in 1990.

OTHER SOURCES OF INFORMATION

Agencies

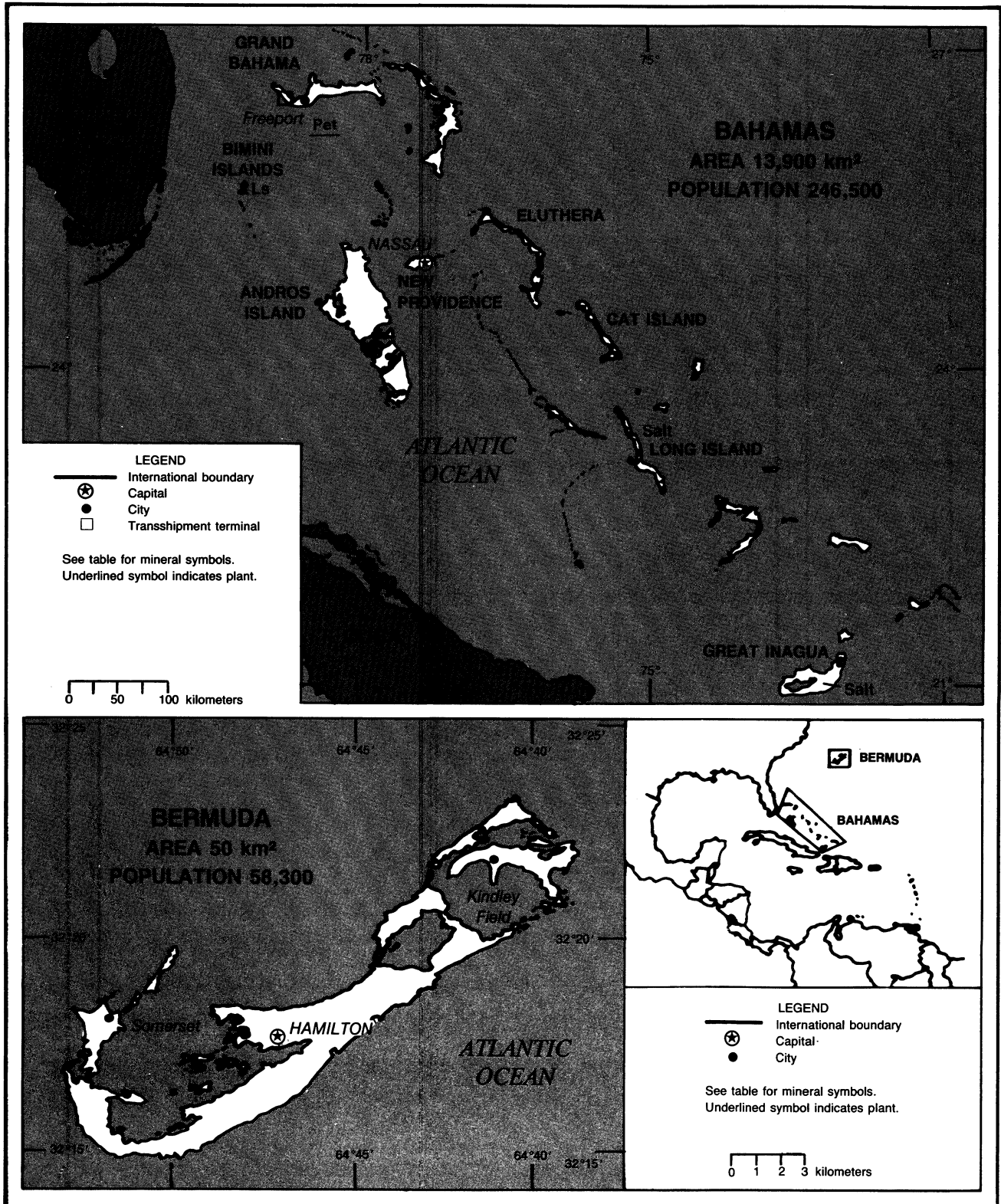
Dirección Nacional de Geología y Minería
Ave. Santa Fé 1548
1060 Buenos Aires, Argentina
Servicio Minero Nacional
Ave. Santa Fé 1548
1060 Buenos Aires, Argentina
Servicio Geológico Nacional
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Yacimientos Petrolíferos Fiscales
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Sociedad Mixta Siderúrgica Argentina
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BAHAMAS AND BERMUDA



THE BAHAMAS AND BERMUDA

By Ivette E. Torres

THE BAHAMAS

Mineral production in The Bahamas in 1990 was limited to aragonite, salt, and small amounts of sand, gravel, and stone for construction. Two other mineral-related commodities that had been produced in The Bahamas, cement and petroleum products, were not produced in 1990. A small amount of cement was last produced in 1986, after 2 years of inactivity. The petroleum refinery in Freeport, closed in 1985, was sold to the Venezuelan Government. The dominant sector of the Bahamian economy was tourism, followed by banking services.

Production

The value of mineral production in 1990 was \$13.1 million, an 18% decrease from that of 1989.¹ Salt and aragonite (a form of calcium carbonate) accounted for the major part of the total, with production that decreased 13% and 33%, respectively. Production of byproduct sulfur ceased with the shutdown of the oil refinery.

Trade

The United States continued to be The Bahamas most significant trading partner. In 1990, the value of exports from the United States to The Bahamas totaled \$800 million, 55% of The Bahamas total imports. Exports from The Bahamas to the United States was about \$507 million. Other trading partners included Bermuda, Canada, Curacao, the European Community, Gabon, Iraq, Jamaica, Mexico, Nigeria, Panama, Saudi Arabia, and Venezuela. Within the European Community, the United Kingdom was the leading trading partner. In 1989, the last year for

TABLE 1
THE BAHAMAS: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e
Petroleum refinery products ^e thousand 42-gallon barrels	91	—	—	—	—
Salt thousand tons	899	736	616	858	³ 751
Stone: Aragonite do.	426	1,524	897	1,086	³ 732

^eEstimated. ^pPreliminary.

¹Table includes data available through July 15, 1991.

²In addition to commodities listed, crude construction materials (sand and gravel, stone, etc.) may also be produced, but data on such production are not always available and information is inadequate to make reliable estimates of output levels.

³Reported figure.

TABLE 2
THE BAHAMAS: STRUCTURE OF THE MINERAL INDUSTRY

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Bahamas Cement Co.	Grand Bahama Island	690
Limestone	Marcona Ocean Ind. Inc.	Ocean Cay	2,500
Petroleum products	Bahamas Oil Refining Co.	Grand Bahama Island ¹	² 127,750
Salt	Morton Bahamas Ltd.	Great Inagua Island	1,500

¹Used for storage and transshipment. Refining ceased in 1984.

²Thousand 42-gallon barrels per year.

which information is available, crude oil was imported from Gabon, Iraq, Nigeria, the United Kingdom, and Venezuela.

Commodity Review

In 1990, Chevron Corp. announced the sale of the Freeport, Bahamas, facilities to the Venezuelan petroleum company, Petróleos de Venezuela S.A. (PDVSA). The facilities sold include the 500,000-barrel-per-day refinery, marine facilities, and storage facilities, with a capacity of 20 million barrels.² PDVSA planned to use the facility for storage and

transshipment. It did not plan to reopen the refinery in the near future.

Infrastructure

The Bahamas has two major commercial ports, Freeport in Grand Bahama Island and Nassau on New Providence Island. Nine small ports are used mainly for interisland transport. Of the 2,400-kilometer road system, 1,350 kilometers is paved and 1,050 is gravel. In 1989, installed electrical generating capacity totaled 386 megawatts.

TABLE 3

THE BAHAMAS: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Destinations, 1988	
		United States	Other (principal)
METALS			
Aluminum: Metal including alloys:			
Unwrought	36	36	
Semimanufactures	kilograms 150	150	
Copper: Metal including alloys:			
Unwrought	do. 272	272	
Semimanufactures	1	1	
Gold: Metal including alloys, unwrought and partly wrought			
	value, thousands \$95	\$47	Switzerland \$47.
Iron and steel: Metal:			
Scrap		694	694
Pig iron, cast iron, related materials	2	2	
Steel, primary forms	137	137	
Semimanufactures:			
Bars, rods, angles, shapes, sections	21	10	Turks and Caicos Islands 11.
Hoop and strip	kilograms 91	91	
Wire	550	550	
Tubes, pipes, fittings	5	5	
Castings and forgings, rough	6	6	
Lead: Metal including alloys, all forms	1	1	
Nickel: Metal including alloys, all forms	2	2	
Zinc: Metal including alloys, all forms	4	4	
Other: Ashes and residues	281	281	
INDUSTRIAL MINERALS			
Cement	219,618	170,730	Bermuda 28,892; Jamaica 8,398.
Fertilizer materials: Manufactured, phosphatic	20	20	
Gypsum and plaster	9,258	9,258	
Salt and brine	thousand tons 1,236	1,194	Canada 21; Jamaica 21.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	732,137	732,137	
Worked	value, thousands \$5	\$5	
Gravel and crushed rock	39,832	39,498	Turks and Caicos Islands 313; United Kingdom 21.
Sand other than metal-bearing	137	117	Bermuda 20.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude	thousand 42-gallon barrels 49,909	48,836	Canada 629; Panama 444.
Refinery products:			
Liquefied petroleum gas	do. 1	—	All to Turks and Caicos Islands.
Gasoline:			
Aviation	do. 305	292	Turks and Caicos Islands 12; Curacao 1.
Motor	do. 307	251	Curacao 45; Turks and Caicos Islands 11.
Kerosene and jet fuel	do. 1,198	621	Brazil 221; Panama 187.
Distillate fuel oil	do. 580	540	Turks and Caicos Islands 27; Curacao 13.
Lubricants	do. (²)	(²)	
Residual fuel oil	do. 16,142	15,266	Canada 217; Jamaica 180.

¹Table prepared by H. D. Willis. Export data for 1987 and 1989 were not available at time of publication.²Less than 1/2 unit.

TABLE 4
THE BAHAMAS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
METALS			
Aluminum: Metal including alloys:			
Unwrought	1	1	
Semimanufactures	289	287	Canada 2.
Copper: Metal including alloys:			
Unwrought kilograms	7	7	
Semimanufactures	111	108	Canada 1; United Kingdom 1.
Gold: Metal including alloys, unwrought and partly wrought value, thousands			
	\$27	\$5	United Kingdom \$14; Canada \$3.
Iron and steel: Metal:			
Pig iron, cast iron, related materials	358	358	
Steel, primary forms	282	282	
Semimanufactures:			
Bars, rods, angles, shapes, sections	4,499	4,120	United Kingdom 378; Netherlands 1.
Universals, plates, sheets	603	517	United Kingdom 86.
Hoop and strip	17	17	
Rails and accessories	10	10	
Wire	17	17	
Tubes, pipes, fittings	2,693	2,547	Netherlands 97; Canada 35.
Castings and forgings, rough	11	11	
Lead: Metal including alloys, all forms	19	17	United Kingdom 2.
Nickel: Metal including alloys, all forms	2	1	United Kingdom 1.
Silver: Metal including alloys, unwrought and partly wrought ² kilograms			
	13,339	12,753	Canada 322; Israel 164.
Tin: Metal including alloys, all forms	4	4	
Zinc: Metal including alloys, all forms	135	117	United Kingdom 15; Dominican Republic 2.
Other:			
Ores and concentrates	10	10	
Base metals including alloys, all forms	15	14	Japan 1.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc.	1	1	
Grinding and polishing wheels and stones value, thousands			
	\$35	\$35	
Asbestos, crude	1	1	
Cement	369,149	233,805	Sweden 150,853; Greece 80,444.
Clays, crude kilograms	8,373	8,069	United Kingdom 164; Colombia 86.
Diamond, natural: Gem, not set or strung value, thousands			
	\$2	\$2	
Fertilizer materials:			
Crude, n.e.s.			
	116	116	
Manufactured:			
Nitrogenous			
	2,807	2,807	
Phosphatic			
	654	654	
Potassic			
	374	374	
Unspecified and mixed			
	1,577	1,577	
Gypsum and plaster	2,925	2,925	

See footnotes at end of table.

TABLE 4—Continued

THE BAHAMAS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988		
		United States	Other (principal)	
INDUSTRIAL MINERALS—Continued				
Lime	1,259	1,259		
Mica: Worked including agglomerated splittings	value, thousands	\$370	\$350	Taiwan \$20.
Nitrates, crude	1	1		
Phosphates, crude	208	208		
Potassium salts, crude	26	26		
Precious and semiprecious stones other than diamond:				
Natural	value, thousands	\$113	\$93	United Kingdom \$13; Colombia \$3.
Synthetic	do.	\$18	\$1	United Kingdom \$17.
Salt and brine		2,063	2,043	Denmark 15; Canada 5.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked		4,339	4,339	
Worked	value, thousands	\$1,241	\$1,236	Italy \$4; Switzerland \$1.
Gravel and crushed rock		11,829	8,056	Canada 3,762; France 10.
Sand other than metal-bearing		8,086	8,086	
Other:				
Crude			378	378
Slag and dross, not metal-bearing		107	107	
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural		105	105	
Coal: All grades including briquets		488	367	Haiti 120; Dominican Republic 1.
Peat including briquets and litter		600	563	West Germany 33; Canada 4.
Petroleum:				
Crude	thousand 42-gallon barrels	35,153	—	Saudi Arabia 14,951; Nigeria 11,400; Iraq 3,134.
Refinery products:				
Liquefied petroleum gas	do.	117	117	
Gasoline:				
Aviation	do.	384	368	Curacao 16.
Motor	do.	297	266	Curacao 31.
Mineral jelly and wax	do.	(³)	(³)	
Kerosene and jet fuel	do.	1,523	639	Mexico 515; Netherlands 355.
Distillate fuel oil	do.	1,301	432	Venezuela 733; Curacao 136.
Lubricants	do.	44	43	United Kingdom 1.
Residual fuel oil	do.	11,863	4,504	Mexico 5,122; Venezuela 1,181.

¹Table prepared by H. D. Willis. Import data for 1987 and 1989 were not available at time of publication.²May include other precious metals.³Less than 1/2 unit.

OTHER SOURCES OF INFORMATION

Agency

Ministry of Agriculture, Trade and Industry
P.O. Box N3028
Nassau, The Bahamas

BERMUDA

The mineral industry of Bermuda is insignificant. Although small quantities of coral limestone have been quarried for use

as construction material for building, roofing, and water-storage tanks, statistics on production are not available. The production of stone in Bermuda constitutes a negligible part of the gross domestic product and the country's limited mineral requirements have to be imported. Bermuda, an archipelago of small islands about 1,100 miles east of South Carolina, has no rivers or streams, and ground water resources are not potable. Rain and seawater desalinization provide the freshwater supply. Electrical generating capacity in 1989 was 134 megawatts, all from oil-fired plants. Imports of petroleum products sup-

ply all energy requirements.

Bermuda is an independent territory of the United Kingdom whose main industry is tourism, which provides about 60% of the country's earnings.³ The United States continued to be one of Bermuda's most important trading partners. Other significant partners include Canada, Italy, and the United Kingdom.

¹Where necessary, values have been converted from Bahamian dollars (B\$) to U.S. dollars at the rate of B\$ 1.00=US\$1.00.

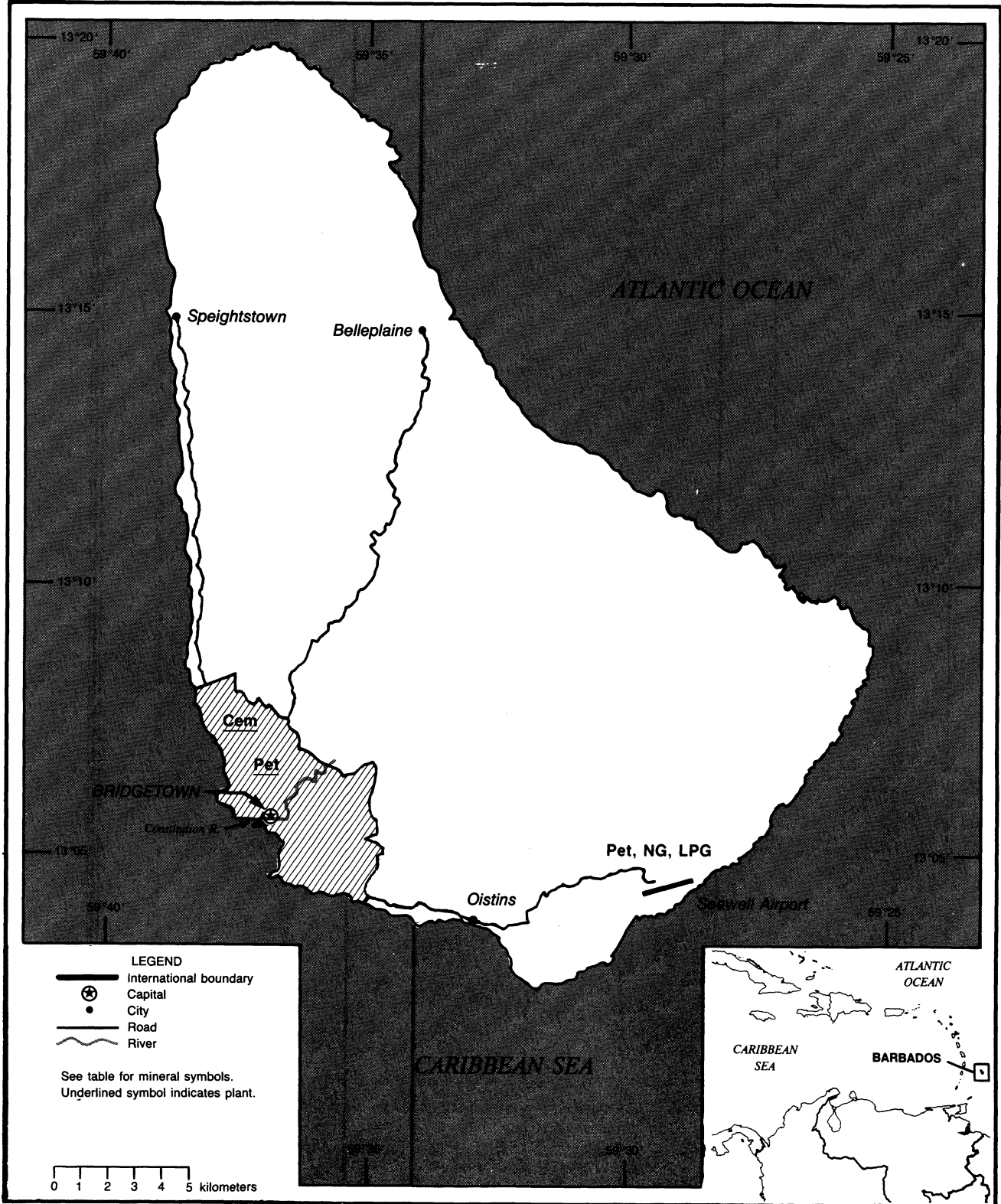
²Journal of Commerce, Aug. 1, 1990.

³Financial Times, Aug. 30, 1990, Section III, p.

BARBADOS

AREA 430 km²

POPULATION 258,100



BARBADOS

By Ivette E. Torres

Oil and gas continued to dominate the mineral industry of Barbados. Other mineral commodities produced in Barbados, such as cement, were related to the construction industry. Mining and quarrying continued to represent a very small part of the gross domestic product, about 1%. The mineral industry also contributed an unspecified amount through oil refining and cement production. Construction activity decreased in 1990.

Barbados' gross domestic product decreased by 3.1% in real terms. Output of the agricultural sector grew, but that of manufacturing and tourism declined. Even though the index of industrial production declined, that of mining and quarrying increased by about 4%, after 3 years of output decline.

GOVERNMENT POLICIES AND PROGRAMS

Foreign investment was encouraged by tax advantages and other incentives. The nonfuel mineral sector was too small to attract foreign investment. Concessions for petroleum exploration were available to foreign oil companies.

PRODUCTION

Although commercial and residential construction activity decreased, cement sales increased about 18%. Production of crude petroleum and natural gas (marketed) increased by about 17% and 4%, respectively. Output of refinery products increased by 11%.

TRADE

The United States continued to be Barbados' leading trading partner. Barbados is a member of the Caribbean Common Market. It received preferential trade benefits

under the Caribbean Basin Initiative, and it was also eligible to receive investment funds generated in Puerto Rico at reduced interest rates through the Tax Information Exchange Agreement with the United States. Barbados also qualified for trade benefits with Canada and Europe through CARICAN and the Lomé Convention, respectively. In 1990, the United States received 12% of Barbados' total exports of \$211 million.¹ Barbados imported 33% of its total requirements of about \$700 million from the United States. Finished iron, steel and aluminum products, and refined petroleum products were among the items that Barbados imported from the United States. The United States' mineral-related imports from Barbados included nonferrous metals, stone, sand and gravel, cement, and other construction materials. Other important trading partners were Canada, Caribbean Common Market Countries, Japan, Germany, the United Kingdom, and Venezuela. In 1989, 688,058 barrels of crude oil were imported from Venezuela. In 1990, imports of crude oil decreased by 20% to 1 million barrels. Imports of reformate decreased by about 13% to 313,700 barrels from 361,900 in 1989. In terms of value, the value of crude oil imports decreased only 4% to about \$20 million. However, total energy imports increased by almost 4% to about \$35 million.

STRUCTURE OF THE MINERAL INDUSTRY

The petroleum and cement companies are the largest mineral sector employers. Nonetheless, employment by the mineral sector is less than 2% of the estimated 123,000 labor force. Industry ownership is by the Government, in joint venture or alone, and private companies. Petroleum activities are under the control of the National Petroleum Corp., which assumed ownership of Mobil Oil Corp.'s assets in 1982. Petroleum exploration ventures are conducted in cooperation with the Barba-

dos National Oil Co. Ltd., a National Petroleum Corp. subsidiary. Small mining and quarrying operations are privately owned.

COMMODITY REVIEW

Industrial Minerals

Production of cement began in 1984 with the construction of the Arawak Cement Co. plant in Cheker Hall, St. Lucy Parish. Production for 1990 was estimated at 250,000 tons.

Mineral Fuels

All of Barbados' energy requirements are met by petroleum and natural gas. Production of crude oil increased 16.7% to 454,424 barrels. Operating wells increased to 107 after 19 new wells were brought into production. Barbados' crude output met 31% of the country's demand. Production of natural gas increased to 32.9 million cubic meters. Installed electric generating capacity in 1988 was 132 megawatts, all based on thermal plants.

Reserves

Reserves of crude oil as of December 31, 1990, were estimated at 3.1 million barrels, about a 6% decrease from the estimated reserves at yearend 1989. Reserves of natural gas were estimated at 209.3 million cubic meters, 1% less than the 1989 figure.

INFRASTRUCTURE

Barbados has no railroad; therefore, mineral production is transported over a 1,570-kilometer road system. Petroleum is imported at terminals on the south and west coasts. The capital, Bridgetown, is also the only port. Natural gas is piped through an expanding network to commercial and residential consumers.

TABLE 1

BARBADOS: PRODUCTION OF MINERAL COMMODITIES¹

Commodity ²	1986	1987	1988	1989 ^P	1990 ^P
Cement, hydraulic thousand metric tons	199	205	184	215	250
Gas, liquefied petroleum 42-gallon barrels	—	—	16,632	16,824	18,000
Gas, natural:					
Gross million cubic meters	27	30	35	32	³ 33
Marketed do.	11	10	17	15	15
Petroleum:					
Crude thousand 42-gallon barrels	559	497	427	389	³ 454
Refinery products do.	1,697	1,669	1,723	1,915	2,125

^PEstimated. ^PPreliminary.

¹Table includes data available through Apr. 1991.

²In addition to commodities listed, crude construction materials (lime, sand and gravel, stone, etc.) may also be produced, but data on such production are not always available and information is inadequate to make reliable estimates of output levels.

³Reported.

TABLE 2

BARBADOS: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Destinations, 1988	
		United States	Other (principal)
METALS			
Aluminum: Metal including alloys:			
Scrap value, thousands	\$13	\$13	
Semimanufactures	32	32	
Copper: Metal including alloys:			
Scrap	12	12	
Semimanufactures value, thousands	\$9	—	United Kingdom \$5; St. Lucia \$2; Antigua and Barbuda \$1.
Iron and steel: Metal:			
Scrap	110	—	United Kingdom 80; Republic of Korea 30.
Ferroalloys	30	—	All to United Kingdom.
Semimanufactures:			
Bars, rods, angles, shapes, sections	2,987	—	St. Lucia 1,256; Antigua and Barbuda 727; Dominica 593.
Universals, plates, sheets	8,014	—	St. Lucia 6,039; Grenada 1,658; Jamaica 144.
Hoop and strip	5	—	Mainly to St. Lucia.
Wire	1	—	All to St. Lucia.
Tubes, pipes, fittings	32	—	St. Lucia 15; St. Kitts and Nevis 11; Grenada 2.
Lead: Metal including alloys, semimanufactures	144	—	All to Trinidad and Tobago.
Other:			
Oxides and hydroxides value, thousands	\$2	—	St. Lucia \$1; Trinidad and Tobago \$1.
Ashes and residues	14	14	
INDUSTRIAL MINERALS			
Cement	124,017	—	Dominica 17,180; St. Vincent and the Grenadines 15,570; Grenada 13,198.
Clays, crude	1	—	All to Dominica.
Diatomite and other infusorial earth value, thousands	\$1	—	All to United Kingdom.
Fertilizer materials: Manufactured:			
Ammonia	1	NA	NA.
Nitrogenous	4	—	St. Lucia 3; Grenada 1.
Unspecified and mixed	87	NA	NA.

See footnotes at end of table.

TABLE 2—Continued

BARBADOS: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Destinations, 1988	
		United States	Other (principal)
INDUSTRIAL MINERALS—Continued			
Gypsum and plaster	72	—	St. Vincent and the Grenadines 53; Grenada 11; St. Kitts and Nevis 5.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	21	—	St. Lucia 11; Jamaica 10.
Worked	1,356	—	St. Lucia 131; Trinidad and Tobago 4.
Gravel and crushed rock	261	—	Trinidad and Tobago 200; Jamaica 31; St. Lucia 20.
Limestone other than dimension	3,995	—	Trinidad and Tobago 3,300; St. Vincent and the Grenadines 380; Guyana 275.
Sulfur: Elemental: Colloidal, precipitated, sublimed	value, thousands \$2	—	Antigua and Barbuda \$1; Dominica \$1.
MINERAL FUELS AND RELATED MATERIALS			
Carbon: Carbon black	value, thousands \$1	NA	NA.
Petroleum refinery products:			
Gasoline	42-gallon barrels 6,069	NA	NA.
Mineral jelly and wax	do. 79	—	Grenada 8; St. Lucia 8; unspecified 55.
Kerosene and jet fuel	do. 989,946	NA	NA.
Distillate fuel oil	do. 46,722	NA	NA.
Lubricants	do. 5,607	14	St. Lucia 1,568; Grenada 826; Jamaica 245.
Residual fuel oil	do. 36,124	NA	NA.
Bituminous mixtures	do. 4,993	—	Dominica 4,242; St. Vincent and the Grenadines 267; Jamaica 79.

NA Not available.

¹Table prepared by H. D. Willis. Export data for 1987 and 1989 were not available at time of publication.

TABLE 3

BARBADOS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
METALS			
Aluminum:			
Oxides and hydroxides	20	18	France 1; United Kingdom 1.
Metal including alloys:			
Scrap	value, thousands \$1	\$1	
Semimanufactures	47,812	45,325	United Kingdom 2,438; Hong Kong 18.
Columbium and tantalum: Tantalum metal including alloys, all forms	1	1	
Copper: Metal including alloys, semimanufactures	18,614	14,548	United Kingdom 3,206; Trinidad and Tobago 845.
Iron and steel:			
Iron ore and concentrate	2,446	—	All from Venezuela.
Metal:			
Pig iron, cast iron, related materials	9	3	West Germany 3.
Steel, primary forms	value, thousands \$6	\$5	United Kingdom \$1.

See footnotes at end of table.

TABLE 3—Continued

BARBADOS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
METALS—Continued			
Semimanufactures:			
Bars, rods, angles, shapes, sections	59,123	25,914	Japan 22,125; Trinidad and Tobago 8,970.
Universals, plates, sheets	9,511	557	United Kingdom 7,048; Japan 886.
Hoop and strip	80	78	United Kingdom 1.
Rails and accessories	3	2	United Kingdom 1.
Wire	22,867	2,003	Trinidad and Tobago 20,031; France 483.
Tubes, pipes, fittings	90,203	9,575	United Kingdom 43,822; Canada 867.
Castings and forgings, rough	3	1	Canada 1; West Germany 1.
Lead:			
Oxides	141	2	Trinidad and Tobago 108; West Germany 28.
Metal including alloys:			
Scrap	value, thousands	\$1	\$1
Semimanufactures	58,739	58,727	United Kingdom 12.
Nickel: Metal including alloys, semimanufactures	2	1	Spain 1.
Silver: Metal including alloys, unwrought and partly wrought			
	value, thousands	\$12	—
			West Germany \$11; Italy \$1.
Tin: Metal including alloys, semimanufactures	1,313	722	France 391; United Kingdom 124.
Titanium: Oxides	394	188	United Kingdom 93; Italy 56.
Zinc:			
Oxides	15	13	France 2.
Metal including alloys, semimanufactures	66	—	United Kingdom 60; West Germany 6.
Other: Ores and concentrates	808	808	
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc.	3,727	21	Turkey 3,679; United Kingdom 27.
Grinding and polishing wheels and stones	7	2	Netherlands 2; Switzerland 2.
Asbestos, crude	4	—	All from Canada.
Barite and witherite	2,042	5	Netherlands 2,036; Canada 1.
Cement	27,941	429	Trinidad and Tobago 15,000; Venezuela 12,123.
Chalk	10	—	All from United Kingdom.
Clays, crude	437	432	United Kingdom 4; Canada 1.
Diatomite and other infusorial earth	5	3	Canada 1; United Kingdom 1.
Fertilizer materials:			
Crude, n.e.s.	4	—	All from New Zealand.
Manufactured:			
Ammonia	17	4	United Kingdom 10; Netherlands 3.
Nitrogenous	2,850	2,170	West Germany 254; Dominican Republic 240.
Phosphatic	4,165	2,749	Martinique 820; Dominican Republic 470.
Potassic	1,693	11	Belgium-Luxembourg 1,524; Guyana 100; Dominican Republic 30.
Unspecified and mixed	5,777	151	Haiti 2,020; Dominican Republic 1,977; Bahamas 1,620.
Gypsum and plaster	28,856	75	United Kingdom 22,064; Jamaica 6,717.
Lime	19	—	All from United Kingdom.
Mica:			
Crude including splittings and waste	4,877	2	Norway 4,875.
Worked including agglomerated splittings	2	2	

See footnotes at end of table.

TABLE 3—Continued

BARBADOS: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988		
		United States	Other (principal)	
INDUSTRIALS MATERIALS—Continued				
Phosphates, crude	60,312	60,112	Netherlands 180; United Kingdom 20.	
Pigments, mineral: Iron oxides and hydroxides, processed	36	15	United Kingdom 13; West Germany 5.	
Salt and brine	8,758	6,973	Canada 1,456; Jamaica 257.	
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	914	858	Italy 46; United Kingdom 10.	
Worked	214	114	United Kingdom 100.	
Gravel and crushed rock	1,978	1,928	Jamaica 36; Trinidad and Tobago 7.	
Sand other than metal-bearing	187	137	Trinidad and Tobago 50.	
Sulfur: Sulfuric acid	64	24	Jamaica 29; West Germany 4.	
Talc, steatite, soapstone, pyrophyllite	4,844	7	Norway 4,821; United Kingdom 11.	
Other:				
Crude	86	86		
Slag and dross, not metal-bearing	5,839	—	Venezuela 5,838; Hong Kong 1.	
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	7	5	West Germany 1; United Kingdom 1.	
Carbon: Carbon black	24	4	United Kingdom 15; Belgium-Luxembourg 3.	
Coal:				
Lignite excluding briquets	15,852	2	West Germany 15,850.	
All grades including briquets	36	35	West Germany 1.	
Coke and semicoke	1	1		
Peat including briquets and litter	5,782	598	Canada 5,085; Ireland 34.	
Petroleum refinery products:				
Liquefied petroleum gas				
thousand 42-gallon barrels	105	8	Netherlands Antilles 52; Trinidad and Tobago 28; Venezuela 17.	
Gasoline	do.	12	6	Netherlands Antilles 4; Trinidad and Tobago 2.
Mineral jelly and wax	do.	(²)	(²)	
Kerosene and jet fuel	do.	1,018	—	Trinidad and Tobago 596; Netherlands Antilles 312; Venezuela 110.
Distillate fuel oil	do.	29	—	Netherlands Antilles 26; Venezuela 3.
Lubricants	do.	778	472	West Germany 93; United Kingdom 73.
Residual fuel oil	do.	1,300	—	Venezuela 966; Trinidad and Tobago 302; Netherlands Antilles 32.
Bitumen and other residues	do.	(²)	—	All from Netherlands.
Bituminous mixtures	do.	9	(²)	Jamaica 7; Trinidad and Tobago 1; United Kingdom 1.

¹Table prepared by H. D. Willis. Import data for 1987 and 1989 were not available at time of publication.²Less than 1/2 unit.

TABLE 4

BARBADOS: STRUCTURE OF THE MINERAL INDUSTRY

(Thousand metric tons unless otherwise specified)

Major commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Arawak Cement Co.	Checker Hall, St. Lucy Parish	300
Gas, liquefied petroleum thousand barrels	Barbados National Oil Co. Ltd.	Woodbourne Field, St. Philip Parish	25
Petroleum, crude do.	do.	Woodbourne Field, St. Philip and Christ Church Parishes	694
Refinery products do.	Mobile Oil Barbados Ltd.	Bridgetown	1,100

OUTLOOK

Production of nonfuel minerals has been restricted to the construction, ceramics, and pottery industries because of limited resources. The mineral fuels have assumed a greater economic role as increased production of natural gas and petroleum decrease the need for petroleum imports and the corresponding demand for foreign exchange.

¹Where necessary, values have been converted from Barbadian dollars (BD\$) to U.S. dollars at the rate of BD\$2.0=US\$1.00.

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Agency

Ministry of Trade, Industry and Commerce
Reef Road, Fontabelle
Bridgetown, Barbados, W.I.

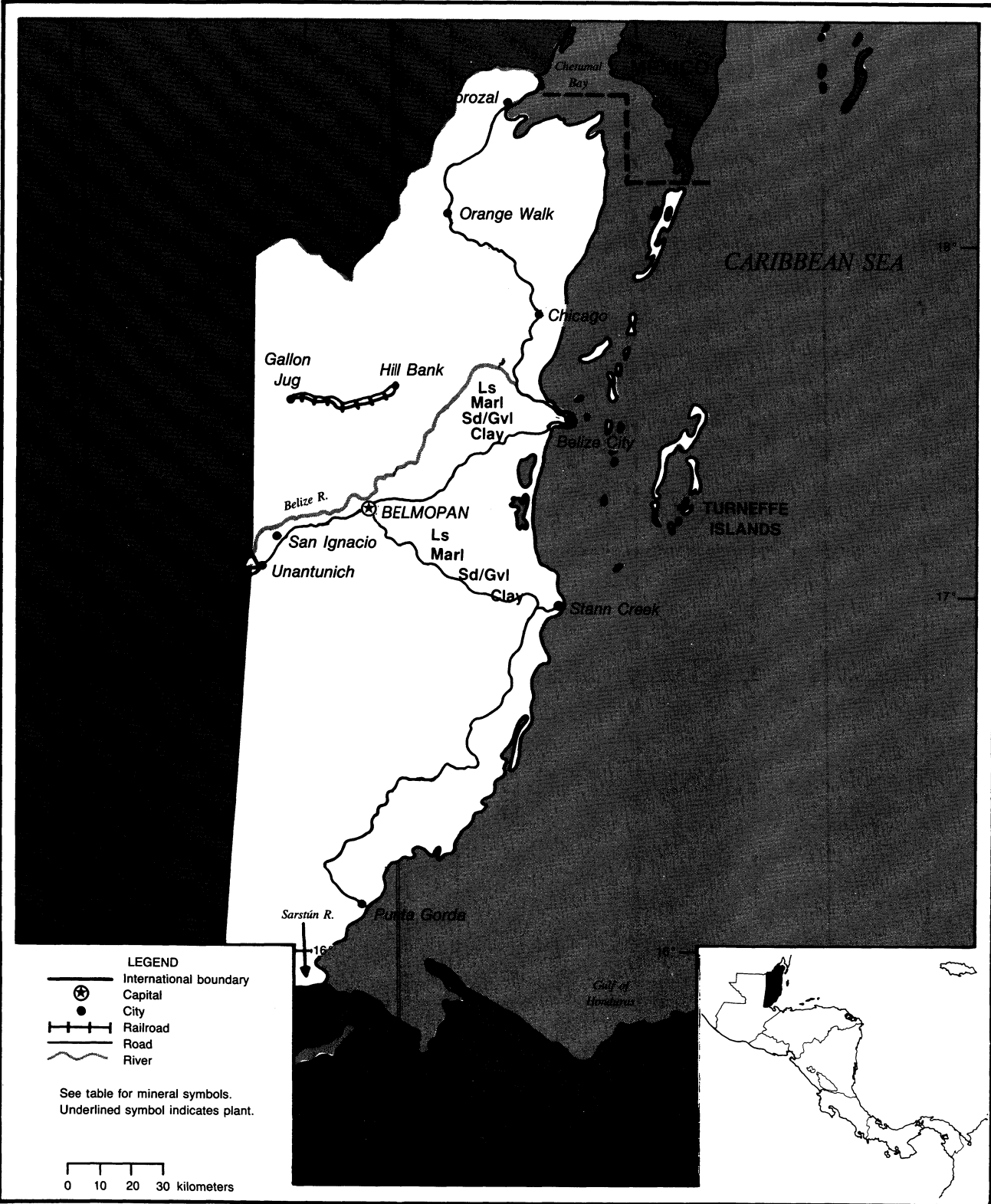
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Barbados Economic Report 1990.

BELIZE

AREA 23,000 km²

POPULATION 176,000



BELIZE

By Philip M. Mobbs

Belize's mining activities accounted for less than 1% of the country's \$ 352 million¹ gross domestic product (GDP) in 1990. The country's mining output was used to satisfy industry's demand for construction material. During 1990, mining activity consisted primarily of production of clay, dolomite, limestone, marl, and sand and gravel.

GOVERNMENT POLICIES AND PROGRAMS

The Government of Belize actively encouraged foreign investment. Foreign investors were able to benefit from guaranteed capital and unrestricted earnings repatriation, negotiated tax holidays, and lowered capital equipment import duties.

The Belize Investment Code, last revised in 1985, assigned priorities to suggested economic development. Investments in the less-developed sections of the country were encouraged, especially ventures that hired and trained local population and used local natural resources. Undertakings which involved technology transfer and the generation of foreign exchange were also sought.

The Mineral Industry was subject to the Mines and Minerals Act, 1988, which became effective January 1, 1989. The act concerned itself with both the type of mineral to be extracted and the proposed size of production operations. Petroleum was specifically excluded from the provisions of the new act.

Exclusive mineral rights were assigned through the granting of reconnaissance licenses, exclusive prospecting licensing and mining licenses. The Government encouraged Belizean participation in joint ventures, however, up to 100% foreign ownership of a company was allowed.

The act also covered nonexclusive prospecting licenses, claims, quarry permits, and mineral dealer's licenses.

A reconnaissance license allowed its holder the exclusive right to explore for specified minerals in areas up to 50 km². Identification of the reconnaissance area and the minerals of interest, a description of the operations program, projected schedule and estimated costs, a statement of the financial and technical resources of the applicant, and an estimate of the environmental impact of the investigation were to be submitted as part of the application. The administrative fee for a reconnaissance license was \$250 for foreign operators. The duration of the license would not exceed 12 months, commencing on the date the license was granted.

Exclusive prospecting licenses were allowed for areas up to 25 km². Applicants would be required to submit the same information required for a reconnaissance license, with additional statements on infrastructure requirements and proposals for the employment and training of citizens of Belize. The application fee was \$300.00. Exclusive prospecting licenses were authorized to be issued for up to 3 years. Prospecting operations were required to start within 3 months after the granting of the license.

Applications for mining licenses would be accepted on areas up to 10 km². At the request of the Minister, applicants were subject to contracting out an independent feasibility study to evaluate the proposed operations. Licenses were available for up to 20 years or the life of the deposit, whichever came first. The administrative fee for a mining license application in effect during 1990 was \$500.

Subsequent regulations required all proposed operations greater than approximately 30,582 tons per year (specified as 16,000 cubic yards per year in the act) provide a formal environmental impact statement. Quarry operations along the riverbanks and offshore marl dredging would be closely monitored for the generation of suspended solids. There was concern about the effects of potential stream contamination on the barrier reef. The reef ranged up to 30 km off

the mainland in the south before coming ashore at Ambergris Cay.

Reconnaissance, exclusive prospecting and mining licenses could be renewed with certain provisions. Transfers of mineral rights were subject to ministry approval.

The Mines and Minerals Act, 1988, also set out provisions for nonexclusive prospecting licenses, claim licenses, and registered quarry permits.

A nonexclusive prospecting license allowed its holder to prospect for the minerals identified on the license. The license would be good for 12 months. Nonexclusive prospecting license holders could stake out claims, which must then be registered within 30 days. Claim holders had exclusive rights to enter their claim area, prospect, mine, remove, and dispose of minerals for which the claim was registered. A claim may not exceed approximately 0.08 km² (20 acres). The license fee was set at \$200 for foreign operators. Claim licenses were designed for small-scale and precious-minerals operations.

Construction minerals could be mined under the authority of a registered quarry permit or a mining license. Holders of exclusive prospecting licenses and mining licenses were authorized to take construction minerals for site improvements. Registered Quarry Permits had a maximum 1-year term, with a statutory December 31 expiration date.

The act covered rehabilitation of areas damaged by prospecting or mining. Subsequent interpretation of the act specified remediation, such as requiring exhausted quarries to be infilled, rehabilitated, or converted into ponds.

Royalties were set by subsequent regulations. The industrial and construction minerals royalty was 3% on Government land and 2.5% on private land. The rate for all other minerals, including precious minerals, was 5% ad valorem. In addition, there was a \$5 per acre annual rental charge for exclusive mineral rights operations.

Possession of reserved minerals, such as unmanufactured gold, silver, platinum, and

rough and uncut diamonds, emeralds, rubies, and sapphires was prohibited, unless a mineral dealer's license was held or the materials were obtained under the holder's valid license or claim. Museums and schools that displayed or studied such material were exempted from this section of the act.

PRODUCTION

Mineral production consisted primarily of clays, limestone, marl and sand and gravel for the construction industry. Belize depended on imports for its other mineral and fuel requirements.

TRADE

Belize was highly dependent on foreign trade. Fifty-one percent of the country's \$104.9 million exports went to the United States. The United States was responsible for 56% of the Nation's \$190.9 million imports. The country had preferential access to the Caribbean, European, and U.S. markets through the Caribbean Common Market, the Lome Convention, and the Caribbean Basin Initiative, respectively. Despite an abundance of arable land, Belize used only 10 to 15% of it for the production of basic commodities. Approximately 70% of the country's export earnings was based on agriculture.

STRUCTURE OF THE MINERAL INDUSTRY

The Government's Department of Public Works produced much of the industrial minerals output prior to 1988. The remainder was produced by small private firms. Since 1988, the Geology and Petroleum Office administered movement of minerals in Belize.

COMMODITY REVIEW

Minerals

Between January 1989 and June 1990, 50 Quarry Permits and 16 Mineral Rights were issued under the new law. Eight local companies obtained mining licenses for construction or industrial minerals. The Belize, Sibun, and Monkey Rivers, as well as North and South Stann Creeks, were the focus of the country's clay, gravel, and sand operations. Three foreign companies were

TABLE 1

BELIZE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^P	1990 ^E
Clays ^E	—	—	—	² 127,670	2,724,283
Limestone ^E	350,000	350,000	350,000	² 216,588	310,308
Marl ^E	900,000	900,000	900,000	² 1,350,299	1,000,000
Sand and gravel ^E	500,000	500,000	500,000	² 363,655	206,153

^EEstimated. ^PPreliminary.

¹Includes data available through July 11, 1991.

²Reported figure.

TABLE 2

BELIZE: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons per year)

Commodity	Major operating companies	Location of main facilities	Capacity
Limestone	Belize Aggregate Ltd.	Near Belmopan	150
Marl	Cisco Construction	Offshore	500
Sand and gravel	Broadstar Construction Supplies	Near Belize City	100
	National Sand and Gravel	Near Belmopan	100

awarded exclusive prospecting licenses for base metals, clay, and limestone ventures.

The 3-year UNDP-funded Ciebo Chico Creek Gold Project concluded after the 1990 field season. Recommendations included reconnaissance of additional promising gold mineralization tracts and more detailed study of the project area.

Mineral Fuels

Belize depended upon imported oil to generate electricity. Despite the Belize Electricity Board's (BEB) 10 diesel generating plants with a total generating capacity of 25 megawatts, electricity was unavailable in most rural areas. Many industries and individuals generated their own electricity.

Projects to improve electricity generation and distribution were actively pursued. The BEB investigated hydroelectric, waste-generated, and other alternative energy projects. The northern districts of Corozal and Orange Walk were partially tied into the Mexican electric grid. Mexico also supplied diesel fuel under the San José Accord.

Petrojam Belize, Ltd., began operations in 1989. This Jamaican national energy company subsidiary converted Belizean sugar to molasses, which was shipped to Jamaica for refining into ethanol.

The Alston/Central Resources Group

drilled a dry hole. Vaalco Energy Co., Houston, TX, ran seismic surveys on Blocks 6, 7, and 8. Pentagon Petroleum of Baton Rouge, LA, signed a 4-year exploration license on Block V-14, just north of Vaalco's leases.

INFRASTRUCTURE

Quarried construction minerals were trucked to consumers over a 2,575-km road system, most of which was paved or gravel surfaced. Dredged marl was barged to port.

Road access to much of the country was limited. Large tracts of land were inaccessible. Even sections of the main highway system were subject to closure during the rainy season. The infrastructure improvement program begun in 1989 continued into 1990. Extensive roadbed rehabilitation was underway. River crossings were upgraded with steel and concrete bridges, to ensure the major highways would remain open all year.

Deep-water ports in Belize City, Daigriga, and Big Creek handled the nation's shipping.

OUTLOOK

Belize has extensive limestone deposits which may be suitable for export. There are

potentially developable dolomite deposits. Five granite outcrops have been identified as prospective sources of crushed stone and possibly dimension stone. Gypsum deposits have been located but not evaluated. Areas of metallic mineralization in the Maya Mountains have been reconnoitered. Barite deposits were identified in the 1970's. A zinc deposit was to be investigated under an exclusive prospecting license in the vicinity of Cabbage Haul Gap.

The prospect for a commercial petroleum discovery continues to attract independent operators to the country. After no exploration operations activity in 1988 or 1989, the changes in petroleum royalty and tax laws were expected to encourage exploration activity. The Korean conglomerate

Lucky Gold Star was to begin exploration operations in northeastern Belize during 1991.

¹Where necessary, values were converted from Belizean dollars (Bz\$) to U.S. dollars at the fixed rate of Bz\$2.00=U.S.\$1.00.

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Ministry of Natural Resources
84-36 Unity Blvd.
Belmopan, Belize
Ministry of Economic Development
P.O. Box 41
Belmopan, Belize

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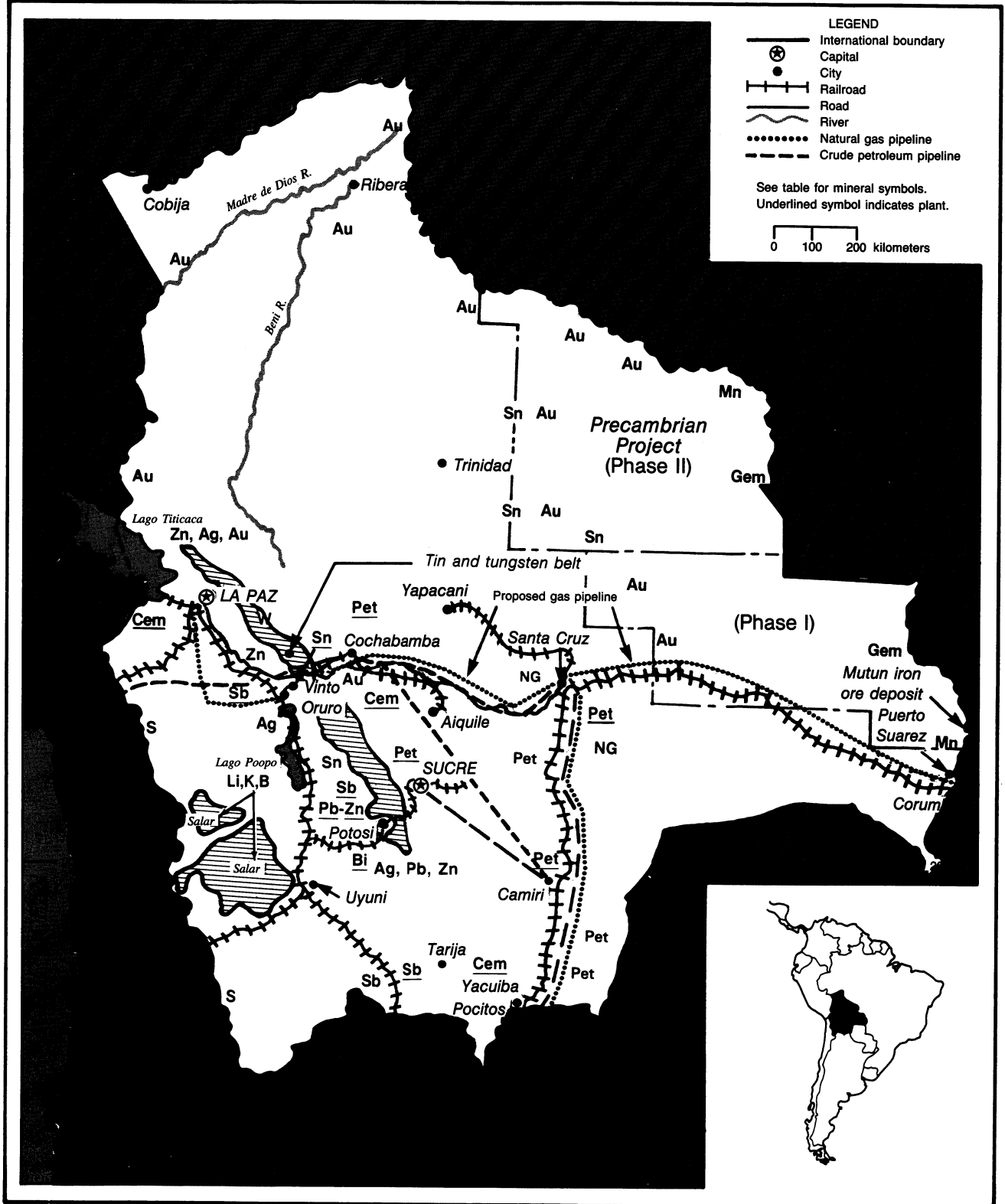
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BOLIVIA

AREA 1.1 million km²

POPULATION 6.7 million



BOLIVIA

By Pablo Velasco

In 1990, Bolivia's mining industry began to recover from the deep economic recession that overwhelmed it in the mid-1980's; the retreat from mining in the national economy has been reversed. Depressed mineral prices, particularly that of tin, and the austerity programs of the previous Government resulted in more than one half of the mines being closed in 1986; some of them had been reopened by yearend. The economic stability of Bolivia has become evident, and the mining industry now is much more responsive to market forces and is less dependent upon a single commodity than in the past. Although it had access to more credit than at any time during the past 11 years, investment capital continued to be scarce. The value of nonfuel mineral exports increased to \$407.4 million, a 1% change relative to that of 1989, surpassing hydrocarbons for the third consecutive year as Bolivia's leading foreign exchange earner.

Tin and zinc production led the expansion in the nonfuel mineral sector, with strong performances by silver and gold. The value of gold exports increased 46% as contraband trade decreased, especially of alluvial gold mined in the Araras area in the Department of Beni and around Consata-Guanay gold fields in the Department of La Paz. Tin output—traditionally the most important commodity in the sector—recovered modestly from the crisis of late 1985, reaching 17,249 tons of fine tin content in 1990, an increase of 9% from that of 1989. As a result Bolivia improved its relative position as the sixth largest tin producer in the world.

The State mining corporation, *Corporación Minera de Bolivia (COMIBOL)*, formerly the largest mineral producer in the country, has now focused its efforts on attracting private firms to operate its mines under joint venture or operating contracts and had reopened some of its mines in order to improve their mineral output in 1990. The private mining sector, composed of medium- and small-scale mining entities

and cooperatives, maintained its position as the largest producers of antimony, gold, lead, tin, tungsten, and zinc in the country. However, some of its tungsten, tin, and antimony mines—closed in previous years—stayed shut as market prices remained low. The private mining sector increased its national economic importance relative to the reduced output of COMIBOL.

Bolivia's economy continued to grow for the fourth consecutive year. The fiscal deficit was reduced from 6% of the GDP in 1989 to 2.7% of the GDP in 1990. The Government estimated that the GDP grew by 2.6%, in real terms, to \$5.6 billion.¹ The mining sector contributed \$492 million or 8.9% of the GDP. Preliminary data showed a positive trade balance of \$210.5 million as exports increased by 13%, while imports rose by about 16%. Inflation increased from 16.5% in 1989 to 18% in 1990, among the lowest rates in Latin America.

Exports of hydrocarbons continued to be the second largest foreign exchange earner, contributing 24% to Government revenues. Exports of natural gas to Argentina were valued at almost \$224 million compared with \$219 million in 1989.

GOVERNMENT POLICIES AND PROGRAMS

As a part of a general program for the stabilization and restructuring of the Bolivian economy, the new Government implemented its economic policy through a series of decrees published in late 1989. The new policy was widely discussed beforehand, notably with the International Monetary Fund (IMF). A review of the Government's policy toward the country's mineral sector was made by Congress in order to revise key aspects of the mining legislation with emphasis on the concerns of the potential foreign investors. The old policy lacked a stable and clearly defined legal framework. The proposed changes to the previous mining code were intended to reflect the overall thrust of Government

policy to open the economy to market forces, making Bolivia more attractive to potential foreign investors and to also encourage domestic private sector investment. The aim was to introduce incentives to create an investment climate as favorable as those in other countries with substantial mineral potential.

The proposed modifications to the Bolivian mining code in order to attract new foreign investments can be summarized as follows:

1. Mining activity would be expanded with marketing and processing operations, beneficiation or smelting, without the need for transfer of title of the material treated.
2. Elimination of the prohibition against engaging in mining activities by corporations or entities of foreign States or by international multilateral organizations.
3. National holders of mining concessions within 50 km of the international border would be allowed to sign service contracts (sharing risks to carry out mining activities). However, foreign nationals of the bordering country still would not be allowed to work, transfer, or lease any part of mining concessions within the 50- km zone.
4. COMIBOL would be authorized to sign or establish all kinds of contracts covering rentals, operational services, and joint ventures, in accordance with established regulations.
5. The reinvestment of profits and dividends in the mining industry would be completely free of all kinds of national, departmental, and municipal taxes, currently or in the future.
6. Mining companies would be allowed to freely market their production by exporting directly or selling their production within the country to legal and authorized buyers.
7. Gold producers would be allowed to negotiate sales with authorized enti-

ties or export their production freely, eliminating Government control.

8. State monopoly of smelting and refining operations would be eliminated.

The proposed new mining code was designed to make Bolivia more attractive to potential investors and to simplify procedures. The old mining legislation provided assurances of nondiscrimination for national and foreign investors. The only limitation on foreign investors in mining was the prohibition in articles 13 and 14 of the 1965 Mining Code on foreign ownership of mining rights or foreign investment within 50 km of Bolivia's international boundaries. However, the proposed new mining law would permit foreign investment in the 50-km belt through a Bolivian subsidiary company. Because many potentially exploitable mineral reserves lie within this zone, the economic impact could be considerable. Licensing procedures would be modernized and simplified. Proposed basic fees are quite low with an annual fee payment of \$1.00 per hectare while in production. There would be a limit of 30,000 ha per company, but holding companies may have several subsidiaries, each entitled to work 30,000 ha.

Bolivia's mineral sector has been characterized by the existence of fiscal reserves, or mineralized areas where exploration and exploitation require special authorization. Until recently, the most promising mineralized areas in Bolivia were tied up in fiscal reserves. During 1990, the Government enacted several other laws, Supreme Decrees (D.S.) and Supreme Resolutions (R.S.), regulating the different activities of the mining industry. One of the most important was D.S. No. 22408 of January 11, 1990, that allowed COMIBOL to undertake the following:

- a. Mining activities by direct administration, through joint ventures, and the use of all types of contracts for rentals and services. Joint ventures were authorized.
- b. The leasing of concessions held since the mining nationalization act of 1952. Leasing could be by invitation or through public bidding.

Among other D.S.'s promulgated by the Government were D.S. No. 22407 of February 19, 1990, called "Economic Reactivation," "Investment Law" No. 1182 of September 17, 1990, and "Hydrocarbons Law" No. 1194 of November 1, 1990.

The new investment law encouraged and guaranteed foreign and national

investments. The investment law recognized that foreign investors have the same rights, obligations, and guarantees as national investors. It guaranteed property rights, convertibility of currency, and repatriation of capital as well as profits. Free contracting of insurance for investment in the country or overseas was allowed. Procedures for imports and exports were liberalized. The law authorized tribunals for arbitration of differences in conformity with the Constitution of the nation and international formalities. Other provisions of the new investment law concerned:

Obligations—The investment must perform in accordance with the current tributary regime. Working contracts must be implemented or executed freely in conformity with the general working law. The social security system of the country must be respected. No form of private monopoly will be recognized nor protectionist privileges by the state granted.

Contracts with risk sharing—The Government would recognize joint ventures between nationals and foreigners, under the modality (risk sharing) and other arrangements fulfilling the requisites established in national legislation.

Free zones—The Executive power would be authorized to establish industrial-free zones oriented to exportation or terminal storage.

The new hydrocarbons law replaced the "General Law of Hydrocarbons" promulgated in 1972. The new law would permit private firms to explore and exploit hydrocarbons in the country under contract with the Bolivian State Petroleum Co. (Yacimientos Petrolíferos Fiscales Bolivianos—YPFB) in any part of the Bolivian territory except within the 50-km border belt. The law also would allow YPFB to enter into joint ventures to develop new or old oilfields and gasfields. Congress would have to pass an "Express Law" required by the Constitution to permit foreign oil firms to operate within the border belt.

PRODUCTION

Official figures for 1990 indicated that the value of Bolivia's mineral production

increased slightly, by 1%, compared with that of 1989, while the contribution of mining to the GDP of the country was maintained at about 9%.

The tin industry showed a modest recovery as primary tin output increased by 9% to 17,249 tons in 1990.

COMIBOL's overall mineral output improved modestly in 1990 for the third consecutive year. The mine output of the private mining sector surpassed past levels in 1990 with moderate growth expected in the future as mineral prices are expected to remain low.

During the past 2 years, the Bolivian mining industry has tried to diversify its mineral production away from tin by increasing production of lead, zinc, and associated silver. Zinc production reached a record figure of almost 104,000 tons.

In 1990, lead prices continued their highest level since 1981, giving increased value to the almost 20,000 tons of lead concentrate produced. Silver production increased 16.3% over that of the previous year. There was an increase of officially recorded gold production from 3,595 kg in 1989 to 5,198 kg in 1990. Gold production from the Araras area and from the Consata-Guanay area was sold to local traders, rather than the Bolivian Mining Bank (BAMIN), which was shut down for corruption. It was estimated that about 6,000 kg of gold was smuggled out of the country. The most accurate official figures were for gold produced as precipitates by Inti Raymi in heap-leaching operations and exported as such. The mining sector work force, including the mining cooperatives, had remained fairly constant for the past 3 years at about 4% of Bolivia's total work force.

COMIBOL's efforts were concentrated on attracting private firms to operate its mines under joint ventures or operating contracts. The company's reopening or expansion of those mines that could be exploited without economic losses was deferred in order to consider joint ventures. In 1990, COMIBOL's losses totaled \$5.8 million. COMIBOL continued to operate as a holding company with five subsidiary mining companies and two subsidiary smelting companies.

TRADE

Nonfuel minerals and mineral fuels (oil and gas) continued to be Bolivia's leading exports; in combination they contributed 70% of Government revenues. All miner-

TABLE 1
BOLIVIA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989	1990 ³
METALS³					
Antimony:					
Mine output, Sb content	10,243	10,635	9,943	9,189	8,454
Metal including Sb content of trioxide	1,171	1,723	1,015	1,236	1,046
Arsenic, mine output, arsenic trioxide, arsenic sulfide	241	132	191	338	300
Beryllium: Beryl concentrate:					
Gross weight	—	42	—	—	—
BeO content	—	3	—	—	—
Bismuth, mine output, Bi content	45	1	13	41	68
Cadmium, mine output, Cd content ⁴	36	15	39	79	102
Copper, mine output, Cu content	338	9	153	298	156
Gold, mine output, Au content ⁵ kilograms	763	2,755	4,889	3,595	5,198
Iron ore:⁶					
Gross weight	10,586	7,490	33,840	14,254	125,264
Fe content	6,669	4,718	21,319	8,980	78,916
Lead:					
Mine output, Pb content	3,121	9,043	12,544	15,728	19,913
Metal, smelter	182	201	24	12	117
Manganese, mine output, Mn content	—	—	—	100	4
Silver, mine output, Ag content kilograms	95,115	141,987	231,766	267,084	310,543
Tantalum, tantalite do.	—	—	—	—	1,984
Tin:					
Mine output, Sn content	10,462	8,128	10,504	15,849	17,249
Metal, smelter	7,673	2,667	5,373	9,448	12,567
Alloys	—	—	—	—	1,203
Tungsten, mine output, W content	1,095	638	900	1,118	1,014
Zinc:					
Mine output, Zn content	33,472	39,292	56,957	74,789	103,849
Metal, smelter	—	—	—	(⁷)	—
INDUSTRIAL MINERALS					
Barite	129	1,337	—	—	300
Calcite	300	600	*600	*500	300
Cement, hydraulic	295,176	396,018	452,285	*505,426	560,446
Gem stone, amethyst kilograms	—	—	—	—	50
Gypsum, crude ⁸	100	100	100	100	100
Marble	—	—	187	70	81
Pumice	—	—	—	200	100
Salt	*100	*100	*100	60	155
Slate	—	—	—	84	104
Sulfur, native	4,730	8,746	6,733	8,167	2,101
Ulexite	—	—	586	9,609	3,076
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural:					
Gross million cubic meters	*4,556	4,565	4,811	*5,291	5,276
Marketable do.	2,444	2,394	2,520	2,565	2,203
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	540	514	544	627	732
Other do.	1,406	2,097	*2,600	2,628	2,040

See footnotes at end of table.

TABLE 1—Continued

BOLIVIA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989	1990 ³
MINERALS FUELS AND RELATED MATERIALS—Continued					
Petroleum:					
Crude including condensate					
thousand 42-gallon barrels	6,415	6,890	7,019	7,274	7,635
Refinery products:					
Liquefied petroleum gas	1,007	886	878	1,106	1,200
Gasoline	2,909	3,239	3,266	3,504	3,400
Jet fuel	587	547	578	631	600
Kerosene	359	360	325	317	300
Distillate fuel oil	1,736	2,108	2,067	2,252	2,560
Residual fuel oil	290	225	208	106	90
Lubricants	107	107	107	75	100
Unspecified	66	73	311	164	200
Refinery fuel and losses	(7)	(7)	33	(7)	50
Total	7,061	7,545	7,773	8,155	8,500

⁴Estimated. ⁵Preliminary. ⁶Revised.¹Table includes data available through May 1992.²In addition to the commodities listed, a variety of crude construction materials (clays, crushed and broken stone, dimension stone, and sand and gravel) are produced, but available information is inadequate to make reliable estimates of output levels.³Unless otherwise specified, data represent actual production by COMIBOL and small- and medium-size mines.⁴Cadmium contained in zinc concentrates produced by COMIBOL. (Cadmium is not recovered in elemental form in Bolivia.)⁵Small- and medium-size mines output sales to BAMIN, and COMIBOL exports (small- and medium-size mines cannot legally export gold).⁶Data represent exports and are regarded as being equal to production.⁷Revised to zero.

als accounted for 40.3% of the total exports. Exports of nonfuel minerals increased slightly, about 1%, in value to \$407.4 million in 1990 compared with that of 1989. This was due to increased international market prices as well as increased mine output. As it was, mineral export values decreased except for gold, lead, silver, and zinc, which increased 46%, 42%, 14%, and 11%, respectively. Tin export earnings, historically Bolivia's most important mineral export, decreased about 19% in value to \$104 million in 1990. The nonfuel minerals sector surpassed the hydrocarbon sector as the leading foreign exchange earner for the third consecutive year.

Empresa Metalúrgica de Vinto, formerly ENAF, the former foreign exchange leader in the mining sector, increased its metallic tin exports although the dollar value decreased to \$78.4 million from \$81.8 million in 1989. The medium-size mine group, for the third consecutive year, was the largest exporter of mineral products within the mining sector. Its exports increased slightly, approximately 1%, compared with those of the previous year, and represented about 39% of Bolivia's total mineral exports.

The small-size mine group, including the mining cooperatives, accounted for about 29% of the country's total minerals exports.

In 1990, hydrocarbons were the second largest export earner, contributing 25% or \$226.9 million of the country's total export value. Natural gas exports to Argentina were valued at \$225.2 million compared with \$218.5 million in 1989. This increase was due to sales of gas with a higher content of condensates. Argentina continued to be the sole importer of Bolivia's natural gas.

In terms of value, the EC continued to be Bolivia's leading importer of ore concentrates and metallurgical products at 55% of total export value. It was followed by the United States, with 17%; the Latin American Integration Association, with 14%; and the European Free Trade Association, the Centrally Planned Economic Countries, the Andean market, Canada, Asia, and others accounting for the remaining 14%.

STRUCTURE OF THE MINERAL INDUSTRY

The Ministry of Mining and Metallurgy and the Ministry of Energy and Hydrocarbons were the principal policymaking regulatory agencies within the mining and petroleum sectors of the economy. The Bolivian Government controlled and participated in the mineral industry with the

following autonomous entities: (1) COMIBOL, which was decentralized by D.S. No. 21060 of August 29, 1990, and reorganized as a holding company, with five subsidiaries. The subsidiaries were Empresa Minera Quechisla, which controlled the mines of Tasna, Chocaya, Tatasi, and San Vicente; Empresa Minera de Potosí, which controlled the mines of Unificada del Cerro Rico de Potosí; Empresa Minera de Oruro, which controlled the mines of Huanuni, Bolívar, San José, María Luisa, Santa Fé, and Poopó; Empresa Minera de La Paz, which controlled the mines of Viloco, Colquiri, and Caracoles; and Empresa Minera del Oriente, which controls the El Mutún iron and manganese ore deposit. Some of the mines listed above were originally tin mines, but shifted to producing associated metals. (2) Servicio Geológico de Bolivia (GEOBOL), whose basic functions were to prospect for and explore the mineral resources of Bolivia. (3) The Instituto de Investigaciones Minero-Metalúrgicas (IIMN). (4) BAMIN, which provided credits to small-scale miners and purchased the output of small mines and sells minerals to mineral market traders, and (5) The Fondo Nacional de Exploración Minera (FONEM), which finances and supervises the development of small mining

projects. Despite the scaling down of its operations, COMIBOL was still the major single producer of various minerals in the country and may become more important and productive now that its reorganization has been implemented. COMIBOL operated about 10 mining units and has the responsibility for running the Vinto tin and antimony smelter and for maintenance of the Karachipampa smelter. Furthermore, COMIBOL held some very interesting properties, which have been explored in varying degrees. It was particularly interested in attracting private firms to operate its mines under joint ventures or operating contracts.

In the private sector, there were 18 affiliated mining companies under the National Association of Medium-size Miners. This group was Bolivia's and the world's largest producer of antimony and tungsten among free market countries. It also produced gold, lead, silver, tin, and zinc and became the most productive entity in the mineral sector. The most significant antimony producers in this group were Empresa Minera Unificada S.A. (EMUSA), San Juan Ltda., and Hermanos Bernal S.A. Tin producers were Consultora y Promotora Minera S.A. (COPROMIN), International Mining Co. (IMCO) Barrosquira Ltda., and Empresa Minera Quioma S.A. The principal lead and zinc producers were Compañía Minera del Sur S.A. (COMSUR), Empresa Minera Quioma S.A., and Thiawanacu Ltda. Tungsten producers were IMCO and San José de Berque.

Grouped under the Cámara Nacional de Minería are 1,200 small mines registered in 1989, an increase of 400 mines over those of 1988. Mining cooperatives are organized under the Federación Nacional de Cooperativas Mineras (FENCOMIN) and included most of the gold mining cooperatives of Tipuani, Guanay, and Mapirí. There were more than 200 mining cooperatives in the country, of which about 85% was mining gold in 1990, mainly in the Province of Larecaja, La Paz Department. In addition to gold, cooperatives also produced antimony, copper, iron ore, manganese, salt, sulfur, tin, and tungsten.

The Government continued the control of the smelting and refining of metals through Empresa Metalúrgica de Vinto (antimony and tin) and Empresa Metalúrgica de Karachipampa (lead, silver, and zinc), which remained shut down since mid-1984 for a shortage of ore feed and the lack of operating capital; both are subsidiary companies of COMIBOL.

COMMODITY REVIEW

Metals

Antimony.—Bolivia's antimony output fell about 12% below that of 1989, the lowest production since 1980. However, Bolivia remained as the second largest producer in the world after China. The decline in output was due to depressed world demand and lower prices as China continued flooding the world market. Antimony production was entirely by the private sector, with the medium-size mining sector contributing about 68% of the total production, followed by the small-size mining sector with 25%, and the remainder by COMIBOL and others. The largest producer of antimony continued to be EMUSA with its Chilcobija and Caracota Mines followed by Empresa Minera San Juan Ltda. and Empresa Minera Hermanos Bernal S.A. (shut down in 1990).

In 1990, Bolivia exported 7,937 tons of antimony, a 14% decrease in weight and a 25% decline in value from those of 1989. Of the total amount of antimony exported, 91% was in concentrates and 8% was as antimony trioxide, with the remainder as regulus (impure metal produced during smelting of ores or concentrates) and alloys. The Vinto antimony smelter of COMIBOL has remained closed for the past 3 years; however, in August 1989, the antimony smelter was fired-up for testing a new smelting method to produce antimony metal and trioxide provided by the Laurel Industries of Ohio, of the United States. As part of a 3-year toll contract agreement signed in March 1989 between the U.S. firm and the Bolivian Committee of Antimony Producers, the Vinto smelter started on August 15, 1990, to refine antimony concentrate purchased locally by Laurel at a rate of 270 tons for an agreed toll fee of about \$300 per ton. Vinto and Laurel planned to treat 400 mt/month of antimony concentrates (58% Sb and 0.5% Pb-As) starting in January 1991. The end product will be crude antimony trioxide (80% Sb). The Vinto labor force was reduced to 807 workers from more than 2,000 workers in 1985.

The private Palala antimony smelter of Hermanos Bernal in Tupiza, Department of Potosí, produced all of the antimony trioxide and alloys exported by Bolivia in 1990. About 60% of these trioxides and alloys was exported to the United Kingdom, with the remainder going to Chile, Peru, and the United States.

Gold.—Official gold production in Bolivia increased by about 45% to 5,198 kg. This increase was largely due to decreased gold contraband in 1990.

Official gold production figures were unreliable. They reflected the reported figures, not the actual production total, and failed to account for the considerable quantities of gold that were smuggled out of the country. Unofficial but more reliable estimates by industry observers placed production about 20,000 kg. The U.S. Embassy estimated that gold production in 1989 was more than 10,000 kg. The principal source of gold production in Bolivia continued to be the 78 gold mining cooperatives operating in the gold fields of Guanay, Huayti, Mapirí, Teoponte, and Tipuani (120 km north of La Paz), which accounted for approximately 61% of total production. The medium-size mining sector contributed 39% of total output. Most of the gold cooperatives are small-size operations, poorly organized and seriously undercapitalized, and according to industry watchers, these producers continued selling a large part of their gold production to private buyers instead of to BAMIN. This resulted in unregistered exports of unknown amounts of gold. The U.S. Embassy estimated that in Bolivia at least 6,000 to 7,000 kg of gold was sold to local and foreign traders without being registered. It was estimated that the cooperatives included more than 50,000 miners, including more than 10,000 barranquilleros or small-scale miners, all of them grouped under the National Mining Cooperatives Federation (Federación Nacional de Cooperativas Mineras de Bolivia—FENCOMIN). According to the National Institute of Cooperatives (INALCO), about 166 cooperatives are still awaiting legal approval to begin mining operations on about 52,000 ha of gold-bearing material.

In the medium-size mining sector, Empresa Minera Inti-Raymi S.A. has become the largest private gold producer in Bolivia, and it is jointly owned by the U.S. companies Battle Mountain Gold Co. (51%), Westworld Resources of Texas Inc. (24.5%), and EMUSA of Bolivia (24.5%). Inti-Raymi is mining gold at its Kori Khollo open pit mine, next to the old La Joya Mine near Oruro. In 1990, Inti-Raymi nearly doubled its proven gold reserves at the Kori Khollo Mine and continued its intensive drilling program to determine reserves of sulfide gold mineralization below the oxide cap currently under exploitation. The company has estimated Kori Khollo sulfide

TABLE 2
BOLIVIA: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	1990	Principal destinations, 1990
METALS			
Antimony:			
Ore and concentrate	7,973	7,268	NA.
Trioxides	836	663	United States 388; United Kingdom 222; Chile 47.
Metal including alloys:			
Regulus	121	6	Chile 5; Argentina 1.
All forms	279	443	United Kingdom 246; Chile 149; United States 38.
Arsenic: Trioxides and other compounds	338	300	NA.
Bismuth:			
Ore and concentrate	18	—	
Metal including alloys, all forms	32	137	All to United States.
Cadmium: Cd content of zinc ore	22	30	NA.
Columbium and tantalum: Tantalum ore and concentrate	1,984	583	NA.
	kilograms		
Copper: Ore and concentrate	—	456	NA.
Gold:			
Ore and concentrate, Au content	kilograms	1,251	1,500 NA.
Metal including alloys, unwrought and partly wrought	do.	2,350	3,757 NA.
Iron and steel: Iron ore and concentrate	24,553	38,157	NA.
Lead:			
Ore and concentrate	17,009	19,553	NA.
Metal including alloys	12	278	Brazil 275; Panama 3.
Manganese: Ore and concentrate	101	3,644	NA.
Silver:			
Ore and concentrate	kilograms	296,529	281,400 NA.
Metal including alloys, unwrought and partly wrought	do.	35,568	46,376 France 28,184; United Kingdom 9,701; Switzerland 6,861.
Tin:			
Ore and concentrate	5,103	3,730	NA.
Metal including alloys, all forms	9,909	13,685	Chile 10,150; United States 1,924; Colombia 431.
Tungsten: Ore and concentrate	1,390	1,220	NA.
Zinc:			
Ore and concentrate	80,491	98,882	NA.
Metal including alloys, all forms	37	—	
INDUSTRIAL MINERALS			
Barite	—	300	NA.
Boron materials: Crude natural borates	9,609	3,104	NA.
Precious and semiprecious stones other than diamond: Natural	kilograms	(?)	³ 50 NA.
Salt, natural	60	155	NA.
Stone, sand and gravel: Dimension stone:			
Crude and partly worked	² 354	285	NA.
Sulfur, all forms	8,167	2,101	NA.
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural	million cubic meters	2,210	2,203 All to Argentina.
Petroleum refinery products:			
Liquefied petroleum gas	42-gallon barrels	6,100	NA

¹Revised. NA Not available.

²Table prepared by H. D. Willis. Table includes partial provisional export data. Import data for 1989 and 1990 were not available at time of publication.

³Revised to zero.

³Amethyst.

TABLE 3

BOLIVIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Antimony		Empresa Minera Unificada S.A. (EMUSA)	Caracota, Chilcobija, and Espiritu Santo Mines, Potosí Department	2.7.
Do.		Empresa Minera San Juan Ltda.	Candelaria Mine, Potosí Department	2.1.
Antimony trioxide		Empresa Minera Hermanos Bernal S.A.	Palala smelter, Tupiza, Potosí Department	1.0.
Gas, natural				
million cubic meters per year		Yacimientos Petroliferos Fiscales Bolivianos (YPFB)	Río Grande, and La Peña gasfields, Santa Cruz Department	1,348.
Do.	do.	do.	San Roque, Vuelta Grande gasfields, Southern District	1,274.
Do.	do.	do.	Sirari, Naranjillos Santa Cruz gasfield Central District	1,872.
Do.	do.	Occidental Boliviana Inc., Tesoro Bolivia Petroleum Co. (U.S.) and Empresa Naviera Pérez-Compac-Sacfic (Argentina) contractors	El Porvernir, La Vertiente, gasfields, Santa Cruz Department	66,100.
Gold	kilograms per year	Cooperatives (some with U.S. equity) and Teaponte rivers, La Paz Department	Tipuani, Guanay, Mapiri, Huayta, Kaka	2.2.
Do.	do.	Empresa Inti Raymi S.A. (Battle Mountain Gold Mining Co., shareholder)	Gold Leaching, open pit operation at La Joya, near Oruro, Oruro Department	1.5.
Do.	do.	Bolivian Army's Development Corp.; 200 dredges operating in the Araras Region (without legal concessions)	Araras, Cachueta Esperanza gold-dredging, Pando and Beni Departments	6.0.
Lead		Empresa Minera Quioma S.A. (COMSUR S.A.) (Formerly owned by ASARCO Incorporated of the United States)	Asientos, lead-silver-zinc mine at Mizque, Cochabamba Department	6.5.
Do.		Corporacion Minera de Bolivia (COMIBOL)	Santa Fé, Tatasi, Animas-Inocente, and San José Mines, Potosí Department	3.2.
Do.		Empresa Metalúrgica de Karachipampa (Autonomous subsidiary company of COMIBOL) Lead/silver smelter (to be fired up in 1991)	Karachipampa, Potosí Department	24.0.
Petroleum				
thousand barrels per year		Yacimientos Petroliferos Fiscales Bolivianos (YPFB)	La Peña, Vuelta Grande, Río Grande San Roque, and Monteagudo oilfields Santa Cruz Department	6,037.
Do.	do.	Occidental Boliviana Inc. and Tesoro Bolivia Petroleum Co., both U.S. companies and others contractors	Porvenir, La Vertiente, and Tita oilfields	1,238.
Silver	kilograms per year	Corporación Minera de Bolivia (COMIBOL) Cía. Minera de Oruro, Cía. Minera Quechisla, and Cía. Minera de Potosí subsidiaries	San José, Bolívar, Poopo, Santa Fe, San Vicente, Tatasi, Animas-Inocente, and Unificada Mines at Ururo, and Potosí Departments	126,000.
Do.	do.	Cía. Minera del Sur, S.A. (COMSUR) (RTZ of the United Kingdom, shareholder)	Martha, Huari, Porco, and Milluni Mines La Paz, Department	38,600.
Tin		COMIBOL: Cía. Minera de Oruro, Cía. Minera Quechisla, Cía. Minera de Potosí and Cía. Minera La Paz	Huanuni, Colquiri, Caracoles, Viloco, and Chorolque Mines, at Oruro, Potosí, and La Paz Departments	6.4.
Do.		COMSUR, Barrosqira, International Mining Co., Yana Mallcu and Avicaya companies	Martha, Cerro Grande, Milluni, and Berenguela tin mines	2.4.
Do.		Small miners and cooperatives	Catavi-Siglo XX, Caracoles, Bolivar Viloco, Colquiri, and Colquechaca Mines	6.4.
Tin, refined		Empresa Metalúrgica de Vinto (COMIBOL's subsidiary)	Vinto, Oruro Department	9.0.
Do.		Fundestano de Oruro S.A.	City of Oruro, Oruro Department	5.0.
Do.		Cía. Metalúrgica Industrial y Comercial-Hormet S.A.	City of La Paz, La Paz Department	0.2.
Tungsten		COMIBOL-Cía. Minera La Paz	Kami, Tasna, and Bolsa Negra Mines, La Paz Department	Closed in 1987.

TABLE 3—Continued

BOLIVIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Tungsten—Continued	International Mining Co. (IMCO)	Chojlla Mine, La Paz Department	0.5.
Do.	Empresa Minera San José Berque	Esmoraca, Pueblo Viejo, Espanola, and La Argentina Mines, Sudchichas Province Potosí Department	0.2.
Zinc	COMIBOL, Cía. Minera de Oruro, Cía. Minera Quechisla, Cía. Minera de Potosí	Santa Fé, Colquiri, San Vicente, Tatasi, Animas-Inocente, and Unificada Mines at Oruro, Potosí, and La Paz Departments	16.3.
Do.	COMSUR S.A., Maragua Ltda., Caballo Blanco S.A.	Porco, Asientos, Maragua, Huari-Huari Monserrat, and Monte Blanco Mines at Cochabamba, Oruro, and Potosí Departments	50.0.

TABLE 4

BOLIVIA: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1990

(Metric tons unless otherwise specified)

Commodity	Reserves
Antimony, metal content	308,000
Lead, metal content	25,965
Lithium carbonate thousand metric tons	5,500
Natural gas billion cubic meters	153
Petroleum thousand 42-gallon barrels	180,440
Silver, metal content	1,099
Tin, metal content	170,000
Tungsten, metal content	45,000
Zinc, metal content	837,000

mineralization at 55.1 Mmt of minable sulfide ore and 5.7 Mmt of minable oxide ore with an average grade of 2.08 g of gold per ton and 13.7 g of silver per ton. The recovery rate for the sulfide ore is expected to average 63% for gold and 25% for silver. About 3 Mmt of the oxide ore will be processed through the current cyanide leaching operation before the startup of a new mill in 1992 that will be capable of extracting gold and silver from the sulfide ore. The oxide zone is being mined at the rate of 1,400 kg of gold per year.

Gold exploitation began 6 years ago on the Brazilian border in the Araras region on the Madera River, 80 km north of the city of Guajara-Merín in Beni Department. Three separate groups formed by a small, private mining company, the Empresa Minera Comercial Boliviana, included a large cooperative, Buena Esperanza, and Armed Forces Development Corp. (COFADENA), that dredged on the Bolivian side of the Madera River. They rented

Brazilian suction dredges for their operations. Empresa Minera INGEOBOL, a subsidiary of ESTALSA, bought three small suction dredges from Brazil for use in its operations. Lack of roads on the Bolivian side forced Bolivian operators to use the Brazilian roads that join Guajara-Merín to Presidente Márquez for transportation of gold production and supplies. Most of the gold produced in the Araras region is sold to Brazilian merchants on the border. Annual production in this area has been estimated to be about 500 kg.

Production of gold from the Madre de Dios River was substantially increased by new cooperatives and miners that moved into the area. More than 15,000 new gold concessions were granted to the village of Nueva Esperanza. Estimates by the Ministry of Mines indicated that between 200 to 500 small suction-dredges were operating on the Madre de Dios River and produced 200 to 400 g of gold per day. COMIBOL had a very large gold mining concession in the Madre de Dios River, and from December 1985 through July 1989 it granted 39 mining concessions totaling 14,668 ha. Thirty one of the concessions were canceled owing to irregularities in the contracts.

Among other U.S. mining companies involved in mining activities in Bolivia exploring the Altiplano and alluvial gold deposits in the Tipuani-Guanay-Mapiri region are ASARCO Incorporated, United Mining Corp., and PanAmerican Mining Ltd. In addition, there are several small gold operations involving small U.S. investors in Guanay, Yuyo, Mapiri, and Teoponte areas that had operating contracts with local gold mining cooperatives.

Iron Ore.—Production and exports of iron ore increased sharply in 1990 over his-

toric levels. Empresa Minera del Oriente (EMEDO), a subsidiary of COMIBOL, continued mining and exporting iron ore from the rich Mutun iron ore mine near the Brazilian border, east of Santa Cruz. Its iron ore exports went to neighboring Paraguay's state steel plant, Aceros del Paraguay S.A. (ACEPAR). After the completion of a successful pilot operation and the signing of the contract in October 1989, EMEDO exported 125,000 tons of iron ore grading 62% iron in 1990. The pilot operation began in August 1989, when about 30,000 tons of iron ore was sold to ACEPAR. Over the next year, sales should generate about \$1.6 million for Bolivia. Paraguay will also benefit from this transaction, because it will pay \$12.50 per ton f.o.b. Puerto Ladario on the Paraguayan River, \$3 to \$6 less per ton than it was paying to Brazilian private suppliers. However, EMEDO'S officials were complaining that Brazilian suppliers, who have started legal proceedings against ACEPAR for breaking the contract, were trying to block Bolivia's exports by placing a series of obstacles at Brazilian ports.

Lead, Silver, and Zinc.—Production of all three commodities increased substantially in 1990 compared with that of 1989. Lead ore and concentrate increased 27%, silver was up 16%, and zinc was up 39%. Output of metallic lead, including alloys, recovered from the depressed level of previous years. Output of metallic silver increased 30% over that of the previous year. The medium-size mining sector was the dominant lead and zinc producer with 56% of total lead and 61% of total zinc. In this sector, the major producers were Cía. Quioma S.A., COMSUR, and Tiahuanacu Ltda. COMIBOL mines continued to be the largest silver producers in the country with

42% of total output. The medium-size mines produced 40% and the small mines 18% of total silver. Cía. Minera de Oruro, one of the five subsidiary companies of COMIBOL in charge of six COMIBOL's mines, reopened the San José lead-silver mine and the Bolívar silver-tin-zinc mine in July 1987.

Golden Star Resources Ltd. of Canada had its main interest in COMIBOL's troubled Bolívar Mine, with estimated reserves of 4 Mmt grading 17% zinc and 400 g/mt silver, which it planned to mine in a joint venture with COMIBOL and Placer Dome of Canada. The ongoing controversy over foreign company interest in COMIBOL's Bolívar Mine was thought to have ended with the company's announcement that there would be no joint venture with the Placer Dome and that COMIBOL would develop the mine alone. Despite the statement, Golden Star and Placer Dome, who were already working together developing the Omani gold mine, were still confident that they would eventually get the go-ahead from the Government. Under the arrangement drawn up with the former Government, which was still valid under Bolivian law, COMIBOL would retain ownership of the mine while the joint venture with Golden Star and Placer Dome would manage it. Investment for the first 2 years was to be \$45 million, and another \$16 million after 3 years. Profits would be shared 55-45 in favor of COMIBOL.

COMSUR, Bolivia's largest private-sector mining firm, was seeking \$26 million in foreign financing to carry out its ambitious plans to increase production at its existing deposits. The company was about to secure a \$7 million loan from the International Finance Corp. (IFC), an affiliate of the World Bank. The bulk of the IFC financing was destined for improving infrastructure and the construction of a new mill at COMSUR's Porco Mine (lead, silver, and zinc) at Potosí, which the company has been leasing from COMIBOL since 1964. COMSUR also planned to increase capacity at its heap-leaching plant from 500 mt/d to 1,000 mt/d at the giant Cerro Rico deposit. Other operations to benefit from COMSUR's expansion were its Asientos Mine (lead, silver, and zinc) at Cerro Grande. Río Tinto Zinc Corp. Ltd. (RTZ) has taken 30% interest in COMSUR, and together they were assessing the silver reserves of the Cerro Rico de Potosí deposit.

The Karachipampa lead-silver smelter in Potosí now operates as an autonomous subsidiary company of COMIBOL as the

Empresa Metalúrgica de Karachipampa. Since completion of construction, the smelter has never been fired, although this may occur in 1993. Shortage of mineral feed and lack of operating capital continued as the main problem.

Tin.—Tin continued to be Bolivia's most important nonfuel mineral commodity. Its output increased about 9% from that of 1989 to about 17,250 tons. The largest production increase in the private sector was by the small-size mines and cooperatives, which for the fourth consecutive year replaced COMIBOL as the leading tin-producing sector, and in 1990, accounted for about 54% of Bolivia's tin production. The COMIBOL mines produced about 35% of the total, and the remaining 11% was produced by the medium-size mining sector.

COMIBOL management operated under the restructuring program established by D.S. 22623 of October 1990. Tin mines rich in complex silver ores like the San José and Unificada del Cerro de Potosí Mines were able to remain open, although tin was no longer mined. Tin mines associated with wolframite mineralization, such as the Chambilaya and Enramada Mines, have remained closed since 1987. The reopening of COMIBOL's Huanuni Mine helped to increase its output of tin. The Huanuni Mine has become the largest and the richest tin mine in the country since its reopening in September 1988.¹

In August 1989, COMIBOL's Colquiri Mine was reopened with a new 1,000-mt/d mill for ores grading 1.2% tin and 6.6% zinc. Production of tin at COMIBOL's Catavi-Siglo XX Mine, once the largest tin mine in the world, remained shut down; however, Catavi's large mine and mill dumps are currently being recycled by small mining cooperatives formed by former COMIBOL miners. COMIBOL planned to start full operations at the Caracoles tin mines. Mill and mine tailings from COMIBOL's tin mines at Catavi, San Miguel, Porvenir, Molinos, Telamayu, and Itos were programmed for joint ventures or leasing contracts with private companies. COMIBOL, in 1990, has started to focus its efforts on attracting private firms to operate its mines under joint ventures or operating contracts. In late 1989, the United States-Australian company MINPROC signed a 10-year lease with COMIBOL to mine the tailings of Colquiri Mine. MINPROC's contract has a 4-month exploration stage together with metallurgical tests and an exploitation stage. COMIBOL

in return will receive an annual rent of \$500,000 for an estimated annual output of 2,025 tons of tin, 27,000 tons of zinc, and 20 kg of silver. However, the startup of the project had some problems with the Colquiri miners.

In the private sector, COPROMIN S.A. was the largest single tin producer in the country in 1990 with 503 tons of tin concentrate. COMSUR's Empresa Minera Quioma, a subsidiary of Minera Bolivia S.A., was no longer the country's largest producer of tin. Tin production at the Chojlla tin-tungsten mine of IMCO increased in 1990 compared with that of 1989. Estalsa's tin dredging operation remained closed since September 1988.

Bolivia's tin concentrate exports decreased 27% in 1990 to 3,722 tons. Exports of metallic tin, including alloys, increased about 40% to 13,231 tons.

The state-owned Vinto tin smelter (formerly ENAF) increased its metallic tin exports, although the dollar value decreased to \$78.4 million from \$81.1 million in 1989. The dollar value export figure is still well below the almost \$191 million exported in 1984. In 1990, the Vinto smelter exported about 12,300 tons of metallic tin (97.4% tin content). About 40% of Bolivia's metallic tin exports went to Chile and another 40% to the United States. Vinto planned to produce just over 14,000 tons of metallic tin in 1991. The smelter, which re-opened in 1987 without state subsidies, improved consistently on the basis of Bolivia's growing production. In 1990, 13,231 tons valued at \$83.0 million was produced, enabling the smelter to record a \$1.5 million profit. In 1990, the Vinto smelter purchased 13,618 tons of high-grade tin concentrates more than 45% tin) compared with 10,300 tons purchased in 1989. There were strong allegations that tin smuggled from Brazil was sold as Bolivian tin production. It has been estimated that about 3,000 tons of tin in concentrates was smuggled into Bolivia and sold to Empresa Metalúrgica Vinto in 1990.

Bolivia's relative position as a world tin producer recovered to sixth place after Brazil, Malaysia, Indonesia, China, and the U.S.S.R.

Tungsten.—Bolivia's production of tungsten concentrate, (WO₃), heavily dependent on international prices, decreased to about 1,300 tons from 1,400 tons in 1989. The mines that were closed 4 years ago owing to severe ore depletion and high operating costs did not resume operations.

Increased production since 1987 was from those mines that remained open, but had reduced their output. COMIBOL ceased production completely in 1986. Output of the medium-size mining sector increased 18% compared with that of 1989, and production by the small-size mining sector decreased about 6% to 617 tons (WO_3 content). IMCO continued to be the country's largest producer of tungsten, contributing 37% of the national total from its Chojilla Mine. IMCO's Chambilaya and Enramada Mines closed in 1986 and remained closed. Empresa Minera San José de Berque became the second largest producer of tungsten with 17% of the total produced from its Esmoraca, Pueblo Viejo, Española, and La Argentina Mines in Sud Chichas, Potosí Department. The Chicote Grande Mine of Churquini Enterprises Incorporated, a subsidiary of Anschutz Mining Corp. of the United States, continued limited exploitation with its production registered as part of the small-size mining sector.

Industrial Minerals

Cement.—Cement in Bolivia was produced by four cement plants in different regions of the country having a total production capacity of about 700,000 tons. The largest one was Fábrica Nacional de Cementos S.A. (FANCESA) at Cal Orko (Mesa Verde) in Sucre Department, with a production capacity of 330,000 mt/a. In 1990, FANCESA produced 39% of the total. The second largest was Sociedad Boliviana de Cementos S.A. (SOBOCE), at Viacha, La Paz Department, with a production capacity of 210,000 mt/a in 1990 (35%). The third was Compañía Boliviana de Cementos S.A. (COBOCE), at Irpa-Irpa, Cochabamba Department, with a capacity of 100,000 mt/a in 1990 (24%), and the fourth was Fábrica de Cementos El Puente, at Méndez, Tarija Department, with a production capacity of 60,000 mt/a in 1990 (2%). Three plants, COBOCE, FANCESA, and El Puente, were state-owned. SOBOCE in La Paz Department was the only privately owned cement plant in the country.

During 1990, production of cement increased by about 11% from that of 1989. Production of clinker in 1990 was more than 400,000 tons, but the U.S. Embassy estimated the output of limestone from quarries near the cement plants at more than 600,000 tons. The Yacuses limestone deposit, with 60 Mmt of reserves in eastern Bolivia, in Santa Cruz Department, is jointly owned

by the Regional Development Corporación of Santa Cruz (CORDECRUZ) and private entrepreneurs (Roda Group). They plan to install a 345,000 mt/a cement and clinker plant. The new company will be named Compañía de Cemento Camba S.A. (COSECA).

Lithium.—November 17, 1989, the Ministry of Mines and Metallurgy signed a \$46 million preliminary exploration and exploitation contract concerning the lithium resources of the Uyuni salt flats. The contract was valid for 40 years, or the extraction of up to 400,000 tons of metallic lithium equivalent, whichever came first. A feasibility study was to be prepared for the construction of surface facilities to produce at least 7,000 mt/a of lithium carbonate.

Since November 1989, Bolivia's national press has demanded changes to the contract; moreover, there was opposition in Congress. The Federación Sindical de Trabajadores Mineros de Bolivia-FSTMB and the regional civic committee were vociferous critics. The criticism was centered around insufficient taxes and royalties to be paid by LITHCO. May 4, 1990, the Bolivian Government announced that the \$46 million preliminary contract was canceled and issued a verbal order that the project be open for international bidding. Then the Ministry of Mines and Metallurgy, through Complejo Industrial de los Recursos Evaporíticos del Salar de Uyuni (CIRESU), the Government agency in charge of the development of the Uyuni salt flats, announced that, in January 1991, an international calling for bids will be issued for the formation of a joint venture with the Bolivian Government to implement the project.

Mineral Fuels

Bolivia's hydrocarbon sector participation in the worldwide energy picture remained negligible, and it appeared that this position would continue for the foreseeable future. However, Bolivia continued to be self-sufficient in petroleum crude, natural gas, and refined petroleum products. In 1990, crude oil production increased by 5% to 7.6 Mbbl, compared with that of 1989.

Bolivia's oil and gas industry continued to be the second largest export earner, contributing 24.5% of the total value of exports and 35% of revenues. The sector accounted for 6.4% of GDP and it employed about 6,000 persons out of a total work force estimated at 2 million. The industry con-

tinued to be controlled by the Ministerio de Energía e Hidrocarburos through its agency, Yacimientos Petrolíferos Fiscales Bolivianos (YPFB). YPFB conducted exploration, production, refining, transportation, and marketing in 1990. YPFB has signed 30 operational contracts since 1973, when the Bolivian former hydrocarbon law was implemented. Of this total, four were new contracts signed in 1990. Two contracts were signed with the U.S. company Santa Fe Energy Resources of Bolivia, Inc. one contract with the U.S. company Chevron International Ltd., and one contract with the Argentine-Bolivian company, Pluspetro-Petrotec.

Occidental Boliviana Incorporated (a subsidiary of Occidental Petroleum Corp.) and Tesoro Bolivia Petroleum Co. (owned by Tesoro Petroleum Corp. and Mobil Oil Corp.) continue to be the only two U.S. oil companies operating in the country with exploitation contracts. Both companies started, in late 1990, deep-pool exploration drilling in their respective fields.

Petroleum reserves were estimated by YPFB December 31, 1990 at 180.44 Mbbl of liquids (119 Mbbl as proven reserves) and 152.9 billion m^3 natural gas (117.2 billion m^3 as proven reserves). At current production and consumption rates, Bolivia's oil reserves would last for another 21 years.

Natural Gas.—Production of natural gas decreased 0.3% from that of 1989 to 5,276 Mm^3 . YPFB's Río Grande and Vuelta Grande Gasfield continued to be Bolivia's largest natural gas producer, followed by Occidental Boliviana's Porvenir Gasfield and Tesoro Bolivia's La Vertiente Gasfield. Of the total production of natural gas, 65% was produced from YPFB Gasfields and 35% by Occidental and Tesoro.

Bolivia's domestic consumption of natural gas continued to be minimal at 440 Mm^3 , 24.3% over that of 1989. The major consumers of natural gas in 1990 were the Empresa Nacional de Electricidad (ENDE), which consumed more than 50% of national production. In 1990, Bolivia LPG consumption increased from 1.97 Mbbl to 2.25 Mbbl. Argentina continued to be Bolivia's sole foreign customer for natural gas. Accordingly, interest by Argentine firms in exploration and enhanced recovery contracts with YPFB has increased in the past 3 years. Bolivia's natural gas export agreement with Argentina ends in April 1992. In 1990, gas exports to Argentina decreased slightly from that of 1989 to 2,203

Mm³, but increased 3.1% in value to \$223.7 million. This increase in value was due to sales of gas with higher content of condensates bringing higher prices paid by Argentina. Payments for gas sales were more regular than during the previous 4 years. Payments continued to be made 82% in cash and 18% deposited in an escrow account to be used for purchase and contract of Argentine goods and services in Bolivia.

Of the natural gas produced in Bolivia, 42% was exported to Argentina; 8% was consumed domestically; 35% was reinjected into the gasfields; 8% was vented, flared, or lost; 4% was consumed as fuel by YPF; and the remainder was consumed in miscellaneous uses. As a result of YPF's program of substituting gas products for liquids, domestic consumption of LPG continued increasing from about 1.99 Mbbbl in 1989 to 2.04 Mbbbl in 1990. In 1989 and 1990, however, several natural gas pipelines were installed and a larger volume of natural gas was consumed domestically. YPF operated four LPG plants at Río Grande, Gas Norte, Camiri, and Vuelta Grande in the Department of Santa Cruz, which produced LPG and natural gasoline.

On July 25, 1989, Bolivia and Brazil signed three agreements that established the sale-purchase of goods and services to start in September 1992. The contracts were as follows: (1) The sale of electricity generated by a 500-MW thermoelectrical plant. ENDE will sell electricity to Electrobrás and Electrosul of Brazil to cover the energy needs of the state of Matto Grosso. (2) The sale of 100,000 mt/a of urea for the Brazilian market. (3) The marketing by Brazil of 100,000 mt/a of polyethylene of high density and low density.

All these projects were based the construction of a 50.8 cm, 557-km gas pipeline from Santa Cruz to Puerto Suárez the Bolivian-Brazilian border. The pipeline will be constructed by Bolivia and will carry natural gas from YPF's and its contractors' gasfields. The cost of the three projects was estimated at \$810 million. The financing for the projects was being sought from international financial institutions, private sources, and bilateral financing.

Petroleum, Crude.—The total average daily production of crude oil increased slightly to 20,918 bbl in 1990 from 19,929 bbl in 1989. Of the total crude oil produced, the YPF share was almost 83%, and the remainder was produced by Occidental Boliviana and Tesoro Bolivia.

During 1990, YPF and the two U.S.

contractors were active in exploration drilling. YPF drilled 24,353 m, 2% higher than in the previous year. YPF made two new oil discoveries, the Víbora and Patujú Fields, both in the Central area of Santa Cruz.

Domestic consumption of refined petroleum products increased by 5% over that of 1989, to 24,831 bbl/d. The domestic prices for refinery products were increased twice by the Government in 1990, with the price at yearend set at .34¢ per liter for unleaded gasoline. On July 31, 1989, Maxus Boliviana Incorporated, a subsidiary of Diamond Shamrock Corp. of Dallas, Texas, signed an exploration contract with YPF (contract XXV) to explore 1.4 Mha in the Boomerang (Mamoreé) region at the border of the Departments of Cochabamba (Chapare) and Santa Cruz. According to the contract, Maxus will receive 55% of the production, if hydrocarbons are found, and YPF 45%.

After 3 years of production, the sharing rate will change to 50% each. Maxus announced plans to invest \$1.6 million during the next 2 years and \$2.5 million in the third year for exploration. If the company decides to continue for a fourth year, the assigned tract will be reduced to a target area and a wildcat well will be drilled.

Reserves

In keeping with the new 1989 5-year plan, mineral reserve estimates for lead, silver, tin, tungsten, and zinc were recalculated and revised for greater accuracy, not only at the nucleus mines, but also for the medium- and small-size mining sectors. In view of the conspicuously widespread occurrence of both lode and placer gold in Bolivia, gold reserves have not yet been projected.

INFRASTRUCTURE

The development of communication and transportation systems in Bolivia has been determined by its rugged topography. The Andean Range constitutes a very difficult barrier for communication and transportation between the western and eastern regions of the country. The alignments of railroad lines and highways are sinuous, and during the rainy season mud avalanches occur, blocking them temporarily. In the eastern plains, the flooding of rivers constitutes a serious problem, preventing deliveries of supplies and food to the consumers. Nevertheless, Bolivia has a reasonably well-

developed infrastructure. The transportation network is composed of a total of 38,836 km of highways: 1,300 km paved, 6,700 km gravel, and 30,836 km unimproved earth. The Pan-American highway linking Argentina and Peru crosses Bolivia from south to north-west. As a landlocked country, Bolivia has no ocean ports, but does have access to ports in Chile and Peru.

The railroad system consisted of 3,675 km of 1,000-meter gauge and 32 km of 0.760-meter gauge, all Government owned and controlled by Empresa Nacional de Ferrocarriles. Minerals produced in La Paz Department are transported by rail and truck to Arica, Chile, and to Matarani, Peru, for export. Minerals from Oruro, Potosí, Cochabamba, and Santa Cruz Departments are transported by railway to Antofagasta, Chile, for export and to Argentina and Brazilian consumers. Bolivia has 14,000 km of commercially navigable waterways, which connect the eastern region of the country with the Amazon basin.

Crude oil and condensates, refined oil products, and natural gas are transported from oilfields, gasfields, and refineries to domestic consumption centers and neighboring countries by a network of 1,800 km of pipeline for crude oil, 580 km for refined products, and 1,495 km for natural gas.

The Ministry of Energy and Hydrocarbons formulates national policies for the electrical power sector and regulates power systems operations. The generation, transmission, and distribution of electrical power in Bolivia is carried out by both state and private companies. ENDE, the state-owned electricity company, is in charge of planning the expansion of the electrical power sector. It is also responsible for contracting and operating new generation and transmission facilities everywhere except in the cities of La Paz and Oruro. As for the electricity supply for the country, an estimated 1,763 Mkw.h was produced in 1990, an increase of 2% over that of 1989. The average consumption was 260 kw.h per capita. Bolivia had an installed electrical generating capacity of 605 MW, of which 301 MW or 50% was generated by hydroelectric plants and 304 MW or 50% by thermoelectric plants. ENDE has an installed generating capacity of 318.1 MW (53% of Bolivia's total). The privately-owned Bolivian Electric Power Co. (COBEE-BPC), originally Canadian, has 140.3-MW installed capacity (24% of the country's total). COBEE supplies electricity to the cities of La Paz and Oruro.

On March 9, 1984, the Bolivian Government signed a joint project agreement

with the Italian Government and the United Nations Development Program (UNDP) to prepare a feasibility study of the geothermal potential in the Western Cordillera region of the country. YPFB and ENDE were assigned as the national counterpart agencies. The geological fieldwork and preliminary drilling was done by the Bolivian Geological Survey (GEOBOL) with technical assistance from the Italian Government. Four wells have been drilled by YPFB and ENDE at the geothermal field of Laguna Colorada. The geothermal field is about 220 km southwest of the town of Uyuni, Department of Potosí, and about 11 km east of the Bolivian-Chilean border. ENDE's plan to install a pilot geothermal plant with Italian funding has not made any progress owing to lack of total financing.

OUTLOOK

Prospects for Bolivia's mineral industry continue to be mixed. The current Government has pledged to retain established economic policies in order to keep inflation down and continue the growth trend begun under the previous Government. Nevertheless, Bolivia continues to be one of the poorest countries in Latin America, and it remains vulnerable to price fluctuations for its limited exports, mainly nonfuel minerals and natural gas.

Future generation of electrical power from geothermal fields at Laguna Colorada could be sold to existing mining interests in the Uyuni salt flat area or might attract new mining exploitation interest to the area of South Lipez, where sulfur and low-grade epithermal gold-silver deposits exist near Laguna Colorada.

Natural gas has the greatest potential for sustained long-term growth. The base metal sector appears to be recovering as a result of COMIBOL's rehabilitation program. Future resource development is likely to focus continued expansion of the hydrocarbon sector as well as the development in a rational manner of Bolivia's gold industry and the iron ore-steel prospects at the Mutún deposit near Brazil. Planned medium-term mining projects include continuation of COMIBOL's rehabilitation program, the lithium and potassium

projects, and the expansion of sulfur production and gold from alluvial deposits. The Bolivia and Brazil energy integration agreement includes the sale-purchase of electricity generated by gas-fired thermoelectrical plant and the sale-purchase of urea and high density polyethylene from a plant in Puerto Suárez, Department of Santa Cruz, and the construction of the 557-km gas pipeline between the Santa Cruz gasfields and Puerto Suárez, near the Brazilian border. There also is the possibility of expansion of the current agreement concerning the export of natural gas to Argentina.

All the future Bolivian projects are expected to be carried out under the general program of stabilization and restructuring of the nation's economy. Also included are a revision of key aspects of the mining legislation (to be approved in 1991), reforms of the petroleum laws, and foreign and domestic investment laws, all with emphasis attracting the potential foreign and domestic investors.

¹Where necessary, values have been converted from bolivianos (\$b) to U.S. dollars at the rate of \$b3.2=US\$1.00.

OTHER SOURCES OF INFORMATION

Agencies

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Tel. (02) 379310
- Ministerio de Energía e Hidrocarburos
Ave. Mariscal Santa Cruz 1322
La Paz, Bolivia
Tel. (02) 374050
- Corporación Minera de Bolivia (COMIBOL)
Ave. Mariscal Santa Cruz 1092
Casilla 349
La Paz, Bolivia
Tel. (02) 354044
- Empresa Metalúrgica Vinto (EMV)
Casilla 612
Oruro, Bolivia
Tel. 52857
- Instituto Nacional de Inversiones (INI)
Calle Colombia 263

- Casilla 4393
La Paz, Bolivia
Tel. (02) 375730
- Yacimientos Petrolíferos Fiscales Bolivianos (YPFB)
Calle Bueno, Casilla 401
La Paz, Bolivia
Tel. (02) 356540
- Asociación Nacional de Mineros Medianos
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Casilla 6094
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- Cámara Nacional de Minería Bernardo Trigo 429
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BRAZIL

AREA 8.5 million km²

POPULATION 151 million



BRAZIL

By H. Robert Ensminger

Brazil ranks as a world leader in the production and export of columbium (ferrocolumbium), gem stones (nondiamond), iron ore, lithium, tantalite, and tin. Within the Latin American region, Brazil is a major producer of aluminum, cement, ferroalloys, gold, iron ore, manganese, steel (crude), and tin. The country is engaged in an ambitious exploration program to expand reserves and reduce Brazil's dependence on oil imports. In 1990, Brazil imported approximately 40% of its crude oil requirements. Brazil's economy was in recession in 1990. The GDP decreased by approximately 4.6% to \$275 billion¹ in current dollars. Industrial output decreased by almost 9% while the minerals sector showed an estimated increase of almost 3% over that of 1989. The major contributors to the output increase in the mineral sector were bauxite, iron ore, and petroleum. The Government continued to utilize all measures to avoid hyperinflation in 1990; however, inflation reached an annualized rate of 1,800% by yearend.

It remains too early to evaluate the long-term impact of the 1988 constitutional restriction on foreign mining companies, which requires a majority Brazilian partner. The reduction in exploration and mine development since 1988 was probably more the result of general political and economic uncertainties than concern about the new mining law.

GOVERNMENT POLICIES AND PROGRAMS

In 1990, the President of Brazil reorganized the Executive Branch of Government. Under the reorganization, the Ministry of Mines and Energy became part of the new Ministry of Infrastructure. Included in the new ministry were the National Secretary of Mines and Metallurgy. The National Secretary of Mines and Metallurgy oversees the entire mineral industry while the National Department of Mineral Production

(DNPM), an arm of the new secretariat, has the specific responsibility over mining.

At yearend, DNPM listed 5,880 mining concessions that were to be revoked because owners were found to have made insufficient efforts to exploit them as required by the Constitution. The new Constitution stipulated that companies would have 1 year to prove they were working their concessions, rather than hoarding holdings for speculative reasons. The listed revocations involved one-fifth of all registered mining concessions in Brazil. The affected owners are permitted to appeal the decision before the concessions are offered for sale at auction.

PRODUCTION

The total value of minerals produced in 1990 was approximately \$9.3 billion. This represented approximately 3.4% of GDP.

Brazil's mineral production increased by approximately 3% in 1990. The overall increase in mineral production was principally driven by the increase in crude petroleum production as 1990 was not a good year for the nonfuel mineral industry. The mineral commodities that were major contributors to the total mineral production in 1990 were bauxite, chromite, ferroalloys, gold, gypsum, iron ore, kaolin, lime, manganese, petroleum, steel, and zinc. In 1989, gold production declined for the first time since 1979; however, 1990 production reported by DNPM showed an estimated increase of 60% over that of 1989. Domestic demand for most metals was below expected levels.

In 1990, Companhia Vale do Rio Doce S.A. (CVRD), the mixed equity mining conglomerate, invested \$83.2 million to further increase gold production.

TRADE

The negative trade balance in the mineral sector for 1990 was heavily influenced by the value of petroleum imports. Total

mineral imports were valued at \$4.9 billion, while total exports were \$2.6 billion. Exports of iron ore and bauxite combined for 89% of Brazilian mineral exports in 1990. Besides petroleum, other major mineral imports, in alphabetical order, were coal, copper, lead, natural gas, potash, sulfur, and zinc.

In 1990, the total value of exports was approximately \$31.3 billion versus the estimated total value of \$20.2 billion for imports. The \$11.1 billion trade surplus was 32% below that of 1989.

In 1989, Brazil and the United States reached an accord on a new Voluntary Restraint Agreement (VRA) that boosted steel shipments to the United States by up to 55% during 1990 and 1991. The VRA allowed for steel exports of up to 1,556,000 tons in 1990, with an increase of 260,000 tons in 1991.

STRUCTURE OF THE MINERAL INDUSTRY

The major portion of the mineral industry of Brazil was partially or wholly owned by private Brazilian investors, Brazilian companies, and foreign companies in 1990. The few exceptions were the natural gas and petroleum industry, which was 100% Government-owned through *Petróleo Brasileiro S.A. (PETROBRAS)*, and the five large majority State-owned steel companies. In 1990, PETROBRAS was composed of five subsidiaries (1) *Petrobrás Distribuidora S.A. (BR)*, the petroleum products distribution company; (2) *Petrobrás Química S.A. (PETROQUISA)*, the petrochemical company; (3) *Petrobrás Internacional S.A. (BRASPETRO)*, the foreign operating company; (4) *Petrobrás Fertilizantes S.A. (PETROFERTIL)*, the agricultural fertilizer company; and (5) *Petrobrás Mineracao S.A. (PETROMIN)*, the mining company. PETROBRAS is the domestic operator. The Government-owned steel holding company, *Siderúrgica*

BRAZIL — MINERAL PROVINCE OF CARAJÁS

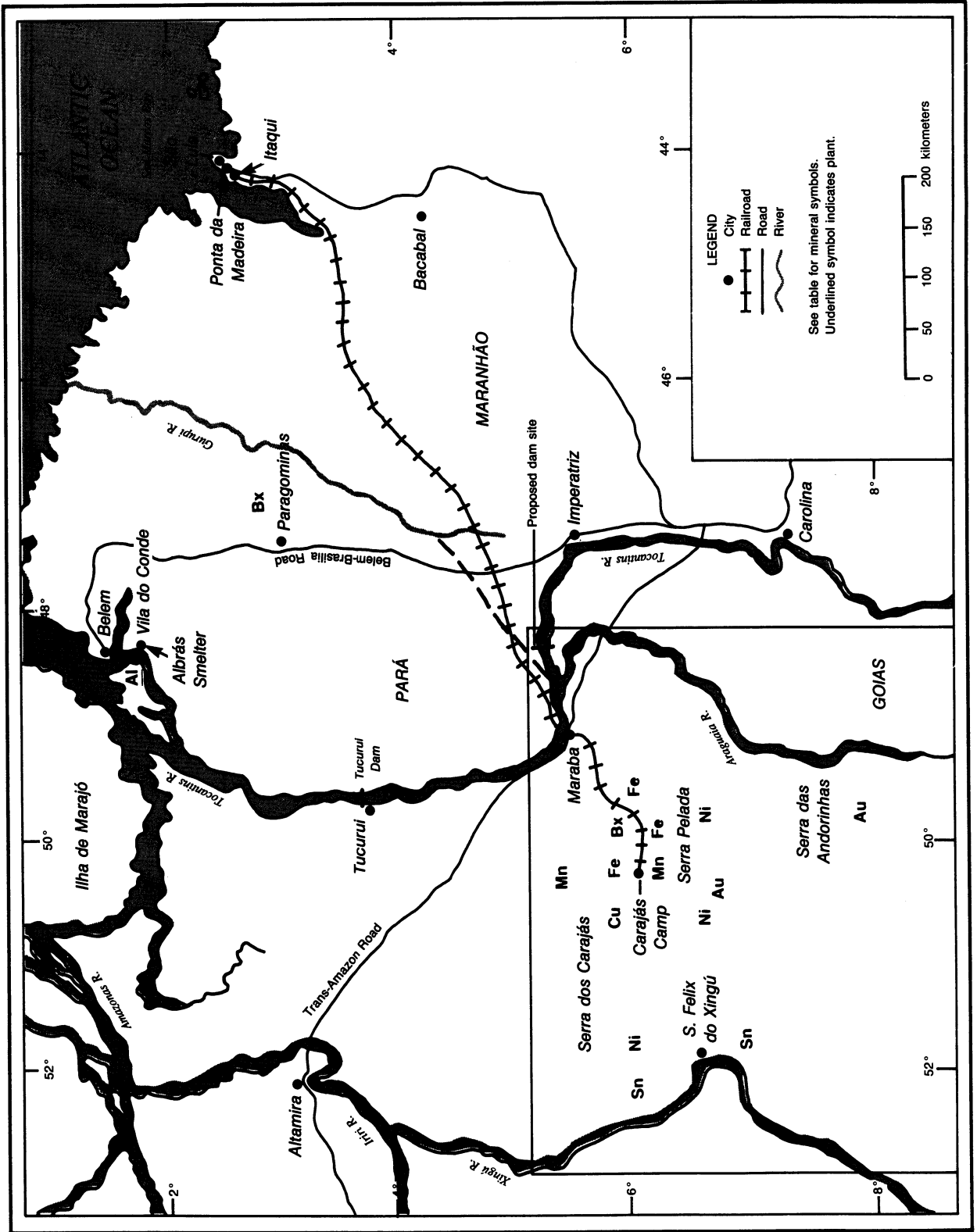


TABLE 1
BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES FOR 1990¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e
METALS					
Aluminum:					
Bauxite, dry basis, gross weight	6,544,000	6,566,500	7,727,600	8,442,000	³ 9,875,600
Alumina	¹ 1,258,000	¹ 1,326,000	1,487,850	1,632,000	³ 1,624,400
Metal:					
Primary	757,375	843,500	873,500	889,500	³ 930,600
Secondary	47,971	50,284	60,500	66,000	³ 60,000
Beryllium: Beryl concentrate, gross weight	907	1,000	913	800	850
Cadmium: Metal, primary	233	214	283	283	200
Chromium:					
Crude ore	763,000	830,000	779,000	^r 810,000	810,000
Concentrate	¹ 126,000	¹ 170,000	222,000	188,000	³ 105,000
Marketable product ⁴	222,990	191,033	229,912	^r 225,000	225,000
Cobalt:					
Mine output, Co content by hydroxide ^e	150	150	150	200	200
Metal, electrolytic	—	—	—	^r 30	60
Columbium-tantalum ores and concentrates, gross weight:					
Columbite and tantalite	274	282	381	426	436
Djalmaite concentrate ^e	³ 10	10	10	10	10
Pyrochlore concentrate, Cb ₂ O ₃ content	¹ 17,267	¹ 10,263	20,275	15,787	³ 17,500
Copper:					
Mine output, Cu content	40,183	40,332	44,845	44,440	45,800
Metal:					
Primary	115,990	146,969	147,880	153,376	³ 140,000
Secondary	50,000	52,200	38,050	42,272	45,000
Gold:^{e5}					
Mine output	23,900	31,400	30,800	30,000	30,000
Garimpeiros (independent miners)	43,600	52,300	69,400	70,000	50,000
Total	67,500	83,700	100,200	100,000	80,000
Iron and steel:					
Ore and concentrate (marketable product):⁴					
Gross weight	132,288	¹ 134,493	146,002	153,700	³ 150,000
Fe content	89,956	91,200	98,600	^o 102,300	99,900
Metal:					
Pig iron ⁶	² 20,163	² 20,944	23,454	24,363	³ 21,141
Ferroalloys, electric-furnace:					
Chromium metal	138	123	155	135	³ 37
Ferroboron	35	—	—	—	—
Ferrocilicon	23,715	25,673	31,519	33,020	³ 27,520
Ferrochromium	109,392	105,394	130,024	113,267	³ 83,753
Ferrochromium-silicon	9,512	8,079	9,177	8,938	⁴ 9,973
Ferrocolumbium	17,391	10,880	19,106	16,378	³ 16,643
Ferromanganese	164,093	155,252	180,588	180,668	³ 170,504
Ferromolybdenum	511	422	427	332	³ 69
Ferronickel	34,296	35,496	33,930	34,997	³ 34,257
Ferrophosphorus	1,461	1,784	1,469	1,928	³ 1,278
Ferrosilicon	217,715	231,159	267,538	286,994	³ 229,408
Ferrosilicon magnesium	13,053	17,575	17,000	15,864	³ 10,340

See footnotes at end of table.

TABLE 1—Continued

BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES FOR 1990¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e
METALS—Continued					
Iron and steel—Continued					
Metal—Continued					
Ferrosilicon zirconium	852	398	793	1,392	³ 503
Ferrotitanium	755	80	549	430	³ 125
Ferrotungsten	173	123	133	22	³ 6
Ferrovandium	439	88	261	302	³ 44
Inoculant	3,244	3,308	7,678	12,098	³ 11,461
Silicomanganese	177,568	188,022	193,490	208,262	³ 216,779
Silicon metal	37,077	39,982	79,287	116,779	³ 131,614
Total	811,420	823,838	973,124	1,031,806	³ 939,314
Steel, crude, excluding castings thousand tons	² 21,233	22,228	24,657	25,055	³ 20,567
Semimanufactures, flat and nonflat do.	³ 31,250	³ 31,068	32,306	32,537	³ 29,450
Lead:					
Mine output, Pb content	13,614	11,633	14,314	16,050	³ 13,700
Metal:					
Primary	32,718	29,842	29,501	32,522	³ 35,000
Secondary	51,973	58,361	68,681	53,295	55,000
Magnesium metal:					
Primary	4,356	5,488	5,865	6,200	6,500
Secondary	1,767	1,376	¹ 1,500	¹ 1,500	1,600
Manganese ore and concentrate, marketable, gross weight ⁴	2,696,799	2,067,385	1,990,646	² 2,080,000	³ 1,900,000
Nickel:					
Mine output, Ni content	21,240	21,897	20,832	20,963	³ 23,490
Ferronickel, Ni content	9,579	9,739	9,216	9,445	9,250
Rare-earth metals: Monazite concentrate gross weight	1,246	1,560	1,300	1,900	2,000
Silver ⁷ kilograms	101,500	110,400	124,100	124,400	125,000
Tin:					
Mine output, Sn content	26,246	27,364	44,102	50,232	³ 39,149
Metal:					
Primary	² 25,347	² 29,446	41,857	44,240	³ 39,149
Secondary ^e	200	200	250	250	250
Titanium concentrates, gross weight:					
Ilmenite	75,472	¹ 169,303	142,167	144,200	147,400
Rutile	495	³ 324	1,514	2,600	2,600
Tungsten, mine output, W content	875	⁸ 800	739	679	422
Zinc:					
Concentrate and saleable ore	692,547	700,348	832,383	⁸ 800,000	700,000
Mine output, Zn content	123,902	133,375	155,531	175,998	³ 132,100
Metal, smelter:					
Primary	130,555	138,652	139,667	155,846	150,000
Secondary	4,741	9,384	4,307	6,409	5,500
Zirconium: Zircon concentrate, gross weight ⁸	15,116	18,140	28,029	32,970	33,000
INDUSTRIAL MINERALS					
Asbestos:					
Crude ore	2,582,500	³ 3,176,231	3,554,916	3,500,000	3,940,000
Fiber	204,460	212,807	227,653	206,195	³ 232,332

See footnotes at end of table.

TABLE 1—Continued

BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES FOR 1990¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e	
INDUSTRIAL MINERALS—Continued						
Barite:						
Crude	101,917	99,424	68,855	63,665	55,000	
Beneficiated	102,956	102,220	78,842	51,407	40,000	
Marketable product ⁴	103,072	102,345	85,287	^e 95,000	65,000	
Calcite	41,554	60,284	51,138	^e 50,000	50,000	
Cement, hydraulic	thousand tons	25,297	25,470	25,328	25,883	³ 25,900
Clays:						
Bentonite	² 229,371	² 216,591	110,893	146,550	175,000	
Kaolin:						
Crude	2,207,600	2,259,777	2,092,635	2,200,000	2,000,000	
Beneficiated	623,822	661,149	759,892	846,200	³ 769,700	
Marketable product ⁴	<u>706,017</u>	<u>742,825</u>	<u>867,902</u>	<u>^e900,000</u>	<u>850,000</u>	
Diamond:						
Gem	thousand carats	310	300	353	350	³ 600
Industrial	do.	315	200	180	150	³ 900
Total ⁹	do.	<u>625</u>	<u>500</u>	<u>533</u>	<u>500</u>	<u>³1,500</u>
Diatomite:						
Crude	¹ 13,128	² 26,375	33,500	¹ e35,000	35,000	
Beneficiated	¹ 11,268	¹ 15,956	13,145	15,618	³ 13,300	
Marketable product ⁴	<u>20,189</u>	<u>¹16,011</u>	<u>14,387</u>	<u>¹e15,000</u>	<u>15,000</u>	
Feldspar and related materials:						
Feldspar, marketable product ⁴	120,572	118,608	109,534	^e 120,000	120,000	
Leucite, marketable product ⁴	10,207	⁴ 3,369	5,562	¹ e5,000	5,000	
Sodalite, crude, marketable product	1,452	⁵ 35	517	¹ e500	500	
Total	<u>132,231</u>	<u>123,512</u>	<u>115,613</u>	<u>¹e125,500</u>	<u>125,500</u>	
Fluorspar:						
Crude	<u>234,944</u>	<u>242,414</u>	<u>401,384</u>	<u>¹e400,000</u>	<u>400,000</u>	
Concentrates, marketable product:						
Acid-grade	53,560	58,736	54,050	56,973	³ 52,900	
Metallurgical-grade	31,015	31,212	35,310	38,558	³ 17,200	
Total	<u>84,575</u>	<u>89,948</u>	<u>89,360</u>	<u>95,531</u>	<u>³70,100</u>	
Graphite:						
Crude	<u>462,815</u>	<u>525,164</u>	<u>730,851</u>	<u>¹e650,000</u>	<u>650,000</u>	
Marketable product:						
Direct-shipping crude ore	19,074	10,505	18,269	^e 20,000	20,000	
Concentrate	28,586	31,414	34,520	31,700	32,000	
Total	<u>47,660</u>	<u>⁴41,919</u>	<u>52,789</u>	<u>^e51,700</u>	<u>52,000</u>	
Gypsum and anhydrite, crude	706,463	⁸ 801,667	788,773	799,253	³ 875,300	
Kyanite:						
Crude	1,489	922	689	¹ e700	750	
Marketable product ⁴	950	510	630	¹ e600	600	
Lime, hydrated and quicklime	thousand tons	<u>4,909</u>	<u>5,300</u>	<u>5,500</u>	<u>5,730</u>	<u>5,700</u>
Lithium mineral concentrates:						
Amblygonite	49	⁵ 52	25	¹ e25	25	
Lepidolite	30	(¹⁰)	(¹⁰)	(¹⁰)	—	
Petalite	1,614	² 2,946	1,115	^e 1,800	1,200	
Spodumene	366	⁵ 505	301	^e 400	350	
Total	<u>2,059</u>	<u>³3,503</u>	<u>1,441</u>	<u>¹e2,225</u>	<u>1,575</u>	

See footnotes at end of table.

TABLE 1—Continued

BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES FOR 1990¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^a	1990 ^a	
INDUSTRIAL MINERALS—Continued						
Magnesite:						
Crude	648,752	778,502	810,837	1,385,565	1,000,000	
Beneficiated	296,792	383,378	404,126	259,508	275,000	
Mica, all grades	2,185	2,415	2,520	2,579	2,500	
Nitrogen: N content of ammonia	881,784	957,630	935,400	935,400	³ 937,500	
Phosphate rock including apatite:						
Crude:						
Mine product	thousand tons	25,665	28,135	26,458	^a 27,000	27,000
Of which, sold directly	do.	39	656	38	35	35
Concentrate:						
Gross weight	do.	4,509	4,777	4,672	3,655	³ 2,968
P ₂ O ₅ content	do.	1,620	1,694	1,663	1,293	1,051
Pigments, mineral: Other, crude		5,474	5,803	5,223	^r 5,500	5,500
Potash: Marketable product (K ₂ O)		17,542	37,111	54,121	96,945	60,000
Precious and semiprecious stones except diamond, crude and worked:						
Agate		3,000	5,300	2,600	3,000	3,000
Amethyst		500	1,400	1,500	1,000	1,000
Aquamarine		9	34	197	20	20
Citrine		15	400	160	100	100
Emerald		16	60	100	90	90
Opal		13	16	13	500	500
Ruby ^c	value	³ \$987	\$10,000	\$10,000	\$10,000	\$10,000
Sapphire ^c	do.	³ \$2,474	\$15,000	\$15,000	\$15,000	\$15,000
Topaz		14	22	72	50	50
Tourmaline		10	60	170	80	80
Other		311	500	500	^e 500	500
Quartz crystal, all grades		4,214	3,802	3,020	3,174	3,100
Salt:						
Marine	thousand tons	1,600	3,600	3,020	2,355	2,500
Rock	do.	⁹ 954	950	1,336	1,291	1,300
Silica (silex)		3,576	3,654	4,009	4,100	4,000
Sodium compounds:						
Caustic soda ^e		975,000	975,000	975,000	975,000	975,000
Soda ash, manufactured (barilla)		201,000	170,000	184,416	^e 200,000	200,000
Stone, sand and gravel:						
Dimension stone:						
Marble, rough-cut	cubic meters	^r 76,079	96,051	132,490	^r 150,000	200,000
Slate		^r 111,873	^r 32,474	45,384	^r 50,000	50,000
Crushed and broken stone:						
Basalt	cubic meters	^r 637,392	^r 664,794	993,855	^r 1,000,000	1,000,000
Calcareous shells		495,887	450,006	440,589	^e 450,000	450,000
Dolomite	thousand tons	2,622	2,848	3,395	^e 3,500	3,500
Gneiss	cubic meters	^r 514,234	^r 480,340	1,042,467	1,039,829	1,000,000
Granite	thousand cubic meters	^r 48,268	^r 50,843	58,646	^r 60,000	60,000
Limestone	thousand tons	56,550	57,021	60,111	^r 60,000	60,000
Quartz ¹¹		147,023	^r 207,000	247,465	^r 250,000	250,000

See footnotes at end of table.

TABLE 1—Continued

BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES FOR 1990¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e
INDUSTRIAL MINERALS—Continued					
Stone, sand and gravel—Continued					
Crushed and broken stone—Continued					
Quartzite:					
Crude	333,124	437,115	393,346	^r 400,000	400,000
Processed	172,776	267,918	197,886	^r 200,000	200,000
Sand: Industrial	<u>2,730,643</u>	<u>2,566,220</u>	<u>2,613,027</u>	<u>^e2,700,000</u>	<u>2,700,000</u>
Sulfur:					
Frasch	5,642	5,742	6,039	5,721	6,000
Pyrites	91,596	76,704	102,856	71,740	90,000
Byproduct:					
Metallurgy	100,033	153,038	152,013	163,724	160,000
Petroleum	<u>73,572</u>	<u>77,322</u>	<u>61,396</u>	<u>60,121</u>	<u>60,000</u>
Total	270,843	312,806	322,304	301,306	316,000
Talc and related materials:					
Talc, marketable product ⁴	336,706	425,513	339,077	^e 400,000	430,000
Pyrophyllite, marketable product ⁴	81,910	51,114	60,070	^e 60,000	60,000
Other: Algalmatolite, marketable product	131,036	104,536	^e 120,000	^e 120,000	120,000
Vermiculite:					
Crude	84,139	123,261	124,419	^e 120,000	120,000
Marketable product ⁴	14,150	16,825	18,849	19,000	19,000
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous, marketable ⁴ thousand tons	7,441	6,742	7,428	7,186	7,200
Coke, metallurgical, all types do.	1,416	962	1,185	1,006	1,000
Gas, natural: Gross million cubic meters	5,659	5,938	5,844	6,091	³ 6,280
Natural gas liquids thousand 42-gallon barrels	4,586	9,529	^e 9,400	^e 9,500	9,600
Petroleum:					
Crude do.	217,175	215,419	210,605	217,941	³ 231,045
Refinery products:					
Gasoline do.	77,015	73,000	81,395	68,700	70,000
Jet fuel do.	20,075	20,075	19,345	19,458	20,000
Kerosene do.	2,555	3,285	3,285	2,292	2,500
Distillate fuel oil do.	142,715	150,015	155,125	145,752	145,000
Lubricants do.	4,745	6,205	5,110	4,206	4,200
Residual fuel oil do.	90,520	84,315	78,110	74,166	80,000
Other do.	118,990	101,470	89,060	124,068	125,000
Refinery fuel and losses do.	18,980	18,250	18,250	22,008	22,000
Total do.	475,595	456,615	449,680	460,650	468,700

^eEstimated. ^pPreliminary. ^rRevised.¹Table includes data available through Oct. 1, 1991.²In addition to the commodities listed, bismuth, molybdenite, and uranium oxide are produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.³Reported figure.⁴Direct sales and beneficiated.⁵Officially reported figures are as follows, in kilograms: Major mines: 1986—9,348; 1987—13,095; 1988—22,160; 1989—23,000; and 1990—29,913. Small mines (garimpos): 1986—22,076; 1987—22,700; 1988—34,260; 1989—31,000; and 1990—57,418.⁶Includes sponge iron as follows, in thousand metric tons: 1986—295; 1987—202; 1988—195; 1989—239; and 1990—260.⁷Officially reported output; of total production, the following quantities are identified as placer silver (the balance being silver content of other ores and concentrates), in kilograms: 1986—19,900 (estimated); 1987—20,200 (estimated); 1988—20,200 (estimated); 1989—22,000 (estimated); and 1990—22,000 (estimated).⁸Includes baddeleyite-caldasite.⁹Figures represent officially reported output plus official Brazilian estimates of output by nonreporting miners.¹⁰Revised to zero.¹¹Apparently includes crude quartz used to produce quartz crystal (listed separately in this table) as well as additional quantities of common quartz.

Brasileira S.A. (SIDERBRAS), was eliminated in 1990. The Government had planned to privatize a number of the State steel companies during 1990; however, none took place. CVRD, the huge mining conglomerate, is 51% Government-owned. There are several smaller companies engaged in the mineral industry that are partially or wholly Government-owned.

The mineral industry of Brazil is large by world standards. In 1986, the last year for which there is information, there were 162 cement and limestone mining companies operating 247 limestone mines in Brazil. In the same year, there were 34 separate iron ore mining companies operating 80 mines.

The five major integrated steelworks produced approximately 66% of the crude steel in 1990. CVRD produced approximately 60% of the iron ore. Mineracao Rio do Norte S.A. (MRN), which is majority privately owned, produced approximately 65% of the total bauxite production. The five major aluminum smelters, all predominantly private Brazilian or foreign owned, produced approximately 77% of the primary aluminum in 1990.

Brazil's total labor force was approximately 57 million in 1990. Of the total, services comprised 42%, agriculture 31%, and industry 27%. The mineral sector comprised approximately 4% (700,000) of the industry total of 15.4 million. This did not include the 500,000 to 1 million *garimpeiros* (independent miners) active in Brazil.

COMMODITY REVIEW

Metals

Alumina, Aluminum, and Bauxite.—In 1990, primary aluminum production increased by 5% over that of the previous year while bauxite production increased 17% for the same period. Alumina production remained at the 1989 level. Apparent consumption of primary aluminum for 1990 was 341,200 tons.

Industrias Votorantim, Brazil's largest private-sector company, began investing in its Cia. Brasileira de Alumínio (CBA) primary aluminum plant in 1989 to increase its production of aluminum from 170,000 mt/a to 255,000 mt/a by 1991. CVRD announced plans to construct a 1-Mmt/a alumina refinery near Paragominas, Pará State, to process the bauxite from the 850-Mmt deposit there. It will be known as the Jabuti Project.

CVRD announced that debt rescheduling talks with the International Monetary Fund and private creditor banks were crucial to the completion of the Alumina do Norte do Brasil S.A. (ALUNORTE) alumina refinery, which at yearend was half-built. The reentry of Japan's Nippon Amazon Aluminum Co. (NAAC) as an investor is dependent on the satisfactory conclusion of these talks. Other companies that are participants in ALUNORTE are Cia. Brasileira de Alumínio (7%), Alcan Alumínio do Brasil S.A. (9%), and Mineracao Rio do Norte S.A. (22%). CVRD, which held 100% of ALUNORTE, will see its participation in the project decline to between 30% and 49%.

Mineracao Rio do Norte S.A., the world's third largest bauxite producer and exporter, announced that it has begun a \$44 million expansion that will boost bauxite production to 8-Mmt/a. Brazil's second largest aluminum smelter, Albras-Alumínio Brasileiro S.A. (ALBRAS), announced plans to increase its plant capacity from 160,000 to 345,000 mt/a by 1995 at a cost of approximately \$650 million.

Reynolds Internacional do Brasil will triple its output of aluminum cans to 750,000 mt/a and begin the export of cans to Latin American markets. This was announced at yearend by Reynolds Metals of the United States, the holding company. At yearend, it was announced that Alcoa Alumínio S.A. and Billiton Metais S.A. would begin development of a jointly owned bauxite mine in the Trombetas region in the State of Pará. The operator of the mine will be Alto Brasil Mineracao, a joint venture of Alcoa Alumínio S.A. (60%) and Billiton Metais S.A. (40%). Construction will begin in 1991 on the first phase, which will have a capacity of 2.5-Mmt/a. When in operation it will supply the feed to the Alcoa Alumínio S.A. refinery at Sao Luis, Maranhao State.

Columbium and Tantalum.—In 1990, Cia. Brasileira de Metalurgia e Mineracao (CBMM) accounted for approximately 80% of Brazil's production capacity and supplied approximately 65% of the world demand for ferrocolumbium.

In midyear, CBMM began construction of a new ferrocolumbium unit at Araxa, Minas Gerais State. The plant will have a capacity of 22,800 mt/a and will cost \$15 million.

Early in the year the Mining Resources and Research Co. of Amazonas announced the discovery of what may be the largest columbium-containing deposit in the world.

It is in the Sao Gabriel da Coxoeira district of the State of Amazonas and contains approximately 2.9 billion tons of columbium ore.

In 1990, tantalum production in Brazil was 426 tons compared with 435 tons in 1989. Brazil was first in tantalum concentrate production in 1990, followed by Australia and Malaysia. Brazilian output was from *garimpeiros* and as a byproduct of tin operations.

Copper.—CVRD announced plans to build a \$450 million, 225,000-mt/a copper refinery plant near its Salobo Mine. The mine is part of the Carajás mineral reserve in the State of Pará. The plant is expected to go on-line sometime in 1994. It was estimated that the plant, in addition to copper, would recover 3 tons of gold per year and 13 tons of silver per year as byproducts.

Copper consuming companies in Brazil imported approximately 40,000 tons of copper in 1990, 6% below that of 1989.

CPRM, the State mineral resources prospection company, announced plans to invest \$1.5 million in an extensive survey of the national copper reserve that covers an area of 546,000 km² straddling the States of Amapá and Pará. The reserve created in 1984 has never been properly surveyed.

Gold.—Official gold production in 1990 was approximately 87,000 kg, which was an increase of about 60% over that of 1989. Mining companies produced 37% of the total output, with the balance produced by *garimpeiros*. The large increase in official production was the result of a more liberal Government policy regarding identification of the gold's origin.

CVRD announced plans to spend \$136 million by 1992 and to become Brazil's largest gold producer. In 1990, Mineracao Morro Velho S.A., a mixed equity company, was the largest producer in Brazil.

The discovery, in September 1989, of a new gold deposit at the old Serra Pelada Mine in the Carajás area of the State of Pará caused *garimpeiros* to flood back into the region. This open pit mine previously had been considered depleted. The new discovery occurred in the main street of the original mine site boomtown. A large pit was quickly developed, which threatened the foundations of nearby homes and stores.

In February 1989, the President of Brazil signed a decree prohibiting the use of mercury and cyanide in the mining of gold unless approved by Brazilian State environmental agencies. The States most af-

TABLE 2

BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
(METALS)			
Aluminum	Albras-Aluminio Brasileiro S.A. (ALBRAS)	Belem, Para State (smelter)	160 (metal).
Do.	Alcan Aluminio do Brasil S.A.	Saramenha, Minas Gerais State (refinery)	150 (alumina).
Do.	Alcan Aluminio Pocos de Caldas (ALUCALDAS)	Pocos de Caldas, Minas Gerais State (mine)	1,000 (bauxite).
Do.	Alcoa Aluminio S.A. (ALUMAR)	Pocos de Caldas, Minas Gerais State (mine)	400 (bauxite).
Do.	do.	Sao Luis, Maranhao State (refinery) (smelter)	550 (alumina). 174 (metal).
Do.	Aluminio do Brasil Nordeste S.A.	Aratu, Bahia State (smelter)	58 (metal).
Do.	Billiton Metais S.A.	Sao Luis, Maranhao State (refinery)	375 (alumina).
Do.	Compahnia Brasileira de Aluminio (CBA)	Pocos de Caldas, Minas Gerais State (mine)	1,000 (bauxite).
Do.	do.	Sorocaba, Sao Paulo State (refinery) (smelter)	170 (alumina). 170 (metal).
Do.	Compahnia Geral do Minas	Pocos de Caldas, Minas Garais State (refinery) (smelter)	275 (alumina). 90 (metal).
Do.	Mineracao Rio do Norte S.A.(MRN)	Oriximina, Para State (mine)	8,000 (bauxite).
Do.	Vale do Sul Aluminio S.A.	Santa Cruz, Rio de Janeiro State (smelter)	86 (metal).
Chromite	Coitezeiro Mineracao S.A. (COMISA)	Campo Formosa, Bahia State (mine)	50 (ore).
Do.	Companhia de Ferro Ligas da Bahia (FERBASA)	Campo Formoso, Bahia State (mine) (beneficiation plant)	370 (ore). 66 (concentrate).
Copper	Companhia Brasileira do Cobre (CBC)	Cacapava do Sul, Rio Grande do Sul State (mine) (beneficiation plant)	1,000 (ore). 1,800 (concentrate).
Do.	Mineracao Caraiba Ltda.	Jaquarari, Bahia State (mine) (beneficiation plant)	3,000 (ore). 5,700 (concentrate).
Columbium	Companhia Brasileira de Metalurgia e Mineracao (CBMM)	Araxa, Minas Gerais State (mine) (beneficiation plant)	1,200 (ore). 44.
Do.	Mineracao Catalao de Goias Ltda.	Ouvidor, Goias State (mine)	500 (ore).
Ferroalloys	Companhia Brasileira Carbureto de Calcio (CBCC)	Santos Dumont, Minas Gerais State (plant)	54.
Do.	Companhia Ferro-Ligas de Bahia S.A. (FERBASA)	Pojuca, Bahia State (plant)	194.
Do.	Companhia Ferro-Ligas Minas Gerais (MINASLIGAS)	Pirapora, Minas Gerais State (plant)	58.
Do.	Companhia Paulista de Ferro-Ligas	Barbacena, Caxambu, Jeceaba, Passa Quatro, and Passa Vinte, Minas Gerais State; Corumba, Matto Grosso do Sul State; and Xanxere, Santa Catarina State (seven plants)	326.
Do.	Italmagnesio S.A. Industria e Comercio	Braganca Paulista, Sao Paulo State; and Varzeada Palma, Minas Gerais State (two plants)	63.

TABLE 2—Continued

BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity	
(METALS)—Continued				
Gold	kilograms	Companhia de Mineracao e Participacoes (CMP)	Lourenco, Amapa State (mine) Currais Novos, Rio Grande do Norte (mine)	3,000 (ore).
Do.		Mineracao Morro Velho S.A.	Novo Lima, Raposos, and Sabara, Minas Gerais State; and Jacobina, Bahia State (four mines)	11,500.
Do.		Sao Bento Mineracao S.A.	Santa Barbara, Minas Gerais State (mine)	3,750.
Iron ore		Companhia Vale do Rio Doce (CVRD)	Serra dos Carajas, Para State; and Itabira, Ouro Preto, and Santa Barbara, Minas Gerais State (four mines)	91,000.
Do.		Ferteco Mineracao S.A. (Ferteco)	Ouro Preto and Brumadinho, Minas Gerais State (two mines)	12,800.
Do.		Mineracoes Brasileiras Reunidas (MBR)	Novo Lima and Itabirito, Minas Gerais State (two mines)	31,500.
Do.		Samarco Mineracao S.A. (Samarco)	Mariana, Minas Gerais State (mine)	11,700.
Do.		S.A. Mineracao da Trindade (SAMITRI)	Mariana, Rio Piracicaba, Itabira, Ouro Preto, and Sabara; Minas Gerais State (five mines)	9,300.
Lead			Mineracao Boquira S.A. (mine) (Beneficiation plant)	Boquira, Bahia State 300 (ore). 310 (concentrate).
Manganese ore		Companhia Vale do Rio Doce (CVRD)	Corumba, Minas Gerais State (mine) Serra dos Carajas, Para State (Beneficiation plant)	500. 1,000 (concentrate).
Do.		Industria e Comercio de Minerios S.A. (ICOMI)	Macapa and Mazagao, Amapa State (two mines) (Beneficiation plant)	1,500 (ore). 800 (concentrate).
Nickel		Companhia Niquel Tocantins	Niquelandia, Goias State (mine)	150 (ore).
Steel			Aco Minas Gerais S.A. (ACOMINAS) Gerais State	Rodovia, Minas 2,000.
Do.		Companhia Acos Especiais Itabira (ACESITA)	Timoteo, Minas Gerais State (stainless steel plant)	600.
Do.		Companhia Siderurgica Belgo - Mineira	Joao Monlevade, Minas Gerais State	1,000.
Do.		Companhia Siderurgica de Tubarao (CST)	Serra, Espirito Santo State	3,000.
Do.		Companhia Siderurgia Nacional (CSN)	Volta Redonda, Rio de Janeiro State	4,600.
Do.		Companhia Siderurgica Paulista (COSIPA)	Cubatao, Sao Paulo State	3,900.
Do.		Usinas Siderurgicas de Minas Gerais S.A. (USIMINAS)	Ipatinga, Minas Gerais State	4,400.
Tin		Mineracao Jacunda Ltda.	Santa Barbara, Novo Mundo, and Potosi; Rondonia State (six mines) (three beneficiation plants)	108 (ore). 450 (concentrate).
Do.		Parapanema S.A. Mineracao, Industria e Construcao	Aripuana, Mato Grosso State; Ariquemes, Rondonia State; Novo Aripuana and Presidente Figueiredo, Amazonas State; and Sao Felix do Xingu, Para State (five mines) (two beneficiation plants)	35 (metal).
Do.		do.	Piraporada Bom Jesus, Sao Paulo State (refinery)	25 (metal).
Titanium		Rutilo e Ilmenita do Brasil S.A. (RIB)	Mataraca, Paraiba State (mine) (two beneficiation plants)	4,200 (ore). 120 (concentrate).
Zinc		Companhia Mineradora de Metais (CMM)	Vazante, Minas Gerais State (mine) (beneficiation plant)	800 (ore). 48 (concentrate).

TABLE 2—Continued

BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
(METALS)—Continued			
Zinc—Continued	Companhia Mineradora de Metais (CMM)	Tres Marias, Minas Gerais State (refinery)	72 (metal).
Do.	Mineracao Areiense S.A.-MASA(MASA)	Vazante, Minas Gerais State (mine)	400 (ore).
Zirconium	Nuclemon Mineradora-Quimica Ltda.	Sao Joao da Barra, Rio de Janeiro State (mine)	660 (ore).
Do.	do.	Itapemirim, Espirito Santo State (mine)	90 (ore).
Do.	do.	Prado, Bahia State (mine) (three beneficiation plants) (three separation plants)	90 (ore). 123 (concentrate). 90 (zircon).
(INDUSTRIAL MINERALS)			
Asbestos	SAMA-Sociedade Anonima Mineracao de Amianto (SAMA)	Minacu, Goias State (mine) (beneficiation plant)	9,000 (ore). 230 (concentrate).
Cement		Cimento Santa Rita S.A. State (plant)	Itapevi, Sao Paulo 1,000.
Do.	do.	Salto de Pirapora, Sao Paulo State (plant)	1,200.
Do.	Companhia Cimento Portland Itau	Itau de Minas, Minas Gerais State (three plants)	2,400.
Do.	Companhia de Cimento Portland Paraiso	States of Espirito Santo, Goias, Minas Gerais, and Rio de Janeiro (five plants)	4,000.
Do.	Companhia de Cimento Portland Rio Branco	Rio Branco do Sul, Parana State (two plants)	5,000.
Diamond thousand carats	Mineracao Tejucana S.A.	Diamantina, Minas Gerais State (mine)	100.
Fluorspar	Mineracao Nossa Senhora do Carmo Ltda.	Morro da Fumaca and Pedras Grandes, Santa Catarina State (four mines) (two beneficiation plants)	180 (ore). 220 (concentrate).
Do.	Mineracao Santa Catarina Ltda.	Morro da Fumaca and Pedras Grandes, Santa Catarina State (four mines) (beneficiation plant)	100 (ore). 120 (concentrate).
Do.	Nacional de Grafite Ltda.	Itapecerica and Pedra Azul, Minas Gerais State (three mines) (two beneficiation plants)	840 (ore). 720 (concentrate).
Gypsum	CBE-Companhia Brasileira de Equipamento (CBE)	Codo, Maranhao State, and Ipubi, Pernambuco State (two mines)	100.
Do.	Companhia de Cimento Portland Paraiso	Ipubi, Pernambuco State (mine)	50.
Kaolin	Caulim da Amazonia S.A. (CADAM)	Mazagao, Amapa State (mine) (beneficiation plant)	720 (ore). 360 (concentrate).
Do.	Empresa de Mineracao Horii Ltda. (Horii)	Biritiba and Mogi das Cruzes, Sao Paulo State (two mines) (two beneficiation plants)	200 (ore). 180 (concentrate).
Limestone	Companhia de Cimento Portland Paraiso	States of Goias, Minas Gerais, and Rio de Janeiro (five mines)	2,000.
Do.	Companhia de Cimento Portland Rio Branco	Rio Branco do Sul, Parana State (three mines)	5,500.
Do.	S.A. Industrias Votorantim	States of Rio de Janeiro, and Sao Paulo (four mines)	1,000.
Magnesite	Magnesita S.A.	Brumado, Bahia State—(one major mine and numerous small mines) (two beneficiation plants)	770 (ore). 820 (concentrate).
Phosphate rock	Arafertil S.A. (Arafertil)	Araxa, Minas Gerais State (mine)	5,000.
Do.	Copebras S.A.(Copebras)	Ouvidor, Goias State (mine)	4,400.
Do.	Fertilizantes Fosfatados S.A.-Fosfertil (FOSFERTIL)	Tapira, Minas Gerais State (two mines)	10,500.
Do.	Serrana S.A. de Mineracao (Serrana)	Jacupiranga, Sao Paulo State (mine)	6,000.

TABLE 2—Continued

BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
(INDUSTRIAL MINERALS)—Continued			
Salt (rock)	Mineracao e Quimica do Nordeste S.A.	Vera Cruz, Bahia State (mine)	1,000.
(MINERAL FUELS)			
Coal	Carbonifera Criciuma S.A.	Criciuma and Sideropolis, Santa Catarina State (two mines)	4,000.
Do.	Companhia Carbonifera de Urussanga (CCU)	Criciuma, Sideropolis, and Urussanga, Santa Catarina State (three mines)	7,200.
Do.	Companhia de Pesquisas e Lavras Minerais-Copelmi (COPELMI)	Arroio dos Ratos, Butia, and Charqueadas, Rio Grande do Sul State (four mines)	5,700.
Petroleum thousand 42-gallon barrels	Petroleo Brasileiro S.A. (PETROBRAS)	99 fields in the States of Alagoas, Amazonas, Bahia, Ceara, Espirito Santo, Rio de Janeiro, Rio Grande do Norte, Para, Maranhao, and Sergipe	220,000.
Petroleum products	do.	11 refineries in the States of Amazonas, Bahia, Ceara, Minas Gerais, Parana, Rio de Janeiro, Rio Grande do Sul, and Sao Paulo	503,000.
Do.	Refinaria de Petroleo Ipiranga S.A.	Ipiranga, Rio Grande do Sul	3,400.
Do.	Refinaria de Petroleos de Manguinhos S.A.	Manquinhos, Rio de Janeiro State	3,650.

ected were those in the Pantanal and Amazon regions.

At yearend, the Minas Gerais Environment Policy Commission closed a garimpeiro alluvial gold mining operation on the Paracatu River. Health checks on the 2,000 garimpeiros that worked there revealed an excessive exposure to mercury. Many had absorbed mercury at more than 200 times the permissible levels in the bloodstream. Sao Bento Mineracao S.A. announced plans to invest \$8.5 million to boost gold output at its mine in east-central Minas Gerais State from 2,300 kg to 4,500 kg by 1993. The gold will be extracted by a combination of bioleaching using General Mining Union Corp. Ltd. (Republic of South Africa) technology and pressure oxidation.

Iron and Steel.—Ferroalloys.—In 1990, ferroalloy production decreased by 10% from that of the previous year. For the year, exports increased 24% while imports decreased 39%. In 1990, Brazil was the fourth largest ferroalloy producer in the world and the third largest exporter. Apparent domestic consumption for 1990 was approximately 693,000 tons.

Industria e Comercio de Minerios (ICOMI) announced in midyear that ferrochrome production had begun at its new

plant at Porto de Santana, Amapa State. The plant, with a capacity of 20,000 mt/a, was operated by Cia. Ferroligas do Amapa S.A. (CFA), a wholly owned subsidiary of ICOMI.

Norway's Elkem A/S, one of the world's largest manganese alloy producers, agreed to invest \$70 million in a joint venture with Brazil's Prometal Produtos Metalurgicos S.A. to build a 160,000-mt/a ferro-manganese plant. The plant, to be in Maraba, Para State, is a \$170 million project in which Elkem will hold a 40% share. The manganese will come from a nearby Prometal mine, and the iron ore will come from the Carajás area.

Prometal announced at yearend that two fixed export contracts had been signed totaling 90,000 mt/a of ferromanganese for delivery to one buyer in Germany and two in Japan. The term for the contract is 5 years. The ferroalloy will come from the plant at Maraba, Para State, which is to begin production in midyear 1992.

Iron Ore.—Brazil's 1990 production of iron ore decreased by almost 3% from that of the previous year. CVRD produced 55% of the total production or approximately 83 Mmt. The remaining major producers, in order of descending production, were Mineracoes Brasileiras Reunidas (MBR), Samarco Mineracao S.A., Ferteco

Mineracao S.A., and S.A. Mineracao da Trindade (SAMITRI).

Total iron ore exports for 1990 were 115 Mmt which exceeded the 1989 figure by 2 Mmt for a new record. The total export revenues of \$2.43 billion also exceeded the record of \$2.20 billion set in 1989. The major importers of Brazilian iron ore were Japan (25.5%) and the Federal Republic of Germany (19.3%). In 1990, the United States imported 4% of Brazil's total iron ore exports.

Mineracao Brasileiras Reunidas (MBR), Brazil's second largest iron ore producer, announced plans to invest \$1 billion over a 10-year period beginning in 1991. The investment program is aimed at increasing reserves and production. The target is to increase output to 35 Mmt/a from the present 20 Mmt/a by the end of the century.

In midyear 1989, Brazil finalized export contracts at substantially increased prices and at a level well above that set by the Association of Iron Ore Exporting Countries. The Brazilian iron ore producers' association attributed the increase in prices to a greater world demand, which in part was due to a continued expansion of the world's steel industry.

Pig Iron.—In 1990, Brazil exported approximately one-third of the pig iron

traded in the world; however, by yearend, the industry in Brazil was in serious trouble. The major source of the problem was the new environmental laws that stipulated that by 1990 a minimum of 50% of the charcoal used had to come from reforested areas rather than the virgin forests. A maximum of 20% of the charcoal used was allowed to be purchased from third parties. It was also stipulated that the percentage of charcoal used by the producers from their own reforestation programs must grow by 10% per year until it reaches 100% by 1995. The Government found that of 110 pig iron producers, only 12 had conformed to the new laws, and as a consequence, at least 60 plants were shut down for environmental reasons by yearend.

Steel.—At yearend 1989, Brazil's export quota to the United States was raised to 1.556 Mmt/a. Within the quota, a 790,000-mt/a limit was placed on semifinished products and a 766,000-mt/a limit placed on finished steel products.

Brazil's 1990 steel production decreased almost 22%, while steel exports fell approximately 20%.

Brazil's five large parastatal steel mills lost \$2 billion in 1990, increasing their accumulated debt to \$7 billion. The losses were primarily attributed to lower domestic demand, an unfavorable exchange rate, and lower world prices, which were down between 13% and 20% from those of 1989. During the year the work force in the mills was reduced from 172,000 to 140,000. There also was great concern that without further investment the steel mills would be obsolete by the mid-1990's.

In 1989, Cia. Siderúrgica Belgo-Mineiro, in a joint venture with Trefil Arbed of Luxembourg, commenced construction of a 20,000-mt/a steel cord works in Pine Bluff, Arkansas (United States). The plant is to come on-stream in 1992, with 50% of its wire rod requirement to come from Belgo-Mineiro's wire mill in Brazil.

The Gerdau Group, Brazil's largest private steelmaker, announced plans to modernize the direct-reduced iron 300,000-mt/a Usiba plant it purchased at a Government auction in October 1989. The upgrading options under consideration were the newer HYL-III process and the Midrex process. If the Midrex option is adopted, a completely new plant would have to be constructed.

At yearend, none of the five large parastatal steel companies had been privatized.

Manganese.—Manganese concentrate production continued a decline that began in 1987. The 1990 output figure was more than 9% below that of 1989. The largest decline occurred in 1987 when production decreased almost 30% from that of 1986. The principal reason for the diminution of total manganese production was the dwindling of the high-grade ore reserves of Industria e Comercio de Minerios' (ICOMI) Serra do Navio Mine near Macapá, Amapá State. Another negative factor was the grade of the ore being mined by CVRD at its new manganese mine, the Azul Mine, in the Carajás complex. The Azul manganese ore is 45% Mn, while the average grade of the ore on the international market is 48% Mn. The high content of aluminum in the ore, about 8%, may be a mitigating factor affecting the marketability of the Azul ore.

In 1990, CVRD and ICOMI produced 997,500 tons of metallurgical- and battery-grade manganese; of this total, 72% was exported.

Tin.—Tin production decreased by 13% in 1990 from that of 1989. Tin prices decreased markedly in 1990; this in part was the result of the smuggling by garimpeiros of about 6,000 tons of tin from the Bom Futuro Mine in the State of Rondonia across the border into Bolivia and Perú.

Parapanema S.A. Mineracao, Indústria e Construção, Brazil's largest tin mining company, reported that tin sales declined \$65 million from that of the preceding year.

In December, Mineracao Taboca S.A., a subsidiary of Parapanema, was fined \$1.2 million by the Brazilian Government for mining in a permanent reserve.

At yearend, the Federal police announced that they had closed down three illegal tin mines that were active in Yanomami Indian territory in the Territory of Roraima. Collectively, the three mines had produced 150 tons of tin per month.

Titanium.—In 1989, CVRD began investing in the production of titanium sponge and an advanced titanium compound used in the space, shipbuilding, and chemical industries on an industrial scale. CVRD reached an agreement with the space technology institute of the air force, whereby the institute will receive 1% of all royalties when the compound is produced industrially in exchange for the transfer of equipment to CVRD.

The Brazilian subsidiary of E. I. du Pont de Nemours and Co. Inc. of the United States began construction of a titanium di-

oxide sizing and packaging facility at Uberaba, Minas Gerais State. The plant is due to begin operation in late 1991.

Industrial Minerals

Gem Stones.—For many years Brazil has been an important producer of gem stones in the world. This ranking has applied in terms of volume as well as variety. The large proportion of gem stones produced was mined by garimpeiros. For this reason gem stone reserves are unknown, but Brazil appears to have potential for very large reserves.

The total value of gem stone (including diamond) exports increased by 18% in 1990. Exports of uncut gem stones have declined since 1989 despite the removal of some export barriers.

Quartz.—A consortium that consisted of CVRD, Nisso Iwai (Japan), and Telequartz began production of quartz powder in 1989. The powder is an important constituent in the production of optic fibers, crucibles, oscillators, solar cells, wafers and integrated circuit packing, and ceramic materials of exceptional purity.

In 1990, Brazil was the largest producer of quartz in the world. Brazil is estimated to have 53 Mmt of reserves representing 95% of the known world supply.

Other Industrial Minerals.—Potash production in 1990 decreased by an estimated 60% from that of 1989. Because of the reduced production, Brazil imported an estimated 90% more potash than in 1989.

Phosphate concentrate and phosphoric acid production declined approximately 23% from that of the previous year. Phosphate concentrate imports decreased from 146,000 tons in 1989 to 114,000 tons in 1990.

Mineral Fuels

In 1989 (the last year for which there are published data), the total amount of energy produced was 152,428,000 tons of oil equivalent. The primary sources, in order of importance, were hydraulic energy, firewood, petroleum, sugar cane bagasse, natural gas, steam coal, metallurgical coal, and uranium. Imported energy sources were 47,373,000 tons of oil equivalent. Total energy consumption was 162,457,000 tons of oil equivalent. Export, variations in inventory, nonutilized, and reinjected energy totaled 10,068,000 tons of oil equivalent.

The transportation sector consumed 32,629,000 tons of oil equivalent and the industrial sector 69,229,000 tons of oil equivalent. Consumption, by categories, in the mineral industry, in order of importance, was pig iron and steel, 17,552,000 tons of oil equivalent; nonferrous and other metals, 8,231,000 tons of oil equivalent; cement, 2,799,000 tons of oil equivalent; mining and pelletization, 2,591,000 tons of oil equivalent; and ferroalloys, 2,569,000 tons of oil equivalent.

With more than 13 million alcohol-powered vehicles on the road and with an alcohol shortage, the production breakdown of road vehicles has shifted to 70% gasoline-powered from almost entirely alcohol-powered production in 1989.

Coal.—Brazil's total coal production in 1990 was about the same as the figure for 1989. Imports increased by more than 4% to approximately 11,000,000 tons, which was almost entirely composed of metallurgical coal. The United States exported an estimated 5 Mmt of metallurgical coal to Brazil in 1990.

Natural Gas and Petroleum.—The gas pipeline linking the Enchova platform in the offshore Campos Basin to Macaé, Rio de Janeiro State, and which was completed in midsummer 1989, has added 5 Mm³/day gas flow to the Rio de Janeiro and Sao Paulo markets.

BRASPETRO, the foreign operating subsidiary of PETROBRAS, began producing natural gas in the Gulf of Mexico at yearend 1989. The gas was recovered from the Frederick Field, 27 km off the Louisiana coast by Petrobrás América Inc., a subsidiary of BRASPETRO.

Petroleum production increased 6% over that of 1989, while natural gas production increased almost 2%. In November, PETROBRAS set a monthly production record of 678,413 bbl of crude petroleum. In 1990, Brazil's imports of petroleum declined by almost 4% to about 6.8 Mbbbl while import costs increased by 28% to \$4.35 billion.

The Enchova platform in the Campos Basin went back into production at yearend 1989, only 18 months after almost being completely destroyed by fire.

Nuclear.—At yearend 1989, a bill was submitted to the Brazilian Congress that proposed the termination of the Brazil-Germany nuclear energy accord signed in 1975. Construction continued on a pilot

powerplant that has the capability to produce 1 ton of 99.6%-pure heavy water per year. The plant is to be completed in 1994. The site of the top-secret plant and the production process were not announced.

Reserves

In 1990, Brazil was among the world leaders in reserves of the following mineral commodities, by rank: columbium (1); barite (2); bauxite (3); vermiculite (3), tin (3); iron ore (5), manganese (5), and talc and pyrophyllite (5). Brazil's reserves of major mineral commodities are given in table 3.

INFRASTRUCTURE

In 1990, Brazil had a total of 32,002 km of railroads composed of 25,268 km 1.000-m/gauge, 4,339 km 1.600-m/gauge, 74 km

1.600- to 1.000-m/gauge, 13 km 0.760-m/gauge, and 2,308 km electrified. The country contained a total of 1,448,000 km of roads, composed of 48,000 km paved and 1,400,000 km of gravel and dirt. There was 50,000 km of navigable inland waterways. The major shipping ports were Belém, Manaus, Porto Alegre, Recife, Rio de Janeiro, Rio Grande, Salvador, and Santos. Among the 271 ships were 56 tankers, 15 chemical tankers, 10 liquefied natural gas, 14 combination ore and oil, 82 bulk, and 2 combination bulk vessels. There were 2,000 km of crude petroleum pipelines, 3,804 km of refined petroleum product pipelines, and 1,095 km of natural gas pipelines. In 1989 (the latest year for which there is information), Brazil's installed electrical generating capacity was 52,865 MW. Total production of electric power for the year was 202,280 GW.h, which translated into 1,340 kW.h per capita.

In late 1989, power investment negotiations were underway between the Brazilian Government and five companies, of which four were foreign subsidiaries. The companies involved were Alcan Alumínio do Brasil S.A. (Canada), Alcoa Alumínio S.A. (United States), Billiton Metais S.A. (Netherlands), Dow Química S.A. (United States), and the Brazilian company, Camargo Corrêa Industrial S.A. The proposal submitted by the five companies was to build a 1,200-MW dam on the Tocantins River on the border between Maranhao and Goias States. A Billiton spokesman stated that the dam construction would cost approximately \$1 billion and that Billiton has pledged \$350 million. The companies all have been receiving electricity from the Tucuruí Dam on the Tocantins River, but the demand has been increasing at such a rapid rate that the demand could exceed the supply in a very few years. Another factor was the 10% subsidy on electricity prices that expires in the year 2004.

During the past several years, the lack of funding has led to a significant deterioration in the quality of Brazilian highways. A recent World Bank study found that 28% of the country's highways was in bad condition versus only 10% in 1979. Another study found that the lack of proper maintenance of Brazilian roads added 10% to 15% to total transportation costs in the country.

A study by the Brazilian Steel Institute (IBS) found that the loading of 1 ton of steel at the Port of Santos cost \$32.50. In comparison, the average cost of loading 1 ton of steel in Asian, European, and U.S. ports was \$4.50. At the Ports of Rio de Janeiro and

TABLE 3

BRAZIL: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Reserves
Asbestos, fiber	3,000
Bauxite, ore	2,310,000
Chromite, Cr ₂ O ₃ content	4,850
Coal, all types	8,815,000
Columbium, pyrochlore, and columbite ore	3,975
Copper, metal content	12,000
Fluorspar, ore	11,000
Gold; metal	metric tons 950
Graphite, ore	38,000
Gypsum	671,500
Iron ore, 60% to 65% Fe content	18,200,000
Kaolin	1,060,000
Lead, metal content	345
Magnesite	153,000
Manganese, metal content	55,250
Natural gas ¹	million cubic meters 114,600
Nickel, metal content	6,140
Petroleum ¹	thousand 42-gallon barrels 2,840,000
Phosphate rock	310,000
Tin, metal content	590
Titanium, TiO ₂ content	2,630
Zinc, metal content	4,100
Zirconium, ore	1,638

¹1990 International Petroleum Encyclopedia, 1991.

Vitoria, the costs were \$10.00 plus per ton of steel.

The ports of Brazil were found to require heavy investments in modernization and expansion. The bottlenecks resulting from the lack of capacity were found to be so great that Brazilian importers in 1988 paid almost \$300 million in penalties charged by ships that had to wait in line to be unloaded.

In 1990, CVRD invested \$118.8 million to improve its rail transportation system.

OUTLOOK

For the economy to improve over the longer term, the Government will have to keep inflation at a manageable level. In addition, the public deficit will need to be reduced along with improvement in the foreign debt situation. A factor that may have a negative effect over the longer term is the environment, especially the Amazon rain forest. Much depends on what approaches are used to protect environmental quality.

The condition of the infrastructure will have a major, direct bearing on Brazilian industry for the foreseeable future. The common denominator that is apparent is that among the many problems they have, the Brazilian companies will have to spend more money to improve and expand Brazil's infrastructure. If this is not done, Brazil's ability to increase industrial production and competitiveness will be negatively affected by the country's infrastructure problems. The results may well be that the companies will pay more for the services, therefore, losing competitiveness, or they will stand in line to use these services, losing capacity. The sectors most likely to be affected are those that depend most heavily on elec-

tricity, transport, and the shipping ports. The aluminum, auto, petrochemical, and pulp and paper industries, which depend heavily on energy and on exports, probably will be most severely affected by inadequate infrastructure.

¹Where necessary, values have been converted from Brazilian cruzeiros (Cz\$) to U.S. dollars at the rate of Cz\$68.3=US\$1.00, the average rate for 1990.

OTHER SOURCES OF INFORMATION

Agencies

Comissao Nacional de Energia Nuclear (CNEN)
Rua General Severiano
90 Botafogo-ZC-02
22290-Rio de Janeiro-RJ-Brasil
Companhia de Pesquisa de Recurso Minerais (CPRM)
Avenida Pasteur 404-Anexo, 2º Andar, Pcia Vermelha
22290-Rio de Janeiro-RJ-Brasil
Conselho de Nao-Ferrosos e de Siderurgia (CONSIDER)
Esplanados dos Ministerios-Bloco 6-5º Andar
70053-Brasilia-DF-Brasil
Conselho Nacional do Petróleo (CNP)
SGAN-Q.603 Modulos J, I e H
70830-Brasilia-DF-Brasil
Departamento de Mineracao Informacao Instituto Brasileiro de Mineracao (IBRAM)
Avenida Afonso Pena, 3880 3º, 4º e 5º Andares
30000-Belo Horizonte-MG-Brasil
Departamento Nacional de Producao Mineral (DNPM)
Ministerio das Minas e Energia
SAN-Quadra 01-Bloco "B"

70040-Brasilia-DF-Brasil
Petróleo Brasileiro S.A. (PETROBRAS)
Avenida República do Chile, 65
20035-Rio de Janeiro-RJ-Brasil
Rio Doce Geologica e Mineracao S.A. (DOCEGEO)
Avenida President Wilson 11º Andar
22030-Rio de Janeiro-RJ-Brasil

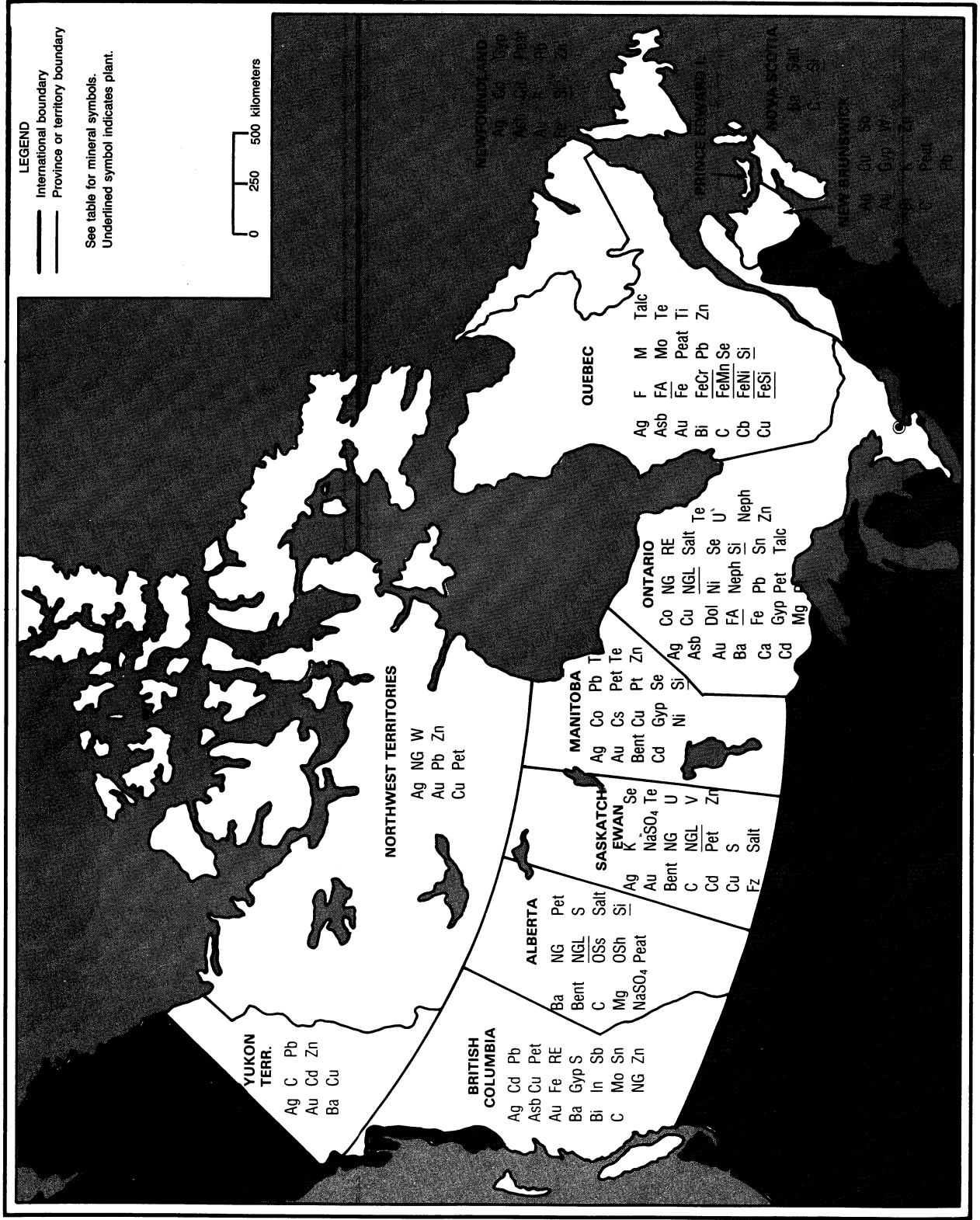
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CANADA

AREA 9.9 million km²

POPULATION 26 million



CANADA

By David B. Doan

The year 1990 was an economic turning point for Canada as well as a time of political uncertainty concerning the future of the federation of Canadian provinces. Mineral production measured in tonnages was, for the most part, lower than that of 1989 as well as 1988. Even so, the total value of mineral production for 1990, exclusive of value-added processing such as for aluminum, was \$35.4 billion,² up almost \$2 billion compared with that of 1989. The increase was solely attributable to a sharp rise in volume of natural gas produced.

The first quarter of 1990 saw the continuation of a 7-year trend of expansion of the Canadian economy, similar to that of its neighbor, the United States. After the first quarter, however, the economy commenced a decline that lasted through the remainder of the year. Although Real Gross Domestic Product (GDP at constant dollars) managed a 1% gain in 1990, this did not compare with the 3% to 4.5% gains of previous years. Increasing unemployment, weakening corporate profits, subdued consumer spending, and a decrease in investment spending all joined to continue the downturn as a true recession. A relatively high Canadian dollar relative to the U. S. dollar fostered a weakened export trade, and business confidence fell steadily. In the fourth quarter of 1990, the United States began its recession with a repetition of most of the adverse economic factors above mentioned. In Canada, labor problems in some parts of the mineral industry added to the picture until a number of mines suspended operations temporarily or indefinitely, and a few closed altogether. In both countries, signs of a classic deflation appeared, including shrinking commodity prices, a decrease in the volume of spending, and a decrease of the amount of money in circulation.

Meanwhile, the Canadian political debate increased over proposals by Quebec to separate from Canada, partly because such a move would introduce business, and hence

economic, uncertainties on a gigantic scale. Business realignments, allocation of national debt, reallocation of Provincial debt, questions of ownership of property, survival of the Free Trade Agreement (FTA) with the United States, and the role of land tenure by the native peoples of northern Quebec all came to the fore as issues for intense debate. At the end of 1990 the major issues were still unresolved.

The combined uncertainties of the economy and the intentions of the Province of Quebec engendered problems to all business in Canada, including mineral exploration, mining, and mineral processing. The combination of these political and economic uncertainties along with increasing pressures from environmental activists led a number of Canadian mining companies to begin to look elsewhere in the world (especially to Latin America) for minable ore deposits. Beyond the United States, where Canadian companies have operated for a long time, opportunities seemed to present themselves from Mexico to Chile. Rising interest in a proposed North American Free Trade Agreement (NAFTA), involving Canada, the United States, and Mexico was complemented by the fact that the latter country was entering an economic renaissance that boded well for the future of investment and trade cooperation.

GOVERNMENT POLICIES AND PROGRAMS

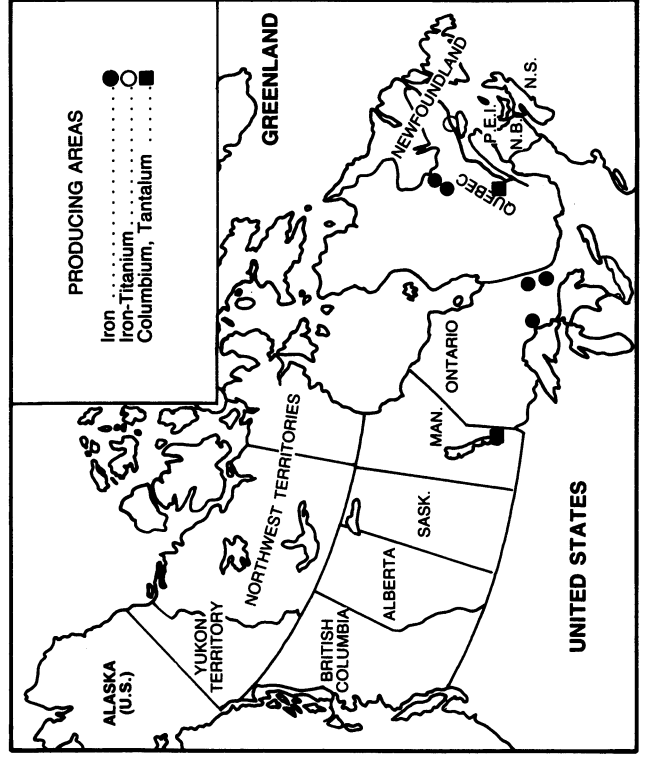
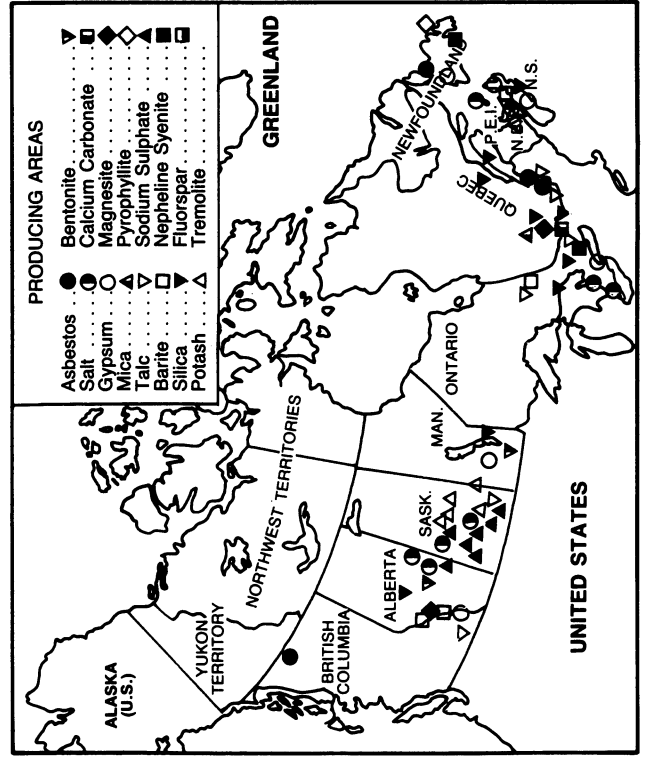
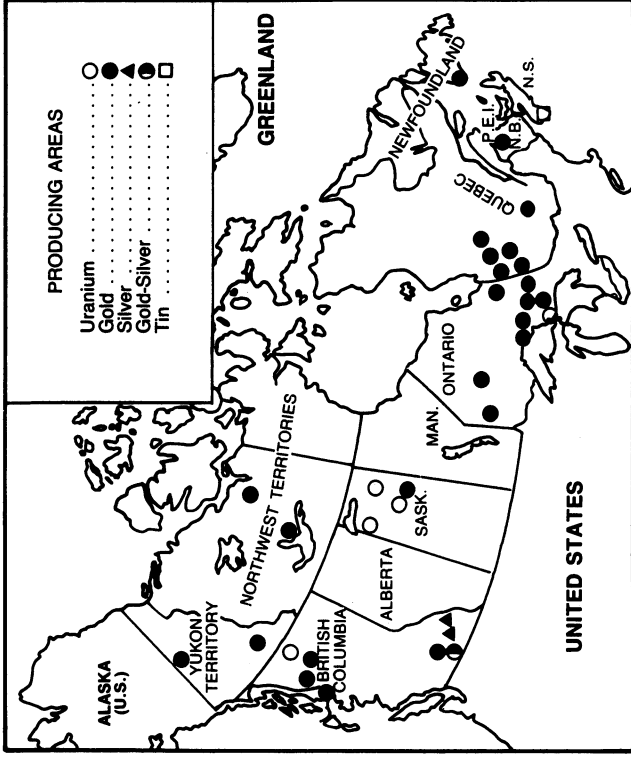
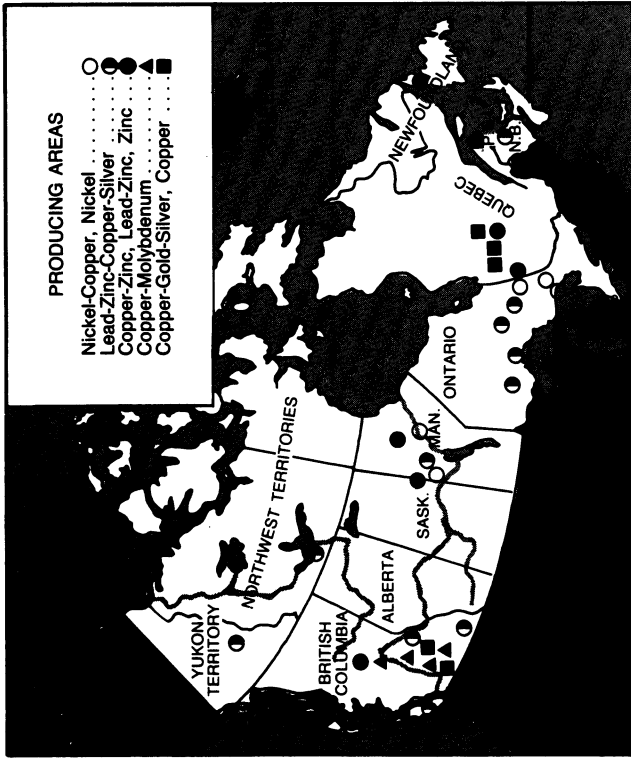
The FTA with the United States, which the Canadian mining industry actively supported, completed its second year of existence in 1990. The United States-Canada FTA had been in effect since January 1989. With the 10-year phase-out of tariffs on mineral commodities, business on both sides of the border was studying the new trade and investment opportunities that the FTA had generated. Not only did the FTA create the largest such area in the

Western Hemisphere, but both countries looked southward toward Mexico as a candidate for an even larger NAFTA.

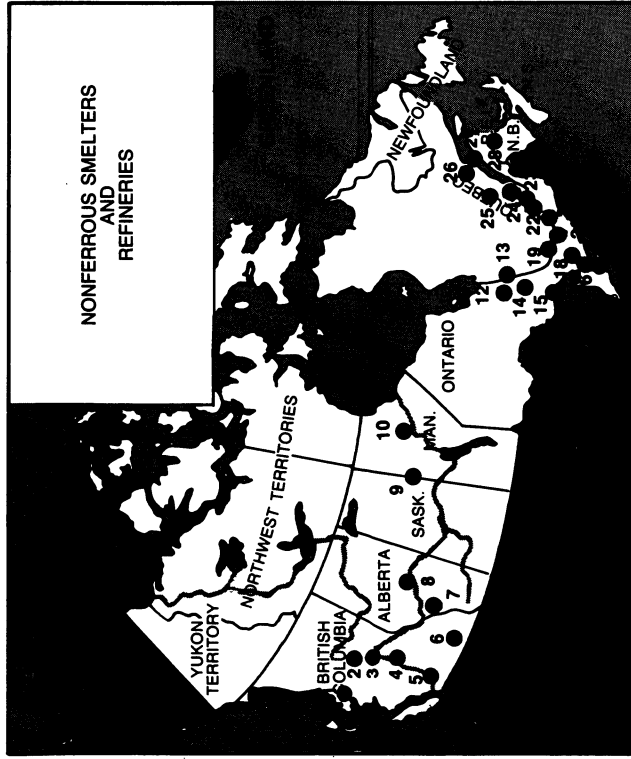
The Tariff Acceleration Agreement between the United States and Canada in 1989 testified to the FTA's success. The phase-out of tariffs was accelerated on more than 400 products, including minerals (as shown in table 4), worth \$6 billion in two-way trade. A second round of talks with Canada on tariffs for another group of products was underway. United States-Canada subsidy issues, however, continued to be thorny. Chapter 19 of the FTA provided for continuing negotiations on subsidies and antidumping measures, and a bilateral working group was established to negotiate on subsidies. This will depend on the completion of the GATT subsidy negotiations in the Uruguay Round.

In response to various pressures in favor of environmental protection measures, the Government of Canada came forward with its long-anticipated Green Plan, more ambitious than any previously formulated in Canada. Too wide-reaching to be detailed here, the plan sponsored more than 100 initiatives to be funded through a 6-year period at a cost of \$2.6 billion. The plan included policies, programs, and standards to clean up, protect, and enhance the country's air, land, and water. Among other things, the plan encompasses the use of renewable resources, reduction of waste generation, the improvement of energy efficiency, environmentally responsible decisionmaking, and the maintenance of global environmental security. Although most of the Green Plan does not take aim at mining and minerals production, the implications were plain. Some of the response required of the mining industry would include control of major emissions from metal mines and smelters; regulations dealing with transboundary movement of hazardous wastes and their disposal, consistent with the Basel Convention; capping of sulfur dioxide and "greenhouse" gas emissions by the year 2000; creation of an extended na-

CANADA — PRINCIPAL PRODUCING MINES

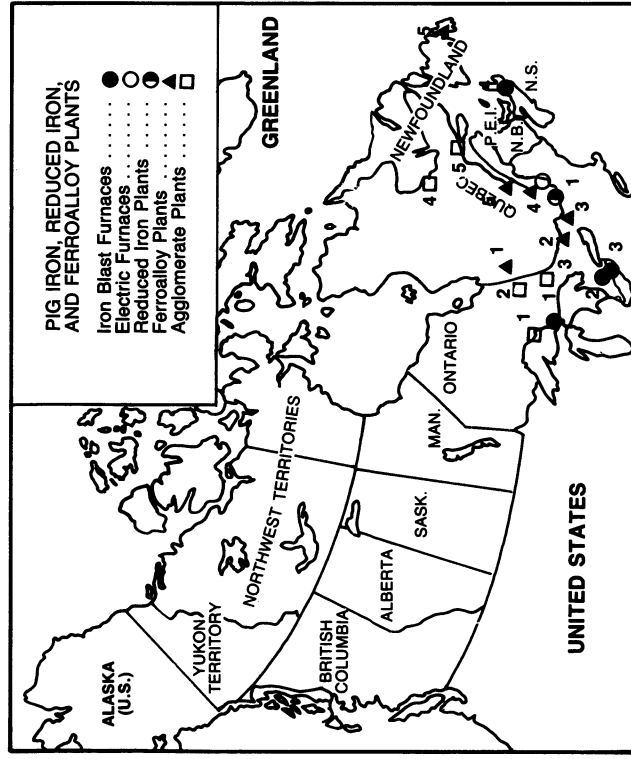


CANADA — PRINCIPAL FERROUS & NONFERROUS PROCESSING PLANTS



NONFERROUS SMELTERS AND REFINERIES

- NONFERROUS SMELTERS OR REFINERIES**
26. BAIÉ COMEAU: Aluminum ingots and alloys
 21. BEAUHARNOIS: Aluminum ingots and alloys
 24. BÉCANCOUR: Aluminum ingots and alloys, Magnesium ingots and alloys
 28. BELLEDUNE: Lead, Silver, Copper matte, Bismuth, Sulphuric acid, Antimony, Diammonium phosphate
 11. BLIND RIVER: Uranium trioxide
 16. BRAMPTON-TORONTO: Gold, Silver
 14. COBALT: Silver
 3. ENDAKO: Molybdc trioxide
 15. FALCONBRIDGE: Nickel-Copper matte
 9. FLIN FLON: Copper anodes, Zinc, Cadmium
 8. FORT SASKATCHEWAN: Nickel, Cobalt, Copper sulphide, Ammonium sulphate
 25. GRANDE BAIE: Aluminum ingots and alloys
 19. HALEY: Magnesium, Magnesium alloy ingots, Calcium, Calcium alloys, Strontium
 7. HIGH RIVER: Magnesium ingots and alloys
 2. HOUSTON: Ammonium dimolybdate, Molybdc trioxide
 25. ISLE MALIGNE: Aluminum ingots and alloys
 25. JONQUIÈRE: Aluminum ingots and alloys, Alumina, Aluminum chemicals, composites
 1. KITMAT: Aluminum ingots and alloys
 4. McLEESE LAKE: Copper cathodes
 22. MONTREAL-EAST: Copper (cathodes, billets), Gold, Silver Tellurium, Selenium, Selenium salts, Nickel sulphate, Copper sulphate
 27. MURDOCHVILLE: Copper anodes, Sulphuric acid
 13. NORANDA: Copper anodes
 20. OTTAWA: Gold, Silver
 17. PORT COLBORNE: Utility Nickel, Nickel oxide, Nickel-Chromium-Iron ingots, Platinum metals (in



PIG IRON, REDUCED IRON, AND FERROALLOY PLANTS

- Iron Blast Furnaces
- Electric Furnaces
- Reduced Iron Plants
- Ferroalloy Plants
- ▲ Agglomerate Plants

5. PORT COQUILLAM: Tungsten, Titanium and Tantalum-Niobium (Columbium) metal powders and carbides
 18. PORT HOPE: Uranium hexafluoride, Uranium dioxide, Uranium metals and alloys
 23. SOREL: Titanium dioxide slag, Iron powder, Nickel oxide (sinter), Nickel pellets and powder, Nickel sulphate, Copper (cathodes, wire bars), Gold, Silver, Selenium, Tellurium, Platinum metals (in residues), Sulphuric acid, Liquid SO₂, Sulphur
 10. THOMPSON: Nickel, Copper matte, Precious metal residue, Cobalt oxide
 12. TIMMINS: Zinc, Copper cathodes, Cadmium, Indium, Sulphuric acid
 6. TRAIL: Zinc, Lead, Silver, Gold, Cadmium, Bismuth, Tin, Indium, Germanium, Antimonial lead, Mercuric chloride, Copper matte, Sulphuric acid, Ammonium sulphate, Sulphur, Liquid SO₂, High purity metals
 21. VALLEYFIELD: Zinc, Cadmium, Sulphuric acid
- PIG IRON PLANTS**
- BLAST FURNACES**
1. Sault Ste. Marie, The Algoma Steel Corp., Ltd.
 2. Hamilton, Stelco Inc.
 3. Nanticoke, Stelco Inc. (Lake Erie Works)
 4. Sydney, Sydney Steel Corporation
- ELECTRIC FURNACES**
1. Sorel, QIT-Fer et Titane Inc.
- REDUCED IRON PLANTS**
1. Contrecoeur, Sidbec-Dosco Inc.
- FERROALLOY PLANTS (Primary)**
1. Duparquet, Eldorado Gold Mines Inc.
 2. Ottawa, Masteroy Products Ltd.
 3. Beauharnois, Elkem Metal Canada Inc.
 3. Beauharnois, Chromasco Division of Timminco Ltd.
 4. Varennes, ERCO Industries, Ltd.
 5. Chicoutimi, Elkem Metal Canada Inc.
 6. Long Harbour, ERCO Industries Ltd.
- IRON ORE AGGLOMERATE PLANTS**
1. Wawa, The Algoma Steel Corp. Ltd., (Algoma Ore Division)
 2. Adams Mine, Dofasco Inc.
 3. Sherman Mine, Dofasco Inc.
 4. Labrador City, Iron Ore Co. of Canada
 5. Pointe Noire, Wabush Mines
 5. Port Cartier, Quebec Cartier Mining Co.

tional accounts reporting system, including environmental indicators; and completion of the national parks system by 2000. With the number of ramifications of the Green Plan for the mineral industry of Canada, there was continuing study and discussion of roles and consequences.

Recognizing the strong contribution of the mineral industry to the regional economies of Canada, the Government promulgated the "Minerals and Metals Policy of the Government of Canada," which commits the Government to promote the development of the mining sector as a basis for regional economic development. Joint federal-provincial agreements, called Mineral Development Agreements (MDAs), were intended to strengthen and diversify the minerals sectors of the provincial economies. The MDAs were thus a vehicle to be tuned to the specific needs of each region or Province. MDAs that commenced in 1984 were due to expire in fiscal year 1990-91 so that new negotiations were underway during 1990 for updating, realigning, or initiating new MDA arrangements.

PRODUCTION

The value of mineral production in Canada in 1990 overall, including fuels, was \$35.4 billion, up 5.2% from the equivalent total of the year before. Production of the fuels themselves increased by a remarkable 18.8% from \$16,957 million in 1989 to \$20,150 million in 1990, largely as the result of greatly expanded output of natural gas and sharply higher prices for crude oil.

Although this gain in the petroleum sector made the overall value of mineral production rise in 1990, the value of nonfuel mineral output was a different story. The aggregate value of all nonfuel mineral production in Canada during the year 1990 was \$15,253 million, down between 8% and 9% from that of the preceding year. Of this total, the value of metals produced was \$10,952 million, a decrease of 8.6% from the 1989 value. In the industrial mineral group, the value of nonmetals produced was \$2,044 million, down 8.1% from that of 1989, and the value of the so-called structurals, or construction materials, dropped by 9.1% to \$2,257 million in 1990.

Regionally, Alberta led the Canadian provinces in total mineral production, including fuels, with an output valued at \$16.6 billion or almost 47% of the total for the year. Ontario was a distant second with a

total of \$5.5 billion or less than 16% of the total. Third place was occupied by British Columbia, which produced \$3.5 billion worth of minerals, representing about 10% of the total.

TABLE 1
CANADA: VALUES OF
PROVINCIAL MINERAL
PRODUCTION

(Billions of dollars)

Province or Territory	1989	1990 ^P
Alberta	14.0	16.5
Ontario	6.3	5.4
British Columbia	3.5	3.5
Saskatchewan	2.6	2.8
Quebec	2.4	2.5
Manitoba	1.5	1.0
Northwest Territories	.9	1.0
New Brunswick	.8	.8
Newfoundland	.9	.7
Yukon	.4	.5
Nova Scotia	.3	.4
Prince Edward Island	(¹)	(¹)
Total ²	33.6	35.4

^PPreliminary.

¹Less than 1/2 unit.

²Data may not add to total shown because of independent rounding.

Source: Energy, Mines and Resources Canada, Ottawa, 1990.

Mineral fuels led the list in terms of value of output during the year 1990, with petroleum crude first and natural gas second. After these came copper, zinc, and gold for the top five commodities. The next highest five in value produced were natural gas byproducts, nickel, coal, iron ore, and finally potash in tenth place.

On a regional basis, considering the Provinces from east to west, Newfoundland and Labrador registered a decrease from that of 1989 of about 4% for a total output value of \$739 million. Newfoundland Zinc Mines Ltd. closed after depleting its ore reserves, and St. Lawrence Fluorspar Ltd. closed for lack of profitability at the relatively low world market prices for fluorspar. Baie Verte Mines Inc.'s open pit asbestos mine was expected to close in 1991.

New Brunswick's production increased 2.5% in value to about \$759 million in 1990, with coal playing a leading role. The Caribou lead-zinc mine suspended operations but expected to reopen in 1991 after a new determination of reserves. Labor problems impeded lead and zinc production at Brunswick Mining and Smelting Corp. Ltd. and were not settled by the end of the year.

TABLE 2

CANADA: VALUES OF PRINCIPAL MINERAL PRODUCTION

(Millions of dollars)¹

Commodity	1989 ^r	1990 ^P
Metals:		
Copper	2,017	2,138
Zinc	2,313	2,123
Gold	1,956	2,038
Nickel	2,569	1,735
Iron ore	1,156	1,125
Uranium	771	744
Lead	236	230
Silver	232	219
Platinum-group	120	176
Molybdenum	94	85
Total ²	<u>11,464</u>	<u>10,613</u>
Industrial minerals:		
Potash	859	778
Cement	811	741
Sand and gravel	738	681
Stone	559	558
Sulfur, elemental	354	312
Asbestos	226	220
Salt	193	206
Lime	170	155
Clay products	169	123
Sulfur in smelter		
gas	73	80
Gypsum	73	69
Total	<u>4,225</u>	<u>3,923</u>
Mineral fuels:		
Petroleum crude	9,174	11,855
Natural gas	4,555	4,798
Natural gas byproducts	1,368	1,893
Coal	1,611	1,604
Total ²	16,708	20,150

^PPreliminary. ^rRevised.

¹Values shown here were converted to U.S. dollars using the 1989 and 1990 average conversion rates for each entire year, thus these values may differ slightly from those noted in text.

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

Source: Energy, Mines and Resources Canada, Ottawa, 1990.

Mineral production in Nova Scotia increased in value by 2.4% to about \$387 million in 1990. Although gold production declined sharply, base metal output compensated to some degree. Further effort by Falconbridge Ltd. at the Jubilee mine and Westminster Canada Ltd.'s Gays River Mine have bolstered significantly the province's base metal production and value.

The value of Quebec's mineral production in 1990, at \$2.52 billion, grew 4% from that of the previous year. In particular, cop-

per production was up 44% thanks to the resumption of production at the Mines Gaspé Div. of Noranda Minerals Inc. plus increased activity at the Ansil and Mobern Mines. The value of silver and zinc output also rose respectively by 9% and 16%, adding to the overall strength.

At \$5.42 billion, Ontario showed a decrease of 13.5% in the value of mineral production in 1990. The decline in world prices for nickel played the leading role in this contraction, but labor problems and the closing of two iron mines likewise exerted a negative effect on production overall. Counter to these trends, the value of uranium production grew moderately. Exploration for gold was discouraged by lowered world prices, the drying up of financing of junior companies, and the general removal of fiscal incentives.

In spite of some expected positive developments in 1991, the value of Manitoba's mineral production in 1990 fell 23% from that of 1989 to a total of \$1.04 billion. The closure of LynnGold Resource Inc.'s MacLellan gold mine in late 1989 has its effect, as did nickel price uncertainties during the year. Inco Ltd. planned increased nickel mining activity in the near future, and the Manitoba Government was preparing a new mines act that would revise mining taxes.

Saskatchewan saw the value of its mineral output drop 21% to \$950 million in 1990, largely the result of price weakness and a lack of demand in the two principal mineral products of the Province, potash and uranium. The former industry operated at about 60% of capacity overall, with the largest mine operating at only about 50%.

The value of mineral output in Alberta increased by a healthy 17.5% to \$16.5 billion, mostly from the sale of mineral fuels, including coal. Although the production of crude oil was down slightly, the marked increase in world prices put this commodity into a positive position. Beyond this, however, the substantial increase in output of natural gas played a major role.

At \$3.52 billion, the value of mineral production in British Columbia was down less than 1% from that of the previous year. Coal represented about \$900 million of this, about the same as that for 1989. Sulfur production was up about 5%, thus helping to counteract the influence of mine shut-downs and cutbacks in output. Lower coal prices, high taxes, and a stronger Canadian dollar took their toll.

The value of mineral production in the

Northwest Territories, including fuels, was \$1.0 billion even, or 1.6% higher than that of 1989. Nonfuel mineral production eased about 6% from that of the previous year. Since closure of Pine Point Mines Ltd. in 1988, shipments of stockpiled lead and zinc concentrates have been nearing completion in 1990.

The Yukon Territory realized mineral production worth \$464 million in 1990, up less than \$1 million from that of 1989. Although lead-zinc-silver output was up during the year, both gold prices and gold production were likewise down. The number of placer gold operations decreased from 226 in 1989 to 194 in 1990, the result of high production costs and, presumably, lower grade placer mineralization.

TRADE

In January 1990, the FTA with the United States had been in effect for 2 years with little or no sign of the import-export disasters predicted by various naysayers on both sides of the border. Regardless of such hyperbole, the FTA will not be fully implemented until 1998, at which time 10 years of progressively diminishing tariffs will essentially phase out. In 1990, Canada was the United States' largest export market and vice versa. About two-thirds of Canada's exports reached the United States, and 54% of Canada's imports were from the United States. Japan was Canada's second largest market at about 10% of exports, and the European Communities (EC) took about 9.6%.

Trade between the United States and Canada exceeds that of any other two countries in the world, amounting in 1989 to \$200 billion, and can be expected to grow. So far, FTA implementation had been successful and smoother than might have been expected for such a complex accord, particularly when subsidy issues were yet to be resolved. The Economic Council of Canada, a research organization of the Federal Government, forecast that by 1998, free trade would bring a net gain of 251,000 jobs to Canada, increasing employment by almost 2% and Canada's GNP by 2.5%. The U.S. Department of Commerce estimated that the elimination of tariffs alone would result in a \$25 billion increase in trade between the two countries during a 5-year period, with more than 14,000 new U.S. jobs created.

Although Canada's mineral exports were down slightly from the \$21.9 billion of 1989, they amounted to \$21.4 billion in

1990. The mining and metallurgical extractive industries registered about three-quarters of the total. As well as its best overall customer, the United States continued to be Canada's best mineral exports customer in 1990, absorbing 53.9% of the total, excluding crude oil and natural gas. Of the remaining mineral exports, 13.4% went to the EC and 13.1% to Japan.

Meanwhile, 1990 mineral imports were \$11.7 billion, down from \$12.3 billion in 1989. Of these imports in 1990, 68.2% came from the United States, 12.0% from the EC, and 3.2% from Japan. The mineral industry of Canada thus contributed a net trade surplus of \$9.7 billion to the country's merchandise balance of trade, not much different from that of 1989.

Other than for petroleum, Canada's main exports were as follows: crude materials—iron ore, potash, and sulfur to the United States; copper concentrates to Japan; iron ore and zinc concentrates to the EC; smelted and refined metals—aluminum, copper, gold, iron and steel, nickel, silver, and zinc to the United States; aluminum and gold to Japan; and copper and nickel to the EC. Coal exports went mostly to Japan.

STRUCTURE OF THE MINERAL INDUSTRY

The Canadian mineral industry comprised 143 foreign and 2,078 domestic companies. Companies were considered foreign whose corporate voting rights were at least 50% non-Canadian. Broken down by operating category, there were 34 foreign and 428 Canadian firms in the primary metals sector; 83 foreign and 1,542 Canadian concerns in the nonmetallic minerals sector, and 26 foreign and 108 Canadian corporations in the petroleum and coal sectors. Downstream from these were 221 foreign and 6,427 companies in fabricated metals production. In general, foreign companies were subject to all of the same taxes as domestic companies, and repatriation of earnings was unimpeded. Some companies are partly Government-owned, such as Potash Corp. of Saskatchewan Inc., of which 63% is owned by the Provincial government, and Saskatchewan Oil & Gas Corp., 81% owned by the same Government. Moreover, the Province of Alberta owned 37% of Alberta Energy Co. Ltd. Petro-Canada was owned partly by federal and partly by provincial governments, but was expected to be completely privatized. In general, the mineral industry in Canada

TABLE 3

CANADA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989	1990 ²	
METALS						
Aluminum:						
Alumina, gross weight	thousand tons	1,015	952	950	950	1,087
Metal:						
Primary		1,355,161	1,540,439	1,534,499	1,554,753	1,567,395
Secondary		58,338	67,838	113,000	77,000	80,000
Antimony ²		3,805	3,706	3,171	2,818	653
Bismuth ³		153	.00	181	157	100
Cadmium ⁴		1,484	1,481	1,664	1,711	1,643
Calcium	kilograms	W	W	W	W	W
Cobalt:						
Mine output, Co content ⁵		2,486	2,490	2,398	2,344	2,291
Metal ⁶		1,990	2,527	2,356	2,109	2,062
Columbium and tantalum:						
Pyrochlore concentrate:						
Gross weight		5,216	4,304	5,230	5,443	5,272
Cb content		2,340	1,937	2,354	2,458	2,382
Tantalite concentrate:						
Gross weight		—	91	295	333	
Ta content		—	—	27	73	82
Copper:						
Mine output, recoverable Cu content ⁷		698,527	794,149	758,478	721,936	801,998
Metal, primary and secondary:						
Blister and anode		472,700	499,400	537,000	510,000	525,204
Refined		493,445	491,178	528,723	511,183	515,835
Gold	kilograms	102,899	115,818	134,813	159,494	164,991
Iron and steel:						
Iron ore:⁸						
Gross weight	thousand tons	36,167	37,702	38,742	40,900	36,443
Fe content	do.	22,785	23,658	24,540	26,180	22,959
Metal:						
Pig iron	do.	9,249	9,719	9,500	10,139	7,346
Ferroalloys	do.	260	260	207	250	240
Steel, crude	do.	14,081	14,737	14,866	15,458	12,281
Lead:						
Mine output, Pb content		349,281	413,685	368,444	275,018	232,100
Metal, refined:						
Primary		169,934	139,475	179,461	157,330	100,400
Secondary		87,746	91,186	89,863	87,210	91,665
Lithium: Spodumene ⁹		7,500	11,500	14,000	14,000	12,000
Magnesium metal, primary		7,000	7,000	7,000	7,000	25,300
Molybdenum		11,251	14,771	13,535	13,543	13,481
Nickel:						
Mine output, Ni content ¹⁰		163,639	189,086	198,744	200,900	199,400
Metal, plant production ¹¹		105,859	132,528	159,605	195,554	191,145
Platinum-group metals	kilograms	12,190	10,930	12,541	9,820	11,209
Selenium, refined ¹²	do.	354,000	300,000	321,000	213,000	389,000
Silver	do.	1,197,072	1,374,946	1,443,166	1,312,433	1,399,572
Tellurium, refined ¹²	do.	20,000	13,000	10,000	8,000	13,000

See footnotes at end of table.

TABLE 3—Continued

CANADA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989	1990 ^p
METALS—Continued					
Tin, mine output, Sn content kilograms	2,450	2,779	3,591	2,790	2,828
Titanium:					
Sorel slag (80% TiO ₂) ¹³	850,000	925,000	1,025,000	1,040,000	760,000
Tungsten, mine output, W content	1,959	—	—	—	—
Uranium oxide (U ₃ O ₈)	13,564	15,560	15,130	15,598	10,374
Zinc:					
Mine output, Zn content	1,290,765	1,481,544	1,351,664	1,214,935	1,175,824
Metal, refined, primary	570,981	609,909	703,206	669,677	591,788
INDUSTRIAL MINERALS					
Asbestos thousand tons	662	665	710	701	665
Arsenic trioxide ^e ¹⁴	3,000	2,000	2,000	2,000	1,900
Barite	40,000	42,000	51,000	39,000	48,000
Cement, hydraulic ¹⁵ thousand tons	10,602	12,590	12,036	11,832	11,300
Clays and clay products ¹⁶ value, thousands	\$180,353	\$159,000	\$196,724	200,138	143,072
Diatomite ^e	4,100	4,200	4,200	4,200	4,100
Gypsum and anhydrite thousand tons	8,803	9,094	9,512	8,196	8,202
Lime do.	2,243	2,330	2,518	2,552	2,404
Magnesite, dolomite, brucite	144,000	150,000	150,000	150,000	150,000
Mica, scrap and flake	12,000	13,500	12,000	12,000	16,000 ^e
Nepheline syenite	469,000	500,000	540,000	551,000	536,000
Nitrogen: N content of ammonia	3,540,000	3,511,719	4,010,161	4,100,000	2,967,653
Potash, K ₂ O equivalent thousand tons	6,678	7,399	8,154	7,014	7,015
Pyrite and pyrrhotite, gross weight ^e	6,000	5,000	5,000	5,000	5,000
Salt thousand tons	10,332	10,129	10,687	11,057	11,097
Sand and gravel do.	257,971	278,550	287,653	274,848	250,070
Silica (quartz) thousand tons	2,640	2,560	2,807	2,332	1,900 ^e
Sodium compounds, n.e.s.:					
Sodium carbonate (soda ash) ^e	350,000	325,000	325,000	325,000	315,000
Sodium sulfate, natural ¹⁷	371,000	342,000	331,000	327,000	347,000
Stone ¹⁸ thousand tons	97,602	128,969	120,126	118,016	112,005
Sulfur:					
Elemental byproduct:					
Of smelter gases do.	758	723	856	809	929
Of sour natural gas do.	6,966	5,809	5,981	5,183	5,210
Of refineries ^e do.	189	190	200	200	207
Of tar sands do.	435	426	485	500	503
Talc, soapstone, pyrophyllite	123,000	136,418	146,443	144,828	137,290
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	154,418	160,000	180,697	180,000	178,212
Coal:					
Bituminous and subbituminous	48,700,000	51,200,000	57,500,000	60,085,000	58,924,088
Lignite	8,281,312	10,000,000	12,000,000	10,915,000	9,406,963
Coke, high-temperature	4,552,600	4,636,629	4,663,441	4,414,418	3,707,892
Gas, natural:					
Gross million cubic meters	89,992	98,700	109,088	114,661	138,358
Marketed do.	75,479	79,652	88,035	92,530	98,773

See footnotes at end of table.

TABLE 3—Continued

CANADA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989	1990 ^P	
INDUSTRIAL MINERALS—Continued						
Natural gas liquids:						
Gross:						
Ethane	thousand 42-gallon barrels	32,444	37,120	38,165	42,352	44,694
Propane	do.	31,288	33,428	39,327	41,302	42,448
Butane	do.	18,733	20,130	19,044	22,194	21,621
Pentanes plus	do.	36,932	38,110	40,620	43,414	41,567
Condensate	do.	828	1,210	1,521	1,871	976
Total	do.	120,225	129,998	138,677	151,106	151,306
Peat		738,000	662,000	736,000	812,000	749,000
Petroleum:						
Crude ¹⁹	thousand 42-gallon barrels	<u>538,000</u>	<u>560,000</u>	<u>584,000</u>	<u>583,827</u>	<u>381,362</u>
Refinery products:						
Liquefied petroleum gas, propane, and butane	do.	27,375	39,055	19,610	20,700	17,224
Gasoline:						
Aviation	do.	2,214	2,619	2,477	1,059	813
Other	do.	201,115	208,415	218,635	228,298	231,545
Petrochemical feedstocks	do.	37,836	43,327	42,330	29,080	31,345
Jet fuel	do.	30,660	32,485	32,485	26,980	33,288
Kerosene	do.	14,235	13,140	11,680	15,546	2,792
Distillate fuel oil, diesel and light	do.	143,810	150,015	160,600	166,731	174,588
Residual Fuel oil, heavy	do.	41,975	44,530	50,735	53,903	56,673
Lubricants	do.	6,205	5,840	7,300	7,372	6,549
Asphalt	do.	19,286	22,045	21,577	17,018	16,894
Petroleum coke	do.	(²⁰)	(²⁰)	(²⁰)	(²⁰)	5,398
Unspecified	do.	35,929	41,144	40,196	40,072	33,730
Refinery fuel ²¹ and losses	do.	33,215	38,024	37,595	32,726	26,537
Total	do.	593,855	640,639	645,230	639,485	637,376

⁶Estimated. ^PPreliminary. ^RRevised. ^WWithheld to avoid disclosing company propriety data.¹Table includes data available through Dec. 1991.²Sb content of antimonial lead alloys, flue dust, and dore slag estimated on the basis of reported gross production.³Refined metal and bullion from domestic ores plus recoverable Bi content of exported concentrates.⁴Refined metal from domestic ores plus recoverable Cd content of exported ores and concentrates.⁵Actual output not reported. Data represent the Co content of all products derived from ores of Canadian origin, including nickel oxide sinter shipped to the United Kingdom and nickel-copper-cobalt matte shipped to Norway for further processing.⁶Actual output not reported. Data represent the output within Canada of metallic cobalt from ores of both Canadian and non-Canadian origin.⁷Blister copper from domestic ores plus recoverable Cu content of exported matte and concentrates.⁸Series represent gross weight and metal content of usable iron ore as mine shipments.⁹Based on all of Canada's spodumene concentrates (Tantalum Mining Corp. of Canada Ltd.'s Tanco property.)¹⁰Refined nickel from domestic ores plus recoverable Ni content of exported matte.¹¹Includes metallic nickel, nickel oxide, Incomet, nickel powder and pellets, utility nickel, nickel carbonate, and nickel residue.¹²From all sources, including imports and secondary sources.¹³Refined sinter slag contained 80% TiO₂ in 1984-88.¹⁴Refined arsenic (AS203) from Nerco's Con Mine in Yellowknife, Northwest Territories.¹⁵Cement shipped and/or used by producers.¹⁶Includes bentonite products from common clay, fire clay, stoneware clay, and other clays.¹⁷Excludes byproduct production from chemical plants.¹⁸Crushed, building, ornamental, paving, and similar stone.¹⁹Including synthetic crude (from oil shale and/or tar sands).²⁰Combined with "unspecified" category.²¹Represents total reported production of still gas, including a small amount sold.

TABLE 4

**CANADA: UNITED STATES-CANADA-FREE TRADE AGREEMENT
SCHEDULE OF SELECTED TARIFFS¹**

Commodity	Existing tariffs 1988 (percent)		Phaseout schedule
	Canada ²	United States ²	
METALS			
Chromium	10.2	3.7	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
Cobalt	10.2	5.5	Do.
Columbium (niobium)	4.0	4.9	Do.
Copper:			
Refined	10.3	1.0	Do.
Alloys	10.2	1.0	10-year elimination starting Jan. 1, 1989; 10% reduction per year.
Ferroalloys:			
Ferromolybdenum	10.2	4.5	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
Ferosilicon chromium	10.2	10.0	Immediate lifting of tariffs on Jan. 1, 1989.
Ferrotitanium	10.2	3.7	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
Ferrotungsten and ferrosilicon tungsten	10.2	5.6	Do.
Ferrovanadium	10.2	4.2	Do.
Manganese	10.2	5.5	10-year elimination starting Jan. 1, 1989; 10% reduction per year.
Minor metals:			
Beryllium, waste and scrap	10.2	8.5	5-year elimination starting Jan. 1, 1989;
Germanium, unwrought	10.2	2.7	20% reduction per year.
Magnesium containing at least 99.8% by weight of Mg	4.0	7.2	10-year elimination starting Jan. 1, 1989; 10% reduction per year.
Lead:			
Refined (metal content)	8.1	2.7	10% reduction per year.
Oxide	8.1	10.1	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
Rare-earth metals	12.5	3.7	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
Tantalum	10.2	5.5	Do.
Vanadium	10.2	3.0	Do.
Zinc:			
Refined	—	1.5	10-year elimination starting Jan. 1, 1989; 10% reduction per year.
Zirconium	10.2	4.2	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
INDUSTRIAL MINERALS			
Granite, cut	5.5	4.2	5-year elimination starting Jan. 1, 1989; 20% reduction per year.
Graphite, powder	9.2	—	Do.
Gypsum, wallboard	9.4	2.4	10-year elimination starting Jan. 1, 1989; 10% reduction per year.

¹Based on the United States-Canada Free-Trade Agreement and Minerals and Metals: An assessment, Energy, Mines and Resources Canada, Ottawa, 1988.

²Previous tariff rates under the General Agreement on Tariffs and Trade (GATT).

TABLE 5

**CANADA: PROPORTIONATE
CONTRIBUTION OF LEADING
MINERALS TO TOTAL VALUE OF
MINERAL PRODUCTION**

Commodity	(Percent)	
	Share of 1989 ^a	Share of 1990 ^a
Petroleum, crude	27.7	33.5
Natural gas	13.7	13.6
Zinc	7.0	6.0
Copper	6.1	6.0
Gold	5.9	5.8
Natural gas byproducts	4.1	5.3
Nickel	7.7	4.9
Coal	4.9	4.5
Iron ore	3.5	3.2
Potash	2.6	2.2
Cement	2.4	2.1
Uranium	2.3	2.1
Sand and gravel	2.2	1.9
Others	9.9	8.9
Total	100.0	100.00

^aPreliminary. ^bRevised.

Source: Energy, Mines and Resources Canada, Ottawa, 1990.

TABLE 6
CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
METALS²				
Alkali and alkaline-earth metals:				
Alkali metals	640	122	85	Norway 24; Japan 13.
Alkaline-earth metals	353	382	170	Netherlands 120; Brazil 42.
Aluminum:				
Ore and concentrate	2,032	3,933	3,933	
Oxides and hydroxides	139,095	128,257	114,968	United Kingdom 5,379; West Germany 2,878.
Ash and residue containing aluminum	1,256	5,263	4,899	Taiwan 321; United Kingdom 22.
Metal including alloys:				
Scrap	165,216	164,492	136,620	Japan 17,036; Taiwan 2,932.
Unwrought	1,155,019	1,159,682	747,950	Japan 143,408; Netherlands 81,147.
Semimanufactures	136,008	159,313	146,339	United Kingdom 4,541; Saudi Arabia 2,894.
Antimony:				
Ore and concentrate	3,833	2,371	—	United Kingdom 1,784; Austria 409; Belgium-Luxembourg 108.
Oxides	23	20	20	
Metal including alloys, all forms	11	102	102	
Arsenic: Metal including alloys, all forms	32	209	81	West Germany 119; France 9.
Beryllium: Metal including alloys, all forms kilograms	22,482	58	—	All to Panama.
Bismuth: Metal including alloys, all forms	103	28	27	United Kingdom 1.
Cadmium: Metal including alloys, all forms	1,113	1,433	816	Japan 344; France 105.
Chromium:				
Ore and concentrate	552	49	24	Hong Kong 25.
Oxides and hydroxides	342	239	215	Portugal 17; Antigua and Barbuda 3.
Metal including alloys, all forms	171	82	9	Hong Kong 50; Netherlands 14.
Cobalt:				
Ore and concentrate	98	22	21	Japan 1.
Oxides and hydroxides	953	372	(³)	United Kingdom 367; Australia 4.
Metal including alloys, all forms	3,061	3,245	1,391	Norway 1,359; United Kingdom 233.
Columbium and tantalum:				
Ores and concentrates ⁴	1,935	4,653	2,433	United Kingdom 1,212; Japan 639.
Tantalum metal including alloys, all forms	254	67	67	
Copper:				
Ore and concentrate, Cu content	337,470	333,343	358	Japan 226,376; Spain 30,625; Republic of Korea 29,758.
Matte and speiss including cement copper	10,952	18,796	1,156	Norway 16,720; United Kingdom 793.
Oxides and hydroxides	20	—		
Sulfate	946	1,910	1,910	
Ash and residue containing copper	47,064	50,422	47,531	Republic of South Africa 1,361; Namibia 1,280.
Metal including alloys:				
Scrap	77,107	67,327	47,056	West Germany 5,407; Republic of Korea 3,845.
Unwrought	276,288	326,279	180,516	United Kingdom 68,416; Netherlands 29,362.
Semimanufactures	45,535	32,544	28,476	Colombia 1,095; Mexico 715.
Germanium: Metal including alloys, all forms kilograms	194	302,527	302,525	Indonesia 2.
Gold:				
Ore and concentrate, Au content kilograms	9,831	9,917	NA	NA.

See footnotes at end of table.

TABLE 6—Continued

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989		
			United States	Other (principal)	
METALS²—Continued					
Gold:—Continued					
Metal including alloys, unwrought and partly wrought	kilograms	126,937	161,985	62,994	Hong Kong 40,006; Switzerland 21,755.
Iron and steel:					
Iron ore and concentrate excluding roasted pyrite, gross weight	thousand tons	30,523	30,222	9,640	United Kingdom 4,840; West Germany 3,919.
Metal:					
Scrap	do.	1,682	900	660	Taiwan 66; Republic of Korea 61.
Pig iron, cast iron, related materials		573,048	471,320	195,386	Netherlands 215,924; Italy 27,475.
Ferrous alloys:					
Ferrosilicon		1,660	38	18	United Kingdom 19.
Ferromanganese		26,591	21,893	20,390	Japan 1,500; Philippines 2.
Ferromolybdenum		8	15	—	Mainly to Philippines.
Ferronickel		190	—	—	
Ferrosilicochromium		14	—	—	
Ferrosilicomanganese		65	1,589	1,589	
Ferrosilicon		30,248	32,505	20,744	Japan 6,871; West Germany 3,525.
Silicon metal		20,637	16,564	6,340	Japan 4,590; West Germany 3,321.
Unspecified		6,379	954	636	United Kingdom 250; Sweden 35.
Steel, primary forms		180,608	293,291	138,856	Thailand 47,293; Morocco 34,241.
Semimanufactures:					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		982,055	1,458,179	726,843	Republic of Korea 213,056; Philippines 57,453.
Clad, plated, coated		327,462	399,358	233,867	Mexico 67,185; Australia 36,509.
Of alloy steel		69,400	68,625	51,075	Ecuador 6,060; Republic of Korea 2,839.
Bars, rods, angles, shapes, sections		1,030,050	1,026,232	966,472	Mexico 20,510; Thailand 15,415.
Rails and accessories		157,907	95,688	32,432	Mexico 30,375; Burkina Faso 11,003.
Wire		264,253	182,856	179,211	Belgium-Luxembourg 1,225; Hong Kong 467.
Tubes, pipes, fittings ⁵		475,119	468,338	426,116	China 21,566; Singapore 7,778.
Lead:					
Ore and concentrate		169,499	155,175	2,936	Japan 56,517; Belgium-Luxembourg 27,672; Italy 25,043.
Oxides		2,159	1	(³)	Mainly to Antigua and Barbuda.
Ash and residue containing lead		933	1,111	18	Brazil 961; India 115.
Metal including alloys:					
Scrap		9,214	15,686	4,783	Brazil 7,156; Philippines 942.
Unwrought		199,588	123,356	45,080	China 19,242; United Kingdom 17,021.
Semimanufactures		4,040	11,060	3,809	East Germany 3,300; Turkey 1,999.
Lithium: Oxides and hydroxides		14	—	—	
Magnesium: Metal including alloys:					
Scrap		1,907	483	414	Republic of Korea 63; Italy 6.
Unwrought		3,761	1,421	281	Australia 321; United Kingdom 258.
Semimanufactures		486	684	534	Ireland 82; Republic of Korea 30.
Manganese:					
Ore and concentrate, metallurgical-grade		218	—	—	
Oxides		1,058	225	125	Brazil 99.
Metal including alloys, all forms		398	1,382	1,303	Philippines 79.

See footnotes at end of table.

TABLE 6—Continued

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
METALS²—Continued				
Mercury kilograms	48,701	14	—	Japan 12; Australia 2.
Molybdenum:				
Ore and concentrate	13,978	16,140	101	Japan 4,452; Belgium-Luxembourg 4,205; Chile 2,011.
Oxides and hydroxides	53	—		
Metal including alloys:				
Unwrought including waste and scrap	32	(³)	(³)	
Semimanufactures	92	4	4	
Nickel:				
Ore and concentrate, Ni content	7,581	21	15	Japan 2; Republic of Korea 2.
Matte and speiss	68,639	65,496	3,096	Norway 35,939; United Kingdom 26,455.
Oxides and hydroxides	751	741	446	Belgium-Luxembourg 112; Mexico 50.
Metal including alloys:				
Scrap	7,155	7,936	6,213	United Kingdom 791; Netherlands 378.
Unwrought	2,923	62,675	61,738	Belgium-Luxembourg 663; Republic of Korea 68.
Semimanufactures	11,050	10,567	8,059	Japan 1,602; Netherlands 198.
Platinum-group metals:				
Ore and concentrate ⁶ kilograms	12,494	10,148	8	United Kingdom 10,129; West Germany 12.
Waste and sweepings value, thousands	\$15,735	\$36,504	\$28,836	United Kingdom \$5,189; West Germany \$2,286.
Metals including alloys, unwrought and partly wrought:				
Palladium kilograms	2,548	4,645	1,156	United Kingdom 3,080; France 311.
Platinum do.	1,787	5,125	807	Japan 1,896; Australia 1,811.
Rhodium do.	321	—		
Rare-earth metals including alloys, all forms	52	64	52	Japan 12.
Selenium, elemental	428	386	101	United Kingdom 116; Belgium-Luxembourg 71.
Silicon, high-purity kilograms	227	105	—	Japan 99; Indonesia 6.
Silver:				
Ore and concentrate ⁷ do.	18,697	111,893	8	West Germany 62,147; United Kingdom 10,251; Japan 3,359.
Waste and sweepings ⁷ value, thousands	\$37,976	\$43,886	\$15,400	United Kingdom \$14,188; West Germany \$13,023.
Metal including alloys, unwrought and partly wrought				
	1,141	1,025	941	Singapore 42; Hong Kong 18.
Tin:				
Ore and concentrate	3,593	2,790	—	Malaysia 1,602; Singapore 684; Mexico 434.
Metal including alloys:				
Scrap	1,003	3,205	3,048	India 120; Pakistan 25.
Unwrought	400	131	129	United Kingdom 2.
Semimanufactures	1,786	845	504	Taiwan 140; Hong Kong 100.
Titanium:				
Ore and concentrate	360,856	120,295	13,505	Brazil 34,650; Japan 19,884; China 16,456.
Oxides	25,854	31,349	29,306	India 661; Saudi Arabia 488.
Metal including alloys, all forms				
	440	480	372	United Kingdom 56; India 37.
Tungsten:				
Ore and concentrate kilograms	1,306	365	—	United Kingdom 313; Italy 52.
Metal including alloys:				
Unwrought including waste and scrap	124	2	2	
Semimanufactures	37	14	10	Australia 1; Sweden 1.

See footnotes at end of table.

TABLE 6—Continued

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
METALS²—Continued				
Uranium and thorium:				
Ore and concentrate kilograms	(⁶)	396,295	396,288	Japan 7.
Oxides and other compounds	208	76	15	Netherlands 38; Switzerland 22.
Vanadium:				
Oxides and hydroxides	105	—		
Ash and residue containing vanadium	163	501	501	
Metal including alloys, all forms	17	137	—	All to Hong Kong.
Zinc:				
Ore and concentrate	850,243	657,841	12,253	Belgium-Luxembourg 228,974; West Germany 85,612.
Oxides	34,407	40,046	36,718	U.S.S.R. 3,236; Hong Kong 54.
Blue powder	4,971	5,207	4,914	Taiwan 186; India 63.
Ash and residue containing zinc	8,560	10,816	8,341	Republic of Korea 791; United Kingdom 489.
Metal including alloys:				
Scrap	16,942	11,583	4,341	Taiwan 4,098; China 2,274;
Unwrought	556,819	508,996	416,979	Japan 19,676; United Kingdom 13,364.
Semimanufactures	1,701	500	130	Bolivia 231; France 78.
Zirconium:				
Ore and concentrate	1,685	127	80	France 45; United Kingdom 2.
Metal including alloys, all forms	68	164	43	France 89; Taiwan 21.
Other:				
Ores and concentrates	2,969	12,827	12,182	Republic of Korea 300; Taiwan 100.
Oxides and hydroxides	446	19	1	Singapore 17; Bermuda 1.
Ashes and residues	17,502	59,469	35,619	United Kingdom 23,397; Taiwan 131.
Base metals including alloys, all forms	2,672	1,592	30	Taiwan 1,387; United Kingdom 67.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	12,498	2,001	1,903	West Germany 43; United Kingdom 42.
Artificial:				
Corundum	130,782	107,855	94,204	United Kingdom 8,584; France 2,792.
Silicon carbide	69,537	63,374	63,364	Norway 10.
Dust and powder of precious and semi-precious stones excluding diamond kilograms	22	12,210	12,210	
Grinding and polishing wheels and stones value, thousands	\$6,368	\$10,881	\$6,833	Finland \$1,306; Italy \$427.
Asbestos, crude	684,905	707,816	65,183	Japan 84,830; Thailand 58,680.
Barite and witherite	9,312	6,214	5,939	Netherlands 249; Jamaica 26.
Boron materials:				
Crude natural borates	120	—		
Elemental including tellurium kilograms	57,454	52,028	51,910	West Germany 72; France 25.
Oxides and acids	115	132	97	Hungary 35.
Cement thousand tons	3,639	2,543	2,505	Bermuda 22; Cameroon 3.
Chalk	45	66	65	Japan 1.
Clays, crude:				
Bentonite	1,120	2,398	2,157	West Germany 162; Australia 36.
Chamotte earth	133	—		
Fire clay	247	40	27	Belgium-Luxembourg 12; Norway 1.
Fuller's earth	385	161	—	All to West Germany.

See footnotes at end of table.

TABLE 6—Continued

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Clays, crude:—Continued				
Kaolin	861	668	84	West Germany 584.
Unspecified	1,730	517	152	West Germany 309; China 32.
Cryolite and chiolite	1,952	13	13	
Diamond, natural:				
Stones:				
Gem, not set or strung	carats 66,722	175,676	56,833	Belgium-Luxembourg 50,071; Israel 27,278.
Industrial stones	do. 249,981	195,252	72,443	Israel 106,052; Hong Kong 9,100.
Unsorted	value, thousands \$66	\$3,052	\$973	Israel \$614; Hong Kong \$428.
Dust and powder	carats 2,715,039	2,801,820	2,795,620	Ireland 5,500; Australia 700.
Feldspar, fluorspar, related materials:				
Feldspar	337	331	144	Taiwan 177; West Germany 10.
Fluorspar	38,301	40,123	34,336	Laos 5,787.
Unspecified	589,086	407,099	361,239	Netherlands 32,647; United Kingdom 5,236.
Fertilizer materials:				
Crude, n.e.s.	9,533	3,058	3,056	Bermuda 1; Japan 1.
Manufactured:				
Ammonia	thousand tons 1,386	4,776	4,753	Cameroon 18; China 4.
Nitrogenous	do. 2,003	1,627	1,348	Australia 101; China 32.
Phosphatic	8,195	2,998	2,564	Australia 432; West Germany 2.
Potassic	thousand tons 12,719	10,976	5,869	China 1,096; Japan 634.
Unspecified and mixed	do. 202	171	136	Spain 24; Jamaica 9.
Graphite, natural	6,101	999	331	Japan 430; Australia 163.
Gypsum and plaster	5,700,793	5,214,258	5,213,738	New Zealand 129; Japan 86.
Iodine kilograms	1,394	71	—	Japan 46; Dominican Republic 25.
Kyanite and related materials	3	5	5	
Lime	122,950	83,607	83,572	Bermuda 35.
Magnesium compounds:				
Magnesite, crude	1,397	526	433	Japan 72; Colombia 20.
Oxides and hydroxides	67,845	56,449	51,500	West Germany 2,219; Austria 1,161.
Sulfate	1,366	265	103	Saudi Arabia 146; West Germany 17.
Mica:				
Crude including splittings and waste	8,775	12,859	10,224	Japan 2,040; Netherlands 370.
Worked including agglomerated splittings	22	139	103	Netherlands 26; France 6.
Nitrates, crude	891	948	948	
Phosphates, crude	173	4,909	4,905	Jamaica 3; Trinidad and Tobago 1.
Phosphorus, elemental	39,885	22,155	17,205	United Kingdom 3,371; Colombia 1,365.
Pigments, mineral:				
Natural, crude	212	—		
Iron oxides and hydroxides, natural and processed	19,316	12,323	12,144	Australia 121; United Kingdom 37.
Potassium salts, crude	691	171	171	
Precious and semiprecious stones other than diamond:				
Natural	value, thousands \$9,955	\$12,097	\$4,239	France \$2,372; China \$1,258.
Synthetic	do. \$417	\$188	\$17	Ireland \$102; Belgium-Luxembourg \$38.
Pyrite, unroasted	4,585	10,540	554	Brazil 9,986.

See footnotes at end of table.

TABLE 6—Continued

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Quartz crystal, piezoelectric	value, thousands	\$304	—	
Salt and brine	thousand tons	3,038	2,138	2,091 Grenada 22; St. Vincent and the Grenadines 22.
Sodium compounds, n.e.s.:				
Soda ash, natural and manufactured		115,121	130,113	130,113
Sulfate, natural and manufactured		166,831	175,668	167,482 Venezuela 8,165; Netherlands 20.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked		154,212	118,679	24,670 Japan 79,504; Italy 10,588.
Worked	value, thousands	\$23,000	\$23,432	\$21,513 Japan \$820; Italy \$510.
Dolomite, chiefly refractory-grade		676,856	485,710	485,710
Gravel and crushed rock		1,855,854	1,073,876	989,167 Bahamas 65,208; Bermuda 10,988.
Limestone other than dimension		1,106,971	928,723	928,680 St. Lucia 43.
Quartz and quartzite		102,151	41,179	41,104 Taiwan 75.
Sand other than metal-bearing		232,896	20,637	19,179 St. Pierre and Miquelon 1,000; France 268.
Sulfur:				
Elemental:				
Crude including native and byproduct	thousand tons	7,380	5,516	1,072 Brazil 471; Australia 470.
Colloidal, precipitated, sublimed		3,256	281	281
Dioxide		52,643	77,871	77,871
Sulfuric acid		849,460	628,082	627,881 Barbados 81; Cameroon 61.
Talc, steatite, soapstone, pyrophyllite		45,937	43,740	42,814 West Germany 527; United Kingdom 379.
Vermiculite, perlite, chlorites		802	3,143	3,115 Spain 17; Australia 11.
Other:				
Crude		55,711	42,392	40,539 Republic of Korea 930; France 409.
Slag and dross, not metal-bearing		(⁹)	909,820	273,000 France 222,454; West Germany 120,489.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural		12,132	8,363	8,363
Carbon including carbon black		71,514	61,024	48,793 West Germany 2,540; France 2,106.
Coal:				
Anthracite		9,137	—	
Bituminous	thousand tons	29,336	31,706	271 Japan 19,820; Republic of Korea 4,916; Brazil 1,358.
Lignite including briquets		4,090	20,900	20,862 Singapore 36; Hong Kong 2.
All grades including briquets		105,845	95,112	11,058 Japan 75,334; West Germany 8,649.
Coke and semicoke		251,918	172,563	112,930 Spain 30,000; Belgium-Luxembourg 20,044.
Gas, natural: Gaseous ¹⁰	million cubic meters	35,913	37,964	37,964
Peat including briquets and litter		690,015	720,628	592,600 Japan 117,128; Netherlands 4,571.
Petroleum:				
Crude	thousand 42-gallon barrels	257,712	235,603	231,924 Japan 1,800; Republic of Korea 831.
Refinery products:				
Liquefied petroleum gas	do.	45,897	40,528	40,523 France 1; Nicaragua 1.
Gasoline ¹⁰	do.	23,987	20,723	20,043 Japan 230; United Kingdom 51.
Naphtha ¹⁰	do.	3,783	3,332	3,332
Mineral jelly and wax	do.	254	274	272 Unspecified 2.
Kerosene and jet fuel ¹⁰	do.	5,441	6,913	NA NA.
Distillate fuel oil ¹⁰	do.	28,214	29,191	27,430 Japan 440; United Kingdom 418.
Lubricants	do.	14	30	20 Hong Kong 5; Taiwan 4.

See footnotes at end of table.

TABLE 6—Continued

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Petroleum:—Continued				
Refinery products:—Continued				
Residual fuel oil ¹⁰ thousand 42-gallon barrels	14,692	12,581	10,609	NA.
Bitumen and other residues do.	2,150	1,242	1,240	China 1; United Kingdom 1.
Bituminous mixtures do.	112	96	95	Australia 1.
Petroleum coke do.	269	255	255	

¹Revised. NA Not available.¹Table prepared by H. D. Willis.²Data for ores and concentrates equal total weight of all metals contained unless otherwise indicated.³Less than 1/2 unit.⁴May include vanadium ore and concentrate.⁵Quantities for fittings were not provided, valued at \$45,655,000 in 1988 and \$45,937,000 in 1989.⁶Metal content.⁷Includes other precious metals.⁸Quantity not available valued at \$1,258,000.⁹Quantity not available valued at \$178,418,000.¹⁰Source: International Energy Agency, Organization for Economic Co-operation and Development.

TABLE 7

CANADA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS²				
Alkali, alkaline- and rare-earth metals:				
Alkali metals	5,664	3,702	3,683	France 18; United Kingdom 1.
Alkaline-earth metals	61	76	8	China 58; France 10.
Aluminum:				
Ore and concentrate, gross weight thousand tons	2,352	2,541	38	Brazil 1,329; Guinea 383; Sierra Leone 309.
Oxides and hydroxides do.	1,895	2,041	926	Jamaica 525; Australia 497.
Ash and residue containing aluminum	1,816	2,179	936	Norway 1,243.
Metal including alloys:				
Scrap	62,201	58,203	56,871	United Kingdom 1,127; Argentina 55.
Unwrought	59,391	64,979	60,612	France 2,106; Brazil 1,287.
Semimanufactures	309,458	344,159	303,903	Belgium-Luxembourg 7,356; France 7,072.
Antimony:				
Ore and concentrate	137	56	19	China 37.
Oxides	1,444	1,322	899	United Kingdom 320; Belgium-Luxembourg 103.
Metal including alloys, all forms	130	243	68	China 155; United Kingdom 18.
Arsenic:				
Elemental	45	67	38	China 29.
Oxides and acids	133	540	377	France 163.
Beryllium: Metal including alloys, all forms				
kilograms	16,414	15,644	15,241	Brazil 368; West Germany 35.
Bismuth: Metal including alloys, all forms				
	59	27	27	
Cadmium: Metal including alloys, all forms				
	19	62	35	Canada 20.

See footnotes at end of table.

TABLE 7—Continued

CANADA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS²—Continued				
Chromium:				
Ore and concentrate	28,975	33,842	7,183	Philippines 21,466; New Caledonia 3,200.
Oxides and hydroxides	3,556	2,634	1,267	West Germany 627; United Kingdom 579.
Metal including alloys, all forms	265	150	47	Japan 60; Italy 28.
Cobalt:				
Ore and concentrate	19	1	1	
Oxides and hydroxides	37	33	10	Belgium-Luxembourg 15; Finland 8.
Metal including alloys, all forms	686	716	194	Zaire 437; Norway 77.
Columbium and tantalum:				
Ores and concentrates	26	38	18	Brazil 20.
Metal including alloys, all forms:				
Columbium (niobium)	9	6	6	
Tantalum	57	23	22	China 1.
Copper:				
Ore and concentrate, Cu content ³	47,795	47,935	13,876	Portugal 12,229; Chile 11,323.
Matte and speiss including cement copper	4190	4,234	2,970	Norway 1,117; Mexico 104.
Oxides and hydroxides	883	735	198	Australia 522.
Sulfate	3,897	5,202	1,222	Poland 1,026; Yugoslavia 844.
Ash and residue containing copper	NA	24,762	13,497	Brazil 10,048; France 1,197.
Metal including alloys:				
Scrap	90,991	97,174	90,315	Chile 5,349; Canada 335.
Unwrought	7,387	18,984	7,974	Finland 3,891; Zaire 2,646.
Semimanufactures	88,682	77,247	54,378	West Germany 2,774; Brazil 2,266.
Germanium: Metal including alloys, all forms				
	kilograms	10,793	4,063	3,971 Belgium-Luxembourg 92.
Gold:				
Ore and concentrate, Au content	kilograms	1,588	998	NA
Waste and sweepings		3,325	2,064	1,994 United Kingdom 53; France 13.
Metal including alloys, unwrought and partly wrought	kilograms	51,495	52,628	33,081 Mexico 12,269; Uruguay 5,025.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite, gross weight	thousand tons	4,796	5,368	4,996 Brazil 372.
Pyrite, roasted, gross weight		60,151	2,413	2,413
Metal:				
Scrap		1,151,412	1,460,467	1,458,301 France 51; Austria 50.
Pig iron, cast iron, related materials		31,732	40,148	30,278 Brazil 4,758; East Germany 4,007.
Ferroalloys:				
Ferrochromium		50,146	48,550	3,473 Republic of South Africa 34,937; Sweden 3,250.
Ferromanganese		35,060	44,840	5,288 Republic of South Africa 20,502; Norway 7,671; West Germany 6,698.
Ferromolybdenum		345	1,150	157 Belgium-Luxembourg 691; Chile 210.
Ferronickel		3,176	2,993	64 Dominican Republic 2,355; New Caledonia 574.
Ferroniobium		1,179	1,067	577 Brazil 490.
Ferrosilicochromium		2,358	2,441	2,441
Ferrosilicomanganese		17,141	13,096	2,859 Republic of South Africa 6,168; Brazil 3,022.

See footnotes at end of table.

TABLE 7—Continued

CANADA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS²—Continued				
Iron and steel:—Continued				
Metal:—Continued				
Ferroalloys:—Continued				
Ferrosilicon	20,155	20,925	17,047	U.S.S.R. 3,003; Brazil 602.
Ferrotitanium and ferrosilicotitanium	647	432	260	United Kingdom 172.
Ferrovandium	NA	371	371	
Silicon metal	⁵ 1,258	1,318	516	Brazil 711.
Unspecified	¹ 11,404	8,566	4,806	France 1,969; Brazil 1,199.
Steel, primary forms	1,341,188	653,858	50,682	Brazil 518,542; Netherlands 38,032.
Semimanufactures:				
Flat-rolled products:				
Of iron or nonalloy steel:				
Not clad, plated, coated	608,860	448,412	232,047	West Germany 40,785; Romania 36,916.
Clad, plated, coated	355,144	294,046	206,269	Japan 28,505; United Kingdom 12,424.
Of alloy steel	168,446	146,233	62,688	Sweden 17,022; West Germany 16,192.
Bars, rods, angles, shapes, sections	849,703	711,510	271,330	Brazil 116,181; Spain 57,164.
Rails and accessories	(⁶)	72,703	16,549	Japan 32,052; United Kingdom 12,945.
Wire	71,344	62,658	31,143	United Kingdom 7,037; France 6,993.
Tubes, pipes, fittings ⁷	499,303	312,085	160,637	Japan 47,133; West Germany 16,436.
Lead:				
Ore and concentrate	15,922	34,375	17,167	Peru 7,581; Australia 3,408.
Oxides	8,621	7,577	7,403	Republic of South Africa 150; Mexico 20.
Ash and residue containing lead	NA	546	NA	NA.
Metal including alloys:				
Scrap	36,692	26,660	26,208	Poland 396; Italy 35.
Unwrought	14,810	11,131	7,111	Mexico 3,746; Venezuela 204.
Semimanufactures	1,323	820	753	Belgium-Luxembourg 23; West Germany 23.
Lithium: Oxides and hydroxides	NA	102	100	NA.
Magnesium: Metal including alloys:				
Scrap	67	80	80	
Unwrought	8,558	10,826	8,570	Norway 1,712; France 304.
Semimanufactures	2,850	2,030	1,989	Canada 22; France 18.
Manganese:				
Ore and concentrate, metallurgical-grade	108,245	79,047	4,540	Republic of South Africa 32,966; Australia 24,970; France 11,529.
Oxides	6,545	7,740	5,457	Japan 1,714; Brazil 438.
Metal including alloys, all forms	4,119	5,225	1,763	Republic of South Africa 3,197; United Kingdom 158.
Mercury	36	32	32	
Molybdenum:				
Ore and concentrate	165	521	521	
Oxides and hydroxides	188	124	124	
Metal including alloys:				
Unwrought including waste and scrap	142	28	28	
Semimanufactures	9	31	27	Austria 2; Belgium-Luxembourg 1.
Nickel:				
Ore and concentrate, Ni content	1,202	1,097	(⁸)	Mainly from Finland.
Matte and speiss	4,284	2,521	1,066	United Kingdom 663; Australia 351.

See footnotes at end of table.

TABLE 7—Continued

CANADA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
METALS²—Continued					
Nickel:—Continued					
Oxides and hydroxides	NA	77	56	Finland 21.	
Metal including alloys:					
Scrap	12,946	13,480	12,141	United Kingdom 274; West Germany 208.	
Unwrought	1,593	3,787	247	Norway 2,144; U.S.S.R. 1,203.	
Semimanufactures	3,470	2,253	1,819	West Germany 280; Japan 36.	
Platinum-group metals:					
Waste and sweepings	value, thousands	\$13,235	\$10,189	\$6,715	Australia \$2,555; Mexico \$762.
Metals including alloys, unwrought and partly wrought:					
Palladium	kilograms	1,880	1,430	490	Republic of South Africa 280; West Germany 81.
Platinum	do.	8,555	4,440	1,004	West Germany 1,269; U.S.S.R. 1,034.
Rhodium	do.	445	229	63	Republic of South Africa 79; U.S.S.R. 33.
Iridium, osmium, ruthenium	do.	13	11	NA	NA.
Selenium, elemental		NA	6	NA	NA.
Silicon, high-purity		NA	447	78	Japan 360.
Silver:					
Ore and concentrate ⁹	value, thousands	\$6,226	\$5,968	\$3,563	Guyana \$2,290; Portugal \$75.
Waste and sweepings ⁹	do.	\$91,819	\$59,545	\$48,123	Cuba \$7,811; United Kingdom \$1,766.
Metal including alloys, unwrought and partly wrought					
	kilograms	115,100	231,801	185,851	Mexico 39,485; Brazil 4,029.
Tin:					
Ore and concentrate		21	49	49	
Metal including alloys:					
Scrap		180	270	270	
Unwrought		4,128	3,959	124	Brazil 962; Malaysia 842; Indonesia 565.
Semimanufactures		301	447	305	United Kingdom 60; China 37.
Titanium:					
Ore and concentrate		32,054	58,246	1,500	Australia 41,443; India 5,601; Norway 4,878.
Oxides		10,560	6,466	3,651	West Germany 1,281; Australia 551.
Metal including alloys:					
Unwrought including waste and scrap		437	861	797	United Kingdom 50; Japan 10.
Semimanufactures		1,247	1,760	1,479	Japan 155; United Kingdom 53.
Tungsten:					
Ore and concentrate	kilograms	NA	194	194	
Metal including alloys:					
Unwrought including waste and scrap		182	141	136	United Kingdom 5.
Semimanufactures		48	67	51	Denmark 5; Japan 5.
Uranium and thorium:					
Ore and concentrate		(¹⁰)	78	76	NA.
Oxides and other compounds		(¹¹)	34	NA	NA.
Vanadium:					
Oxides and hydroxides		NA	1,263	277	Republic of South Africa 945; China 23.
Metal including alloys, all forms		2	2	2	
Zinc:					
Ore and concentrate		38,165	40,564	36,738	Peru 3,826.
Oxides		1,295	1,917	1,290	Taiwan 524; Netherlands 61.

See footnotes at end of table.

TABLE 7—Continued

CANADA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS²—Continued				
Zinc:—Continued				
Blue powder	1674	658	620	Unspecified 38.
Ash and residue containing zinc	108	293	NA	NA.
Metal including alloys:				
Scrap	2,474	1,379	1,379	
Unwrought	8,026	4,707	2,920	Argentina 945; Peru 295.
Semimanufactures	2,365	2,272	2,051	Mexico 68; West Germany 58.
Zirconium:				
Ore and concentrate	7,599	10,426	2,473	Australia 6,052; Republic of South Africa 1,900.
Metal including alloys:				
Unwrought including waste and scrap	25	15	3	France 11.
Semimanufactures	259	281	230	France 50.
Other:				
Ores and concentrates, metal content	2,257	2,176	2,139	China 37; Brazil 20.
Oxides and hydroxides	3,354	1,749	540	Belgium-Luxembourg 29; Japan 2.
Ashes and residues	36,357	30,264	10,693	United Kingdom 8,105; Italy 5,916.
Base metals including alloys, all forms	25	11	11	
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	19,315	16,106	7,808	Greece 4,601; Turkey 2,972.
Artificial:				
Corundum	4,597	6,176	4,985	Austria 820; West Germany 118.
Silicon carbide	6,667	7,280	5,527	China 992; Norway 536.
Dust and powder of precious and semi-precious stones including diamond				
	value, thousands	\$7,113	\$5,259	\$1,969 Ireland \$1,939; U.S.S.R. \$1,184.
Grinding and polishing wheels and stones	do. \$32,381	\$39,050	\$22,122	Italy \$5,618; West Germany \$2,855.
Asbestos, crude	384	1,174	1,131	Zimbabwe 43.
Barite and witherite	4,748	5,577	4,092	Netherlands 1,059; West Germany 395.
Boron materials:				
Crude natural borates	1,127	596	596	
Elemental ¹²	NA	3	NA	NA.
Oxides and acids	4,530	5,257	5,149	Italy 89; United Kingdom 12.
Bromine and fluorine	¹³ 1,412	1,373	1,368	NA.
Cement	thousand tons 1,023	660	444	Spain 55; France 54.
Chalk	17,466	16,430	16,081	United Kingdom 247; France 84.
Clays, crude:				
Bentonite	335,012	294,267	180,838	Greece 113,426; Italy 2.
Chamotte and dinas earths	NA	10,271	10,271	
Fire clay				
Fuller's earth	NA	7,377	7,377	
Kaolin	389,650	431,516	429,969	Italy 1,209; United Kingdom 209.
Unspecified	227,516	182,480	181,276	United Kingdom 1,006.
Cryolite and chiolite	1,117	9,359	7,256	Australia 1,669; Denmark 313.
Diamond, natural:				
Stones:				
Gem, not set or strung	value, thousands \$45,449	\$64,022	\$21,565	Belgium-Luxembourg \$20,875; Israel \$11,953.

See footnotes at end of table.

TABLE 7—Continued

CANADA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity		1988	1989	Sources, 1989	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Diamond, natural:—Continued					
Stones:—Continued					
Industrial stones	value, thousands	\$6,475	\$4,338	\$2,180	Ireland \$1,264; Zaire \$700.
Unsorted	do.	\$103,471	\$129,732	\$21,954	Belgium-Luxembourg \$52,260; Israel \$33,405.
Dust and powder	thousand carats	NA	6,364	1,560	U.S.S.R. 4,304; Ireland 394.
Diatomite and other infusorial earth		19,593	21,041	20,702	West Germany 278; France 60.
Feldspar, fluorspar, related materials:					
Feldspar		13,213	3,961	3,961	
Fluorspar		194,074	162,664	8,519	Mexico 107,351; Morocco 31,300; China 10,242.
Leucite, nepheline and nepheline syenite		—	2	NA	NA.
Fertilizer materials:					
Crude, n.e.s.		6,188	4,540	4,449	Austria 48; Netherlands 33.
Manufactured:					
Ammonia		15,251	12,084	12,082	NA.
Nitrogenous		405,966	273,322	145,544	Netherlands 95,136; Spain 11,000.
Phosphatic		116,678	51,874	51,872	West Germany 2.
Potassic		59,430	46,149	45,400	West Germany 519; Italy 121.
Unspecified and mixed		455,214	431,663	428,026	Belgium-Luxembourg 2,061; Japan 428.
Graphite, natural		9,311	6,047	5,883	Sri Lanka 66; China 55.
Gypsum and plaster		940,066	323,934	127,274	Mexico 98,673; Spain 97,224.
Iodine		NA	45	16	Chile 26.
Kyanite and related materials:					
Andalusite, kyanite and sillimanite		NA	6,183	5,655	NA.
Mullite		NA	480	NA	NA.
Lime		32,517	38,929	38,444	United Kingdom 485.
Magnesium compounds:					
Magnesite, crude		28,831	125,657	542	China 125,010; Austria 105.
Oxides and hydroxides		110,447	86,166	59,165	China 20,933; Republic of South Africa 2,955; West Germany 2,070.
Mica:					
Crude including splittings and waste		1,828	2,512	2,472	India 31; Japan 8.
Worked including agglomerated splittings	value, thousands	\$3,738	\$4,123	\$3,541	France \$314; India \$232.
Nitrates, crude		25,809	10,000	1,180	Chile 8,537; Switzerland 123.
Phosphates, crude	thousand tons	2,157	1,847	920	Togo 901; Senegal 25.
Phosphorus, elemental		NA	62	21	Japan 10; unspecified 31.
Pigments, mineral:					
Natural, crude		NA	1,531	1,409	NA.
Iron oxides and hydroxides, processed		5,710	6,579	5,676	West Germany 571; Spain 282.
Potassium salts, crude		34	10	10	
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	\$18,356	\$22,135	\$6,223	Thailand \$4,182; Hong Kong \$1,052.
Synthetic	do.	\$1,544	\$1,639	\$724	India \$223; Switzerland \$126.
Pyrite, unroasted		5,970	4,588	4,588	
Quartz crystal, piezoelectric	value, thousands	\$1,077	\$1,698	\$1,212	United Kingdom \$288; Japan \$196.
Salt and brine	thousand tons	1,201	2,361	1,842	Mexico 343; Chile 116.

See footnotes at end of table.

TABLE 7—Continued

CANADA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Sodium compounds, n.e.s.:				
Soda ash, natural and manufactured	89,458	140,691	140,679	West Germany 7; United Kingdom 5.
Sulfate, natural and manufactured	13,037	8,550	4,010	United Kingdom 4,375. Japan 64.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	87,258	85,101	45,586	Republic of South Africa 16,540; Zimbabwe 4,835.
Worked value, thousands	\$56,799	\$77,945	\$15,600	Italy \$43,730; India \$1,468.
Dolomite, chiefly refractory-grade	29,444	16,946	6,613	NA.
Gravel and crushed rock	921,519	905,826	902,968	France 2,277; Italy 278.
Limestone other than dimension thousand tons	2,639	3,274	3,274	
Quartz and quartzite	10,616	10,227	9,159	Brazil 1,068.
Sand other than metal-bearing thousand tons	1,297	1,455	1,455	
Sulfur:				
Elemental:				
Crude including native and byproduct	21,826	18,311	18,311	
Colloidal, precipitated, sublimed	2,314	1,845	1,755	West Germany 90.
Dioxide	1,495	470	470	
Sulfuric acid	40,073	28,433	28,397	West Germany 20; United Kingdom 15.
Talc, steatite, soapstone, pyrophyllite	179,692	48,438	48,250	United Kingdom 73; China 45.
Vermiculite	21,896	53,020	39,018	Republic of South Africa 8,829; Greece 4,084.
Other:				
Crude	79,783	21,361	20,657	NA.
Slag and dross, not metal-bearing	59,960	155,915	149,804	East Germany 5,433; Netherlands 611.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	7,342	4,332	4,302	Trinidad and Tobago 21; West Germany 9.
Carbon including carbon black	18,387	20,305	19,782	West Germany 225; Republic of Korea 220.
Coal:				
Anthracite	406,323	422,178	422,178	
Bituminous thousand tons	15,084	14,903	14,870	Colombia 33.
Briquets of anthracite and bituminous coal	6,183	4,870	1,387	West Germany 3,453; Netherlands 30.
Lignite including briquets	177	214	214	
Unspecified including briquets thousand tons	130	122	104	West Germany 17.
Coke and semicoke do.	1,111	970	913	West Germany 46; Poland 11.
Gas, natural: Gaseous ¹⁴ million cubic meters	384	771	771	
Peat including briquets and litter	186	274	272	United Kingdom 2.
Petroleum:				
Crude thousand 42-gallon barrels	145,630	178,003	11,567	United Kingdom 70,459; Norway 28,368; Nigeria 20,941.
Refinery products:				
Liquefied petroleum gas do.	5,778	7,378	7,363	West Germany 1; unspecified 14.
Gasoline do.	9,852	10,158	2,261	Netherlands 2,338; France 1,284.
Naphtha ¹⁴ do.	2,066	349	349	
Mineral jelly and wax do.	170	148	133	United Kingdom 6; West Germany 2.
Kerosene and jet fuel ¹⁴ do.	12,625	12,144	NA	NA.
Distillate fuel oil ¹⁴ do.	7,997	7,893	6,319	U.S.S.R. 955; Venezuela 216.
Lubricants do.	1,027	1,074	989	Venezuela 74; United Kingdom 3.
Residual fuel oil ¹⁴ do.	18,228	27,313	8,152	Venezuela 12,627; France 1,006.

See footnotes at end of table.

TABLE 7—Continued

CANADA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum —Continued				
Refinery products —Continued				
Bitumen and other residues				
	thousand 42-gallon tons			
Bituminous mixtures	do.	'1,049 2,739	1,698	Venezuela 645; Spain 313.
Petroleum coke	do.	'476 1,012	397	Venezuela 613; France 1.
	do.	'7,410 5,900	5,853	China 32; West Germany 6.

¹Revised. NA Not available.²Table prepared by H. D. Willis.³Data for ores and concentrates equal total weight of all metals contained unless otherwise indicated.⁴Includes copper content of other ores and concentrates.⁵Excludes cement copper.⁶May include high-purity silicon.⁷Quantity not available valued at \$46,784,000.⁸Quantities for fittings were not provided; valued at \$183,932,000 in 1988 and \$187,135,000 in 1989.⁹Less than 1/2 unit.¹⁰Includes other precious metals.¹¹Quantity not available valued at \$23,000.¹²Quantity not available valued at \$378,000.¹³May include tellurium.¹⁴May include iodine.¹⁵Source: International Energy Agency, Organization for Economic Co-operation and Development.

consisted of underground mines, open pits, leaching operations, concentrators, smelters, and refineries, as well as the drilling and production operations characteristic of the petroleum industry. Table 8 depicts the structure of the mineral industry by sectors of the major mineral commodities.

On the labor scene, total employment in mining and primary metals in 1990 was, at 150,255 jobs overall, projected to be down about 3% from that of year before, following at least 3 years of relative stability. The work force in metal mines, down 7% overall, was diminished particularly in gold, down 13%, and nickel-copper-zinc, down 5%. The labor force in industrial mineral mining was likewise down generally, with the exception of a 5% increase in the gypsum work force. Jobs in the the coal mining sector also rose, showing an increase of 12%.

Average earnings in mining in Canada have been among the highest of all industrial classifications. Average weekly earnings in 1989 for hourly waged employees were \$679.73 for metal mines and \$560.09 for nonmetals, with indications of at least a 5% increase for 1990. However, changes in technology, skill levels, and work force demographics, combined with a weakening of enrollment in mining-related courses at colleges and universities, have raised questions about the future viability of the mining work force in Canada. Accordingly,

attention is being focused by the industry, provincial governments, and educational institutions to develop strategies for human resource development.

COMMODITY REVIEW

Metals

Aluminum.—Production of aluminum continued steady during the year, increasing between 1% and 2% to 1.567 Mmt even though the economic climate deteriorated in the latter half. Prices weakened at the end of the year as inventories were expected to accumulate, but at the same time primary smelters were operating at the full nameplate capacity of 1.635 Mmt.

Alcan Aluminium Ltd. (Alcan) started up phase III of its Laterriere smelter, rated at 200,000 mt/a, and planned to begin the next phase during the following year. Alcan also began closing three Soderberg potlines at the Arvida smelter in Jonquiere, lowering capacity to 230,000 mt/a. Plans are to lower four more Soderberg potlines, reducing capacity to 140,000 mt/a, when the company's new smelter at Alma is built in the late 1990s.

Pollution control at Laterriere is projected to capture more than 99% of the fluorides and dust particles in effluent gases. For that

region of Quebec, startup of Laterriere and closure of the Soderberg potlines at Arvida is expected to reduce atmospheric emissions of polycyclic aromatic hydrocarbons by 60% and fluorides by 50%.

Although committed to the reduction of capital spending for 1991, Alcan planned to provide \$200 million to its Kemano hydroelectric project in British Columbia, scheduled to cost \$1 billion altogether, that will upgrade its generating capacity from 896 MW to 1,436 MW. The company will sell excess power to the British Columbia Hydro Power Authority until such time as it decides to add additional smelting capacity.

Alcan also began production of DURALCAN, formed of metal matrix composites and ceramic materials, at Jonquiere. This \$36 million plant, with a capacity of 11,000 mt/a, will make foundry ingot, wrought extension billet, and sheet ingot.

Canadian Reynolds Metals Co. Ltd. (Can. Reynolds) initiated startup of the Baie Comeau smelter's 120,000-mt/a potline in Quebec, which should achieve capacity operation by mid-1991. It is expected that this will increase total Baie Comeau capacity to 400,000 mt/a.

Aluminerie Alouette Inc., owned by VAW-Vereignigte Aluminum-Werke AG of Germany (20%); Austria Metall

TABLE 8

CANADA: STRUCTURE OF THE MINERAL INDUSTRY

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Aluminum:	Alcan Aluminum Ltd.	Montreal, Quebec	
Do.	do.	Smelter, Laterriere, Quebec	150.
Do.	do.	Smelter, Isle Maligne, Quebec	73.
Do.	do.	Smelter, Beauharnois, Quebec	47.
Do.	do.	Smelter, Shawinigan, Quebec	84.
Do.	do.	Smelter, Grand Baie, Quebec	171.
Do.	do.	Smelter, Jonquiere, Quebec	282.
Do.	do.	Smelter, Kitmat, B.C.	268.
Do.	Aluminiere de Becancour Inc.	Smelter, Beaconsour, Quebec	282.
Do.	Canadian Reynolds Metals Co. Ltd.	Smelter, Baie Comeau, Quebec	280.
Asbestos	LAB Chrysotile Inc.	Black Lake, Quebec (Lac d'Amiante du Quebec, Ltee [LAQ], 55%; Societe Nationall de l'Amiante [SNA], 45%)	160 (fiber).
Do.	JM Asbestos Inc.	Jeffrey Mines, Asbestos, Qebec	300 (fiber).
Do.	Cassiar Mining Corp.	Cassiar, British Columbia	100 (fiber).
Cement	Lafarge Canada Inc.	Bath, Montreal, Quebec	1,000 (dry process cement).
Do.	do.	Exshaw, Alberta	1,080 (dry process cement).
Do.	Ciment St. Laurent Inc. (Private, 100%)	Joliette, Quebec	1,075 (dry process cement).
Do.	St. Lawrence Cement Inc.	Mississauga, Ontario	1,900 (wet and dry).
Do.	Lake Ontario Cement Ltd.	Picton, Ontario	1,260 (dry process cement).
Coal:	Brinco Coal Corp.	Quinsam Coal Mine, Campbell River, British Columbia	14,400 (open pit underground).
Do.	Cape Breton Development Corp.	Sydney, Nova Scotia	22,000 (longwall).
Do.	Luscar, Ltd.	Obed Mountain Mine, Hinton, Alberta	3,500.
Do.	Manalta Coal Ltd.	Gregg River Mine, Hinton, Alberta	3,960 (open pit).
Do.	do.	Highvale Mine, Seba Beach, Alberta	11,610 (open pit).
Do.	do.	Utility Mine, Estevan, Saskatchewan	3,600 (open pit).
Do.	Smoky River Coal Ltd.	Grande Cache, Alberta	3,600 (underground and open pit).
Copper:	Brenda Mines Ltd.	Peachland, British Columbia	10,800.
Do.	Broken Hill Proprietary Co. Ltd.	Island Copper Mine, Port Hardy, British Columbia	16,740.
Do.	Cassiar Mining Corp.	Similco Mine, Princeton, British Columbia	8,180.
Do.	Curragh Resources Inc.	Faro Mine, Yukon Territory	4,860.
Do.	Falconbridge Ltd.	Sudbury Operations, Sudbury, Ontario	4,250.
Do.	do.	Strathcona and Timmins operations, Timmins, Ontario	4,860.
Do.	do.	Smelter, Timmins, Ontario	570.
Do.	Gibraltar Mines Ltd.	McLease Lake, British Columbia	13,070.
Do.	Highland Valley Copper (Cominco, 50%; Rio Algom Ltd., 33.5%; Teck Corp., 11.5%; and Highmont Mining Co., 5%)	Logan Lake, British Columbia	43,200.
Do.	Inco Ltd.	Sudbury and Shebandowan, Ontario	20,250 (mine).
Do.	do.	Thompson District, Manitoba	
		Smelter, Sudbury, Ontario	1,500.
		Refinery, Subdury, Ontario	180.
Do.	Noranda Inc.	Bell Copper Mine, Babine Lake, British Columbia	5,550 (mine).
Do.	do.	Smelter Horne, Noranda, Quebec	150.
Gold:	Agnico-Eagle Mines Ltd.	Joutel, Quebec	590 (ore).
Do.	American Barrick Resources Corp.	Camflo Div., Val-d'Or, Quebec	436 (ore).
Do.	Cassiar Mining Corp. (Acquired by Prinacton)	Similco Mine, Princeton, British Columbia	450 (kg metal).
Do.	Echo Bay Mines Ltd.	Lupin Mine, Contwoyto Lake; Northwest Territories	612 (ore).

TABLE 8—Continued

CANADA: STRUCTURE OF THE MINERAL INDUSTRY

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Gold—Continued	Giant Yellowknife Mines Ltd.	Giant Mine, Yellowknife, Northwest Territories	407 (ore).
Do.	do.	Giant Mill-tailings, Yellowknife, Northwest Territories	3,265 (ore).
Do.	do.	Pamour, Ontario	945 (ore).
Do.	do.	Schumacher, Ontario	931 (ore).
Do.	Hemlo Gold Mines Inc.	Golden Giant Mine, Marathon, Ontario	1,080 (ore).
Do.	Hope Brook Gold Inc.	Hope Brook Mine, Conseau Bay, Newfoundland	3,000 (ore).
Do.	Hudson Bay Mining and Smelting Co.	Flin Flon and Snow Lake, Manitoba	2,600 (kg metal).
Do.	do.	Rutan Mine, Leaf Rapids, Manitoba	2,412 (ore).
Do.	Placer Dome Inc.	Campbell Mine, Red Lake, Ontario	384 (ore).
Do.	do.	Detour Lake Mine, N.E. Ontario	828 (ore).
Do.	do.	Dome Mine, South Porcupine, Ontario	1,130 (ore).
Do.	do.	Sigma Mine, Val-d'Or, Quebec	465 (ore).
Do.	do.	Kiena Mine, Val-d'Or, Quebec	
Do.	do.	Equity Silver Mine, Houston, British Columbia	3,240 (ore).
Do.	Teck-Corona Corp.	David Bell Mine, Hemlo, Ontario	385 (ore).
Gypsum:	Domtar Inc.	Flat Bay, Newfoundland	1,300.
Do.	Georgia-Pacific Corp.	River Denys, Sugar Camp, Nova Scotia	1,440.
Do.	Little Narrows Gypsum Co. Ltd.	Little Narrows, Nova Scotia	1,145.
Do.	National Gypsum (Canada) Ltd.	Milford, Nova Scotia	3,240.
Do.	Westroc Industries Ltd.	Windermere, British Columbia	1,150.
Iron and steel:	Iron Ore Co. of Canada	Carol Lake, Labrador	5,000 (concentrate).
Do.	do.	do.	10,000 (acid pellets).
Do.	Quebec Cartier Mining Co.	Mount Wright, Quebec	9,000 (concentrate).
Do.	do.	Mount Wright, Quebec	8,000 (acid pellets).
Do.	The Algoma Steel Corp. Ltd.	Sault Ste. Marie, Ontario	4,115 (pig iron).
Do.	Dofasco Inc.	Hamilton, Ontario	4,498 (crude steel).
Do.	Stelco, Inc.	do.	3,820 (pig iron).
Do.	Wabush Mines Ltd.	Wabush, Labrador and Pointe Noitre, Quebec	4,500 (crude steel).
Do.	Wabush Mines Ltd.	Wabush, Labrador and Pointe Noitre, Quebec	6,200 (pellets).
Lead:	Brunswick Mining and Smelting Corp. Ltd.	No. 12 Mine, Bathurst, New Brunswick	304 (Pb/Zn contained).
Do.	Falconbridge Ltd.	Strathcona, Timmins, Ontario	212 (Pb/Zn contained).
Do.	Hudson Bay Mining and Smelting Co., Ltd.	Flin Flon and Snow Lake, Manitoba	60 (Pb/Zn contained).
Do.	Curragh Resources Inc.	Faro Mine, Yukon Territory	184 (Pb/Zn contained).
Do.	Pine Point Mines Ltd.	Pine Point, Northwest Territories	294 (Pb/Zn contained).
Limestone:	Lafarge Canada Inc.	Steep Rock, Manitoba	906.2 (quarrying limestone).
Do.	Scotia Limestone Ltd.	Iris Cove, Sydney, Nova Scotia	720 (limestone).
Do.	Inland Cement Ltd.	Mafeking, Manitoba	720 (limestone).
Do.	do.	Cadomin, Alberta	2,160 (quarry limestone).
Do.	Havelock Ltd. (Kickenson Mines, Ltd. 100%)	Havelock, New Brunswick	864 (limestone).
Do.	Continental Lime Ltd.	Faulkner, Manitoba	1,440 (320/R-1 crushed stone).
Nickel:	Falconbridge Ltd. (Noranda Inc., 50%; Trelleborg AB, 50%)	East, Fraser, Lockerby, Onaping, Strathcona, and Craig in Sudbury, Ontario	30 (metal contained).
Do.	do.	Smelter, Falconbridge	45 (rated capacity).
Do.	Inco Ltd.	Sudbury district mines: Frood Stobie, Little Stobie, Creighton, Copper Cliff North and South, Garson, Levace McCreedy East and West, Shebandowan, Clarabelle, Lower Coleman, Crean Hill, Murray, and Totten in Sudbury area, Ontario	106 (metal contained).
Do.	do.	Smelter, Sudbury, Ontario	110 (metal contained).

TABLE 8—Continued

CANADA: STRUCTURE OF THE MINERAL INDUSTRY

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Nickel—Continued	Inco Ltd.	Refinery, Sudbury, Ontario	56.8 (metal contained).
Do.	do.	Refinery, Port Colborne, Ontario	30 (metal contained).
Do.	do.	Thompson, Pipe, Birchtree mines in Manitoba	62 (metal contained).
Do.	do.	Smelter, Thompson, Manitoba	82 (metal contained).
Do.	Sherritt Gordon Ltd.	Refinery, Fort Saskatchewan, Alberta	24 (metal contained).
Petroleum:			
Gas billion cubic meters	Bow Valley	Edgerton, etc.	1.4.
Do.	BP Canada Inc. (The British Petroleum Co. p.l.c.)	Noel Area, North Alberta; Chauvin, Sibbald, N Pembina, Alberta London, 100%)	1.3.
Do.	Canterra Energy Ltd. (Canada Development Corp., 100%)	Grand Banks, Canterra, Beaufort Sea, Terra Nova, and Raimbo Lake, Ram River, Alberta	1.8.
Do.	do.	do.	2.0.
Crude million 42-gallon barrels	Dome Petroleum Ltd.	Primrose, Lindbergh, Alberta	23.8.
Do.	Gulf Canada Corp. (Olympia & York Developments, 80%) Gulf, 20%)	Fenn-Big. Valley, Swan Hills, Goose River, Peerless, and Sene, Alberta	33.1.
Do.	Home Oil Co. Ltd.	Red Earth, Garrington, Cherhill, Medicine River, and Swan Hills, Alberta	12.0.
Gas billion cubic meters	do.	do.	1.7.
Crude million 42-gallon barrels	Husky Oil Ltd. (Nova Corp., 57%; Husky, 43%)	Lloyd minster, Cold Lake, Alberta	13.9.
Gas billion cubic meters	do.	do.	1.5.
Crude million 42-gallon barrels	Imperial Oil Ltd. (EXXON Corp., USA, 70%; others, 30%)	Judy Creek, Cold Lake, Alberta, and Mackenzie Delta, Beaufort Sea, Yukon and Northwest Territories	37.3.
Gas billion cubic meters	do.	do.	1.5.
Crude million 42-gallon barrels	Mobil Oil Canada Ltd. (Mobil Corp., USA, 100%)	Hibernia, Grand Banks, SE of Newfoundland and Sable Island, Nova Scotia, and others in Alberta, Saskatchewan, and British Columbia	26.1.
Gas billion cubic meters	do.	do.	3.0.
Crude million 42-gallon barrels	Norcen Energy Resources Ltd. (Hollinger Inc., 59%; Hees International, 41%)	Pembina, Bodo, Majorville, Alberta	12.2.
Do.	Oakwood Petroleums Ltd.	Grantham, Hays, Ronalane, Peace River, Normandville, Randell, Alberta, and Grizzly Valley, British Columbia	24.6.
Do.	PanCanadian Petroleum Ltd. (Canadian Pacific Enterprises, 87%; Others, 13%)	Rycroft, Wembley, Elk Point, Rio Bravo, Alberta	14.7.
Do.	Shell Canada Ltd. (Shell Investments, 79%; Others, 21%)	Dimsdale, Little Smoky Lake, Sousa, Alberta, Midale, Benson, Saskatchewan	23.3.
Crude million 42-gallon barrels	Suncor Inc. (Sun Co. Inc., USA, 75%; Ontario Energy Resources, 25%)	Kidney, Zama Lake, Cosway, Albersun Prevo, and Medicine River, Alberta and Leitchville, Unwin, Saskatchewan	13.7.
Crude million 42-gallon barrels	Texaco Canada Inc. (Texaco Inc., USA, 78%; Others, 22%)	Eaglesham, Virgo, Alberta, & Desan, British Columbia	51.0.
Gas billion cubic meters	do.	do.	1.5.
Crude million 42-gallon barrels	UNOCAL Canada Ltd.	Calgary, Alberta	14.7.

TABLE 8—Continued

CANADA: STRUCTURE OF THE MINERAL INDUSTRY

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Potash (K ₂ O equivalent):	Potash Corp. of Saskatchewan Inc. (Private, 37%; Provincial Government, 63%)	Lanigan, near Lanigan Saskatchewan	2,090.
Do.	do.	Rocanville, S.E. Saskatchewan	1,200.
Do.	International Minerals & Chemical Corp. (Canada) Ltd. (IMC Fertilizer Corp., 100%)	Esterhazy, (SK, 25%; INC, 75%) S.E. Saskatchewan	1,745.
Do.	Kalium Chemicals (Kalium Canada Ltd., 100%)	Potash Mine, 40 km west of Regina, Saskatchewan	1,245.
Salt and brine operations:	The Canadian Salt Company	Pugwash, Nova Scotia	1,200 (rock salt).
Do.	do.	Iles-de-la-Madeleine, Quebec	1,200 (rock salt).
Do.	do.	Ojibway, Ontario	2,500 (rock salt).
Do.	do.	Goderich, Ontario	2,800 (rock salt).
Silver:	Cambior, Inc.	Yvan Vezina, Quebec	396 (mill feed).
Do.	Corona Corp.	Nickel Plate Mine, Hedley, British Columbia	1,320 (mill feed).
Do.	Equity Silver Mines Ltd. (Placer Dome Inc. 58.8%)	Houston, British Columbia	2,970 (Ag/Au/Cu conc.).
Do.	LAC Minerals Ltd. do.	Macassa Mine, Ontario Bousquet Mine, Quebec	165 (mill feed). 580 (mill feed).
Do.	Similco Mines Ltd.	Princeton, British Columbia	8,250 (mill feed).
Do.	United Keno Hill Mines Ltd.	Elsa, Yukon Territory	132 (mill feed).
Sodium chlorate production using salt:	Dow Chemical Canada Inc. (The Dow Chemical Co. Michigan, USA, 100%)	Fort Saskatchewan, Alberta	524 (caustic soda).
Do.	do.	do.	476 (chlorine).
Do.	do.	Sarnia, Ontario	350 (caustic soda).
Do.	General Chemical Canada Ltd.	Amherstburg, Ontario	363 (sodium carbonate).
Sulfur (Petroleum refinery capacities):	Consumer's Cooperative Refineries Ltd.	Regina, Saskatchewan	54.
Do.	Imperial Oil Ltd.	Sarnia, Ontario	50.
Do.	Sulconam Inc.	Montreal, Quebec	108.
Sulfur:			
Main sulfur extraction plants (sour gas and oil sands)	Amoco Canada Petroleum Co., Ltd.	East Crossfield-Elkton, Alberta	650.
Do.	Canadian Occidental Petroleum, Ltd.	East Calgary-Cross field, Alberta	610.
Do.	Chevron Standard Ltd.	Kaybob South III, Alberta	1,281.
Do.	Husky Oil Ltd.	Ram River, Ricinus, Alberta	1,646.
Do.	Shell Canada Ltd.	Waterton, Alberta	1,120.
Principal SO ₂ and H ₂ SO ₄ production capacities:	Canadian Electro Zinc Ltd. (CEZ)	Valleyfield, Quebec	155 (H ₂ SO ₄).
Do.	Inco Ltd.	Copper Cliff, Ontario	198 (H ₂ SO ₄).
Do.	Falconbridge Ltd.	Kidd Creek, Ontario	202 (H ₂ SO ₄).
Do.	ESSO Chemical Canada	Redwater, Alberta	328 (H ₂ SO ₄).
Uranium:	Denison Mines Ltd.	Elliot Lake, Ontario	2,572 (ore).
Do.	Rio Algom Ltd.	Quirke, Elliot Lake, Ontario	1,525 (ore).
Zinc:	Brunswick Mining and Smelting Corp. Ltd.	Bathurst, New Brunswick	304 (Pb/Zn contained).
Do.	Falconbridge Ltd.	Timmins Operations, Ontario Smelter	212 (Pb/Zn contained). 133 (rated).
Do.	Hudson Bay Mining and Smelting Co., Ltd.	Flin Flon and Snow Lake concentrator, Manitoba Smelter	60 (Pb/Zn contained). 85 (rated).
Do.	Cominco Ltd. (Cominco, 55%; Pine Point Mines Ltd., 45%)	Sullivan Mine, Kimberley, British Columbia Smelter, trail, British Columbia	70 (Pb/Zn contained). 272 (rated).
Do.	Curragh Resources Inc.	Faro Mine, Yukon Territory	184 (Pb/Zn contained).
Do.	Pine Point Mines Ltd.	Pine Point, Northwest Territories	294 (Pb/Zn contained).

Aktiengesellschaft of Austria (20%); Hoogovens Groep B.V. of the Netherlands (20%); Société Générale de Financement du Québec (SGF) (20%); Kobe Steel Ltd. (13.33%); and Marubeni Corp. of Japan (6.67%), ran into cost overruns on their smelter project at Sept-Iles, Quebec. By altering the technology for their anode baking furnace and by eliminating products other than 50-pound remelt ingots, they hope to hold the cost of the 215,000-mt/a smelter to \$1.4 billion.

Five existing and intended aluminum producers in Quebec, including Alcan, Aluminerie Alouette Inc., Aluminerie de Becancour Inc., Aluminerie Lauralco Inc., and Can. Reynolds, formed the Quebec Aluminum Association in order to represent the interests of the industry to government and the public.

Copper.—Continuing price strength in international copper markets sustained production of copper in Canada and likewise stimulated exploration for more. Recoverable copper content of ore produced rose 11% to 802,000 tons. Blister and anode copper production rose somewhat to 525,000 tons, while refined copper increased slightly to 516,000 tons.

Exploration activity and results were reasonably promising, and plans went forward for development of known deposits. In British Columbia, Geddes Resources Ltd. continued with its Windy Craggy project that involved at least 165 Mmt in the north and south zones grading 1.9% copper and 0.8% cobalt along with significant gold and silver. During the year, the company verified the existence of the new Ridge zone that should increase total reserves. Although the original mine plan was rejected by the Provincial Mine Development Steering Committee because it did not completely consider the problem of generation of acid wastewaters, a revised plan was submitted at the end of 1990.

Originally developed by Noranda Inc., the Goldstream copper-zinc mine near Revelstoke, British Columbia, was operated briefly in 1984 and then closed owing to low metals prices and problems with zinc recovery. During the past year, however, Nippon Mining Co. Ltd. and Sumitomo Corp. agreed to finance the reopening of the mine, now owned by Bethlehem Resources Corp. and Goldnev Resources Inc. Reserves are projected at 1.86 Mmt grading 4.81% copper and 3.06% zinc, plus some silver. Future annual output is targeted at 16,000 tons of contained copper and 3,000 tons of contained zinc.

After 20 years of intermittent operation, Brenda Mines Ltd. had planned to close its copper-molybdenum mine near Peachland, British Columbia, at the end of June after exhausting its ore reserves. A rock slide in April, however, forced earlier closure.

Hudson Bay Mining & Smelting Co. Ltd. (HBM&S) of Manitoba found a high-grade zinc-copper mineralization zone beneath the existing workings of the Trout Lake Mine, owned jointly with Granges Inc. and Manitoba Minerals Resources Ltd. Although actual size of the discovery was not yet known, reserves should be enhanced sufficiently to extend the life of the mine for several years. HBM&S also improved its ore handling system at this mine with a new 4.9-m-diameter shaft, 652 m deep, that will enable an ore hoisting rate of 300 mt/h.

Minnova Inc. made a massive-sulfide copper-zinc discovery about 1.5 km southwest of the main shaft of its Winston Lake Mine about 20 km northwest of Schreiber, Ontario. Three times the depth of the Winston Lake ore body, the new so-called Deep Pick zone would represent a significant addition to the present 1,000-mt/d operation.

Settlement was reached between Aur Resources Inc. and Louvem Mines Inc. as to ownership of the Louvicourt property near Val d'Or, Quebec, containing an estimated 37 Mmt grading 3.6% copper, 1.59% zinc, 21.3 g/mt silver, and 0.09 g/mt of gold. Louvem's share of ownership fell to 45% from 50%, whereas Aur's share increased to 55%. Aur, however, must grant first right of refusal to Noranda Inc. for purchase of a minimum of 50% of Aur's share of concentrates from the first 8 years of production from the mine. Resolution of the dispute enables the partners to go forward with a \$3.9 million exploration program, including the sinking of a 915-m shaft. With total cost of development projected at somewhere between \$125 and \$175 million, production could start as early as 1993.

Gold.—Canada produced 165,000 kg of gold in 1990, placing it fifth in world production behind the Republic of South Africa, the United States, the U.S.S.R., and Australia, but nonetheless representing a fivefold increase compared to Canadian production in 1980. For 1990, about 80% of the gold produced came from 60 primary gold mines. The total value of production, based on price averaging, increased 2.7% to \$2.04 billion. Employment in gold mines, however, decreased about 13.5%, or from 12,645 to 10,937 jobs in 1990.

Gold prices during the year, generally less than \$400, were not robust compared to those of previous years. Bullish factors included certain apprehensions concerning the impending Gulf War. Bearish factors were increased sales by socialist countries, fairly high interest rates in many industrialized nations, selling early in the year by Middle East countries, and strong production by the mines of the Western countries.

A number of mines suspended activity for various reasons, mostly involving lack of profitability at lowered gold prices while utilizing existing methods and equipment to mine marginal grades of ore. Among them were Skyline Gold Co.'s Johnny Mountain mine and MinVen Gold Corp.'s Blackdome mine in British Columbia; Canamax Resources Inc.'s Kremzar mine, Flanagan McAdam Resources Inc.'s Magnacon mine, ERG Resources Inc.'s Timmins tailing operations, and the Musselwhite project of Placer Dome Inc., Inco Gold Co., and Corona Corp., all in Ontario; and Aurizon Mines Ltd.'s Sleeping Giant mine in Quebec. Also in Quebec, Muscocho Explorations Ltd.'s Montabaun mine and Campbell Resources Inc.'s S-3 mine at Chibougamau were closed upon exhaustion of reserves, as was Giant Yellowknife Mines Ltd.'s tailings reprocessing operation at Yellowknife in the Northwest Territories.

On the positive side, exploration was pursued vigorously in many parts of Canada, and new gold mines were in the making. In spite of legal problems, work went ahead on the Eskay Creek property of Prime Resources Group Inc. and Stikine Resources Ltd. About 200,000 m of drilling and the driving of a 500-m adit were followed by bulk sampling tests for determining milling parameters. With an estimated 44 Mmt of ore grading 26.4 g/mt gold and 998.4 gm/t silver, the mine could be in commercial production in 1994 if challenges to the ownership of the property are resolved.

Northwest Gold Corp.'s Colomac mine at Indin Lake in the Northwest Territories poured its first gold bar in May. A low-grade, high-volume open pit operation, the mill throughput was reportedly less than the 9,100-mt/d target because of grinding circuit difficulties relating to the abrasiveness of the ore. With gold recovery about 20% less than that projected, the company began negotiating to restructure its loan payments.

Three new mines opened in Ontario. The Kerr mine belonging to GSR Mining Corp. and Deak Resources Corp. went on-stream

at 360 mt/d in August; the Cheminis mine of Northfield Minerals Inc. began production at 350 mt/d; and Giant Yellowknife Mines Ltd.'s Hoyle mine at Timmins opened at 2,700 mt/d.

In Quebec, the Silidor mine opened in September to begin production of a projected 1.8 mt/a from ore grading 5.4 g/mt. Noranda is the operator of the mine, owned by Noranda Minerals Inc. (55%), Cambior Inc. (25%), and Nova-Cogesco Resources Inc. (20%). Late in the year, Nova-Cogesco sold its share to Cambior, raising the latter's share to 45%. Also, the Golden Pond West mine in the Casa Berardi area was opened by TVX Gold Inc. and Golden Knight Resources Inc. With reserves of 3.6 Mmt grading 8.0 g/mt gold, the mine will be upgraded in capacity to produce about 2.2 mt/a.

Iron Ore.—At 36.4 Mmt for 1990, iron ore production in Canada decreased about 10% from that of the year before. Two mines closed permanently, labor problems took their toll, and a revised mining plan at the country's largest producer reduced output significantly. Employment throughout the iron ore mining and processing industry dropped to 6,200 from 6,900 the previous year.

The Iron Ore Co. of Canada (IOC) celebrated the shipment of its 50 millionth ton of iron ore to Japan, marking two decades of a market relationship in which IOC provides the lowest alumina (0.1%) and phosphorus (0.007%) content of all of Japan's suppliers. During the year, IOC shipped 14.2 Mmt of ore, including 6.2 Mmt of acid pellets, 5.4 Mmt of concentrates, 2.4 Mmt of fluxed pellets, and 0.1 Mmt of pellet fragments, elsewhere statistically lumped with acid pellets. The last 38,000 tons of Schefferville red ore was shipped that had been stockpiled at Sept-Iles for several years.

Production dropped 10% to 14.5 Mmt as Quebec Cartier Mining Co. (QCM) ran into difficulties stemming from a changed mining plan. Utilizing its stockpile of concentrates, QCM shipped 15.3 Mmt of ore during the year, including 4.8 Mmt of acid pellets, 2.1 Mmt of fluxed pellets, and 0.9 Mmt of pellets for direct reduction. During the year, QCM also agreed to a seemingly generous contract with its employees, represented by the United Steelworkers of America (USWA). Wages would increase by 31% over 3 years and certain social benefits would be enhanced, thereby setting new standards for the other two major mines.

As the result of labor strikes, Wabush Mines output slid 5% to 5.7 Mmt because of disruption of rail shipments of ore and a walkout at Stelco Steel, Wabush's largest owner-client. Actual shipment during 1990 totaled 5.5 Mmt, including four grades of ore pellets: acid pellets with 1% and 2% manganese, respectively, and fluxed pellets, likewise in grades of 1% and 2% manganese.

A strike by USWA workers closed the Algoma Ore Div. (AOD) of The Algoma Steel Corp. for almost 5 months. Even so, AOD was able to produce 769,000 tons of superfluxed sinter from siderite ore and about 190,000 tons of recycled material. Whether this operation will close in 1992 was thought to depend upon the success of an alternative process for treating ore from the Wawa mine that could extend the life of the project. However, Dofasco Inc.'s two mines in northern Ontario, the Adams and the Sherman, closed during the year.

Lead and Zinc.—Output of lead fell about 17% as Canadian mines produced 224,000 tons in 1990, in spite of prices that increased to \$0.37 from \$0.31 per pound the year before. Production of primary and secondary refined metal dropped from 242,845 tons in 1989 to 195,000 tons in 1990. Labor disputes, mine suspensions, and production problems all helped reduce output during the year. Mine production of zinc in Canada fell about 3% to 1.183 Mmt during the year, reflecting price weakness to some extent, but also some of the same labor disputes, technical troubles, and mine closures.

Brunswick Mining and Smelting Corp. Ltd.'s Bathurst operations encountered difficulties stemming from both labor disputes and technical problems. Brunswick No. 12 mine's production was hampered by a reduction in hoisting capacity during deepening of the No. 3 shaft, interfering with output of concentrate feed and causing temporary closing of the Belledune smelter. In midyear, 1,100 striking Brunswick No. 12 mine workers were joined by 470 workers at the Belledune smelter in a demand for higher wages and protection against contracting out. Management personnel were able to maintain about 25% of normal capacity and had to continue operating this way into 1991 after union members rejected the company's latest offer in December. Cominco Ltd.'s Sullivan mine at Kimberly, British Columbia, which is said to be depleting rapidly, showed a production decrease of about 70% from that of the

previous year as the result of labor problems. Operations were suspended from January to November, at which time a new labor contract with the USWA, at both the Kimberly and Trail projects, showed a wage increase of 19% plus a new bonus plan at the Sullivan mine.

Problems continued through the year at Cominco's new 160,000 mt/a QSL smelter and related operations at Trail. The company discontinued modifications of the plant and postponed the forthcoming 1991 startup pending tests on similar equipment in Germany. Meanwhile, the old 136,000 mt/a conventional sinter and blast furnace smelter increased its output from 50% to 80% of capacity in September after repairs to the lead sinter plant.

Breakwater Resources Ltd. acquired Bathurst Base Metals Ltd. and the Caribou mine, which had suspended operations for 6 months during production troubles. Although output was increased to 3,000 mt/a and the company began a \$25 million development program, the mill itself required about one-half that amount in addition to meet the increased throughput. In view of the forecasted drop in base metal prices, the company decided in October to suspend operations rather than assume excess debt. In Quebec, however, Breakwater began production at its 175,000-mt/a Estrades mine in the second half of the year. Reserves there are projected at 0.94 Mmt grading 0.9% lead and 10.7% zinc with a mine life of 5 years.

Other zinc mine closures included Newfoundland Zinc Mines Ltd.'s mine near Daniel's Harbour and Abcourt Mines Inc.'s mine near Barraute, Quebec; both mines had exhausted their reserves.

Westminer Canada Ltd., a subsidiary of Western Mining Corp. Holdings Ltd. of Australia, reopened the Gays River mine early in the year in Nova Scotia. Production was scheduled at 10,000 mt/a of lead in concentrate.

Magnesium.—Refinery production of magnesium increased sharply to 26,726 tons in 1990, representing 10% of the output of the Western World. The three Canadian producers expected to achieve full capacity of 60,000 mt/a sometime in 1991, which would make Canada second only to the United States in output of magnesium.

Norsk Hydro inaugurated its plant at Becancour, Quebec, in May, after which it was said to be producing at 75% of its capacity of 40,000 mt/d by yearend. The company announced that it plans a \$6 mil-

lion refinery at Becancour for conversion of scrap to high-purity alloys to be operating possibly as soon as 1991. The company further stated that it plans a \$2.6 million expansion of its casting operation at Becancour to turn out alloy billets for magnesium extrusion. Currently, the plant processes raw magnesite imported from China.

Magnesium Co. of Canada Ltd. (MAGCAN) commissioned its 12,500 mt/a plant at Aldersyde, Alberta, during the year, but ran into trouble with the unexpectedly low electrical resistance of the feedstock. The transformers were not able to provide enough power to operate the reactors, so that startup difficulties led to cost overruns in construction of the \$90 million plant. Raw material for this plant comes from the Baymag high-grade magnesite deposit near Radium Hot Springs, British Columbia.

Timminco Metals, a division of Timminco Ltd., makes high-purity magnesium for specialized applications at its 6,000 mt/a plant at Haley Station, Ontario. With purity as high as 99.95%, this company's products are used for alloys with calcium and aluminum, electronic products, and reagents for the pharmaceutical industry. Timminco uses dolomite mined at the plant site.

Timminco utilizes the Pidgeon magnesium process, in which vacuum retorting involves the reduction of calcined dolomite by ferrosilicon, while MAGCAN and Norsk Hydro use different methods of reducing magnesium chloride to the metallic state. MAGCAN uses a single-stage reactor to convert magnesite ore to molten anhydrous magnesium chloride (the MPLC process), whereas Norsk Hydro leaches magnesite with hydrochloric acid to produce a brine of magnesium chloride that is reduced electrolytically to yield metallic magnesium.

Nickel.—Mining, processing, and marketing of nickel were all influenced by price weakness and uncertainty as to whether 1991 would see improvement or further softening. Prices dropped from \$6.25 in 1988 and \$6.04 in 1989 to an average of \$4.03 per pound in 1990. Certain Canadian companies reduced production during the year, but increased exports by Cuba (16,000 tons) and the U.S.S.R. (about 95,000 tons) into world markets in the face of a declining price level did nothing to help the situation. At a total of 199,400 tons produced by Canada during the year, output was down less than 1% from that of 1989.

At a cost of \$153 million, INCO Ltd. began developing the McCreedy East Mine near Sudbury with the object of starting production in 1993 and achieving 18,000 mt/a by 1996. Intended to use state-of-the-art mining technology, including the newest bulk mining methods (vertically cratered retreat), this will be the first major new mine developed at Sudbury by INCO in two decades. At Thompson, Manitoba, INCO said that beyond the \$93 million presently committed, another \$246 million would go for further development over the next several years. At a cost of \$179 million, the so-called 1-D ore body is being developed to connect with existing Thompson mine shafts.

Falconbridge Ltd. continued its \$240 million development of the Craig Mine at Sudbury, which should produce 20,000 mt/a by 1993. The company carried further its \$28 million program at the nearby Lindsley property where a shaft is being sunk to 1,390 m, to be followed by drifting and more drilling at the 1,310-m level.

At its Fort Saskatchewan, Alberta, refinery Sherritt Gordon Ltd. ran out of feed following the expiration of its 10-year supply contract with INCO and shut down for 2 months at midyear. Although some new feed material was obtained, and for the first time some nickel matte from the U.S.S.R. was processed, at yearend the company had not settled on a long-term supply of feed.

In the Ungava region of northern Quebec, New Quebec Raglan Mines Ltd. finished 26,700 m of drilling and concluded that the reserves estimates could be increased to 16 Mmt grading 3.13% nickel and 0.88% copper plus some platinum-group metal values. A new wholly owned subsidiary of Falconbridge since the year before, the company had previously announced that a sustained nickel price of \$4.00 per pound would be required to turn the property into a producer.

Silver.—World silver prices were soft throughout the year, the average price having dropped from \$6.51 per troy ounce in 1988 to \$5.50 in 1989 and then to \$4.83 per ounce in 1990. As is well known, silver is a byproduct of gold and base metal mining and subject to whatever mining incentive applies to the major product, whether this be gold, copper, or lead-zinc. Thus, the production of silver in Canada rose almost 7% to about 1,400 tons in 1990. Production of silver at Brunswick Mining and Smelting Ltd.'s Bathurst operation suffered from

labor unrest, as noted in more detail in the preceding discussion of lead production, and the volume of output was scheduled at 25% of capacity into 1991. The same situation held for Cominco Ltd.'s Sullivan mine, where activity was suspended for most of the year until a new labor contract was ratified.

Canada's largest primary silver producer, the Equity Silver mine in British Columbia, accounted for approximately 212 tons in 1990, essentially unchanged from that of 1989. This mine, however, was expected to produce less in 1991 and to close upon exhaustion of reserves in 1992. Postclosure reclamation costs were being negotiated with the Government of British Columbia and the company, Equity Silver Mines Ltd., was putting aside something on the order of \$27 million against such charges. Also in British Columbia, the Samatosum mine near Kamloops, owned jointly by Minnova Inc. and Rea Gold Corp., produced 133 tons of silver in its first full year of operation.

Closures were projected for Min Ven Gold Corp.'s Blackdome mine near Clinton, British Columbia, in January 1991 and for Teck Corp.'s Beaverdell mine east of Kelowna in the same province. NovaGold Resources Inc., whose Murray Brook gold-silver mine was opened in New Brunswick in 1989, produced 3.35 tons of silver in 1990 by vat leach processes in a 1,300-mt/d operation.

Uranium.—Canada produced 10,374 tons of U_3O_8 during the year, which was about 23% less than the 13,475 tons produced in 1989. A combination of falling prices and continuing oversupply weakened the market and in turn the incentive to mine uranium. Prices fell to an alltime low of \$8.35 in October of the year before firming somewhat to \$9.70 at yearend.

Rio Algom closed its Quirke and Panel mines at Elliot Lake in August, and Denison cut back approximately 450 workers at its Elliot Lake operation in the same month. Collectively, the loss of 2,200 jobs to a community of 15,000 people was an economic shock that brought help from Ontario and federal agencies to diversify and revitalize the local economy.

At the end of the year, Denison announced that it was entering a 50-50 joint venture with Freeport Uranium Recovery Co. of the United States, starting in 1991. Uranium concentrates from Freeport's two phosphate processing plants in Louisiana will be marketed by Denison, thus sustaining Denison's position as a leading supplier.

Annual capacity of the two plants is at least 450 tons of metallic uranium.

Other Metals.—Antimony production decreased sharply from 2,818 tons in 1989 to 653 tons in 1990, primarily because Dominion Explorers Inc. closed its Durham mine at Lake George, New Brunswick. In spite of the fact that this is the only primary antimony mine in North America, oversupply from China induced price deterioration to the point at which profitability disappeared.

Cobalt production decreased marginally from 2,344 tons in 1989 to 2,290 tons in 1990, as nickel producers INCO and Falconbridge lowered production in response to sagging nickel prices. Cobalt prices, however, doubled during the year before easing at yearend. This had the effect of enhancing the value of production even though the quantity diminished. The Windy Craggy deposit in British Columbia, a copper-cobalt ore body under continuing study, was estimated to have cobalt reserves sufficient for 6 years' demand in the Western World.

Canadian molybdenum production amounted to 12,188 tons in 1990, down about 10% from that of 1989. Although reserves had been diminishing more or less steadily for the past 10 years, they rose about 2% during 1989 to reach approximately 234,000 tons in January 1990. The turnaround occurred as both tonnage and grade were increased at Canada's only primary molybdenum producer, Placer Dome Inc.'s Endako mine in British Columbia.

Industrial Minerals

Asbestos.—Despite firm prices for asbestos during the year, a 3.8% decrease in production, or 665,000 tons compared with 701,000 tons in 1989, resulted mostly from the transition of the mine at Cassiar, British Columbia, to underground extraction. Also, however, a decline in demand for short fibre was a contributing factor. Purchases by the United States were down sharply in response to the negative implications of the U. S. Environmental Protection Agency's (EPA) final asbestos rule in 1989 and phase-in of restrictions beginning in September of 1990. The EPA ruling said essentially that all but about 5% of current uses of asbestos in the United States must phase out by 1997. Briefs were filed during 1990 to the Fifth Circuit Court of Appeals contesting the decision, but the first hearings were not scheduled until 1991.

Following restructuring, Princeton Mining Corp. became the owner of Cassiar Mining Corp. and used stockpiled material from the open pit for mill feed while switching to material from the underground McDame ore body. McDame produced mill feed at a rate of between 1,500 and 2,000 mt/d by the end of the year, but problems at that time with tailings disposal caused suspension of the wet-process operation.

Cement.—Along with the general economic recession, the decrease in housing starts seriously affected the demand for cement in 1990. Production totaled 11.3 Mmt, down 4.5% from that of the year before. An interconnected North American cement market has been developing for a number of years. Marine transportation at low cost has attracted buyers to sellers to a degree that about 20% of U.S. consumption is from Canada. Particularly affected states are Michigan, Minnesota, New York, Vermont, and Washington. Both cement and clinker are competitive in the American market because of Canadian production efficiency and the relatively strong American dollar.

Gypsum and Anhydrite.—At approximately 8.2 Mmt produced in 1990, output of gypsum remained even with that of the previous year. Production is primarily by subsidiaries of U.S. companies acting according to demand for wallboard by both U.S. and Canadian consumers in all building categories. Nova Scotia and Newfoundland produced the bulk of Canadian gypsum, plus lesser amounts from Ontario, Manitoba, and British Columbia.

Although gypsum occurs widely in Canada (and the world), the relatively high unit weight, low unit cost, and vulnerability to damage of wallboard combine to give these gypsum products a relatively high place value, discouraging long-distance transportation. Instead, new gypsum industries tend to develop in new localities to serve developing construction requirements.

U.S.-based Louisiana-Pacific Corp. finished its \$65 million fibre-gypsum board plant at Port Hawksbury, Nova Scotia, which will use local gypsum, imported perlite, and recycled paper to produce board for both the regional and export markets. Domtar Inc. pressed its \$17 million mine project to support the company's board complex at the same site at Caledonia, Ontario. Continuous mining machines will be used to extract material from gypsum

reserves thought to be sufficient for 75 years.

At Hagersville, Ontario, CGC Inc., partly owned by USG Corp. of Chicago, carried on its 6-year expansion program intended to produce sufficient raw material to ensure output of 650,000 mt/a of finished products.

Potash.—Production of potash dropped in 1990 to 6.989 Mmt from 7.333 Mmt the previous year, a difference of between 4% and 5% that reflected continuing price softness and a weakened demand. This level of output was significantly less, by more than 1 Mmt, than the recent high of 8.328 Mmt in 1988. A worldwide oversupply of potash, likely to continue for at least 5 years, has depressed the mining incentive of many producers, both in Canada and the remainder of the world. Canada's normal production rate at about 80% of capacity was as low as 50% and as high as 90% during the year. Potash Corp. of Saskatchewan Inc. (PCS) saw its net income drop from about \$71.5 million in 1989 to an expected \$21.5 for 1990, reflecting not only lower prices but the cessation of sales to Potash Co. of America. During the year, PCS acquired all of the shares of Saskaterra Fertilizers Ltd. from Husky Oil Ltd. for about \$40 million plus working capital, giving PCS 100% ownership of the Allan mine that it previously owned jointly with Saskaterra. Excluding Saskaterra concessions, PCS ended the year owning rights to 575,000 acres in Saskatchewan, thought to contain reserves of 4.3 billion tons of 22.8% K₂.

Potash prices were generally soft during the year, particularly in the first half. In a number of instances, East European and Soviet sales were known to have been discounted in the midst of frequently contradictory central and local regulations as the deterioration of the U.S.S.R. continued. One consequence was the West European Dumping Complaint, to be heard by the EC in 1991, alleging that Soviet potash has been dumped starting sometime in 1989. Although potash of Soviet origin was offered at prices as low as \$72 per ton, prices firmed in the second half to as high as \$100 or \$101 per ton for Canadian potash in China, Indonesia and Japan, and South Korea.

All this variation in price and supply tended to whipsaw the Canadian producers, some of them invoking long holidays or vacations and temporary suspensions of production for their entire work forces for a total of as much as 4 months out of the year. PCS closed three of its four mines for several weeks in July and August, and all mines

through the greater part of December and into January 1991.

In any case, Saskatchewan continued to produce about 86% of Canada's potash in 1990, with New Brunswick producing the remainder and Manitoba eyeing the possibility of its own production before the end of the decade. On January 1, 1990, Saskatchewan replaced the old Potash Resource Payment Agreement, known as PRPA, with a new tax system. Under the new plan all companies are liable for a base payment of about \$9.45 per ton of K_2O sold, plus a progressive profit tax ranging from 15% to 50%. Although the base payment and profit taxes will be adjusted upward for inflation each year, the Crown and freehold royalties are deductible against the base payment. Other credits may be given for research and development costs and market development costs. The base payment will shift upward to about \$9.75 the first day of 1991.

Silica.—Recycled waste glass, the use of lighter glass in vehicle construction, and increasing competition from paper, plastic, and aluminum combined to decrease the demand for glass, particularly for the large variety of container products traditionally dominated by glass. Because iron and steel operations were significantly cut during the year, the requirement for both foundry sand and silicon carbide was lower than in past years. Demand for both flat glass products and fiberglass also slumped because of lowered construction activity and automobile sales. Production in 1990 was estimated to be about 1.9 Mmt, down from 2.3 Mmt the year before and 2.8 Mmt in the recent peak year of 1988.

Unimin Corp. in Connecticut, United States, bought out the Indusmin Div. of Falconbridge Ltd. The purchase included two silica mines, one each in Ontario and Quebec; the nepheline syenite operation at Nephton, Ontario; and a silica refinery at Midland, Ontario. Unimin has been the largest producer of silica sand in the United States, and it also produces dolomite, feldspar, and mica. The company's largest shareholder is Belgium's SCR-Sibelco SA, itself the largest European producer of industrial sand.

In Newfoundland, the 1989 closure of Tenneco Canada Inc., a producer of elemental phosphorus, led in turn to the closure of the quartzite quarry at Villa Marie in 1990.

Sulfur.—Production of elemental sulfur increased a little less than 2% to 5.92 Mmt

for 1990, representing output from sour natural gas, petroleum refineries, and tar sands. In addition to these sources, smelter gases accounted for an additional 929,000 tons, for a total of 6.849 Mmt from all sources. New natural gas fields and expansion of gas processing facilities accounted for an increase in production, but this was partly compensated by the decline of production from established reservoirs. After potash, the sulfur industry ranks second in value of production of industrial minerals. Altogether the sulfur industry in Canada accounted for 1,300 jobs directly, including sulfur forming, handling, transportation, marketing, and sales. Total productive capacity was rated at 30,650 mt/d in 1989 or one-third the capacity of the entire world. Canadian producers, however, operated at about 50% to 55% of capacity or about 16,350 mt/d.

About 100 km northwest of Calgary, in Alberta, the so-called Caroline Project dominated the sulfur recovery scene during the year. The Caroline gasfield, having about 35% H_2S , contains an estimated 25 Mmt of sulfur reserves. Shell Canada Ltd. discovered the field as part of a joint venture in which Husky Oil Ltd. was a major investor. Husky pulled out of the initial development plan, instead filing application for \$565 million for a 4,240-mt/d expansion of its Ram River gas processing plant. Shell, meanwhile, began its own plan for development that included construction of a new 1.4-Mmt/a gas plant, about 14 km south of Caroline, plus an underground pipeline to carry liquid sulfur to Shantz. After public hearings to evaluate both plans, Shell was given approval to initiate its \$710 million project for developing the Caroline field. Late in the year, construction began of the gas plant, compression stations, and the sulfur-forming facility. The process will be designed to recover a minimum of 99.8% of the sulfur dioxide emissions to meet the specifications of the Alberta Energy Resources Conservation Board. Small sulfur pellets will be formed from liquid sulfur using the Sandwick Rotoform process. Startup of operations is expected sometime in 1993. In the meantime, Shell reported discovery near the Caroline field of a new sour gas reservoir containing about 47% H_2S .

A 5-year project for evaluation of the technical and economic feasibility of extracting commercial sulfur from super sour gas was planned by Shell Canada Ltd., Mobil Oil Canada Ltd., PanCanadian Petroleum Ltd., and Norcen Energy Resources Ltd. as

they commissioned the \$56 million Bearberry pilot plant near Sundre, Alberta. This 224-mt/d recovery plant will process 90% H_2S sour gas for sulfur extraction. Bearberry sulfur reserves have been projected at between 70 Mmt and 100 Mmt.

Other Industrial Minerals.—Production of lime, at 2.4 Mmt, was down about 6% from the previous year's 2.552 Mmt as the result of major labor strikes in the Ontario steel industry, and lower demand in the chemical sector as well as the pulp and paper industry. During 1990, the lime industry included 14 companies that operated 20 plants, 13 of them in eastern Canada. Employment rose to 927 jobs, significantly above the average of 810 since about 1961.

Production of salt reached about 11.1 Mmt in 1990, an increase of perhaps 1% from that of the previous year, but production was influenced by a 6-month labor strike that put The Canadian Salt Co. Ltd.'s operations on suspension from February to August. Total annual capacity was steady at 12.6 Mmt, with salt operations overall running at 88.1% of capacity compared with 87.8% the previous year.

Production of all types of stone decreased to 112 Mmt from 118 Mmt the previous year, in all probability reflecting the sluggishness of the national economy. This category includes all types of stone for general construction, aggregate, chemical uses, pulverizing, roofing, and masonry. Granite, marble, limestone, sandstone, and slate were all utilized for these purposes.

Mineral Fuels

Coal.—Not an easy year for coal, 1990 saw production of Canadian coal and lignite, at a total of 68.3 Mmt, down almost 4% from that of the previous year. Consumption by the power-generation industries of Nova Scotia, Ontario, and Saskatchewan sagged during the year, as did demand by the steel sector. A drop in export demand for Canadian metallurgical coal by Japan did not help matters.

A decade of declining coal prices gradually edged parts of the coal sector into financial difficulty. Exporters in British Columbia were particularly affected, but in spite of these troubles other parts of the country were seeing expanded demand for coal in the near future. One coal mine was under development, a new coal-fired power station was commissioned, and four others were under construction.

In Nova Scotia, the new Westray coal mine near Stellarton in Pictou County,

owned 90% by Curragh Resources Inc., was expected to produce more than 1 Mmt/a and to employ 250 miners upon achieving capacity. This mine, which extends offshore under the ocean, was expected to enable Nova Scotian power units to combine advance combustion technology with lower sulfur coal to reduce nitrogen oxides and sulfur dioxide emissions to the atmosphere. In Saskatchewan, demand for local lignite will increase by 1.5 Mmt/a to supply the 300-MW Shand power station expected to be in service sometime in 1992. Alberta will see growth in the subbituminous coal market in that the 375-MW Sheerness powerplant was commissioned in late 1990, and the 400-MW Genesee II station was scheduled to come on-stream possibly in 1994, depending upon demand for power.

Natural Gas.—Production of natural gas rose substantially in 1990, gross output having been better than 138 billion m³ compared with slightly less than 115 billion m³ in 1989. Although the number of active drilling rigs fell sharply in 1989 to levels resembling those of 1976, the one hope of the industry had been that gas drilling activity and production would pick up through 1990. Not only did production increase but prices held reasonably stable, in contrast to the ups and downs of prices for crude. Production of marketable gas in Canada increased from an average of 249 Mm³/d in 1989 to 264 Mm³/d in 1990, an increase of more than 6%. Marketable gas is total production minus reinjected gas and producer consumption.

What had seemed to be a beneficial arrangement between Alberta gas producers and San Francisco-based Pacific Gas & Electric Co. (PG&E) began to go sour in midyear, when contract negotiations stalled over price. Approximately 190 local producers in Canada, who sell their gas to Alberta and Southern (ANS) to be transported over the Pacific Gas Transmission (PGT) pipeline to California, have refused to accept offers of less than the preexisting rate of \$1.80 per thousand cubic feet. The Canadian view was that PG&E was trying to force prices down by having its subsidiary, PGT, accommodate other cheaper surplus gas from certain producers in Canada and thus undercut the market. The contrary view, by the California Public Utilities Commission (CPUC), was that gas prices were too high to its retail consumers in the PG&E area. This might normally be a case in which the dynamics of the market would be expected to allocate volumes and prices

of gas most efficiently, but there were complications. The Alberta Petroleum Marketing Commission (APMC) threatened heavy fines, up to \$1 million per day, against producers who took gas out of the province without removal permits issued by APMC. Alberta had already withheld removal permits for gas sales to Ontario in its dispute with the latter over core markets in that province.

It seemed plain to some observers that the disagreement was out of the hands of PG&E and the Alberta producers and had become something of a contest between CPUC and APMC, in which either could be construed, especially by the other, as using regulatory powers to thwart market pricing mechanisms. The problem had not been solved by yearend and threatened to grow in complexity.

Petroleum Crude.—The production of crude fell sharply, if not catastrophically for the industry, from 584 Mbbl in 1989 to 381 Mbbl in 1990, a decrease of 35% overall. The combined effects of instability in the world pricing of crude oil, a growing economic recession in Canada and the United States, the drying up of exploration funds, and the continuous pressure from environmental advocates all raised the specter of hard times for Canadian exploration and production. The same could be said of the situation south of the border in the United States, where the same factors prevailed, although not necessarily in the same proportion.

A positive development was the announcement in September that the immense Hibernia petroleum prospect, offshore Newfoundland, would be developed. The final step in the approval process was to be the passing of federal legislation approving the commitment of \$2.3 billion to the project. Concerns had been raised that the funding bill could be stalled in the upper house because of reports that crude produced by the project would not be available for refiners in Atlantic Canada. Project officials as well as the Newfoundland government retorted that the crude would be available to anyone that could buy it and refine it. The fly in this ointment, however, is that Atlantic Canada refiners would need to change their equipment and processing capabilities to accommodate the physical properties of Hibernian oil, essentially its gravity and composition.

It was thought that Canadian petroleum companies may have been offered the inside track on \$2 billion worth of petroleum-

related construction work to assist in rebuilding Iran's oil and gas industry, not quite destroyed during the Iran-Iraq war. The Managing Director for International Trade at Alberta's Ministry of Economic Development said that it was incumbent upon private companies to assemble consortia for addressing the various tasks involved in the reconstruction. The Iranian Minister of Petroleum reportedly offered the Canadians exclusivity on at least 60 different projects within the massive rebuilding effort.

Reserves

Table 9 shows the levels of Canadian reserves of major mineral commodities as of the early part of 1990, in terms of metal contained in ore. These reserves represent "proven" and "probable" categories. Tonnage reported as "possible" was not included. Reserves were defined as well delineated and economically minable ore from producing mines and deposits committed to production.

Canadian reserves of gold decreased about 4% or 70 tons from those of the previous year. This was the first reversal of the marked growth in gold reserves during the 1980's, reflecting in turn the impetus of high gold prices at the beginning of that decade. On-site exploration and development at existing mines did not replace the amount of gold removed during the year.

Canadian copper reserves decreased almost 3%. In spite of two large additions of 172,000 tons by Heath Steele-Stratmat operations in New Brunswick and 141,000 tons by the Highland Valley mine in British Columbia, other copper producers lowered the reserves total through routine depletion of the ore mined during the year. Canadian reserves of molybdenum increased throughout 1989 to about 234,000 tons in January of 1990. Both tonnage and grade were increased at the Endako mine of Placer Dome, the only primary molybdenum producer in the country. Changes at the Highland Valley mine also pushed the reserve values to the positive side. At 6.941 Mmt, lead reserves were down less than 1% from those of the year before. Although the Heath Steele-Stratmat operation added more than 450,000 tons for the beginning of 1990, the combination of normal mining and more conservative methods of reporting pulled the reserve totals down slightly.

Zinc reserves increased almost 3% to 21.688 Mmt, up for the second straight year. The largest addition, which was also the largest change at any mine in Canada

through 1989, was 1.4 Mmt at Heath Steele-Stratmat, which was committed to production in 1989. The largest single decrease in zinc reserves was 570,000 tons at Curragh Resources Inc.'s Faro mine in Yukon Territory, where the company began reporting only open pit reserves rather than other subsurface reserves.

At 26,790 tons, silver reserves were down 2% at the beginning of 1990. Mining and changes in reporting subtracted more silver from the reserve lists than was replaced or added by development decisions.

Canadian reserves of nickel declined between 1% and 2% to 6.132 Mmt. About one-half of the metal mined during 1989 was replaced by newly determined ore. Nonetheless, the ratio of reserves to average yearly production of nickel was significantly higher than for any of the other metals.

TABLE 9

CANADA: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1990

(Thousand metric tons unless otherwise specified)¹

Asbestos, fiber		^e 39,000
Coal, all types		^e 6,400,000
Copper, metal content		12,258
Gold, metal	metric tons	² 1,748
Gypsum		³ e500,000
Iron ore, iron content		1,351,000
Lead, metal content		6,941
Molybdenum, metal content		234
Natural gas	million cubic meters	⁴ 2,016,362
Nickel, metal content		6,132
Petroleum crude	thousand barrels	⁴ 6,765,392
Potash, K ₂ O equivalent		^e 14,000,000
Salt		³ 312,200
Silver, metal	metric tons	26,790
Sodium sulfate		³ 92,000
Sulfur		137,000
Uranium		⁵ 148
Zinc, metal content		21,688

^eEstimated.

¹1990 Canadian Minerals Yearbook, Energy, Mines and Resources Canada, unless noted.

²Excludes metal in placer deposits.

³Data in thousand short tons, unless noted.

⁴1991 Canadian oil and gas handbook, The Northern Mines Press Ltd.

⁵Recoverable at prices of \$100 per kilogram of U, or less.

INFRASTRUCTURE

With a total land area of about 9,221,000 km², which is slightly larger than the United

States, Canada has networks of highly developed infrastructure as well as other vast areas of trackless wilderness. The country has 884,272 km of roads, comprising 250,023 km of paved highway, 462,913 km of gravel or other loose surface, and 171,336 km of earth-surface roads, the latter not graded or drained in many places. Bulldozed temporary roads have been established for mining exploration in many out-of-the-way places, but these deteriorate quickly where not maintained.

A total of 93,544 km of railroads included two main systems, the Canadian National and the Canadian Pacific. The country also has about 3,000 km of inland waterways, including the St. Lawrence Seaway, one of the greatest in the world. Principal ports were Halifax, Montreal, Québec, St. John (New Brunswick), St. Johns (Newfoundland), Toronto, and Vancouver. Canada's merchant marine was made up of approximately 75 ships of 1,000 or more gross registered tons.

The country has about 1,400 airports, 1,155 of them usable. Of these, 443 have permanent-surface runways, 4 with runways longer than 3,659 m; 30 with runways 2,440 to 3,659 m long; and 328 with runways 1,220 to 2,439 m in length. Civil aviation includes about 636 major transport aircraft, with Air Canada as the major carrier.

Canada generates electrical power from coal and natural gas fuels as well as massive hydroelectric facilities. Total capacity is approximately 105,000 MW. About 500 MMWh, or 18,840 kWh per person, was produced in 1990. Pipelines included 23,564 km for crude oil and refined products as well as 74,980 km for transmission of natural gas.

OUTLOOK

In an immediate sense, the continuing pattern of new mineral discoveries confirmed the desirability of further exploration and increased the reserves in some mineral categories. Canada's mineral industry thus provided assurances that it is alive and well and, by supporting a number of regional economies, will continue to be a significant part of the national economy. Some observers, however, saw a lack of balance in exploration results in that precious metals seemed to be absorbing effort that might alternatively be spent on base metals. Reserves of the latter have declined generally in recent years, but there were signs that the

situation could be turning around in terms of recent discoveries.

The larger picture starts with the Canadian economy in recession, along with that of the United States, its major trading partner. Uncertainties of demand, price weaknesses, and labor instabilities are predictable characteristics of economic downturns, and there was no clear indication as to whether these would improve in the forthcoming year.

Over the longer term, there were questions of Quebec's potential secession and the economic consequences to both Quebec and the remainder of Canada. Previous strong, if not uncompromising, comments on both sides of the question have moderated somewhat as financial and political realities have become apparent. The political leadership in Quebec, however, is under continuing pressure to do something in the way of redefining the Province's role vis a vis Canada, so the issue remains.

Another long-term consideration is embodied in the concept of "sustainable development," or the degree to which mining companies can balance the need for development and economic growth by good stewardship in the protection of the natural environment and human well-being. The Canadian mineral industry is committed to environmental responsibility in the development of resources, but the ultimate costs are not yet discernible. Some companies, responding to both environmental restrictions and taxation, are expected to look elsewhere for viable projects, particularly in Latin America.

On the positive side, the FTA between Canada and the United States should become an economic plus factor in both countries. Although preliminary concern has been heard both north and south of the border, the long-term benefits of this agreement should include gradual labor shifts into more productive industries in both countries. Beyond this loomed the possibility of a NAFTA, with Mexico as the third partner, based on negotiations already underway.

¹For more detailed information on the mineral industry, see the Canadian Mineral Surveys for 1989 and 1990, prepared by the Mineral Policy Sector and the Energy Sector, Ministry of Energy, Mines and Resources, Ottawa, Canada, both of which were used extensively as source material for this report. The U.S. Department of the Interior, Bureau of Mines, has arranged to have these Canadian publications placed in selected depository libraries of the 50 States and Puerto Rico.

²Where necessary, values have been converted from Canadian dollars (CAN \$) to U.S. dollars at the rate of CAN\$1.1667=US\$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Energy, Mines and Resources Canada
580 Booth Street
Ottawa, Ontario K1A 5H3
Canada
Mineral Policy Sector
Geological Survey of Canada
Surveys, Mapping, and Remote Sensing
Sector
Canada Centre for Mineral and Energy
Technology
Energy Sector
Statistics Canada
Tunney's Pasture
Ottawa, Canada
Department of Indian Affairs and Northern
Development
Les Terrasses de la Chaudière
Ottawa, Ontario K1A 0H4
Canada
Ministry of Energy, Mines and Petroleum
Resources
Parliament Buildings,
Victoria, British Columbia V8V 1X4
Canada
Department of Energy
Petroleum Plaza, North Tower, 9945 108
Street
Edmonton, Alberta T5K 2G6
Canada
Department of Energy and Mines
Room 306, Legislative Building
Regina, Saskatchewan S4S 0B3
Canada
Administration of Mining Lands
Toronto-Dominion Bank Building
1914 Hamilton Street
Regina, Saskatchewan S4P 4V4
Canada
Department of Energy and Mines
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Winnipeg, Manitoba R3C 0V8
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Ontario Geological Survey
Southern Ontario Region
Northeastern Region
Northwestern Region
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Ottawa, Ontario K1R 7S8
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Northwest Territories Chamber of Mines
P.O. Box 2818
Yellowknife, Northwest Territories X1A
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Yukon Chamber of Mines
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Whitehorse, Yukon Territory 1A 3T5
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840 West Hastings Street
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Saskatchewan Mining Association Inc.
1740 Avord Tower

Regina, Saskatchewan S4P 0R7
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700-305 Broadway
Winnipeg, Manitoba R3C 3J7
Canada
Ontario Mining Association
1114-111 Richmond Street West
Toronto, Ontario M5H 2G4
Canada
Québec Asbestos Mining Association
410-1140 Sherbrooke Street West
Montreal, Québec H3A 2M8
Canada
Québec Mining Association Inc.
942-2635 Boulevard
Hochelaga, Ste. Foy
Québec G1V 4W2
Canada
The New Brunswick Mining Association
Suite 312-236 St. George Street
Moncton, New Brunswick E1C 1W1
Canada
Chamber of Mineral Resources of Nova
Scotia
202-5525 Artillery Place
Halifax, Nova Scotia NS B3J 1J2
Canada

Publications

Canadian Institute of Mining and
Metallurgy, monthly.
Canadian Mineral Analysts, monthly.
Canadian Mining Journal, Canada's Top
Mining Companies, monthly.
Energy, Mines and Resources Canada,
Canadian Minerals Yearbook, annual.
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Canadian Mineral Industry Reports,
monthly.
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Production, Reserves, Development, and
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The Journal of Commerce (United States) newspaper, weekdays.

The Wall Street Journal, newspaper, daily.

United Nations, Energy Statistics Yearbook, annual.

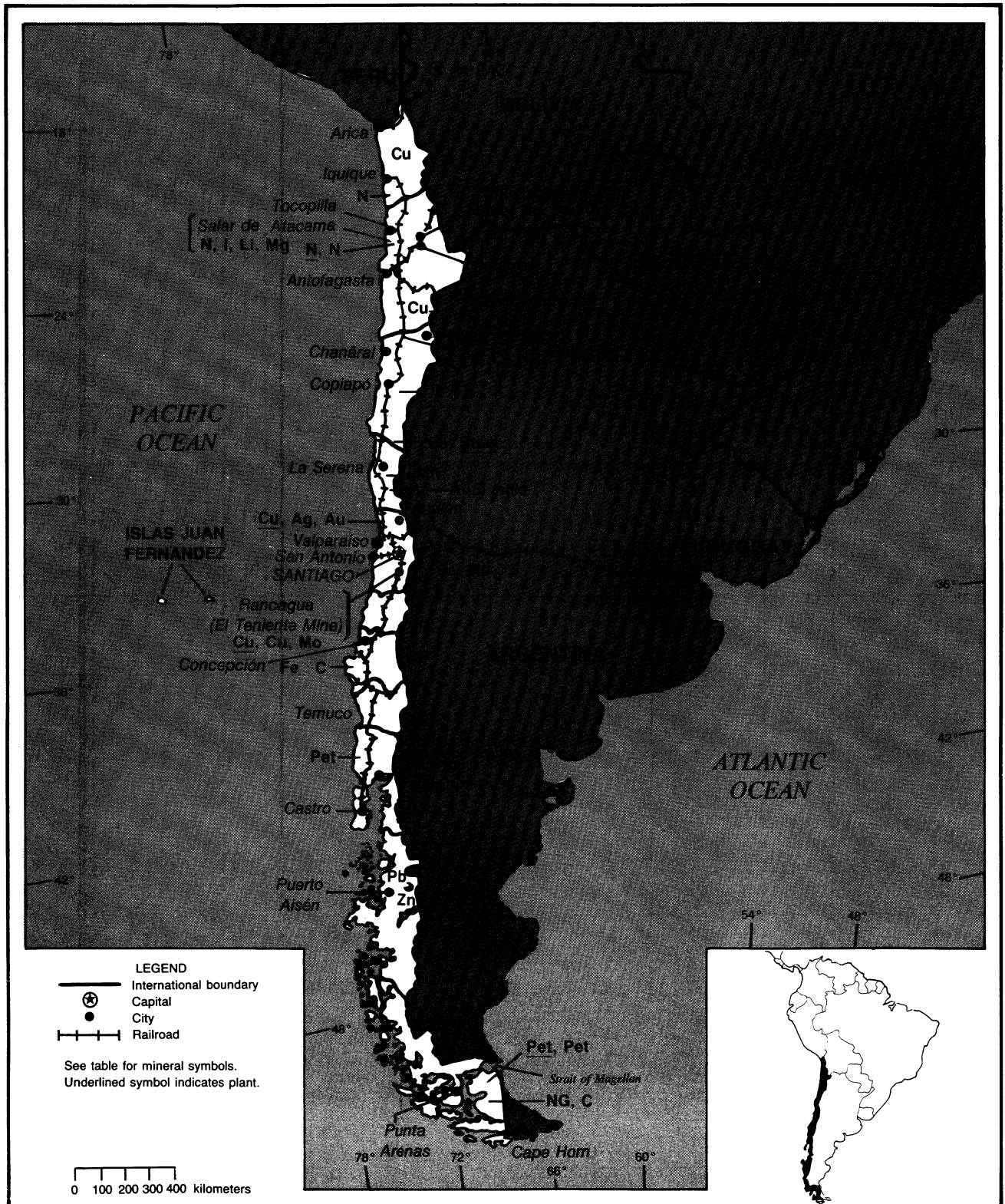
Also:

Corporate annual reports of each mining company.

CHILE

AREA 756,900 km²

POPULATION 12.8 million



CHILE

By Pablo Velasco

Chile continued to be the largest producer and exporter of copper in the world, although the United States was a close second. Chile's copper production accounted for 22% of the total output of the market economy copper-producing countries and was expected to maintain this lead in the foreseeable future because of the startup of the large Escondida Mine in late 1990. This mine was projected to add 320,000 mt/a to raise annual copper production capacity to about 2 Mmt in 1991. Chile was also one of the world's significant producers and exporters of potassium nitrate and sodium nitrate. It ranked second in the world production of iodine, lithium, molybdenum, and rhenium after the United States. Chile produced a record of 27.6 tons of gold and 633.1 tons of silver in 1990. In addition, Chile possessed approximately 23% of the world's copper reserves, as well as important reserves of lithium, 58%; rhenium, 40%; iodine, 23%; selenium, 21%; and molybdenum, 20%.

The mining sector's contribution to the total export value was \$4.7 billion or 55.1%. Corporación Nacional del Cobre de Chile CODELCO-Chile, with its four mining divisions, contributed about 74% of the total copper produced in the country. Despite the various problems confronted by CODELCO-Chile during the past 3 years, 1990 was another profitable year for the company with earnings before taxation totaling \$1.54 billion mainly as a result of higher-than-expected copper prices whose average price at the London Metal exchange was \$1.20 per pound. CODELCO-Chile contributed \$1.5 billion to the Chilean treasury in 1990, significantly down from the \$1.82 billion that was contributed in 1989. CODELCO's copper production declined to 1.2 Mmt in 1990, down 3.9% from a peak of 1.24 Mmt in 1989, and it was expected that the CODELCO's output of copper would drop further in 1991 as a result of declining ore grades and continued production problems at the El Teniente Mine. Preliminary data received from Chile indicated that the Chilean economy registered real GDP growth of

2% to \$27.8 billion¹ in 1990, the third highest annual rate in the past 31 years, while per capita income increased 0.5% to \$2,113. Despite modest GDP growth in 1990, Chile's economy performed rather well.

The most important pieces of new mining legislation were: Chile's first mineral depletion allowance; the authorization of CODELCO-Chile to negotiate the sale of its many unexploited mineral properties; the transfer of mineral patent income from the Ministry of Finance to the regional Governments; an amendment to Chile's mining code to minimize future legal disputes; the first nationwide gaseous emission standards for mineral smelters, roasters, and thermal powerplants; a petroleum price stabilization fund; and permission for a U.S. oil company to explore for oil and gas in Chile's national parks.

GOVERNMENT POLICIES AND PROGRAMS

The Central Bank of Chile modified the rules for debt for equity swap transactions under chapter XIX of its Compendium of Foreign Exchange Rules. Foreign companies can now repatriate capital after 3 years and profits immediately instead of the respective 10- and 3-year waiting periods required with earlier contracts. The change would enable investors to speed up capital and profit repatriation under certain conditions, such as agreeing to prepayment of compensation to bring the investment in line to those made under Decree Law 600 (DL 600) Chile's direct investment statute.

The Foreign Investment Committee announced that inflows of foreign investment through DL 600 in 1990 totaled about \$1.13 billion, about 26% larger than that in 1989. Sectors of the Chilean economy that received the largest influx of foreign capital included mining, with \$629 million or (55.6%) of the total; services, with \$379.6 million (33.5%); and industry, with \$83.7 million (7.4%). In 1990, foreign capital came mostly from Canada, \$490 million; the United Kingdom, \$226.6 million; the

United States, \$220.1 million; and Netherlands, \$75.6 million.

There were three main mechanisms by which foreign investment could enter the country: Chapter XIV and Chapter XIX of the Compendium of Foreign Exchange Regulations of the Chilean Central Bank and Decree Law 600. DL 600 was passed in the late seventies and was amended in 1981, 1985, 1987, 1989, and 1990. The purpose of the law was to regulate the flow of foreign investment capital into Chile, and it applies to investments in all sectors of the Chile's economy. Application for a DL 600 foreign investment contract with the Government of Chile was an option, not a requirement, for foreign investors. The application review process was lengthy and could take 6 months or more from the time a company applied. The law required that an investor state how much foreign capital will be brought into Chile during a specified period of time. The length of the project period can vary from 3 years to 12. Once a contract is approved, the investor would receive several benefits: foreign exchange protection, the option to choose a fixed income tax rate for a specified time period, tax rules in effect at the time of the contract remaining the same for a specified period of time; financial records can be kept in U.S. dollar amounts rather than in Chilean pesos, and export proceeds (i.e., gross receipts) can be kept in an offshore account and need not be remitted back to the investor's country of origin. Some of these benefits apply only to projects in excess of \$50 million.

Chile's mining code, which has been in place for at least 10 years, applies equally to domestic and foreign firms. No mining licenses were required under the mining code. The code allowed ownership of mining concessions, grants an owner the right to extract ore from the concession, and required that the owner obtain the necessary permits before extracting the ore.

Responding to a serious loophole in the new mining code, the Ministry of Mines was preparing a law that would make it more difficult for individuals to place mining

claims on mineral properties already claimed under the old mining code. Under the new code, some individuals have been able to take advantage of a loophole that allows them to place claims on properties that had been incorrectly surveyed. The incorrect location of mineral properties was not uncommon before the introduction of modern surveying practices. This loophole has created a legal nightmare for several foreign mining companies, and while the amendment will not contribute to the resolution of existing disputes, it should minimize the problems in the future. It is not clear when this proposal will be presented to Congress.

The Ministry of Mining was also preparing a presidential decree for the control of emissions from Chile's smelters, roasters, and thermal powerplants that would address a longstanding environmental problem. The decree was expected to be signed by the President before the end of March 1991. The Ministry of Mines was also developing a law that would allow CODELCO-Chile, a state copper corporation, to sell its unused mining properties to raise capital for future development.

Chile's National Energy Commission (NEC) was preparing a law to promote the development of geothermal resources. The State Development Corp. (CORFO) would probably end up controlling Chile's best-known geothermal deposits. Union Oil of California (UNOCAL) the world's largest producer of geothermal energy, and a number of other U.S. companies have expressed an interest in the country's potential. If the proposed law is passed and Unocal begins exploration, Chile could become a significant producer of geothermal energy. The United States can be expected to play a dominant role in this area.

As a result of a 10-month effort by the U.S. Department of Energy and the Chilean National Energy Commission, a memorandum of understanding on the deployment of clean coal technology was prepared, and it was proposed by the Chilean Government to be signed in Washington in June 1990. This agreement could lead to a marginal improvement in Chile's balance of payment through a decreased dependency on petroleum imports, improved environmental conditions through lower sulfur dioxide emissions, and increased U.S. imports through greater exports of U.S. equipment and services. The agreement was pending approval by the Department of State, Department of Commerce, and Department of Energy of the United States.

PRODUCTION

The Chilean mining industry experienced another year of continued growth in 1990 as a result of Chile's mining sector attractiveness to domestic and foreign investors and the realization of several large projects such as La Escondida, La Coipa, Marte, La Pepa, and other projects such as Los Pelambres and Lince, which are in a construction phase, and still others that were in an advanced stage of development such as Quebrada Blanca and La Candelaria. Review of the production statistics for 1990 shows the effective contribution of the medium-sale mining sector in comparison with the large-scale mining sector, which was handled entirely by CODELCO-Chile. CODELCO-Chile's copper production maintained the leadership with another record high output or 74% of the total copper produced in the nation. The small- and medium-size mining sectors produced the remaining 26% of the copper.

The leading minerals produced in Chile were coal, copper, crude oil, gold, iodine, iron ore, lead, lithium carbonate, manganese, molybdenum, natural gas, petroleum products, silver, sodium and potassium nitrates, sodium sulfate, and zinc.

Output of copper, crude oil, iodine, iron ore, lead, manganese, molybdenum, natural gas, and potassium nitrate showed decreases, while production of gold, lithium carbonate, petroleum products, silver, sodium nitrate, sodium sulfate, and zinc showed increases compared with those of 1989. The production of fine copper decreased slightly, 0.7% to 1.6 Mmt, still another record high. Molybdenum, metal doré, and sulfuric acid were produced as by-products of copper. CODELCO-Chile accounted for all of the output of molybdenum in the form of molybdenum trioxide and concentrate. In addition, CODELCO-Chile produced sulfuric acid.

TRADE

Total exports amounted to \$8.31 billion and total imports \$7.04 billion in 1990 to yield a \$1.27 billion trade surplus, down 19.3% from a \$1.58 billion surplus in 1989. In 1990, total exports increased 2.8% and imports decreased 8.2% compared with those of 1989.

In 1990, Chile's main export was copper, \$3.86 billion (46.5% of the total exports). Other industrial and raw material exports were \$2.4 billion (28.8%), other minerals, \$719.8 million (8.6%), fresh fruit, \$703.8 million (8.5%); fish meal, \$379.7 million (4.5%); and cellulose, \$314.2 million (3.8%).

On the import side, capital goods grew 17.3% to \$2.12 billion; intermediate goods grew 5.7%, and consumer goods fell 0.9%.

Mineral exports from Chile totaled \$4.7 billion or 55.1% of the total of all exports for 1990. Besides copper, Chile's main minerals exports were gold, iodine, iron ore, lithium carbonate, molybdenum, silver, and zinc. CODELCO-Chile shipped about 1.22 Mmt of fine copper, with the remainder sold by small and medium producers. Sales of fine copper plus byproducts by CODELCO-Chile amounted to \$3.3 billion, which represents a decrease of \$250 million compared with that of 1989. Based on a pretax profit of \$1.5 billion, the net profit for 1990 amounted to \$621.4 million, decreasing by \$135.2 million the total earnings achieved in 1989. The unfavorable effects of decreased production and sales were largely owing to a decrease in the price of copper. The United States was Chile's principal trading partner, accounting for about 17% of Chile's total imports and 19% of Chile's total exports. According to official U.S. Department of Commerce data in 1990, U.S. exports to Chile amounted to \$1.37 billion while U.S. imports from Chile totaled \$1.47 billion.

Chile was one of the first Latin American countries to sign a bilateral framework agreement on trade and investment with the United States, doing so in September 1990. The U.S. Trade Representative formally recommended that the United States reinstate Chile as a beneficiary country under the U.S. Generalized System of Preference (GSP). Chile was suspended from the program in February 1988 because of a determination that it did not meet the worker rights eligibility standard. A review of changes in Chile's labor practices initiated last April found that Chile had "substantially overcome" the problem that had caused its suspension. Chile resumed being a beneficiary of the GSP program. The GSP qualified Chile for trade valued at \$300 million for duty-free status, of which about \$100 million covered copper products.

STRUCTURE OF THE MINERAL INDUSTRY

The Chilean Government exercised dominant control over the mineral industry through three large mining enterprises: CODELCO-Chile, Empresa Nacional de Minería (ENAMI), and Corporación de Fomento de la Producción (CORFO), which includes Cía. de Acero del Pacífico S.A. de Inversiones (CAP), Empresa Nacional del Petróleo S.A. (ENAP), Empresa Nacional del Carbón S.A. (ENACAR), Cía. Chilena

TABLE 1
CHILE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989	1990 ^P
METALS					
Arsenic trioxide	°4,000	3,616	3,207	°3,400	°3,400
Copper:					
Mine output, Cu content ³	'1,398,781	1,412,936	1,472,041	'1,628,269	1,616,261
Metal:					
Smelter, primary ⁴	1,123,900	1,106,900	1,189,400	°1,266,600	1,328,500
Refined: ⁵					
Fire, primary refined ^c	185,100	180,300	'188,400	'199,000	221,600
Electrolytic	757,200	790,000	'824,300	'872,000	970,000
Total	942,300	970,300	1,012,700	1,071,000	1,191,600
Gold, mine output, Au content kilograms	17,947	17,035	20,614	'22,559	27,503
Iron and steel:					
Iron ore and concentrate:					
Gross weight thousand tons	6,981	6,637	7,710	'9,030	8,248
Fe content ^c do.	°4,197	4,380	5,089	'5,478	5,035
Metal:					
Pig iron do.	591	617	776	679	675
Ferroalloys:					
Ferromanganese	6,277	6,613	'6,935	'7,492	6,956
Ferrosilicomanganese	1,706	1,231	683	'180	°200
Ferrosilicon	3,732	'4,655	5,686	'6,370	°5,800
Ferromolybdenum	1,397	1,325	1,191	'2,990	°3,000
Other	247	'475	'2,212	'2,840	°2,500
Total	13,359	14,299	'16,707	'19,872	18,456
Steel, crude ⁷ thousand tons	706	726	'909	'800	772
Semimanufactures (hot-rolled) do.	481	502	'664	'643	516
Lead, mine output, Pb content	1,501	829	1,359	1,241	1,120
Manganese ore and concentrate:					
Gross weight	31,631	31,803	43,655	'43,806	39,697
Mn content	10,967	10,821	14,511	'13,865	12,350
Molybdenum, mine output, Mo content	16,581	16,941	'15,515	'16,550	13,830
Rhenium, mine output, Re content kilograms	8,441	6,564	°6,940	°6,800	°6,800
Selenium do.	47,000	45,909	47,051	°47,000	°47,000
Silver do.	500,077	499,761	506,501	'545,412	633,075
Zinc, mine output, Zn content	10,504	19,618	19,182	18,370	25,146
INDUSTRIAL MINERALS					
Barite	53,121	'2,109	43,135	'59,873	3,038
Bentonite	—	—	529	2,005	1,262
Borates, crude, natural (ulexite)	6,440	13,438	32,122	'130,512	131,763
Cement, hydraulic thousand tons	1,434	1,594	1,833	'1,700	°1,800
Calcite (chalk) do.	2,757	3,017	3,647	'3,745	1,346
Clays:					
Cimita	220	82	1,488	'1,405	2,969
Kaolin	42,170	44,533	54,464	'58,512	32,416
Other (unspecified)	14,215	15,893	18,769	'20,100	18,563
Diatomite	2,684	3,218	2,919	3,315	3,877
Feldspar	2,275	705	4,569	'8,081	2,980
Gypsum:					
Crude	'192,848	235,173	315,904	'277,276	253,744
Calcined	60,452	92,441	92,135	'104,300	105,786

See footnotes at end of table.

TABLE 1—Continued

CHILE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989	1990 ^P
INDUSTRIAL MINERALS—Continued					
Iodine, elemental	3,076	3,181	³ 6,600	⁴ 4,200	4,100
Lapis lazuli ^e kilograms	8,000	8,000	8,000	8,000	8,000
Lime, hydraulic ^e thousand tons	⁹ 900	¹ 1,000	¹ 1,200	¹ 1,300	1,300
Lithium carbonate	<u>4,458</u>	<u>6,139</u>	<u>7,332</u>	<u>7,508</u>	<u>9,082</u>
Nitrogen: Natural crude nitrates:					
Sodium	⁷ 69,600	⁵ 76,960	546,560	⁵ 28,020	⁵ 50,000
Potassium (KNO ₃)	¹ 1400	¹ 149,200	² 76,230	² 66,850	² 50,000
Total	<u>⁷70,000</u>	<u>⁷26,160</u>	<u>⁸22,790</u>	<u>⁷94,870</u>	<u>⁸00,000</u>
Phosphates:					
Guano	7,546	5,685	4,052	³ 1,127	1,452
Rock (apatite)	6,684	10,389	9,161	¹ 4,354	13,986
Total	<u>14,230</u>	<u>16,074</u>	<u>13,213</u>	<u>¹7,481</u>	<u>15,438</u>
Pigments, mineral, natural: Iron oxide					
Potash, K ₂ O equivalent	4,404	8,145	8,542	23,653	15,557
Pumice (includes pozzolan)	20,000	23,110	25,343	² 5,000	² 5,000
Quartz, common	222,080	242,453	277,179	² 99,834	305,147
Quartz, common	293,218	350,488	495,484	⁴ 77,497	541,714
Salt, all types	1,032,373	865,168	1,043,397	⁹ 03,932	1,834,971
Sodium compounds, n.e.s.: Sulfate ⁸	58,700	60,406	62,879	⁶ 6,490	⁷ 3,000
Sand and gravel (silica sand) ^e thousand tons	300	300	300	300	300
Stone:					
Limestone (calcium carbonate) do.	2,757	3,017	3,647	³ 746	3,776
Marble	—	—	2,022	<u>1,115</u>	<u>1,347</u>
Sulfur:					
Native, other than Frasch:					
Refined	13,297	14,917	16,924	¹ 5,463	28,235
Caliche	43,826	22,131	20,725	² 0,000	347
Byproduct, (from smelters and oil refining)	41,142	<u>335,116</u>	<u>416,266</u>	<u>⁴00,000</u>	<u>⁴00,000</u>
Total	<u>98,265</u>	<u>372,164</u>	<u>453,915</u>	<u>¹435,463</u>	<u>⁴28,582</u>
Talc	2,257	980	1,070	835	898
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous and lignite thousand tons	1,441	1,736	2,470	² 404	2,695
Coke: Coke oven do.	294	297	287	³ 00	³ 00
Gas, natural:					
Gross million cubic meters	4,357	4,353	4,279	⁴ 236	4,198
Marketed do.	<u>1,199</u>	<u>1,145</u>	<u>⁷990</u>	<u>¹962</u>	<u>2,121</u>
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	893	⁶ 26	⁷ 06	⁶ 98	695
Liquefied petroleum gas do.	2,716	<u>2,761</u>	<u>2,657</u>	<u>²520</u>	<u>2,154</u>
Total do.	<u>3,609</u>	<u>³387</u>	<u>³363</u>	<u>³218</u>	<u>2,849</u>
Petroleum:					
Crude do.	<u>12,204</u>	<u>10,922</u>	<u>8,934</u>	<u>⁸063</u>	<u>7,157</u>
Refinery products:					
Liquefied petroleum gas do.	5,044	2,560	2,422	² 849	2,774
Gasoline:					
Aviation do.	82	69	69	¹ 26	126
Motor do.	7,793	8,586	9,642	¹ 2,416	12,309
Jet fuel do.	1,372	1,453	1,157	¹ 705	1,767
Kerosene do.	969	1,069	1,434	¹ 648	1,365

See footnotes at end of table.

TABLE 1—Continued

CHILE: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989	1990 ³
MINERAL FUELS AND RELATED MATERIALS—Continued					
Petroleum—Continued					
Refinery products—Continued					
Distillate fuel oil thousand 42-gallon barrels	9,661	9,554	11,454	¹ 13,259	14,410
Residual fuel oil do.	5,642	6,114	6,925	¹ 8,586	9,246
Unspecified do.	1,566	1,679	2,743	¹ 1,836	1,973
Total do.	32,129	31,084	35,846	¹ 42,425	43,970

⁴Estimated. ⁵Preliminary. ⁶Revised.¹Table includes data available through Apr. 1992.²In addition to the commodities listed, pyrite is also produced, but available information is inadequate to make reliable estimates of output levels.³Figures are the nonduplicate copper content of ore, concentrates, cemented copper, slags and minerals, copper as a byproduct of gold and silver precipitate, and other copper-bearing products measured at the last stage of processing as reported in available sources.⁴Figures are total blister, fire-refined, electrolytic, and equivalent copper output, including that blister subsequently refined in Chile and copper produced by electrowinning. Detailed statistics on electrowinning are not available; although based on current plant capacities, electrowon copper production is estimated to be approximately 55 metric tons per year.⁵Figures are total refined copper distributed into two classes according to method of refining, fire-refined and electrolytic, which includes electrowon copper refined in Chile.⁶Reported figure.⁷Excludes castings.⁸Includes natural sodium sulfate and anhydrous sodium sulfate, coproducts of the nitrate industry.

TABLE 2

CHILE: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Destinations, 1988	
		United States	Other (principal)
METALS			
Aluminum: Metal including alloys:			
Scrap	370	57	Japan 237; Peru 36.
Semimanufactures	3,410	2	Bolivia 3,352; Uruguay 27; Peru 11.
Chromium: Oxides value, thousands	\$1	—	All to Iraq.
Copper:			
Ore and concentrate ²	810,821	74,103	Brazil 253,471; Japan 209,651; Spain 85,746.
Metal including alloys:			
Scrap	140,616	56,241	West Germany 18,635; United Kingdom 14,013.
Unwrought	986,634	132,269	Italy 146,093; West Germany 141,004.
Semimanufactures	20,176	4,681	Colombia 6,735; Uruguay 2,666.
Gold: Metal including alloys, unwrought and partly wrought kilograms	31,676	9,884	United Kingdom 12,937; West Germany 6,818.
Iron and steel:			
Iron ore and concentrate thousand tons	6,582	138	Japan 5,021; West Germany 847; France 255.
Metal:			
Scrap	12,587	—	Peru 12,564; Brazil 23.
Pig iron, cast iron, related materials	6	—	All to Iraq.
Ferroalloys:			
Ferromanganese	504	—	Ecuador 370; Peru 134.
Unspecified	7,565	1,665	Colombia 2,271; Belgium-Luxembourg 746.
Steel, primary forms	54,299	2,073	Ecuador 22,955; Costa Rica 18,486; Bolivia 4,831.
Semimanufactures:			
Bars, rods, angles, shapes, sections	10,041	998	Ecuador 6,773; El Salvador 2,143.
Universals, plates, sheets	4,506	—	Ecuador 2,896; Costa Rica 1,448; Bolivia 118.
Hoop and strip	83	—	Bolivia 36; Argentina 23; Costa Rica 13.

See footnotes at end of table.

TABLE 2—Continued

CHILE: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Destinations, 1988		
		United States	Other (principal)	
METALS—Continued				
Iron and steel: Metal—Continued				
Semimanufactures—Continued				
Wire	2,143	1,894	Bolivia 150; Panama 43.	
Tubes, pipes, fittings	19,017	18,952	Peru 19; Australia 18.	
Castings and forgings, rough	431	21	Canada 225; Argentina 91; Dominican Republic 50.	
Lead:				
Ore and concentrate	33,579	—	Japan 30,629; Belgium-Luxembourg 2,950.	
Metal including alloys, scrap	94	54	Argentina 40.	
Molybdenum: Ore and concentrate, Mo content	1,255	—	Netherlands 1,021; United Kingdom 234.	
Nickel: Ore and concentrate	5,693	—	All to West Germany.	
Silver: Metal including alloys, unwrought and partly wrought	value, thousands	\$83,315	\$22,580	United Kingdom \$15,340; France \$12,984.
Tin: Metal including alloys, semi-manufactures	1	—	All to Ecuador.	
Titanium: Oxides	2	—	All to Peru.	
Tungsten: Ore and concentrate	26,712	1,458	Japan 7,856; United Kingdom 5,715; Brazil 3,825.	
Zinc: Metal including alloys, semi-manufactures	6	—	Peru 5; Guatemala 1.	
Other:				
Ores and concentrates ³	107,513	—	Finland 41,202; Japan 35,667; West Germany 12,287.	
Ashes and residues	98	—	Mainly to Japan.	
Base metals including alloys, all forms	5	5		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	243	—	All to Spain.	
Grinding and polishing wheels and stones	1	1		
Barite and witherite	25,076	25,076		
Boron materials:				
Crude natural borates	11,926	—	Brazil 5,845; Colombia 4,000; Philippines 1,900.	
Oxides and acids	5,603	910	Netherlands 1,818; Italy 1,666.	
Bromine, fluorine, and iodine	4,320	905	Netherlands 2,947; Brazil 175.	
Cement	34,427	—	France 7,600; unspecified 26,827.	
Chalk	85	—	All to Ecuador.	
Clays, crude	6	—	All to Venezuela.	
Diamond, natural: Gem, not set or strung	value, thousands	\$92	\$18	Japan \$41; Italy \$17.
Diatomite and other infusorial earth	732	—	Argentina 533; Peru 129; Colombia 34.	
Fertilizer materials:				
Crude, n.e.s.	98	18	Italy 80.	
Manufactured:				
Nitrogenous	2,181	—	Argentina 969; Ecuador 426; Bolivia 425.	
Unspecified and mixed	113,504	26,222	Brazil 71,950; Belgium-Luxembourg 4,000; Italy 4,000.	
Gypsum and plaster	33	—	France 14; unspecified 19.	
Nitrates, crude	311,620	129,889	Belgium-Luxembourg 85,198; Japan 20,305.	
Phosphates, crude	430	—	Paraguay 151; Bolivia 148; Ecuador 111.	
Pigments, mineral: Iron oxides and hydroxides, processed	18	—	All to Colombia.	
Potassium salts, crude	20,795	—	All to China.	

See footnotes at end of table.

TABLE 2—Continued

CHILE: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Destinations, 1988	
		United States	Other (principal)
INDUSTRIAL MINERALS—Continued			
Salt and brine	493,413	357,320	Uruguay 51,860; Brazil 47,542.
Sodium compounds, n.e.s.:			
Soda ash, natural and manufactured	301	—	Bolivia 199; Paraguay 2.
Sulfate, natural and manufactured	32,722	—	Brazil 22,028; Venezuela 6,000; Colombia 1,706.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	21	—	NA.
Worked	35	29	Sweden 2; Costa Rica 1.
Limestone other than dimension	13	—	All to Ecuador.
Quartz and quartzite	3	—	All to United Kingdom.
Sulfur:			
Elemental: Crude including native and byproduct	250	—	Brazil 122; Argentina 105; Ecuador 20.
Sulfuric acid	554	—	All to Bolivia.
Talc, steatite, soapstone, pyrophyllite	6	—	All to Ecuador.
Other:			
Crude	101	—	Uruguay 76; Argentina 25.
Slag and dross, not metal-bearing	41,675	5,646	Philippines 36,029.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural value, thousands	\$1	—	All to Bolivia.
Coal: Anthracite	106	—	Do.
Petroleum refinery products:			
Liquefied petroleum gas 42-gallon barrels	116	—	All to Republic of Korea.
Gasoline do.	12,886	—	Panama 12,860; Bolivia 26.
Mineral jelly and wax do.	87	—	All to Bolivia.
Kerosene and jet fuel do.	42,424	—	Sweden 39,975; Bolivia 2,449.
Distillate fuel oil do.	1,195,980	497,821	Netherlands Antilles 215,549; Uruguay 204,068.
Lubricants do.	49	—	All to Bolivia.
Residual fuel oil do.	10,789	—	Uruguay 6,660; Paraguay 2,224; Bolivia 1,465.
Bitumen and other residues do.	24	—	All to Bolivia.
Bituminous mixtures do.	12	—	Do.

NA Not available.

¹Table prepared by H. D. Willis. Export data for 1987 and 1989 were not available at time of publication.²Copper content 224.2 thousand metric tons. Complete breakdown available in table 2 of the Chile section, 1989 Minerals Yearbook, Volume III.³May include oxides and hydroxides.

de Electricidad S.A. (CHILECTRA), Sociedad Química y Minera de Chile S.A. (SOQUIMICH), and others.

CODELCO-Chile, the largest copper producer and exporter not only in Chile, but also in the world, is composed of four divisions, Chuquicamata, El Teniente, Andina, and El Salvador, which had a total production of 1.2 Mmt of fine copper in 1990. CODELCO-Chile was also a producer of molybdenum (trioxide, concentrate), metal doré, and silver and gold (42% and 7% of the total, silver and gold produced respectively). CODELCO-Chile is also a signifi-

cant producer of sulfuric acid and ammonium perchlorate (rhenium). ENAMI, the second largest state-owned company, was created in the early 1960's to promote the development and processing of Chile's small- and medium-size mines output and the operation of two industrial smelters, a sulfuric acid plant, a heap-leaching plant, and an oxygen plant. CORFO was created in early 1939 to develop economic programs to promote manufacturing activities by exploiting natural resources. These objectives led to the birth of other major enterprises such as ENAP, CAP, ENDESA, and

ENACAR. In time, CORFO became the state's most important corporation, exercising significant control of the national economy. This situation has gradually changed to obtain greater efficiency and decentralization of the decisionmaking process in accordance with open-economy policies based on initiatives of the private sector and the Government.

During the past several years, CORFO has privatized a growing number of state mining and energy companies. They included CAP and SOQUIMICH and Chile's private electronic companies. In 1989,

TABLE 3
CHILE: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
METALS			
Aluminum:			
Oxides and hydroxides	2,072	513	United Kingdom 1,172; West Germany 266.
Metal including alloys:			
Scrap	21	21	
Unwrought	3,764	—	Argentina 3,139; Canada 478; Venezuela 125.
Semimanufactures	4,339	378	West Germany 1,380; Brazil 1,230; Argentina 700.
Chromium: Oxides and hydroxides	181	6	Argentina 121; West Germany 45.
Cobalt: Oxides and hydroxides	17	11	United Kingdom 5; West Germany 1.
Copper:			
Ore and concentrate	3,339	40	Guyana 3,261; China 38.
Matte and speiss including cement copper	4	4	
Metal including alloys:			
Unwrought	16	1	United Kingdom 14; Spain 1.
Semimanufactures	395	46	Brazil 136; Republic of Korea 68.
Gold: Metal including alloys, unwrought and partly wrought	kilograms 3	3	
Iron and steel:			
Iron ore and concentrate	value, thousands \$6	\$2	Japan \$3.
Metal:			
Scrap	120	(?)	NA.
Pig iron, cast iron, related materials	945	71	West Germany 332; Argentina 313; Brazil 178.
Ferrous alloys:			
Ferromanganese	332	42	Republic of South Africa 116; Norway 72; United Kingdom 51.
Ferrosilicon	2	—	All from France.
Unspecified	816	83	West Germany 199; Zimbabwe 192; Turkey 103.
Steel, primary forms	30,302	720	Republic of South Africa 10,103; Brazil 9,708; West Germany 2,614.
Semimanufactures:			
Bars, rods, angles, shapes, sections	81,891	290	Brazil 26,300; Argentina 25,799; Republic of South Africa 16,107.
Universals, plates, sheets	47,436	181	Republic of South Africa 14,249; Brazil 8,374; United Kingdom 5,994.
Hoop and strip	3,444	1,139	Brazil 1,211; Canada 546.
Rails and accessories	2,772	1,634	United Kingdom 410; Belgium-Luxembourg 388.
Wire	2,285	38	Argentina 787; Sweden 313; Japan 285.
Tubes, pipes, fittings	26,154	8,417	Brazil 5,203; Argentina 4,296.
Castings and forgings, rough	3,006	139	Brazil 1,310; Belgium-Luxembourg 459; West Germany 445.
Lead:			
Ore and concentrate	3	—	All from Bolivia.
Oxides	229	4	Peru 201; Republic of South Africa 21.
Metal including alloys:			
Unwrought	2,735	148	Peru 2,336; Mexico 246.
Semimanufactures	107	1	United Kingdom 70; West Germany 35.
Magnesium: Metal including alloys:			
Unwrought	1	1	
Semimanufactures	11	1	West Germany 7; Brazil 2.

See footnotes at end of table.

TABLE 3—Continued

CHILE: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
METALS—Continued			
Manganese:			
Ore and concentrate, metallurgical-grade	9,411	373	Turkey 4,020; Philippines 3,631; France 1,000.
Oxides	53	39	Belgium-Luxembourg 12; Netherlands 2.
Mercury	26	1	Algeria 14; China 5; United Kingdom 3.
Molybdenum: Metal including alloys, semimanufactures	2	2	
Nickel: Metal including alloys, semimanufactures	127	10	Canada 54; Norway 25; Netherlands 12.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, unspecified value, thousands	\$37	\$18	West Germany \$11; United Kingdom \$8.
Silver: Metal including alloys, unwrought and partly wrought do.	\$236	\$54	West Germany \$149; Italy \$18.
Tin: Metal including alloys:			
Unwrought	392	8	Bolivia 203; Brazil 128; Indonesia 30.
Semimanufactures	19	—	Bolivia 15; Brazil 1; West Germany 1.
Titanium: Oxides	154	7	United Kingdom 116; Belgium-Luxembourg 16.
Tungsten: Metal including alloys, semimanufactures value, thousands	\$2	\$2	
Zinc:			
Ore and concentrate	1	—	All from Bolivia.
Oxides	215	2	Peru 171; Argentina 23; Netherlands 10.
Metal including alloys:			
Unwrought	9,263	—	Peru 8,077; France 521; Belgium-Luxembourg 399.
Semimanufactures	488	(?)	Peru 317; United Kingdom 82; Republic of South Africa 58.
Other:			
Ores and concentrates	237	26	Republic of South Africa 126; Australia 85.
Oxides and hydroxides	344	279	United Kingdom 12; Norway 7.
Base metals including alloys, all forms	128	11	Republic of South Africa 60; Sweden 23; China 11.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc.	81	14	West Germany 60; Peru 5.
Artificial: Corundum	246	2	Brazil 195; China 37; Canada 11.
Dust and powder of precious and semi-precious stones excluding diamond value, thousands	\$12	\$8	Belgium-Luxembourg \$2; West Germany \$2.
Grinding and polishing wheels and stones	924	37	Brazil 280; Switzerland 219; West Germany 118.
Asbestos, crude	10,602	474	Canada 8,327; Italy 819; Peru 636.
Barite and witherite	3	—	All from Canada.
Boron materials: Oxides and acids	16	(?)	West Germany 9; France 4; Belgium-Luxembourg 2.
Bromine, fluorine and iodine	1	(?)	Mainly from West Germany.
Cement	22,053	18	Argentina 18,860; France 1,535; Peru 1,157.
Clays, crude	9,219	6,230	Argentina 2,717; Spain 99.
Diamond, natural: Gem, not set or strung value, thousands	\$675	\$428	United Kingdom \$209; Ireland \$18.
Diatomite and other infusorial earth	162	115	Mexico 46.
Feldspar, fluorspar, related materials	3,651	12	Mexico 3,139; Argentina 356; Republic of South Africa 100.

See footnotes at end of table.

TABLE 3—Continued

CHILE: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
INDUSTRIAL MINERALS—Continued			
Fertilizer materials: Manufactured:			
Ammonia	26,591	1	Trinidad and Tobago 16,170; Colombia 10,400; Argentina 15.
Nitrogenous	202,594	141,248	Venezuela 25,072; Trinidad and Tobago 15,810.
Phosphatic	205,354	205,344	West Germany 10.
Potassic	34,300	34,300	
Unspecified and mixed	84,886	84,103	Netherlands 413; Belgium-Luxembourg 282.
Graphite, natural	150	8	Canada 53; West Germany 30; Peru 26.
Gypsum and plaster	16	12	Argentina 2; Italy 2.
Lime	7,500	1	Argentina 7,499.
Magnesium compounds: Magnesite, crude	9,857	888	Brazil 8,413; Austria 369.
Mica:			
Crude including splittings and waste	20	9	Argentina 7; Brazil 4.
Worked including agglomerated splittings	8	1	India 5; France 1.
Nitrates, crude	1,818	—	Mexico 2; unspecified 1,816.
Phosphates, crude	18,276	18,256	Peru 20.
Pigments, mineral: Iron oxides and hydroxides, processed			
	137	7	West Germany 86; Brazil 30; Argentina 10.
Potassium salts, crude	143,917	3,492	Canada 140,411; West Germany 13.
Salt and brine	117	15	West Germany 60; Netherlands 41.
Sodium compounds, n.e.s.:			
Soda ash, natural and manufactured	56,432	40,743	Belgium-Luxembourg 13,468; Poland 978.
Sulfate, natural and manufactured	19	3	United Kingdom 11; West Germany 5.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	376	—	Italy 245; Argentina 130.
Worked	786	3	Italy 599; Spain 136; Argentina 28.
Dolomite, chiefly refractory-grade	15,201	14,832	Argentina 327; Spain 42.
Gravel and crushed rock	5	—	Mainly from France.
Quartz and quartzite	2	—	Mainly from West Germany.
Sand other than metal-bearing	321	318	Italy 2; West Germany 1.
Sulfur:			
Elemental:			
Crude including native and byproduct	69,540	1,629	Canada 47,070; Bolivia 20,830.
Colloidal, precipitated, sublimed	94	92	West Germany 2.
Sulfuric acid	72,328	28,067	Peru 12,175; Spain 11,527.
Talc, steatite, soapstone, pyrophyllite	1,037	546	Italy 187; Spain 81.
Other:			
Crude	1,339	862	Mexico 241; Argentina 114.
Slag and dross, not metal-bearing	73	(²)	United Kingdom 42; Argentina 30; Belgium-Luxembourg 1.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	449	10	Argentina 400; Trinidad and Tobago 36.
Carbon: Carbon black	7,835	379	Venezuela 5,406; Argentina 1,157; Colombia 811.
Coal:			
Anthracite	417,450	50,740	Australia 210,781; Canada 155,929.
All grades including briquets	109	109	
Coke and semicoke	132,440	—	Japan 92,184; West Germany 21,819; Colombia 11,754.

See footnotes at end of table.

TABLE 3—Continued

CHILE: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988		
		United States	Other (principal)	
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum:				
Crude	thousand 42-gallon barrels	29,018	—	Venezuela 6,997; Nigeria 5,915; Colombia 5,291.
Refinery products:				
Liquefied petroleum gas	42-gallon barrels	854,027	12	Venezuela 853,899; Brazil 104.
Gasoline	do.	248,294	144,304	Argentina 41,828; Venezuela 37,944.
Mineral jelly and wax	do.	68,878	2,330	Argentina 29,906; West Germany 17,361; Brazil 13,615.
Kerosene and jet fuel	do.	1,502,717	457,289	Venezuela 744,868; Netherlands Antilles 275,404.
Distillate fuel oil	do.	2,290	2,290	
Lubricants	do.	15,148	7,441	Belgium-Luxembourg 3,724; West Germany 2,366.
Residual fuel oil	do.	589,663	177,349	Venezuela 145,441; Netherlands Antilles 106,580.
Bitumen and other residues	do.	27,409	442	Argentina 26,967.
Bituminous mixtures	do.	67	30	Brazil 30; West Germany 6.
Petroleum coke	do.	14,372	1,314	Argentina 13,030; Brazil 28.

NA Not available.

¹Table prepared by H. D. Willis. Import data for 1987 and 1989 were not available at time of publication.²Less than 1/2 unit.

CORFO privatized ENACAR, Carbonífera Schwagar, Sociedad Chilena del Litio, and ENDESA. Since it was created in 1950, ENAP's principal activity has been the exploitation and production of hydrocarbons in Chile and/or abroad. These activities are closed to private enterprises except for the right to enter into "risk contracts" with private investors (including foreign investors) for the exploration and exploitation of designated areas.

CAP, the state-owned steel company, is now 100% privately owned; its primary function remained the making and marketing of steel, but it also operated a number of iron ore mines. The pelletizing is done through its subsidiaries, Cía. Minera del Pacífico S.A. (CMP); Manganesos Atacama S.A., the only manganese producer in Chile; and Cía. Siderúrgica de Huachipato S.A. (CSH).

The total labor force, including staff and office personnel, working directly in the mineral sector numbered 76,843 which represented about 1.6% of the total labor force (4,732,000) in the country. Approximately 5.6% of the total labor force was unemployed during the year. The metals sector's labor force was 59,746, 77.8% of which 46,248 was copper workers. The industrial minerals sector labor force was 3,594, and the mineral fuels sector was 13,503, 85.4% of which was coal miners.

CODELCO-Chile employed about 25,674 copper workers in 1990, or about 43% of the total metals sector employees.

COMMODITY REVIEW

Metals

Copper.—Chile's copper production in 1990 reinforced its position as the world's largest producer and exporter of copper. According to official statistical figures released by the Ministry of Mines through its agency Servicio Nacional de Geología y Minería (SERNAGEOMIN), Chile produced another historical record of 1.6 Mmt of copper in 1990. Although this was 1.5% below that of the previous year. The small decline in copper output was due to a decrease in CODELCO-Chile (3.8%) production because of some difficulties encountered at the El Teniente Mine.

CODELCO's copper production declined 3.8% in 1990 compared with that of 1989. On the other hand, the production of copper by the medium and small mining sectors increased by 5% and 12%, respectively. The largest amount of copper produced was contributed by the expansion of Carolina de Michilla and others, and the shipment of 10,500 tons of fine copper in late December by Minera Escondida.

CODELCO-Chile invested \$330 million in 1990 to overcome the declining ore grade at its four mines, to fund improvements in evaluation processes, and for allocation of resources for various projects. The 1990 investment was about \$80 million less than that in 1989. CODELCO-Chile's contribution to the Chilean Treasury decreased in 1990 to \$1.5 million. This contribution, in absolute as well as in relative terms, still accounted for a considerable portion of Chile's fiscal income. The company expected to consolidate the production increments defined in the eighties through major investments being made in mining development, equipment, facilities, and transportation systems in order to solve the technical and operational problems in some of the CODELCO's divisions. High priority has been given to solving the rock mechanics problems affecting the El Teniente mine. CODELCO-Chile was studying the development of an alternative project, an open pit mining operation of an ore body near the surface, which should compensate for production losses arising from these problems. The company made public the existence of a copper porphyry ore deposit, with high molybdenum content, between Chuquicamata and the city of Calama. The future mine, named Mina Nueva, will be exploited by Chuquicamata Div. CODELCO-Chile, in line with the goals and

TABLE 4

CHILE: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons per year unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity	
Coal	Empresa Nacional del Carbón S.A. (ENACAR)	Moneda 1025, 6to. Piso Santiago, Chile	1,500.	
Do.	Cía. de Carbones de Chile Ltda. (COCAR)	Ahumada 174, Piso 12 Santiago, Chile	1,500.	
Copper	Corporación Nacional del Cobre de Chile (CODELCO-Chile)	Huérfanos 1270 Santiago, Chile	1,195.	
	Chuquicamata Div. of CODELCO	Antofagasta, Province Region II	680.	
	El Teniente Div. of CODELCO	Rancagua Province Region VI	300.	
	Andina Div. of CODELCO	Santiago Province Region V	120.	
	El Salvador Div. of CODELCO	Copiapó Province Region III	95.	
Do.	Empresa Nacional de Minería (ENAMI)	MacIver 459 Santiago, Chile	290.	
Do.	Cía. Minera Disputada de Las Condes, S.A.	Pedro de Valdivia 291 Santiago, Chile	200.	
Do.	Cía. Minera Mantos Blancos S.A.	Pedro Valdivia 295 Santiago, Chile	100.	
Gold	kilograms per year	Cía. Minera San José Ltda. El Indio Mine	Las Urbanas Santiago, Chile	15,000.
Do.	do.	ENAMI	MacIver 459	5,000.
Do.		CODELCO-Chile (byproduct from copper) Santiago, Chile	Huérfanos 1270	2,000.
Iodine	metric tons per year	Sociedad Química y Minera de Chile (SOQUIMICH)	Moneda 970 Santiago, Chile	6,000.
Potassium nitrate	do.	do.	do.	270.
Sodium nitrate	do.	do.	do.	675,000.
Sodium sulfate	do.	do.	do.	65,000.
Iron ore		Cía. Minera del Pacífico S.A. La Serena, Chile	Pedro Pablo Muñoz 675	7,900.
Iron ore pellets		do.	do.	4,400.
Lead and zinc		Sociedad Contractual Minera El Toqui Ltda.	Estado 10, Piso 16, Ofic. 1601 Santiago, Chile	5 (lead). 15 (zinc).
Lithium carbonate		Sociedad Chilena de Litio Ltda. (SCL)	Huérfanos 669, Ofic. 505 Santiago, Chile	9.
Manganese		Manganesos Atacama S.A.	Agustinas 1022, Ofic. 920 Santiago, Chile	44.
Molybdenum		CODELCO-Chile (byproduct from copper)	Huérfanos 1270 Santiago, Chile	20.
Natural gas	billion cubic meters per year	ENAP	Ahumada 341 Santiago, Chile	4.2.
Petroleum	million barrels per year	do.	Ahumada 341 Santiago, Chile	8.
Silver	kilograms per year	CODELCO-Chile byproduct from copper Santiago, Chile	Huérfanos 1270	275,000.
Do.		Cía. Minera San José Ltda. El Indio Mine	Las Urbanas 53, Piso 11 Santiago, Chile	57,000.
Steel		Cía. Siderúrgica Huachipato S.A.	Huérfanos 669 Santiago, Chile	900.

policies set out by the Chilean Government concerning environmental impact of its mining operations, has taken a variety of measures and was to allocate considerable resources to control pollution at the smelter facilities, especially at Chuquicamata and El Teniente. In 1990, a new sulfuric acid plant started operations at Chuquicamata.

CODELCO-Chile, in order to increase its competitive position as well as its influence within the mining industry, was evaluating the possibility of selectively increasing its participation in business and in international integration projects in the semifinished copper products manufacturing industry. CODELCO-Chile was most interested in

associating with other large companies in the industry, either domestic or foreign. CODELCO-Chile, was incorporated on April 1, 1976, as a state-owned legal entity engaged in mining, industrial, and business operation, with its own equity. At present, the company's organizational structure comprises its headquarters and five divi-

sions, namely Chuquicamata, Tocopilla, Salvador, Andina, and El Teniente. Chuquicamata Div. reached a new record in copper production of 680,740 tons of fine copper or 57% of the total copper produced by CODELCO-Chile. CODELCO's other three mines' output was as follows: El Teniente, 300,472 tons; El Salvador, 95,059 tons; and Andina, 119,051 tons.

The fifth Div. of CODELCO, the Tocopilla powerplant, produced all the power required for Chuquicamata's operation plus a surplus for the national grid (2,404,375 MWh, an increase of 14.6% over that of 1989). Sulfuric acid production in 1990 was 516,624 tons (about 1,476 mt/d), compared with 424,624 tons in the prior year.

In the future, CODELCO-Chile will devote resources to upgrading the existing facilities and was not expected to increase future copper output beyond 1,200,000 mt/a. Additional copper production will be contributed by the private sector. For the next 5 years, this production will be mainly from the Australian firm Broken Hill Proprietary Co. Ltd.'s (BHP) large La Escondida Mine, which was inaugurated in November 1990 with an investment of less than \$1 billion. La Escondida Mine is owned by BHP, Australia (57.5%), RTZ Corp. PLC United Kingdom (30%), IFC (2.5%), and a Japanese consortium led by Mitsubishi (10%). Planned output was 320,000 mt/a of copper concentrate, though 1990 was planned as a shakedown year in which output would be lower by about 10%. La Escondida, when completed, will be the second largest copper producer mine in the world now that El Teniente Mine production has dropped to 300,000 mt/a. Future capacity of La Escondida Mine operation will depend on market demand, as the ore is of such a high grade (reserves are 1.8 billion of ore grading 2.14% Cu) that output can be adjusted with small changes in tonnage and cutoff grade.

On August 8, 1989, the Chilean Government and Exxon Minerals International Inc., the major shareholder of La Disputada de las Condes, signed a capital investment agreement of \$2.4 billion. Thus began expansion of the Los Bronces copper project that will require \$400 million investment between 1989 and 1992 to increase ore treatment capacity from 12,000 to 37,000 mt/d, increasing production capacity from 46,000 mt/a of fine copper to 130,000 mt/a. Adding to it, the El Soldado Mine production, Disputada de las Condes will reach 205,000 metric tons annual production by 1992.

Exxon's new concentration plant and the new tailings dam will be at El Cajón de las Tórtolas in Peldehue, north of Santiago, and ore production will be transported by a 56-km slurry pipeline from Los Bronces Mine, passing through two 3.5- and 1.8-km long tunnels to the processing plant at Las Tórtolas, which will replace the San Francisco concentrator. Exxon is currently studying the expansion of its Chagres smelter to handle the increased output.

Empresa Minera de Mantos Blancos, owned jointly by Anglo-American of the Republic of South Africa (61.1%), Inversiones Sudafricanas (38.8%), and Midway Investment (0.1%), currently is expanding its copper production capacity from 85,700 mt/a to approximately 100,000 mt/a after completion of its Elvira open pit mine northeast of Antofagasta in the II Region. In January 1989, the company bought the option to explore and exploit the Manto Verde Mine in the III Region. This ore deposit was being developed with an estimated investment of about \$40 million.

In 1983, Compañía Minera Ojos del Salado, a subsidiary of Phelps Dodge of the United States, began an intensive exploration program in the area surrounding its Pedro de Aguirre Cerda concentration plant in the II Region. This led to the discovery of the large La Candelaria copper deposit in 1987. Phelps Dodge then established the Compañía Minera Phelps Dodge of Chile to develop the deposit as a separate project. The deposit is only 4 km from the concentration plant. La Candelaria total official reserves are 390 Mmt of ore with a grade average of 1.14% copper and 0.25 g of gold per ton. The Company estimated La Candelaria's copper reserves at 500 Mmt. If Phelps Dodge could straighten out the litigation on the ownership of a part of the property, it was expected to go ahead with a \$200 million investment project to produce 90,000 mt/a. So far, it has invested about \$14 million in exploration, plant design, and project evaluation.

Other copper projects that look viable in 1990 include Quebrada Blanca, in northern Chile in the I Region, which originally belonged to the state mining company (ENAMI), was tendered by Cominco Resources International Ltd. from Canada and had been granted the right jointly with ENAMI to develop the copper deposit. Cominco will have 85% interest in the project while ENAMI, the original promotor, will hold 10% stake in the project with the remaining 5% belonging to

Sociedad Minera Pudahuel, a private Chilean mining concern that will contribute with a new mining technology in the project. A zone of secondary enrichment was reported to contain at least 85 Mmt of oxide and sulfide reserves grading 1.4% copper, and the underlying primary zone was estimated to contain 400 Mmt of ore grading 0.8% copper. Production of cathode copper was projected at an average rate of 70,000 mt/a using bacteria, heap leaching, solvent extraction, and electrowinning processes. Feasibility studies and test leaching were scheduled for 1991. Total planned investment was projected to be about \$350 million.

The Nippon Mining Co. first explored the Cerro Colorado copper deposit in the I Region between 1975 and 1980. Río Algom (TSE) of Canada, which is a subsidiary of Río Tinto Zinc of the United Kingdom, signed an option on the property in 1981 and completed a feasibility study the following year. Río Algom negotiated a financing and long-term copper concentrate sales agreement with Outokumpu Oy of Finland in 1985. However, Outokumpu abandoned the project in 1986 because of doubts concerning the economic feasibility of the deposit. Río Algom has now revived the project. Although the original project was based on the flotation of sulfide ores, the new project is based on bacteria heap leaching with sulfuric acid.

The Cerro Colorado, a porphyry copper deposit, had more than 100 Mmt of estimated reserves with an average grade of 1.3% copper. The project was designed to produce 40,000 tons of copper cathodes per year. The mine will be open pit with bacteria heap leaching and an electrowinning process. The company is currently negotiating project financing with a large U.S. bank. The project construction could begin in mid-1991 with a production that could begin in 1993. Total planned investment was estimated at \$290 million.

The Lo Zaldívar copper deposit was discovered in 1981 at the same time as BHP-UTAH International's La Escondida deposit and was explored by the same drilling company. The Lo Zaldívar copper deposit was purchased from Utah Minerals by Sociedad Minera La Cascada, a subsidiary of Sociedad Minera Pudahuel, for \$8 million in 1988. Pudahuel then sold the property to Outokumpu Chile Ltda. in an international public auction for \$25 million in November 1989. The Lo Zaldívar deposit contains an estimated 100 Mmt of ore with an average grade of 1.67% copper. The

project was originally designed to produce 40,000 tons of copper cathodes per year by mid-1993. It would be an underground operation with a bacteria heap leaching and an electrowinning process. Total investment required to produce copper cathodes, from copper oxides and the production of copper concentrates through flotation of copper sulfates, was reported by Outokumpu Chile Ltda. to be \$300 million.

The Compañía Minera Doña Inés de Collahuasi was established in 1979 by Superior Oil Co. of the United States, Superior Oil of Canada, and Falconbridge Mines of Canada for the purpose of developing the Collahuasi copper and silver project in the I Region. The company invested \$10 million in the project before it was abandoned. In 1985, Mobil Oil Co. of the United States took control of Superior's interest as a result of Mobil's purchase of Superior. In June 1985, Mobil Oil, Shell-Chile, and Chevron Minerals began an 8-year, \$45 million joint exploration effort to further develop the Collahuasi project. In January 1989, Falconbridge purchased Mobil's interest in Chile for \$12 million. Falconbridge now owns 100% of the company. When Shell-Chile and Chevron Minerals' \$45 million investment is completed sometime in 1992, Falconbridge, Shell-Chile, and Chevron Minerals will each become one-third owners of the company.

Los Pelambres was a porphyry copper mine on the border with Argentina, east of the city of Salamanca in the IV Region, and was another investment of the Luksic group of Antofagasta. The mine was acquired in 1986 from Anaconda South America Inc. for \$6.2 million, and it will probably be one of the largest investments once it starts operating at the beginning of 1992.

The project's total investment reached \$66 million, \$53 million of which will be contributed by the Midland Bank of the United Kingdom and the remaining \$13 million by Anaconda Chile S.A., a company related to the Luksic Group. Two mineralized areas contain an estimated 124 Mmt of ore grading 1.25% copper, among other areas of large reserves with lower metal content. It has also been announced that the South Korean company Lucky-Goldstar International, a subsidiary of the Lucky Group of South Korea, purchased one-half of Midland Bank's 80% interest in the Los Pelambres copper project for \$31 million. The Lucky Group, a producer of electronic appliances and copper wire, presumably will make the investment as a means of securing a reliable future supply of copper

concentrates for Lucky Metals, its copper smelting subsidiary. The project will have a design capacity of 21,000 tons of fine copper per year in the form of copper concentrates and was expected to begin production in late 1991.

Gold and Silver.—Servicio Nacional de Geología y Minería (SERNAGEOMIN), an agency under the Ministry of Mines, reported that gold production increased 22.3% to 27,591 kg and silver production increased 16.1% to 633,075 kg. The medium-size mines produced almost 90% of the gold and 55% of the silver in the country, followed by the large-size mines of CODELCO, with almost 7% of the gold and 44% of the silver primarily as byproducts of the copper industry, and with the remainder being produced by the small-size mines. Among the small and medium gold-producing companies, the biggest gold producer was still the El Indio Mine, now owned by LAC Minerals of Canada. As grades dropped, ore being milled was increased from the original 1,250 mt/d to 2,600 mt/d, and, by the end of 1991, was expected to reach 3,000 mt/d. Reserves were now estimated to be 10 Mmt with an average grade of 7 g of gold per ton, 97 g of silver per ton, and 4.7% copper plus 105 Mmt of heap-leaching ore at El Tambo Mine grading 1 g of gold per ton. Other important gold producers were Cía. Minera Mantos de Oro, Cía. Minera Tres Cruces (Marte deposit), and Cía. Minera Horus (La Pepa deposit). CODELCO increased its gold output to more than 400 kg in 1990 as a byproduct of its electrolytic copper refining.

The production of gold from the small-sized mines, including Choquelimpie (Vilacollo), El Hueso (Homestake), San Cristóbal (Niugini), El Bronce de Petorca, and La Coipa, declined by 12% compared with that of 1989.

The largest silver producer in the country is still CODELCO, with 275,317 kg in 1990, nearly one-half the country's total output, followed by La Coipa. Other important producers were Mantos Blancos, El Indio, Vilacello, and El Hueso.

Iron Ore, Manganese, and Steel.—Compañía de Acero del Pacífico S.A. de Inversiones (CAP), the formerly state-owned group of companies, was transferred to the private sector. Its three major shareholders were Cía. de Inversiones Suizandina, S.A. (29.3%), Cía. Explotadora de Minas, S.C.M. (6.69%), and MC. Inversiones Ltda. (6.21%), which was in-

corporated in 1989, buying its share from the Sociedad Química y Minera de Chile (3.95%) and other shareholders. CAP, together with Sociedad Manufacturera de Papeles y Cartones and Cía. de Petróleos de Chile's group (COPEC), is among the largest private companies in Chile with a capital of \$745 million and assets amounting to \$1.2 billion.

Compañía Minera del Pacífico, S.A. (CMP) was the only Chilean producer of iron ore. Although there were many other deposits, current iron production comes from El Romeral Mines in the IV Region, El Algarrobo in the III Region, and the reactivated El Laco Mine in the II Region. Proven reserves amount to approximately 1 billion tons of iron ore, 45% of which was attributed to the abovementioned mines. Other deposits included: Algarrobo District, Los Colorados District, El Tofo, Cerro Negro Norte, the Pleito-Cristales District, and other mines. El Romeral Mine, which had proven reserves of 56.5 Mmt grading 55.8% with a cutoff grade of 30% iron, produces about 3.6 Mmt of ore per year for direct exportation mainly to Japan, with the remainder for the Huachipato smelter. Chilean iron production, including iron ore pellets, was 7.8 Mmt in 1990, a decrease of 6% compared with that of 1989. Production of pellets was about 4.2 Mmt in 1990. The El Laco iron deposit is currently at 4,800 m above sea level, east of Antofagasta, at Sico, near the Bolivian border. It was reopened in 1988 after being closed for 8 years due to problems with its high sulfur content. Reserves at El Laco were estimated to be 224 Mmt of high iron ore content. The ore extracted was exported to Altos Hornos de Zapla in Jujuy Province, Argentina. In 1990, 55,000 tons was sold for \$1.3 million to China Metallurgical Import and Export Corp. The company estimates that China buyers will contract for an additional 500,000 tons for \$12 million. The El Laco Mine had an annual production capacity of 130,000 tons. At present, it only produces 42,000 mt/a.

Manganesos Atacama, S.A. (MASA) is a subsidiary of CAP and produced manganese, ferromanganese, and ferrosilicon alloys as well as steel cones for mills. The company produced manganese ore at El Corral Quemado and Los Loros Mines in the IV Region; MASA also buys ore from other producers in the same region.

In 1990, production of manganese ore reached 39,697 tons, 9.4% less than that in 1989. Most of the manganese produced by MASA was bought by the Huachipato

smelter. Manganese sales in 1989 amounted to \$6.1 million, exceeding the previous year by 4.9%.

Investments of CAP companies being developed for the 5-year period 1989-94 amounted to \$850 million. In the Huachipato steel mill, the most important project was the coke plant under the license of Still-Otto, with a capacity of 500,000 mt/a and an investment of \$140 million. Its coal consumption would be 700,000 mt/a, and it was expected to start operating by yearend, replacing the old coke plant. With this plant, operating production was expected to reach 1.2 Mmt of steel per year.

Cía. Siderúrgica Huachipato, S.A., an affiliated company of CAP, had a net profit in 1990 of \$21.4 million, a decline of 68.6% compared with that of 1989. Sales revenues from steel products in the domestic market fell 11.7% as compared with those of 1989 owing to a decrease in shipments and lower prices. The production of steel ingots at Huachipato amounted to 771,800 tons in 1990 (760,200 tons in 1989). Total deliveries of Siderúrgica Huachipato decreased to 561,258 tons in 1990, 421,922 tons of which was sold domestically. Income from the sale of steel products reached \$277.5 million (\$337.5 in 1989), \$237 million of which were sold internally; therefore, total income exceeded 1989 income by 19%. Investment projects that CAP S.A. de Inversiones is developing since the 1988-92 period have, in total, a value that exceeds \$450 million.

Lead and Zinc.—Chile's lead production declined for the second consecutive year by 9.8% compared to that of 1988. Most of the lead production was derived from operations at Cía. Minera Catemo Ltda. in the V Region instead of the XI Region where Sociedad Contractual Minera El Toqui, Ltda. (SCMT) operates. The average price for lead in 1990 was \$807 per metric ton which was 20.3% higher than that of the previous year.

Production of zinc increased 36.9% in 1990 to 25,146 tons, of which 91% was from SCMT owned by Minera LAC Chile, S.A., a subsidiary of LAC Minerals of Canada established in 1987. The average price of zinc in 1990 was \$1,519 per metric ton, which was at \$8.4 less than that in 1989. Minera LAC Chile, S.A., carried out a feasibility study on increasing production to 200,000 mt/a together with construction of a zinc refinery. Several problems were still to be resolved, including the availability of electric power.

Empresa Minera de Aysén, Ltda. was owned by CORFO, which sold its shares through public bid. The announcement was made in August 1989 by CORFO. The company operated the Rosillo Mine and a concentration plant in Puerto Cristal, in the XI Region. Minera Outokumpu Chile, Ltda. has signed an agreement with Empresa de Aysén (EMA) to explore zinc mineralization in southern Chile. The zinc deposits are 80 km south of General Carrera Lake in the XI Region. Outokumpu Chile will invest \$500,000 in the exploration. If a decision is made to develop a mine, EMA and Outokumpu Chile will form a joint company. EMA already operates a small zinc mine and concentrator in the region.

Cía. Minera Catemu, which belonged to Chilean interests, exploited the Veta Grande Mine and operated a concentration plant in Santa Rosa in the V Region. The company produced about 9,000 tons of zinc and 1,000 tons of lead annually.

Industrial Minerals

Lithium and Potassium.—Chile was the second largest producer of lithium in the world after the United States. Production of lithium carbonate in 1990 reached 9,081 tons, 21% more than that of the previous year. The only producer of lithium in Chile was Sociedad Chilena del Litio, Ltda. (SCL), owned by Foote Minerals of the United States, a subsidiary of Cyprus Minerals Co. SCL was originated as a joint venture between Foote Minerals Co. of the United States (55%) and CORFO (45%). In 1988, CORFO sold 25% of SCL shares to Cyprus Minerals of the United States for \$6.5 million, thereby increasing Cyprus ownership to 80%; in 1989, CORFO sold the remaining 20% of its equity to Foote Minerals, which subsequently became a subsidiary of Cyprus Minerals.

SCL's Government-authorized monopoly for the production of lithium in Chile expired at yearend. In 1989, SCL completed the construction of a potassium chloride plant in the Atacama Salar, which has a production capacity of 35,000 to 45,000 mt/a of 95%-pure potassium chloride. The plant would utilize the large amounts of sylvite discarded at the solar evaporation ponds. Also under construction at La Negra, in Antofagasta Province, was a plant to remove boron from lithium salts before carbonate precipitation. This plant will also produce metallic lithium and lithium chloride. Construction of the \$2.6 million plant was initiated in 1989.

Sociedad Minera Salar de Atacama, Ltda. (MINSAL), a consortium of AMAX Exploration, Inc., 63.75%; CORFO, 25%; and Molíbdenos y Metales, S.A. (Molymet), 11.25%, was established in 1986 to develop the Mixed Salts Project in the Atacama salt flat in the II Region. The project was designed to produce lithium carbonate, potassium chloride, potassium sulfate, and boric acid. Future production is expected to be 16,450 tons of lithium carbonate, 451,441 tons of potassium chloride, 226,844 tons of potassium sulfate, and 25,674 tons of boric acid per year.

When the project of Compañía Minera Salar de Atacama, Ltda. (MINSAL) of AMAX Exploration, Inc. (63.75%), Molíbdenos y Metales, S.A. (Molymet) (11.25%), and CORFO (25%) is completed, lithium production could rise to about 25,005 mt/a. In December 1989, Jacobs Engineering of the United States completed an economic feasibility study for the project. In February 1990, AMAX placed the project on hold for 1 year owing to difficulties in obtaining the necessary financing for the project. Under the terms of AMAX's original contract with CORFO, it may place the project on hold for a maximum of 3 years after completion of the feasibility study, after which time the property must be returned to CORFO. Thus, a final decision must be made before February 1993. Changes in the ownership of the project are now being considered. The most likely buyers appear to be Tenneco Minerals, which is a large producer of soda ash, and Lithium Corp. of America (LITHCO). Depending on who purchases the project, the new owner will probably decide to downsize or redesign the project. AMAX's total investment in the project to date is \$13.5 million, but the total planned investment is \$380 million.

Nitrates and Iodine.—The Chilean nitrate and iodine industry basically was the Sociedad Química y Minera de Chile (SQM), which is the only producer of nitrate, potassium nitrate, and anhydrous sodium sulfate. SQM also has more than a 90% share of the country's iodine market.

In 1990, SQM's gross revenue reached \$285 million, up from \$270 million reported in the previous year, which included \$41 million in products purchased and resold. However, this increase in sales was not reflected in profitability, which had a significant drop to \$14 million compared with \$61 million in 1989 and \$48 million in 1988. SQM stated that the drop could be accounted

for by a \$16 million reduction in iodine revenue due to price erosion and lower volume. Export returns were lower in 1990 owing to a sharp drop in iodine prices that caused iodine export earnings to fall 27% to \$5.7.6 million compared to that of 1989. Nitrate and saltpeter exports increased in volume and value, but sodium nitrate sales abroad fell 13.9% in value and 2.7% in volume. A project that would involve the production of potassium nitrate and iodine in the Atacama salt flat was announced by two Canadian companies—Atacama Resources, Ltd. and Kap Resources, Ltd.

In July 1988, Atacama Resources, Ltd. initiated an intensive exploration program to determine the minable reserves of nitrate, sulfate, and iodine in the caliche ore of the Atacama Desert of northern Chile. The exploration revealed an area, inland from the port of Taltal, that had never been aggressively exploited in the past because of the presence of high levels of iodine, formerly considered a contaminant in nitrate production. In December 1988, Atacama Resources, Ltd. entered into an agreement with North Lily Mining Co. whereby North Lily was selected as the operator to explore and evaluate the 70 km² concession zone. In June 1989, Kap Resources, Ltd. entered into a 50-50 joint venture with Atacama Resources, Ltd., known as the Taltal Joint Venture, in which North Lily Mining Co. was retained as the operator and will receive a 10% share in the profits. North Lily Mining Co. released the results of assays on the sodium sulfate content of samples taken from its Yolanda property in northern Chile that indicate an average sodium sulfate content of 9.3%.

Geostatistical estimates of the sodium sulfate reserves conducted by Davy McKee Corp. by solution mining process indicated that the sodium sulfate could be recovered as a by-product of the heap leaching of the nitrate-iodine ore or "caliche." The Yolanda property was sampled extensively during 1989, and the reserves of iodine and nitrate were announced earlier this year. Using a cutoff grade of 8% sodium nitrate, Davy McKee calculated that the deposit holds in excess of 20 Mmt of "caliche" grading 11.8% sodium nitrate and 237 parts per million of iodine. At current prices, the iodine and nitrate content of the deposit is worth about \$900 million.

Sulfur.—Chile has been an importer and producer of sulfur for many years. In 1990, Chile imported about 70,000 tons of sulfur mostly from Canada and Bolivia. Chile's

native sulfur production derived from caliche increased 78.5% over that of 1989 to 28,488 tons. Chile's total production of sulfur, including sulfur derived from smelters and oil refineries, was maintained at about 400,000 tons. Its main use was as raw material to produce sulfuric acid. Chile has large reserves of volcanic sulfur, at more than 4,000 m above sea level. Its costly extraction historically has not been able to compete with less expensive imported sulfur. Therefore, exploitation is carried out sporadically when the price increases.

Among the sulfur deposits currently under exploration or development are the Sillajuaya Volcano where the R.M.S. group of Canada announced an investment of \$85 million in a plant to process 5,000 mt/d of caliche. The greatest expense in this project was found to be the construction of facilities in addition to metallurgical problems in the flotation circuit. The project has been delayed indefinitely. The Tacora Volcano, on the Peruvian border, had an estimated reserve of 7 Mmt. Azufrera Chile, Ltda. was formed by DEVCO of the United States and SAUSALCO of Saudi Arabia to analyze an investment of \$10 million in a project to produce 120,000 mt/d of sulfur pellets from this deposit.

Condesa Mining Corp. of the United States has received authorization from the Foreign Investment Committee to carry out a \$25 million development in two sulfur mines near San Pedro de Atacama with a capacity to treat 1,000 mt/a. The project would include construction of a concentrating plant, a refining plant, and a pipeline up to the port of Coloso, south of Antofagasta. No initiation date had been reported.

Empresa Minera y de Transportes Hemani extracted caliche from the Purico Volcano, in the I Region, for the production of sulfuric acid. Output of refined sulfur from this deposit reached 1,100 mt/a. Placer Developments of Canada also completed a geological analysis in the Purico Volcano.

Consumption of sulfuric acid in Chile amounted to 675,000 mt/a with a deficit of about 30,000 tons purchased abroad. To produce sulfuric acid, Chile must import about 70,000 tons of sulfur annually. Startup of new sulfuric acid plants using gases from the smelters will increase CODELCO-Chile's production to more than 1.5 Mmt annually. As a result, Chile will significantly lower sulfur imports. In the medium term, the country could become a net exporter of this product. In Chile, sulfuric acid was pro-

duced from gases from three copper smelters: Chuquicamata, Paipote (Hernán Videla Lira), and Chagres. These plants have a production capacity of 680,000 mt/a: 550,000 tons from Chuquicamata, 60,000 from Paipote, and 70,000 from Chagres.

Mineral Fuels

Coal.—Coal output increased 12.1% to 2.7 Mmt in 1990. The Chilean Government has encouraged greater domestic coal production as a means of reducing Chile's dependence upon petroleum. In 1990, imports of coal reached approximately 1.6 Mmt, mainly for use in thermal powerplants to produce electricity. Empresa Nacional del Carbón (ENACAR) is the most important traditional producer of coal in the country, supplying about 120 relevant companies. At present, Compañía de Carbones de Chile, S.A. (COCAR) supplies only one large company: CODELCO-Chile's Tocopilla Section, whose contract was a condition for investing and startup of the Pecket coal mine in XII Region and COCAR's signing of a 10-year contract to supply coal to CODELCO's Tocopilla electric power division in the II Region. Coal provides almost 70% of the electricity for Chile's Northern Electric Powergrid that supplies the I and II Regions. The Chilean Coal Producers Council is composed of five large producers, which together account for 85% of Chile's domestic production of approximately 2.6 Mmt/a. The Council includes two state-owned companies, ENACAR and Carbonífera Victoria de Lebu S.A. (CARVILE), and three privately owned companies: Carbonífera San Pedro Catamuntun, COCAR, and Carbonífera Schwager. ENACAR and CARVILE reported substantial losses during the first semester of 1990 while Carbonífera San Pedro de Catamuntun, COCAR, and Carbonífera Schwager reported lower profits compared to those of the same period in 1989.

With the exception of COCAR, which operated the highly mechanized Pecket open pit mine near Punta Arenas in the XII Region, Chile's coal industry was obsolete and inefficient. This was particularly true in the case of ENACAR and CARVILE, which survive on Government subsidies. ENACAR alone has lost \$20 million during the past 3 years.

Carbonífera Schwager, a former division of ENACAR, was reportedly losing money. Carbonífera San Pedro de Catamuntun was reportedly making a profit, but its operations were very high cost with little oppor-

tunity for improvement in the near future. Only COCAR made a healthy profit, reportedly because of its 10-year sales contract with CODELCO-Chile.

Recent developments have been complicated by 3 years of drought. A related decline in hydroelectric power production required large volumes of imported steam coal to increase the production of thermal power. Given the limited production capacity of the domestic coal industry, Chile imported 1.2 Mmt of steam coal in 1990. These steam coal imports represented approximately one-third of Chile's total steam coal consumption in 1990. As foreign producers have begun to compete for this new market, estimated to have a total value of \$150 million per year, the price of imported coal has increasingly undercut the price of domestic coal. Unable to compete with growing coal imports, the Chilean producers council has argued that unrestricted coal imports will eventually lead to the collapse of domestic industry and a serious deterioration in the standard of living in the VIII and X Regions, Chile's principal coal-producing areas. According to the Chilean coal producer officials, imports of coal threaten 17,000 jobs in the domestic coal industry, another 100,000 jobs in supporting industries, and more than \$200,000 worth of capital investment in the sector. The Council of Chilean coal producers has complained that the Colombian coal is subsidized and has asked for Government protection. The Minister and President of the National Energy Commission subsequently announced on August 16 that the Colombian coal was not subsidized. Nevertheless, because of the potential damage to the domestic coal industry, the Government will withdraw the preferential Latin American Free-Trade Association (LAFTA) tariff of 13.5% for Colombian coal, which will then be subject to the standard import tariff of 15%. The council also proposed the establishment of a National Development Fund for the coal industry with an annual budget of \$8 million per year to subsidize domestic production. This fund would support the greater mechanization of the industry, promote the increased consumption of coal, develop clean coal technologies, and stimulate greater research and development. The fund would be financed by a surcharge on electric power consumption with an exception for the poorest consumers.

Natural Gas.—Natural gas production amounted to 4,198 Mm³, a decrease of 0.9%

compared with that of 1989, continuing the declining trend since 1982. Of the total production, about 49% was reinjected, 5% was flared, and 26% was marketed internally. During 1990, 2 drilling teams worked on land and 4 worked offshore, totaling 57 wells drilled. With the start up of the \$300 million Cape Horn methanol plant, northeast of Punta Arenas, gas sales rose sharply from 493 Mm³ in 1988 to 1,080 Mm³ in 1990. Owing to depletion of the Springhill district, ENAP was mainly dedicated to exploring new oil- and gas- producing areas, both in the country and abroad. At the beginning of 1990, seven contracts for operations had been signed with several foreign private companies. Six of them were in the north of Chile and one was on Tierra del Fuego. Exploration was also underway in the Andean foothills of Magallanes and in the Strait. No positive results have been obtained from explorations in the north. Drillings performed in the Atacama salt flat II Region by Chile Hunt Oil Co., a subsidiary of Hunt Oil Co. of Texas (United States), were not successful.

Magellan International Nitrogen Co. (MINCO) was planning to construct an ammonia-urea plant in Cabo Negro, in the XII Region. The gas for this project would be supplied by ENAP in a contract similar to that for the methanol plant built by Cape Horn Methanol plant northeast of Punta Arenas. Combustion Engineering of the United States would invest between \$20 and \$30 million in this project under DL 600. The Manufacturers Hanover Bank would invest another \$60 million using chapter XIX for a debt-equity swap. CORFO would invest \$18 million, which it would transfer to ENAP. International Finance Corp. (IFC) of the World Bank would provide between \$7 and \$10 million while two local companies would contribute to the project with \$2 million each. The remaining \$260 million could be financed by IFC, foreign banks, and export credits. The Henley group has expressed its particular interest in providing a significant capital contribution to MINCO. ENAP extended the term of MINCO's option to develop the project. Construction was supposed to be initiated in 1989 and completed by the end of 1991. Production would be 570,000 tons of urea and 150,000 tons of ammonia per year, respectively.

Petroleum.—Chilean production of crude oil suffered a further decrease in 1990, 11.2% from that of 1989, to 7.2 Mmbl. That continued a decline that started in 1983,

owing to the exhaustion of Chile's existing reserves and growing consumption. Off-shore production represented 61% of the annual total. Production wells on Tierra del Fuego Island accounted for almost 21%, while mainland production accounted for only 18% of the total.

In March 1990, Shell Oil-Pecten International of the United States, acting as operator in San Pedro de Atacama-Imilac salt mine, decided not to carry out the second stage of the prospecting program, probably influenced by Hunt's failure in the Atacama salt flat nearby.

The area of Lonquimay was also being explored by SERNAGEOMIN to analyze the possibility of an extension of the oil reserves of Argentina. Abroad, exploration wells have been drilled in the East Amazonic Region of Ecuador and in the basin of the Magdalena River in Colombia; the results are still being evaluated. In Ecuador, ENAP was associated with the Canadian Oil Co. PETROCANADA, and with the Uruguayan Oil Co., ANCAP. They found high viscosity oil in Cachicayu No. 1 well, but obtained negative results in the Golondrina No. 1 well. In Colombia, ENAP has 20% share in a joint venture with Eurocan Ventures Ltd. They completed the La Laguna drilling, where no oil was found.

ENAP is also negotiating the possibility of forming a partnership with Yacimiento Petrolíferos Fiscales (YPF) of Argentina to jointly exploit a deposit at the eastern entrance to the Strait of Magellan, where YPF wishes to participate as operator. Eighteen wells would be drilled with an investment of \$134 million. According to information from Argentina, ENAP has offered the extraction of 3.8 Mm³ of oil and 1,700 Mm³ of gas in a period of 20 years for a 15% return of investment.

Probably the most important law regarding the foreign investment in the oil and gas sector was the Special Operation Contract for the Exploration and Exploitation of Hydrocarbons. This law, passed in 1975 and subsequently amended, reduced the state's monopoly over the exploration and exploitation of petroleum and natural gas and made it possible for foreign oil companies to work in Chile. The law established rules for Petroleum Operation Contracts (POC's), also referred to as Special Operating Contracts, and risk contracts, regarding taxes, foreign exchange, customs tariffs, and rights of way.

The three following options are considered for POC's: (1) contractor operating independently; (2) contractor operating with

ENAP during the exploration and exploitation phases; and (3) contractor associated with ENAP in which ENAP participates upon determination of a commercial discovery.

As a result of these amendments to the 1975 Decree Law 1089, POC's with foreign oil companies were encouraged. Six foreign oil companies have signed POC's for work in Chile; five were U.S. companies and one was a Canadian company. The U.S. companies included Hunt Oil Co., Pecten International, Maxus Energy Corp., Anderman-Smith, and Argerado. These companies have negotiated a total of seven POC's, six of which were in the northern part of Chile. Three other U.S. oil companies—the Anschutz Overseas Corp., Grynberg Petroleum Co., and UNOCAL—have visited Chile and were considering signing POC's.

INFRASTRUCTURE

Chile extends approximately 4,200 km along the Pacific Coast of South America and has an average width of approximately 180 km between the coastline and the Andes. Chile was divided into 12 numbered regions, beginning with the I Region at the northern border with Peru and continuing in sequence to XII Region at the southend, with each having a regional capital. Chile has three main geographical areas that vary dramatically in climate, resources, and population. The northern area from I Region to IV Region includes the Atacama Desert, one of the world's driest areas. Farming is limited to a few irrigable areas. However, abundant and varied mineral and energy resources are in this area. Its vast reserves of copper, iron ore, nitrates, and lithium carbonate constitute a major asset to the Chilean economy. Continuing south from V Region to X Region is the central area, where 90% of the population resides. The Andes compose one-third to one-half of the middle Chile area. Near the northern end of the valley lies Santiago, Chile's capital and home to about one-third of the country. Industrial resources include large copper deposits, as well as coalfields and hydropower.

The southern Chile area from XI Region to XII Region is one of the wettest and stormiest parts of the world. Less than 2% of the population resides here. Southern Chile's resources are concentrated in the area lying east of the mountains. These natural resources include coal, natural gas, and petroleum.

The railway system of Chile served all the important industrial, mining, and agricultural areas from I Region (Iquique) to X Region (Puerto Montt) for a total of 8,613 km. The pattern of Chile's highways was similar to that of its railways. The road system totals 79,025 km of which 9,913 km was paved, with most of the remainder of secondary quality.

International trade of mineral commodities, chiefly copper and its byproducts, are handled through the ports of Arica, Antofagasta, and Valparaíso. Five of the biggest ports in the Country are Valparaíso, Tocopilla, Cruz Grande, Talcahuano, and San Antonio, which handle almost 60% of the total tonnage.

Crude oil, refined products, and natural gas are transported to consumption centers by three major pipelines that are 785 km, 755 km, and 320 km, respectively.

OUTLOOK

Implementation of the Foreign Investment Law of 1974 (Decree Law 600) and the 1977 and 1987 amendments, which provided the legal framework guaranteeing the rights of foreign investors, established maximum tax rates, offshore accounts, and a minimum period after which profits and capital could be repatriated. The new labor code, law 18,620 of 1980, as amended in 1987, and the new Mining Code of 1984, allowed ownership of mining concessions, granted owners the right to extract ore from the concession, and the first mineral depletion allowance amendment.

An important recent factor in attracting foreign investment in Chile has been the debt-equity swaps under the Central Bank's chapter XIX regulations. Under these regulations, foreign investors can purchase discounted debt notes for conversion into equity; these debt notes are redeemable at near-face value, approximately 80% on the dollar, in Chilean pesos at the official exchange rate. Debt-equity swaps have had a significant impact in Chile's mining sector since the first investment was approved in March 1987. The swaps have resulted in a number of foreign mining companies and banks investing in a wide number of mining projects. The Special Operation Contract for the Exploration and Exploitation of Hydrocarbon's Law of 1975, as subsequently amended, established the rules for POC's.

The Chilean mining activities were concentrated in five areas: coal, copper and its

byproducts, industrial minerals, iron and steel, and precious metals. Chile's annual copper production is expected to grow from the current 1.6 Mmt in 1990 to more than 2 Mmt in 1992, while gold is projected to increase from 27,600 kg to 40,000 kg, and silver is projected to increase from 630,000 kg to more than 1,000,000 kg during the same period.

The production of bentonite, boric acid, nitrates, diatomite, iodine, lithium carbonate, potassium chloride, potassium sulfate, and sulfuric acid are also expected to increase by significant amounts. Finally, in the energy sector, coal is expected to increase from 2.7 Mmt in 1990 to more than 3 Mmt in 1992. The Chilean Government has encouraged greater domestic coal production as a means of reducing Chile's dependence on imported petroleum. The Pecket coal mining project is expected to save Chile about \$40 million in energy costs and an additional \$100 million in oil imports. Chile's domestic petroleum production has declined from 54% of national consumption in 1982 to 20% in 1990. This percentage is expected to continue to drop in the coming years because of the exhaustion of Chile's existing reserves, Chile's rapid economic growth, and the growing consumption of petroleum.

The largest and most visible foreign investment that came on-stream ahead of schedule in 1990 was the \$1.2 billion La Escondida copper project. The list of U.S. companies currently active in Chile include: Utah International, Exxon Minerals, Phelps Dodge, Cyprus Minerals, AMAX, Homestake, Chevron Resources, Freeport, Newmont, Hunt Oil, Pecten, and Maxus Energy. Citibank and Bankers Trust have also taken an equity interest in two important mining projects, a practice that is expected to be followed by a number of other U.S. banks. Five other large foreign investments are also expected to come to a decision in the near future. These include Exxon's (United States) \$380 to \$400 million Los Bronces copper expansion project; AMAX's (United States) \$200 to \$250 million MINSAL lithium, potassium chloride, potassium sulfate, and boric acid project; Phelps Dodge's (United States) \$150 to \$250 million Geolar and La Candelaria project; Magellan International Nitrogen Co. (MINCO) and Combustion Engineering's (United States) \$380 to \$400 million ammonia-urea plant in Cabo Negro in the XII Region. In addition, there were Placer Dome's (United States) \$140 to \$160 million Ladera-Farellon gold project, Placer

Dome and TVX Mining's (United States) \$230 million Minera Mantos de Oro-La Coipa project, COMINCO (Canada) and ENAMI's (Chile) \$135 million Minera Quebrada Blanca S.A. (Chile) project, Outokumpu's (Finland) \$100 million Zaldívar project, and Midland Bank (United Kingdom) and Minera Anaconda's (Chile) \$66 million Minera Los Pelambres Ltda. copper project.

¹Where necessary, values have been converted from Chilean pesos (Ch\$) to U.S. dollars at the rate of Ch\$305=US\$1.00, the average exchange rate for 1990.

OTHER SOURCES OF INFORMATION

Agencies

Ministerio de Minería
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Comisión Chilena del Cobre
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Servicio Nacional de Geología y
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Santa María 0104
Santiago, Chile
Empresa Nacional de Minería (ENAMI)
McIver 459
Santiago, Chile
Sociedad Nacional de Minería
(SONAMI)
Santiago, Chile

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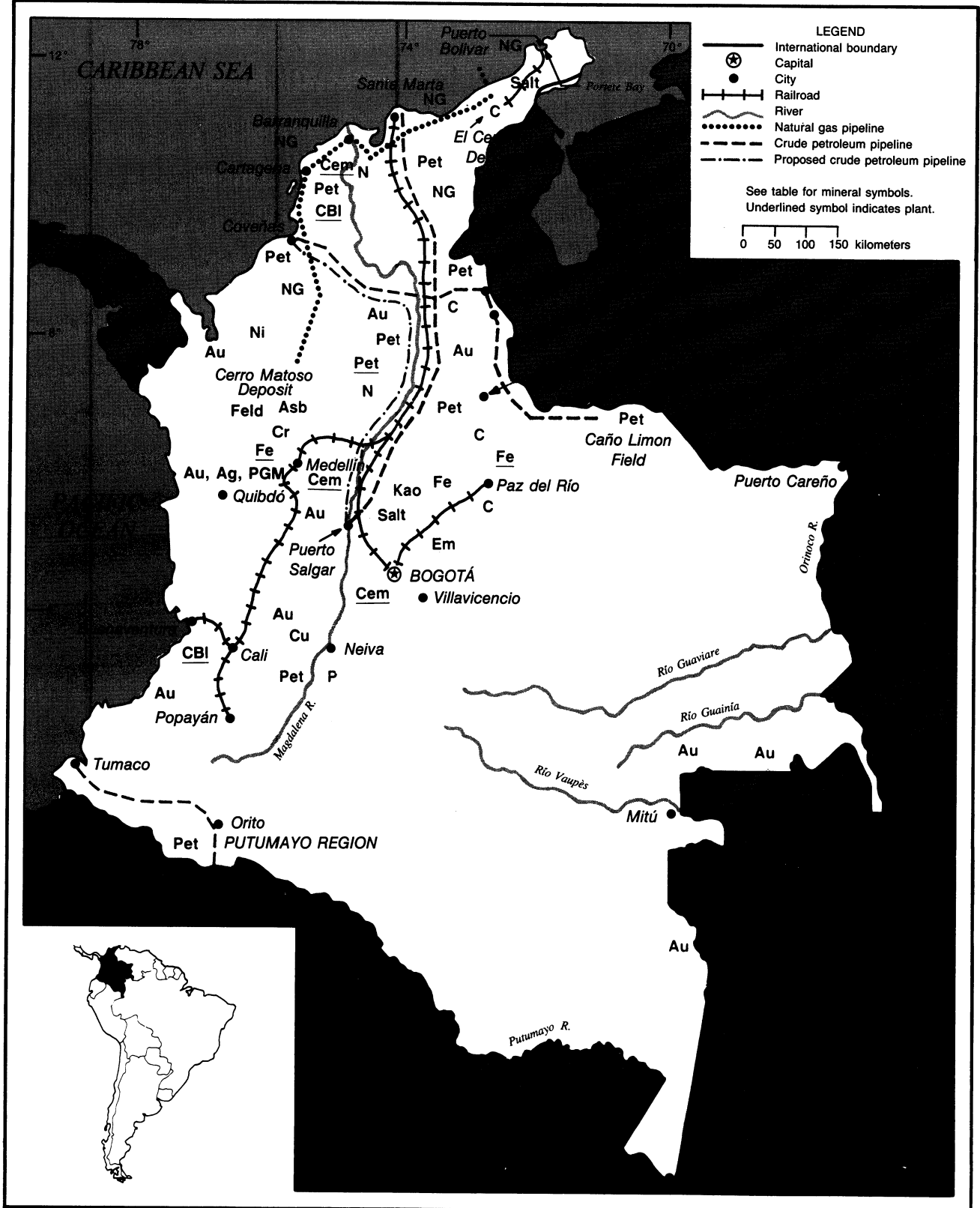
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COLOMBIA

AREA 1.14 million km²

POPULATION 33.1 million



COLOMBIA

By H. Robert Ensminger

Colombia's mineral industry experienced a substantial increase in 1990, primarily to increased production of coal, emeralds, and petroleum. The output of petroleum and natural gas accounted for approximately 80% of the total value of mineral production in 1990. Colombia produced a limited diversity of mineral commodities; it is recognized worldwide as a source of quality emeralds. Within Latin America, Colombia was the leading producer of coal, kaolin, and platinum and a major producer of asbestos, cement, ferronickel, gold, salt, and—to a lesser extent—crude petroleum and natural gas.

In recent years, mining has gained a more important place in Colombia's economy, and in 1990, commanded an approximate 9.5% share of the GDP compared with 1% in the early 1980's. The petroleum sector was a major force in this respect. A number of major projects were programmed for the ensuing 2 to 3 years. Included were the construction of a new refinery, several oil and gas pipelines, several petrochemical plants, and the drilling of a large number of exploratory and exploitation wells. The large expansion of coal output was also a factor.

Colombia's GDP grew by an estimated 3.7% in 1990 to \$31.5 billion in current prices. This was among the higher annual growth rates registered for the year in Latin America. In 1990, Colombia was the only Latin American country to have experienced uninterrupted GDP growth for more than a decade. The fastest growing sectors of the economy were mining, which expanded by more than 25%, and agriculture, excluding coffee, which grew by 5.6%. Colombia's total (fuel and nonfuel) mineral production had an estimated value of \$3.3 billion¹ in 1990, which was about 9.5% of the GDP. The major mineral products were petroleum, natural gas, coal, gold, petroleum products, and nickel, in that order. In 1990, total foreign investment in Colombia decreased by 68%, from \$2.7 billion in

1989 to approximately \$865 million. This was primarily due to guerrilla activity and foreign economic recessionary pressures on the major industrial countries.

The inflation rate for 1990 was 32%, the highest in 27 years.

GOVERNMENT POLICIES AND PROGRAMS

To promote continued development of its mineral resources, Colombia has relied on the capital and technological knowledge of large, specialized companies. They include Empresa Colombiana de Petróleos (ECOPETROL), the state petroleum enterprise and associated foreign petroleum companies; Carbones de Colombia (CARBOCOL), the state coal mining enterprise; and Cerro Matoso S.A., the mixed-equity nickel mining company.

The new mining code (Código Minero) became law in late 1989. The new mining act, which was crafted to facilitate and encourage mineral exploration and development, contains provisions to facilitate and expedite the processing of claim applications, to improve the security of mineral occupancy and tenure, and to establish a fund to provide financial assistance to small- and medium-scale miners. The mining development fund (Fondo de Fomento Minero) went into effect when the new mining code was approved at yearend 1989. The fund is financed by the Government and supervised by Empresa Colombiana de Minas (ECOMINAS), the state mining company. The fund provides small- and medium-sized mining enterprises with credit and technical assistance.

Mining projects were allocated a total of \$427 million for disbursement for the 2-year period covering 1989 and 1990. Most of the funding was designated for the El Cerrejón coal projects and for petroleum projects.

In 1990, the Government initiated the "Apertura" program. It is a 5-year trade

liberalization plan that seeks to improve economic growth and efficiency and promote foreign trade. The new Foreign Investment Statute puts foreign investors on an equal basis with domestic ones, except for remittances abroad. In 1990, U.S. companies accounted for 72% of all direct foreign investment in Colombia.

PRODUCTION

The 25% increase in the value of mineral production in 1990 was principally driven by the mineral fuels, coal and petroleum. Petroleum accounted for approximately 80% of the total value of mineral sector production in 1990. Colombia ranked as the third largest coal producer in the Western Hemisphere after the United States and Canada. Mineral fuels production, overall, increased approximately 8%, metals stayed the same, and industrial minerals (including emeralds) increased 31%. Among the metals, nickel and platinum provided the major increases in production. The major contributors to the increased production in the industrial minerals sector were emerald, feldspar, kaolin, limestone, magnesite, and sulfur, alphabetically.

TRADE

In 1990, the value of petroleum exports exceeded the annual value of coffee exports. The total value of mineral fuel exports composed 35% of the total value of exports for 1990. This was an increase of about 4% over that of the previous year. In 1990, the total value of Colombian exports to the United States was approximately \$3.2 billion, while the total value of imports from the United States was about \$2.0 billion. Colombia's balance of trade with the United States for the year was approximately \$1.2 billion.

Approximately 73 million barrels of crude petroleum and petroleum products was exported in 1990, and it was projected that exports would almost double by 1992.

TABLE 1
COLOMBIA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^p	1990 ^e
METALS					
Gold kilograms	39,995	26,546	29,014	29,506	² 29,352
Iron and steel:					
Iron ore and concentrate thousand tons	508	615	609	573	² 628
Pig iron do.	319	326	309	297	² 323
Steel, crude do.	631	689	754	706	² 703
Semimanufactures, hot-rolled do.	457	532	597	598	² 592
Lead:					
Mine output, Pb content	202	158	31	394	² 331
Refined (secondary) ^e	4,000	4,000	4,000	³ 3,500	3,500
Manganese					
Mine output, Mn content	—	—	3,580	3,600	4,000
Nickel:					
Mine output, Ni content	^e 22,600	^e 25,200	19,979	21,425	² 22,439
Ferronickel, Ni content	19,028	19,324	16,669	16,954	² 18,425
Platinum-group metals kilograms	447	638	815	973	² 1,316
Silver do.	⁵ 5,816	4,977	6,563	6,847	² 6,591
Zinc, mine output, Zn content	6,000	—	138	394	² 356
INDUSTRIAL MINERALS					
Asbestos:					
Mine output	129,155	132,723	152,896	158,149	160,000
Fiber ^e	⁶ 5,500	⁶ 6,600	7,600	7,900	8,000
Barite	4,198	3,792	⁴ 4,000	5,460	² 5,380
Cement, hydraulic thousand tons	6,011	5,965	6,764	6,643	² 6,320
Clays: kaolin do.	1,155	1,221	1,306	1,800	² 1,800
Diatomite	—	—	—	3,600	3,600
Feldspar	35,722	33,760	37,136	40,850	² 34,800
Gypsum thousand tons	295	302	307	553	500
Lime, hydrated and quicklime ^e do.	1,300	1,300	1,300	1,300	1,300
Magnesite	14,936	15,444	17,760	20,425	² 20,425
Nitrogen: N content of ammonia	93,440	88,600	84,100	91,800	90,000
Phosphate rock	28,626	³ 34,000	35,000	31,200	² 37,000
Precious and semiprecious stones: Emerald ³ carats	<u>634,561</u>	<u>886,551</u>	<u>1,095,650</u>	<u>1,200,000</u>	<u>²3,100,000</u>
Salt:					
Rock thousand tons	227	205	209	190	² 209
Marine do.	501	450	473	470	² 478
Total do.	728	655	682	660	² 687
Sodium compounds, n.e.s.: Sodium carbonate	112,920	116,864	114,087	^e 115,000	115,000
Stone and sand:					
Calcite	5,334	5,334	⁸ 736	12,060	² 4,808
Dolomite thousand tons	14	33	33	45	² 45
Limestone ^e do.	12,000	12,000	² 11,980	12,000	² 17,000
Marble	19,568	17,500	^e 17,500	^e 17,500	30,000
Sand excluding metal-bearing	<u>516,215</u>	<u>602,400</u>	<u>654,800</u>	<u>700,000</u>	<u>²703,000</u>
Sulfur:					
Native (from ore)	36,038	41,490	42,795	45,575	² 31,686
Byproduct, from petroleum	10,000	¹ 10,200	8,200	8,000	8,000
Total	^e 46,038	51,690	50,995	53,575	<u>39,686</u>
Talc, soapstone, pyrophyllite	9,013	11,927	12,800	9,196	² 10,113

See footnotes at end of table.

TABLE 1—Continued

COLOMBIA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^p	1990 ^e
MINERAL FUELS AND RELATED MATERIALS					
Carbon black ^e	18,000	18,000	18,000	18,000	20,400
Coal:					
Metallurgical thousand tons	630	759	585	650	700
Steam do.	11,540	13,835	14,315	18,252	19,700
Total do.	12,170	14,594	14,900	18,902	² 20,400
Coke, all types ^e do.	550	600	550	550	³ 339
Gas, natural:					
Gross million cubic meters	^e 5,240	^e 5,380	5,029	² 5,113	5,600
Marketed do.	(⁴)	(⁴)	4,062	^e 4,100	4,500
Natural gas liquids thousand 42-gallon barrels	2,216	1,717	1,384	^e 1,400	1,500
Petroleum:					
Crude do.	110,714	147,843	136,760	147,563	159,500
Refinery products:					
Liquefied petroleum gas (propane) do.	2,782	¹ 4,380	4,745	^e 4,500	4,500
Gasoline:					
Aviation do.	313	276	255	^e 260	265
Motor do.	24,589	² 28,194	27,120	^e 28,500	29,000
Jet fuel do.	3,829	³ 3,650	3,650	^e 3,800	4,000
Kerosene do.	2,147	² 2,190	2,190	^e 2,200	2,300
Distillate fuel oil do.	11,152	¹ 14,235	14,235	^e 14,300	14,300
Residual fuel oil do.	21,017	² 24,820	23,360	^e 23,500	24,000
Lubricants ^e do.	730	750	733	750	750
Asphalt and bitumen do.	973	1,079	1,127	^e 1,100	1,100
Refinery fuel and losses, and unspecified products do.	1,915	2,555	3,285	^e 3,500	3,500
Total do.	69,447	² 82,129	80,700	^e 82,410	83,715

^eEstimated. ^pPreliminary. ^rRevised.¹Table includes data available through July 1991.²Reported figure.³Based on registered exports by the Banco de la Republica.⁴Comparable historical data were not available at the time of publication.

Coal exports, mainly steam coal, exceeded 16 million tons in 1990. The principal regions of destination with associated percentages were Western Europe (39%), Northern Europe (37%), Mediterranean area (14%), the United States (6%), and the Far East (2%). In 1989, Colombia supplanted China as the fourth largest coal exporter in the world. Coal exports composed 10% of the country's total foreign trade in 1990.

In part, as a result of increased guerrilla terrorist activity, the influx of foreign capital into the mineral sector decreased from the almost \$500 million in 1989 to approximately \$400 million in 1990.

TABLE 2

COLOMBIA: VALUE OF MINERAL EXPORTS

(Millions of U.S. dollars)

Commodity	1986	1987	1988	1989	1990 ^e
Crude oil and refined products	\$619.0	\$1,341.0	\$952.7	\$1,438.0	\$2,000
Coal	190.4	359.6	424.5	650.0	700
Ferronickel	48.0	77.1	179.4	190.0	135
Emeralds	34.0	62.0	89.8	103.0	105
Cement	25.3	62.8	65.7	70.0	74
Total	916.7	1,902.5	1,712.1	2,451.0	3,014
Total Exports	5,434	5,638	5,805	6,364.0	7,000
Minerals as percent of total	17%	34%	29%	39%	43%

^eEstimated.

TABLE 3
COLOMBIA: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989		
			United States	Other (principal)	
METALS					
Aluminum:					
Oxides and hydroxides	104	78	—	Ecuador 42; Panama 18; Venezuela 18.	
Metal including alloys:					
Scrap	267	913	913		
Unwrought	185	118	36	Japan 54; Italy 21.	
Semimanufactures	36	127	—	Ecuador 77; Chile 20; Cuba 16.	
Copper: Metal including alloys, semimanufactures	3	15	—	Costa Rica 11; Panama 3; Ecuador 1.	
Iron and steel: Metal:					
Scrap	—	93	1	Spain 92.	
Pig iron, cast iron, related materials	272	60	—	All to Venezuela.	
Ferroalloys:					
Ferromanganese	338	—			
Unspecified	42,432	34,691	1,221	Netherlands 25,593; France 4,952; Japan 2,761.	
Steel, primary forms	(?)	7	—	All to Panama.	
Semimanufactures:					
Bars, rods, angles, shapes, sections	(?)	53	10	Venezuela 43.	
Universals, plates, sheets	3,497	6,108	—	Cuba 5,418; Trinidad and Tobago 635; Ecuador 30.	
Wire	228	380	92	Peru 160; Dominican Republic 92; Honduras 30.	
Tubes, pipes, fittings	450	1,242	586	Ecuador 350; Cuba 284.	
Castings and forgings, rough	256	250	84	Venezuela 161; Nicaragua 4.	
Lead: Metal including alloys, semimanufactures	158	5	—	All to Ecuador.	
Manganese: Oxides	71	140	—	Do.	
Mercury	—	60	—	All to Venezuela.	
Platinum-group metals: Platinum metal including alloys, unwrought and partly wrought	value, thousands	\$10,671	\$62	—	All to Spain.
Silver: Metal including alloys, unwrought and partly wrought	do.	\$103	—		
Titanium: Oxides	do.	—	\$1	—	All to Panama.
Zinc: Oxides	—	10	—	All to Venezuela.	
Other:					
Ores and concentrates of precious metals, n.e.s.	304	1,291	—	Belgium-Luxembourg 856; Republic of Korea 370; Japan 36.	
Oxides and hydroxides	11	34	—	Ecuador 22; Venezuela 9; Panama 3.	
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.	value, thousands	—	\$8	\$8	
Grinding and polishing wheels and stones	9	3	(?)	Ecuador 1; Guatemala 1; Panama 1.	
Bromine, fluorine, iodine	—	50	—	All to Peru.	
Cement	thousand tons	1,137	1,024	598	Dominican Republic 130; Haiti 74.
Chalk	53	—			
Clays, crude	2,099	395	—	Venezuela 340; Ecuador 55.	
Fertilizer materials:					
Crude, n.e.s.	—	95	—	All to West Germany.	
Manufactured:					
Ammonia	10,405	5,519	5,519		

See footnotes at end of table.

TABLE 3—Continued

COLOMBIA: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989		
			United States	Other (principal)	
METALS—Continued					
Nitrogenous	2	5			
Phosphatic	230	690	—	Do.	
Unspecified and mixed	5,205	23,116	—	Venezuela 21,055; Honduras 1,477; Panama 500.	
Gypsum and plaster	653	2,473	—	Venezuela 1,535; Ecuador 938.	
Lime	—	65	—	All to Panama.	
Mica: Crude including splittings and waste	—	6	6		
Pigments, mineral: Iron oxides and hydroxides, processed	—	6	4	Peru 2.	
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	\$90,498	\$108,762	\$18,000	Japan \$86,525; Switzerland \$787.
Synthetic	do.	—	\$1	—	All to Costa Rica.
Pyrite, unroasted	—	30	—	All to Ecuador.	
Salt and brine	23,100	72,684	—	Brazil 72,654; Panama 30.	
Sodium compounds, n.e.s.: Sulfate, natural and manufactured	—	5	—	All to Venezuela.	
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked	—	125	—	Venezuela 102; Dominican Republic 18; Netherlands Antilles 5.	
Worked	99	34	26	Panama 5; Ecuador 2.	
Dolomite, chiefly refractory-grade	100	90	—	All to Ecuador.	
Gravel and crushed rock	—	15,283	14,883	Netherlands Antilles 400.	
Quartz and quartzite	11	7	7		
Sand other than metal-bearing	6	101	—	All to Honduras.	
Sulfur:					
Elemental: Crude including native and byproduct	2,671	843	—	Guatemala 276; Honduras 200; Peru 186.	
Sulfuric acid	3	—			
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural	68	43	—	All to Ecuador.	
Carbon black	3,059	5,241	—	Ecuador 2,686; Venezuela 1,883; Chile 663.	
Coal, all grades including briquets	thousand tons	10,126	12,487	1,274	Denmark 2,585; Netherlands 1,824.
Coke and semicoke	102,568	102,456	—	Venezuela 80,416; Mexico 11,000; Chile 7,875.	
Petroleum:					
Crude	thousand 42-gallon barrels	54,920	62,139	55,351	Chile 5,356; Canada 653.
Refinery products:					
Mineral jelly and wax	do.	1	(⁴)	—	All to Ecuador.
Distillate fuel oil	do.	1,778	2,145	1,200	Peru 345; Brazil 174.
Lubricants	do.	11	5	—	Peru 3; Dominican Republic 1.
Residual fuel oil	do.	21,151	21,479	17,498	Bahamas 1,815; Netherlands Antilles 909.
Bitumen and other residues	do.	—	(⁴)	—	All to Costa Rica.
Bituminous mixtures	do.	1	1	—	Mainly to Peru.

¹Revised.²Table prepared by H. D. Willis.³Quantity not available, valued at \$1,000.⁴Quantity not available, valued at \$2,000.⁵Less than 1/2 unit.

TABLE 4
COLOMBIA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS				
Alkali and rare-earth metals	1	4	4	
Aluminum:				
Ore and concentrate including alumina	7,658	9,151	3,213	Hong Kong 5,717; Brazil 112.
Oxides and hydroxides	3,096	4,273	96	West Germany 3,085; United Kingdom 1,073.
Metal including alloys:				
Unwrought	8,714	13,791	1,324	Venezuela 10,247; Argentina 1,078.
Semimanufactures	9,726	6,271	1,829	Venezuela 2,859; West Germany 280.
Chromium: Oxides and hydroxides	93	127	62	West Germany 54; Netherlands 10.
Cobalt: Oxides and hydroxides	1	1	1	
Copper:				
Matte and speiss including cement copper value, thousands	\$7	—		
Metal including alloys:				
Unwrought	359	2,125	9	Peru 1,996; Chile 99; Yugoslavia 11.
Semimanufactures	20,577	17,876	659	Peru 5,611; Chile 4,949; Belgium-Luxembourg 2,255.
Iron and steel:				
Iron ore and concentrate	217	388	81	West Germany 198; Peru 100.
Metal:				
Scrap	157,009	204,887	133,975	Netherlands 60,239; Panama 5,422.
Pig iron, cast iron, related materials	7,150	16,093	191	Switzerland 14,767; Brazil 583; Haiti 300.
Ferroalloys:				
Ferromanganese	7,238	5,844	94	Mexico 3,496; Brazil 2,215.
Ferrosilicon	3,105	3,125	25	Chile 2,013; Brazil 776; Venezuela 303.
Unspecified	5,076	5,371	2,094	Brazil 1,413; Mexico 870.
Steel, primary forms	12,473	62,045	1	Venezuela 37,211; Brazil 21,416; United Kingdom 2,176.
Semimanufactures:				
Bars, rods, angles, shapes, sections	57,387	58,772	4,544	Spain 11,334; United Kingdom 10,753; Venezuela 7,836.
Universals, plates, sheets	348,502	300,260	12,403	Japan 88,779; Venezuela 73,372; Brazil 73,326.
Hoop and strip	7,398	5,827	203	United Kingdom 3,689; Japan 832; Brazil 442.
Rails and accessories	2,802	8,641	29	France 7,709; Spain 430; Japan 155.
Wire	1,445	994	39	Belgium-Luxembourg 367; West Germany 203; Brazil 160.
Tubes, pipes, fittings	75,176	110,681	50,200	Venezuela 19,235; Argentina 14,255.
Castings and forgings, rough	1,678	619	25	Spain 180; Peru 163; Sweden 124.
Lead:				
Oxides	2,116	1,522	6	Peru 1,491; Mexico 25.
Metal including alloys:				
Unwrought	2,636	2,615	—	Peru 2,515; Mexico 100.
Semimanufactures	8	13	5	West Germany 8.
Magnesium: Metal including alloys:				
Scrap	—	200	—	All from Ecuador.
Unwrought	54	28	10	Norway 18.
Semimanufactures	34	67	50	Netherlands 15; Venezuela 2.
Manganese:				
Ore and concentrate: Metallurgical-grade	9,809	3,360	1	Mexico 3,089; Brazil 260; Peru 10.
Oxides	592	489	62	Brazil 180; Belgium-Luxembourg 144; Japan 94.
Mercury	34	59	2	Spain 26; West Germany 19; Algeria 5.

See footnotes at end of table.

TABLE 4—Continued

COLOMBIA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS—Continued				
Molybdenum: Metal including alloys:				
Unwrought	1	—		
Semimanufactures	3	4	4	
Nickel:				
Ore and concentrate	148	1	1	
Metal including alloys:				
Scrap	5	5	3	Canada 2.
Unwrought	170	284	223	Canada 61.
Semimanufactures	174	116	63	Canada 23; West Germany 16.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, unspecified value, thousands				
	\$35	\$34	\$21	West Germany \$12.
Silver: Metal including alloys, unwrought and partly wrought do.				
	\$56	\$35	\$1	Venezuela \$27; Japan \$3; Brazil \$2.
Tin: Metal including alloys:				
Unwrought	329	398	(²)	Bolivia 363; Peru 35.
Semimanufactures	55	47	6	Bolivia 40; West Germany 1.
Titanium: Oxides	358	414	15	Venezuela 145; United Kingdom 117; West Germany 110.
Tungsten: Metal including alloys, semimanufactures				
	4	(³)		
Zinc:				
Oxides	67	101	2	West Germany 52; Peru 37; Gambia 10.
Metal including alloys:				
Scrap	—	1	1	
Unwrought	18,946	14,890	1	Peru 14,859; Mexico 30.
Semimanufactures	387	546	122	Venezuela 320; Costa Rica 52.
Other:				
Ores and concentrates	695	292	172	Netherlands 98; Republic of South Africa 20.
Oxides and hydroxides	97	72	41	United Kingdom 12; Italy 11.
Base metals including alloys, all forms	157	83	46	United Kingdom 17; Belgium-Luxembourg 8.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	4,133	7,271	92	Ecuador 7,136; Italy 18.
Artificial: Corundum	1,808	1,420	13	Brazil 1,382; West Germany 18.
Dust and powder of precious and semi-precious stones value, thousands				
	\$1	\$8	\$8	
Grinding and polishing wheels and stones	42	28	17	Belgium-Luxembourg 3; Italy 3.
Asbestos, crude	16,614	14,370	168	Switzerland 7,525; Canada 6,572.
Barite and witherite	12,095	16,029	15,979	Peru 50.
Boron materials:				
Crude natural borates	6,034	4,120	—	Chile 2,099; Peru 2,020; West Germany 1.
Oxides and acids	385	384	75	Peru 280; Argentina 20.
Bromine, fluorine, and iodine	42	2	(²)	Chile 1; West Germany 1.
Cement	5,434	3,906	398	Brazil 1,307; Honduras 1,000; France 659.
Chalk	81	132	26	Switzerland 106.
Clays, crude	18,431	11,649	10,921	Mexico 354; Venezuela 306.

See footnotes at end of table.

TABLE 4—Continued

COLOMBIA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
INDUSTRIAL MINERALS—Continued					
Diamond: Natural:					
Gem, not set or strung	value, thousands	\$32	\$22	\$22	
Industrial stones	do.	\$5	\$6	\$4	West Germany \$1; Spain \$1.
Diatomite and other infusorial earth		1,612	1,406	407	Mexico 978; Sweden 15.
Feldspar, fluorspar, related materials		791	1,118	2	Republic of South Africa 573; Mexico 310; Spain 150.
Fertilizer materials:					
Crude, n.e.s.					
		—	2	2	
Manufactured:					
Ammonia		26,247	21,472	16,686	Venezuela 4,782; Italy 2.
Nitrogenous		524,547	429,719	164,659	Venezuela 133,940; U.S.S.R. 35,000.
Phosphatic		10,345	9,332	9,332	
Potassic		257,263	255,322	125,406	East Germany 113,027; Canada 14,213.
Unspecified and mixed		226,016	169,917	144,166	Norway 18,627; Brazil 6,604.
Graphite, natural		40	130	40	Mexico 60; Canada 20.
Gypsum and plaster		34,838	32,121	370	Dominican Republic 31,688; Japan 50.
Magnesium compounds: Magnesite, crude		897	1,916	336	Austria 556; Venezuela 480.
Mica:					
Crude including splittings and waste					
		118	132	110	France 19; Japan 2.
Worked including agglomerated splittings					
		19	9	3	Spain 4; France 1.
Nitrates, crude		—	54	—	All from Spain.
Phosphates, crude		45,696	37,703	37,703	
Pigments, mineral: Iron oxides and hydroxides, processed		1,602	1,136	131	West Germany 617; Mexico 196.
Precious and semiprecious stones other than diamond:					
Natural					
	value, thousands	\$11	\$13	\$9	Brazil \$4.
Synthetic					
		1	—	—	
Pyrite, unroasted		—	21	—	Sweden 19; West Germany 2.
Salt and brine		152	141	82	West Germany 59.
Sodium compounds, n.e.s.:					
Soda ash, natural and manufactured					
		31,817	21,614	21,609	West Germany 5.
Sulfate, natural and manufactured					
		3,007	6,194	6,171	West Germany 12; Peru 10.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked					
		11,791	12,323	44	Peru 9,129; Italy 1,614; Guatemala 744.
Worked					
		650	763	1	Ecuador 411; Peru 351.
Dolomite, chiefly refractory-grade		6,579	6,802	3,017	Belgium-Luxembourg 3,725; Italy 59.
Gravel and crushed rock		20,646	22,850	264	Venezuela 22,495; Italy 40.
Quartz and quartzite		2	7	7	
Sand other than metal-bearing		1,086	4,392	1,062	Brazil 3,284; Austria 26.
Sulfur:					
Elemental:					
Crude including native and byproduct					
		25,984	31,904	25,783	Venezuela 6,121.
Colloidal, precipitated, sublimed					
		69	63	63	
Sulfuric acid		105	14	10	West Germany 3; Netherlands 1.
Talc, steatite, soapstone, pyrophyllite		2,137	2,198	713	Italy 629; North Korea 608.
Other: Crude		9,807	11,572	6,694	East Germany 3,937; United Kingdom 540.

See footnotes at end of table.

TABLE 4—Continued

COLOMBIA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural	14	104	104		
Carbon black	711	751	244	West Germany 363; Singapore 73.	
Coal: Anthracite	14	2	—	All from United Kingdom.	
Coke and semicoke	value, thousands	\$1	—	All from Spain.	
Peat including briquets and litter	—	13	—	All from Netherlands.	
Petroleum refinery products:					
Liquefied petroleum gas					
thousand 42-gallon barrels	(²)	1	1		
Gasoline	do.	8,208	9,505	1,041	Argentina 4,266; Venezuela 1,000.
Mineral jelly and wax	do.	8	121	2	Brazil 67; Spain 49; United Kingdom 3.
Kerosene and jet fuel	do.	4	11	(²)	Mainly from Brazil.
Distillate fuel oil	do.	74	1	—	All from Brazil.
Lubricants	do.	374	441	60	Venezuela 377; West Germany 3.
Residual fuel oil	do.	24	25	—	All from Brazil.
Bitumen and other residues	do.	(²)	(²)	(²)	
Bituminous mixtures	do.	2	(²)	(²)	
Petroleum coke	do.	1	2	2	

¹Table prepared by H. D. Willis.²Less than 1/2 unit.³Quantity not available, valued at \$9,000.

STRUCTURE OF THE MINERAL INDUSTRY

Colombia is composed of three major regions of economic activity—the central, north coast, and western regions. The primary center of activity in the central region was Bogotá, the country's capital city. The Bogotá area produced 81% of refined petroleum products and 35% of all chemicals in 1990. In addition, cement and steel plants in this region were major domestic producers. The western region contains important coal deposits and has vast hydroelectric resources with an installed capacity of 3,810 MW. The north coast or Caribbean region contains the second largest petroleum refinery, and large chemical and petrochemical production facilities. The Cerro Matoso nickel mine as well as the extensive El Cerrejón Norte and El Cerrejón Centro coal-mining complexes are in this region.

According to a recently completed mining census, 35 minerals were exploited on a national basis. It was determined that Colombia has about 7,300 mines, more than one-half of which are associated with the mining of gold. The following mineral

commodities are listed in the order of number of operating mines: gold, coal, industrial minerals, platinum, clay, limestone, marble, and emeralds. It was also found that 74% of the mining was on the surface with the remainder being underground. Approximately 19% of the mining was done in the traditional manner, with pickax and shovel or by washing placer deposits. The survey, Colombia's first detailed endeavor, was conducted by the Departamento Nacional de Estadística (DANE), CARBOCOL, Instituto Nacional de Investigaciones Geológicas y Mineras (INGEOMINAS), and ECOMINAS.

The major part of Colombia's mining industry is privately owned. This is especially true with the industrial minerals (excluding emerald), iron and steel, and the precious metals (gold, platinum, and silver). The natural gas and petroleum sector is primarily controlled and operated by the Government entity ECOPETROL, established in 1948, the 14th largest company in Latin America. Two Government agencies were created to administer mining exploration and development: INGEOMINAS, founded in 1919 for exploration activities, and ECOMINAS, created in 1968 to implement mining projects and execute the

national mining development plan. Additional Government entities were created to administer and exploit the coal, nickel, and nuclear industries.

In 1990, the Government announced that plans were being considered to sell its 50% interest in the El Cerrejón Norte coal mine to the private sector. The mine is jointly owned with International Colombia Resources Corp. (Intercor), a subsidiary of the Exxon Corp. of the United States. Intercor is also the operator.

COMMODITY REVIEW

Metals

Gold.—In Colombia, gold mining can be traced back to pre-Columbian times. Colombia ranked fourth in gold production in the Western Hemisphere after the United States, Canada, and Brazil, in that order.

The major source area, Department of Antioquia, produced about 70% of the total gold output in 1990. Most of the remaining production came from various river placers along the Pacific coastal plains.

A survey program was carried out in the Department of Guainía to more accurately

TABLE 5

COLOMBIA: STRUCTURE OF THE MINERAL INDUSTRY

(Thousand metric tons unless otherwise specified)

		Location of main facilities	Annual capacity
Asbestos	Minera Las Brisas S.A.	Campamentos, Antioquia Department (mine)	9,000
Carbon Black	Cabot Colombiana S.A.	Cartagena, Bolívar Department	
Do.	Productos Petroquímicos S.A.	Cali, Valle del Cauca Department (two plants)	12,000
Cement	Cía. de Cemento Argos S.A.	Medellín, Antioquia Department (plant)	3,750,000
Do.	Cementos del Caribe S.A.	Barranquilla, Atlántico Department (plant)	1,000,000
Do.	Cementos del Valle S.A.	Yumbo, Valle del Cauca Department (plant)	950,000
Coal	Carbones de Colombia (CARBOCOL) and International Colombia Resources Corp. (INTERCOR)	El Cerrejón Norte, La Guajira Department (mine)	15,000,000
Do.	Carbones de Colombia (CARBOCOL)	El Cerrejón Central, La Guajira Department (mine)	1,500,000
Do.	Acerías Paz del Río S.A.	Paz del Río, Boyacá Department (mine)	600,000
Emerald	Empresa Colombiana de Minas	Coscuez, Muzo, and Peñas Blancas, Boyacá Department (three mines)	—
Gold	Frontino Gold Mines Ltd.	Segovia, Antioquia Department (El Silencio Mine)	—
Do.	ore Greenstone Resources Ltd.	Segovia, Antioquia Department (Oronorte Mine)	20,000
Do.	Mineros de Antioquia S.A.	Bagre and Río Nechi, Antioquia Department (two mines)	—
Do.	Small miners (Individual prospectors and Cooperatives)	Río Nechi, Antioquia Department (mines and Cooperatives)	—
Iron ore	Acerías Paz del Río	Paz del Río, Boyacá Department (mine)	500,000
Kaolin	Cerámicas del Valle Ltda.	Yumbo, Valle del Cauca Department (mine)	—
Natural gas	Empresa Colombiana de Petróleos	North coast, Guajira Department (national gasfields)	3,500
Do.	do. International Petroleum Colombia Ltd.	Barrancabermeja locale, Antioquia & Santander Departments (national gasfields)	1,200
Nickel	Cerro Matoso S.A.	Montelíbano, Córdoba Department (mine)	23,000
Nitrogen	Abonos de Colombia	Cartagena, Bolívar Department (plant)	100,000
Do.	Monomeros Colombo-Venezolanos S.A.	Barranquilla, Atlántico Department (plant)	85,000
Petroleum	ECOPETROL	16 fields in various Departments	30
Do.	do. Houston Oil Colombiana S.A. (HOCOL)	14 fields in various Departments	16.5
Petroleum products	do. ECOPETROL	Four refineries located in the Departments of Bolívar, Norte de Santander, Putumayo, and Santander	101.3
Phosphate	Fosfatos de Colombia S.A.	Neiva, Huila Department	30,000
Platinum	Small miners (Individual prospectors and Cooperatives)	NA	—
Salt (marine)	Instituto de Fomento Industrial (IFI)	Manaure Salina, La Guajira Department	1,200,000
(rock)	Concesión Salinas	Zipaquirá, Cundinamarca Department	500,000
Silver	kilograms per year Frontino Gold Mines Ltd.	Segovia, Antioquia Department (mine)	2,500
Do.	do. Small miners (Individual prospectors and Cooperatives)	Río Nechi, Antioquia Department (mines and Cooperatives)	2,000
Steel (integrated plant)	Acerías Paz del Río S.A.	Belencito, Boyacá Department (plant)	300,000
(semi-integrated plants)	Hojalata y Laminados S.A.	Medellín, Antioquia Department	
Do.	Siderúrgica del Boyacá S.A.	Bogotá, Federal District	
Do.	Siderúrgica de Medellín S.A.	Medellín, Antioquia Department	
Do.	Siderúrgica del Pacífico S.A.	Cali, Valle del Cauca Department	(Total) 300,000
Sulfur	Industrias Purace S.A.	El Vinagre Mine, Cauca Department	50,000

NA Not available.

locate and define the gold deposits in that potential area. During the year, the Government held a series of discussions with private Colombian companies as well as foreign companies with regard to the undertaking of a large-scale mining venture in the Guainía region. Any venture agreed to most likely would involve a consortium of mining companies.

Greenstone Resources of Canada began production at its Oronorte Mine at Segovia, District of Frontino. Preliminary production figures for 1990 were 625 kg from an ore output of 20,000 tons. Remaining reserves were about 139,000 tons grading 21 grams of gold per ton. At yearend, the mine contained about 7 years of life at the 1990 production level.

The Ministry of Mines and Energy stated that rudimentary extraction methods were causing up to a 60% loss of Colombia's total gold production. This was especially true in the Andean region hard-rock and placer mines.

Iron and Steel.—Iron ore production increased while steel production stayed the same in 1990. Iron ore output was up by 10% for the year. One of the major iron ore deposits lies approximately 248 km northeast of Bogotá. The mine was the major source of iron ore for Acerías Paz del Río, Colombia's only fully integrated steel mill. The mill has a crude steel capacity of 300,000 tons, including a 50,000-ton capacity to process scrap. The five semi-integrated steel plants in other parts of the country utilized electric furnaces to produce steel from pig iron and scrap.

Nickel.—Colombia's nickel production in the form of ferronickel increased by more than 8% in 1990; however, the value of ferronickel exports decreased substantially relative to the record value of 1989. This was principally due to the decrease in world market price. The entire production came from the Cerro Matoso Mine at Montelíbano, Department of Córdoba. The operation is a joint venture between Billiton Overseas Ltd. (55%), a subsidiary of Royal Dutch Shell (Netherlands), and Empresa Colombiana de Níquel (ECONIQUEL) (45%), a Government entity. The mine has yielded about 800,000 tons of ore per year (2.7% Ni). At the 1990 rate of extraction, the reserves are projected to last about 20 years. Exploratory surveys have revealed the existence of nickel-bearing ores nearby, though of lower nickel content.

Platinum.—Platinum production increased by 35% over that of the previous year. As in prior years, the entire output came from placers adjoining the San Juan River in the Department of Chocó. Colombia's production corresponded to 1% of the world's newly mined output. Since 1984, production has more than tripled as a result of higher world prices.

Industrial Minerals

Asbestos has been mined in Colombia since 1982. About one-third of the country's production came from a single mine in the Department of Antioquia. Gypsum has been produced in various regions for many years. In 1990, gypsum production satisfied approximately 80% of the cement industry's requirements. Limestone is widely found in Colombia. Most of the cement plants were near limestone mine sites. Nearly one-third of the country's cement production was exported to the United States and the Caribbean region in 1990. The primary phosphate rock deposits are principally along the eastern range of the Andes Mountains, with the largest deposit situated about 250 km northeast of Bogotá.

In 1990, Colombia accounted for more than 90% of the world's emerald production. The preponderance of the country's production came from the Chivó, Coscuez, and Muzo Mines proximal to Bogotá. Japan continued as the single largest market in 1990.

Mineral Fuels

In 1986 (the last year for which there was published data), the total amount of electrical energy produced (expressed in tons of oil equivalent = toe) was 7,073,000 toe. The primary sources were hydraulic (hydroelectric), which composed 70% of the total, and thermal with 30%. Natural gas provided 66% of the fuel for thermal generating plant coal, 30%; and petroleum, 4%. Total energy consumption, which included losses due to conversion, transportation, and distribution, was 6,918,000 toe. Households, transportation, and others consumed 3,570,000 toe, while the industrial and construction sectors consumed 1,767,000 toe. The estimated efficiency (percentage of output to input) of the thermal power plant sector was 23%.

Coal.—Based on yearend figures, Colombia contained the largest coal reserves in Latin America, principally of steam

coal. Existing reserves are sufficient to last 1,000 years at the current rate of extraction. About one-fifth of the country's reserves occur along the north coast, concentrated in the La Guajira Peninsula; approximately 15 million tons of steam coal was mined from the El Cerrejón Norte Mine in 1990. The El Cerrejón Centro Mine, which was reopened in 1988, produced about 500,000 tons. The coal from this region was an excellent quality steam coal having a sulfur content of less than 1% and an ash content not exceeding 8%. The major part of the El Cerrejón Norte coal was primarily exported to Western Europe, the United States, and the Far East.

In 1990, Colombia produced 20.4 million tons of coal and exported 16.5 million tons. This resulted in an apparent domestic consumption of 3.9 million tons for the year. The interior coal basins provided most of the coal to the domestic market in 1990. It is the interior areas, mainly around Bogotá, where the preponderance of Colombia's coal reserves occur. There was also significant production near the cities of Cali and Medellín. Additional mining operations have been planned for the La Guajira region and include the new La Loma Mine development and further expansion of the El Cerrejón Mines.

Natural Gas and Petroleum.—Natural gas production increased an estimated 10% over that of 1989. Of the estimated 5.6 billion m³ produced, about 4.5 billion m³ was marketed domestically. There was no export of natural gas in 1990. The great majority of natural gas reserves occur both offshore and onshore of the La Guajira Peninsula.

Recoverable petroleum reserves have been conservatively estimated to be in excess of 2 billion bbl. At the 1990 rate of production, the reserves would last approximately 15 years. The petroleum reserves are dispersed among seven basins throughout Colombia. Approximately one-half of the reserves lie in the Eastern Plains (Los Llanos) principally in the Arauca subbasin containing the huge Caño Limón Field discovered in 1983. This structure contains estimated reserves of 300 million bbl of heavy-grade petroleum. Colombia's newest emerging petroleum basin, in the upper Magdalena Valley, contains about one-fourth of the total petroleum reserves.

In 1990, ECOPETROL entered into a \$24 million contract with the Italian company Tecnologie Progeti Lavori (TPL) for the construction of a new petroleum refinery in

the middle Magdalena Valley. The contract covers the siting, design, and basic engineering of the plant. Oleoducto de Colombia let a \$350 million contract to a joint venture of Spie Batignolles of France and Techint of Argentina for construction of the second stage of a pipeline system to link oilfields in the upper Magdalena Valley with a Caribbean port. The 150,000-bbl/d pipeline will extend from Puerto Salgar, Department of Cundinamarca, to the port of Coveñas, Department of Sucre. The major, active pipeline that extends from the Caño Limón Field to Coveñas is 787 km in length, cost \$845 million, and was put into service in 1986.

Reserves

In 1990, Colombia contained the largest coal reserves in Latin America. It also was among the leaders in asbestos, emerald, gold, natural gas, petroleum, phosphate rock, and sulfur. Colombia's reserves of major minerals are included in table 6.

TABLE 6

COLOMBIA: RESERVES OF MAJOR MINERALS

(Thousand metric tons unless otherwise specified)

Asbestos, fiber	17,000
Coal, all types	22,000,000
Gold, metal	2
Iron ore, 45% Fe	100,000
Limestone	900,000
Natural gas million cubic meters	114,000
Nickel, 2% Ni	62,000
Petroleum million 42-gallon barrels	2,000
Phosphate rock	450,000
Platinum, metal	1
Sulfur, 28% to 34% S	300,000

INFRASTRUCTURE

Hydropower furnished 87% of the total installed electrical generating capacity of 9,250 MW in 1989 (the latest year for which there is information). This represented only 5% of the hydropower potential available in Colombia. Based on recent surveys and studies, it was determined that the country contained at least 308 potential hydroelectric plant sites that were identified as economically feasible for development.

One of the major hydroelectric plants under construction was the 1,000-MW

Guavio River project in the Department of Cundinamarca, which is to be completed in 1993. When completed, it will be the tallest earth and gravel dam in the Western Hemisphere, rising to a height of more than 47 m.

Colombia contained 3,563 km of single-track, 0.914-m gauge railroad in 1990. The country had a total of 75,450 km of roads, composed of 9,350 km paved and 66,100 km having dirt and gravel surfaces. There was 14,300 km of inland waterways navigable by riverboats. The major shipping ports were Barranquilla, Buenaventura, Cartagena, Coveñas, Santa Marta, and Tumaco. Among the 34 merchant marine vessels were 23 cargo ships; 1 chemical tanker; 1 petroleum, oils, and lubricants tanker; and 9 bulk carriers. There was a total of 5,890 km of pipeline consisting of 3,585 km of crude petroleum, 1,350 km of refined products, 830 km of natural gas, and 123 km of natural gas liquids.

In 1989, approximately \$285 million of foreign investments went to the transportation sector. This involved construction and paving of highways, access roads, and improvements in ocean ports and airports. In addition, a portion of ECOPETROL's earnings was set aside to finance basic infrastructural works in select petroleum-producing regions.

In 1989, the Government eliminated the country's national railroad organization, replacing it with two new entities. One, known as Ferrovías, is a state-run entity with responsibility for construction and maintenance of track, station, and related facilities. The other, Colombian Railway Transport Co., is a mixed (private and public) stock company that is responsible for rail service operations.

Privatization of the Colombian port system was considered likely to take from 3 to 5 years. Major road improvements, projected to cost approximately \$300 million, are on hold as the Government is having a difficult time repairing infrastructural damage from increased guerrilla activity.

OUTLOOK

Colombia has made impressive progress during the past generation in terms of social indicators such as extension of health services, literacy, and mortality rates. The economy has shown a remarkable resilience in dealing with chronic violence and sociopolitical conflicts and continues to

expand and diversify at a time when most of Latin America has remained mired in the morass of past economic policy errors. It has been calculated that a medium-term growth rate of at least 5% will be necessary to prevent the unemployment rate from rising, a development that would have political as well as economic implications.

The medium- and long-term outlook for the mineral sector look promising. This is especially true concerning the mineral fuels coal, natural gas, and petroleum. The long-term outlook for gold looks good providing adequate exploration and development of the Guainía region takes place. Emerald and nickel production at current levels are expected to continue for the next 15 to 20 years.

¹Where necessary, values have been converted from Colombian pesos (Col\$) to U.S. dollars at the average rate for 1990 of Col\$502.3=US\$1.00.

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División de Minas
Carrera 7, 7-56

Bogotá-DE-Colombia
Empresa Colombiana de Petróleos
(ECOPETROL)
Postal 808

Bogotá-DE-Colombia
Empresa Colombiana de Minas
(ECOMINAS)

Apartado Aéreo 17878
Avenida 34, 19-05
Bogotá-DE-Colombia

Empresa Colombiana de Níquel
(ECONIQUEL)
Carrera 7, 26-20

Bogotá-DE-Colombia
Instituto de Fomento Industrial (IFI)
Apartado Aéreo 874
Bogotá-DE-Colombia

Instituto Nacional de Investigaciones
Geológico-Mineras (INGEOMINAS)
Diagonal 53, 34-53
Bogotá-DE-Colombia

Carbones de Colombia S.A. (CARBOCOL)
Carrera 7, 31-10
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Carrera 8a, 13-31 Pisos 7 a 11
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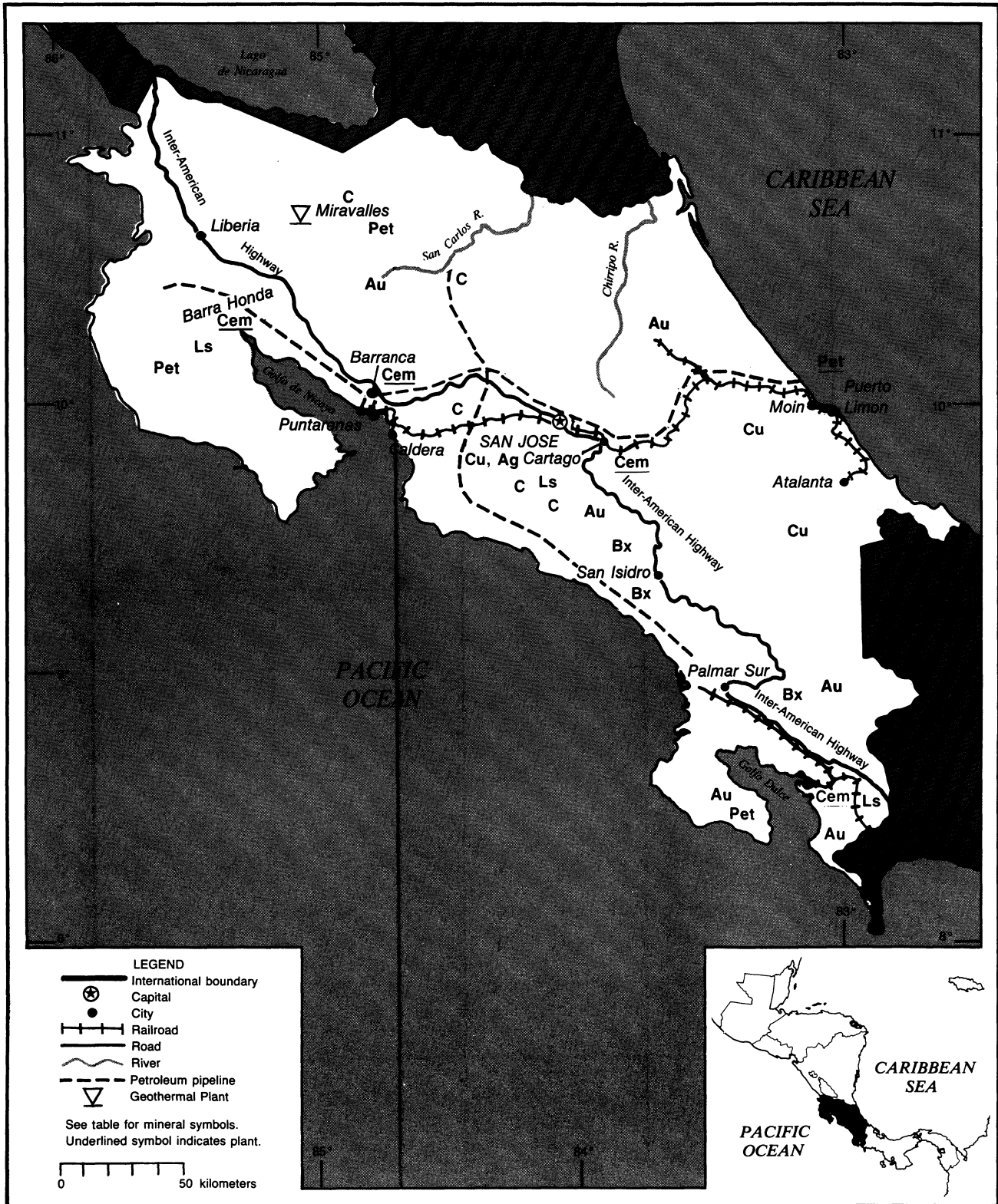
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COSTA RICA

AREA 51,100 km² (includes Isla del Coco)

POPULATION 2.95 million



COSTA RICA

By Philip M. Mobbs

Costa Rica has been the most prosperous of the Central American countries, a position attributed to its political stability. Manufacturing, agriculture, and tourism dominated the nation's economy. The mineral industry of Costa Rica was of minor importance. It contributed less than 1% to the GDP. Limestone and cement dominated the local mineral-related production.

GDP was projected to be \$5.5 billion¹ in current dollars for 1990, compared to \$5.2 billion in 1989. GDP growth dropped to 3.5% from 1989's 5.5% rate. The inflation rate increased to 27% in 1990, up from 10% in 1989.

GOVERNMENT POLICIES AND PROGRAMS

The principal legislation governing mining was Law 6797 of October 4, 1982. The Ministerio de Recursos Naturales, Energía y Minas (MRNEM) was responsible for the control and development of Costa Rica's mineral resources through the Dirección de Geología, Minas y Hidrocarburos (DGMH), the Minera Nacional, S.A. (MINASA), and the National Environmental Commission. The Refinadora Costarricense de Petróleo S.A. (RECOPE) operated the Government's monopoly in oil-refining operations.

In December 1989, Costa Rica, Guatemala, Honduras, Nicaragua, and El Salvador signed the Central American Agreement for the Protection of the Environment. This pact established a regional commission to determine the most appropriate strategies to promote environmentally sustainable development of the region's natural resources.

During 1990, the Inter-American Development Bank authorized a \$1.7 million grant to fund the creation of a Costa Rican environmental management council to coordinate environmental policies and activities.

The Central Bank approved two deeply discounted debt-for-nature swaps totaling \$10.8 million. An additional \$45 million of debt-for-nature exchanges proposed through 1993 were threatened by the increased inflation rate.

Costa Rica had an extensive system of Forest Reserves, National Parks, Protected Zones, and Wildlife Refuges. Approximately 28% of the country was within an environmentally protected area. Consolidation of Costa Rica's Chirripo National Park and several nearby ecological reserves was considered by the Government. If approved, the proposal would form a 10,000 km² international La Amistad Park along the Costa Rica-Panama border.

In November, Costa Rica and the United States signed a Framework Agreement on Trade and Investment.

PRODUCTION

The Mineral Industry continued to be dominated by the extraction of industrial minerals, gold, and the production of iron, steel, and petroleum products. The Costa Rican Government continued to place emphasis on the development of the country's gold potential.

STRUCTURE OF THE MINERAL INDUSTRY

MINASA was responsible for coordination between the private sector and Government agencies. It had the authority to assess and develop mineral resources. RECOPE actively pursued coal and petroleum exploration studies. The state-owned Corporación Costarricense de Desarrollo S.A. was involved in the industrial mineral sector through the ownership of Cementos del Pacífico S.A.

Canadian and U.S. companies were involved in a number of precious metal exploration and mining operations.

COMMODITY REVIEW

Metals

Gold and Silver.—Declared records of gold production by individual operators, especially from the Osa Peninsula placer operations, were generally thought to be understated and should be treated with caution. The Banco Central de Costa Rica has purchased domestically produced gold since 1981. Payment was in colones at a slight premium over prevailing world market prices. However, small-scale producers avoided paying taxes if they sold their gold privately. Additionally, nuggets could be sold for appreciably more than the prevailing world price. Thus, a large proportion of the gold output was sold privately with a resulting loss of tax revenue for the Government.

Ariel Resources Ltd. of Vancouver, Canada, expanded the carbon-in-pulp mill at the Tres Hermanos Mine to 200 tons per day. The mine, near Las Juntas, was approximately 107 km west-northwest of San José, the Capital. Production operations at the company's Esperanza Mine at Libano were suspended in 1989. Tunneling and subsurface sampling furthered the 1990 exploration program at Esperanza, which concentrated on a multivein mineralized zone.

The Canadian companies, Black Cliff Mines Ltd. of Toronto and Lyon Lake Mines Ltd. of Rouyn-Noranda began drilling on the Beta Vargas joint venture near Pozo Azul, approximately 97 km northwest of San José. Adonos Resources Inc. of Toronto subsequently obtained Black Cliff's interest in the property. A 21-hole drilling program was planned to confirm an estimated 6.7 million tons of ore averaging 1.17 grams of gold per ton. An open pit heap leach operation was proposed for the property. The joint venture also proposed a 1,800-m drilling program at the Canamazo prospect 4 km to the northwest.

TABLE 1
COSTA RICA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^a	1990 ^a
Cement	533,766	581,740	556,360	^a 800,000	996,500
Clays, common ^c	200,000	200,000	200,000	² 506,685	304,700
Diatomite ^c	4,500	4,500	² 4,500	4,500	4,400
Gold kilograms	361	300	313	387	460
Iron and steel: Semimanufactures	52,905	98,613	71,628	72,500	65,000
Lime ^c	10,000	10,000	10,000	10,000	12,700
Petroleum refinery products thousand 42-gallon barrels	4,740	4,594	4,557	4,724	4,500
Pumice	10,000	12,000	14,000	14,000	4,900
Salt, marine ^c	30,000	30,000	30,000	30,000	40,000
Silver ^c kilograms	62	62	62	² 194	—
Stone: ^c					
Crushed rock and rough stone thousand tons	1,200	1,300	² 1,500	1,500	1,450
Limestone and other calcareous materials thousand tons	1,000	1,000	² 1,015	² 2,300	1,600
Sand and gravel do.	1,000	1,000	² 1,350	1,400	1,020
Sandstone	1,000	1,000	² 1,000	1,000	650

^aEstimated. ^bPreliminary. NA Not available.

¹Includes data available through September 24, 1991.

²Reported figure.

TABLE 2
COSTA RICA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990.

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Industria Nacional de Cemento S.A. (INCSA)	Aguas Calientes, Cartago, Cartago Province	350
Do.	Cementos del Pacífico S.A., (CEMPASA)	near Colorado, Guanacaste Province	300
Clay	CEMPASA	Tajo Finca, near Platanar, Guanacaste Province	100
Gold kilograms	Minera Macona Ltda.	Santa Clara Mine, Puntarenas Province	160
Do. kilograms	Ariel Resources Ltd.	Tres Hermanos mine, Las Juntas, Guanacaste Province	93
		Esperanza Mine, Líbano, Guanacaste Province	30
Limestone	INCSA	La Chilena Quarry, near Cartago, Cartago Province	¹ 550
Do.	CEMPASA	Cerro Peña Blanca Quarry, Guanacaste Province	300
Petroleum Products	Refinadora Costarricense de Petróleo S.A. (RECOPE)	Moin Refinery, Limon Province	² 5,760

¹Includes 200,000 mt/a interbedded limestone and shale.

²Thousand 42-gallon barrels.

Greenstone Resources Ltd. of Toronto prepared a prefeasibility study for its El Recio property in Guanacaste Province, 64 km southeast of Liberia.

Operations at the Río Chiquito open pit gold and silver mine were suspended in late 1989. Mallon Resources Corp. of Denver began an exploratory drilling program south of the old pit. The Río Chiquito Mining Co. was subsequently formed by Mallon, Sun-

shine International Exploration Co. of Dallas, and Red Rock Ventures Inc. A 36-hole, 4,000-m diamond drilling program was completed in December 1990. There were 3 additional targets to investigate on the 61 km² concession.

Minera Rayrock of Toronto worked on the feasibility study for the Bellavista/Montezuma project, 72 km northwest of San José.

Industrial Minerals

Sulfur.—MRNEM revoked the sulfur exploration permit of Empresas Eurospect S.A. The proposed open pit sites of the company's concessions, 45 km northwest of San José, had been engulfed by an expansion of the Juan Castro Blanco Forest Reserve. Natural resources exploitation within the reserve was authorized, subject to stringent

environmental requirements. However, environmental opposition to mining the Fila Chocoseula deposit, also known as the Volcán Viejo and the Quebrada Azufrada Prospects, resulted in the cancellation.

Mineral Fuels

The country had an estimated 909 MW installed electrical generating capacity. Approximately 80% was from hydroelectric plants.

Construction of the 32-MW capacity Sandillal hydroelectric plant was approximately 40% completed. Construction continued on the 55 MW Miravalles I geothermal plant. Instituto Costarricense de Electricidad (ICE) received a \$182.8 million loan from the Inter-American Development Bank to build the 55-MW Miravalles II geothermal plant and the Toro I (24 MW) and II (66 MW) hydroelectric plants.

A Florida-based firm's \$50 million garbage recycling plant contract for the San José metropolitan area was rescinded. Methane gas from the proposed landfill was to have been used to generate electricity.

Petro-Canada International Assistance Corp. and RECOPE completed a multiwell stratigraphic test program, part of a petroleum study funded by the World Bank. The study was expected to encourage exploration activity onshore and off both coasts. Bids were received on 11 of the 27 blocks offered in the first round of Costa Rica's lease sale. Onshore and shallow-water concessions were acquired by seven independent oil companies.

INFRASTRUCTURE

Costa Rica had a relatively well developed transportation infrastructure. The

national paved-road system exceeded 7,030 km. The Ministry of Public Works and Transport obtained a \$60 million loan from the World Bank to rehabilitate 458 km of the system over the next 5 years. Access to remote mining areas was provided by an additional 7,010 km of gravel roads, 1,360 km of dirt roads, and 730 km of seasonably navigable inland waterways.

There were 950 km of railroad track available. The railroad linked Puerto Limón, the major Caribbean port to Puntarenas, the major port on the Pacific coast. Petroleum was offloaded at the coastal refinery complex at Moin. RECOPE distributed refined petroleum products across the country by a 348-km pipeline network.

OUTLOOK

Costa Rica's central geographic position could support further growth of its mineral industry. The nation's extensive infrastructure and reserves of precious metals and bulk aggregates, such as limestone, pumice, and sand, could sustain increased demand. Mine startup costs dictate that export markets for the nation's mineral commodities be readily available, because of Costa Rica's relatively small domestic market.

The difficulties that mining companies have recently had with obtaining financing is affecting mineral development in Costa Rica. Numerous joint ventures have blossomed, then faded. Some precious metal concessions seem to change hands yearly. Increased exploration activity is expected as more North American companies take an interest in a more stable Central America.

However, the increased environmental opposition to mining projects is not expected to abate.

¹Where necessary, values have been converted from Costa Rican colones (¢) to U.S. dollars at the rate of ¢100=US\$1.00.

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Dirección de Geología, Minas y Hidrocarburos
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Minera Nacional S.A.
Apartado 5298, Zona 1000
San José, Costa Rica
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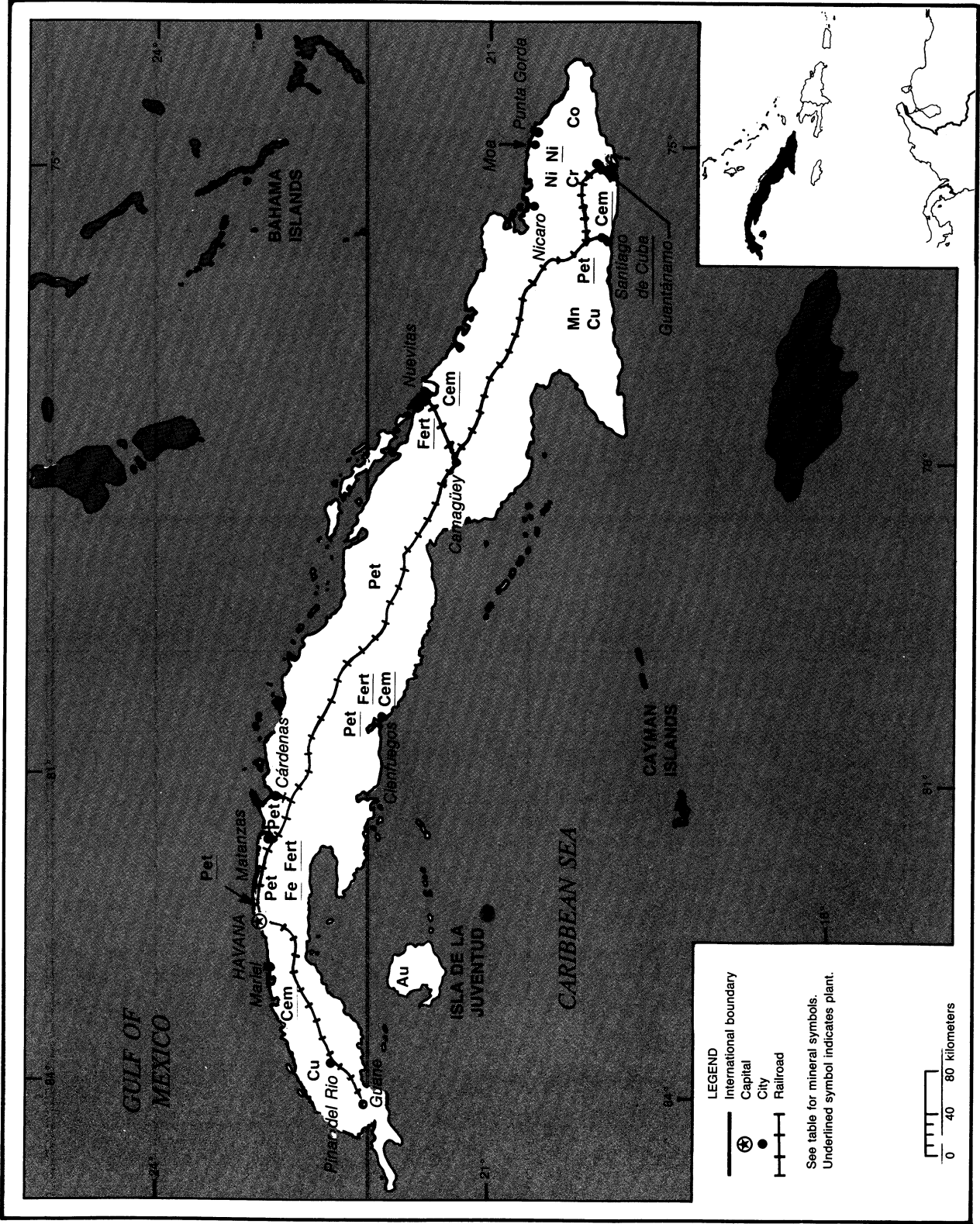
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CUBA

AREA 110,860 km²

POPULATION 10.6 million



CUBA

By Alfredo C. Gurmendi

Cuba is an important producer of nickel worldwide and has the largest known reserves. The country's main quarrying and mining activities were confined to the production of gypsum, lime, marble, and zeolite and base metals. Cuba produced mostly for local consumption hydraulic cement, iron and steel, nitrogen, and sulfur. Cuba's main mineral exports were nickel ore, nickel metallurgical products, and chromite. Cuba has no significant oilfields and continued to be heavily dependent on imported crude oil. Ninety percent of the natural gas produced was for local consumption and 10% for exports. The GNP for 1990 was \$20.9 billion;¹ unemployment approached 6%. The mineral sector employed less than 5% of the total 3.4 million labor force; the remainder was 30% in services and government, 22% in industry, 20% in agriculture, 11% in commerce, 10% in construction and mining, and 7% in transportation and communication. Cuba has had difficulty servicing its foreign debt of \$7 billion since 1982, and its foreign reserves stand at less than \$100 million. Cuba's centrally planned economy, largely state-owned, was highly dependent on its agricultural sector and foreign trade. The Government was encouraging foreign investment in tourism, sugar, basic foods, and nickel industries. The annual \$4 billion Soviet subsidy may be cut as a result of the U.S.S.R.'s mounting economic problems and internal changes.

GOVERNMENT POLICIES AND PROGRAMS

Cuba was undergoing internal adjustments as a result of foreign debt problems, trade deficits, foreign exchange shortages, reduced subsidies from the U.S.S.R., and unpredictable Soviet trade; these adjustments were causing serious food and fuel shortages and reduced production of cement and nickel. However, cooperation was ex-

pected to continue under bilateral agreements between Cuba and the countries of the CMEA, whereby CMEA will honor its commitments in the construction of the Moa nickel facility in Holquín. A new bilateral cooperation agreement was signed between Cuba and the U.S.S.R.; this constituted the final stage of a 5-year (1990-95) bilateral treaty. On the economic front, Cuba will be assisted with its nickel program, which included plans to complete the fourth Cuban nickel plant at Las Camariocas, in 1993, at a cost of \$1.0 billion for 30,000 tons per year of capacity. Cuba and the U.S.S.R. also agreed to build the Antillana iron and steel plant in the foreseeable future. Cuba was stepping up its nuclear power program with Soviet technology and assistance because of energy shortages caused by reductions in Soviet oil shipments by 15% to 81.1 million barrels per year, which was a result of Soviet economic problems and internal changes. The Cuban Government initiated gasoline rationing, lowered the speed limits, and imposed cuts in electrical power consumption to realize savings of energy. Nickel sales were part of the Cuban-Soviet trade agenda, which called for open market pricing and convertible currencies beginning in 1991.

The stringent energy-saving measures adopted by Cuba included:

1. A 50% reduction in the supply of gasoline and diesel,
2. A 10% cutback in the domestic use of electricity,
3. Reversion to animal traction in agriculture,
4. An unspecified cutback in Government construction projects, and
5. The shutdown of cement and nickel plants in Moa that resulted from the postponement of construction projects and curtailment of oil supplies from the U.S.S.R. amounting to 14.3 million barrels during 1990.

The Legislative Decree No. 50 enacted in 1982 allowed Cuba to enter into commercial joint ventures with foreign inves-

tors. U.S.-based businesses were prohibited from participating because of U.S. Government restrictions. Additionally, constraints were placed on third party use of U.S. technology and machinery in joint ventures with the Cuban Government.

Cuba and Ghana signed an agreement of cooperation on mining projects. Ghanaian engineers were to assist in the development of gold deposits on Isla de la Juventud and in Pinar del Río in Western Cuba. The Government was considering to grant 6-year oil exploration concessions to French oil companies in Cuba's north coast.

Cuba's economy was mostly dependent on conditions in the U.S.S.R. and CMEA countries. However, trade with Canada, Mexico, Venezuela, and Uruguay was improving. Finally, further developments in Cuba's mining industry will be tied to the political and social decisions made by the Government. Tourism probably provided Cuba an income of about \$200 million per year. Cuba promised that investors in tourism will be able to repatriate profits. Investment was mostly coming from Europe.

PRODUCTION

Cuba has an internationally significant mineral resource. Overall, Cuba ranks sixth in world nickel output. Allowing for the Che Guevara nickel plant shutdown, nickel production in 1990 fell short by 14% of the 46,500 tons reported for 1989. The mix was nickel oxide, 30%; nickel sinter, 35%; and nickel-cobalt sulfide, 35%, with an average cobalt content of 5%. The decision taken by the Government to shut down the Che Guevara nickel plant at Punta Gorda near Moa in southeastern Cuba caused decreased production from 17,000 tons per year to 12,000 tons per year. Cuba's largest trading partner, the U.S.S.R., received 5,000 tons less of nickel supplies in 1990. Che Guevara's shut down was the result of energy shortages caused by reduced Soviet oil shipments. On an annual basis, produc-

tion of 10,000 tons of nickel would require almost 1 million barrels of fuel oil at a cost of more than \$25 million in the open market. Most of the industrial minerals were produced for local consumption, although cement and marble were important exports. Cuba continued to be heavily dependent on imported crude oil.

TRADE

During 1990, Cuban exports of nickel and petroleum refinery products represented almost 25% of export revenues and were mostly exported to the U.S.S.R. and other CMEA countries. Total Cuban exports amounted to \$5.5 billion. At the end of 1990, the Government had been trying to increase trade with Canada, Latin America, and China. Cuba's trade deficit grew as exports declined and imports increased to \$7.6 billion. Soviet trade amounted to 70% of Cu-

ban imports and exports, with sales of nickel, sugar, and citrus and purchases of crude oil, industrial equipment, and food under a barter accord since neither trading partner has convertible currency. Until early 1990 the U.S.S.R. was supplying 95.4 million barrels of oil per year to Cuba. Shipments were reduced by 15% during 1990 because of Soviet economic problems. Ghana supplied aluminum to Cuba as part of a barter deal. Trade with CMEA countries decreased to 5% from 15% of Cuba's total trade. Trade between Cuba and the U.S.S.R. amounted to about \$1.5 billion in 1990, including Cuban nickel, chrome, and agriculture products. Cuba exported 9 million tons of sugar, of which 50% went to the U.S.S.R. After Mexico, Cuba is Canada's second largest trading partner in Latin America. Prensa Latina reported that Cuba-Canada trade for 1990 was \$226 million, up 6% from that of the previous year.

Canada imported mainly sugar, tobacco, and some nickel in the form of oxide sinter with 5% cobalt content. Cuba imported livestock, powder milk, lumber, and other items from Canada. Cuba supplied the U.S.S.R. in 1990 with sugar, nickel, citrus, and tobacco; however, the supply of goods from the U.S.S.R. was reduced.

The U.S. economic sanctions imposed against Cuba in 1962 continued throughout 1990. The U.S. trade embargo set in 1983 banned all imported third country products that contained Cuban nickel.

STRUCTURE OF THE MINERAL INDUSTRY

The mineral industry, like the overall economy, was controlled by the Government. Mining and petroleum operations were centrally planned by the Ministerio

TABLE 1
CUBA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1987	1988	1989 ^a	1990 ^a		
Cement, hydraulic	thousand tons	3,305	3,535	3,566	*3,700	2,600
Chromite	do.	50	52	52	51	50
Cobalt ³		1,553	1,566	1,783	*2,000	1,600
Copper, mine output, Cu content		3,257	3,461	2,951	1,825	2,800
Gas, natural:						
Gross ^e	thousand cubic meters	56,634	65,129	21,900	34,000	34,000
Marketed	do.	*5,911	*6,796	1,524	*4,000	4,000
Gypsum ^e	thousand tons	130	130	130	130	150
Iron and steel: Steel, crude	do.	412	402	314	336	270
Lime	do.	*177	185	179	*180	200
Nickel:						
Mine output, Ni-Co content of oxide and sulfide		*35,101	35,860	44,128	46,509	40,000
Metallurgical products, Ni content: ³						
Granular oxide and powder		8,382	5,905	12,620	14,354	11,000
Oxide sinter		8,289	11,319	11,211	11,856	11,000
Sulfide		16,547	16,600	18,314	18,475	16,400
Total		33,218	33,824	42,145	44,685	38,400
Nitrogen: N content of anhydrous ammonia	thousand tons	163	148	135	134	140
Petroleum:						
Crude ⁴	thousand 42-gallon barrels	6,240	5,950	4,768	5,200	5,738
Refinery products	do.	50,213	52,103	50,839	55,000	53,000
Salt	thousand tons	266	231	201	*200	200
Sulfur, byproduct of petroleum ^e	do.	5	5	5	5	5

¹Table includes data available through Aug. 1991.

²In addition to commodities listed, crude construction materials (lime, salt, marble, sand and gravel, stone, etc.) may also be produced, but data on such production are not always available, and information is inadequate to make reliable estimates of output levels.

³Anuario Estadístico de Cuba provides figures of nickel-cobalt content of granular and powder oxide, oxide sinter, and sulfide production. Using an average cobalt content in these products of 0.9% in total granular and powder oxide, 1.1% in total oxide sinter, and 4.5% in total sulfide, the cobalt content of reported Ni-Co production was determined to be 1.16% of granular and powder oxide, 1.21% of oxide sinter, and 7.56% of sulfide. The remainder of reported figures would represent the nickel content.

⁴Cuba reports crude oil production in metric tons. A conversion to barrels was made using a factor of 6.652.

TABLE 2
CUBA: APPARENT EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989 ^p	Principal destinations, 1989	
METALS				
Aluminum:				
Ore and concentrate	NA	971	All to West Germany.	
Ash and residue containing aluminum	NA	691	All to Netherlands.	
Metal including alloys:				
Scrap	3,122	1,638	Netherlands 1,524; Italy 85; Spain 29.	
Unwrought	811	423	All to Spain.	
Semimanufactures	52	NA		
Chromium: Ore and concentrate	31,405	16,020	West Germany 8,306; Austria 4,270; Mexico 2,242.	
Copper:				
Ore and concentrate ²	3,108	2,783	NA.	
Ash and residue containing copper	NA	28	All to Netherlands.	
Metal including alloys:				
Scrap	4,476	1,804	Do.	
Unwrought	NA	9	All to Spain.	
Semimanufactures	10	NA		
Gold: Waste and sweepings	value, thousands	NA	\$9,595	All to West Germany.
Iron and steel: Metal:				
Scrap	190,365	10,808	Italy 5,874; Spain 2,965; Netherlands 1,969.	
Steel, primary forms	10,264	20	All to Italy.	
Semimanufactures	² 229,408	49,548	Egypt 44,446; Japan 4,999; France 101.	
Lead: Metal including alloys:				
Scrap	5,021	2,404	All to Netherlands.	
Unwrought	188	NA		
Lithium: Oxides and hydroxides	NA	144	West Germany 140; Netherlands 4.	
Nickel:				
Ore and concentrate	15	NA		
Matte and speiss	1,838	339	Austria 176; Japan 128; Argentina 35.	
Oxides and hydroxides, Ni content	NA	2	West Germany 1; Italy 1.	
Sinter, Ni content	NA	1,205	Italy 1,143; Spain 44; Mexico 18.	
Metal including alloys:				
Scrap	NA	409	Netherlands 292; Austria 117.	
Unwrought	46	813	Netherlands 718; Italy 95.	
Semimanufactures	NA	7	All to Netherlands.	
Platinum-group metals: Waste and sweepings	value, thousands	NA	\$2,343	All to West Germany.
Silver: Waste and sweepings	do.	NA	\$7,811	All to Canada.
Tin: Metal including alloys, scrap	8	NA		
Titanium: Metal including alloys, semimanufactures	NA	1	All to Italy.	
Vanadium: Ash and residue containing vanadium	NA	117	All to Netherlands.	
Zinc:				
Ash and residue containing zinc	NA	585	Do.	
Metal including alloys:				
Scrap	296	391	Do.	
Semimanufactures	2	NA		
Other:				
Ores and concentrates	9,565	NA		

See footnotes at end of table.

TABLE 2—Continued

CUBA: APPARENT EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989 ^p	Principal destinations, 1989	
METALS—Continued				
Other—Continued				
Oxides and hydroxides	45	59	All to Argentina.	
Ashes and residues	2,034	6	All to United Kingdom.	
INDUSTRIAL MINERALS				
Asbestos, crude	NA	206	All to Belgium-Luxembourg.	
Cement ²	54,831	14,183	NA.	
Clays, crude	5	12	All to Italy.	
Diamond: Gem, not set or strung	carats	NA	141	All to Belgium-Luxembourg.
Fertilizer materials: Manufactured:				
Nitrogenous	NA	18	All to United Kingdom.	
Phosphatic	55	650	All to Panama.	
Unspecified and mixed	1,405	NA		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	1,522	2,411	Italy 1,792; Mexico 380; Colombia 136.	
Worked	249	224	Netherlands 157; Spain 54; Japan 12.	
Gravel and crushed rock	234	NA		
Other:				
Crude	449	NA		
Slag and dross, not metal-bearing	NA	19	All to Spain.	
MINERAL FUELS AND RELATED MATERIALS				
Petroleum:				
Crude	thousand 42-gallon barrels	639	684	All to Spain.
Refinery products:				
Gasoline	do.	3,308	2,241	All to United Kingdom.
Lubricants	do.	(³)	NA	

^pPreliminary. NA Not available.¹Table prepared by H. D. Willis. Owing to a lack of official trade data published by Cuba, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the partner trade countries. The United States reported no mineral commodity imports from Cuba in 1989.²Anuario Estadístico de Cuba, 1989.³Less than 1/2 unit.

TABLE 3

CUBA: APPARENT IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989 ^p	Principal sources, 1989
METALS			
Aluminum:			
Oxides and hydroxides	441	92	Japan 62; China 30.
Metal including alloys:			
Unwrought	99	80	All from Canada.
Semimanufactures	² 18,500	² 15,500	Canada 490; Argentina 123; Colombia 16.
Arsenic: Metal including alloys, all forms	NA	1	All from United Kingdom.
Cadmium: Metal including alloys, all forms	NA	2	All from Belgium-Luxembourg.
Chromium:			
Oxides and hydroxides	2	NA	
Metal including alloys, all forms value, thousands	\$4	NA	

See footnotes at end of table.

TABLE 3—Continued

CUBA: APPARENT IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989 ^a	Principal sources, 1989
METALS—Continued			
Cobalt: Metal including alloys, all forms	1	NA	
Copper:			
Ore and concentrate	2	NA	
Oxides and hydroxides	NA	5	United Kingdom 3; West Germany 2.
Sulfate	5	NA	
Metal including alloys:			
Scrap	2	NA	
Unwrought ²	7,446	7,815	NA.
Semimanufactures	1,775	1,892	Canada 238; Mexico 117; Argentina 21.
Gold: Metal including alloys, unwrought and partly wrought kilograms	NA	15	Spain 10; West Germany 4; Canada 1.
Iron and steel:			
Iron ore and concentrate excluding roasted pyrite	334	217	United Kingdom 210; Netherlands 7.
Metal:			
Scrap	53	NA	
Pig iron, cast iron, related materials	236	NA	
Ferroalloys:			
Ferrochromium	329	NA	
Ferromanganese	980	NA	
Ferrosilicomanganese	806	NA	
Ferrosilicon	91	NA	
Silicom metal	112	NA	
Unspecified	144	NA	
Steel, primary forms	616	292	Spain 255; West Germany 37.
Semimanufactures:			
Flat-rolled products:			
Of iron or non-alloy steel:			
Not clad, plated, coated	NA	6,011	West Germany 5,029; Japan 820; United Kingdom 128.
Clad, plated, coated	NA	209	Belgium-Luxembourg 102; Spain 90; West Germany 14.
Of alloy steel	NA	713	West Germany 444; Spain 117; United Kingdom 85.
Bars, rods, angles, shapes, sections	1,441	6,734	Spain 2,800; West Germany 1,952; Belgium-Luxembourg 1,481.
Universals, plates, sheets	² 701,477	² 969,284	Colombia 5,418; Argentina 44.
Hoop and strip	86	NA	
Rails and accessories	130	50	Italy 23; Portugal 23; Spain 4.
Wire	² 8,578	6,376	China 5,868; Spain 273; Austria 142.
Tubes, pipes, fittings	² 89,591	² 84,709	U.S.S.R. 65,000; Spain 1,606; West Germany 419.
Castings and forgings, rough ²	184,792	239,544	NA.
Lead:			
Oxides	170	23	All from France.
Metal including alloys:			
Scrap	14	NA	
Unwrought	2,153	1,494	All from Mexico.
Semimanufactures	242	2	All from Japan.
Lithium: Oxides and hydroxides	NA	1	All from Netherlands.
Magnesium: Metal including alloys, unwrought	28	NA	

See footnotes at end of table.

TABLE 3—Continued

CUBA: APPARENT IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989 ^p	Principal sources, 1989
METALS—Continued			
Manganese:			
Oxides	NA	265	Spain 203; China 62.
Metal including alloys, all forms	1,055	NA	
Mercury	NA	23	China 11; Spain 10; West Germany 2.
Molybdenum:			
Oxides and hydroxides value, thousands	NA	\$13	All from United Kingdom.
Metal including alloys, semimanufactures	NA	2	All from Japan.
Nickel: Metal including alloys:			
Unwrought	1	NA	
Semimanufactures	7	NA	
All forms value, thousands	\$9	NA	
Platinum-group metals: Metals including alloys, unwrought and partly wrought:			
Palladium do.	NA	\$4	All from Spain.
Platinum do.	NA	\$35	West Germany \$32; United Kingdom \$3.
Unspecified do.	\$30	NA	
Silicon, high-purity kilograms	227	NA	
Silver: Metal including alloys, unwrought and partly wrought value, thousands	\$60	\$21	Spain \$13; West Germany \$8.
Tin: Metal including alloys, semimanufactures	138	NA	
Titanium:			
Oxides	110	22	West Germany 18; Canada 4.
Metal including alloys, all forms	NA	1	All from Italy.
Vanadium: Ash and residue containing vanadium	15	NA	
Zinc:			
Oxides	391	2,212	China 2,075; United Kingdom 134; Japan 3.
Metal including alloys:			
Unwrought	1,290	48	All from Mexico.
Semimanufactures	351	NA	
Other:			
Ores and concentrates	203	NA	
Oxides and hydroxides	1,900	NA	
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc.	70	12	All from Italy.
Artificial: Corundum	2	410	China 399; Japan 7; West Germany 4.
Grinding and polishing wheels and stones	159	82	Spain 80; West Germany 2.
Asbestos, crude	1,224	2,013	All from Canada.
Barite and witherite	NA	2,015	All from Mexico.
Boron materials: Oxides and acids	121	355	China 200; Argentina 151; West Germany 4.
Cement	24,800	22,000	China 5,034; Spain 7.
Chalk	NA	17	All from Spain.
Clays, crude:			
Bentonite	27	24	France 23; United Kingdom 1.
Fire clay	118	NA	
Kaolin	2,366	60	All from United Kingdom.
Unspecified	362	6,268	China 6,258; Spain 10.

See footnotes at end of table.

TABLE 3—Continued

CUBA: APPARENT IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989 ^p	Principal sources, 1989
INDUSTRIAL MINERALS—Continued			
Diamond: Natural: Gem, not set or strung			
value, thousands	\$1	NA	
Diatomite and other infusorial earth	72	268	Mexico 136; Italy 105; West Germany 27.
Feldspar, fluorspar, related materials	2	172	All from China.
Fertilizer materials: Manufactured:			
Ammonia ²	52,000	73,000	NA.
Nitrogenous	² 458,000	² 623,000	U.S.S.R. 581,000; West Germany 21; United Kingdom 1.
Phosphatic (total)	299,000	337,000	U.S.S.R. 295,000; Tunisia 25,630.
Of which:			
Superphosphate, simple ²	283,000	311,000	NA.
Superphosphate, triple ²	16,000	26,000	NA.
Potassic (total)	374,000	414,000	U.S.S.R. 253,000; West Germany 23.
Of which:			
Potassium chloride ²	323,000	394,000	NA.
Potassium sulfate ²	20,000	20,000	NA.
Unspecified and mixed	24	169	All from Belgium-Luxembourg.
Graphite, natural	15	NA	
Gypsum and plaster	517	368	West Germany 366; Spain 2.
Iodine	2	4	West Germany 3; Switzerland 1.
Lime	16	NA	
Magnesium compounds:			
Oxides and hydroxides	231	67	Netherlands 46; Japan 21.
Other	10	14	All from Mexico.
Mica:			
Crude including splittings and waste	2	78	France 44; Mexico 31; West Germany 3.
Worked including agglomerated splittings	124	147	Spain 99; Mexico 46; Canada 2.
Pigments, mineral:			
Natural, crude	NA	51	All from Italy.
Iron oxides and hydroxides, processed	82	408	China 399; Spain 8; Japan 1.
Precious and semiprecious stones other than diamond:			
Natural	value, thousands	NA	\$14
Synthetic	do.	\$7	\$14
			Do.
Salt and brine	117	33	West Germany 28; Canada 4; Italy 1.
Sodium compounds, n.e.s.:			
Soda ash, manufactured	4	3	All from West Germany.
Sulfate, manufactured	NA	88	China 86; Italy 2.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	4,142	5,341	U.S.S.R. 5,337; Spain 4.
Worked	29	45	Spain 26; Italy 19.
Gravel and crushed rock	3,711	62	All from Italy.
Sand other than metal-bearing	8,120	NA	
Sulfur:			
Elemental, all forms	² 166,275		² 154,191 Canada 39,308; Mexico 20,100; West Germany 5.
Sulfuric acid	75	32	Switzerland 15; West Germany 13; United Kingdom 2.
Talc, steatite, soapstone, pyrophyllite	9	NA	
Other: Crude	4,655	NA	

See footnotes at end of table.

TABLE 3—Continued

CUBA: APPARENT IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989 ^a	Principal sources, 1989	
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	22	NA		
Carbon: Carbon black	6,184	600	China 550; Japan 32; West Germany 18.	
Coal:				
Anthracite ²	60,819	193,861	NA.	
Lignite including briquets	228	202	All from Mexico.	
Coke and semicoke	² 66,029	² 66,860	U.S.S.R. 51,000; Colombia 900.	
Peat including briquets and litter	NA	151	All from West Germany.	
Petroleum:				
Crude	thousand 42-gallon barrels	² 62,050	243	All from Ecuador.
Refinery products:				
Liquefied petroleum gas	do.	97	NA	
Gasoline	do.	² 814	28	Mainly from Italy.
Mineral jelly and wax	do.	6	34	West Germany 23; China 11.
Kerosene and jet fuel	do.	46	281	Trinidad and Tobago 146; Italy 73; Netherlands 62.
Distillate fuel oil	do.	² 8,972	NA	
Lubricants	do.	² 596	192	Netherlands 67; Italy 63; Spain 59.
Residual fuel oil	do.	² 21,505	1,210	All from Trinidad and Tobago.
Bitumen and other residues	do.	(³)	2	Mainly from United Kingdom.
Bituminous mixtures	do.	(³)	NA	
Petroleum coke	do.	(³)	(³)	Mainly from West Germany.

^aPreliminary. NA Not available.¹Table prepared by H. D. Willis. Owing to a lack of official trade data published by Cuba, this table should not be taken as a complete presentation of this country's mineral trade. Unless otherwise specified, these data have been compiled from United Nations information and data published by the partner trade countries. The United States reported no trade in mineral commodities with Cuba in 1989.²Anuario Estadístico de Cuba, 1989.³Less than 1/2 unit.

de Industria Básica. The Ministerio de Industria Materia Construcción was in charge of the exploration and exploitation of construction-related industrial minerals.

COMMODITY REVIEW

Metals

Iron and Steel.—Limonitic residues were byproducts from treatment of the nickel-cobalt laterite ores. These residues contained from 48% to 52% of iron. Cuba plans to produce 10 million tons of pig iron over the next 5-year planning period. The U.S.S.R. has agreed to continue to assist in the expansion of the Antillana iron and steel plant in Cotorro, Havana Province.

Nickel.—Cuba ranked sixth in world nickel production. The largest nickel plant in Cuba is Pedro Soto Alba at Moa with a rated capacity of 24,000 tons per year. The second largest nickel producer is the René Ramos Latour plant at Nicaro with a 22,500-

ton per-year capacity, followed by Che Guevara plant at Punta Gorda with 17,000 tons of capacity; however, Che Guevara, when fully operational, could produce 30,000 tons of nickel per year. Another plant of similar size was under construction with U.S.S.R. technical and financial aid at Las Camariocas near Moa. If Las Camariocas is completed, Cuba could produce about 100,000 tons of nickel per year and rank third or fourth worldwide.

Industrial Minerals

Cement.—Production was reduced by 30% as a result of the postponement of construction projects, which was triggered by serious fuel shortages.

Marble.—Cuban marble is considered to be of high quality. About 70% of its production was bartered or sold to Italy, Mexico, and Spain.

Salt.—Cuba produced about 250,000 tons per year of salt. It was produced from

solar evaporation of seawater from small production centers along the northeast and south coasts.

Mineral Fuels

Unión de Petróleo de Cuba, a state-owned company, granted to two French companies, Total Compagnie Francaise des Petroles S.A. and Compagnie Europeene des Petroles, a 6-year oil exploration contract in an approximately 1,800-square-kilometer concession off Cuba's north coast. The agreement stipulates production-sharing of any economic deposit found.

Oil production exceeded 1989 levels. Sulfur from domestically produced sour crude was processed at the Hermanos Díaz refinery in Santiago de Cuba. The Cienfuegos refinery was designed for a 19-million-barrel capacity, with planned expansion to a 38-million-barrel annual output. Mexico was planning to increase oil exports to Cuba for processing at Cienfuegos. Mexico planned to buy Cuba's

TABLE 4

CUBA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity	
Cement	Empresa del Cemento	Mariel, Pinar del Rio Province Cienfuegos, Cienfuegos Province	3,500	
Chromite	Ministerio de Industria	Mercedita Mine and plant, Holguin Province	40	
Copper	Empresa Minera de Occidente	Mantua, Matahambre, and Jucard Mines, Pinar del Rio Province Mina Grande, Santiago de Cuba Province	3	
Nickel	Empresa Niquelifera Comandante Rene Ramos Latour	Nicaró, Holguin Province	23	
Do.	Empresa Niquelifera Comandante Pedro Soto Alba	Moa, Holguin Province	24	
Do.	Empresa Niquelifera Comandante Ernesto Che Guevara	Punta Gorda, Holguin Province	30	
Petroleum:				
Crude	42-gallon barrels per year	Empresa de Perforacion y Extraccion de Petroleo	Northern coast area between Havana and Cardenas	16,000
Refinery products	do.	Instituto Cubano del Petroleo	Refineries at Cienfuegos, Havana, and Santiago de Cuba	160,000
Steel	Empresa Metalurgica Jose Marti	Cotorro, Havana Province		400

cement, pharmaceutical products, and nickel.

Cuba was exporting its biogas technology. As part of a multimillion dollar barter deal with Uganda, a biogas plant was to be built in Kampala. The plant will use sugarcane to produce methane for residential and industrial use. It will also produce carbon dioxide for soft drinks and hydrogen sulfide for fertilizers.

Domestic oil extraction increased to 5.7 million barrels. The main drilling area was Varadero, followed by Havana Province, where 14 new wells were being drilled. The internally produced oil was mostly consumed by the sugar, rum, and cement industries.

Uranium found in lead and zinc deposits in Pinar del Río Province was of interest because of the potential for accelerating Cuba's nuclear power program. The driving force behind Cuba's nuclear energy program was the fear that the U.S.S.R. could cut off or reduce the 93.2 million barrels of crude oil shipped to Cuba every year. Cuba was installing the twin 440-megawatt Soviet nuclear power reactors and was storing a 10-megawatt Soviet research reactor that uses enriched uranium. Originally, their operation was scheduled for 1993, but is likely to be delayed. Extensive training of Cuban personnel was underway. The Juraguá nuclear plant, near the bay of Cienfuegos, at an estimated cost of \$2.5 billion dollars, represented more than 1,600

megawatts of generating capacity and was designed to save about 15 million barrels of crude oil every year.

INFRASTRUCTURE

The country had about 21,000 kilometers of roads. Nine thousand kilometers of road was paved; the remainder had gravel or earthen surfaces. Nickel ore was moved primarily by truck and conveyor belts from the mining areas to processing plants, although a new 2.5-kilometers rail line was under construction from the mine to the Nicaro processing complex. Processed nickel was shipped by truck to port facilities at Nicaro and Moa. Other important mineral industry ports included Havana, Santiago de Cuba, Nuevitas, Matanzas, and Mariel.

The Matanzas supertanker complex, 150 kilometers east of Havana, offloaded its first tanker in 1989. The port allowed for transshipment from supertankers to coastal tankers for the voyage to the Havana and Santiago de Cuba refineries. The docks, capable of handling a 150,000-deadweight-ton tanker and a 70,000-deadweight tanker simultaneously, took 4 years to complete. A 187-kilometers oil pipeline was built to connect the new port with the Cienfuegos refinery.

Other mineral production is transported by either truck or rail. The state maintained

5,295 kilometers of standard-gauge (1.435 meters) track. Most of the remaining 9,630 kilometers of railroads was associated with sugar plantations.

OUTLOOK

Cuba's investment had been prioritized to food production, tourism, and medicinal goods. Mining took a second tier position as a result of reduced crude oil shipments from the U.S.S.R. Production of cement and construction materials was expected to continue at reduced levels. The recently completed first line at the Cienfuegos crude oil refinery and the Punta Gorda nickel refinery in Moa were mothballed. Cuba's industrial output has fallen as imports of equipment and spare parts have been cut sharply. When the Juraguá nuclear reactor complex is fully operational, perhaps by the turn of the century, it could meet one-fifth of Cuba's energy needs. It was estimated that the first of the four reactors might start up in 1994. Meanwhile, the main immediate effort was directed toward energy conservation.

Changes in Eastern Europe are expected to accelerate Cuban trade links with other Latin American countries. Changes in the U.S.S.R. may result in the United States lifting the economic embargo of 30 years in exchange for the end of Soviet subsidies, which amounted to \$4 billion in 1990. Cuba

used to import 70% of its basic goods from the United States and exported 87% of its production. An advisory commission on U.S. policy toward Cuba would be required to review the trade embargo against Cuba.

¹Where necessary, values have been converted from Cuban pesos (CP) to U.S. dollars at the rate of CP0.8=US\$1.00.

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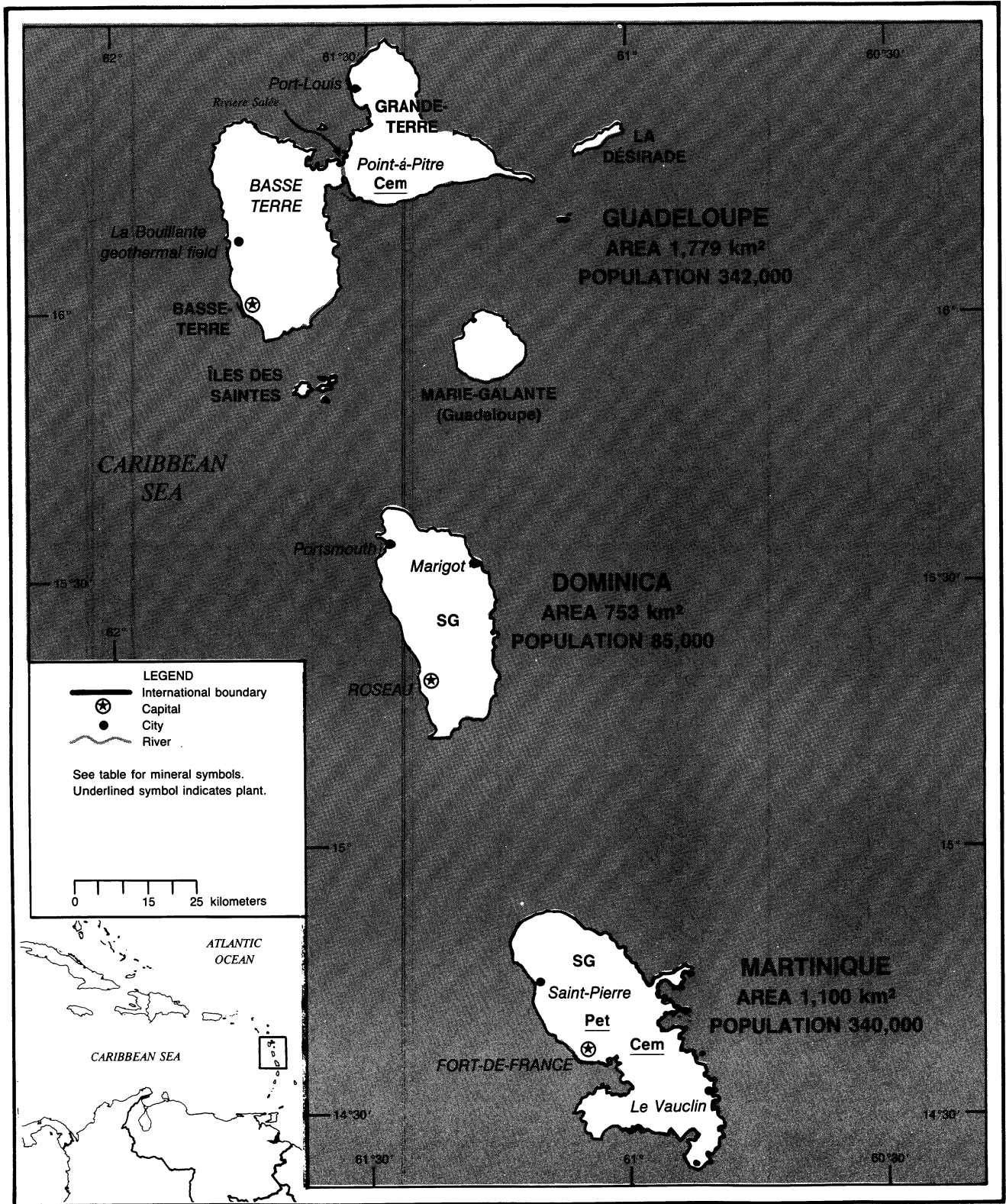
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DOMINICA, GUADELOUPE, AND MARTINIQUE



DOMINICA, GUADELOUPE, AND MARTINIQUE

By Philip M. Mobbs

DOMINICA

Dominica, an independent state within the British Commonwealth, had primarily an agricultural-based economy. In 1990, the GDP was estimated to be \$153 million.¹

Mineral production in 1990 consisted of the mining of clay, limestone, pumice, volcanic ash, and quantities of sand and gravel for construction purposes. No significant expansion or diversification of the mining sector was considered likely.

This volcanic island's rugged terrain and heavy rains impeded the development of an adequate road system. The island's interior remained relatively isolated from the transportation network. Roseau was the island's major shipping port.

In 1990, Dominica had a rated electrical capacity of 7,000 kW with approximately 60% derived from hydroelectric generation plants. The 1,240-kW hydroelectric gener-

ating facility at Laudat, about 8 km east of Roseau, was scheduled to come fully on-line in 1991. Because of the steadily increasing demand for electricity, Dominica Electricity Services was investigating geothermal prospects and considering additional hydroelectric plant expansion. These actions should allow the nation to move toward its goal of generating most of the country's electricity requirements by hydroelectric power, further reducing its reliance on imported mineral fuels.

GUADELOUPE

Guadeloupe, an Overseas Department of France, includes the islands of Basse-Terre, Grande-Terre, Îles des Saintes, La Désirade, Marie-Galante, St. Barthélemy, and the French side of Sint Maarten. The mineral sector made a negligible contribution to the gross departmental product, which was es-

timated at \$1.1 billion² for 1987, the last year for which there is information. The mineral policy was the same as that of other French Overseas Departments. Direct French involvement in mineral development was encouraged as was foreign investment.

The country produced a small amount of pumice in 1990. A clinker-grinding cement plant, majority owned by Ciments La Farge of France, was in operation during the year. Lime, salt, sand and gravel, and stone were also produced, but production data were not available for 1990.

The principal mineral commodity export in 1989 was cement. A small amount of scrap metal was also exported.

Guadeloupe has a total of 1,940 km of roads. Railroads were used for the agricultural industry. The Department's major shipping ports were Pointe-à-Pitre on Grande Terre and Basse-Terre on Basse-Terre. The country's electrical energy generation capacity was 171.5 MW.

TABLE 1

DOMINICA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	Destinations, 1989	
		United States	Other (principal)
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc.	500	—	All to St. Kitts and Nevis.
Aluminum: Metal including alloys, semimanufactures value, thousands	\$3	—	All to United Kingdom.
Copper: Metal including alloys, scrap	14	—	All to Netherlands.
Petroleum refinery products: Lubricants 42-gallon barrels	66,906	66,906	
Stone, sand and gravel:			
Quartz and quartzite	500	—	All to U. S. Virgin Islands.
Sand other than metal-bearing	8,000	—	U.S. Virgin Islands 7,500; Guadeloupe 500.

¹Table prepared by H. D. Willis. Export data for 1988 were not available at time of publication.

TABLE 2

DOMINICA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	Sources, 1989	
		United States	Other (principal)
METALS			
Alkali and rare-earth metals	1	1	
Aluminum: Metal including alloys, semimanufactures	97	27	United Kingdom 53; Netherlands 8.
Copper: Metal including alloys, semimanufactures	6	2	United Kingdom 4.
Iron and steel: Metal: Semimanufactures:			
Bars, rods, angles, shapes, sections	5,096	22	Trinidad and Tobago 4,807; Venezuela 107; Barbados 74.
Universals, plates, sheets	2,289	31	Antigua and Barbuda 2,011; Jamaica 102; St. Vincent and the Grenadines 55.
Hoop and strip	120	—	Mainly from Canada.
Wire	58	3	United Kingdom 51; Canada 3.
Tubes, pipes, fittings	995	79	West Germany 404; Canada 258; United Kingdom 101.
Castings and forgings, rough	1	1	
Lead: Metal including alloys, semimanufactures	value, thousands	\$1	\$1
Tin: Metal including alloys, semimanufactures	do.	\$1	—
Titanium: Oxides	59	17	United Kingdom 23; Italy 19.
Other: Oxides and hydroxides	value, thousands	\$1	\$1
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones	1	(²)	Mainly from United Kingdom.
Cement	25,889	—	Barbados 12,847; Trinidad and Tobago 9,661; Guadeloupe 918.
Clays, crude	value, thousands	\$1	\$1
Fertilizer materials:			
Crude, n.e.s.	1	1	
Manufactured:			
Ammonia	2	2	Trinidad and Tobago 1.
Nitrogenous	1,888	7	France 1,280; Martinique 600.
Potassic	value, thousands	\$3	\$3
Unspecified and mixed	7,872	1	France 3,959; Dominican Republic 1,470; United Kingdom 900.
Lime	88	—	All from Martinique.
Salt and brine	639	23	Canada 336; Jamaica 238; Trinidad and Tobago 37.
Sodium compounds, n.e.s.: Soda ash, manufactured	11	1	Belgium-Luxembourg 9; Trinidad and Tobago 1.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	value, thousands	\$1	—
Worked	3	—	Mainly from United Kingdom.
Sand other than metal-bearing	value, thousands	\$1	\$1
Sulfur: Sulfuric acid	6	—	All from United Kingdom.
MINERAL FUELS AND RELATED MATERIALS			
Carbon: Carbon black	1	1	
Petroleum refinery products:			
Liquefied petroleum gas	42-gallon barrels	98,032	(²)
			Venezuela 95,039; Trinidad and Tobago 1,856; Guadeloupe 1,137.

See footnotes at end of table.

TABLE 2—Continued

DOMINICA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1989	Sources, 1989		
		United States	Other (principal)	
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum refinery products—Continued				
Gasoline	42-gallon barrels	63,104	—	Trinidad and Tobago 59,559; Antigua and Barbuda 3,545.
Mineral jelly and wax	do.	1,031	47	United Kingdom 889; West Germany 47.
Kerosene and jet fuel	do.	4,200	—	All from Trinidad and Tobago.
Distillate fuel oil	do.	38,412	—	Trinidad and Tobago 37,181; Antigua and Barbuda 1,223; Barbados 7.
Lubricants	do.	4,025	3,444	Trinidad and Tobago 182; Netherlands 42.
Residual fuel oil	do.	15,911	14,525	Trinidad and Tobago 1,385.
Bitumen and other residues	do.	727	—	All from Venezuela.
Bituminous mixtures	do.	2,588	(²)	Trinidad and Tobago 1,697; Venezuela 879; Guadeloupe 12.

¹Table prepared by H. D. Willis. Import data for 1988 were not available at time of publication.²Less than 1/2 unit.

TABLE 3

GUADELOUPE: PRODUCTION OF MINERAL COMMODITIES¹

(Thousand metric tons)

Commodity ²	1986	1987	1988	1989	1990
Abrasives, natural: Pumice ^c	³ 221	220	220	220	220
Cement ^c	³ 181	190	200	200	200

^cEstimated.¹Table includes data available through Jan. 14, 1992.²In addition to commodities listed, crude construction materials (lime, salt, sand and gravel, stone, etc.) may also be produced, but information is inadequate to make estimates of output levels.³Reported figure.

TABLE 4

GUADELOUPE: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Principal destinations, 1989	
METALS				
Aluminum: Metal including alloys:				
Scrap	113	396	France 323; Belgium-Luxembourg 73.	
Unwrought	1	—		
Semimanufactures	19	3	French Guiana 1; Martinique 1; United States 1.	
Copper: Metal including alloys:				
Scrap	545	468	France 385; Belgium-Luxembourg 82.	
Semimanufactures	value, thousands	\$1	—	
Gold: Metal including alloys, unwrought and partly wrought				
	kilograms	7	6	All to France.
Iron and steel: Metal:				
Scrap	25	—		
Steel, primary forms	1	—		

See footnotes at end of table.

TABLE 4—Continued

GUADELOUPE: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Principal destinations, 1989	
METALS—Continued				
Iron and steel—Continued				
Semimanufactures:				
Flat-rolled products:				
Of iron or non-alloy steel:				
Not clad, plated, coated	3	(²)	All to Dominica.	
Clad, plated, coated	(²)	69	French Guiana 65; Haiti 3; Martinique 1.	
Of alloy steel	2	—		
Bars, rods, angles, shapes, sections	30	45	Martinique 22; France 21; Dominica 2.	
Wire	40	7	French Guiana 6; St. Lucia 1.	
Tubes, pipes, fittings	3	40	Haiti 37; French Guiana 1; Martinique 1.	
Lead: Metal including alloys, scrap	2	—		
Other: Ashes and residues	66	47	All to France.	
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	—	6	All to Martinique.	
Grinding and polishing wheels and stones value, thousands	\$14	—		
Cement	7,877	4,522	French Guiana 3,604; Dominica 918.	
Clays, crude: Bentonite	—	8	All to French Guiana.	
Fertilizer materials: Manufactured:				
Ammonia	87	81	All to Martinique.	
Phosphatic	40	—		
Potassic	20	—		
Unspecified and mixed	15	—		
Gypsum and plaster	1,020	870	Trinidad and Tobago 650; Martinique 220.	
Salt and brine	—	14	French Guiana 13; Martinique 1.	
Stone, sand and gravel:				
Dimension stone, worked	1	—		
Sand other than metal-bearing value, thousands	\$1	—		
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products: Liquefied				
petroleum gas	42-gallon barrels	128	116	All to France.

¹Table prepared by H. D. Willis.

²Less than 1/2 unit.

TABLE 5

GUADELOUPE: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS				
Alkali metals value, thousands	—	\$2	—	All from France.
Aluminum:				
Oxides and hydroxides do.	\$6	\$1	—	Do.
Metal including alloys, semimanufactures	654	867	308	France 524; Italy 15.
Chromium: Oxides and hydroxides	2	1	—	Mainly from West Germany.

See footnotes at end of table.

TABLE 5—Continued

GUADELOUPE: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS				
Copper: Metal including alloys:				
Unwrought value, thousands	\$2	—		
Semimanufactures	212	207	3	France 193; Italy 9.
Gold: Metal including alloys, unwrought and partly wrought kilograms				
	18	14	—	French Guiana 9; France 5.
Iron and steel: Metal:				
Pig iron, cast iron, related materials				
	155	5	—	All from France.
Steel, primary forms				
	10	3	—	Do.
Semimanufactures:				
Flat-rolled products:				
Of iron or non-alloy steel:				
Not clad, plated, coated				
	1,205	586	—	France 314; Belgium-Luxembourg 272.
Clad, plated, coated				
	10,762	14,483	—	France 13,718; Martinique 287; Belgium-Luxembourg 207.
Of alloy steel				
	175	354	—	Belgium-Luxembourg 206; France 107; Italy 41.
Bars, rods, angles, shapes, sections				
	21,303	21,647	—	France 6,913; Spain 5,646; Brazil 3,043.
Rails and accessories				
	27	16	—	Mainly from France.
Wire				
	1,373	959	(?)	Belgium-Luxembourg 452; Venezuela 436; France 70.
Tubes, pipes, fittings				
	4,805	3,558	1	France 2,091; Spain 1,217; Belgium-Luxembourg 153.
Lead:				
Oxides value, thousands				
	\$2	\$1	—	All from France.
Metal including alloys:				
Unwrought do.				
	—	\$1	—	Do.
Semimanufactures				
	9	25	(?)	Mainly from France.
Mercury value, thousands				
	\$1	—		
Nickel: Metal including alloys, semi-manufactures do.				
	\$10	\$4	—	France \$3; West Germany \$1.
Platinum-group metals: Platinum metal including alloys, unwrought and partly wrought do.				
	\$3	\$1	—	All from France.
Silver: Metal including alloys, unwrought and partly wrought do.				
	\$2	\$1	—	Do.
Tin: Metal including alloys, semimanufactures				
	1	1	—	Do.
Titanium: Oxides				
	32	27	—	Do.
Tungsten: Metal including alloys, unwrought value, thousands				
	\$1	—		
Zinc:				
Oxides				
	—	2	—	All from France.
Metal including alloys, semimanufactures (?)				
	(?)	41	—	France 40; Italy 1.
Other: Ashes and residues				
	106	—		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.				
	1	88	—	All from France.
Artificial: Corundum				
	—	3	—	Do.
Grinding and polishing wheels and stones				
	37	24	—	France 16; Switzerland 5; Italy 1.
Asbestos, crude				
	116	107	—	France 61; Italy 46.
Barite and witherite				
	6	5	—	All from France.
Boron materials: Crude natural borates				
	1	—		

See footnotes at end of table.

TABLE 5—Continued

GUADELOUPE: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
INDUSTRIAL MINERALS—Continued					
Cement	217,917	153,303	11	Tunisia 70,102; Venezuela 63,092; Trinidad and Tobago 12,725.	
Chalk	781	798	—	All from France.	
Clays, crude:					
Bentonite	—	11	—	Do.	
Kaolin	82	40	—	France 20; United Kingdom 20.	
Unspecified	16	15	—	All from France.	
Diamond: Gem, not set or strung					
value, thousands	\$6	—	—	—	
Diatomite and other infusorial earth	40	51	—	All from France.	
Fertilizer materials:					
Crude, n.e.s.	41	73	—	Do.	
Manufactured:					
Ammonia	109	121	—	Do.	
Nitrogenous	2,147	2,854	155	Netherlands 1,491; West Germany 801; Belgium-Luxembourg 217.	
Phosphatic	452	84	—	All from France.	
Potassic	461	426	323	France 64; Belgium-Luxembourg 40.	
Unspecified and mixed	22,752	16,908	—	Martinique 7,910; France 5,071; Netherlands 2,239.	
Gypsum and plaster	17,651	9,192	—	Dominican Republic 8,500; France 692.	
Lime	1,691	2,562	—	France 1,993; Martinique 569.	
Magnesium compounds:					
Magnesite, crude	—	76	—	France 40; Netherlands 36.	
Oxides and hydroxides	180	94	—	Netherlands 54; France 40.	
Mica: Crude including splittings and waste	11	—	—	—	
Pigments, mineral: Iron oxides and hydroxides, processed	45	19	—	Mainly from France.	
Precious and semiprecious stones other than diamond, natural	value, thousands	\$4	\$1	—	All from France.
Pyrite, unroasted	6	—	—	—	
Salt and brine	2,481	2,309	—	France 798; West Germany 596; Spain 551.	
Sodium compounds, n.e.s.:					
Soda ash, natural and manufactured	—	9	—	West Germany 7; France 2.	
Sulfate, manufactured	value, thousands	\$1	—	—	
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked	value, thousands	—	\$6	—	All from France.
Worked	332	442	2	Italy 203; France 116; Portugal 50.	
Dolomite, chiefly refractory-grade	344	489	—	All from France.	
Gravel and crushed rock	122	20,779	5,000	Martinique 15,073; France 706.	
Quartz and quartzite	11	13	—	All from France.	
Sand other than metal-bearing	2,547	6,821	—	Barbados 5,564; Martinique 810; France 404.	
Sulfur:					
Elemental:					
Crude including native and byproduct	(³)	1	—	All from France.	
Colloidal, precipitated, sublimed	1	—	—	—	
Sulfuric acid	191	165	—	France 102; Belgium-Luxembourg 63.	

See footnotes at end of table.

TABLE 5—Continued

GUADELOUPE: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Talc, steatite, soapstone, pyrophyllite	109	185	—	All from France.
Other:				
Crude	143	216	—	France 121; West Germany 81; Belgium-Luxembourg 14.
Slag and dross, not metal-bearing	—	108	—	All from France.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural value, thousands	\$10	\$11	—	All from France.
Carbon black	—	17	—	Do.
Peat including briquets and litter	14	85	—	West Germany 60; France 25.
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	129,943	89,645	8,665	Netherlands Antilles 61,225; Venezuela 12,830
Mineral jelly and wax do.	1,267	787	—	France 748; Belgium-Luxembourg 39.
Bitumen and other residues do.	333	8,708	(?)	Netherlands Antilles 8,635; France 73.
Bituminous mixtures do.	485	727	(?)	Mainly from France.

¹Table prepared by H. D. Willis.²Less than 1/2 unit.³Quantity not available, valued at \$1,000.

MARTINIQUE

The country's mineral sector was a small contributor to the GDP, which was estimated at more than \$2 billion³ in 1986, the last year for which there is information. The mineral policy of Martinique is the same as other Latin American Overseas Departments of France. The French Government-owned company Société Anonyme de la Raffinerie des Antilles held a majority ownership of the local petroleum refinery. Ciments La Farge of France was the majority owner of the clinker-grinding cement plant.

TABLE 6

MARTINIQUE: PRODUCTION OF MINERAL COMMODITIES¹

(Thousand metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989	1990
Cement, hydraulic ^c	200	200	200	200	200
Lime ^c metric tons	5,000	5,000	5,000	5,000	5,000
Petroleum refinery products ^c thousand 42-gallon barrels	³ 4,938	4,800	4,800	4,800	4,800
Pumice ^c	140	130	130	140	140

^cEstimated.¹Table includes data available through Jan. 14, 1992.²In addition to commodities listed, crude construction materials (salt, sand and gravel, stone, etc.) may also be produced, but information is inadequate to make estimates of output levels.³Reported figure.

TABLE 7

MARTINIQUE: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Scrap	57	203	18	France 184.
Semimanufactures	9	22	5	Guadeloupe 15; French Guiana 2.
Copper: Metal including alloys:				
Scrap	407	375	—	All to France.
Semimanufactures	—	5	—	All to French Guiana.

See footnotes at end of table.

TABLE 7—Continued

MARTINIQUE: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
METALS—Continued				
Gold: Metal including alloys, unwrought and partly wrought kilograms	1	6	—	All to France.
Iron and steel: Metal: Semimanufactures:				
Flat-rolled products: Of iron or non-alloy steel:				
Not clad, plated, coated	4	—		
Clad, plated, coated	—	118	—	Guadeloupe 89; French Guiana 29.
Bars, rods, angles, shapes, sections	1,668	528	—	French Guiana 267; Guadeloupe 245; Trinidad and Tobago 16.
Tubes, pipes, fittings	(²)	15	—	Haiti 11; Guadeloupe 3; French Guiana 1.
Lead: Metal including alloys, scrap	—	7	—	All to France.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	—	\$3	—	Do.
INDUSTRIAL MINERALS				
Cement	8,302	4,888	—	French Guiana 4,788; Guadeloupe 100.
Fertilizer materials: Manufactured:				
Nitrogenous	660	639	—	Guadeloupe 615; France 18; St. Lucia 6.
Phosphatic	50	—		
Potassic	—	228	—	St. Lucia 100; Guadeloupe 90; France 20.
Unspecified and mixed	16,237	18,812	824	Guadeloupe 7,628; St. Lucia 5,001; Dominica 4,327.
Gypsum and plaster	—	17	—	All to Guadeloupe.
Lime	330	828	—	Guadeloupe 589; St. Lucia 88; Dominica 86.
Stone, sand and gravel:				
Dimension stone, worked	26	1	—	All to Guadeloupe.
Gravel and crushed rock	—	19,681	—	Do.
Sand other than metal-bearing	—	1,170	—	Do.
Sulfur:				
Elemental:				
Crude including native and byproduct	—	1	—	Do.
Colloidal, precipitated, sublimed	1	—		
Sulfuric acid	1	—		
Other: Crude	—	8	—	All to St. Lucia.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	23,536	22,121	—	All to Guadeloupe.
Mineral jelly and wax do.	—	8	—	Do.

¹Table prepared by H. D. Willis.²Quantity not available, valued at \$5,000.

TABLE 8
MARTINIQUE: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity		1988	1989	Sources, 1989	
				United States	Other (principal)
METALS					
Alkali and rare-earth metals	value, thousands	—	\$1	—	All from France.
Aluminum:					
Oxides and hydroxides	do.	\$2	\$2	—	Do.
Metal including alloys:					
Scrap		1	—		
Semimanufactures		374	318	18	France 278; Spain 15.
Chromium:					
Oxides and hydroxides		7	1	—	All from West Germany.
Metal including alloys, all forms					
	value, thousands	\$3	—		
Cobalt:					
Ore and concentrate		6	—		
Oxides and hydroxides	value, thousands	\$1	\$2	—	All from France.
Copper: Metal including alloys:					
Scrap		10	—		
Unwrought	value, thousands	\$3	\$2	—	All from France.
Semimanufactures		253	256	1	France 236; Austria 15; Finland 2.
Gold: Metal including alloys, unwrought and partly wrought					
	kilograms	14	41	—	French Guiana 34; France 7.
Iron and steel: Metal:					
Scrap	value, thousands	\$1	—		
Pig iron, cast iron, related materials		1	3	—	All from France.
Steel, primary forms		68	77	—	Do.
Semimanufactures:					
Flat-rolled products:					
Of iron or non-alloy steel:					
	Not clad, plated, coated	808	483	—	France 303; Belgium-Luxembourg 171; Netherlands 9.
	Clad, plated, coated	4,919	3,489	—	France 2,863; Spain 346; Brazil 226.
	Of alloy steel	463	311	(²)	France 259; Italy 27; Belgium-Luxembourg 25.
	Bars, rods, angles, shapes, sections	23,835	28,628	—	Trinidad and Tobago 11,711; France 6,431; Spain 5,827.
	Rails and accessories	115	143	—	France 122; West Germany 21.
	Wire	127	233	—	France 161; Belgium-Luxembourg 68; Italy 3.
	Tubes, pipes, fittings	5,702	6,251	1	France 4,041; Spain 1,671; Italy 391.
Lead:					
Oxides		5	—		
Metal including alloys:					
Unwrought		1	1	—	All from United Kingdom.
Semimanufactures		6	13	—	All from France.
Mercury	value, thousands	—	\$1	—	Do.
Nickel: Metal including alloys:					
Unwrought	do.	—	\$1	—	All from West Germany.
Semimanufactures	do.	\$1	\$2	—	All from France.
Tin: Metal including alloys:					
Scrap		19	—		
Semimanufactures		1	2	—	Mainly from France.
Titanium: Oxides		226	194	(²)	France 112; United Kingdom 61; Netherlands 21

See footnotes at end of table.

TABLE 8
MARTINIQUE: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS				
Zinc:				
Oxides	36	29	—	All from France.
Metal including alloys:				
Unwrought value, thousands	—	\$2	—	Do.
Semimanufactures	7	8	—	Do.
Other: Ashes and residues	3	—		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	(²)	22	—	Mainly from France.
Artificial: Corundum value, thousands	\$1	\$4	—	France \$3; West Germany \$1.
Grinding and polishing wheels and stones	44	57	—	France 51; Italy 3; Netherlands 1.
Asbestos, crude	77	61	—	Mainly from Italy.
Barite and witherite	4	6	—	All from France.
Boron materials:				
Crude natural borates	6	3	—	Do.
Oxides and acids value, thousands	—	\$2	NA	NA.
Cement	177,794	186,827	—	Venezuela 107,983; Tunisia 67,105; Trinidad and Tobago 8,248.
Chalk	654	809	—	All from France.
Clays, crude:				
Bentonite	5	40	—	Do.
Kaolin	120	35	—	United Kingdom 23; France 12.
Unspecified	13	14	—	All from France.
Diamond: Gem, not set or strung value, thousands	\$7	\$8	—	Do.
Diatomite and other infusorial earth	20	24	—	Do.
Fertilizer materials:				
Crude, n.e.s.	100	140	—	France 135; Belgium-Luxembourg 4.
Manufactured:				
Ammonia	88	85	—	Guadeloupe 69; France 16.
Nitrogenous	5,711	7,362	2,999	Netherlands 2,000; Trinidad and Tobago 1,600.
Phosphatic	203	190	—	France 177; Belgium-Luxembourg 13.
Potassic	10,008	9,192	200	Belgium-Luxembourg 4,223; East Germany 4,000; Dominican Republic 500.
Unspecified and mixed	26,384	23,880	—	France 23,018; Belgium-Luxembourg 856; West Germany 4.
Graphite, natural	(²)	1	—	All from France.
Gypsum and plaster	17,833	11,039	—	Jamaica 10,126; France 913.
Lime	208	252	—	All from France.
Magnesium compounds: Oxides and hydroxides	308	1,034	—	Do.
Mica: Crude including splittings and waste	2	—		
Phosphates, crude	40	—		
Pigments, mineral: Iron oxides and hydroxides, processed	25	34	—	West Germany 20; France 14.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	\$1	\$11	—	France \$8; West Germany \$3.
Synthetic do.	\$2	—		
Salt and brine	2,376	2,290	—	West Germany 1,520; France 525; Netherlands 102.

See footnotes at end of table.

TABLE 8—Continued

MARTINIQUE: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Sodium compounds, n.e.s.:				
Soda ash, manufactured	—	4	—	All from France.
Sulfate, manufactured	2	—		
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	12	6	—	France 5; Italy 1.
Worked	1,589	379	—	Italy 187; France 142; Portugal 49.
Dolomite, chiefly refractory-grade	1,309	965	—	All from France.
Gravel and crushed rock	58	28	(²)	Mainly from France.
Quartz and quartzite value, thousands	—	\$1	—	All from France.
Sand other than metal-bearing	229	75	—	Do.
Sulfur:				
Elemental:				
Crude including native and byproduct	1	10	—	Do.
Colloidal, precipitated, sublimed	—	3	—	Do.
Sulfuric acid	194	157	—	France 141; Guadeloupe 15; West Germany 1.
Talc, steatite, soapstone, pyrophyllite	65	51	2	France 49.
Vermiculite, perlite, etc.	—	6	—	All from France.
Other:				
Crude	335	509	—	France 428; West Germany 48; Netherlands 21.
Slag and dross, not metal-bearing	164	509	—	France 357; Belgium-Luxembourg 109; Netherlands 43.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	3	4	—	All from France.
Carbon black	—	35	—	Guadeloupe 34; French Guiana 1.
Peat including briquets and litter	167	364	—	Belgium-Luxembourg 259; West Germany 52; Netherlands 40.
Petroleum:				
Crude thousand 42-gallon barrels	3,657	4,384	—	United Kingdom 2,426; Qatar 659; Saudi Arabia 652.
Refinery products:				
Liquefied petroleum gas 42-gallon barrels	44,370	17,145	6,890	Trinidad and Tobago 6,287; Netherlands Antilles 3,932.
Mineral jelly and wax do.	2,762	1,952	—	All from France.
Bitumen and other residues do.	49,334	52,316	—	Trinidad and Tobago 27,700; Netherlands Antilles 21,174; Guyana 3,121.
Bituminous mixtures do.	303	527	30	France 491; Italy 6.

NA Not available.

¹Table prepared by H. D. Willis.²Less than 1/2 unit.³Quantity not available, valued at \$2,000.

Martinique's mineral industry included the production of cement, clay, petroleum refinery products, pumice, sand and gravel, and stone in 1990. The petroleum refinery produced fuel for domestic consumption and for export to Guadeloupe.

Principal mineral commodities exports in 1989 were fertilizers, petroleum products, and crushed rock. The major mineral commodities imports were cement, crude petroleum, fertilizers, gypsum, petroleum refinery products, and steel semimanufactures.

There was a total of 1,680 km of roads. The major shipping port was Fort-de-France on the west coast. The country's electrical energy generation capacity was 108 MW, all of it thermal.

¹Where necessary, values have been converted from East Caribbean dollars (EC\$) to U.S. dollars at the rate of EC\$2.70=US\$1.00.

²Where necessary, values have been converted from French francs (F) to U.S. dollars at the rate of F6.0107=US\$1.00.

³Where necessary, values have been converted from French francs (F) to U.S. dollars at the rate of F6.0107=US\$1.00.

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Agencies

Service des Mines et de L'Industrie
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97110-Point-a-Pitre
Guadeloupe, French West Indies
Bureau de Recherches Géologiques et
Minières
Villa d'Huy
Morne Notre-Dame
97139 Abymes Cedex
Guadeloupe, French West Indies
Service des Mines et de L'Industrie
B.P. 458
97200 Fort-de-France

Martinique, French West Indies
Bureau de Recherches Géologiques et
Minières
Km 0.9 Route de Didier,
B.P. 394
97204 Fort-de-France Cedex
Martinique, French West Indies

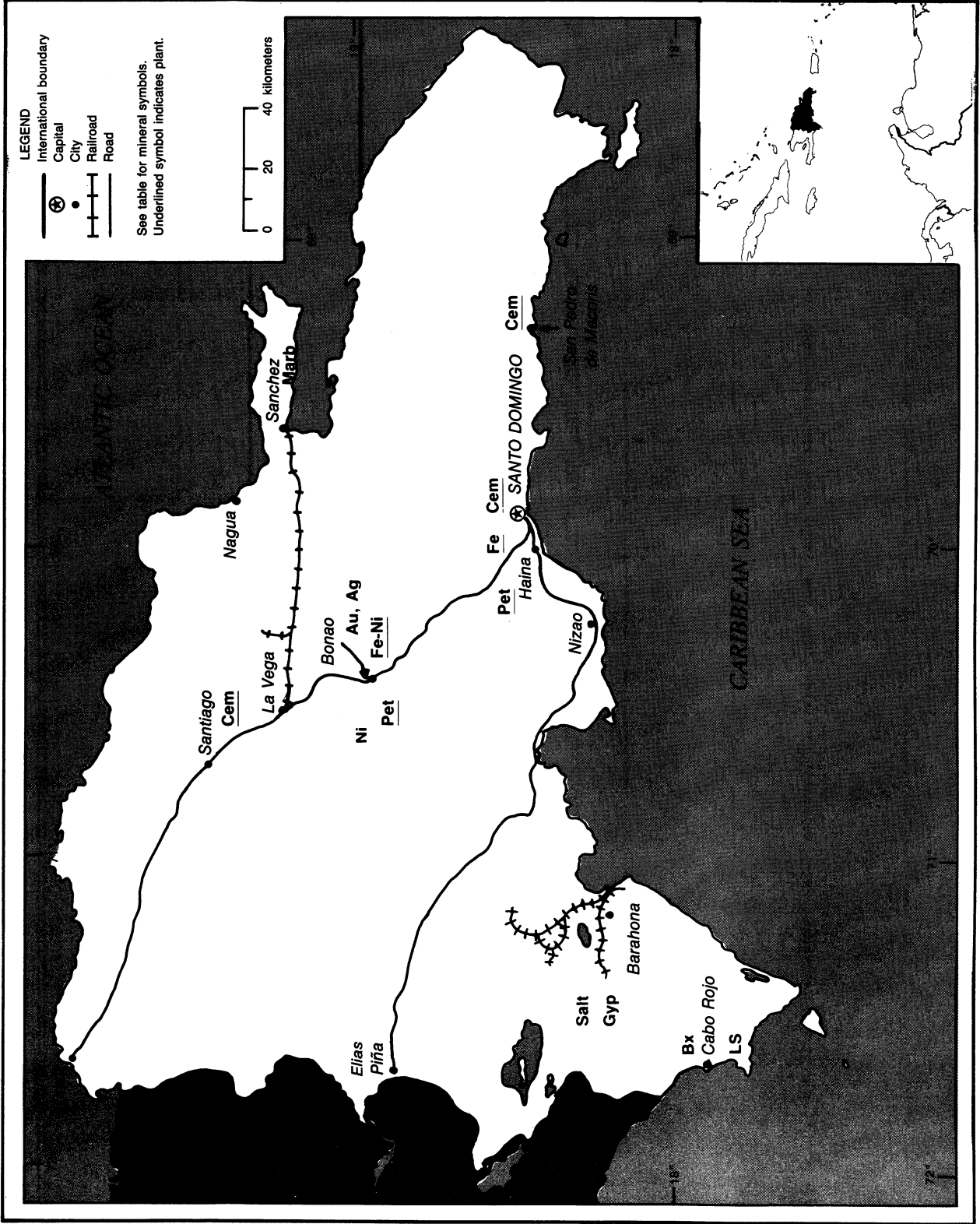
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DOMINICAN REPUBLIC

AREA 48,700 km²

POPULATION 7.2 million



THE DOMINICAN REPUBLIC

By David B. Doan

Mineral production declined virtually across the board in the Dominican Republic in 1990, reflecting both internal and external events. World markets for nickel and, derivatively, ferronickel weakened and lost a degree of predictability in terms of political and economic uncertainties in other nickel-producing countries such as Canada and Cuba. Dominican production and marketing, a major factor in its foreign-exchange position, thus was encumbered to begin with but had to endure the additional vicissitudes of local labor unrest, high fuel costs, and a deteriorating value of its currency.

At the end of 1989, overall arrears in servicing of external debt exceeded the \$700 million¹ mark. Dr. Juan Balaguer, re-elected in May of 1990 by a slim margin, asserted that the Government would have to negotiate directly with the International Monetary Fund (IMF). Possible IMF arrangements could lead to a Paris Club re-scheduling of debt, agreement with commercial-bank creditors, and possibly stepped-up assistance programs by certain bilateral donors, if all went well. Monetary policy was progressively tightened through the second half of the year, primarily by enforcing adherence to commercial bank reserve requirements. In addition, off-budget deficit financing of Government corporations was curtailed, thus diminishing the impetus from one significant source for inflation.

By the end of the year, the Government had made real progress in catching up on its debt arrearage to the World Bank, IMF, and the Inter-American Development Bank. Real GDP, however, had fallen by 5.1%, and the country's consumer price index (CPI) increased by slightly more than 100% for the first time in modern Dominican history. Inflation, likewise, was about 36% for the year. Higher retail prices engendered, predictably, a degree of political unrest and calls for President Balaguer's resignation. The President,

meanwhile, seemed slowly to be turning things around through adjustments in both monetary and fiscal policy.

GOVERNMENT POLICIES AND PROGRAMS

The Government's development policy had four principal targets, including agriculture, mining, tourism, and free zones. These targets or categories, separately and collectively, were seen as the economic engine that could bring about improvement of national income and some semblance of prosperity.

Starting in August 1990, the Government enacted a series of market-oriented reforms intended to decrease aggregate demand and improve overall economic performance. Public works outlays were sharply reduced, and prices were virtually doubled for flour, sugar, and gasoline. Leading sectors of the GDP declined as economic stringency took hold. Construction and housing dropped 15%; electricity, 11%; and mining, about 11%. Beyond the effect of the official actions, problems of debt collection and labor unrest affected the Government electricity company. Likewise, performance of the mining sector was impaired by lower world prices for ferronickel and reduced output of gold at Rosario Dominicano. It was too early at the end of 1990 to determine how successful the austerity measures would prove to be, but there were indications that inflation might be coming under control.

Another action, having more specific application to the mining industry, was the Government's announcement that starting in 1993 Rosario Dominicana would commence gold extraction in the sulfide zone of the mine. After having taken over complete ownership of the mine from AMAX Inc. near the end of 1989, the Government had continued ongoing study of the potential for acid mine water contamination of ground water and surface water supply in a comparatively rich agricultural area.

PRODUCTION

Output of all mineral commodities was down at least moderately in 1990 compared with that of the previous year. This reflected several causes, among them labor discontent, power shortages, and price weaknesses on international markets for mineral commodities. The decline in real wages in 1990, accompanied by poor delivery of public services, including electricity and water, resulted in a string of national protest strikes in August and November. A sharp rise in the price of diesel fuel led to problems in purchasing and supply of fuel to the nation's thermal powerplants, with consequent electricity shortages and brownouts.

A sag in nickel prices on world markets hurt production of both nickel and ferronickel. Gold prices had been working lower through 1990. Silver, as has been true for several years, did not live up to projected price appreciation. Taken together, gold, nickel, and silver, the Dominican Republic's premier mineral products, offered less in the way of mining incentive in 1990. Other mineral-related commodities produced in the country included bauxite, cement, gypsum, lime, limestone, marble, petroleum refinery products, salt, and steel.

TRADE

Principal mineral exports by the Dominican Republic have been bauxite, ferronickel, gold, and silver. In order of decreasing value, total exports for 1990 were projected at roughly 75,000 tons of ferronickel valued at \$238.4 million, 4,323 kg of gold valued at \$53.3 million, 22,929 kg of silver valued at \$3.5 million, and 85,000 tons of bauxite valued at \$800,000. The United States imported a large proportion, but not all, of these commodities. The total export value of these four mineral commodities, at \$296.1 million, was down about 33% from the total value of \$442.6 exported in 1989. This sharp drop reflected

TABLE 1
DOMINICAN REPUBLIC: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ¹	1986	1987	1988	1989	1990 ²
Aluminum: Bauxite, dry equivalent, gross weight thousand tons	—	187	168	151	85
Cement, hydraulic do.	1,066	1,100	1,495	*1,600	1,060
Coal, subbituminouse	600	600	600	600	600
Gold kilograms	8,833	7,651	5,785	5,238	4,354
Gypsum thousand tons	132	59	153	171	78
Iron and steel:					
Ferroalloys, ferronickel	55,954	81,303	73,363	78,170	71,753
Steel, crude	100,043	87,800	75,327	54,855	*50,000
Lime ³	34,000	36,000	36,000	36,000	36,000
Limestone	*150,000	254,251	525,946	1,127,397	491,265
Mercury kilograms	448	69	207	35	—
Nickel:					
Mine output, Ni content	<u>21,878</u>	<u>32,521</u>	<u>29,345</u>	<u>31,264</u>	<u>28,700</u>
Metal:					
Smelter, Ni content of ferronickel	21,878	32,521	29,345	31,264	28,700
Shipments, Ni content of ferronickel	21,989	29,051	32,377	28,944	28,696
Petroleum refinery products:					
Liquefied petroleum gas thousand 42-gallon barrels	278	197	237	378	272
Gasoline, motor do.	2,924	3,068	2,900	3,035	2,213
Kerosene and jet fuel do.	989	1,113	1,038	1,042	692
Distillate fuel oil do.	3,066	3,267	2,486	2,162	2,053
Residual fuel oil do.	3,516	2,817	2,617	2,619	2,686
Total do.	<u>10,773</u>	<u>10,462</u>	<u>9,278</u>	<u>9,236</u>	<u>7,916</u>
Salt	*54,000	*55,000	³ 37,532	³ 30,258	³ 11,339
Silver kilograms	40,994	35,707	39,595	22,614	21,630

*Estimated. ²Preliminary.

¹Table includes data available through Oct. 15, 1991.

²In addition to commodities listed, crude construction materials (sand and gravel, stone, etc.) may also be produced, but data on such production are not always available and information is inadequate to make reliable estimates of output levels.

³Rock salt only.

the lowered production volumes of 1990 as well as ambient price weaknesses.

Imports of mineral commodities centered on coal, crude oil, and petroleum derivatives. In order of decreasing value, projected import data for 1990 showed about 22.5 Mbbl of petroleum and derivatives valued at \$508.7 million as well as an undetermined amount of coal valued at \$5 million. Although these data are preliminary, they can be taken to represent probable magnitudes.

In a barter arrangement with the Federal Republic of Germany, the Dominican State Enterprises Corp. (CORDE) agreed to supply gypsum, marble, and salt in exchange for 30,000 mt/month of cement clinker from the Hamburg-based firm of Riwa International. Such clinker was urgently needed in mitigation of the cement shortage resulting from increasing con-

struction activity in various parts of the country.

STRUCTURE OF THE MINERAL INDUSTRY

The Government agency responsible for promoting mining and metallurgical development, the Direccion General de Minería, is under the Secretaria de Estado de Industria y Comercio. Its functions cover technical, administrative, and legal matters. The Corporación Dominicana de Empresas Estatales, a Government holding company, controls some of the mining entities owned by the Government.

Ownership of the mineral industry of the Dominican Republic is mixed. Rosario Dominicana S.A. in Pueblo Viejo is owned

by the Government, which has the majority interest in Fábrica Dominicana de Cemento in Santo Domingo. The two other cement companies, Cementos Cibao S.A. and Cementos Nacionales S.A., are privately owned. The Government has a minority interest in Falcondo, a subsidiary of Falconbridge Ltd., of Canada. The Refinería Dominicana de Petróleo in Haina is owned by Shell Internationale Petroleum Maatschappij B.V. (50%) and the Government (50%).

COMMODITY REVIEW

Metals

Bauxite.—Production of bauxite in 1990 dropped to 85,000 tons, down 44% from

TABLE 2

DOMINICAN REPUBLIC: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons per year unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Bauxite	Ideal Dominicana S.A.	Sierra de Bahoruco, Pedernales Province	200
Cement	Fábrica Dominicana de Cemento C. por A	Santo Domingo, Distrito Nacional	700
Do.	Cementos Cibao C. por A	Santiago Province	400
Do.	Cementos Nacionales S.A.	San Pedro de Macorís, San Pedro de Macorís Province	561
Doré (gold and silver) kilograms	Rosario Dominicana S.A.	Pueblo Viejo Mine, Cotui, Sánchez Ramírez Province	30,000
Gypsum	Sal y Yeso C. por A	Barahona Province	NA
Nickel	Falconbridge Dominicana C. por A	Mine and plant at Bonao, La Vega Province	30
Petroleum products thousand 42-gallons per day	Refinería Dominicana de Petróleo S.A.	Haina, Distrito Nacional	30
Do.	Falconbridge Dominicana C. por A	La Piguera, La Vega Province	3
Salt	Sal y Yeso C. por A	Barahona Province	NA
Steel	Metaldom	Santo Domingo, Distrito Nacional	100

NA Not available.

that of the year before. Government officials announced that the Aluminum Co. of America (Alcoa) will again purchase Dominican bauxite. Ideal Dominicana S.A., a privately owned subsidiary of a U.S. firm, will manage extraction operations in the Cabo Rojo area in the southwest part of the country. The contract is for 350,000 tons representing a value of approximately \$6.3 million. Ideal's current capacity is about 200,000 mt/a, but before Alcoa closed its Dominican operation in 1983 it had a capacity of about 1.25 Mmt/a. Since that time it has been the chief, if not the only, buyer of Ideal's production.

Gold and Silver.—Although almost 4.4 tons of gold was produced during 1990, output was down 17% from that of 1989. Silver production, likewise, decreased to about 21.6 tons in 1990, down about 4% from that of the previous year. In the face of virtual exhaustion of gold ore in the oxide zone of its Pueblo Viejo Mine, Rosario Dominicana finally won permission to commence mining in the sulfide zone of the gold ore body where it had been feared that mine waters would develop a sulfuric acidity and exert a deleterious effect on surrounding civil water supplies. President Balaguer finally approved mining of the transition zone of the ore body and the sulfide zone after a series of studies showed that formation of acid mine water could be controlled and perhaps even utilized for commercial production of sulfuric acid. Transition-zone mining will require about 3 years, with a projected output of 17.1 to 23.9 kg/d. Sulfide-zone mining would then last for 15 to 30 years depending upon rate

of extraction, tentatively put at anywhere from 29.6 to 68.4 kg/d.² The gold to silver ratio of the transition zone is about 1:4, indicating potential silver production of 68.4 to 96.4 kg/d.

Nickel.—Smelter production of ferronickel had 28,700 tons of contained nickel, a decrease of approximately 8% from that of 1989, that confirmed a downward trend from 1988. Price weakness and buyer diffidence resulted in significantly lower revenues for Falconbridge Dominicana in 1990, or \$262 million versus \$371 million in 1989. The company maintains an active exploration program and has a tentative nickel discovery, named Loma Pesada, not far from the present plant site. Evaluation of Loma Pesada's potential is underway but will require drilling and geologic study.

Reserves

Falconbridge Dominicana estimated its nickel reserves at about 38 million dry tons grading 1.72% nickel. Rosario Dominicana's reserves at Pueblo Viejo in the sulfide zone of the ore body were estimated at 70 Mmt with gold and silver contents of 4.0 and 19 g/mt, respectively. Reserves in the transition zone were estimated at 13 Mmt, with 2.8 and 13 g/mt of gold and silver, respectively.

INFRASTRUCTURE

The Dominican Republic had 12,000 km of roads, including 5,800 km of paved roads,

5,600 km of gravel or other loose surface, and about 600 km of unimproved earth surface that may be seasonally impassable. The country has 1,655 km of railroads in 4 different gauges ranging from 0.558 m to 1.435 m. A total of 44 airports has been built at various times in past decades, but only 30 are presently in condition to be used. Of these, 14 have paved runways, 3 with runways from 2,440 to 3,659 m long, and 9 with runways 1,220 to 2,439 m long.

Major seaports include Santo Domingo, Haina, San Pedro de Macorís, Puerto Plata, and Barahona. A number of smaller ports lines the coast, some of which may grow into major ports upon further development. Electricity is generated at diesel-fueled powerplants, having a total capacity of 1,376 MW, in various parts of the country. About 4 million MW.h of electric power was produced in 1989, amounting to roughly 560 kW.h per capita.

OUTLOOK

The current Balaguer Government has been making a determined effort to get its fiscal house in order, but not without pain to its consuming citizenry, as shown by the rise in CPI, as well as to the overall economy. The Government also, to a degree not presently apparent in many smaller countries, realizes that the future of the Dominican Republic depends heavily on its existing mineral resources as well as those yet to be discovered. It is not only emphasizing the mineral search but calling international attention to the attractiveness of the exploration arrangements that can be

made. The petroleum scene, which has been developing for several decades, includes new efforts to entice capital and expertise to the area of the north coast and the valleys of the Río Yaque del Norte, the Río Camu, and the Río Yuna. Past drilling in these regions has resulted in oil shows, but no production. There are signs that new activity will occur in 1991 and beyond, which could lead to domestic production of the fuels so necessary to power generation and the economy in general.

Although much will depend on agricultural production, as well as maintenance of fiscal and monetary stability, the mineral sector may well be the vehicle for a more stable economic order and prosperity for the Dominican Republic.

¹Where necessary, values have been converted from Dominican Republic pesos (RD\$) to U.S. dollars at the rate of RD\$8.54=US\$1.00.

²Ellis, G. The Hispaniola Report: Newsletter. July 1991.

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Santo Domingo, República Dominicana
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Estatales

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ECUADOR

By Pablo Velasco

The mineral sector of Ecuador continued to be dominated by petroleum. This industry was one of the significant contributors to Ecuador's economy. Output by the mineral sector increased 1.6% in 1990, reversing the negative trend of -7.6% in 1989. The increase in output of petroleum and refinery products contributed in large part to this recovery. Exports of crude oil and its products accounted for 51% of the country's export earnings in 1990. Other major export commodities were bananas (17%), shrimp (13%), coffee (4%), cocoa (5%), fish (2%), and other minor exports (6%). Based on the recovery in oil production following the 1987 earthquake and the impact of economic programs established by the Government since August 1988, the Central Bank estimated that the GDP increased by 0.6% in 1989. During 1990, the GDP grew by 1.5% to \$10.9 billion in current dollars.¹ The annual inflation rate decreased to 48.5% from that of 1989 when it reached 75.6%.

Mining continued to be considered a priority development sector by the Government. In 1990, the nonfuel sector registered an estimated 76% growth, mainly in the areas of industrial minerals and, to a lesser extent, metallic minerals, mainly gold. Crude oil production, which had increased to 300,000 bbl/d in 1988 to compensate for the 5-month production loss brought about by the earthquake in March 1987, was reduced to 290,411 bbl/d in 1990. This was far above the limits of 230,000 bbl/d stipulated by OPEC. In October 1989, the newly established state-owned *Petróleos del Ecuador* (Petroecuador) oil holding corporation took control of the Trans-Andean pipeline and the Anglo and Repetrol refineries, previously operated by Texaco Inc. of the United States, following the expiration of the agreement. Of the other activities in the mineral sector, only gold mining was of any importance.

GOVERNMENT POLICIES AND PROGRAMS

Ecuador continued its efforts to create a favorable investment climate to foreign and domestic investors in exploration and mining activities. These activities had been stimulated by both the country's mineral potential and by implementation of the mining law of August 1985 (Decree Law 06). Further reforms to the country's mining legislation has been discussed in Congress before being submitted to the President. The proposed new law would emphasize rapid exploration and development of mineral resources; encourage private, national, and foreign investments; and at the same time, regulate the disorder prevalent in the small-scale gold mining activity. At yearend 1990, the deliberations continued and the new legislation had not yet passed into law. However, approval of the new mining law was expected during 1991.

The official mining regulatory agency, *Instituto Ecuatoriano de Minería* (INEMIN), established by the mining law of 1985 as an autonomous organization in charge of the execution of mining policies, was suffering from an inadequate budget for executing its program. INEMIN replaced the former General Directorate of Geology and Mines. INEMIN was involved in small on-and-off geological exploration and mining projects, mainly for gold. Some support was being given to INEMIN to carry out these activities by means of Government-to-Government agreements with England, Belgium, Italy, and Japan through technical missions.

PRODUCTION

Production of nonfuel minerals showed modest growth in 1990 and contributed about 1% to the GDP. Mineral production

was limited to a few commodities: gold from placer operations; lead, silver, and zinc from polymetallic mines; and to a lesser degree industrial minerals, including clays, kaolin, limestone, marble, and sulfur. The total value and volume of mineral production was maintained at the same level of the previous year, but was expected to become increasingly important in the future. The total value of mineral output was estimated at \$1.4 billion in 1990 compared with \$1.1 billion in 1989. The mineral fuels and their derivatives accounted for 52% of the total value, and the nonfuel minerals, especially gold, accounted for the remaining 48%. Production of crude oil was little affected by the war in the Persian Gulf. Prior to that event it was producing close to capacity. In response to higher prices, Ecuador increased oil production by about 10,000 bbl/d. Crude oil production in 1990 was 106 Mbbbl, an increase of 3% compared with that of the previous year.

TRADE

Within the economy, the mineral fuels and mining sectors accounted for 13% of the GDP. It lagged behind the agricultural and fishing sector, which contributed 15% to the GDP, while the industry and construction sectors contributed a 26% share. However, the mineral fuels sector is by far the most important in terms of its contribution to state revenues and foreign exchange earnings, generating just under one-half of central Government revenues and 52% of export receipts in 1990 amounting to \$1.46 billion. About \$135 million of the increased oil revenues generated during the period of the Persian Gulf crisis in 1990 was placed by the Government in a special stabilization fund. A trade surplus of about \$1 billion was recorded in 1990, an improvement of \$342 million over that of 1989.

The United States continued as the principal trading partner of Ecuador. Dur-

TABLE 1
ECUADOR: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989	1990 ^e
METALS					
Cadmium, mine output, Cd content ^e kilograms	300	300	300	300	250
Copper, mine output, Cu content ^e	100	100	100	100	100
Gold, mine output, Au content kilograms	9,870	9,500	¹ 10,200	¹ 10,390	² 10,710
Iron and steel:					
Steel, crude	17,084	25,200	23,500	23,400	² 19,800
Semimanufactures	181,850	170,400	170,538	^e 178,000	² 172,600
Lead concentrate, Pb content ^e	200	200	200	200	200
Silver, mine output, Ag content ^e kilograms	60	60	60	60	60
Zinc, mine output, Zn content ^e	100	100	100	100	100
INDUSTRIAL MINERALS					
Cement, hydraulic thousand metric tons	2,015	2,145	2,200	^e 2,250	2,250
Clays:					
Bentonite	^e 100	155	100	250	200
Common:					
For cement thousand metric tons	2,907	255	500	520	500
Other	26,472	29,200	50,000	150,250	100,000
Kaolin	3,867	11,017	^e 16,700	22,576	20,000
Feldspar	2,298	1,558	5,000	21,814	10,000
Gypsum (for cement)	290,680	29,200	50,000	48,368	40,000
Sand:					
Silica (glass sand)	36,649	14,675	50,000	102,345	70,000
Ferruginous	^e 5,500	6,000	6,000	15,334	10,000
Stone, sand and gravel:					
Limestone (for cement manufacture) thousand metric tons	6,500	2,773	5,000	5,617	5,000
Marble	15,195	15,210	20,000	47,771	40,000
Pumice	^e 85,000	—	^e 90,000	^e 144,836	^e 100,000
Sulfur: ^e					
Native	4,000	4,500	4,500	4,300	4,000
Byproduct:					
From petroleum	5,000	5,000	5,000	5,000	5,000
From natural gas	5,000	5,000	5,000	5,000	5,000
Total	<u>14,000</u>	<u>14,500</u>	<u>14,500</u>	<u>14,300</u>	<u>14,000</u>
MINERAL FUELS AND RELATED MATERIALS					
Coal, lignite	^e 1,200	1,541	3,000	5,000	3,000
Gas, natural:					
Gross ^e million cubic meters	623	348	² 177	180	150
Marketable do.	<u>146</u>	<u>92</u>	<u>99</u>	<u>^e100</u>	<u>90</u>
Natural gas, liquids:					
Natural gasoline thousand 42-gallon barrels	232	186	232	^e 240	250
Liquefied petroleum gas do.	789	278	533	^e 550	560
Total do.	1,021	464	765	^e 790	810
Petroleum:					
Crude do.	<u>¹106,995</u>	<u>^e63,687</u>	<u>¹112,553</u>	<u>¹102,953</u>	<u>²106,006</u>
Refinery products:					
Liquefied petroleum gas do.	1,635	770	¹ 1,549	¹ 1,386	² 1,715
Gasoline do.	8,788	6,904	¹ 11,028	¹ 10,350	² 10,473

See footnotes at end of table.

TABLE 1—Continued

ECUADOR: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989	1990 ^e
MINERAL FUELS AND RELATED MATERIALS—Continued					
Petroleum—Continued					
Refinery products—Continued					
Jet fuel	1,170	¹ 1,200	¹ 1,336	¹ 1,266	² 1,368
Kerosene	2,187	¹ 1,587	¹ 1,387	¹ 1,830	² 1,402
Distillate fuel oil	¹ 6,219	¹ 5,882	¹ 8,709	¹ 8,049	² 8,249
Lubricants	¹ 465	¹ 502	¹ 475	¹ 484	² 406
Residual fuel oil	13,667	11,769	¹ 15,012	¹ 15,239	² 15,478
Unspecified	¹ 640	¹ 498	¹ 920	¹ 505	² 140
Refinery fuel and losses	(³)	(³)	—	(³)	—
Total	¹ 34,771	¹ 29,112	¹ 40,416	¹ 39,109	² 39,231

^eEstimated. ^rRevised.¹Includes data available through Aug. 1991.²Reported figure.³Revised to zero.

ing 1990, the export value to the United States reached \$1.45 billion (53.4%), while imports of \$539 million represented 31.5% of total imports. The export value of crude oil to the United States represented (34.8%) of the total, followed by Panama (10.4%), Peru (9.3%), Puerto Rico (8.3%), and Taiwan (4.9%). Ecuador also exported a small amount of petroleum products to the United States, mostly residual fuel oil. During 1990, Ecuador's total imports value was \$1.7 billion, slightly above the level of 1989.

STRUCTURE OF THE MINERAL INDUSTRY

Two Government agencies, the Dirección Nacional de Hidrocarburos and INEMIN, formerly Dirección General de Geología y Minas, both under the Minister of Energy and Mines, oversaw the activities of the mineral industry. The country's mineral industry was dominated by the petroleum industry in terms of contribution to the Ecuadorian GDP, employment, and export earnings. Crude oil and natural gas were produced by companies with production-sharing agreements with the Government, namely, between the Corporación Estatal Petrolera Ecuatoriana (CEPE) and Texaco Inc. CEPE-Texaco combined was also joint owner of the trans-Ecuadorian 800-km-long crude oil pipeline with a 300,000-bbl/d capacity. The pipeline installation was completed in 1972 and crosses the Andes mountains near the capital of Quito. The pipeline transports crude oil from the Lago Agrio Oilfields to

the Balao terminal on the Pacific coast near Esmeralda refinery.

On October 1, 1989, the Government of Ecuador, exercising a contractual agreement with Texaco Inc., took over the operation of the trans-Ecuadorian pipeline through state-owned CEPE. In late September 1989, a law was enacted reorganizing CEPE, and the name was changed to *Petróleos del Ecuador* (Petroecuador) as of January 1, 1990. Petroecuador is the most important company in Ecuador, with sales of about \$1.4 billion in 1990. The company produces, refines, stores, transports, and delivers crude oil and petroleum products. Petroecuador was the majority stockholder in the consortium, with Texaco holding 62.5% of the shares, the largest stockholder in the CEPE-City Association, and a minority shareholder in the Anglo and Repetrol refineries (with 12.5% of the shares). The Government of Ecuador continued plans to assume operation control of the oilfields currently operated by Texaco in July 1990 and the Anglo and Repetrol refineries by yearend.

In 1990, the total national work force was 2.8 million workers distributed as follows: 35% in the agricultural sector; 21% in manufacturing, 16% in commerce, and 28% in services and other activities. The mining and extractive industries employed approximately 25,000 persons, which represented less than 1% of the total labor force. Organized labor constituted less than 15% of the total. Petroecuador had a work force of about 4,300.

INEMIN was carrying out an agreement with Japan for a detailed exploration

followup program to ascertain base metal prospects outlined by the British Geological Mission during the 1970's in the Western Central Cordillera. The Government had encouraged the formation of mixed enterprises, such as mining centers, MINACEN, to install processing plants to treat minerals in the mining districts of Nambija, in the Province of Zamora; Ponce Enríquez, in the Azuay Province; and Portovelo in the Province of El Oro. The Government has also given the Ecuadorian Army's Industry Div. (DINE) joint responsibility with INEMIN for the administration of certain regions, including parts of the Provinces of Zamora and Morona-Santiago.

There were more than 150 small mining companies operating in the country. Ecuador's metallic mining activity was concentrated in the following eight major mining provinces: El Oro Province (stibnite, gold), Azuay Province (copper, gold, silver), Zamora-Chinchipe Province (gold, silver), Napo Province (gold), Cotopaxi Province (gold), Esmeralda Province (gold), Pichincha Province (gold), and Loja Province (copper, gold).

In 1990, there were 20 foreign companies prospecting and exploring for copper, gold, and silver in Ecuador. The countries of origin were Australia, Canada, China, Finland, France, Panama, Spain, the United Kingdom, and the United States. There were four foreign companies actively engaged in the mining of gold and silver; they were Australian, Canadian, French, and Panamanian.

Small-scale industrial mineral operations included marble—Industria Marmolera

TABLE 2

ECUADOR: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc.	30,549	40,558	31,368	Colombia 6,216; Venezuela 2,777.
Aluminum: Metal including alloys, semimanufactures	428	135	—	All to Colombia.
Copper: Metal including alloys, semimanufactures	16	9	—	All to Argentina.
Fertilizer materials: Manufactured, unspecified and mixed value, thousands	\$975,714	—		
Gold: Metal including alloys, unwrought and partly wrought	—	19	19	
Iron and steel: Metal:				
Steel, primary forms	—	400	—	Chile 261; Peru 121; Mexico 18.
Semimanufactures:				
Universals, plates, sheets	748	—		
Wire	—	15	15	
Tubes, pipes, fittings	317	671	—	Chile 190; Guatemala 30; Colombia 2.
Castings and forgings, rough value, thousands	—	\$1	—	All to United Kingdom.
Petroleum:				
Crude thousand 42-gallon barrels	45,951	55,239	31,659	Peru 6,034; Chile 3,074.
Refinery products:				
Gasoline:				
Aviation 42-gallon barrels	1,043	512	NA	NA.
Motor do.	304,794	528,585	NA	NA.
Kerosene and jet fuel do.	—	288,510	NA	NA.
Distillate fuel oil do.	563,193	297,145	NA	NA.
Residual fuel oil do.	8,772,279	7,571,420	NA	NA.
Bituminous mixtures do.	121	115	—	All to Costa Rica.
Stone, sand and gravel:				
Dimension stone, crude and partly worked	16	12	—	All to Colombia.
Quartz and quartzite	18	—		
Sulfur: Elemental, crude including native and byproduct	—	185	—	All to Colombia.

NA Not available.

¹Table prepared by H. D. Willis.

TABLE 3

ECUADOR: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS				
Alkali and rare-earth metals	3	1	—	All from Italy.
Aluminum:				
Oxides and hydroxides	1,636	763	469	West Germany 225; United Kingdom 102.
Metal including alloys:				
Scrap	2	3	3	
Unwrought	4,947	4,256	49	Canada 2,347; Argentina 1,786.
Semimanufactures	14,357	5,566	328	Brazil 3,426; West Germany 554.

See footnotes at end of table

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

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
METALS—Continued					
Chromium:					
Ore and concentrate	20	—			
Oxides and hydroxides	17	17	9	West Germany 6; Brazil 2.	
Cobalt: Oxides and hydroxides	2	1	1		
Copper: Metal including alloys:					
Unwrought	4	236	103	Chile 88; Peru 43.	
Semimanufactures	6,288	3,914	173	Peru 1,557; Chile 1,529; Republic of South Africa 261.	
Iron and steel:					
Iron ore and concentrate	2	266	42	Colombia 200; Italy 23.	
Metal:					
Scrap	—	1,095	—	All from Canada.	
Pig iron, cast iron, related materials	257	41	17	Italy 24.	
Ferroalloys:					
Ferromanganese	392	278	—	Chile 140; Republic of South Africa 123; Brazil 15.	
Ferrosilicon	115	124	—	Chile 89; Argentina 35.	
Unspecified	2	9	—	All from Republic of South Africa.	
Steel, primary forms	183,207	176,038	30	Brazil 88,853; Canada 36,507; Republic of South Africa 19,114.	
Semimanufactures:					
Bars, rods, angles, shapes, sections	45,898	60,797	192	Brazil 36,717; Venezuela 7,946; Republic of South Africa 5,798.	
Universals, plates, sheets	123,153	167,310	1,460	Japan 117,475; Brazil 22,774; West Germany 10,534.	
Hoop and strip	2,626	12,262	145	Japan 10,448; Brazil 929; West Germany 275.	
Rails and accessories	36	466	1	Canada 463; Italy 2.	
Wire	348	711	1	Republic of Korea 360; Japan 123; Brazil 100.	
Tubes, pipes, fittings	31,550	20,340	2,386	Argentina 11,888; Japan 1,984.	
Castings and forgings, rough	418	26	11	Peru 10; Spain 4.	
Lead:					
Oxides	1,569	1,780	54	Peru 829; Mexico 567; Panama 304.	
Metal including alloys:					
Unwrought	1,079	1,326	28	Peru 787; Panama 384; Mexico 90.	
Semimanufactures	203	79	(²)	Colombia 6; West Germany 6; unspecified 67.	
Magnesium: Metal including alloys:					
Unwrought	value, thousands	\$1	—		
Semimanufactures		5	1	1	
Manganese: Oxides		683	560	9	Brazil 274; Mexico 134; Colombia 105.
Mercury	kilograms	2,000	3,000	1,000	West Germany 2,000.
Molybdenum: Metal including alloys, semimanufactures:					
Unwrought	(³)	4	4	Nickel: Metal including alloys:	
Semimanufactures	2	—			
	12	19	2	Canada 12; West Germany 3.	
Platinum-group metals: Metals including alloys, unwrought and partly wrought, unspecified					
	value, thousands	—	\$29	—	All from Switzerland.
Silver: Metal including alloys, unwrought and partly wrought					
	do.	\$76	\$60	\$33	Chile \$26.
Tin: Metal including alloys:					
Unwrought		7	4	3	United Kingdom 1.
Semimanufactures		25	20	2	Bolivia 12; West Germany 3.

See footnotes at end of table.

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

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS—Continued				
Titanium: Oxides	359	308	33	West Germany 187; United Kingdom 50.
Tungsten: Metal including alloys:				
Unwrought value, thousands	\$2	\$2	\$2	
Semimanufactures do.	\$5	\$10	\$10	
Zinc:				
Oxides	19	33	6	Chile 18; Peru 5.
Blue powder	17	11	—	Denmark 8; Belgium-Luxembourg 3.
Metal including alloys:				
Scrap value, thousands	—	\$8	—	All from Netherlands.
Unwrought	53,692	2,696	16	Peru 1,387; Canada 1,292.
Semimanufactures	15	3	(²)	Mainly from Republic of South Africa.
Other:				
Ores and concentrates	116	—		
Oxides and hydroxides	92	329	299	Colombia 22; Mexico 5.
Ashes and residues	143	337	—	Chile 124; Mexico 116; Colombia 55.
Base metals including alloys, all forms	8	1	1	
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	17	138	75	Austria 40; Canada 5.
Artificial: Corundum	79	54	1	Austria 38; Italy 11; Brazil 4.
Grinding and polishing wheels and stones	290	346	3	Italy 100; Brazil 77; Austria 37.
Asbestos, crude	7,036	3,001	18	Canada 2,433; Republic of South Africa 547.
Barite and witherite	91	51	1	Peru 50.
Boron materials:				
Crude natural borates	6	1	1	
Oxides and acids	207	196	1	Peru 155; Chile 21; Italy 14.
Bromine, fluorine, iodine	38	2	—	Mainly from West Germany.
Cement	8,330	11,354	281	Peru 7,550; Colombia 3,480.
Chalk	855	563	—	Belgium-Luxembourg 300; United Kingdom 140; Republic of South Africa 119.
Clays, crude	2,564	8,153	7,342	Colombia 530; United Kingdom 127.
Cryolite and chiolite	—	17	—	All from United Kingdom.
Diamond: Gem, not set or strung value, thousands	\$238	\$184	\$1	Belgium-Luxembourg \$161; Brazil \$22.
Diatomite and other infusorial earth	355	221	220	Denmark 1.
Feldspar, fluorspar, related materials	144	929	761	Peru 97; Italy 46.
Fertilizer materials:				
Crude, n.e.s.	2	—		
Manufactured:				
Ammonia	39	29	1	Netherlands 20; Belgium-Luxembourg 5; West Germany 3.
Nitrogenous	65,081	104,231	42,565	U.S.S.R. 25,500; West Germany 20,067.
Phosphatic	872	6,164	4,798	Colombia 1,026; Belgium-Luxembourg 280.
Potassic	27,150	19,344	10,134	West Germany 7,195; East Germany 2,000.
Unspecified and mixed	21,187	28,786	26,834	West Germany 1,201; Belgium-Luxembourg 470.
Graphite, natural	16	12	(²)	Mainly from Peru.
Gypsum and plaster	65,820	430,791	1,060	Mexico 22,329; Peru 6,420.
Magnesium compounds: Magnesite, crude	1	4	—	Mainly from West Germany.
Mica:				
Crude including splittings and waste	36	2	2	

See footnotes at end of table.

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

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Mica—Continued				
Worked including agglomerated splittings				
value, thousands	\$2	\$1	—	All from Japan.
Nitrates, crude	—	341	11	Chile 325; West Germany 5.
Phosphates, crude	value, thousands	\$2	\$3	\$3
Pigments, mineral: Iron oxides and hydroxides, processed	265	222	12	West Germany 101; Spain 37; Brazil 36.
Potassium salts, crude	5,077	6,200	4,200	West Germany 2,000.
Precious and semiprecious stones other than diamond: Synthetic	value, thousands	\$42	\$25	\$5
value, thousands	\$42	\$25	\$5	Czechoslovakia \$12; unspecified \$8.
Pyrite, unroasted	—	30	—	All from Colombia.
Salt and brine	162	1,330	1,095	United Kingdom 199; West Germany 18.
Sodium compounds, n.e.s.:				
Soda ash, natural and manufactured	6,954	13,338	10,897	France 2,080; West Germany 206.
Sulfate, natural and manufactured	3,506	6,480	3	Mexico 5,880; Chile 586; West Germany 11.
Stone, sand and gravel:				
Dimension stone: Crude and partly worked	22	32	32	
Dolomite, chiefly refractory-grade	302	700	—	Peru 450; Colombia 250.
Quartz and quartzite	6	—		
Sand other than metal-bearing	5,302	99	15	Italy 75; United Kingdom 5.
Sulfur:				
Elemental:				
Crude including native and byproduct	1,367	502	83	Colombia 406; West Germany 13.
Colloidal, precipitated, sublimed	24	75	46	Peru 18; West Germany 11.
Sulfuric acid	2,316	6,473	72	Peru 4,248; Venezuela 2,008; Netherlands 126.
Talc, steatite, soapstone, pyrophyllite	676	756	331	Italy 111; Brazil 45.
Other:				
Crude	459	1,298	978	West Germany 200; Mexico 54.
Slag and dross, not metal-bearing	4	4	4	
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	60	62	17	Colombia 43; Brazil 2.
Carbon:				
Carbon black	2,402	4,129	69	Colombia 3,084; Venezuela 659; Mexico 243.
Gas carbon	(²)	—		
Coal: All grades including briquets	196	33	3	Belgium-Luxembourg 15; Colombia 15.
Coke and semicoke	381	512	—	All from Colombia.
Petroleum:				
Crude	42-gallon barrels	(²)	14	7
value, thousands	\$2,644	—		
Refinery products:				
Liquefied petroleum gas	do.	23	476	476
Gasoline:				
Aviation	do.	39,782	29,999	NA
Motor	do.	50,014	93,673	NA
Mineral jelly and wax	do.	27,057	37,201	2,928
Lubricants	do.	258,545	1,778	714
Residual fuel oil	value, thousands	\$2,644	—	
Bitumen and other residues	42-gallon barrels	721	909	897
Bituminous mixtures	do.	764	261	218
Petroleum coke	do.	6	—	

¹Revised. NA Not available.

²Table prepared by H. D. Willis.

³Less than 1/2 unit.

⁴Quantity not available valued at \$6,000.

⁵May include limestone other than dimension.

⁶Revised to zero. Reclassified as coke and semicoke.

Ecuadoriana S.A., Mármoles Andinos Cía. Ltda., Mármoles Santa Rosa Cía Ltda., and Marmolera Chimborazo; calcium carbonate—Cecal. S.A.; bentonite—Mineral M.D.K. and Mineral Bentonite Charasol; and barite—Mineral Bomboiza.

COMMODITY REVIEW

Metals

Gold.—Gold production in Ecuador was reported to have increased 3% to 10,700 kg in 1990 compared with that of 1989. Most of the gold came from the Nambija, Ponce Enríquez, and the Zaruma-Portovelo Districts. The gold was mined by underground methods and recovered by the gravimetric process followed by amalgamation or cyanidation methods. Placer gold was also extracted from alluvial deposits. The material extracted from these works was processed on a toll basis in beneficiation plants treating 5 mt/d. At present, most of the metallic mines were in the southern part of the country and in approximately 200 rivers containing gold, outlined in 5 main districts formed by the following rivers: Esmeralda-Santiago; Daule-Quevedo; Puyango-Balao, Chinchipe-Zamora-Upano, and Napo-Pastaza-Aguarico. The Government was encouraging joint ventures mainly to install larger processing plants capable of treating 40 to 200 tons of gold-bearing gravel per day.

Three gravimetric plants had been installed in the Catamayo, Bonanza, Vivar, Jubones, and Casacay Rivers. In 1988, Greevor PLC of the United Kingdom began to build a 100-mt/d plant, which would use an acid leaching circuit in the Zaruma-Portovelo District. The plant, which would initially reprocess old tailings dumps and treat low-grade ore from small gold mines, was still under test and should be in full production by the end of 1991. Within the past 3 years several foreign companies had embarked on exploring for primary gold deposits in various regions of the country. These included Rio Tinto Zinc Corp. Ltd.—RTZ (United Kingdom), Compagnie Générale des Matières Nucléaires —COGEMA (France), Rayrock Yellowknife Resources Inc. (Canada), Bureau de Recherches Géologiques et Minières —BRGM (France), and others. Alluvial gold mining was also very active in the country; most of the operations were small-scale. One example was the Los Lilenes operation, where 60,000 m³/month was dredged. Minera Gowanda S.A., a U.S. company established in 1973, mined gold placer deposits in the Esmeraldas area, northwest of Ecuador.

Other Metals.—Armeno Resources Inc. of Vancouver, Canada, had indicated that the exploration and development work carried out during 1989 contributed to an increase in ore reserves from 120,000 tons

to 2.2 Mmt (proven and probable) grading 0.65% lead, 1.9% zinc, 465 g silver per ton, and 0.55 g of gold per ton. Armeno Resources had formed a joint venture with Nissho Iwai Corp. of Japan to finance the development and exploitation of the San Bartolomé Mine and three other exploration prospects in Ecuador in return for a \$1.25 million investment and a loan of \$1.25 million to construct the production facilities in the mine and bring it into production by the end of 1991. Nissho Iwai had agreed to acquire a 50% stake in Armeno's San Bartolomé property and other prospects. The completion of the deal, however, was subject to various approvals by Canadian and Ecuadorian regulatory authorities.

INEMIN maintained under subsidized operating conditions a low production level (20 mt/d) at the Portovelo Mine. According to the latest evaluation performed by INEMIN's technical staff, reserves of 130,000 tons (proven and probable) had been estimated at Portovelo, grading 1% copper, 1.7% zinc, 63 g of silver per ton, and 1.2 g of gold per ton. La Plata and Molleturo were other relatively important prospects. Both mines were in production for several years during the late 1970's and early 1980's, but at present are closed. Intensive exploration, development, and rehabilitation program would be required to bring them into production. According to official sources, the La Plata deposit contained reserves of approximately 300,000

TABLE 4

ECUADOR: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Cementos Selva Alegre S.A.	Near Octavalo, Pichincha Province	350
Do.	Cementos Chimborazo C.A.	Near San Juan Chico, Riobamba Province	250
Do.	La Cemento Nacional C.A.	7.5 kilometers via a Salinas, Guayaquil Guayas Province	150
Do.	Empresa Industrias Guapan S.A.	Azogues, Canar Province	100
Do.	Cemento Cotopaxi C.A.	Near Latacunga, Cotopaxi Province	50
Polimetallic (Au, Ag, Pb, Cd, Zn)	Cía. Armeno Resources Inc. of Vancouver, British Columbia, Canada	San Bartolomé mine, Azuay Province, 30 kilometers south east from Cuenca	36
Polimetallic (Au, Ag, Cu, Pb, Zn)	Minera Toachi, S.A.	La Plata Mine, 113 kilometers southwest of Quito, Cotopaxi Province (currently stagnant)	24
Do.	Ecuadorean Mining Institute (INEMIN)	Portovelo Mine, south of Ecuador Del Oro Province	6
Gold kilograms	Cía. Minera Los Lilenes S.A.	Machala River gold placer, Del Oro Province	120
Do. metric tons	Coperativa Gordillera Nambija	Cordillera Tunantza, southeast of Ecuador, 25 kilometers north of Zamora Chinchipe	10
Do. kilograms	Coperativa Orquídea de Los Andes & Cía. Mineral Cumbinamasa S.A.	Cordillera Las Brisas, Villa 4, Machala	10

tons (proven and probable) with grades of 3.5% copper, 2.3% zinc, 43 g of silver per ton, and 2.5 g of gold per ton. Similarly, at the Molleturo deposit, based on the limited exploration work carried out by the property holders, there was approximately 100,000 tons (proven and probable) grading 1.3% copper, 5.2% lead, 6.9% zinc, 560 g of silver per ton, and 1.5 g of gold per ton.

Industrial Minerals

Industrial minerals played a significant role in the nonfuel mineral sector. The most important operations were in the cement and cement-related industries involving limestone and clay.

Cement.—Production of cement increased 2.3% from that of 1990 to an estimated 2.25 Mmt. Domestic sales in 1990 totaled 2.2 Mmt. Most of cement production was under Government control and managed by regional development corporations.

La Cemento Nacional C.A. (LCN), the largest manufacturer of cement in Ecuador, produced about 67% of the total output in the country. LCN was an established and well-organized cement company serving the entire Ecuadorian market. LCN had been in the local cement business more than 60 years. In 1974, Holderbank FG of Switzerland, a major international cement operator, bought an important equity stake in the company and has since operated the two cement plants of the company, including the implementation of the two major expansions of LCN's production facilities. LCN shares were owned by Corporación Financiera Nacional (CFN), 47%; the Government-owned DFC-Holderbank, 47%; about 95 private Ecuadorian investors, 3.1%; and the U.S. International Finance Corp. (IFC), 2.9%.

In 1988, IFC, after 10 years since its original involvement, had decided to sell its entire shareholding for an undisclosed amount to Compañía de Inversiones Albacerrada S.A. (CIASA). CIASA was an Ecuadorian investment corporation owned by private Ecuadorians.

Kaolin.—In recent years, the ceramic industry of Ecuador has been concentrated in the southern part of the country; it had become a significant factor in Ecuador's economy. Fine ceramic goods, namely earthenware and crockery, were the main products. The location of the ceramic industry around Azogues, Cuenca, and Loja in southern Ecuador was determined by the

deposits of primary kaolin. The initial systematic investigation was made as part of a United Nation Development Program (UNDP) project in the 1960's. The earthenware industry in Azogues, Cuenca, and Loja used roughly 700 tons of raw material per month, approximately 200 to 300 tons of which was raw kaolin mined in the deposits of Belén, Las Mercedes, Lucero-El Valle, Samael, and Tinajillas. Reserves of raw kaolin amounted to more than 2 Mmt and were adequate to meet the long-term needs of the ceramic industry. According to preliminary figures from INEMIN, the production of kaolin in 1990 in this area had decreased to an estimated 3,000 tons from that of the previous year.

Pumice.—Production of pumice stone was estimated to have decreased in 1990. Reportedly, a steadily increasing volume of this stone was coming to the United States via the port of New Orleans from Ecuador, Turkey, and Mexico. There was increased U.S. use of the floating stone, better known as pumice; it was used in producing so-called stonewashed blue jeans.

Mineral Fuels

Gas.—During 1990, Ecuador produced an estimated 150 Mm³ of natural gas. Most of the domestically produced gas was processed at the Petroecuador gas plant in the Shushufindi Oilfield in the oriente region. To meet domestic demand, an additional quantity of cubic meters of natural gas was imported from Colombia. LPG was bottled and distributed by four private firms as well as by Petroecuador.

Petroleum.—Crude oil production in 1990 totaled 106 Mmbl, an increase of 3% from that of the previous year. Ecuador exported 62 Mmbl of crude oil and 9.7 Mmbl of refinery products in 1990. The increase in crude oil output was apparently due to the increase in oil prices in response to the increase in world demand resulting from the War in the Persian Gulf. Petroleum exploration activities continued during 1990 with new wells drilled by Belco Petroleum Corp.—BELCO (United States), Elf Aguitaine S.A.—ELF (France), Petrobrás International S.A.—PETROBRÁS (Brazil), Petro-Canada International Assistance Corp. (Canada), and Tenneco Oil Co. (United States). Oil shows were encountered in some of the wells, but it was not clear whether any of these would have commercial importance. Conoco Petroleum Ltd. (U.S.) made a large find in late 1988, but at

yearend they were still negotiating a development plan with the Government. If Conoco receives approval for its development plan in 1991, it could begin limited production by mid-1993. The Government and Petroecuador have been very slow in approving development plans for those foreign oil companies that have found petroleum. By yearend, the only plan approved was for ORYX Ecuador Energy Co. formerly British Petroleum, which will jointly develop a field with Petroecuador. In Ecuador's eastern jungle, Occidental of Ecuador Inc., a subsidiary of Occidental Exploration and Production Co., made an additional oil discovery that confirms sufficient reserves to warrant commercial development of block 15. Production from the five fields was planned to begin in late 1992 or early 1993. Occidental is operator of the block with 85% interest, and the remainder is owned by Canadian Occidental. Exploration contracts with Hispánica de Petróleos S.A.—HISPANOIL (Spain), Texaco Oil Co.—Pecten International Ltd., Belco, and Occidental (United States) have expired, although Belco received an extension for one of its two blocks.

The Government had announced that seven additional blocks (200,000 ha or about 500 acres each) would be available for exploration bids beginning January 10, 1990. Petroecuador was soliciting bids from foreign oil companies to improve reservoir management of Ecuador's two largest fields, Shushufindi and Sacha, which will include secondary and tertiary recovery techniques in order to maintain current production for an extended period of time.

From the total of crude oil production, Petroecuador-Texaco Consortium accounted for about 75 Mmbl, Northeastern Petroecuador directly produced about 30 Mmbl, and the Petroecuador-City Association produced 1 Mmbl. Practically all of Ecuador's petroleum output came from the Oriente region. Petroecuador-Texaco's main base camp in Oriente was in the town of Lago Agrio, and the main oilfields operated by the consortium included Shushufindi, Sacha, Lago Agrio, Aguatico, and Auca. Most of Petroecuador's own production came from fields north of the Petroecuador-Texaco concession near the Colombian border. In July 1990, the privately owned Repetrol refinery came under control of Petroecuador following the reversion of the Anglo refinery in December 1, 1989.

As of June 1990, proven reserves were estimated at 1.36 bbl, and probable reserves added 700 Mmbl. With an output of 285,000

bbl/d, proven reserves would last 13 years based on present production; probable reserves add about 6.7 years.

Reserves

Ecuador was believed to have gold reserves on a par with those of Peru and Colombia, and because gold mining essentially stopped after the colonial era (16th and 17th centuries), most of Ecuador's gold remains unexploited.

Ore reserves of metallic minerals and industrial minerals were small in world terms, but considered significant in Latin America. Crude oil proven reserves were estimated at 1.36 billion and probable reserves at 700 Mbbl.

INFRASTRUCTURE

Ecuador is limited in the development of its infrastructure. The transportation network was composed of a total of 28,000 km of highways: 3,600 km paved, 17,400 km gravel and improved earth, and 7,000 km unimproved earth.

The railroad system consisted of 965 km total; all was 1.067-m-gauge single track. Mine production was transported by truck and rail to processing plants and shipping ports. The railroad system was operated by the state, with the main line running north-south. Crude oil and refined products were transported by two pipelines that were 800 and 1,358 km long, respectively, to Esmeraldas terminal and Quito from the oilfields in the Oriente region and to Napo Province for final processing, domestic distribution, and export. Four major ports served the country on the Pacific coast. The first (in order of importance) was Guayaquil, through which about 60% of the cargo by volume was channeled, followed by

Esmeraldas, Puerto Bolívar, and Manta.

For international air transportation, there were two airports, one in Quito and the other in Guayaquil. Ecuatoriana de Aviación was the major domestic airline that covered several routes throughout Latin America and the United States. Ecuador had an installed electrical generating capacity of 1,953 MW, of which 53% came from thermal stations and 47% came from hydroelectric sources. Early in 1991, however, this ratio was expected to change in favor of hydroelectric power.

OUTLOOK

For a long time the potential to develop mining in Ecuador had been seen as promising. The mining law enacted in 1985 motivated some foreign investment to flow into the country, but was not sufficient to reactivate the mining sector to any great degree owing mainly to certain inconsistencies in the law, as well as certain bureaucratic obstacles that delayed the implementation of sound projects.

The Ecuadorian authorities concerned with the mineral sector were expected to increase efforts to overcome these pitfalls. A proposed new mining law has been drawn up with provisions to create major incentives to encourage mining investment. Should this proposed law be enacted during 1991, it would offer the prospect of enhanced contributions of the mining sector to the national income of the country.

The new state petroleum company Petroecuador was expected to expand its productive and transport capacity, most notably the construction of a LPG terminal and petroleum product pipelines. An increase in oil reserves may result from the 10 foreign consortia carrying out exploration activities and from the 7 blocks that

were being offered for exploration. Development of two of the exploration blocks may begin during 1991. Observers believe that Ecuador has good potential for finding oilfields beyond those already discovered, although probably of smaller and lower quality than Ecuador's currently producing oilfields.

¹Where necessary, values have been converted from Ecuadorian sucres (S/) to U.S. dollars at the rate of S/ 869.5=US\$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Ministry of Energy and Mines
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Edif. Rosanía, Ofic. 14

Quito, Ecuador

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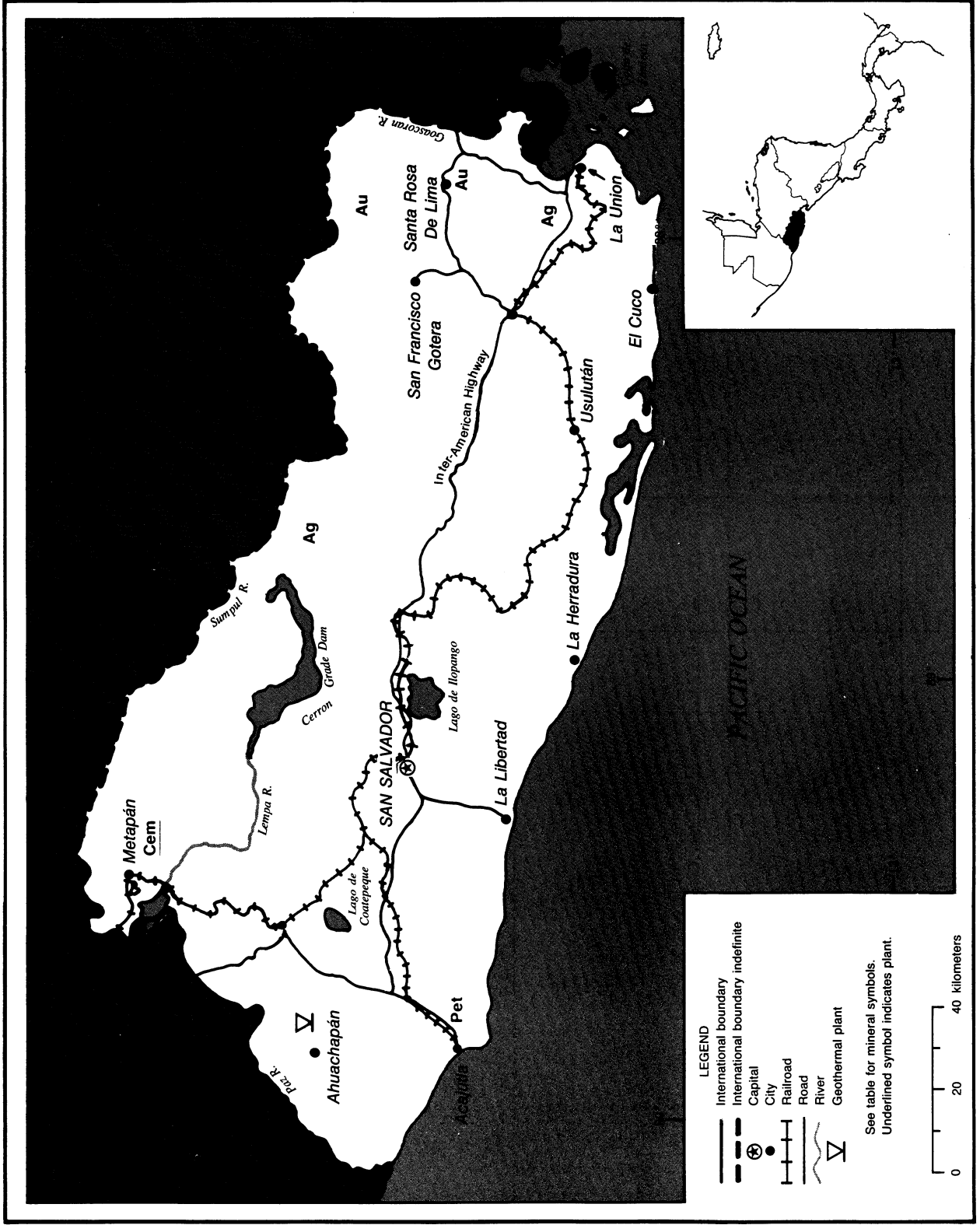
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EL SALVADOR

AREA 21,040 km²

POPULATION 5.1 million



EL SALVADOR

By Philip M. Mobbs

The mining industry of El Salvador continued to be constrained by armed insurgent groups determined to disrupt any economic activity, especially in rural areas. Overall, the mineral industry slumped. There were declines in both the mining and construction sectors during 1990. However, record agricultural production in 1990 helped El Salvador realize a 3.4% real GDP growth rate, compared with a 1.1% growth rate in 1989 and a 1.6% growth rate in 1988. The GDP was estimated to be \$5.35 billion¹ in 1990.

Limestone mined for domestic cement plants dominated the country's mineral extraction industry.

GOVERNMENT POLICIES AND PROGRAMS

The mineral industry fell under the Mining Code of 1922, as amended by the Complementary Mining Law, Decree 930 of 1953. Petroleum operations were subject to the Hydrocarbon Law, Decree 626 of March 1981.

The Ministry of the Economy absorbed the responsibilities of the disbanded Ministry of Foreign Trade. Legislative Decree No. 413 of December 8, 1989, reformed the Foreign Investment Promotion and Guarantee Law. Included under the new law were unrestricted remittance of new profits and unrestricted management of foreign investment. Firms were also allowed to open hard-currency accounts in El Salvador. Regulations for this statute were issued as Decree No. 1 of the Ministries of the President and of the Economy on January 9, 1990. Legislative Decree No. 460, dated March 15, 1990, repealed the Export Promotion Law (Decree 315 of March 1986) and enacted the Export Revival Law, which provided incentives to exporting operations. New maximum price levels were set by the Ministry of the Economy for petroleum products and locally produced portland gray cement.

PRODUCTION

Clay, gravel, gypsum, limestone, miscellaneous rock, marine salt, sand, and tuff production made up most of the country's mineral output for 1990.

STRUCTURE OF THE MINERAL INDUSTRY

Private operations dominated the mineral extraction industry. State-controlled monopolies of mineral-related activities included energy, railroads, and port services.

MINERAL COMMODITIES

Metals

The nation's metals industry included an aluminum works and electric-furnace steel plants.

Industrial Minerals

Clays and weathered tuffs were mined for domestic brick and tile manufacturers. The limestone deposits of the northwest supplied the raw material for Cemento de El Salvador S.A. and Cemento Maya S.A., both east of Metapán. Limestone was also used as feedstock for family-operated quicklime ovens. Construction projects used varied types of locally obtained crushed rock. A number of small operations, concentrated around the Golfo de Fonseca and Bahía de Jiquilisco, produced marine salt. Numerous operations along many of the country's rivers extracted sand and gravel.

Mineral Fuels

Wood remained the most important energy source in El Salvador owing to cultural preferences and its relatively low unit cost.

The country had 669 megawatts installed electrical generating capacity. Almost 60% of the installed capacity was attributed to the Cerrón Grande, the Guajoyo, the 5th of November, and the 15th of September hydroelectric power stations. The three-unit Ahuachapán geothermal plant near Los Ausoles accounted for 14% of the country's generating capacity. The third geothermal well at Chipilapa, northeast of the Ahuachapán field, was being drilled at yearend. Electricity was also generated by diesel and fuel oil plants and was occasionally imported from Guatemala.

Random sabotage of the country's energy distribution system was a favored tactic of the guerrillas. The resultant sporadic power failures affected the 50% of urban population and 20% of rural population that had electric service. Actual power availability was also affected by low river and reservoir levels.

The National Assembly privatized petroleum imports. Formerly, the state-run electric company, Comisión Ejecutiva Hidroeléctrica del Río Lempa (CEL), imported oil from Mexico and Venezuela under the San José Accord and resold it to the Refinería Petrolera Acajutla S.A. in Acajutla.

INFRASTRUCTURE

El Salvador's 10,000-km road network transported 82% of the country's goods and people. The network included 1,500 km paved road, primarily the Inter-American Highway, the Coastal Highway, and connecting feeder roads. Road and rail facilities connected the two major ports, Acajutla on the Pacific and the La Unión and Cutuco complex off the Golfo de Fonseca. The railroad system consisted of 602 km of 0.914 gauge single track.

The Inter-American Development Bank approved a \$44 million loan to help finance the rehabilitation of 400 km of rural roads in the southern and coastal areas. The pro-

TABLE 1
EL SALVADOR: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e
Aluminum metal, including alloys, semimanufactures	1,295	1,526	1,681	1,795	³ 2,040
Cement	442,625	606,462	623,224	632,651	³ 640,943
Fertilizer materials:					
Phosphatic	2,935	3,450	11,702	11,702	³ 7,998
Other mixed chemical	1,350	1,560	43,794	45,484	³ 53,430
Gypsum ^e	4,000	4,500	4,500	4,500	4,500
Iron and steel, metal:					
Steel, crude	9,263	13,106	11,269	11,700	12,000
Semimanufactures	35,460	32,654	32,934	37,804	³ 37,847
Limestone	^e 900,000	1,450,000	1,450,000	1,600,000	³ 1,700,000
Petroleum refinery products thousand 42-gallon barrels	⁴ 4,800	⁴ 4,800	5,113	5,000	³ 4,856
Salt, marine	2,950	3,100	3,200	5,000	³ 8,000

^eEstimated. ^pPreliminary.

¹Table includes data available through June 28, 1991.

²In addition to commodities listed, gold and silver were presumably produced during the first part of the period covered by this table. Clays, gravel, miscellaneous rock, sand, and weathered tuffs were mined as construction material. Available information is inadequate to make reliable estimates of output levels of these commodities.

³Reported figure.

TABLE 2
EL SALVADOR: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Cemento de El Salvador S.A.	El Ronco, near Metapán, Santa Ana Department	684
Do.	Cemento Maya S.A. de C.V.	Cantón Tecomapa, Metapán, Santa Ana Department	240
Petroleum products thousand 42-gallon barrels	Refinería Petrolera Acajutla, S.A.	Acajutla, Sonsonate Department	5,868
Steel, crude	Siderúrgica Centroamericana del Pacífico S.A.	Carretera del Litoral, Sonsonate Department	100

gram will expedite the movement of salt and agricultural products to market. Work on the sparse northern grid was delayed because of prior difficulties attributed to the insurgent operations.

OUTLOOK

Volcanic rocks cover about 80% of the country. There is the potential for exploitation of the volcanic material, especially pumice deposits. Increased use of volcanic ash for pozzolan cement appears possible.

However, significant expansion of mineral operations in El Salvador is not expected in 1991. The ending of hostilities would brighten mining development prospects.

The Salvadoran Legislative Assembly is studying the new mining law drafted in 1989. Approval of the proposed code would modernize the current law and provide incentives for foreign investment in the mining sector.

CEL projected an expansion of its generating capacity with additional geothermal generating units. Two bagasse-burning plants were proposed for construction in the early

1990's. Hydroelectric power expansion was slated for the later part of the decade.

¹Where necessary, values have been converted from Colones (¢) to U.S. dollars at the rate of ¢8.0 = US\$1.00.

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Ministerio de Economía
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San Salvador, El Salvador, C.A.

Comisión Ejecutiva Hidroeléctrica del Río
Lempa
9a Calle Poniente No. 950
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FRENCH GUIANA

AREA 90,909 km²

POPULATION 94,700



FRENCH GUIANA

By Philip M. Mobbs

French Guiana, an overseas department of France, was almost totally supported by the French Government. Funding of the Kourou Space Centre and direct Government payments made up a majority of the Gross Departmental Product. The mineral industry formed a very small part of the Department's economy in 1990. Important French Guiana industries were construction, fresh shrimp, space, sugar cane, timber, and a fledgling tourist industry. The Department's space industry enhanced the remote sensing segment of the global mineral industry with the January launch of SPOT-2, a commercial French observation satellite.

GOVERNMENT POLICIES AND PROGRAMS

French Guiana fell under the mining laws of France. Foreign investment has not been discouraged since 1950, 3 years after the closing of the prison colony, which included Ile du Diable (Devil's Island).

PRODUCTION

Mineral production consisted primarily of columbite and tantalite, gold, gravel, sand, and stone. Columbite and tantalite were produced from alluvial deposits and

gold had been mined at a number of placer sites in the interior since 1853. Sand and gravel was procured from sites along the major rivers and the coastline. Stone was quarried to the southeast of Kourou.

TRADE

France dominated French Guiana trade, accounting for over 65% of imports and 50% of exports in 1989, the last year for which data is available. The United States received 12.9% of the Department's exports and shipped in almost 5% of its imports during 1989.

TABLE 1

FRENCH GUIANA: PRODUCTION OF MINERAL COMMODITIES¹

Commodity	1986	1987	1988	1989 ^a	1990 ^b
Columbite and tantalite kilograms	700	—	566	*600	600
Gold, mine output, Au content do.	326	514	522	*550	550
Stone, sand and gravel ^c thousand metric tons	400	400	400	400	400

^aEstimated. ^bPreliminary.

¹Includes data available through Apr. 2, 1990.

Stone, sand, and gravel were produced for the local construction industry. In 1988, all of the produced columbite and tantalite was exported to the United States and most of the produced gold was exported to France.

STRUCTURE OF THE MINERAL INDUSTRY

Specific ownership information is unavailable. The existing industrial mineral companies are small and locally owned. Placer gold mining is principally done by small independent operators, some financed by foreign investors.

INFRASTRUCTURE

Mineral production was transported down the Department's inland waterway system or along the 700 kilometer road system. Cayenne, the capital, was the sole ocean port.

OUTLOOK

The interest in gold mining should continue to grow. Stone and sand and gravel should continue to be produced at present levels. Production of the bauxite deposits in the Kaw region is not expected to be

economically feasible in the foreseeable future.

OTHER SOURCES OF INFORMATION

Agencies

Bureau de Recherches Géologiques et
Minieres
B.P. 42
Cayenne, French Guiana
Institut National de la statistique et des
études économiques
Service Régional de la Guyane
1 rue Maillard de la Guyane
B.P. 6017
97306 Cayenne Cédex
French Guiana

TABLE 2
FRENCH GUIANA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
Aluminum: Metal including alloys, scrap	—	11	11	
Clays, crude: Kaolin	91	—		
Copper: Metal including alloys, scrap	18	15	—	All to France.
Gold: Metal including alloys, unwrought and partly wrought kilograms	268	217	—	France 181; Martinique 20; Guadeloupe 9.
Iron and steel: Metal: Semimanufactures:				
Tubes, pipes, fittings	1	25	—	All to France.
Petroleum refinery products: Liquefied petroleum gas 42-gallon barrels	35	12	NA	NA.
Precious and semiprecious stones other than diamond, natural value, thousands	—	\$1	—	All to France.
Stone, sand and gravel: Gravel and crushed rock	4	—		
Titanium: Ore and concentrate value, thousands	—	\$10	—	All to France.
Other metals: Ores and concentrates	—	1	—	All to Belgium-Luxembourg.

NA Not available.

¹Table prepared by H. D. Willis.

TABLE 3
FRENCH GUIANA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS				
Alkali metals	—	5	1	France 4.
Aluminum: Metal including alloys:				
Scrap	—	8	—	All from Italy.
Semimanufactures	114	129	1	France 70; Italy 31; Switzerland 23.
Chromium:				
Ore and concentrate value, thousands	—	\$3	—	All from France.
Oxides and hydroxides	1	2	—	France 1; West Germany 1.
Cobalt: Metal including alloys, scrap value, thousands	\$3	—		
Copper: Metal including alloys:				
Unwrought do.	\$2	—		
Semimanufactures	80	123	—	France 109; Austria 5; Yugoslavia 4.
Gold: Metal including alloys, unwrought and partly wrought kilograms	3	28	—	All from France.
Iron and steel: Metal:				
Pig iron, cast iron, related materials	1	21	—	Do.
Ferroalloys: Ferrosilicon value, thousands	—	\$2	—	Do.
Semimanufactures:				
Flat rolled products:				
Of iron or non-alloy steel:				
Not clad, plated, coated	563	395	—	France 197; Belgium-Luxembourg 129; Spain 69.
Clad, plated, coated	2,695	3,125	—	France 2,940; Martinique 76; Finland 47.
Of alloy steel	75	314	—	France 309; Austria 5.

See footnotes at end of table.

TABLE 3—Continued

FRENCH GUIANA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS—Continued				
Bars, rods, angles, shapes, sections	5,689	7,674	—	France 4,299; East Germany 1,123; Italy 291.
Rails and accessories	92	1,353	—	All from France.
Wire	122	175	—	France 109; Belgium-Luxembourg 59; Brazil 2.
Tubes, pipes, fittings	1,307	2,002	1	France 829; Denmark 389; Spain 250.
Lead:				
Oxides value, thousands	\$1	\$1	—	All from France.
Metal including alloys:				
Unwrought	1	—		
Semimanufactures	(²)	—		
Mercury value, thousands	\$18	\$7	—	France \$6; Brazil \$1.
Platinum-group metals: Platinum metal including alloys, unwrought and partly wrought value, thousands				
	\$5	—		
Tin: Metal including alloys, semimanufactures do.	\$67	\$1	—	All from France.
Titanium: Oxides do.	\$2	—		
Zinc: Metal including alloys:				
Unwrought	—	1	—	All from France.
Semimanufactures	—	1	—	Do.
Other: Ashes and residues				
	15	—		
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	—	20	—	All from France.
Grinding and polishing wheels and stones	10	12	—	France 7; Italy 3; Netherlands 1.
Cement	69,498	96,896	—	France 63,900; Belgium-Luxembourg 15,191; Martinique 4,890.
Clays, crude:				
Bentonite	—	52	—	All from France.
Kaolin	—	1	—	Do.
Unspecified	(²)	213	—	Do.
Diamond: Gem, not set or strung value, thousands				
	\$12	\$3	—	Do.
Diatomite and other infusorial earth	7	6	—	Do.
Fertilizer materials:				
Crude, n.e.s.				
	—	54	—	France 53; West Germany 1.
Manufactured:				
Ammonia	14	7	—	All from France.
Nitrogenous	884	759	—	Netherlands 532; France 227.
Phosphatic	459	123	—	All from France.
Potassic	31	14	—	Do.
Unspecified and mixed	788	1,064	—	France 958; Netherlands 100; Switzerland 3.
Gypsum and plaster	11	21	—	All from France.
Lime	179	233	18	France 193; Martinique 22.
Magnesium compounds: Magnesite, crude	3	—		
Pigments, mineral: Iron oxides and hydroxides, processed	4	6	—	France 3; West Germany 3.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	\$45	\$21	—	Brazil \$11; France \$5; Madagascar \$4.

See footnotes at end of table.

TABLE 3—Continued

FRENCH GUIANA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Precious and semiprecious stones other than diamond—Continued				
Synthetic value, thousands	\$2	—		
Pyrite, unroasted	2	—		
Salt and brine	513	444	9	West Germany 269; France 141; Guadeloupe 13.
Sodium compounds, n.e.s.: Soda ash, natural and manufactured	—	2	—	All from France.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	40	—		
Worked	127	114	(²)	France 61; Brazil 32; Italy 20.
Dolomite, chiefly refractory-grade	53	195	—	All from France.
Gravel and crushed rock	—	9	—	Do.
Quartz and quartzite	1	—		
Sand other than metal-bearing	214	306	—	France 300; Italy 5; West Germany 1.
Sulfur:				
Elemental:				
Crude including native and byproduct value, thousands	\$2	\$1	—	All from France.
Colloidal, precipitated, sublimed	1	1	—	Do.
Sulfuric acid	34	24	—	France 12; Guadeloupe 9; West Germany 3.
Other:				
Crude	61	107	—	France 77; West Germany 21; Italy 9.
Slag and dross, not metal-bearing	217	5	—	All from France.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,339	1,888	—	Trinidad and Tobago 1,887; France 1.
Carbon black	—	1	—	All from France.
Peat including briquets and litter	20	6	—	Do.
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	16,750	28,107	12	Netherlands Antilles 12,632; Trinidad and Tobago 10,370; Venezuela 4,965.
Mineral jelly and wax do.		8	8	All from France.
Bitumen and other residues do.	12,102	5,654	—	All from Trinidad and Tobago.
Bituminous mixtures do.	67	42	—	All from France.

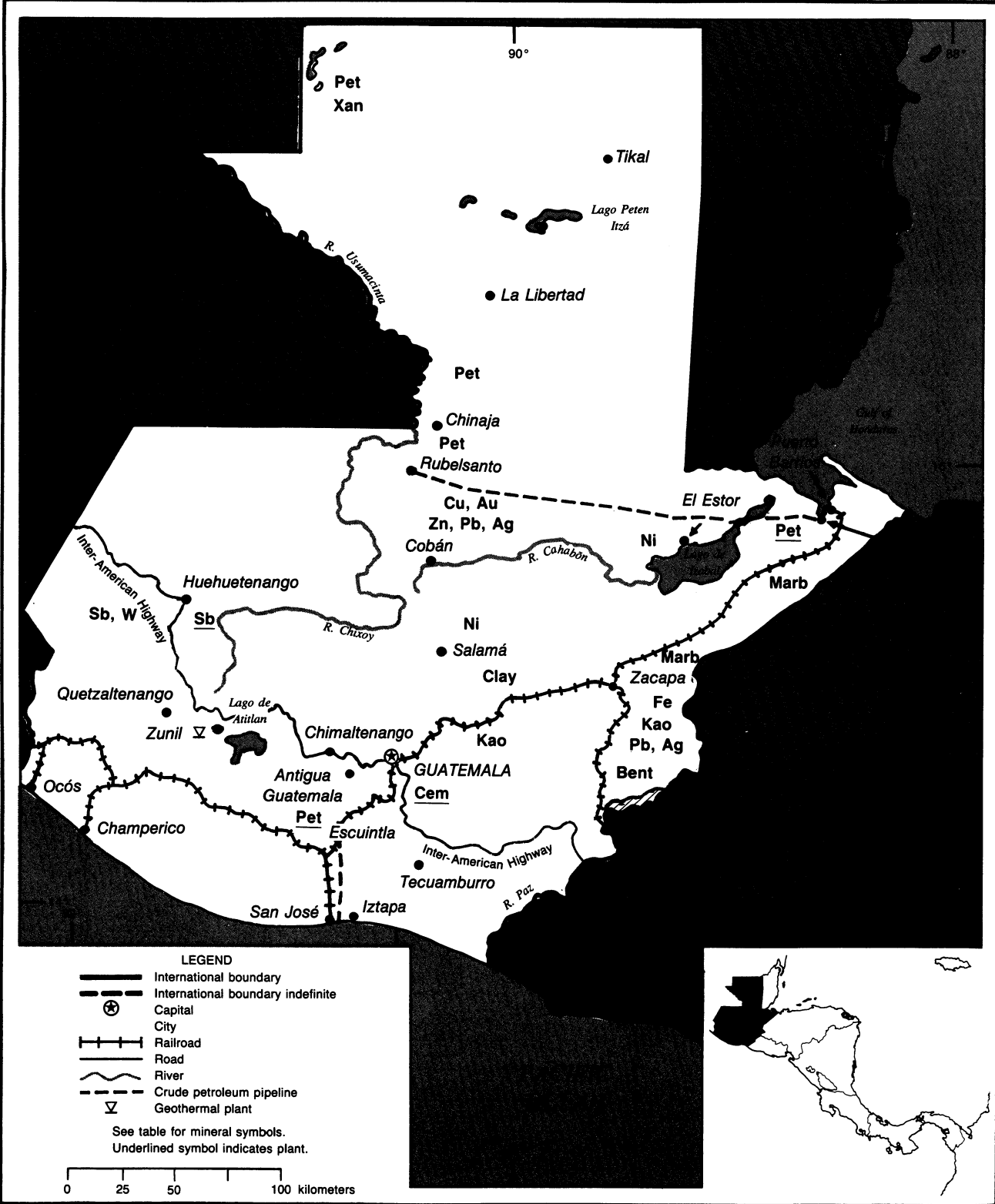
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GUATEMALA

AREA 108,900 km²

POPULATION 9.1 million



GUATEMALA

By Philip M. Mobbs

Guatemalan mineral-related output grew at a 3.2% rate in 1990. However, Guatemala's 61% annual inflation adversely impacted both the economy and the mineral industry. The Government proposed to stimulate economic growth through increased foreign investment and privatization of state-owned companies. Gross domestic product (GDP) for 1990 was estimated to be \$7.5 billion¹ in current U.S. dollars, a 3.5% increase in real terms.

Antimony, gypsum, marble, and pumice were the nation's most important minerals in terms of export value. In 1989, these four commodities accounted for 74% of the \$5.2 million of mineral exports. The country's total exports reached \$1,108 million for 1989.

The country's most significant mineral deposit, the lateritic nickel near El Estor, was worked from 1977 until 1980, when unfavorable economic conditions resulted in the termination of operations.

GOVERNMENT POLICIES AND PROGRAMS

The controlling legislation for mining was Decree Law 69-85 of July 12, 1985. Small-scale mining came under Decree Law 55-90 of December 3, 1990. Petroleum activity was covered by the Hydrocarbon Law, Decree Law 109-83, and associated regulations, especially Government Edicts 1034-83 and 203-84.

PRODUCTION

Guatemala's metal output consisted of small amounts of antimony, gold, iron ore, and lead. Various industrial minerals formed the bulk of the country's production. These were primarily for domestic use. Guatemala was Central America's only crude oil producer. Oil production did not change significantly in 1990.

TRADE

Preliminary data indicated that the United States remained the primary destination for 40% of the \$1.163 billion Guatemalan export market in 1990, up from a 35% share in 1989. Petroleum exports to the United States increased to 1,295,000 42-gallon barrels, up from 655,000 barrels in 1989. Compared with prior years, exports to Jamaica, Japan, Nicaragua, Panama, and the United Kingdom increased significantly during 1990.

Agricultural products dominated the Guatemalan economy, accounting for more than 60% of exports, 60% of employment, and about 25% of the GDP. Mineral production contributed less than 1% of the GDP.

The United States supplied 40% of the \$1.661 billion Guatemalan imports, followed by Venezuela and Mexico. The Latin America region was responsible for providing 29% of Guatemalan imports.

STRUCTURE OF THE MINERAL INDUSTRY

The mineral industry, like the overall economy, was dominated by the private sector. The Government's involvement in the mineral sector was limited to promotion of the industry, regulation, and numerous mineral research projects.

Within the Ministerio de Energía y Minas, the Dirección General de Minería was responsible for administering laws and regulations affecting the metallic, industrial, and radioactive mineral sectors. Petroleum laws were managed by the Dirección General de Hidrocarburos. The Comisión Nacional de Protección del Medio Ambiente was responsible for environmental regulations.

COMMODITY REVIEW

Metals

The Government pursued several projects with funding from the United Na-

tions Revolving Fund for Natural Resources. The area covered under the Trinational Development Plan (Trifino) consisted of 3,392 km² in Guatemala and 4,192 km² in El Salvador and Honduras. Field crews examined 78 mineral deposits in Guatemala for the national nonrenewable natural resources inventory being undertaken as part of the Trifino Plan.

Additional work was recommended for the El Pato-El Poxté project in Chiquimula Department. Trenching revealed massive sulfides (pyrite and arsenopyrite) with traces of gold and silver. A second drilling program was begun in November. Additional work was also proposed for the Quebradas alluvial gold project in Izabal Department. A pilot plant was installed late in the year.

After a geologic evaluation and review of geophysical data, it was recommended not to continue exploratory work on the Managua project. This base metal study covered a 35 km² area near the Honduran border in Zacapa Department about 60 km southwest of the Quebradas project.

Four shallow holes were cored near Esquipulas as part of the Radioactive Mineral Exploration Project. An additional 1,180 km in the southeast of the country was traversed and examined for radioactive anomalies.

Guatemala was the third largest producer of antimony in Latin America after Bolivia and Mexico. Both antimony ore and concentrate were produced from the Anabella, Los Liros, and Clavito mines at Ixtahuacán, near the western border. Output was exported mainly to France, Japan, and the United States.

Industrial Minerals

Cement, ceramics, construction, and glass industries were the country's leading users of industrial minerals. Cement, clays, feldspar, gypsum, lime, and sand and gravel were primarily produced for the local market.

TABLE 1
GUATEMALA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^a	1990 ^a
METALS					
Antimony, mine output, Sb content	1,530	¹ 1,758	1,335	1,348	1,050
Gold kilograms	—	—	—	48	² 62
Iron and steel:					
Iron ore, gross weight	7,186	¹ 10,724	8,092	6,541	² 6,370
Steel, crude	¹ 16,800	² 20,700	² 22,400	22,460	22,000
Steel, semimanufactures	¹ 19,000	⁴ 43,422	⁵ 50,400	49,401	45,000
Lead metal including secondary	⁸ 80	¹ 100	⁷ 70	149	² 109
INDUSTRIAL MINERALS					
Barite	750	¹ 1,202	⁵ 5,064	3,995	² 421
Cement thousand tons	¹ 1,117	1,324	1,506	1,613	1,675
Clay:					
Bentonite	3,836	² 24,782	⁹ 73	8,236	5,000
Kaolin	² 2,377	1,880	3,459	2,573	² 2,050
Unspecified	636	¹ 1,468	3,667	3,200	² 1,260
Feldspar	5,446	7,669	⁸ 9,959	7,000	² 11,895
Gypsum	30,608	51,495	34,448	57,268	² 65,560
Lime	36,798	79,418	71,306	79,359	75,000
Pumice and related materials:					
Pumice cubic meters	¹ 18,307	² 24,305	² 22,843	100	5,000
Volcanic ash ³ do.	1,789	2,446	2,500	2,400	2,400
Volcanic sand	50,862	73,435	75,000	137,000	² 110,125
Volcanic scoria cubic meters	—	—	—	—	² 2,275
Volcanic tufa	—	—	—	596	² 610
Salt	³ 9,400	37,088	42,184	63,063	² 108,720
Stone, sand, and gravel:					
Dolomite	6,876	⁸ 8,824	³ 9,909	10,947	² 14,900
Limestone thousand tons	¹ 1,060	¹ 1,180	¹ 1,247	1,460	² 1,415
Marble:					
Block	3,583	3,578	6,725	17,821	² 16,839
Chips and fragments	6,610	8,709	7,808	9,389	⁸ 8,260
Sand and gravel thousand tons	⁶ 631	⁹ 957	⁹ 952	865	² 1,088
Schist	185,584	223,500	254,940	292,000	² 260,000
Silica sand	22,859	30,665	³ 32,665	31,000	30,000
Stone, crushed thousand tons	895	1,014	1,236	1,414	1,300
Talc	—	¹ 1,114	616	650	² 545
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural, gross thousand cubic meters	³ 1,150	¹ 16,990	⁶ 16,990	⁹ 2,282	10,000
Petroleum:					
Crude thousand 42-gallon barrels	1,802	1,327	1,248	1,328	1,400
Refinery products do.	3,819	4,480	4,504	4,249	4,000

^aEstimated. ^pPreliminary. ^rRevised.

¹Table includes data available through July 1, 1991.

²Reported figure.

³Previously erroneously reported as metric tons.

Mineral Fuels

Fuel wood, used predominantly for residential purposes, provided 62% of

Guatemala's energy consumption. Other vegetation byproducts, such as bagasse and charcoal, were used to produce 4% of the country's energy. Electrical power accounted

for 4% of the nation's energy usage. The country had an installed generating capacity of 729 megawatts. Hydroelectric facilities accounted for 60% of this capacity. The re-

TABLE 2

GUATEMALA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990.

(Thousand metric tons unless otherwise specified)

Commodity	Major operating company	Location of main facilities	Annual capacity	
Antimony	Minas de Guatemala S.A.	Los Liros and Anabella Mines, Ixtahuacan, Huehuetenango Dept.	1	
Cement	Cementos Progreso S.A.	San Miguel Plant, Sanarate, El Progreso Dept. and La Pedrera Plant, Guatemala City	1,000	
Petroleum: Crude thousand 42-gallon barrels	Basic Resources International S.A. and Repsol Exploración S.A.	Rubelsanto, West Chinaja, fields, Alta Verapaz Dept. Caribe, Tierra Blanca, and Xan fields, Petén Dept.	2,000	
Products	do.	Texas Petroleum Co.	Refinery at Escuintla, Escuintla Department	6,120
Do.	do.	Basic	Refinery near Santa Elena, El Naranjo, Petén Department ¹	720

¹Under construction.

maining 30% of the nation's energy was supplied by petroleum products.

Crude oil production in Guatemala reached 1.4 million barrels. 1.3 million barrels were exported through the port of Santo Tomás de Castilla on the Caribbean Sea.

Basic Resources International S.A., a Bahamian company, successfully completed the Xan II well in January. During 1990, Basic also began construction of a 2,000-barrel-per-day refinery. This refinery, 35 km from Santa Elena, in the El Naranjo region of the Department of Petén, was designed to process crude oil produced from the Xan field.

Petén Petroleum Co. drilled 2 wells at Yalpemech during the year. These were on its Contract 1-88 property due east of the West Chinaja field in Alta Verapaz Department. Petén's operations were reportedly suspended by Order 240-90 of the Ministerio de Energía y Minas.

In November, Shell Exploration B.V. signed a 25-year contract with the Ministerio de Energía y Minas to explore the Amatique Basin. The exploration area covered 300,000 hectares in Izabal Department, extending into the Bahía de Amatique.

INFRASTRUCTURE

There were 870 km of narrow-gauge (0.914 meter) railroad in southern Guatemala, of which almost 90% was state-maintained. The country's 26,400-km road network was also concentrated in the southern part of the country. Insurgent forces continued their

campaign of infrastructure sabotage. Three major bridges were destroyed during the year, adversely affecting the country's transportation network.

A 12,000-barrel-per-day capacity crude oil pipeline ran from the Rubelsanto Field to Santo Tomás de Castilla, a distance of 235 kilometers. Pipeline throughput was occasionally disrupted by guerrilla activity during the year. A 48-km pipeline ran between San José and the Texaco refinery at Escuintla.

Puerto Barrios on the Caribbean side of the country was the country's major port. Santo Tomás de Castilla, 5 km southwest of Puerto Barrios also handled mineral exports, primarily petroleum. San José and the adjacent Puerto Quetzal were the country's major ports on the Pacific coast. The country also had 260 km of inland waterways available for year-round traffic.

OUTLOOK

Mining activity should continue to grow. Industrial mineral production may increase slightly if the construction industry persuades the Government to lower interest rates for new construction using funds generated by the 20% tax on housing construction. Physical security problems and lack of infrastructure in the north part of the country are expected to continue to plague petroleum exploration and production.

¹Where necessary, values have been converted from Guatemalan Quetzals (Q) to U.S. dollars, at the rate of 4.50Q = US\$1.00.

OTHER SOURCES OF INFORMATION

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Ministerio de Energía y Minas
Diagonal 17, entre 20 y 30 Calles, Zona 11
Guatemala City, Guatemala
Dirección General de Minería
Diagonal 17, 29-78, Zona 11
Guatemala City, Guatemala
Dirección General de Hidrocarburos
Diagonal 17, 29-78, Zona 11
Guatemala City, Guatemala

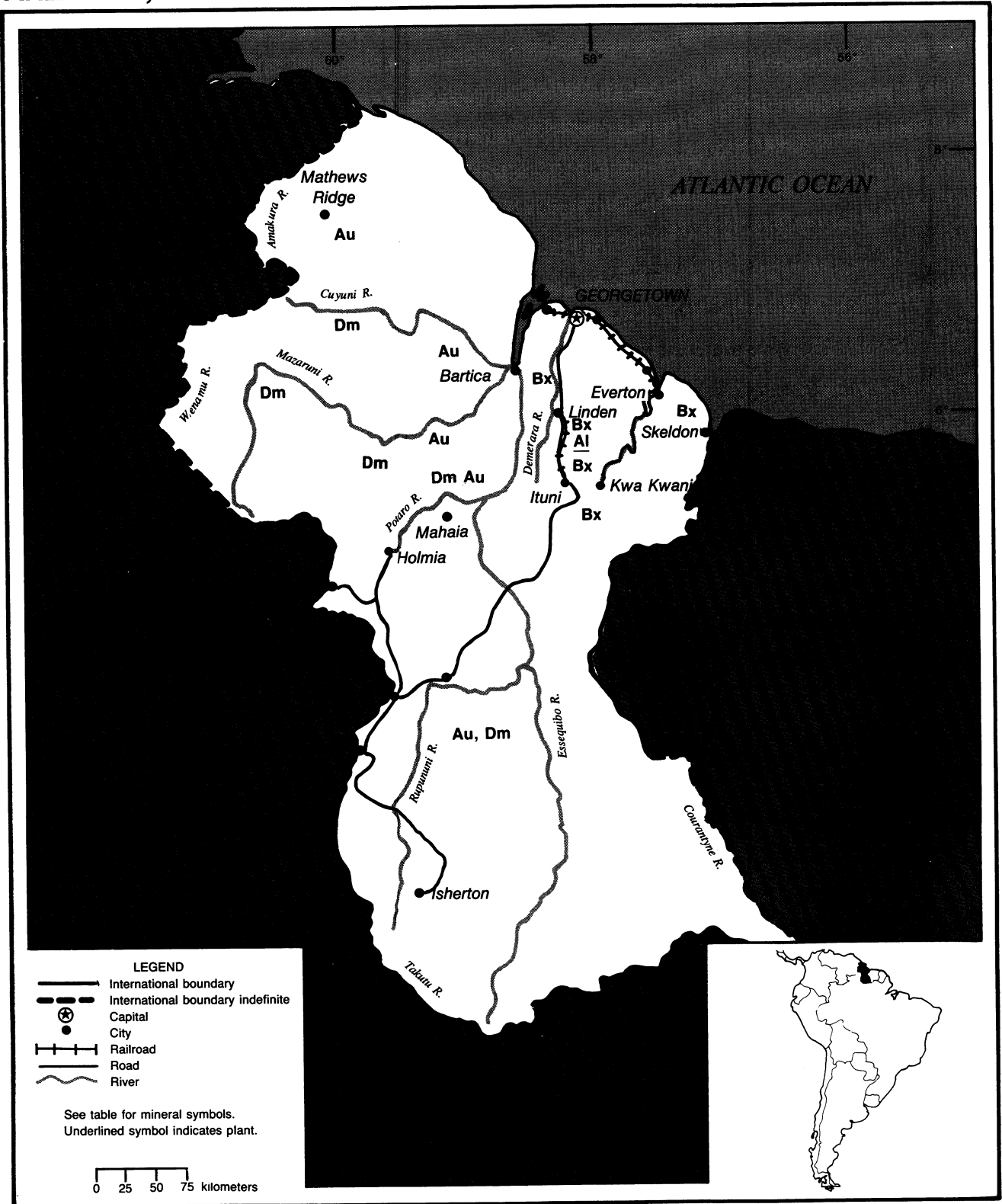
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GUYANA

AREA 214,970 km²

POPULATION 765,500



GUYANA

By Philip M. Mobbs

Guyana ranked 12th in the world in the bauxite production, yielding slightly more than 1% of the world's bauxite output. Within Latin America, the country was the fourth largest bauxite producer. Guyana was the second most important source of refractory grade calcined bauxite for the United States.

Diamonds and gold have been recovered from placer deposits in Guyana for more than 100 years. International companies' recent interest in the country generated a minor gold rush. The intensive exploration activity was expected to result in significantly enlarged gold production.

The Cooperative Republic of Guyana's economy was greatly changed by the Government's Economic Recovery Program. Intended to develop appropriate macroeconomic policies to correct prior social engineering projects, the program made structural adjustments deemed necessary to achieve initial financial stabilization and subsequent sustained economic growth. The mining industry's import duty and consumption tax exemptions were to be eliminated as part of the program.

The economy failed to make the expected rebound in response to the structural adjustments. Instead, real GDP posted a 3.5% negative growth rate in 1990. This was, however, slightly less negative than the 1988 and 1989 real GDP growth figures. The continued decline was attributed to the lower-than-expected production in the key export industries of bauxite and sugar.

The mineral industry accounted for almost 40% of the country's exports. The 1990 GDP was estimated to be \$250 million.¹

GOVERNMENT POLICIES AND PROGRAMS

By June of 1990, the Government had refinanced its estimated \$229 million International Monetary Fund, World Bank, and Caribbean Development Bank arrears with aid from a support group lead by

Canada and a bridge loan from the Bank of International Settlements. Guyana then became eligible for new loans from the international financial institutions for the first time since 1985.

The Guyanese Government formally encouraged foreign investment. While joint ventures were preferred, 100% foreign ownership of Guyanese firms was allowed. The Government continued to pave the way for privatization of state companies. During October, the National Assembly established an autonomous Public Utilities Commission to oversee public utility services and serve as a rate-setting body.

Mining was to be allowed on about 40,500 hectares of the 364,500 hectares in central Guyana set aside for the Project on Sustainable Tropical Forestry. The 6-year \$50 million study was to evaluate the effects of commercial activity in the rain forest.

PRODUCTION

Bauxite production increased slightly after a 2-year decline, aided by the startup of the Aroaima Mine and a full year's production at C.A. Dayco's Dacoura Mine.

Declared gold production increased significantly. The amount declared (sold to the Gold Board) was estimated to be 5% to 20% of the total gold mined. Most miners had smuggled their gold into Brazil or Venezuela and sold it for U.S. dollars, which they traded illegally for Guyana dollars at the higher exchange rates available at foreign exchange houses. During March 1990, the Gold Board began paying miners on a scale based on the exchange house rate rather than the official rate, thus reducing the attractiveness of smuggling. New mechanized dredges also contributed to the increase in production.

TRADE

Guyana's major export commodities were bauxite, gold, and sugar. Sugar was

the country's premier official net hard currency generator in 1989, owing to the Bauxite Industry's more expensive import requirements. Approximately one-third of the value of official Guyanese imports was petroleum from Venezuela.

The country's parallel economy was about as large as the official economy. It consisted primarily of consumer goods shipped in from expatriates or funded by illegal gold sales. Little of the revenue generated from gold extraction entered the official economy.

Total imports of \$246 million were not offset by total exports, which, in 1990, declined 17% to \$190 million. The U.S. accounted for approximately 30% of Guyana's imports, primarily machinery, motor vehicles, steel goods, and wheat. The U.S. also garnered almost 30% of Guyana's exports, especially bauxite, gold, shrimp, and sugar. Europe was the destination of more than 50% of Guyanese refractory bauxite.

STRUCTURE OF THE MINERAL INDUSTRY

All mineral rights were vested in the state. Mineral policy was established by the President and the chief executives of the Guyana Geology and Mines Commission and the Natural Resources Agency. Mineral concessions were negotiated with government agencies such as the Bauxite Industry Development Company Limited (BIDCO) (bauxite), the Guyana Geology and Mines Commission (gold and diamonds), and the Guyana Natural Resources Agency (oil).

The entire bauxite industry was overseen by BIDCO. Bauxite mining and processing were done by the BIDCO subsidiary, Guyana Mining Enterprise Ltd. (Guymine) or under contract to Guymine. Several foreign companies were actively involved in the bauxite industry, including subsidiaries of Alcan Aluminum Ltd. (Alcan) of Canada and C.A. Dayco of Venezuela and the U.S. firms Reynolds International and Green Construction Inc.

TABLE 1

GUYANA: PRODUCTION OF MINERAL COMMODITIES¹

Commodity ²	1986	1987	1988	1989 ^p	1990 ^e
Aluminum: Bauxite, dry equivalent, gross weight thousand metric tons	1,466	2,200	1,339	1,321	³ 1,424
Diamond carats	9,147	7,420	4,242	7,842	8,000
Gold, mine output, Au content ^e kilograms	³ 437	1,568	2,330	3,200	3,500
Stone, crushed tons	—	^e 23,800	34,528	37,820	42,000

^eEstimated. ^pPreliminary.

¹Includes data available through June 28, 1991.

²In addition to the commodities listed, a variety of crude construction materials (common clays, gravel, and sand) were also produced. Available information was inadequate to make estimates of production.

³Reported figure.

TABLE 2

GUYANA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

Commodity	Major operating companies	Location of main facilities	Annual capacity (thousand tons per year)
Bauxite	Guyana Mining Enterprise Ltd. (Guymine)	West Demerara District: Kara Kara, North Dorabece, and East Montgomery Mines, Mackenzie, Linden Processing plant at Linden Alumina refinery at Linden ¹ East Berbice District: Kwakwani (3 mines) Processing plant at Everton	3,500 900 300 1,500 700
Do.	C.A. Dayco	Kwakwani (1 mine)	NA
Do.	Green Mining, Inc.	Dacoura Mine, Linden	NA
Do.	Aroaima Mining Co.	Aroaima, East Berbice District	1,600
Silica sand	Minerals and Technology Ltd.	Sand Hills, Demerara River West Demerara District	300
Gravel	Independent operator	Quarry at St. Mary's, Mazaruni-Potaro District	200

NA Not Available.

¹Refinery closed since 1982.

The domestic private sector dominated the mining of gold and diamonds during 1990. The Guyana Gold Board was the sole official buyer of unprocessed gold. Large-scale gold exploration projects were funded by international companies. Local subsidiaries of private foreign firms carried out petroleum exploration, both offshore and onshore.

COMMODITY REVIEW

Metals

Bauxite.—Bauxite production disappointed most observers. Production came in 15% below target in 1990, and export revenues were 22% less than the original forecast.

A bauxite transshipment station was opened in 1989 near Georgetown on the

Demerara River. With the station and a new channel dredged through the Demerara Bar, Guymine could ship bauxite directly from Guyana instead of barging it to Trinidad for transshipment.

Barbados-based Aroaima Bauxite Co. and Aroaima Mining Co., joint ventures set up by Guymine and Reynolds, opened a mine near Aroaima during the year. The mine, near the Kwakwani operations of Guymine, began shipping bauxite down the Berbice River prior to yearend. Output was destined for the Vialco refinery in the Virgin Islands and to the U.S. Gulf Coast, via New Amsterdam and Georgetown.

The Government of Guyana and Alcan agreed to study the rehabilitation of the Linden bauxite mines. The Linden operations had been run by an Alcan subsidiary until 1971.

BIDCO and Interalumina of Venezuela resolved some of the problems related to the failure of Guyana to make contracted bauxite shipments to Venezuela.

Gold.—Most gold and diamond mining involved river dredging. The mechanized suction dredge, recently introduced on the Mazaruni River, escalated environmental damage. Dredges moved far inland from the original river banks, resulting in increased suspended mud and silt. The river was reportedly unfit for drinking as far as 60 km downstream from each operation. Additionally, the river had provided fishing grounds for the local population, and it was the main transportation route through the area. Sand bars derived from dredging operations allegedly blocked many adjoining waterways, severely degrading access to the area.

TABLE 3

GUYANA: OFFICIAL SALES TO THE GUYANA GOLD BOARD

		1986	1987	1988	1989	1990
Declared gold	kilograms	437	666	584	539	1,213

In addition to the placer workings, there were several major gold projects underway.

The Canadian firms Cambior and Golden Star Resources submitted a feasibility study and an environmental impact statement for the Omai gold project during December 1990. Cambior bought into 60% of the project when Placer Dome pulled out in May 1990.

Denison Mines Ltd. and South American Goldfields Inc. began exploratory drilling on their joint-venture Quartz Hill prospect, a few kilometers north of the Omai deposit. The partners also announced a high-grade discovery at their Aurora gold property and continued to evaluate the West Kaburi and Five Star prospects.

Golden Star explored a placer deposit near Mahdia. Former joint-venture partner Giant Resources Ltd. of Australia left the project in December 1989. Golden Star evaluated the Arakaka and Baramita prospects in the Northwest Region near Mathews Ridge and the Million Mount prospect in the Puruni River area.

The Brazilian firm, Paranapanema S.A. Mineração, Indústria e Construção, continued to evaluate its gold project at Tassawini during the first part of the year.

South American Goldfields agreed to purchase Guyanese joint-venture interests and property from partner Homestake International Minerals Ltd. There was exploratory drilling at Akaiwong during 1990. Additional work at Akaiwong, Peter's Mine, and Dazier Creek was proposed for 1991.

Industrial Minerals.

Clay.—Production from the country's extensive kaolin beds was limited to small-scale mining to supply a factory which produced earthenware products for the domestic market.

Diamonds.—Guyana's declared production has been less than 10,000 carats/a since 1985. Output was traditionally 60% industrial quality and 40% gem-quality stones. Production was from numerous small operations using suction dredges especially along the Mazaruni and Potaro

Rivers in western Guyana. South American Goldfields procured funding from Ivanhoe Capital Corporation for the right to acquire a 65% interest in Golden Star's four diamond prospects in the Mazaruni region. Golden Star's 1990 exploration program included over 500 drill holes and numerous test pits. Grades of 0.39 carats/m² were recorded for the test pits.

Feldspar.—A small feldspar operation was located near Bartica.

Gravel.—The country's three main aggregate quarries were being rehabilitated with funding from the European Community. There was a private operation at St. Mary's, 15 km south of Bartica on the Essequibo River. The Government's Guyana National Service ran two additional pits on the Mazaruni River.

Mineral Fuels

The lack of a reliable supply of electricity in and around Georgetown prompted most businesses to import small motor generators, increasing the total fuel demand and aggravating the hard-currency shortage.

Negotiations were underway to privatize the country's electric utility. Leucadia Corp. of Salt Lake City, Utah, was expected to acquire 60% of the Guyana Electricity Company (GEC). Only 6% to 40% of the 72 MW installed generating capacity on the public grid was normally available on a daily basis. Approximately 60% of GEC's plants were diesel.

The country had 221 MW of total installed generating capacity, which included Guymine, the Guyana Sugar Corporation, and the Guyana Rice Export Board powerplants. About half of the oil that the Government imported from Venezuela was used by the bauxite industry. The Government expressed interest in developing the country's estimated 4,500-MW hydropower potential.

The two 10-MW generators loaned by the Brazilian Government were expected to be functioning by 1991. The Guyana government signed a protocol of intent concerning the connection of Guyana's electricity grid to Venezuela's Guri Dam.

There were three concession holders in 1990. Guyana Hunt Oil Co. obtained a petroleum prospecting license for the Takutu Basin, where Home Oil Co. had drilled a successful test in 1982. Petrolam of Trinidad held the acreage until September 1989, when its license was canceled for failure to comply with its contract. London and Scottish Marine Oil Company (LASMO) and Broken Hill Proprietary (BHP) of Australia began preliminary exploratory work on their offshore concession. LASMO was expected to spud a well during 1991. During 1990, the French firm TOTAL Compagnie Française des Pétroles S.A. (TOTAL) joined Guyana Exploration Ltd. and Petrel Petroleum Corp. as operator on the country's other offshore concession. TOTAL's initial wildcat tested gas.

Mobil Corp. was negotiating for an offshore concession.

INFRASTRUCTURE

Guyana's problems in maintaining its infrastructure severely limited the country's economic activity. Neglect of the seawall, which at one time protected the densely populated coastal areas, led to an increase in the number of floods. Roads and telephone service also suffered from lack of maintenance.

Many remote mining areas relied mainly on riverboats and barges for movement of material. Guyana had 6,000 km of navigable waterways. The railroad connecting the Linden bauxite mines to the Linden plant was part of the country's 187 km of track. There was 7,665 km of roads, mostly gravel or dirt. Most of the countryside away from the rivers was accessible only by jeep tracks and bullock trails or, when available, light aircraft and helicopters.

OUTLOOK

The expected increase in bauxite production with the opening of new bauxite mines is a key element of the Government's economic planning. The Gold Board forecast that declared gold would again increase and that this century's record of 1,229 kg declared gold, set in 1939, would be bettered in 1991. The Government also anticipates that large-scale gold production, such as from the Omai prospect, would significantly boost the nation's economy.

It was anticipated that the National Assembly would consider environmental legislation concerning the mining industry.

International funding is expected to support a growing number of projects in Guyana. The International Bank of Reconstruction and Development plans to help finance infrastructure improvements during the next decade. The Inter-American Development Bank is considering a supplementary loan to continue the rehabilitation of the electrical generating system. Brazil is expected to assist with funding for the \$30 million road from Lethem to Georgetown, and China agreed to supply equipment and material to rehabilitate existing roads.

The Foreign Ministry disclosed that Venezuela's claim on all territory west of the Essequibo River, an area exceeding 146,879 km², may be settled soon. The present border had been defined by the Tribunal of Arbitration in 1899. In 1962, Venezuela questioned the Tribunal's decision and brought the dispute to the attention of the United Nations.

¹Where necessary, values have been converted from Guyanese dollars (G\$) to U.S. dollars at the rate of G\$45 = U.S.\$1.

Other Sources of Information

Agencies

Bauxite Industry Development Co. Ltd.
(BIDCO)
71 Main Street
Georgetown, Demerara, Guyana
Telephone: (592) 2-57780

Guyana Geology and Mines Commission
P.O. Box 1028
68 Upper Brickdam
Georgetown, Guyana
Telephone: (592) 2-53148
Fax: (592) 2-53047

Guyana Gold Board
c/o Guyana Geology and Mines Commission Compound
68 Upper Brickdam
Georgetown, Guyana
Telephone: (592) 2-53173

Guyana Mining Enterprises Ltd. (Guymine)
P.O. Box 27
Mackenzie, Linden, Guyana
Telephone: (592) 04-3311
Fax: (592) 04-2795

Guyana Natural Resources Agency
41 Brickdam and Boyle Place
Stabroek
Georgetown, Guyana
Telephone: (592) 2-66549
Fax: (592) 2-71211

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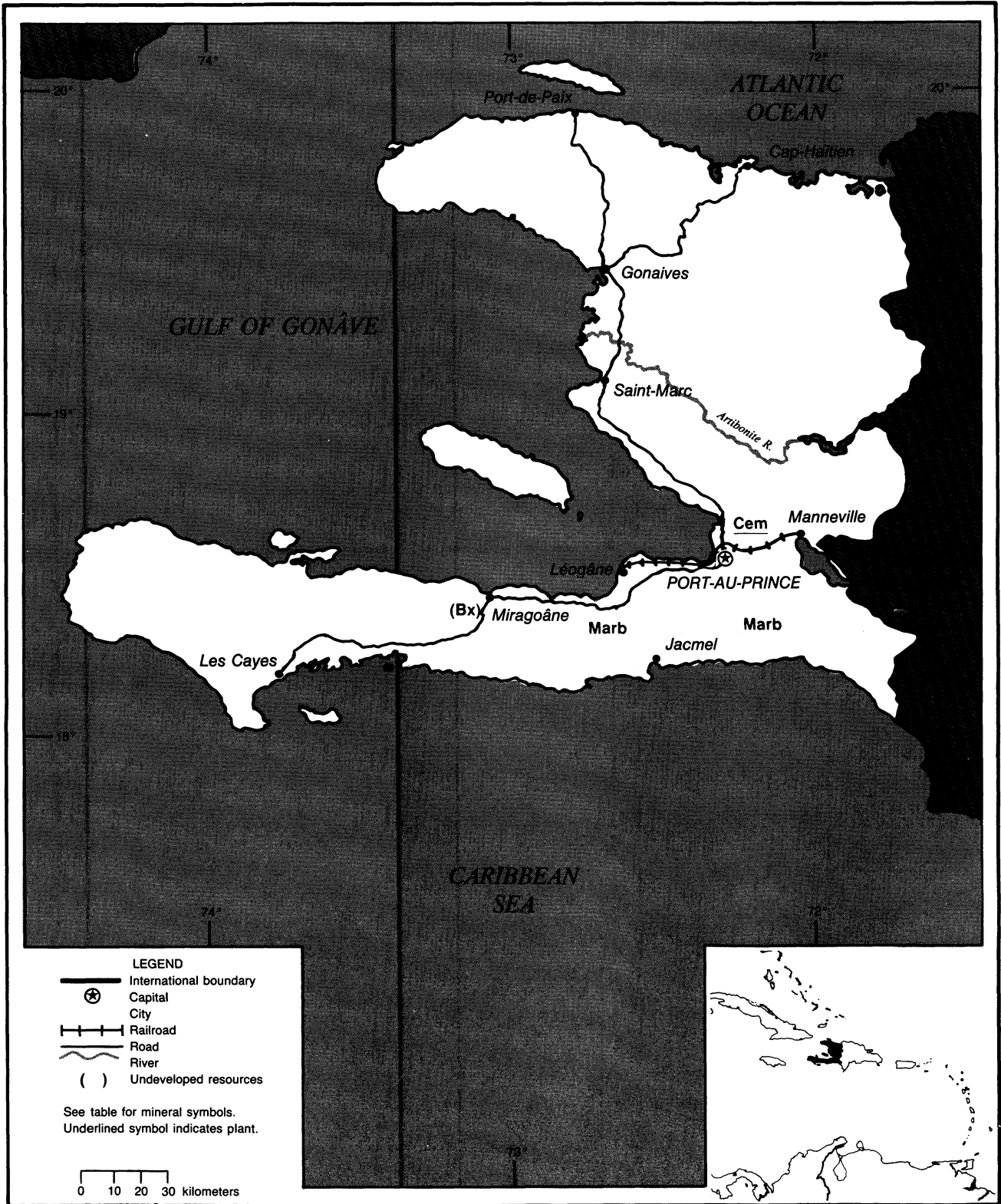
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HAITI

AREA 27,750 km²

POPULATION 6.3 million



HAITI

By Philip M. Mobbs

Political and economic instability continued to plague Haiti's small mineral industry, which revolved about the production of cement, marble, and various minerals used in the nation's construction industry.

In 1990, the country's GDP was estimated to have suffered a 3% decline to \$2.7 billion.¹ The contribution of the mineral industry to the economy has been relatively insignificant since bauxite mining was terminated in 1982.

GOVERNMENT POLICIES AND PROGRAMS

The Mining Law of 1976 and the creation of the Ministère des Mines et des Ressources Énergétiques in 1978 established a framework for an orderly relationship between the Government and private investment. Mining companies may be privately owned. There were no restrictions on the repatriation of capital or profits. The 1985 investment code ended the distinction between foreign and domestic investment.

Exchange controls were liberalized during 1990. Exporters were allowed to keep 60% of their foreign exchange and required to redeem the remaining 40% for gourdes at the official rate.

PRODUCTION

Mineral production during 1990 increased compared to 1989 output. Cement and marble dominated the construction material-oriented industry.

TRADE

The United States continued to be Haiti's main trading partner, garnering an estimated 84% of Haiti's \$165 million export market. Assembled materials and agricultural products formed the bulk of exports.

The United States also provided approximately 62% of Haiti's \$348 million official import market in 1989. A significant amount of the imported material was raw or semifinished stock intended for Haiti's assembly industry. A substantial contraband market, estimated to be almost the same size as the official import market, has developed over the years. Bootleg mineral products included cement smuggled in from Colombia, the Dominican Republic, and Honduras.

Haiti had duty-free access to the United States on certain products under the Caribbean Basin Initiative (CBI). Other significant Haitian trading partners included Canada, France, the Federal Republic of Germany, Italy, Japan, the Republic of Korea, the Netherlands Antilles, and Taiwan.

STRUCTURE OF THE MINERAL INDUSTRY

Mineral-related industries were primarily owned by private concerns. The Government had a minority interest in the nation's 350,000 ton annual capacity cement plant at Fond-Mombin, which Le Ciment D'Haiti S.A. operated.

COMMODITY REVIEW

The Government's promotion of gold deposits in the north culminated in the preliminary negotiations for the Milot prospect with Silver Standard Resources Inc. of Vancouver, Canada. The Milot gold prospect was 12 km south of Cap-Haïtien.

Cement sales were strong when the residential construction sector was booming; however, the sagging economy and higher mortgage rates slowed down construction during the last half of the year. Development of the marble industry continued. Clay, limestone, gravel, and salt were produced for local consumption.

During 1990, Haiti suffered from a severe energy shortage. Electricité d'Haiti (EDH) instituted power rationing in Port-au-Prince. Less than normal precipitation resulted in reduced water levels and diminished the generating capability of the Péligre hydroelectric plant.

EDH sought funding from the Inter-American Development Bank for additional power generation projects. Venezuela agreed to provide financing for purchases of up to 6,500 barrels of oil per day. In 1989,

TABLE 1

HAITI: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989	1990 ^P
Cement, hydraulic	252,000	252,000	250,000	*215,000	*250,000
Clays, for cement	40,537	35,726	27,083	42,890	48,000
Sand and gravel:					
Gravel cubic meters	2,335,369	2,255,686	2,405,646	3,809,700	3,967,928
Sand do.	1,167,685	1,127,843	1,368,328	2,166,952	2,256,952
Stone:					
Limestone, for cement	221,663	246,387	208,118	322,949	286,600
Marble cubic meters	339	179	595	595	595

*Estimated. ^PPreliminary.

¹Table includes data available through Dec. 24, 1991.

²In addition to commodities listed, asphalt, lime, and salt may also be produced, but data on such production are not available, and information is inadequate to make reliable estimates of output levels.

petroleum products had accounted for almost 20% of official imports.

INFRASTRUCTURE

There were 4,000 km of road. The country's 40-km railroad operated intermittently hauling sugar cane. Port-au-Prince was the country's major seaport. Cap-Haïtien on the north coast was capable of servicing small cargo vessels.

OUTLOOK

Haiti has not had the financial resources to develop its natural resources. The continuing political instability may prevent Haiti from obtaining the needed technical and economic support from foreign investors.

¹Where necessary, values have been converted from Haitian gourdes (G) to U.S. dollars at the rate of G5.0=US\$1.00.

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Bureau des Mines et des Ressources
Énergétiques
B.P. 2174
Port-au-Prince, Haiti

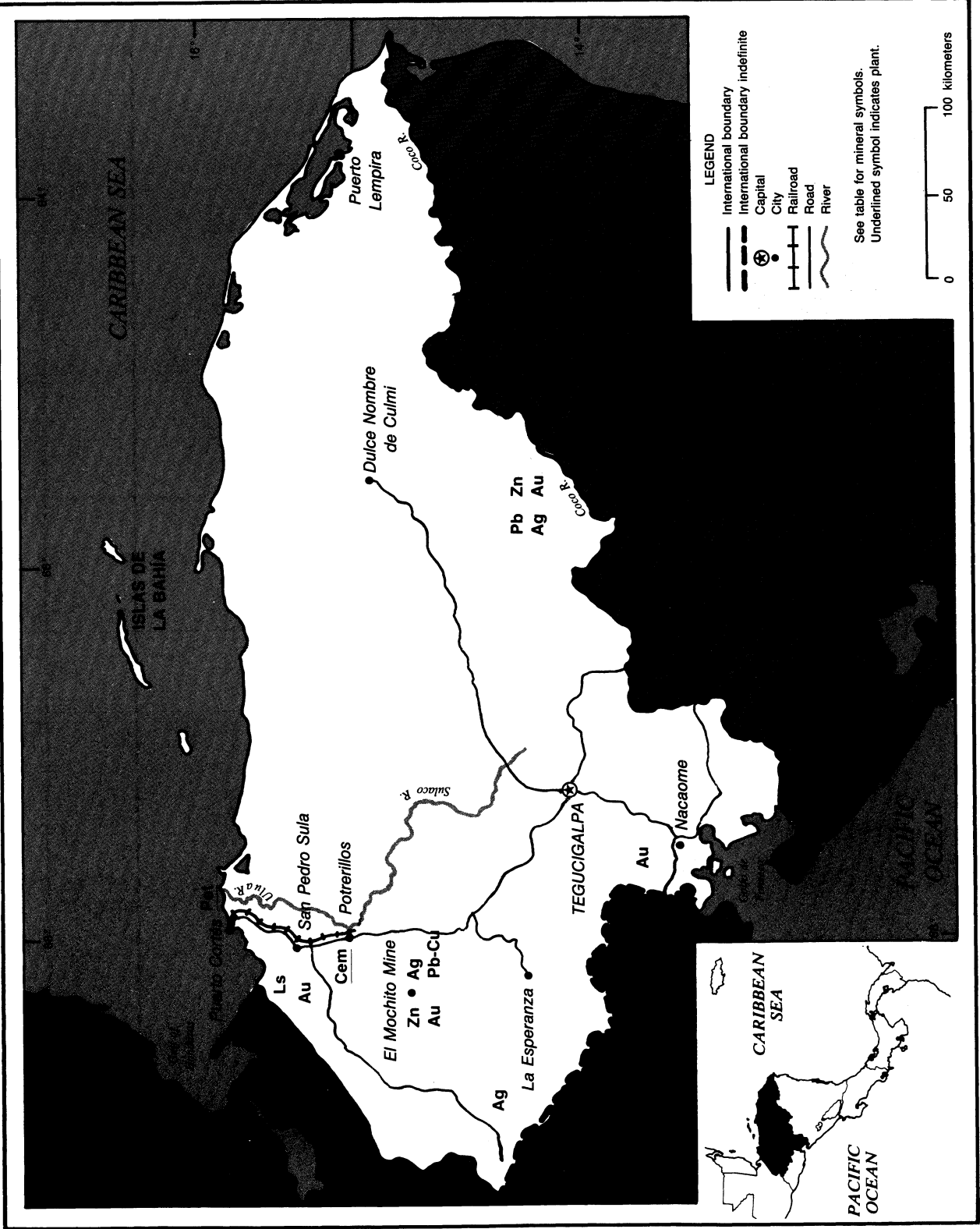
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HONDURAS

AREA 112,100 km²

POPULATION 5.1 million



HONDURAS

By Philip M. Mobbs

The largest active mine in Central America was Honduras' El Mochito lead-zinc mine. Honduras' zinc production ranked among the top 40 zinc-producing countries in the world.

Agriculture continued to carry the Honduran economy. Agriculture's dominance of the export sector was not expected to diminish in the foreseeable future. For 1990, zinc exports brought in \$48 million,¹ following bananas (\$366 million), coffee (\$184 million), and shrimp (\$51 million). On the import side, petroleum products accounted for a significant part of the country's total imports.

In March 1990, the newly elected Government revamped the country's economic program with Decree 18-90. The lempira (L), officially fixed at 2 to the U.S. dollar (US\$) in 1918, was devalued to L4=US\$1.00. By the end of the year, the official exchange rate was L5.3=US\$1.00. The sweeping economic legislation adversely impacted the mineral industry, as existing negotiated incentives, such as duty-free entry of equipment, were eliminated. Decree 123-90, passed 7 months later, re-established some of the benefits, but only for 1 year, emphasizing the Government's interest in immediately stimulating mineral activity.

The rising cost of imported petroleum and the drop in the price received for exported zinc during the last half of the year contributed to Honduras' 1% decline in GDP during 1990. Retail prices shot up a record 35.2% in 1990, shocking a population unaccustomed to double-digit inflation. The inflation rate had been 9.8% in 1989 and 4.5% in 1988.

GOVERNMENT POLICIES AND PROGRAMS

Mineral industry activity fell under the Mining Code of 1968 and a number of revisions, most notably Decree 79 of 1982

and Decree 168 of 1987. The Hydrocarbon Law, Decree No. 194-84, covered the petroleum industry. On November 24, 1990, the latest modifications to existing mineral and petroleum regulations were published as Decrees 123-90 and 131-90.

Decree 123-90 provided for the duty-free importation of machinery, equipment, and instruments for mining and petroleum exploration. Materials, spare parts, and accessories used for exploration and not locally available were also included under the law. Additionally, the decree established a formula for recovery of exploration expenses.

Mining and quarrying commanded a 10% royalty. Gross income of subsidiaries of foreign companies was taxed at a 35% rate.

There were no legal restrictions on remittances of capital and profits. In practice, however, they were difficult to make. Remittances had to be authorized by the Central Bank. Due to the country's chronic foreign exchange shortages, they were not high priority. Higher cost and technically illegal informal transfers through the parallel market were utilized on occasion to maneuver around the foreign exchange problems.

Although exports were encouraged by the Government, transactions were licensed and often taxed. Foreign exchange regulations required that almost all export earnings be returned to Honduras.

PRODUCTION

Flooding was a problem in northern Honduras during November and December. The high water subsided quickly and did not significantly impact the mining industry. Roads were cleared and repaired in a relatively short time, allowing mineral and product shipments to resume.

Lead and zinc output was reduced when the El Mochito Mine was closed for 2 months to correct potential safety problems.

Zero antimony production was reported

for 1990. The last few years of high-grade production from the La Capa Mine, in Yoro Department and from the El Caliche mining district in Santa Bárbara Department had been hand processed.

TRADE

In November, Honduras became the first Central American country to sign a framework agreement with the United States under the Enterprise for the Americas Initiative. This agreement established a bilateral Council on Trade and Investment. As Honduras' principal trading partner, the United States purchased more than 50% of Honduran exports and supplied almost 40% of imports. Honduras was a beneficiary of both the Caribbean Basin Initiative (CBI) and the Generalized System of Preferences (GSP).

The Overseas Private Investment Corp. (OPIC) provided financing to U.S. citizens for Honduran investment. War and expropriation insurance was also offered.

Exporters and importers were required to be registered. The Central Bank licensed both imports and exports.

Mineral products, primarily lead and zinc concentrates, represented about 5% of the nation's exports. Cadmium, copper, gold, and silver were contained in the concentrates. Cement, marble, and salt were also exported.

STRUCTURE OF THE MINERAL INDUSTRY

The state had little active participation in mineral ventures, although the Dirección General de Minas e Hidrocarburos (DGMH) participated in the Mineral Inventory Program administered by the French Bureau de Recherches Géologiques et Minières (BRGM). The DGMH granted mining and petroleum concessions and registered exploration and production

companies. Honduran law required a minimum capitalization of at least \$5,631 for foreign-owned business.

The Government had controlling interest in the cement industry and associated limestone quarrying. Private companies dominated the rest of the nation's mineral extraction and petroleum refining activity.

Breakwater Resources Ltd. of Vancouver, British Columbia absorbed American Pacific Mining Co. Inc. in April 1990. American Pacific had re-opened Rosario's El Mochito Mine in October 1987. The Compañía (Cía.) Minera Santa Bárbara, a wholly owned subsidiary of Breakwater, was established to operate the

mine and to define metal deposits on the company's concessions.

Madeleine Mines and partner Milner Consolidated Silver Mines, both Toronto-based, held 51% of Cía. Minerales de Copán S.A. de C.V., a 9,000-ton-per-month heap-leach gold operation at San Andrés in Copan Department.

TABLE 1
HONDURAS: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^p	1990 ^e
Antimony, mine output, Sb content	50	28	19	^r 10	² —
Cadmium, Cd content of lead and zin concentrates	^e 350	124	276	350	² 372
Cement	359,975	451,180	560,065	648,763	² 652,111
Copper, Cu content of lead and zinc concentrates	^e 5,000	582	538	2,419	² 1,388
Gold kilograms	63	131	127	1,244	² 1,707
Gypsum ^e	22,000	22,000	22,000	² 25,000	25,000
Iron and steel:					
Steel, crude ^e	7,200	7,200	7,200	^r 8,000	8,000
Semimanufactures ^e	12,000	12,000	12,000	^r 17,210	15,000
Lead, mine output, Pb content	12,558	5,041	16,906	9,610	² 5,785
Petroleum refinery products thousand 42-gallon barrels	1,472	^e 1,500	^e 1,500	3,299	2,500
Salt ^e	30,000	30,000	30,000	30,000	30,000
Silver kilograms	54,276	23,234	58,447	49,892	² 18,788
Stone:					
Limestone ^e	500,000	² 448,820	450,000	450,000	460,000
Marble	6,726	962	3,175	³ 74,250	³ 84,400
Zinc, mine output, Zn content	25,443	15,417	23,475	37,184	² 29,628

^eEstimated. ^pPreliminary. ^rRevised.

¹Includes data available through Sept. 4, 1991.

²Reported figure.

³As of 1989, official marble production was reported in square meters.

TABLE 2
HONDURAS: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Industria Cementera Hondureña S.A. de C.V.	Piedras Azules plant, Comayagua Department	390,000
Do.	Cementos de Honduras S.A.	Rio Bijao plant, San Pedro Sula, Cortés Department	360,000
Gold kilograms	Compañía Minera Santa Barbara	El Mochito Mine, Santa Bárbara Department	1,500
Do.	Cía. Minerales de Copán S.A.	San Andres Mine, Copán Department	165
Lead	Cía. Minera Santa Barbara	El Mochito Mine, Santa Bárbara Department	24,000
Petroleum products thousand 42-gallon barrels	Refinería Texaco de Honduras S.A.	Puerto Cortés, Cortés Department	5,040
Silver	Cía. Minera Santa Barbara	El Mochito Mine, Santa Bárbara Department	50
Do.	Cía. Minera El Paso Mining	La Pochota Mine, Valle Department	NA
Steel	Industria Nacional de Acero	Choloma, Cortés Department	14,000
Zinc	Cía. Minera Santa Barbara	El Mochito Mine, Santa Bárbara Department	45,000

NA Not available.

COMMODITY REVIEW

Metals

Gold and Silver.—The exploration license of Eules, Texas-based Honduras Gold Mines Ltd. was canceled by the Government. The license, issued in 1988 for a Yuscaran area prospect, apparently conflicted with a 1985 project agreement with the United Nations Revolving Fund for Natural Resources that covered the same area.

El Corpus, a small, privately owned 30-person operation about 91 km south of Tegucigalpa, mined ore and processed the gold on-site. About 26 km northeast of El Corpus, near San Marcos de Colón in Choluteca Department, Cía. Minera Santa Bárbara was actively exploring a concession.

Melinga Resources had metallurgical tests done on samples from its Macuelizo gold prospect. Melinga also completed an access road to the concession.

Placer production predominated gold operations to the east in Olancho Department. Many companies worked the Río Guyape; however, dredges were not used by the numerous small-scale operations. During the dry season, as many as 1,000 panners and their families flocked to the Río Patuca. Mercury poisoning from the separation procedures was potentially a problem for the miners along the remote rivers.

The low price of silver closed many small intermittent silver operations.

Lead and Zinc.—Cía. Minera Santa Bárbara continued to upgrade the El Mochito Mine in Santa Bárbara Department, about 130 km northwest of the capital, Tegucigalpa. The company reported milling 440,842 tons of ore grading 7.28% zinc and 1.49% lead in 1990. In 1989, the mill throughput was 480,296 tons of ore grading 7.6% zinc and 1.71% lead. The drop in production was due to the suspension of operations during September and October. The mine was closed to repair hoisting equipment and to replace timbering. Cía. Minera Santa Bárbara accelerated its exploration program on concessions surrounding the mine. The company also endeavored to improve the mine's environmental situation.

Industrial Minerals

Cement.—The state proposed to privatize its 51% interest in Cementos de

Honduras S.A. (CEHSA) and its interest in Industria Cementera Hondureña S.A. de C.V. (INCEHSA). Several foreign firms, including the AMPAC Group of Miami and Spain's Atlan Co., were reported to be interested.

During 1990, the cement industry was hit by a 123% increase in the price of fuel. CEHSA studied the feasibility of converting from fuel oil to coal. Cement production increased slightly compared with that of 1989, despite the short strike in July at CEHSA's Río Bijao plant.

Marble.—Mármoles y Terrazos of San Pedro Sula, proposed a joint-venture program for its three marble quarries. The company forecast potential annual production of 45,730 tons (17,000 m³) from its 81-hectare operation.

Mineral Fuels

In 1989, more than 62% of the nation's energy was derived from traditional fuels, primarily wood. Twenty-five percent was provided by imported crude petroleum and petroleum products. Mexico and Venezuela were the chief suppliers of imported petroleum. Hydroelectric power accounted for 10%, primarily from the 292-MW El Cajón hydroelectric powerplant on the Humuya River, 5 km downstream from the junction with the Sulaco River. The remaining 3% was provided by thermally generated electricity. The 550-MW installed generating capacity electricity sector was state-dominated.

Petroleum exploration activity revived in Honduras when Venezuela's Cambria Co. prepared to drill the Brus Laguna concession in Gracias a Dios Department. Only three licenses were outstanding at the beginning of the year, pending the award of an additional five offshore blocks. However, a surge in exploration activity was expected in 1991 in response to the new legislation.

A feasibility study of a second refinery in Honduras, proposed for Trujillo, was undertaken by a team of Venezuelan experts.

INFRASTRUCTURE

The transportation system in Honduras improved in 1990; however, access to many areas remained generally difficult. Most mineral production was trucked out on the country's 9,000 km of roads. The primary metal shipping point was Puerto Cortés. Other Caribbean ports included La Ceiba,

Puerto Castilla, Tela, and Trujillo. San Lorenzo served the Pacific coast.

OUTLOOK

The mineral potential of Honduras is impressive. Interest in the country's unexploited mineral resources is expected to climb as the nation's investment climate improves.

Honduran mineral deposits should be better defined through the Trifino Plan exploration program along the western border and with the continued work of the BRGM.

Suspicion of direct foreign investment, fostered by the country's former vulnerability to a handful of large multinational companies, is expected to eventually subside. Many of the problems encountered by new investors are bureaucratic. Improvement is anticipated, as the 1991 economic program proposes that a number of state agencies be downsized or spun off to the private sector.

A new investment law is expected to be debated during 1991, and there is hope that the 1-year eligibility clause of Decree 123-90 will be extended.

¹Where necessary, values have been converted from Honduran lempiras (L) to U.S. dollars at the average Inter-bank rate of L4.44=US\$1.00.

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Agencies

Dirección General de Minas e
Hidrocarburos
Ministerio de Recursos Naturales
Boulevard Miraflores
Tegucigalpa, D.C.
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Dirección General de Inversiones y
Promoción de Exportaciones
Ministerio de Economía y Comercio
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Tegucigalpa, D.C.
Honduras, C.A.

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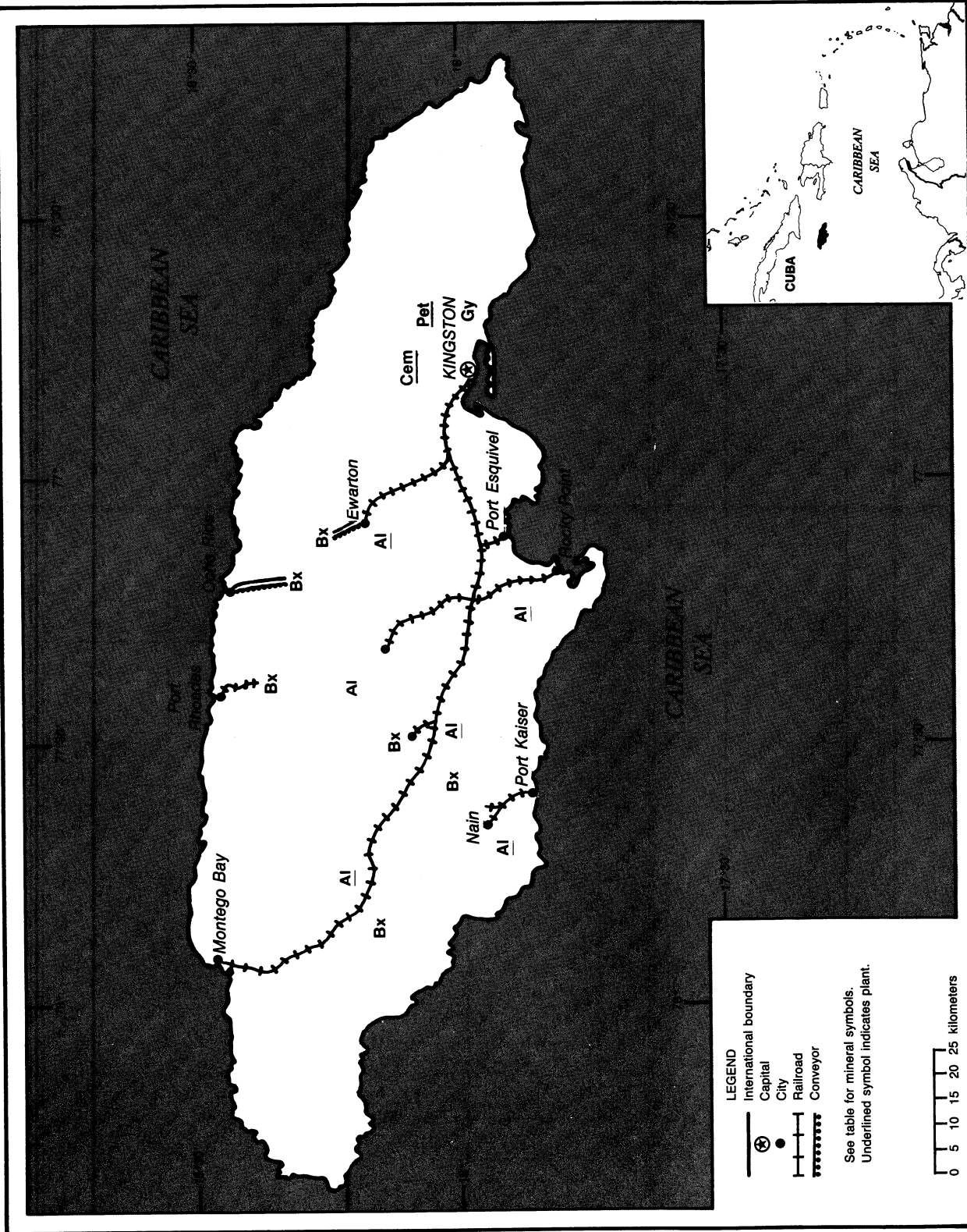
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JAMAICA

POPULATION 2.4 million

AREA 11,000 km²



JAMAICA

By Ivette E. Torres

Bauxite and alumina were not only the two dominant mineral commodities in the Jamaican economy, but were also the only two significant mineral commodities in terms of world production. Jamaica ranked third and fourth worldwide in the production of bauxite and alumina, respectively. In addition, Jamaica produced small amounts of cement, gypsum, construction materials, and oil refinery products, mainly for domestic consumption. Efforts by the Government to develop and diversify the industrial mineral sector continued to be oriented toward marble and other high-value commodities.

The Jamaican economy grew 3.8% at constant prices. The growth was attributed to the expansion of the tourist sector, the continuing recovery of the bauxite and alumina industry, and the improvement in the agricultural sector. However, the country's external debt continued to be large, and inflation as measured by the consumer price index was almost 30%.

Economic programs of stabilization and adjustment begun in the 1980's continued as the Government accelerated the efforts toward deregulation, liberalization, and privatization. Such policies were guided by the 5-Year Plan, which ends in 1995, and programs with both the Bank for Reconstruction and Development (the World Bank) and the International Monetary Fund. The purpose of the economic reforms, according to the Government, was to obtain sustained economic growth of 3% per year.

GOVERNMENT POLICIES AND PROGRAMS

In 1990, the Government of Jamaica accelerated efforts of stabilization and adjustment. Among the significant changes in policy were those of deregulation and liberalization, including foreign exchange. Also of importance were the removal of price controls, elimination of some subsidies, lower fiscal borrowing requirements, and the increased pace of privatization.

In November, the Prime Minister of Jamaica announced the Government's intention of privatizing some of the public sector. The Government also created a new Ministry of Industry, Production, and Commerce, to be headed by the former Minister of Mining and Energy. The former Minister of Agriculture became the new Minister of Mining and Energy. Among the official development assistance programs, two with multilateral agencies, the UN and the World Bank, had elements in the area of minerals. One such program, one of five under the United Nations Development Organization, was to recover rare earths, scandium, and yttrium from red mud. The World Bank program in the mineral sector was under the Multinational Investment Guarantee Agency (MIGA). The MIGA assistance was in the form of an investment promotion conference held in February, which concentrated on the promotion of nontraditional sectors in Jamaica hoping to create investment opportunities in those areas. Among the topics discussed at the conference was the nonmetallic (industrial minerals) area, in particular, marble, limestone, silica, and industrial clays.

The high level of petroleum consumption in reference to the total energy consumption during the year (92% in fuel oil equivalent) geared the energy sector policy toward (a) substituting petroleum imports where feasible, especially with coal, (b) working to achieve a more efficient use of energy, and (c) deregulating the petroleum trade.

In September, the Government of Jamaica began efforts to deregulate the trade of petroleum. During the year, price controls on all products were removed, with the exception of domestic kerosene, which continues to be subsidized.

PRODUCTION

In 1990, Jamaica was the third leading world producer of bauxite, after Australia and Guinea. It produced 10% of the world's

bauxite. The country was also the fourth leading producer of alumina, after Australia, the United States, and the U.S.S.R. It produced 7% of the world's alumina. Production of these two commodities increased significantly from those of 1989 and continued to dominate the mining industry of Jamaica. Other mineral commodities produced in Jamaica represent a very small portion of the economy and are insignificant by world standards. Most of these commodities, which include cement, gypsum, limestone, marble, salt, sand and gravel, steel, and other construction materials, were produced for domestic consumption. Construction activity in 1990 increased slightly and was reflected in the increase in cement production; however, steel production decreased.

TRADE

The United States continued to be Jamaica's main trading partner, receiving 28% of the total Jamaican exports and contributing almost 43% of total Jamaican imports, a slight decrease in import share from that of 1989. Jamaica's main European and CARICOM trading partners were the United Kingdom and Trinidad and Tobago, respectively. Canada, with which Jamaica had a free trade agreement, was the third main trading partner after the United States and the United Kingdom.

In 1990, exports of alumina and crude bauxite totaled 2.9 and 3.9 million tons, respectively. Alumina was the major component of traditional exports, contributing 53% to the value of total exports of \$1,140 million.¹ Crude bauxite ranked second in export value of traditional commodities, about \$103 million or 9% of total export value.

During the year, alumina was exported to Europe (40.8%), the United States (24.2%), Canada (18.9%), Ghana (8.2%), the U.S.S.R. (5.6%), and Brazil (2.1%).

In addition to alumina and bauxite, Jamaica exported small amounts of cement,

TABLE 1

JAMAICA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989	1990 ^P
Aluminum:					
Bauxite, dry equivalent, gross weight					
thousand tons	6,930	7,802	7,305	9,601	10,921
Alumina	1,575	1,609	1,514	2,221	2,869
do.					
Cement, hydraulic	241	306	371	443	518
do.					
Gypsum	117,000	176,300	145,500	78,010	82,200
Iron and steel: Steel, crude	¹ 12,078	¹ 20,629	¹ 27,578	36,732	23,820
Lead, refined (secondary) ^Q	1,000	1,000	1,000	1,000	1,000
Lime	92	90	80	⁹⁰	⁹⁰
thousand tons					
Petroleum refinery products					
thousand 42-gallon barrels	9,597	9,108	9,801	5,928	8,203
Salt	13,090	15,665	15,466	15,621	12,124
Silica sand	13,100	19,930	13,000	15,200	16,620
Stone:					
Limestone	5,331	5,848	5,984	6,800	7,072
thousand tons					
Marble	200	500	2,700	5,000	4,000
Marl and fill	7,020	7,560	7,020	7,560	7,830
thousand tons					
Sand and gravel	1,525	1,700	2,025	2,250	2,375
do.					

^QEstimated. ^PPreliminary. ^RRevised.¹Table includes data available through Dec. 31, 1991.

gypsum, and limestone. Exports of cement represented only about 6% of total sales of 446,760 tons. About 82,000 tons of gypsum was exported, a sharp increase from that of 1989.

Jamaica imported most of its crude oil requirements from Mexico (50%) and Venezuela (41%), under the San José Accord. The remaining 9% was imported from Ecuador. Jamaica also imported oil refinery products. Of the 18.5 million barrels of crude and refinery products imported in 1990, 7.2 million barrels was imported by the bauxite industry sector. Imports of fuel represented 21.6% of total import value, an increase from that of 1989 mainly because of the worldwide price increase. Oil imports increased about 13% from the revised 1989 figure of 16.3 million barrels. Exports of refinery products totaled 579,238 barrels, almost a 28% decrease in volume but less than 1% decrease in value.

STRUCTURE OF THE MINERAL INDUSTRY

The Government of Jamaica is directly involved in the production, trade, and technical developments of bauxite and alumina through Jamaican Bauxite Mining Ltd., Clarendon Alumina Production Ltd., Bauxite and Alumina Trading Co. of Jamaica Ltd.,

and the Jamaican Bauxite Institute Ltd. Other Government organizations involved in the mineral sector are the Ministry of Mining and Energy's Division of Mines and Quarries and the Geological Survey.

State-owned Petroleum Corp. of Jamaica (PCJ) is responsible for conducting oil and gas exploration studies. A subsidiary of PCJ, Petrojam Ltd., operates the oil refinery in Kingston.

In 1990, employment in the mining, quarrying, and refining sector averaged 7,100 people, up from 6,400 (revised) in 1989. This represents less than 1% of the average total work force of 896,300.

COMMODITY REVIEW

Metals

Production of bauxite and alumina increased about 14% and 29%, respectively. Exports of bauxite increased about 16% to 10.9 million tons (the highest level since 1981), while exports of alumina increased even more (35%) to about 2.9 million tons. These are the highest levels of alumina production and exports ever achieved in Jamaica. The previous high was recorded in 1974. In terms of alumina capacity utilization, it increased from 74.3% in 1989 to 97.3 in 1990 mainly because Aluminum Partners of

America (Alpart) in St. Elizabeth Parish (owned by Kaiser Aluminum & Chemical Corp. and Hydro Aluminium Jamaica a/s) increased its capacity utilization, which is now working at nearly full capacity.

At yearend, expansion of the alumina capacity by Alpart and Jamalco plants were still being considered. Jamalco, the joint-venture plant between the Government of Jamaica and Alcoa Minerals of Jamaica, was being considered for a 250,000-ton expansion.

Alpart's expansion plans, originally set for an increase of about 500,000 tons, was upgraded in November when the Prime Minister of Jamaica announced that an agreement had been signed with Kaiser and Hydro Aluminium Jamaica for an expansion to 2 million tons, almost double the plant's present capacity of 1.2 million tons. Reportedly, the 5-year expansion would cost \$250 million and would increase energy efficiency and improve environmental conditions resulting from dust, chemical emissions, and mud disposal.

Feasibility studies by Alcan Jamaica Co. for a new 1-million-ton-per-year plant in Trelawny were nearing completion.

In late 1989, the Governments of Jamaica and the U.S.S.R. had agreed to extend the bauxite contract schedule to expire in 1990. In October 1990, the two countries signed a memorandum of understanding, which covered the bauxite and alumina arrange-

TABLE 2

JAMAICA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons per year unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Alumina	Jamalco	Clarendon, Clarendon Parish	750
Do.	Aluminum Partners of Jamaica	Nain, St. Elizabeth Parish	1,200
Do.	JAMALCAN	Kirkvine, Manchester Parish Ewarton, St. Catherine Parish	547.5 547.5
Bauxite	Jamaica Bauxite Mining Ltd. Lydford Mines ¹	Lydford, St. Ann Parish	2,500
Do.	Kaiser Jamaica Bauxite Co., Ltd.	Water Valley, St. Ann Parish	4,500
Cement	Caribbean Cement Co. Ltd.	Rockfort, St. Andrew Parish	830
Petroleum products thousand 42-gallon barrels	Petroleum Corp. of Jamaica	Kingston	12,958

¹Formerly Jamaica Reynolds Bauxite Partners. Closed since 1984.

ments. In addition to bauxite deliveries, the memorandum covered the settlement of outstanding shipments for 1990, the resumption of shipments, and arrangements to deal with shortfalls of outstanding shipments on the contract to expire in 1995. Discussions between the two countries also considered the potential increase of bauxite to the U.S.S.R. beyond 1995.

Industrial Minerals

Cement.—Cement production in 1990 increased about 17%. Sales, however, increased only about 2% to 446,760 tons. Of total sales, only about 6% was destined for export. The coal conversion project by the Caribbean Cement Co., which began in the late 1980's, allowed the company to use either oil or coal. In 1990, when oil prices increased, the company was able to save more than \$7 million by using coal for about 90% of its fuel requirements. In addition, the company planned to increase its dry-process plant capacity to 200 tons per day.

Other Industrial Minerals.—Production of almost all industrial minerals increased; the only exception was that of marble, which decreased by 20%.

Mineral Fuels

Imported petroleum and refinery products supplied 91.7% of total energy consumption in terms of oil fuel equivalent. The remainder was supplied by bagasse, 5.9%; coal, 1.8%; and hydroelectric power, less than 1%. During the year, end use of petroleum products increased about 22%. This resulted from the increase in demand from the bauxite and alumina sectors.

Jamaica's electric generating capacity was 1,122 megawatts. Because of the Jamaica Public Service Co.'s (JPSC) inability to meet electricity demands, the Government began

to consider the privatization and the deregulation of the power generation sector. Reportedly, the Government seemed to favor power production by the private sector and the sale of JPSC.

Jamaica's industry is energy intensive; therefore, Government policies have centered around energy source diversification and petroleum product substitution to reduce dependence on imported energy. Areas of energy investigation include hydroelectric, coal, solar, and biogas alternatives. Among the studies evaluated during the year was a coal-fired power station. Preliminary investigation of this project was underway after JPSC and the Canadian International Development Agency agreed to work together on the completion of the plant, the engineering aspects, and an environmental impact assessment.

Reserves

The reserves of bauxite were estimated at 2 billion tons.

INFRASTRUCTURE

Jamaica had more than 18,200 kilometers of highways, 70% of which was paved. There were two major ports, Kingston and Montego Bay, and 370 kilometers of railroad. Jamaica's mining sector used railroads, highways, and conveyor belts to transport production to processing facilities, local consumers, and shipping ports. Bauxite was exported from Port Rhoades and Rocky Point. Alumina was shipped from Port Kaiser and Port Esquivel.

OUTLOOK

The Government of Jamaica and the private companies are working together to

increase output of bauxite and alumina. Because of firm demand and strong prices, prospects for the Jamaican industry look promising. The U.S. recession and recent increases in prices of oil and caustic soda, however, may have a limiting effect on the actual industry growth.

¹Where necessary, values have been converted from Jamaican dollars (J\$) to U.S. dollars at the rate of JD\$7.184=US\$1.00.

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Ministry Of Mining and Energy
P.O. Box 141
Hope Gardens
Kingston 6, Jamaica

Mines and Quarries Division
Ministry of Mines and Energy
P.O. Box 189
Hope Gardens
Kingston 6, Jamaica

The Jamaican Bauxite Institute
P.O. Box 355
Hope Gardens
Kingston 6, Jamaica

Petroleum Corporation of Jamaica
12 Ocean Boulevard
Kingston 6, Jamaica

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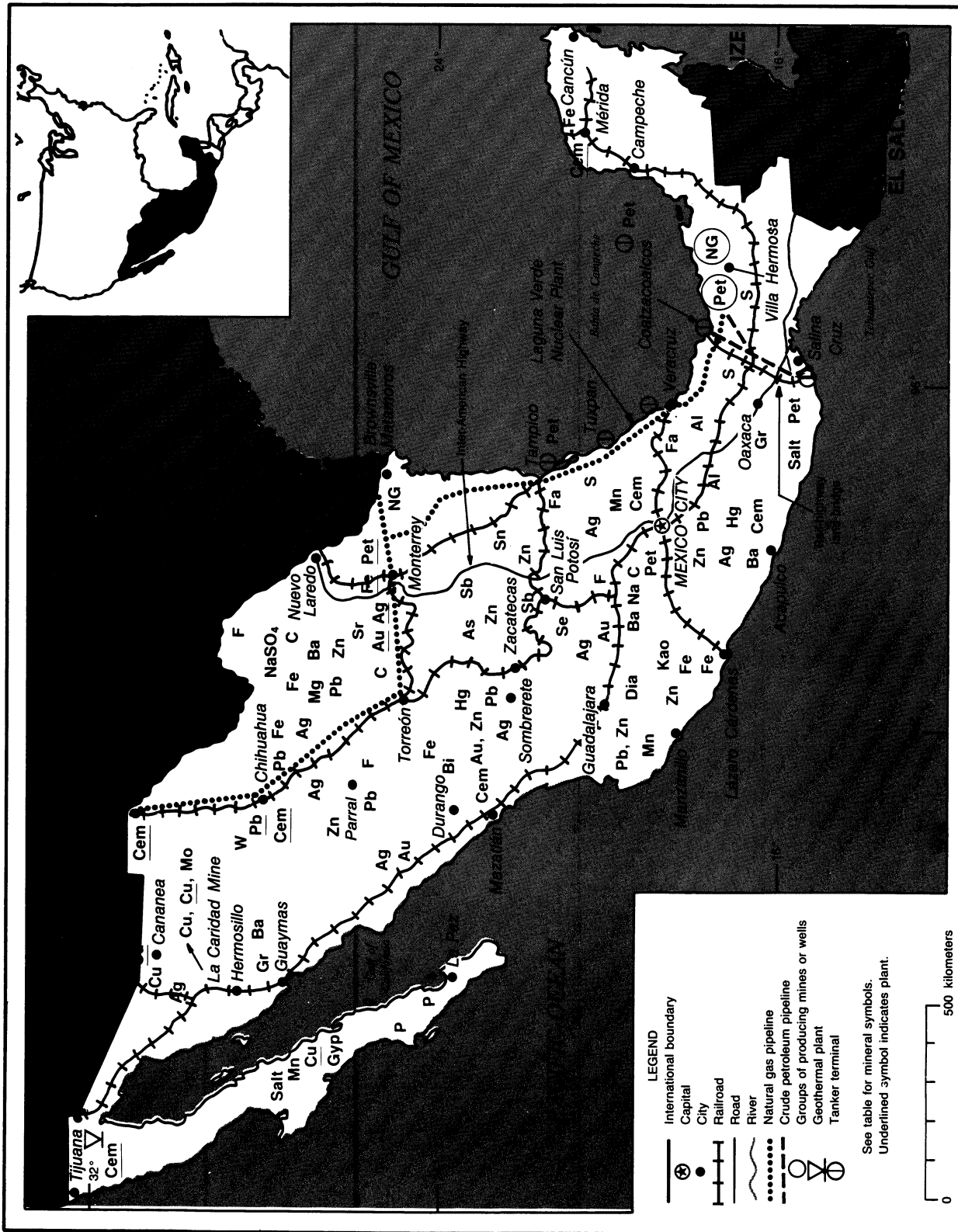
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MEXICO

AREA 1.97 million km²

POPULATION 81.1 million



MEXICO

By Ivette E. Torres

Mexico, one of the world's leading mineral producers, ranked first in the production of silver and celestite (strontium mineral) in 1990. It was among the top five producers of antimony, white arsenic, bismuth, fluorspar, mercury, and molybdenum. The production of barite, cadmium, diatomite, feldspar, gypsum, lead, lime, manganese, nitrogen in ammonia, sulfur, and zinc was of world significance also. In those commodities, Mexico was among the top 10 producers.

Mexico was in sixth place as a producer of crude oil in the world and ranked eighth in terms of oil reserves. In the Western Hemisphere, only the United States produced more oil than Mexico. Venezuela, the second leading producer of crude oil in Latin America, produced about four-fifths of that produced by Mexico. A significant portion of the Mexican crude oil was exported to the United States. The petroleum industry continued to dominate the Mexican economy, although dependence on oil has been reduced significantly in recent years, from almost 80% of the value of total exports in 1980 to approximately 37% in 1990 (34% in terms of net oil exports). About 89% of the value of petroleum exports was from crude oil, a slight decrease from that of 1989.

The Mexican gross domestic product (GDP) was estimated at \$238.2 billion, up from \$208.5 billion (revised) in 1989.¹ Government economic policies continued to be geared toward reducing inflation and maintaining economic growth, which began at the end of 1987 with the Economic Solidarity Pact and was followed by the Pact for Stability and Economic Growth. The current pact, an extension of the Pact for Stability and Economic Growth, announced in November 1990, would continue until December 31, 1991. In 1990, inflation, as indicated by the consumer price index, increased to 29.9%. Reportedly, Government relaxation of some price and wage controls resulted in the increase. However, inflation levels continued to be low when compared with those

of previous years, except 1989 when it was 19.7%. In 1987 and 1988, inflation had been 150% and 57%, respectively.

The success of Mexico's external debt renegotiation has increased interest by domestic and foreign investment and credit communities. In December 1990, Mexico's total external debt was \$98.2 billion, 79% of which was held by the public sector. The external debt ratio to GDP in 1990 was 43%, down from 59% in 1988.

Privatization efforts continued during 1990 with success in the area of telecommunications, with the sale of part of Teléfonos Mexicanos S.A. Cananea, the second largest copper mine in the country, was also privatized. The Government plans for divestment of state-owned enterprises covered many sectors. Although in 1982 the Government owned 1,155 parastatal enterprises, it planned to hold equity in only about 150 entities when all privatization efforts are concluded. At yearend 1990, the Government held equity in less than 275 companies. According to the Comisión de Fomento Minero's general manager, out of 42 mining properties previously owned by the Government, 30 had been sold in recent years, and 4 were in the process of being sold. The Government was planning to retain only eight companies, mainly in strategic materials.

GOVERNMENT POLICIES AND PROGRAMS

On June 6, 1990, the Mexican Government, through the Secretaría de Energía, Minas e Industria Paraestatal (SEMIP), issued a plan (Programa Nacional de Modernización de la Minería 1990-1994) for modernizing the mining sector. The basic plan purposes are to significantly increase mining activity and to increase its contribution to the nation's development. The plan's general objectives are the following:

- Increase mineral exploration by the public and private sectors.
- Revise and modernize the mining legisla-

tion through its decentralization and encourage complementary participation by the public and private sectors.

- Update the tax regime.
- Induce a promoting role by the state and a more direct participation of the domestic private and social sectors, and increased foreign investment in the mining activity.
- Maintain exclusive Government participation in those strategic mineral producing companies as established by the Article 27 of the Mexican Constitution.
- Adequately supply the mining-metallurgical needs of the domestic industry.
- Strengthen the foreign trade of mining products, especially those with higher value added.
- Generate development in economically marginal areas through mining projects.
- Promote better industrial safety conditions and social well-being for the mine workers.
- Establish means for the protection and conservation of the environment that will reduce the pollution created by the mining-metallurgical activity.

The goals of the plan are to achieve a 2.2% to 2.6% annual increase in the nonfuel mineral sector for 1990-91, to achieve an annual increase of 4.5% to 5.0% in the nonfuel mineral sector for 1992-94, to release at least one-half of the 5,067,340 hectares in the National Mining Reserves during 1990-94 to the private sector, and to obtain an annual increase of 3.7% in the mining industry's labor force during 1990-94.

In agreement with the Programa Nacional de Modernización de la Minería 1990-1994, on September 27, 1990, a new regulation to the article 27 of the Mexican Constitution was published by SEMIP in the Diario Oficial de la Federación (official register). The regulation, which became effective on December 10, introduces the possibility of complete foreign control over exploration and production for a limited period of time through the use of fideicomisos (trusts). It also allows the production of some strategic materials such as phosphate rock, potash, and

sulfur by the private sector in a limited partnership with the Government. Other significant changes introduced by the regulation include easier access to land and the simplification of administrative procedures. Because of this, the time for obtaining a mining concession has been reduced significantly to less than 1 year.

For concessionable minerals, the two trusts introduced by the regulation, one for exploration and the other for production, do not require approval outside of SEMIP. The exploration trust is granted for 30 years. The production trust allows foreign control of a company for 12 years. In the 13th year, majority ownership (51%) must return to Mexican hands. The 12 years are counted only after the beneficiating plant is in full commercial production. For phosphate rock, potash, and sulfur, the private sector may now enter into a partnership with the Government in which the private entity has complete control of the operation, the only requirement being to pay royalties and taxes to the Government. On December 26, the *Diario Oficial de la Federación* (official register) published the *Ley Federal de Derechos* to become effective on January 1, 1991. The *Derecho de la Minería* (production tax) was replaced by surface rights on exploration and production assignments and concessions. The fees per hectare, to be paid biannually, were 6,200 pesos per year for exploration assignments and concessions. For production assignments and concessions, payments for metals were 37,000 pesos per year per hectare and 27,000 pesos per year per hectare for industrial minerals (nonmetals), also to be paid in biannual payments. In the case of special assignments and concessions in National Mining Reserves, those awarded for strategic materials (coal, iron ore, phosphate rock, potash, and sulfur), will pay 6,200 pesos per year for the first 4 years and on the following year will pay fees according to the production assignments and concessions for metals or nonmetals, as appropriate.

In addition to the surface taxes aforementioned, some mining companies must pay a water-use tax, which was scheduled to be increased by a factor of 1.9 also on January 1, 1991. The maximum payment, however, would not exceed 1,200 pesos per cubic meter of water. The corporate tax level in Mexico is 35%. *El Derecho de la Minería*, a production tax, was scheduled to be eliminated on January 1, 1991.

In 1990, the Mexican Government removed 612,841 hectares from the National Mining Reserves in the States of Chiapas, Chihuahua, Durango, Guerrero, Hidalgo,

Jalisco, Michoacán, Oaxaca, Puebla, San Luis Potosí, Sinaloa, Sonora, Tamaulipas, and Zacatecas.

PRODUCTION

The value of Mexican nonfuel mineral output plus coal (mining and metallurgical sector) in 1990 was about \$2.5 billion. Nonferrous and precious metals accounted for about 59% and 18% of the total, respectively. Individually, copper was the most important in terms of value (\$760.6 million), followed by zinc (\$515.9 million) and silver (\$359.4 million). In the industrial mineral sector, sulfur, which accounted for 7.7% of the total value (55% of the total industrial mineral value), was the most important in terms of value, followed by salt and fluorspar. The value of many industrial minerals, such as abrasive materials, cement, common clays, diatomite, feldspar, lime, magnesium compounds, mica, nitrogen in ammonia, perlite, sand and gravel, sodium compounds, stone, and talc are not included in this total. During the year, sales of gray portland cement totaled more than \$1.1 billion.

In general, the production of Mexico's leading metal commodities—copper, lead, silver, and zinc—increased, although low silver prices were a concern for the industry during the year. With respect to industrial minerals (nonmetals), production of cement and sulfur also increased, while that of celestite and fluorspar decreased.

Output from the large mining sector remained at about 90% of total production: 60% originated from the private sector and 30% from the parastatal industry. The remaining 10% was produced by the medium and small mining sector. The contribution from the private sector is very likely to increase significantly in the near future as privatization efforts in the mineral-metallurgical sector continue.

Production of crude oil increased mainly in response to the request by the President of the United States for oil exporting nations to increase their output because of Iraq's August invasion of Kuwait. Mexico, the first nation to increase output, averaged a 150,000-barrels-per-day increase from August to yearend.

TRADE

In 1990, total Mexican exports (f.o.b.), which excludes exports from maquiladoras, totaled about \$26.8 billion. Nonfuel minerals plus coal and coke contributed about

6% of export revenues, valued at \$1.58 billion. Relative to total trade, the United States was Mexico's leading trading partner. Other important partners were France, Japan, and Spain. About 70% of Mexico's total exports was to the United States, and about 65% of its total imports was from the United States. The mineral trade between the United States and Mexico was just as important to Mexico. In 1989, the last year for which information was available, about 63% of Mexico's mineral exports went to the United States, while 65% of its mineral imports was from the United States.

Total value of hydrocarbons exports, including refinery products, was \$10 billion (37% of total exports). Mexico's hydrocarbon imports totaled \$972.3 million, therefore, net export earnings were \$9 billion, about 34% of total exports. Crude oil accounted for about 89% of the export earnings, refinery products, 8.1%; and petrochemicals, 2.7%. In terms of volume, Mexico exported 466 million barrels (1.277 million barrels per day) of crude oil to 22 countries. The United States received 56.2% of the total. Spain, Japan, France, and Israel received 16.7%, 11.4%, 4.4%, and 2.3% of the crude exported, respectively. In addition, for the 11th consecutive year Mexico exported 2.7% of its total crude oil to several Caribbean and Central American countries under the San José Accord.

In metals, Mexico was a major exporter of copper, lead, manganese, silver, and zinc. In industrial minerals, it was a major exporter of cement, fluorspar, graphite, gypsum, salt, sodium sulfate, and sulfur.

In June, the Presidents of the United States and Mexico, after meeting in the United States, announced their endorsement of the objective of entering into a free trade agreement between the two countries. In late September, after the President of Mexico officially requested such agreement and the Prime Minister of Canada requested participation in a trilateral agreement, the President of the United States notified the U.S. Congress of his intention of entering into an agreement among the three countries. Negotiations for the proposed agreement, which became known as the North American Free Trade Agreement (NAFTA) had not begun at yearend.

STRUCTURE OF THE MINERAL INDUSTRY

Under the 1917 Mexican Constitution, minerals are considered to be part of the

TABLE 1
MEXICO: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989	1990 ^p
METALS					
Aluminum:					
Primary	37,016	60,200	68,337	71,691	67,515
Secondary	16,432	8,765	4,474	13,172	56,803
Antimony:					
Mine output, Sb content ³	3,337	2,839	2,185	1,906	2,614
Metal (in mixed bars and refined)	1,955	1,602	1,207	1,192	942
Arsenic, white ⁴	5,315	5,304	5,164	5,551	4,809
Bismuth ⁵	749	1,012	958	883	733
Cadmium:					
Mine output, Cd content	1,183	1,249	1,726	1,439	1,414
Metal, refined	719	935	1,117	976	882
Copper:					
Mine output, Cu content ⁶	'184,941	'243,977	'273,544	'253,885	293,620
Metal:					
Blister (primary only)	<u>73,714</u>	<u>126,310</u>	<u>150,334</u>	<u>174,294</u>	<u>175,374</u>
Refined:					
Primary ^{e7}	75,811	114,576	119,097	124,058	131,689
Secondary ^{e8}	<u>13,686</u>	<u>21,185</u>	<u>21,750</u>	<u>22,971</u>	<u>21,150</u>
Total	89,497	135,761	140,847	147,029	152,839
Gold:					
Mine output, Au content kilograms	7,795	7,988	9,098	8,613	8,338
Metal, refined do.	5,885	6,392	6,369	5,919	5,789
Iron and steel:					
Iron ore, mine output:					
Gross weight ⁹ thousand tons	7,298	7,523	8,431	8,141	8,073
Fe content do.	<u>4,817</u>	<u>4,965</u>	<u>5,564</u>	<u>5,373</u>	<u>5,328</u>
Metal:					
Pig iron do.	3,737	3,712	3,678	'3,230	3,665
Sponge iron do.	1,420	1,551	1,686	'2,148	2,525
Total do.	<u>5,157</u>	<u>5,263</u>	<u>5,364</u>	<u>'5,378</u>	<u>6,190</u>
Ferrous alloys:					
Ferromanganese do.	156	161	165	168	186
Silicomanganese do.	61	80	80	99	53
Ferrosilicon do.	18	18	17	9	25
Ferrochromium do.	3	6	9	3	(10)
Other do.	<u>1</u>	<u>1</u>	<u>1</u>	(10)	(10)
Total do.	239	266	272	279	264
Steel, crude do.	7,225	7,642	7,779	'7,851	8,705
Rolled products do.	5,589	5,954	6,207	'5,941	6,462
Forgings and castings do.	'33	'53	'107	'74	80
Lead:					
Mine output, Pb content	182,672	177,161	171,337	163,017	179,947
Metal:					
Smelter:					
Primary	182,021	176,986	171,087	162,478	178,947
Secondary (refined) ^e	<u>33,000</u>	<u>35,000</u>	<u>35,000</u>	<u>35,000</u>	<u>35,000</u>
Total ^e	215,021	211,986	206,087	197,478	213,947

See footnotes at end of table.

TABLE 1—Continued

MEXICO: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989	1990 ^P
METALS—Continued					
Lead—Continued					
Metal—Continued					
Refined:					
Primary (including lead content of antimonial lead)	178,860	173,830	168,093	160,035	167,191
Secondary ^c	33,000	35,000	35,000	35,000	35,000
Total	211,860	208,830	203,093	195,035	202,191
Manganese ore:					
Gross weight ¹¹	458,989	385,282	443,613	394,408	365,395
Mn content	174,416	146,407	168,573	149,875	138,850
Mercury, mine output, Hg content	184	124	345	651	735
Molybdenum, mine output, Mo content	3,350	4,400	4,456	4,189	3,200
Selenium, mine output, Se content	23	29	13	20	12
Silver:					
Mine output, Ag content kilograms	2,303,142	2,414,954	2,358,907	2,306,091	2,346,336
Metallurgical products:					
Impure bars do.	224,670	156,463	247,619	241,211	224,897
Mixed bars do.	66,880	45,257	76,423	83,801	72,809
Metal, refined, primary do.	1,936,518	2,142,280	1,975,996	1,904,286	1,895,527
Other do.	1,088	9,006	16,585	28,251	77,485
Tin:					
Mine output, Sn content	385	369	274	159	5
Metal, smelter, primary	1,488	2,103	1,812	4,752	5,004
Tungsten, mine output, W content	294	213	206	170	183
Zinc:					
Mine output, Zn content	271,351	271,480	262,228	284,058	322,487
Metal:					
Smelter, primary	173,700	—	—	—	—
Refined, primary	172,489	184,755	192,529	193,279	199,295
INDUSTRIAL MINERALS					
Abrasives, natural ¹²	1,458	12,390	15,458	22,022	25,000
Barite	321,186	401,336	534,954	324,739	304,996
Cement, hydraulic thousand tons	19,751	22,347	22,513	22,766	23,824
Clays:					
Bentonite	136,478	129,596	163,916	123,927	144,895
Common	248,351	178,347	158,153	168,000	175,000
Fuller's earth	52,200	49,112	37,226	24,603	29,865
Kaolin	276,427	151,104	162,415	141,519	156,140
Diatomite	36,022	34,708	36,524	44,920	51,064
Feldspar	85,019	106,490	83,170	121,978	163,011
Fluorspar:					
Acid-grade thousand tons	424	291	338	359	268
Ceramic-grade do.	14	—	27	27	11
Metallurgical-grade do.	263	244	253	225	192
Submetallurgical-grade do.	66	189	138	168	163
Total do.	767	724	756	779	634
Graphite, natural:					
Amorphous	36,018	36,674	47,871	38,304	23,916

See footnotes at end of table.

TABLE 1—Continued

MEXICO: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989	1990 ³
INDUSTRIAL MINERALS—Continued					
Graphite, natural—Continued					
Crystalline	1,838	1,787	1,735	1,942	997
Gypsum and anhydrite, crude (yeso)	4,232,805	4,575,416	4,779,827	5,390,391	5,433,804
Lime, hydrated and quicklime ^c thousand tons	¹ 5,545	6,250	¹ 6,000	6,000	6,000
Magnesium compounds:					
Magnesia ¹⁴	99,965	118,332	141,014	125,210	112,280
Magnesite	7,530	7,351	5,384	4,229	579
Mica, all grades	1,748	3,419	6,228	4,510	5,863
Nitrogen: N content of ammonia	¹ 1,602,078	¹ 1,743,346	² 2,067,330	² 2,100,154	2,163,672
Perlite	46,170	39,428	39,169	37,354	42,439
Phosphate rock ¹⁵	746,863	688,973	835,093	655,477	623,481
Salt, all types thousand tons	6,205	6,199	6,788	6,703	7,135
Sodium compounds, n.e.s.:					
Carbonate (soda ash):¹⁶					
Natural ^e	¹ 180,000	¹ 175,000	¹ 176,000	¹ 190,000	190,000
Synthetic ^e	² 225,000	² 242,000	² 245,000	² 267,000	259,000
Sulfate, natural (bloedite) ¹⁷	455,360	488,642	⁴ 30,000	486,000	513,000
Stone, sand and gravel:					
Calcite, common	437,118	486,740	436,183	444,000	451,948
Dolomite	453,861	411,601	340,671	469,564	482,168
Limestone ¹⁸ thousand tons	28,919	23,735	24,741	² 25,232	27,496
Marble	258,000	261,000	468,000	⁵ 24,160	681,408
Quartz, quartzite, glass sand (silica)	886,411	965,921	926,166	1,031,100	¹ 1,000,000
Sand and gravel:					
Sand thousand cubic meters	50,064	52,513	51,904	51,646	55,165
Gravel ^e do.	32,420	34,007	33,477	³ 5,890	39,096
Strontium minerals: Celestite	<u>24,042</u>	<u>47,739</u>	<u>51,626</u>	<u>⁶7,658</u>	<u>66,254</u>
Sulfur, elemental:					
Frasch process thousand tons	1,588	1,806	1,628	1,528	1,441
Byproduct:					
Of metallurgy ^e do.	134	154	240	286	290
Of petroleum and natural gas do.	462	498	510	555	701
Total ^e do.	2,184	2,458	2,378	2,369	2,432
Talc	24,301	17,469	13,645	13,908	13,590
Vermiculite	220	161	² 18	300	132
Wollastonite	9,356	10,993	10,506	10,618	11,442
MINERAL FUELS AND RELATED MATERIALS					
Carbon black (materia prima negro de humo)	<u>543,693</u>	<u>748,124</u>	<u>943,987</u>	<u>1,049,829</u>	<u>¹1,000,000</u>
Coal:					
Run-of-mine:					
Metallurgical thousand tons	7,108	7,014	6,439	5,847	5,544
Steam do.	3,050	4,122	4,147	4,136	4,470
Total do.	10,158	11,136	10,586	9,983	10,014
Washed metallurgical coal do.	<u>3,027</u>	<u>3,026</u>	<u>2,340</u>	<u>2,761</u>	<u>2,850</u>
Coke:¹⁹					
Metallurgical do.	2,594	2,330	2,322	2,260	2,315
Imperial do.	6	6	5	6	6
Breeze do.	4	4	5	4	16
Total do.	2,604	2,340	2,332	2,270	2,337

See footnotes at end of table.

TABLE 1—Continued

MEXICO: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989	1990 ^P
MINERAL FUELS AND RELATED MATERIALS—Continued					
Gas, natural:					
Gross million cubic meters	35,462	36,154	36,046	36,919	37,741
Marketable do.	33,278	33,816	34,512	30,414	34,138
Natural gas plant liquids thousand 42-gallon barrels	<u>117,698</u>	<u>123,116</u>	<u>133,320</u>	<u>139,254</u>	<u>155,575</u>
Petroleum:					
Crude do.	886,092	927,333	⁹ 17,416	917,355	930,023
Lease (field) condensate do.	2,647	2,563	1,857	2,355	1,831
Total do.	<u>888,739</u>	<u>929,896</u>	<u>⁹19,273</u>	<u>919,710</u>	<u>931,854</u>
Refinery products:					
Gasoline:					
Aviation do.	419	418	430	409	372
Motor, leaded and unleaded do.	129,296	134,291	137,044	140,988	153,731
Liquefied petroleum gas do.	66,912	70,306	75,704	79,530	88,639
Jet fuel do.	12,625	15,141	16,495	¹¹ 15,890	18,598
Kerosene do.	9,798	11,009	9,961	9,075	5,778
Distillate fuel oil (diesel) do.	88,521	84,817	75,465	85,518	94,387
Lubricants do.	2,386	2,602	2,842	¹² 2,727	2,678
Residual fuel oil do.	147,974	154,939	154,003	155,832	158,811
Asphalt do.	6,054	6,655	5,463	5,484	5,765
Unfinished crude oil ²⁰ do.	950	660	—	—	—
Unspecified and refinery fuel and losses do.	39,639	38,843	44,667	44,400	43,467
Total do.	<u>504,574</u>	<u>519,681</u>	<u>522,074</u>	<u>¹³539,853</u>	<u>572,226</u>

^PEstimated. ²Preliminary. ³Revised.¹Table includes data available through Feb. 29, 1992.²In addition to the commodities listed, additional types of crude construction materials are produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.³Sb content of ores for export plus Sb content of antimonial and impure bars plus refined metals.⁴Gross weight of white and black (impure) arsenic trioxide.⁵Refined metal plus Bi content of impure smelter products.⁶New series as reported by CAMIMEX. Tonnages reflect a 2.5% metal loss in smelter.⁷Includes cathode copper from the Cia. Mexicana de Cananea S.A. de C.V. electrowinning plant in metric tons as follows: 1986—8,033;⁸Secondary refined copper production is estimated to be 16.8% of the total refined copper produced by Cobre de Mexico S.A.⁹Calculated from reported Fe content on the basis of concentrate and pellets containing 66% iron. Total run-of-mine output in 1986 was just under 15 million tons.¹⁰Less than 1/2 unit.¹¹Calculated from production of Mn content reported by the Consejo de Recursos Minerales.¹²Based on exports, comprised mostly of pumice stone and emery (a granular, impure variety of corundum).¹³Reported figure.¹⁴Reported by Industrias Penoles S.A. de C.V. as the only major producer.¹⁵Includes only output used to manufacture fertilizers.¹⁶Total sodium carbonate reported by Asociacion Nacional de la Industria Quimica.¹⁷Series reflects output reported by Industrias Penoles plus an additional 30,000 tons estimated production by smaller producers.¹⁸Excludes that for cement production.¹⁹Includes coke made from imported metallurgical coal.²⁰Specified by PEMEX as "virgin stock-28" and processed at its refineries primarily for export.

patrimony of the nation. The Government awards concession for the exploration and exploitation of nonfuel minerals. In most cases, foreign participation in the nonfuel mineral sector is limited to 49% ownership. The 1961 Mining Law limited foreign participation in the mining of iron ore, phosphate rock, potassium, and sulfur to 34%. The 1975 Mining Law gave the Government more control over mining activities. It also gave exclusive rights in the

exploration and the production of iron ore, phosphate rock, and potassium to the Government. In 1990, a new regulation was issued by SEMIP, which among other things, allowed more flexibility in foreign ownership through exploration and production trusts under the 1975 mining law (see Government Policies and Programs).

In 1990, the nonfuel mineral sector in Mexico was formed by Government-owned

companies, privately owned companies, companies with the Government as a majority partner, companies with the Government as a minority partner, and companies with foreign equity participation.

The Government's participation in the mineral sector continued to be strong under the policy guidance and coordination of SEMIP. Three SEMIP autonomous agencies, Comisión de Fomento Minero (CFM), Consejo de Recursos Minerales (CRM), and

Fideicomiso de Fomento Minero (FFM), formerly the Fideicomiso de Minerales No-Metálicos (FMNM), operated in the production, exploration, and development of the mining sector. CFM was founded in 1934 with the objective of promoting the mining activity through financial support, technical advice, and assistance to the medium and small mining sector. It was also responsible for constructing and operating regional mineral beneficiating plants and mineral research facilities. CRM, formed in 1976, was given the responsibility for mineral exploration and statistics. FMNM's functions were to promote the development, mining, and processing of the industrial minerals (nonmetal) sector. In 1990, both CFM and FFM participated in the production of minerals through majority or minority ownership of mineral companies. During the year, management of CFM and FFM was merged.

The Dirección de Minas, as part of SEMIP's Subsecretaría de Minas e Industria Básica, had control of mineral concessions and the minerals register, as well as responsibility for updating and revising the mining law and regulations.

Other organizations helped shape the Mexican mining industry. One of them, Cámara Minera de México (CAMIMEX), promoted the interest of the mining industry and was a way for industry and Government to communicate and cooperate. In this industry group, both the private and Government companies were represented. One union represented the mineral industry workers, the Sindicato Nacional de Trabajadores Mineros, Metalúrgicos y Similares de la República Mexicana. In addition, various professional associations complemented the industry.

In the private sector, four large and diversified companies dominated the production of nonfuel minerals. These were Corporación Industrial Sanluis S.A. de C.V. (Sanluis), Empresas Frisco S.A. de C.V. (Frisco), Grupo Industrial Minera México S.A. de C.V. (Grupo IMMSA), and Industrias Peñoles S.A. de C.V. (Peñoles).

Direct employment in the mining sector, at less than 250,000, was less than 1% of the 26 million estimated work force.

The production of crude oil, natural gas, and basic petrochemicals was reserved for the Government operating through Petróleos Mexicanos (PEMEX), the Government-owned monopoly. PEMEX, in 1990, also operated 9 refineries and 21 basic petrochemical complexes throughout the country. PEMEX was organized into eight

subdirectorates, as follows: construction, primary production, industrial transformation, sales, finances, administration, planning, and petrochemicals. The petrochemicals subdirectorate was created in 1990 to consolidate petrochemical activities previously dispersed throughout the company. Enterprises affiliated with PEMEX were regulated and controlled by different subdirectorates. Among them, under the Petrochemical Subdirectorate, were the following: Distribuidora de Gas Natural del Estado de México S.A., (for the distribution of natural gas in the Mexico Valley) owned by PEMEX (51%) and the Government of the State of Mexico (49%); Distribuidora de Gas de Querétaro S.A. (distribution of natural gas in the City of Querétaro) owned by PEMEX (96%); and Cloro de Tehuantepec S.A. de C.V. (manufactures chlorine, caustic soda, and sodium carbonate and its derivatives in Pajaritos, State of Veracruz) owned by PEMEX (20%) and Química Penwalt S.A. de C.V. (80%). Under the Subdirectorate of Primary Production was the Compañía Mexicana de Exploraciones S.A. (exploration). Under the Subdirectorate of Marketing was the Compañía Operadora de Estaciones de Servicio (service stations), which operated 30 service stations. Petróleos Mexicanos Internacional (Grupo PMI) was formed in 1988-89 to market crude oil and refinery products and provide market and financial services, and analysis internationally. In 1990, the companies within Grupo PMI were the following: PMI Holdings N.V. in Curaçao, PMI Holdings B.V. and PMI Services B.V. in Amsterdam, PEMEX Services North America Inc. in Houston, PEMEX Services Europe Ltd. in London, and PEMEX Internacional España S.A. in Madrid. In 1990, through its subsidiary PMI Holdings B.V., PEMEX acquired part of the Spanish company Repsol S.A. in exchange for stock it owned of Petróleos del Norte S.A. (Petronor). Direct employment in PEMEX at yearend was about 170,000.

COMMODITY REVIEW

Metals

Copper.—Copper mine production in 1990 increased more than 15% from that of 1989 to 293,620 tons. Mexicana de Cobre was the leading producer with 53.5% of total output, from its La Caridad Mine, followed by Mexicana de Cananea S.A. de C.V. (until September Cía Minera de Cananea) with 35.1%. In 1989, Mexicana de Cobre and Cananea had produced 55% and 33% of

the total copper produced in Mexico, respectively. In 1990, most of the copper was produced in the State of Sonora (89.5%), where the largest three mines, La Caridad, Cananea, and Cumobabi, are. Other important copper-producing States were, in order of output, Zacatecas (4.8%), Chihuahua (3.1%), San Luis Potosí (0.8%), Querétaro (0.6%), and Hidalgo (0.3%).

Smelter output increased very slightly from 174,294 tons in 1989 to 175,374 tons in 1990. Output was from Mexicana de Cobre (62.7%); Mexicana de Cananea (22.8%); and Industrial Minera México (14.5%), a subsidiary of Grupo IMMSA and ASARCO Incorporated.

Mexico produced 152,839 tons of refined copper, about a 4% increase from that of 1989. The Cobre de México refinery accounted for 125,894 tons, and Mexicana de Cananea produced 26,945 tons of electrolytic copper. Cobre de México received 57,661 tons of copper anode from Mexicana de Cobre and 40,000 tons of blister copper from Mexicana de Cananea.

Production from the Cumobabi Mine, a subsidiary of Empresas Frisco S.A. de C.V. (Frisco) in the State of Sonora, was reduced significantly, according to the parent company's annual report because of decreased reserves. A significant increase in stripping ratio has made the operation uneconomic. Therefore, Frisco planned to close Cumobabi's mining operations by mid-1991 and begin an extensive exploration program in the area, as well as a study on the possibility of copper leaching.

On September 26, the Cananea Mine and metallurgical complex was purchased by Mexicana de Cobre S.A. de C.V. (76%), ACEC Union Minière S.A. of Belgium (21%), and others, principally the workers union, (3%). Reportedly, the purchase price was \$475 million. The former company, Cía Minera de Cananea, became bankrupt and was seized by the army in 1989. From September 27 through December 31, 1990, the new company, Mexicana de Cananea, produced 9,986 tons of blister copper and 9,130 tons of refined copper. According to the Grupo IMMSA's company report, Mexicana de Cananea purchased 20 new trucks with a 170-ton capacity each and another with a 240-ton capacity. The company planned to increase output and efficiency from the mine and metallurgical complex.

Industrias Unidas S.A. (IUSA) purchased a previously used refinery from Japan. IUSA planned to open the refinery in Huejotitlan, State of Mexico, in mid-1991.

TABLE 2

MEXICO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Major commodity	Major operating companies	Location of main facilities	Annual capacity
Aluminum	Aluminio S.A.	Smelter at Veracruz, Ver.	94.
Antimony	Cía. Minera y Refinadora Mexicana S.A.	San José Mine, Catorce, S.L.P.	NA.
Barite	Barita de Sonora S.A.	Mazatán, Son.	165.
Do.	Minera Capela S.A.	La Minita Mine, Mich.	150.
Cement	Cementos Mexicanos S.A.	Antotonilco, Hgo.; Huichapán, Hgo.; México, D.F.; Mixcoac, Mex.; Monterrey, N.L.; Tamuín, S.L.P.; Tolteca, Hgo.; and Torreón, Coah.; Valles, S.L.P.; Zapotiltic, Jal.	¹ 24,300.
Do.	Cementos Cruz Azul S.C.L.	Cruz Azul, Hgo. Laganeas, Oax.	3,900.
Do.	Cementos Apasco S.A.	México, Tabasco	2,600.
Coal	Minerales Monclova S.A.	Mimosa, Palau Mines, Muzquiz Washing Plant at Palau, Coah. and Coking Plant at Monclova, Coah.	2,500.
Do.	Minera Carbonífera Río Escondido S.A. (MICARE) ²	Mina I, Mina II, and Tajo I at Nava and Piedras Negras, Coah.	4,000.
Copper	Mexicana de Cobre S.A.	La Caridad Mine and smelter Nacozari de García, Son.	150.
Do.	Mexicana de Cananea S.A.	Mine-smelter at Cananea, Son.	170.
Ferrous alloys and manganese	Cía. Minera Autlán S.A.	Mines at Molango and Nonoalco, Hgo. Plants in Puebla and Tamos, Ver.	500 (manganese). 185 (ferrous alloys).
Fluorspar	Cía. Minera Las Cuevas S.A.	Salitrera (Zaragoza), S.L.P.	570.
Do.	Fluorita del Río Verde S.A.	Río Colorado and Río Verde Mines, S.L.P.	160.
Gold	Cía. Fresnillo S.A.	Fresnillo Mine, Zac.	³ 1,866.
	Minas de San Luis S.A.	Tayoltita, Durango	³ 1,400.
Graphite	Grafitos Mexicanos S.A.	Lourdes and San Francisco Mines, Son.	60.
Gypsum	Cía. Occidental Mexicana S.A. Island, B.C.S.	Santa Rosalia on San Marcos	1,500.
Lead and zinc	México Desarrollo Industrial Minero S.A. de C.V.	Charcas, S.L.P.; San Martín, Zac.; Santa Eulalia, Chih.; Taxco, Gro.; Rosario, Sin.; Lead smelter at Chih., lead refinery at Monterrey, N.L., zinc refinery at S.L.P.	70 (lead). 150 (zinc).
Do.	Industrias Peñoles S.A.	La Encantada, Coah.; La Negra, Que.; Fresnillo, Zac.; Naica, Chih. mines. Metallurgical complex at Torreón with silver, lead, and zinc smelters and/or refineries operated by Met-Mex Peñoles	50 (Lead). 60 (Zinc).
Molybdenum	Mexicana de Cobre S.A.	La Caridad Mine, Molybdenum Plant, Son.	6.
Do.	Minera Cumobabi S.A. de C.V.	Cumpas, Son.	2.
Petroleum ⁴	Petróleos Mexicanos (PEMEX)	Comalcalco, Poza Rica, and Golfo de Campeche districts	³ 3,500.
Salt	Exportadora de Sal S.A. (ESSA)	Solar salt complex at Guerrero Negro, B.C.S.	6,000.
Silver	Industrias Peñoles S.A. C.V. ⁶	Naica, Chih.; Fresnillo, Zac.; Las Torres, Gto., Cuale, Jal. La Negra, Gro; La Encantada, Coah.; La Minita, Mich. Refinery at Torreón, Coah.	³ 654,000.
Do.	México Desarrollo Industrial Minero S.A.	San Martín Mine, Sombrerete, Zac.; Taxco, Gro.; Charcas, S.L.P. Santa Eulalia, Chih. Refinery at Monterrey, N.L.	³ 467,000.

See footnotes at end of table.

TABLE 2—Continued

MEXICO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Major commodity	Major operating companies	Location of main facilities	Annual capacity
Silver	Minera Real de Angeles S.A. de C.V.	Open pit mine and concentrator at Noria de Angeles, Zac.	³ 373,000.
Sodium carbonate	Sosa Texcoco S.A.	Lake Texcoco, Mex. from subsurface brines	200.
Sodium sulfate	Química Magna S.A. Coah.	Subsurface brines at Laguna del Rey,	350.
Steel	Altos Hornos de México S.A. (AHMSA)	Steelworks at Monclova, Coah. Iron ore from La Perla and Hércules Mines	3,900.
Do.	HYLSA S.A.	Direct-reduction units at Monterrey, N.L. and Puebla; Cerro Nahuatl iron ore mine in Col.	1,800.
Do.	Siderúrgica Lázaro Cárdenas—Las Truchas S.A. (SICARTSA)	Port of Lázaro Cárdenas, Mich.	1,300.
Iron ore	Consorcio Minero Benito Juárez-Peña Colorada	Peña Colorada Mine, and pellet plant near Manzanillo, Col.	3,000.
Do.	Siderúrgica Lázaro Cárdenas-Las Truchas S.A.	Ferrotepec, Volcán, and Mangó deposits in Las Truchas project area, and pellet plant, Mich.	1,900.
Strontium (celestite)	Cía. Minera La Valenciana	San Agustín Mine, Coah.	50.
Sulfur	Azufrera Panamericana S.A. (APSA) ⁷	Coachapa, Patapa, Jaltipán, Ver.	1,230.
Do.	Cía. Exploradora del Istmo S.A.	Texistepec, Ver.	750.
Tin ⁸	Metales Potosí S.A.	San Luis Potosí, S.L.P.	6.4.
	Estaño Electro S.A.	Tlalnepantla, México, D.F.	1.3.
Do.	Fundidora de Estaño S.A.	San Luis Potosí, S.L.P.	1.2.

State abbreviations: Baja California Sur (B.C.S.), Chihuahua (Chih.), Coahuila (Coah.), Colima (Col.), Durango (Dgo.), Guerrero (Gro.), Hidalgo (Hgo.), Jalisco (Jal.), Mexico (Mex.), Michoacán (Mich.), Nuevo León (N.L.), Oaxaca (Oax.), Querétaro (Qro.), San Luis Potosí (S.L.P.), Sinaloa (Sin.), Sonora (Son.), Veracruz (Ver.), and Zacatecas (Zac.).

¹Includes capacities from Cementos Tolteca and Cementos Anahuac.

²Only significant producer.

³Kilograms.

⁴Thousand 42-gallon barrels per day.

⁵In 1990, PEMEX operated nine refineries with an installed capacity of 1.68 million barrels per day.

⁶Includes capacity from Cía Fresnillo S.A. de C.V.

⁷Handles all exports of sulfur including sulfur recovered by PEMEX.

⁸Smelter output from mostly imported concentrated.

Reportedly, Cobre de Pasteje, which was purchased for about \$25 million, will add 60,000 tons per year to Mexico's refined copper capacity. In 1990, Mexico's only other refinery, Cobre de México, had a capacity of 180,000 per year. Cobre de México, owned by Nacional Financiera (48%), Mexicana de Cananea (15%), and six other companies that use the refined copper, also planned to expand its refining capacity to 200,000 tons per year.

Copper reserves of the two most important mines in Mexico were reported at levels of 1,500 million tons of ore with 0.393% copper for La Caridad Mine and for Cananea, 1,677 million tons with 0.618% copper for concentrate to be smelted, plus 860 million with 0.250% copper for electrowinning.

Gold.—Most of the gold produced in Mexico was as a byproduct of silver ores, and the country was a modest producer of gold. However, interest in gold exploration has increased significantly as a result of the new mining regulations published in 1990 by SEMIP. During the year, production decreased by 3% to 8,338 kilograms, less than 0.5% of world output. The leading gold producer was Peñoles, with about 26% of total national output. Guanajuato continued to be the leading producing State, contributing to about one-third of the national volume of production, followed by Durango and Sinaloa.

Iron and Steel.—Production of pig iron and directly reduced (sponge) iron in

Mexico increased 13% and 18%, respectively, to 3.7 million tons and 2.5 million tons. Mexico was the second largest producer of steel in Latin America after Brazil. Together, Brazil and Mexico produced more than 75% of the Latin American output. Mexico's share of the Latin American output was about 22%. Mexican production of crude steel represented about 1% of the world total. Mexico's production of crude steel increased almost 11% from that of 1989, the same trend observed in the construction industry, which increased 7.7%. It was the only important Latin American steel producer that had a production increase during the year. About 56% of steel production was from Altos Hornos de México S.A. (AHMSA) and Siderúrgica Lázaro Cárdenas-Las Truchas S.A.

(SICARTSA), both controlled by the Government-owned parastatal Siderúrgica Mexicana (SIDERMEX). Those two companies, however, controlled their own marketing and administration. In the private sector, the leading producer was Hylsa de México S.A. (HYLSA) in Monterrey, with an output of 1.8 million tons, second only to AHMSA, which produced about 3 million tons. Tubos de Acero de México S.A. (TAMSA), with facilities in Veracruz and headquartered in Mexico City, was the fourth largest producer of crude steel with an output of 503,000 tons. TAMSA's most important domestic client was PEMEX.

In terms of process, 51% of crude steel was produced by electric furnace, 41% was produced by basic oxygen furnace (B.O.F.), and 8% was produced by open hearth.

Mexico exported about 1.5 million tons of semifinished and finished steel products with a value of \$742 million, while it imported 1.1 million tons of semifinished and finished products with a value of \$900 million. Exports of semifinished and finished products in 1989 were (revised) 1.4 million tons valued at \$843 million. Imports of semifinished and finished products in 1989 were (revised) 884,000 tons valued at \$730 million.

According to the Cámara Nacional de la Industria del Hierro y del Acero (CANACERO), Mexico planned to increase its crude steel output to 9.2 million tons in 1991 through an increase in the production level from SICARTSA II, which would exceed the 1-million-ton level. Plans also included an increase of 10% in the export level of semifinished and laminated products.

At yearend, the Government-owned SIDERMEX was one of the companies awaiting privatization.

Lead and Zinc.—Mine production of lead and zinc increased about 10% and 14%, respectively, from that of 1989. Both metals continued to be important to the Mexican mining industry. Mine production of zinc ranked second in terms of value after copper, ahead of silver. Mine production of lead ranked fifth in terms of value, ahead of gold. Mexico produced 5% of the world mine output of lead and 4% of world output of zinc, ranking sixth in the production of zinc and seventh in the production lead. Most of the production of lead and zinc was associated with the production of silver. The leading producers of lead and zinc were Frisco, IMMSA, and Peñoles, together producing about 81% of the zinc and 82% of

TABLE 3
MEXICO: PRODUCTION OF CRUDE STEEL, BY COMPANY
(Thousand metric tons)

Company	1988	1989	1990 ^P
Government-owned companies:			
Siderúrgica Mexicana (SIDERMEX) Group			
Altos Hornos de México S.A. (AHMSA)	3,083	2,862	3,096
Siderúrgica Lázaro Cárdenas-Las Truchas S.A. (SICARTSA)	1,131	1,336	1,802
Total	4,214	4,198	4,898
Private companies:			
Tubos de Acero de México S.A. (TAMSA)	540	468	503
Hylsa de México S.A. (HYLSA)	1,710	1,812	1,875
Others	1,315	1,373	1,429
Total	3,565	3,653	3,807
Grand total	7,779	7,851	8,705

^PPreliminary.

Source: Cámara Nacional de la Industria del Hierro y del Acero, Informe Anual 1990, México, D.F.

TABLE 4
MEXICO: PRODUCTION OF FINISHED STEEL, BY PRODUCT TYPE
(Thousand metric tons)

Product type	1988	1989	1990 ^P
Castings and forgings	107	74	80
Rolled products:			
Flat-rolled	2,531	2,580	2,685
Nonflat products	3,335	3,006	3,447
Seamless tubes	341	355	330
Total	6,314	6,015	6,542

^PPreliminary.

Source: Cámara Nacional de la Industria del Hierro y del Acero, Informe Anual 1990, México, D.F.

the lead output in Mexico. Frisco was the leading producer of lead. Together, Frisco's subsidiaries, Minera Real de Angeles S.A. de C.V. and Minera Francisco del Oro S.A. de C.V., produced about one-third of the total lead and 20% of the zinc output. Grupo IMMSA, in a joint venture with ASARCO Incorporated, was the leading producer of zinc in Mexico. During the year, their subsidiaries, through México Desarrollo Industrial Minero S.A. de C.V. (MEDIMSA), produced 47% of the zinc and 23% of the lead. Peñoles produced 23% of the lead and 13% of the zinc. The five leading States in the production of lead in 1989, the last year for which information was available, were Chihuahua, Zacatecas, Durango, Hidalgo, and San Luis Potosí. Exports of lead (in all forms) during that year were mainly destined to the United States, Japan, the United Kingdom, Italy, and North Korea. Also in 1989, the five leading States in the production

of zinc were Chihuahua, Zacatecas, San Luis Potosí, Guerrero, and Hidalgo. The three leading recipients of Mexican zinc in all forms were the United States, the United Kingdom, and the Federal Republic of Germany (the Eastern states).

Silver.—Although silver in recent years has decreased in relative importance in Mexico's mineral sector, falling third behind copper and zinc in terms of production value, the country continued to be the world's leading producer of silver in 1990. Mine production was 2.346 million kilograms, about 16% of the total world output. This represents a very slight increase from production levels of 1989, when output was 2.306 million kilograms. The top producers were Peñoles (793 tons), Frisco (413 tons, 294 of which was from Real de Angeles S.A. de C.V.), and Grupo IMMSA (366 tons). Real de Angeles, a Frisco-Placer Development Ltd. joint venture in Noria de Angeles, State of Zacatecas, continued to be Mexico's largest individual silver producer.

In December, the Tayoltita Mine owned by Grupo Sanluis in the State of Durango, was closed because of low silver prices and labor problems. The mine, of tremendous historical significance, produces doré bars with 95% silver and 2% gold. At yearend, the company, the Federal and State Governments, and the worker's union were looking at options for reducing production costs in order to resume mine operations. Production from the Grupo Sanluis in 1990 was about 68 tons of silver.

Industrial Minerals

Cement.—Mexico was the 13th largest producer of cement in 1990. With 29 plants,

it produced 2% of the world's cement. As an important part of the Mexican economy, cement sales during the year totaled \$1.1 billion. Cementos Mexicanos S.A. de C.V. (CEMEX) was the leading producer of cement with about 70% of national capacity of about 30 million tons. Other producers included Cemento Cruz Azul S.C.L., Cementos Apascos S.A., and nine independent producers. At yearend, work at CEMEX's new plant in Sonora and the expansion at the Hermosillo plant was nearing completion.

Twenty percent of Cementos Tolteca S.A., a four-plant subsidiary purchased by CEMEX in 1989, was purchased by Japanese and South Korean interests, which planned to reopen the Hidalgo plant and export cement to Africa and Thailand.

From 1987 to 1989, Mexico replaced Canada as the leading exporter of cement to the United States. In 1990, Canada was again the leading exporter of cement to the United States, followed by Mexico. Mexican cement exports to the United States decreased from about 3.9 million in 1989 to 3.2 million in 1990.

In August 1990, the U.S. International Trade Commission determined that clinker and gray portland cement from Mexico was being sold in the United States at less than fair market value and applied a countervailing duty of about 50%.

Sulfur.—Two companies with large Government equity participation, Azufrera Panamericana S.A. (APSA) and Cía. Exploradora del Istmo S.A. (CEDI), produced 1.4 million tons of Frasch sulfur in 1990. PEMEX produced 701,000 tons as a byproduct of petroleum and natural gas operations, and 290,000 tons was produced as a byproduct of metallurgical operations. APSA was owned by the Government through Comisión de Fomento Minero (55.33%), Nacional Financiera S.N.C. (40.65%), Banco Nacional de México S.N.C. (4.00%), Roca Fosfórica Mexicana S.A. (0.01%), and Minera Carbonifera Río Escondido (0.01%). CEDI was owned by the Government entities Comisión de Fomento Minero (51%) and Fertilizantes Mexicanos (13%), and by Texas Gulf Inc. (34%), and 2% by two Mexican private concerns. APSA and CEDI employed 4,272 people as of December 1990, but projected employment for 1991 was 3,861. According to APSA-CEDI consolidated report (1990-91), APSA's 1990 productivity was 260 tons per employee with sales of \$488.8 per employee, at a capacity utiliza-

tion of 53.6%. CEDI's productivity was 520 tons per employee with sales of \$550.2 per employee at a capacity utilization of 85.9%. During the year, APSA operated at a loss.

About 65% of the sulfur produced by APSA and CEDI was for export. In addition, APSA handled all sulfur exports for PEMEX.

Mineral Fuels

Hydrocarbons output continued to dominate Mexico's energy sector. Production of crude oil and natural gas in 1988 (the last year for which energy source information was available) represented about 90% of all energy produced compared with that of 1975, when hydrocarbons accounted for about 80% of the total. In 1988, the remaining 10% of primary energy produced was from coal (1.6%), firewood and sugar cane (4.9%), geothermal (0.9%), and hydroelectric (2.6%) sources.

Coal.—Production (run of mine) of steam and metallurgical coal increased very slightly from that of 1989 to 10 million tons. Minera Carbonifera Río Escondido (MICARE), the principal coal producer in Mexico, owned by Comisión de Fomento Minero (32.91%), the national electric company—Comisión Federal de Electricidad (CFE) (48.14%), Nacional Financiera (18.92%), Altos Hornos (0.02%), and IMMSA (0.01%), was scheduled for privatization.

Natural Gas and Petroleum.—The extraction of oil and natural gas, the refining of oil, the manufacturing of basic petrochemical products, and the distribution of petroleum and petroleum products are activities reserved for the Mexican Government through PEMEX.

Worldwide, Mexico, at yearend 1990, ranked ninth and sixth in the production of natural gas and oil, respectively. In terms of reserves, it ranked 8th for oil and 13th for natural gas. Internationally, PEMEX, in 1989, (as a company) ranked second in the production of crude and fifth in the production of natural gas. The company, in terms of sales, was 15th worldwide, with a total of \$13 billion. In 1990, Mexican production of oil, including lease (field) condensate, increased slightly, mostly as the result of increased production during the last 4 months of the year, when Iraq invaded Kuwait. Mexico was the first oil-producing country that increased its crude oil production (by about 150,000 barrels per day)

when the United States urged oil exporting countries to increase output. Mexican output of natural gas increased about 2%. However, production of marketable natural gas increased significantly, about 12% from that of 1989. Total production of refinery products increased about 6%.

For administrative purposes and to further reporting simplification, Mexico's national territory has been divided into three regions, North, South, and Marine. The North Region includes the Northeast Frontier, North, South, Poza Rica, and the Papaloapán Basin producing Districts. The South Region includes the Agua Dulce, El Plan, Nanchital, Ciudad Pemex, Comalcalco, and Villahermosa Districts. The Marine Region refers to the Bay of Campeche. Oil- and gas-producing fields are found in each of the Districts. The most important producing regions in 1990, the Marine and South Regions, produced 70% and 26% of the total Mexican crude oil, respectively. Those two regions also dominated the production of natural gas. The South Region, mostly the Villahermosa District, produced 56% of the natural gas output in 1990. The Marine Region (Bay of Campeche) accounted for 31% of total natural gas output for the year.

In 1990, Mexico completed 43 exploration wells, of which 10 had oil and 4 had natural gas. The remainder was unproductive. This number represents one more exploration well than in 1989, with the same number of productive wells. PEMEX planned to increase the number of exploration wells to 60 in 1991. According to PEMEX, yearend 1990 (January 1, 1991) proven hydrocarbon reserves was 65.5 billion barrels, a slight increase (about 1%) from that of yearend 1989. About 56% of the oil, 44% of the condensate, and 16% of the gas reserves are found in the Marine Region.

In 1990, PEMEX's affiliate, PMI Comercio Internacional S.A. de C.V. (PMI), completed its first year of operation. PMI, owned by PEMEX (85%), NAFIN (7.5%), and BANAMEX (7.5%), was created to carry out PEMEX's international activities.

Reserves

Most of the minerals reserves data were developed between the U.S. Bureau of Mines Divisions of Mineral Commodities and Resource Evaluation based on the definitions by the U.S. Bureau of Mines and the U.S. Geological Survey as published in the Geological Survey Circular 831, 1980.

TABLE 5
MEXICO: PROVEN HYDROCARBON RESERVES

(Million 42-gallon barrels unless otherwise specified)

Region	Dry natural gas (billion cubic meters)	Liquid hydrocarbons				1989 total	1989 total
		Crude oil	Condensate	Dry natural gas-liquid equivalent			
1989 total	2,060	45,250	6,733	14,467	66,450	XX	
1990:							
Marine (Bay of Campeche)	321	25,195	2,968	2,264	30,677	30,427	
North ¹	1,050	12,300	1,797	7,365	21,744	21,462	
South ²	654	7,065	1,973	4,573	14,029	13,611	
Total	2,025	44,560	6,738	14,202	XX	65,500	

XX Not applicable.

¹Includes North, South, and Northeastern Frontier, Poza Rica, and Papaloapán Basin Districts.

²Includes Agua Dulce, El Plan, Nanchital, Comalcalco, Villahermosa, and Ciudad PEMEX Districts.

Source: Petróleos Mexicanos S.A., Statistical Yearbook 1990, México, D.F.

TABLE 6
MEXICO: PETROLEUM AND NATURAL GAS PRODUCTION

Region and district	Natural gas (million cubic meters)			Crude oil ¹ (thousand 42-gallon barrels)		
	1988	1989	1990	1988	1989	1990
North region:						
Northeastern Frontier	2,478	2,460	2,543	73	110	73
North	466	424	434	8,857	8,505	9,235
South	218	196	206	6,588	6,424	6,132
Poza Rica	550	506	465	20,935	19,382	18,360
Papaloapan Basin	591	1,044	1,261	1,757	1,679	4,088
Total ²	4,301	4,630	4,909	38,210	36,099	37,887
South region:						
Agua Dulce	736	692	734	15,299	14,929	14,308
El Plan	497	465	486	9,773	7,629	6,826
Nanchital	31	21	31	1,355	1,314	1,314
Ciudad PEMEX	1,700	1,809	2,201	73	37	73
Comalcalco	135	145	165	4,576	4,490	4,782
Villahermosa ³	18,261	18,005	17,664	230,726	217,102	210,131
Total ²	21,360	21,137	21,281	261,800	245,499	237,433
Marine region:	10,384	11,152	11,555	617,406	635,757	654,701
Grand total ²	36,046	36,919	37,741	914,416	917,355	930,023

¹Does not include condensate.

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

³Referred to as Mesozoic.

Source: Petróleos Mexicanos, Statistical Yearbook 1990, México, D.F.

The term reserves refers to economic reserves.

Mexico ranked second in reserves of graphite and silver (tied with Canada), with about 15% and 13% of total world reserves, respectively. The country was among the top five reserve holders of antimony (4%), bismuth (9%), cadmium (7%), fluor spar (9%), mercury (4%), selenium (5%), soda ash (0.7%), and sodium sulfate (5%). In reserves of lead and zinc, Mexico ranked sixth each (4% each). It also ranked seventh in reserves of molybdenum (1.6% of world

reserves) and eighth for copper and manganese (less than 0.5%), respectively. Mexico had 5% of sulfur reserves, ranking eighth in the world. World reserves of antimony, bismuth, and fluor spar excluded those of the United States.

INFRASTRUCTURE

Mexico had 20,680 km of railroads, 19,950 km of which was 1.435-meter gauge and 730 km of 0.914-meter gauge. It contained 210,000 km of roads, of which 65,000

km was paved, 30,000 km was semipaved or cobblestone, 60,000 km was rural roads (improved dirt), and 55,000 km was unimproved dirt. The country had 11 ports and 2,900 km of navigable rivers and coastal canals. Of the country's 64 ships in the merchant marine, at least 44 were available for the transportation of mineral products. PEMEX had 35 ships in its fleet, 11 of which were at least 20 years old and 2 that were commissioned in 1989. Capacity utilization in 1990 was 74%.

Most ore and metallurgical products in

TABLE 7

MEXICO: RESERVES OF SELECTED MINERAL COMMODITIES—YEAREND 1991

(Thousand metric tons unless otherwise specified)

Mineral ¹	Reserves
Antimony	181
Barite	7,000
Bismuth	metric tons 10,000
Cadmium	do. 35,000
Copper	14,000
Fluorspar ²	19,000
Gas, natural ³	billion cubic meters 2,025
Graphite, natural	3,100
Lead	3,000
Manganese	3,600
Mercury	metric tons 5,000
Molybdenum	do. 90,000
Petroleum, crude ³	million 42-gallon barrels 44,560
Salt	Large
Selenium	metric tons 4,000
Silver	do. 37,000
Sodium carbonate, natural	180,000
Sodium sulfate, natural	165,000
Sulfur ⁴	75,000
Zinc	6,000

¹All metals expressed in metal content.²Measured as 100% calcium fluoride.³Yearend 1990. Source: PEMEX Statistical Yearbook 1991.

Mexico were transported by truck. Railroads were used mainly for bulk items such as iron ore, coal, and coke. Gray portland cement was transported by railroads (26%), by roads (63%), and by ship (13%). About 65% of the cement was sold in bulk.

Crude oil and natural gas are transported mainly through pipelines within Mexico. Of the nine refineries, eight receive crude oil by pipeline. By law, only PEMEX may own pipelines to distribute oil and oil products in Mexico. At yearend 1990, PEMEX owned and operated almost 60,000 km of pipelines. About 26,000 km of the pipelines was for the collection of hydrocarbons at the wellhead. Of the 403 specialized pipelines, 98 (about 12,300 km) were used for gas, 53 (about 5,000 km) for crude oil, 118 (about 9,500 km) for refinery products, 68 (1,414 km) for petrochemicals, 24 (196 km) for fuel oil, and 34 (224 km) for other purposes. In general, there were 5 pipelines under construction, 10 inoperative, and 6 in size reduction or change of operating classification.

OUTLOOK

In recent years, the Government of Mexico has implemented fiscal and economic programs aimed at reducing inflation and promoting sustained economic growth, particularly in the mining sector. Among the programs introduced in 1990 was the new mining regulation, which in agreement with other programs, attempted to increase interest of domestic and foreign investors in the mining sector, without changing the mining law, through exploration and production trusts (fideicomisos).

Another significant step taken by the Government in recent years has been the privatization of Government-held corporations. Many of the mineral-producing companies have been privatized recently or were on the block waiting privatization, and this process was expected to continue. Foreign ownership was allowed in the cement and steel industries.

According to Mexican Government officials, Mexico needed to increase its exploration program to sustain or increase output levels. The country planned to increase mining output by 2% to 2.6% by 1991 and by 4.5% to 5% by 1994. All Government programs were aimed at facilitating mining activities by simplifying administrative procedures, opening more areas for exploration, and modernizing the tax regime.

¹Where necessary, values have been converted from Mexican pesos (Mex\$) to U.S. dollars at the rates of Mex\$2,453=US\$1.00 and Mex\$2,827=US\$1.00 for the years 1989 and 1990, respectively.

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Paraestatal
Ave. Insurgentes Sur 552
Colonia Roma Sur
06140, México, D.F., México

Secretaría de Energía, Minas e Industria
Paraestatal
Dirección General de Minas
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06720 México, D.F., México

Consejo de Recursos Minerales
Blvd. Felipe Angeles
Carretera México-Pachuca, Km. 93.5
42000 Pachuca, Hidalgo, México

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Puente de Tecamachalco 26

Lomas de Chapultepec
11000 México, D.F., México

Fideicomiso de Fomento Minero
(formerly Fideicomiso de Minerales No-Metálicos)
Puente de Tecamachalco 26
Lomas de Chapultepec
11000 México, D.F., México

Cámara Minera de México
Sierra Vertientes 369
Lomas de Chapultepec
11000 México, D.F., México

Cámara Nacional de la Industria del Hierro y del Acero, A.C.
Amores 338
Colonia del Valle
03199 México, D.F., México

Cámara Nacional del Cemento, A.C.
Leibnitz 77
Colonia Anzures
11590 México, D.F., México

Instituto Mexicano del Aluminio, A.C.
Francisco Petrarca Número 133-9^{no} Piso
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11560 México, D.F., México

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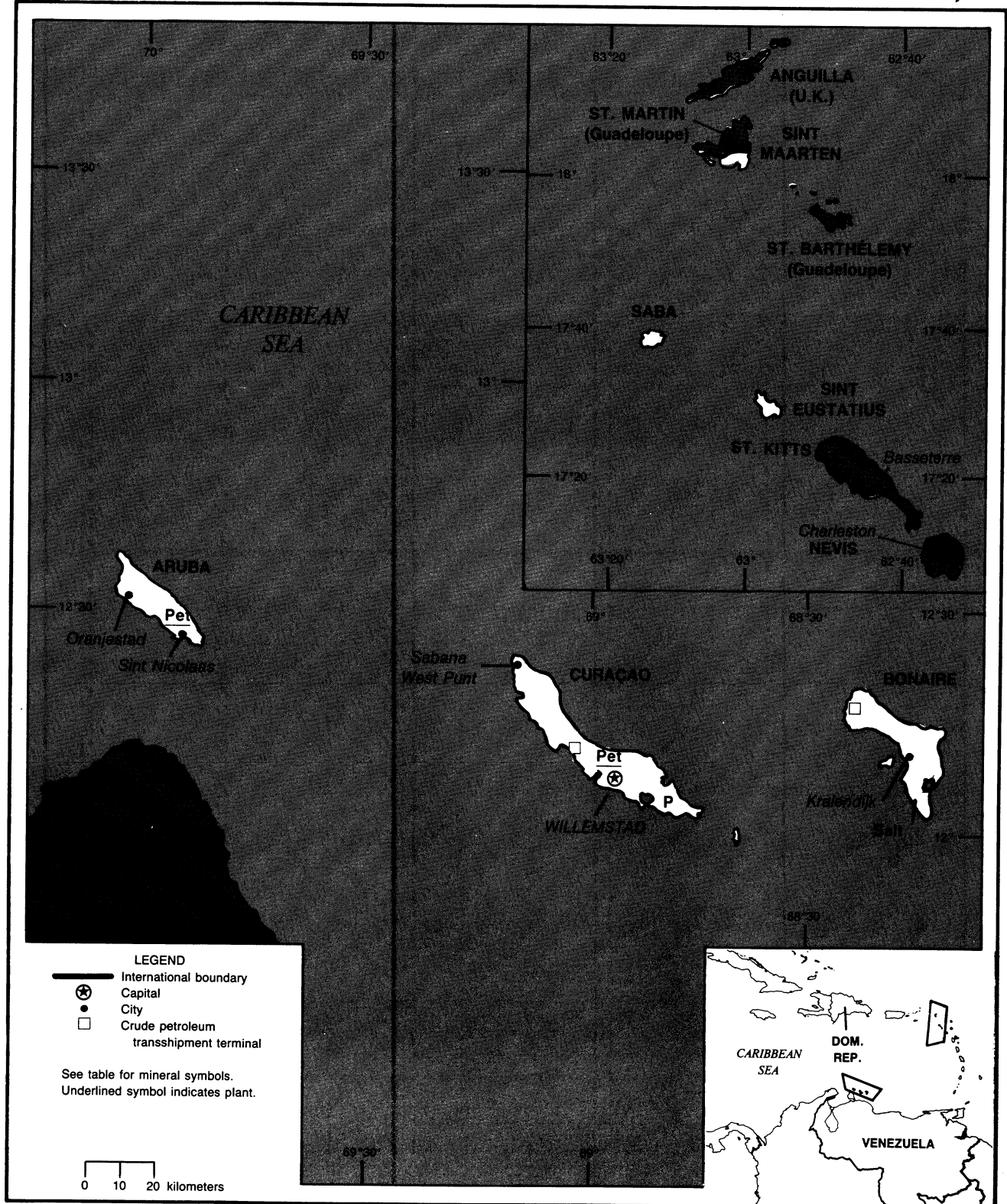
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NETHERLANDS ANTILLES AND ARUBA

AREA 1,153 km²

POPULATION 245,500



THE NETHERLANDS ANTILLES, ARUBA, AND ST. KITTS AND NEVIS

By Ivette E. Torres

THE NETHERLANDS ANTILLES AND ARUBA

In 1990, the economy of the Netherlands Antilles continued to depend primarily on the export of oil refinery products as a source of foreign exchange and employment. Tourism and offshore financing composed the remaining large sectors of the economy.

The economy of Aruba, separated from the Netherlands Antilles since January 1986, was led by tourism. Oil refining on the island, which stopped with the closure of the Exxon's facility in March 1985, was restarted at reduced capacity in November 1990 by Coastal Corp. of the United States.

Production and Trade

The mineral production of the Netherlands Antilles has been limited to salt in

Bonaire and phosphate rock and petroleum products in Curacao.

The Netherlands Antilles' and Aruba's main trading partners are the European Community (EC) and the United States. Goods from the Netherlands Antilles and Aruba, as associate members of the EC and participants in the Caribbean Basin Initiative, have preferential access to the EC and the United States.

Salt from Bonaire is exported to the Caribbean, New Zealand, and the United States.

The Netherlands Antilles had an electrical generating capacity of 125 megawatts in 1988. Total electrical energy produced in the Netherlands Antilles in 1988 was 365 million kilowatt hours. Aruba's electrical generating capacity in 1988 was 310 megawatts. Total electrical energy produced in Aruba in 1988 was 945 kilowatt hours.

Commodity Review

After years of inactivity in Aruba's oil refinery sector, on October 19, 1989, the Government of Aruba signed an agreement with Coastal of Houston, Texas, for the reactivation of the Lago refinery. The new company, Coastal Aruba Refining Co. N.V., began operating in November 1990, as previously planned by the parent company. However, the level of operation (100,000 barrels per day) was only two-thirds of the planned level. The 150,000 barrel-per-day level would be reached in early 1991. Initially, the refinery was producing kerosene, diesel fuel, oil, and feedstocks for Coastal's other refinery. Coastal planned to invest more than \$150 million in Coastal Aruba. In 1990, the Government of the Netherlands Antilles continued to lease its oil refinery in Willemstad, Curaçao, to *Petróleos de*

TABLE 1

NETHERLANDS ANTILLES AND ARUBA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity ²	1986	1987	1988	1989 ^a	1990 ^a
Petroleum refinery products					
thousand 42-gallon barrels	67,160	63,510	69,350	65,335	70,000
Phosphate rock ^c	20	16	16	15	15
thousand tons					
Salt ^c	350	350	350	350	350
do.					
Sulfur, byproduct of petroleum ^c	40	60	60	60	60
do.					

^aEstimated. ^bPreliminary.

¹Table includes data available through July 15, 1991.

²In addition to commodities listed, crude construction materials (lime, salt, sand and gravel, stone, etc.) may also be produced, but data on such production are not always available and information is inadequate to make reliable estimates of output levels.

TABLE 2

NETHERLANDS ANTILLES AND ARUBA: STRUCTURE OF THE MINERAL INDUSTRY

(Thousand metric tons unless otherwise specified)

Country and commodity	Major operating companies	Location of main facilities	Annual capacity
Netherlands Antilles			
Petroleum products thousand barrels	Refinería Isla de Curaçao S.A.	Willemstad, Curaçao	113,150
Salt	AKZO Salt Antilles N.V.	Bonaire	360
Aruba			
Petroleum products thousand barrels	Coastal Aruba Refining Co. N.V.	St. Nicolaas	175,200

Venezuela S.A. (PDVSA). The facilities in Bonaire, purchased by PDVSA in 1989, were used for storage and transshipment.

Infrastructure

There are no railroads in the Netherlands Antilles and Aruba. The Netherlands Antilles has 950 kilometers of roads, 300 of which are paved.

Salt is loaded directly from an AKZO Salt Antilles conveyor belt onto the ship for export.

ST. KITTS AND NEVIS

St. Kitts and Nevis gained independence from the United Kingdom in 1983. Mineral production is negligible and the economy is led by agriculture. Sugarcane is the main crop. Tourism and manufacturing have become more important to the economy in recent years. In 1988, the last year for which information was available, the United States was St. Kitts and Nevis' most important trading partner, followed by the United Kingdom. The United States received 40% of St. Kitts and Nevis' exports and it exported to St. Kitts and Nevis 35% of its requirements. Other trading partners are Canada, Japan, and Trinidad and Tobago.

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Willemstad, Curacao
Centraal Bureau Voor de Statistiek
Windstraat 21
Oranjestad, Aruba

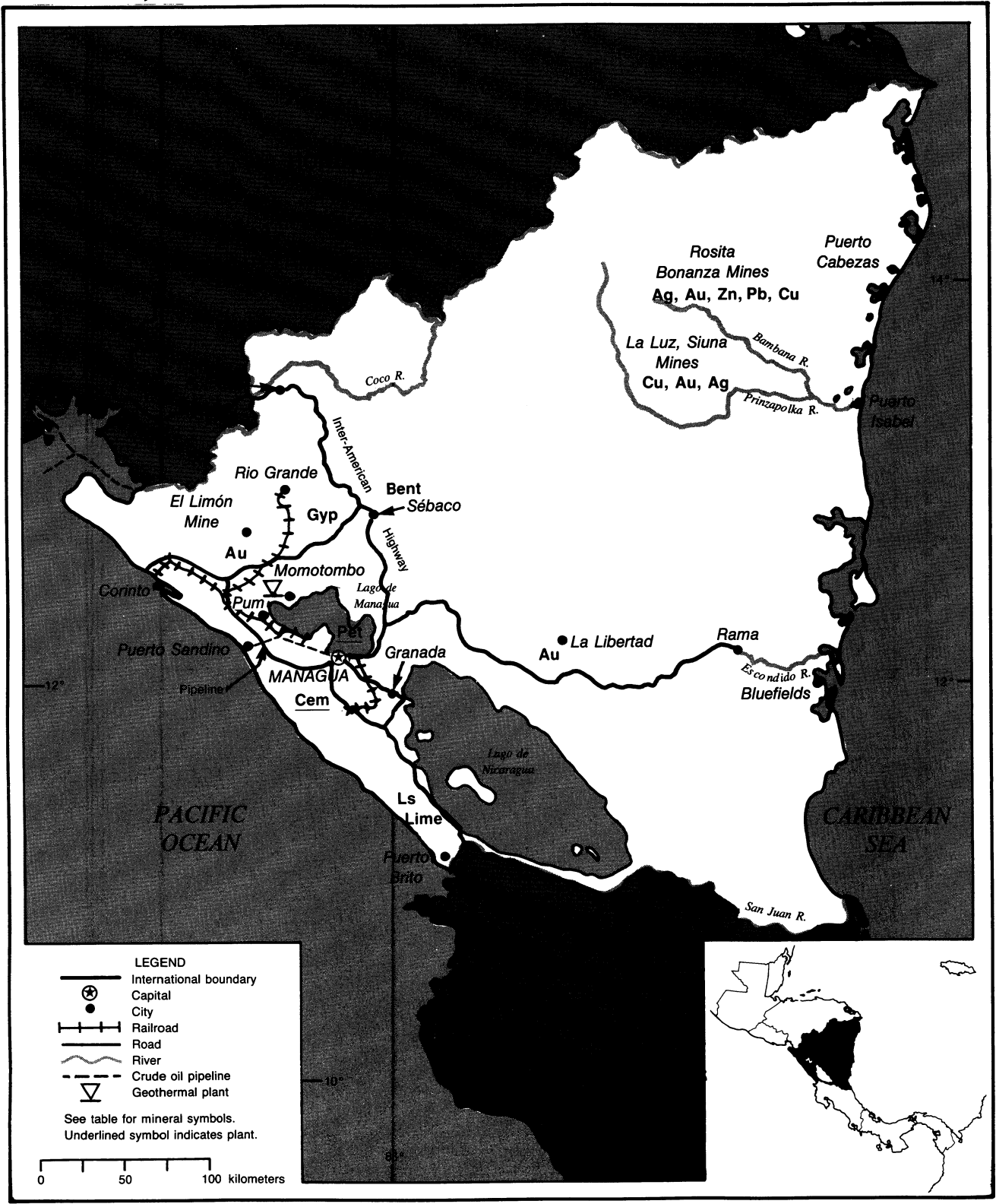
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NICARAGUA

AREA 129,500 km²

POPULATION 3.5 million



LEGEND

- International boundary
- Capital
- City
- Railroad
- Road
- River
- Crude oil pipeline
- Geothermal plant

See table for mineral symbols.
Underlined symbol indicates plant.

NICARAGUA

By Philip M. Mobbs

Mining was a minor facet of the economy of Nicaragua. Most of the country's mining and quarrying activity revolved around gold, silver, and industrial minerals production. Until recently, Nicaragua had been the leading gold producer in Central America. Agriculture was the dominant sector of the economy, accounting for 23% of the GDP and generating approximately 75% of Nicaragua's export earnings.

Nicaragua's export earnings rose to \$321 million¹ in 1990, a 9.9% increase compared with the 24% increase during 1989. Mineral products, primarily gold and silver, accounted for 5.1% of the nation's total export earnings.

Four percent of the country's total imports of \$592 million was mine and quarry products. Petroleum and chemical products accounted for 31% of total imports. Nicaragua was totally dependent on imports for its oil supply, which provided the bulk of its energy needs.

There was a negative \$271 million trade balance in 1990. GDP growth continued the negative trend begun in 1984 with the growth rate for 1990 estimated to be minus 5.7%. Annual inflation topped 13,500%.

In June, the Overseas Private Investment Corporation (OPIC) was authorized to resume operations in Nicaragua. Finance, insurance and investment promotion services were restored. However, currency convertibility coverage was still not available.

GOVERNMENT POLICIES AND PROGRAMS

Nicaragua tried to revitalize its mining industry, especially gold and silver production. In an attempt to resolve disputes resulting from the Sandinista Government's nationalization policies, the present Government passed Decree 11-90 in May. This decree created the Comisión Nacional de Revisión. Claims procedures were established for individuals and companies who

had their properties confiscated by the Sandinista Government. During October, Rosario Mining Company, a subsidiary of the U.S.-based AMAX Incorporated, filed a claim with the Comisión. The former Government had seized, without compensation, the mining concessions and properties of Rosario in November 1979.

The Government of Nicaragua devoted itself to pursuing an export-based economic development strategy. In an effort to attract additional foreign investment, the administration introduced foreign investment legislation in the National Assembly in December. The draft law would guarantee that foreign investors could freely repatriate earnings and capital from Nicaraguan ventures. New export promotion legislation was also drafted at yearend.

In July, the Government reduced the upper income tax rate from 60% to 38.5%.

PRODUCTION

Most of its industrial minerals, such as cement, sand and gravel, and salt, were produced for local consumption. Gold and silver production was primarily for export.

TRADE

The United States lifted the 5-year old trade embargo on Nicaragua in March 1990. During March, Nicaragua also became eligible to reapply for benefits allowed under U.S. Generalized System of Preferences (GSP), which had been revoked in 1987.

During April, Nicaragua permitted private sector imports for the first time in 11 years. In July, the Government slashed import duties from 61% to 20%. It was noted that foreign exchange shortage presented a problem for importers during the year.

Originally excluded when the Caribbean Basin Initiative (CBI) began in 1984, Nicaragua was declared eligible for the program in November 1990.

Late in the year, Nicaragua renegotiated its debt with Venezuela. Nicaragua was then reportedly eligible to receive 15,000 barrels of oil per day from Venezuela, through 1991, under the terms of the San José accords. This would help offset dwindling petroleum availability from their former supplier, the U.S.S.R.

STRUCTURE OF THE MINERAL INDUSTRY

During the Sandinista years, the Government nationalized many strategic industries. The state owned some 350 to 450 corporations, most of them administered through the Government holding company, Corporación Nacional del Sector Público (CORNAP). A privatization strategy for CORNAP's corporations was to be announced in 1991.

The Corporación Nicaragüense de Minas (INMINE), a CORNAP subsidiary, controlled most of the country's mineral exploration and production operations. Güiriseros, local prospectors, ran small private placer gold mining operations, usually in co-operative groups. There was also illegal placer gold production. The Government continued its campaign to control the illegal activity. Salt was produced by privately-owned operations.

In 1989, the total work force was estimated to be 1.2 million persons. Approximately 0.2% of these were engaged in the mining and minerals industry.

COMMODITY REVIEW

Metals

Gold and Silver.—INMINE identified a number of projects through which domestic or foreign investors could help rejuvenate Nicaragua's gold and silver mining industry. Modernization of the mills at El Limón and La Libertad was proposed, with expansion of the mills to 750 to 1,000 tons per

TABLE 1
NICARAGUA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^p	1990 ^e
Bentonite	3,709	3,496	3,853	1,889	² 2,083
Cement ^e	100,000	100,000	100,000	² 131,011	140,000
Gold, mine output, Au content kilograms	892	948	878	1,410	² 1,200
Gypsum and anhydrite, crude	⁸ 8,000	7,299	⁷ 7,000	11,570	² 13,444
Lime ^e	3,500	3,500	3,500	3,500	3,500
Petroleum refinery products ^e thousand 42-gallon barrels	3,560	3,620	3,500	3,500	3,500
Salt, marine ^e	15,000	15,000	15,000	15,000	15,000
Sand and gravel ^e thousand tons	¹ 1,125	¹ 1,125	¹ 1,125	¹ 1,125	² 1,064
Silver, mine output, Ag content kilograms	^e 778	888	776	1,113	² 1,095

^eEstimated. ^pPreliminary. ^rRevised.

¹Includes data available through Aug. 21, 1991. In addition to the commodities listed, Nicaragua continued to produce a variety of industrial minerals to meet domestic needs. Output of these materials was not reported, and there is insufficient general information for formulation of estimates.

²Reported figure.

TABLE 2
NICARAGUA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990.

(Thousands of metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Bentonite	Corporación Nicaragüense de Minas (INMINE)	Sébaco, Matagalpa Dept.	6
Cement	Compañía Nacional Productora de Cemento	San Rafael del Sur, Managua Dept.	330
Gold kilograms	INMINE	El Limón Mine, León Dept.; La Libertad Mine, Chontales Dept.; Bonanza, Zelaya Dept.; Siuna, Zelaya Dept.	2,300
Gypsum	INMINE	Santa Rosa del Peñón, Leon Dept.	12
Petroleum products thousand 42-gallon barrels	Esso Standard Oil S.A. Ltd.	Managua, Managua Dept.	5,400
Silver	INMINE	Bonanza and Siuna mining complexes, Zelaya Dept. El Limón mine, León Dept.	850

day (mt/d) and 500 to 750 mt/d, respectively. El Limón was the country's premier gold mine, having produced almost 7 tons of gold since 1980. During the same period, the Bonanza Mine accounted for 3855 kg. Siuna produced 1250 kg gold, before watering out. Small miners conveyed 1080 kg to INMINE. La Libertad contributed 585 kg gold to the nation's total production.

In the Región Autónoma Atlántico Norte (RAAN), a new hydroelectric plant was proposed for Siuna. The underground mine at Siuna had been closed because of flooding. Inexpensive electricity would be needed to reopen the mine, because of the excessive cost associated with diesel power operations. Exploitation of the mine tailings at Siuna was also promoted. Operations in the Siuna area during 1990 were limited to

small-scale hydraulic mining. Another project in the region was the proposed rehabilitation, enlargement, and modernization of the Bonanza gold and silver mine.

New ventures submitted for consideration included a new gold production plant in the La Libertad-Santo Domingo region with a milling capacity of 1,000 to 2,000 mt/d. Santo Domingo was about 15 km east of La Libertad. A 1,000 to 2,000 mt/d gold and silver operation was also suggested for the Topacio and Quisilala districts in southern Zelaya Dept.

Mechanical dredging for gold along the Siuna and Cuicuin Rivers was suggested for investor consideration. There were also placer opportunities along the Río Coco; however, the ubiquitous minefields leftover from the war, scattered about the lower

reaches of the river, would make operations somewhat hazardous.

The geological study for the La India district, about 80 km north of Managua, was completed in December. The final report was to be issued in March 1991.

A study of the La Talavera area was administered by the Swedish International Development Authority (SIDA). The study was part of a 10-year technical assistance protocol with SIDA that Nicaragua had signed in 1982. Metallurgical testing of samples from La Talavera was to be completed in January 1991 by the Swedish Geological International Company (SGAB) and Boliden AB group working under the SIDA consultancy. The La Talavera Mine was expected to be placed into production by 1992 or 1993.

The Swedish group had also been asked to do a production study of the Bonanza Mine during 1991.

Other Metals.—INMINE invited applications for exploration for antimony, copper, iron, lead, molybdenum, rare earths, tungsten, uranium, and zinc.

Industrial Minerals

INMINE's main quarrying activities were dedicated to the production of construction materials such as gypsum, limestone, and sand and gravel. Most of the production was for local consumption. INMINE also ran bentonite and tufa operations.

Bentonite was produced from a small mine at Sébaco. Gypsum was mined at Santa Rosa del Peñón, about 75 km north of Managua. Limestone was quarried at several locations scattered about the country, including Rivas, San Rafael del Sur, and near Siuna. The Compañía Nacional Productora de Cemento plant at San Rafael del Sur, south of Managua, used local limestone and the Santa Rosa del Peñón gypsum as kiln feed. The high-purity limestone at Rivas was processed for use in the sugarcane mills and as a paint filler.

INMINE planned to promote or develop several of the country's resources for the export market. Proposed projects included a gypsum plant for crude, calcined, and processed gypsum; a limestone plant to export marble and limestone; and a plant in Siuna to process limestone for cement and agricultural lime exports. Other projects included startup of export industries for kaolin from León Dept., bentonite from Matagalpa Dept., and phosphate from Rivas Dept. The possibility of opening a pumice mine near La Paz, 52 km northwest of Managua, existed. There was also interest in beginning diatomite and zeolite export industries.

Mineral Fuels

Installed electrical generating capacity included 100 MW from hydroelectric plants, the Italian-built 70-MW Momotombo geothermal plant, and 190 MW contributed by older thermal plants. The Nicaraguan Institute of Energy was planning to bring on-stream an additional 140 MW of hydroelectric and geothermal capacity, which would allow a reduction in

the country's liquid fuel requirements. The national electric system was also connected to the Honduras and Costa Rica grids.

Venezuela agreed to provide technical assistance for petroleum operations from rank exploration to product distribution. Nicaragua and Venezuela also agreed to establish a Nicaraguan Center for Advanced Study. Programs in ecology, electricity production, geothermal energy, mining, and petroleum were proposed.

INFRASTRUCTURE

Road construction and maintenance were high-priority projects of the Government of Nicaragua. Most mineral products were trucked along the nation's 25,000 km of road, 4,000 km of which was paved and 2,170 km was of gravel or crushed stone. Both the roads and the railroad were used in the movement of gypsum from the mine to the cement plant. However, much of the 373-km railroad system that connected Corinto with many of the nation's western cities needed renovation.

Ports on the Pacific coast included Corinto and Puerto Sandino. A 56-km crude oil pipeline (15,000 bbl/d) extended from Puerto Sandino to the Esso refinery in Managua.

Puerto Cabezas, El Bluff, and Rama serviced Caribbean traffic. Inland waterways totaled 2,220 km, including the Lake Nicaragua and San Juan River course, which had been formally proposed as the core of a transisthmus canal by a colonist as early as 1620.

OUTLOOK

The Government is expected to deregulate foreign trade, a move that will allow private exports for the first time in a decade.

Nicaragua, because of its financial difficulties, has had problems importing sufficient petroleum for domestic needs. Recently, the U.S.S.R. supplied most of Nicaragua's crude oil needs. However, the change in Soviet willingness to supply discounted petroleum will force Nicaragua to look elsewhere for fuel. Venezuela will partially fill the void. Negotiations are reported underway with Mexico. Mexico had halted petroleum shipments to Nicaragua

in 1985 because of outstanding debt.

The Governments of Japan and Venezuela, the Inter-American Development Bank, and the U.S. Agency for International Development are providing financing for building up to 60,000 homes in Managua. Industrial mineral mining and processing activity are expected to increase to meet this domestic demand.

Nicaragua was looking for technical support to expand the nation's small-scale mining sector. INMINE is planning a mineral sector study to help promote the mineral industry. This study will supplement the mineral inventory being assisted by the Governments of the U.S.S.R. and Sweden. Since 1979, Brazil, Bulgaria, Canada, Cuba, France, Mexico, Norway, and Peru have also provided financial and technical assistance to the mineral and energy sectors. Nevertheless, mining cannot be expected to significantly expand or impact the economy for the foreseeable future.

¹Where necessary, values have been converted from Nicaragua Córdobas (C\$) to U.S. dollars at the rate of C\$3,000,000 = US\$1.00.

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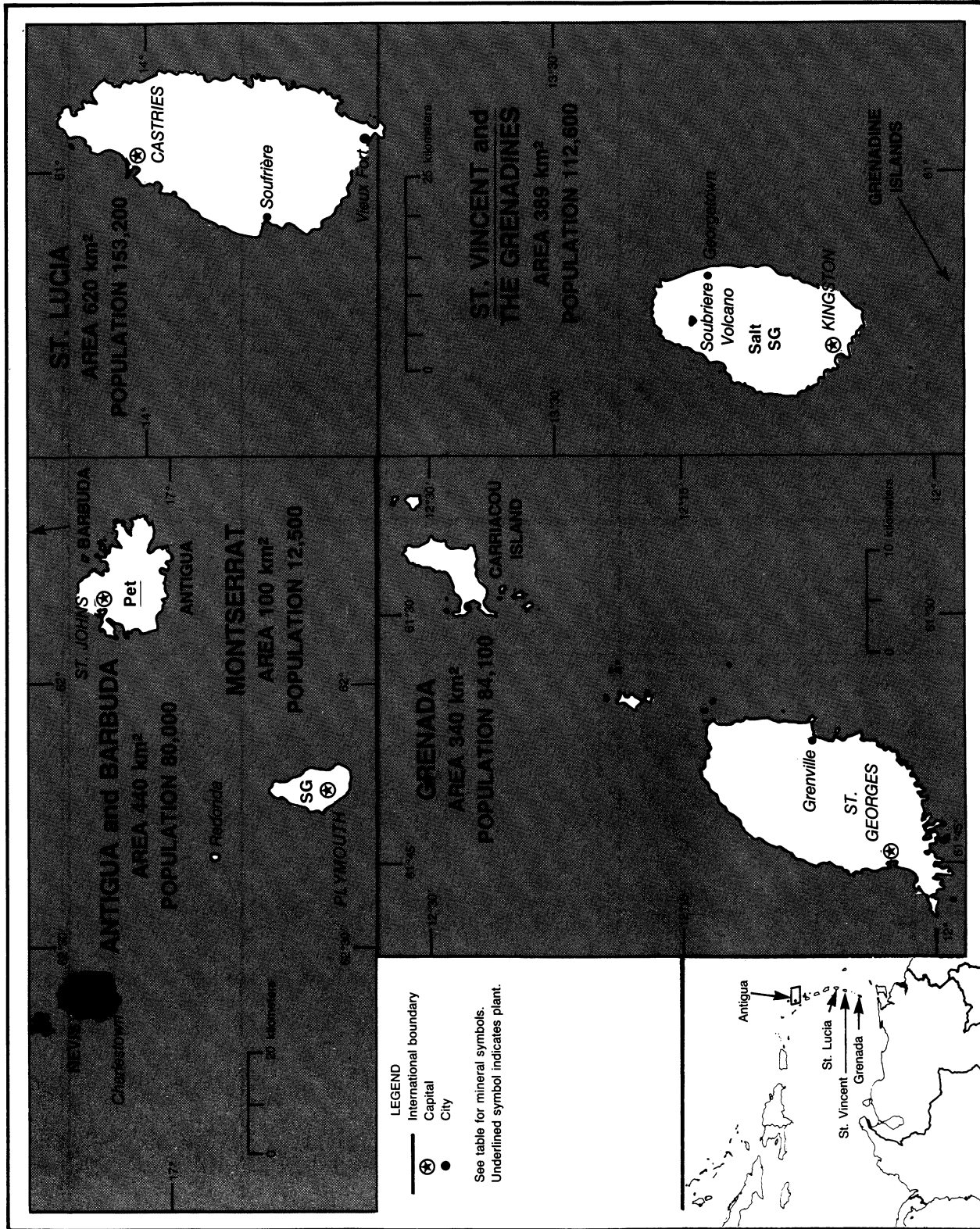
Agency

Corporación Nicaragüense de Minas
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OTHER LESSER ANTILLES



OTHER ISLANDS OF THE LESSER ANTILLES

By Philip M. Mobbs

ANGUILLA

Salt had been an integral part of the island's economy since about 1650. Formerly an important source of revenue for this British Dependent Territory, much of the salt production had been exported to Trinidad for use by the oil refineries. Production resumed in the early 1980's after being suspended during the late 1970's owing to rain damage to the operations. Production and exports were terminated during the late-1980's. Since then, the mounds of salt remaining at the ponds have been used for local personal consumption.

Tourism and related construction drove the economy in 1990. Limited amounts of material were quarried to augment the construction industry's requirements. The island's economy grew by 6.5% in 1990.

ANTIGUA AND BARBUDA

Antigua and Barbuda became independent on November 1, 1981. The three-island nation was a member of the Commonwealth. Antigua, a volcanic island with some limestone deposits along the north coast, was one of the first Caribbean islands to promote tourism, thus indirectly boosting mineral-related activity through the construction industry. Barbuda produced a small amount of salt, and, in the past, phosphate was collected on the uninhabited island of Redonda.

The nation's mineral industry continued to partially supply the requirements of the construction industry. New construction focused attention on the necessity of additional infrastructure upgrades, especially increased electrical power generation capability and road rehabilitation.

GRENADA

The most southern of the Windward Islands, Grenada consists of Grenada and several islands of the southern Grenadines, including Bird, Caille, Carriacou, Diamond, Frigate, Green, Large, Les Tantes, Petite Martinique, Ronde, Saline, Sandy, and Sugar Loaf. The nation became independent from the United Kingdom in 1974.

In 1989, Grenada ratified a bilateral investment treaty with the United States. While this treaty essentially grants national treatment to U.S. investors in Grenada, the use of land and natural resources was specifically excluded.

Residential and commercial construction activity, supplied in part by local quarrying and pit operations, continued its double-digit growth rate.

In June, the Government took under consideration a proposal by the U.S. firm Waste Conversion Ventures to generate electricity from garbage. The proposal called for incineration of a mixture of municipal trash and fuel oil. The plan was subsequently rejected because of local opposition.

Approximately 95% of the Grenada Island is connected to state-owned Grenada Electricity Co.'s distribution grid. By late 1989, total generating capacity reached 13.5 MW. A feasibility study that addressed a proposed 110-kW hydroelectric plant planned for the eastern part of the island was completed during the year. The electric company was also investigating geothermal and solar energy projects.

Much of the road network ringing the island has been rehabilitated since repairs on the infrastructure began in 1983. St. George's was the nation's primary port.

MONTSERRAT

The economy of this small volcanic island 400 km southeast of Puerto Rico was centered on tourism and construction. Small quantities of sand and gravel and other quarry products constitute the mineral industries of Montserrat.

The Port of Plymouth was impaired when Hurricane Hugo swept away the seaport's only jetty in September 1989. Almost 95% of the island's residential units were also destroyed by the hurricane. By yearend, the United Kingdom had committed \$10 million¹ to assist with the rehabilitation of the colony. The rebuilding spurred GDP to a 44% growth rate during 1990.

ST. LUCIA

Mineral production in St. Lucia, the second largest island in the British Lesser Antilles, has not been reported regularly. A few small gravel, pumice, and sand operations continued to supply the island's construction sector. The nation's economy retreated to a 4% annual growth rate.

The \$28 million Cul de Sac hydroelectric generating plant was inaugurated during November 1990, bringing the island's total installed electricity generating capacity up to 32.5 MW. A \$40 million dam was proposed for the Roseau Valley and St. Lucia Electricity Services planned to investigate the feasibility of siting a geothermal electricity generating plant at the island's sulfur springs near Soufrière.

ST. VINCENT AND THE GRENADINES

Local mineral production was used to augment materials needed for the construc-

tion industry. There was also private salt production in noncommercial volumes.

While electrical service is not available to a few of the islands in the Grenadines, almost 70% of St. Vincent was connected to St. Vincent Electricity Services' grid. The Cumberland Hydroelectric plant brought St. Vincent's total installed generating capacity to 16.6 MW.

¹Where necessary, values have been converted from East Caribbean dollars (EC\$) to U.S. dollars at the rate of EC\$2.70=US\$1.00.

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The Valley, Anguilla
(809) 497-2759

Ministry of Economic Development and Energy
Queen Elizabeth Highway
St. John's, Antigua
(809) 462-1960

Ministry of Communications
Young St.

St. George's, Grenada
(809) 440-3598

Ministry of Trade, Industry, and Agriculture
Castries, St. Lucia
(809) 452-2611

Ministry of Trade, Industry, and Agriculture
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(809) 456-1223

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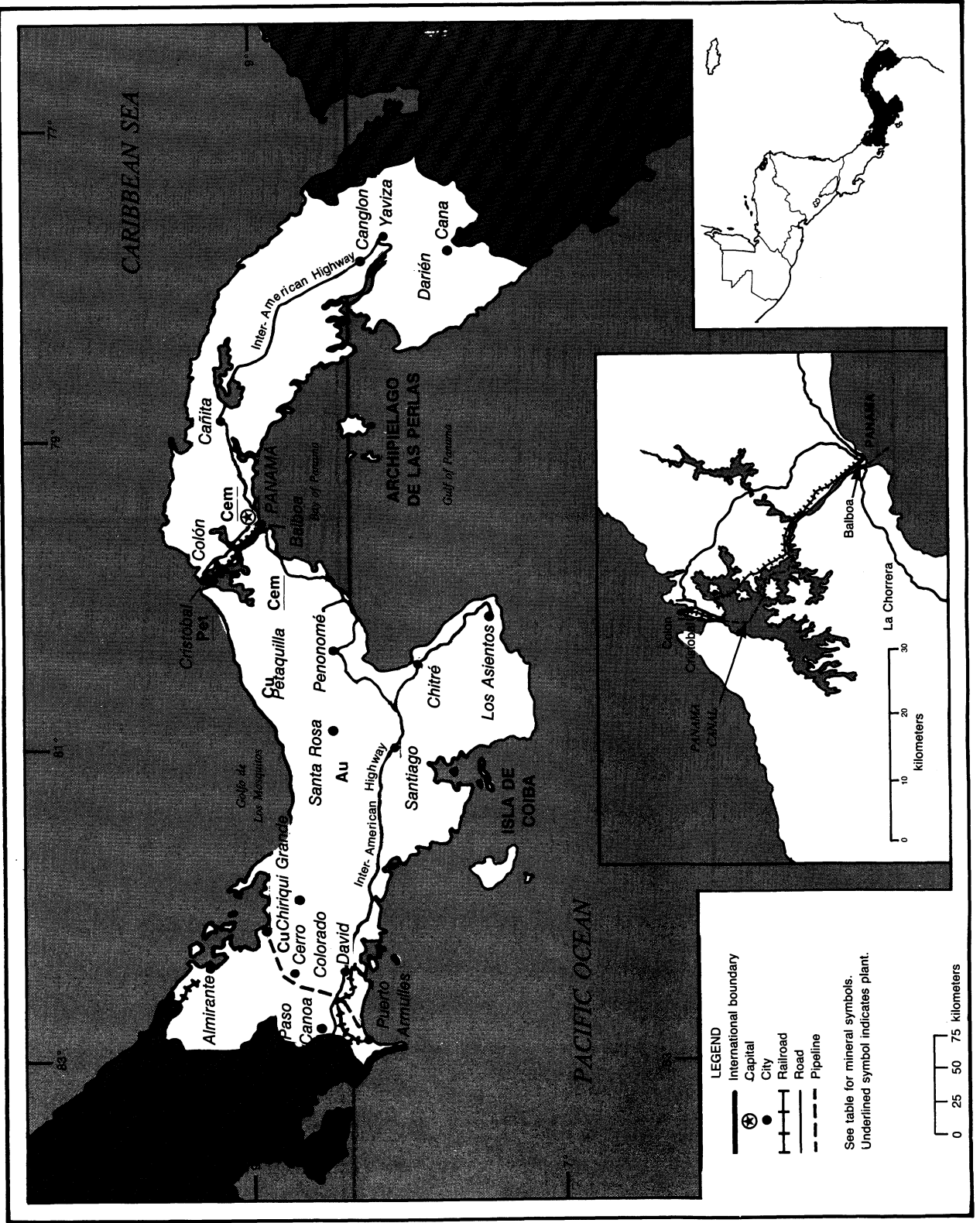
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PANAMA

POPULATION 2.4 million

AREA 75,990 km²



PANAMA

By Philip M. Mobbs

Production of construction-related industrial minerals continued to dominate Panama's mineral sector. The country's mineral output included cement, clay, limestone, salt, and sand and gravel produced for local use. The perennial small amount of placer gold production was increased by the reopening of two gold mines.

Panama imported most mineral requirements for its limited industrial base. Mineral-related exports consisted mainly of scrap metal and of petroleum products that were provided to ships and aircraft in transit.

Mineral transportation and mining contributed almost 5% to the country's economy. Transportation of mineral products, shipped through the canal or sent through the oil pipeline, represented the largest facet of the minerals industry in Panama. However, there were fewer canal transits in 1990 and transisthmus pipeline utilization dropped by 20.8%.

GOVERNMENT POLICIES AND PROGRAMS

Traditionally, the Panamanian Government's mineral exploration initiatives have resulted in private sector development of the targeted natural resources. The most recent of these was the National Mineral Inventory Project 1988-1990. Funded by the Inter-American Development Bank (IDB), the project was carried out by the Swedish Geological International Company (SGAB) with assistance from the Dirección General de Recursos Minerales (DGRM).

The controlling legislation for mining is The Code of Mineral Resources, originally defined by Decree Law No. 23 of August 22, 1963. This was amended by: Decree No. 126, July 21, 1964; Decree No. 142, August 31, 1964; Cabinet Decree No. 26, August 21, 1969; and Cabinet Decree No. 404, December 29, 1970. Additional amendments included: Law No. 55, July 10, 1973; Law No. 70, August 22, 1973; Law No. 89, October 4, 1973. Also, Law No. 109, October 8, 1973;

Law No. 9, January 8, 1974; Law No. 22, February 16, 1974; Law No. 33, November 8, 1984; and Law 20, December 20, 1985.

The most recent amendment, Law No. 3, January 28, 1988, revised the Code and added incentives to the mining industry. Royalty on placer gold was set at 4%; all other minerals had a 2% levy on net smelter returns. According to the Fiscal Code, income tax rates ranged from 20% on less than \$30,000¹ taxable income to 50% of annual income more than \$500,000. Law No. 3 provided a permanent discount of 30% on payable income tax if production commenced prior to February 1993. Projects entering production between February 1992 and 1998 were eligible for a 20% discount.

Depletion allowances up to 50% of the net taxable income were authorized. Straight line, Sum of the Years Digits, and Declining Balance depreciation methods were authorized. Faster rates were subject to negotiation. Import duties and customs charges were waived for a concessionaires's mining equipment, material and replacement parts, except fuel. Exploration expenditures could be capitalized or expensed. Exploration surface fees ranged from \$0.50 to \$1.50 per hectare. Surface fees for mining properties varied from \$1.00 to \$3.50 per hectare.

The 1972 Labor Code was considered to be a foreign investment disincentive. The Code mandated an annual "thirteenth month" pay bonus and a month of paid vacation. It also made layoffs and employee terminations difficult.

The Government disclosed that the "National Strategy for Development and Economic Modernization" would go into effect in 1991. The plan described privatization and delineated changes in the labor code and tax system needed for further developing the country's economy.

PRODUCTION

The mineral industry rebounded after a 2 year decline. Construction-related material

production prospered with the surge in Panama's construction industry.

Transisthmian oil pipeline shipments were reduced because of declining Alaskan crude oil shipments. The Alaskan Pipeline had been closed earlier in the year to repair corroded pipe. By October, after the pipeline was reopened, there was a shortage of tankers to move petroleum down the coast.

TRADE

Panama regained trade benefits under the U.S. Generalized System of Preferences and the Caribbean Basin Initiative in February.

Transportation of bulk commodities through the Canal was the most prominent aspect of the mineral industry in Panama's economy. Dwindling mineral shipments reflected the impact of shifting world trade patterns. However, about 70% of the canal shipments were leaving or heading for the United States.

Canal coal shipments from the United States to the Far East continued the decline first noticed in 1983. The 1988 deepening of the outbound channel from the Lambert's Point coal terminal at Hampton Roads resulted in increased amounts of coal being shipped in Capesize bulk carriers, too large for the Canal. By October 1990, the Baltimore channel was also deepened to 15.24 meters (m). Atlantic to Pacific bound coal had accounted for just over 3% of total canal traffic in fiscal year 1989.

A 20% surcharge on Canal marine services (line handling, tug fees etc.) was instituted in April 1990.

STRUCTURE OF THE MINERAL INDUSTRY

Near yearend, there were 9 metal extraction concessions and 61 industrial mineral production operations in Panama. Thirteen industrial mineral extraction applications were also filed with the DGRM.

TABLE 1
PANAMA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^p	1990 ^e
Cement	336,000	^e 350,000	^e 200,000	168,500	300,000
Clays:					
For cement	111,335	78,000	56,000	43,047	90,000
For products	71,035	79,452	49,553	^e 36,000	² 122,332
Gold ³ kilograms	—	—	—	—	² 85
Manganese ore	6,000	^e 6,000	—	—	—
Petroleum refinery products ^e thousand 42-gallon barrels	9,000	9,000	9,000	² 6,552	² 8,466
Salt, marine ^{e,4}	² 9,816	10,000	9,000	8,000	9,000
Silver kilogram	—	—	—	—	² 41
Stone, sand and gravel: Limestone:					
For cement	¹ 442,122	226,000	185,000	181,304	² 315,955
For other uses	¹ 109,594	17,884	9,358	16,509	77,000
Sand and gravel thousand tons	1,673	1,980	1,390	^e 1,000	² 470
Sand, silica ^e	² 16,290	17,000	15,000	12,000	² 14,829

^eEstimated. ^pPreliminary. ^rRevised.

¹Includes data available through July 31, 1991.

²Reported figure.

³An unquantifiable amount of gold was recovered from placer deposits in Darien Province during the period 1986-89.

⁴Represents sales.

TABLE 2
PANAMA: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Scrap	37	33	29	Italy 2; Japan 1.
Semimanufactures	4	3	1	Costa Rica 2.
Copper: Matte and speiss including cement copper				
	5	9	6	Unspecified 3.
Gold:				
Waste and sweepings value, thousands	—	\$3	\$3	
Metal including alloys, unwrought and partly wrought do.	—	\$50	—	All to Greece.
Iron and steel: Metal:				
Scrap	1	4	2	Colombia 2.
Steel, primary forms	—	1	—	Mainly to Cuba.
Semimanufactures:				
Bars, rods, angles, shapes, sections value, thousands	—	\$5	—	All to Cuba.
Universals, plates, sheets do.	\$7	—		
Tubes, pipes, fittings do.	\$1	\$3	—	Costa Rica \$2; Cuba \$1.
Lead:				
Oxides	4	4	—	Mainly to Ecuador.
Metal including alloys, scrap	8	11	5	Ecuador 4; Guatemala 1.

See footnotes at end of table.

TABLE 2—Continued

PANAMA: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989	
			United States	Other (principal)
METALS—Continued				
Silver: Metal including alloys, unwrought and partly wrought value, thousands	—	\$12	—	All to Costa Rica.
Zinc: Metal including alloys, semimanufactures	2	1	—	All to Nicaragua.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones value, thousands	—	\$1	—	All to Costa Rica.
Cement	(²)	6	—	Do.
Lime	—	23	—	All to Honduras.
Sodium compounds, n.e.s.: Sulfate, natural and manufactured	25	12	—	All to Costa Rica.
Stone, sand and gravel: Dimension stone, crude and partly worked value, thousands	—	\$2	NA	NA.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural do.	\$1	\$2	—	All to Costa Rica.
Petroleum refinery products, gasoline 42-gallon barrels	17	102	—	Do.

NA Not available.

¹Table prepared by H. D. Willis.²Quantity not available valued at \$4,000.

TABLE 3

PANAMA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	2,026	1,149	5	Brazil 500; Italy 24; Colombia 18.
Metal including alloys:				
Scrap	554	1,014	673	Unspecified 341.
Semimanufactures	1,259	1,430	1,089	Belgium-Luxembourg 94; West Germany 80.
Chromium: Oxides and hydroxides value, thousands	\$1	—		
Cobalt: Oxides and hydroxides	—	3	NA	NA.
Columbium and tantalum: Tantalum metal including alloys, all forms value, thousands	\$2	—		
Copper:				
Matte and speiss including cement copper	63	23	NA	NA.
Metal including alloys, semimanufactures	208	361	73	Chile 130; Mexico 56.
Gold: Metal including alloys, unwrought and partly wrought kilograms	(²)	670	490	Switzerland 130; West Germany 10.
Iron and steel:				
Iron ore and concentrate: Pyrite, roasted	11	16	10	West Germany 5.

See footnotes at end of table.

TABLE 3—Continued

PANAMA: 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:				
Scrap	498	559	NA	NA.
Ferrous alloys	value, thousands	\$1	—	
Steel, primary forms	6,927	9,188	452	Republic of South Africa 5,919; Venezuela 1,000; Japan 978.
Semimanufactures:				
Bars, rods, angles, shapes, sections	7,815	8,007	1,175	Brazil 2,574; Republic of Korea 761.
Universals, plates, sheets	11,179	17,313	1,004	Republic of Korea 3,490; West Germany 2,993; Japan 2,882.
Hoop and strip	718	672	30	Republic of Korea 355; Brazil 70; Argentina 60.
Rails and accessories	—	66	64	Costa Rica 2.
Wire	1,138	1,705	92	Venezuela 1,025; Republic of Korea 338; Brazil 119.
Tubes, pipes, fittings	2,700	3,438	472	Costa Rica 1,865; Republic of Korea 302.
Castings and forgings, rough	NA	173	89	Costa Rica 11; Italy 11.
Lead:				
Oxides	18	47	6	Peru 24; Mexico 16.
Metal including alloys:				
Scrap	203	766	122	Jamaica 371; Trinidad and Tobago 133.
Semimanufactures	20	25	(³)	Bolivia 12; unspecified 13.
Magnesium: Metal including alloys, Semimanufactures				
value, thousands	\$145	\$7	\$7	
Manganese: Oxides				
	NA	500	NA	NA.
Mercury				
value, thousands	\$23	\$1	\$1	
Nickel:				
Matte and speiss	do.	\$1	—	
Metal including alloys, semimanufactures	NA	5	(³)	Mainly from Iceland.
Platinum-group metals: Metals including alloys, unwrought and partly wrought				
value, thousands	\$1	—		
Silver: Metal including alloys, unwrought and partly wrought				
do.	\$28	\$43	\$39	Peru \$2; Colombia \$1.
Tin: Metal including alloys, semimanufactures				
	3	2	2	
Titanium: Oxides				
	128	346	46	Mexico 280; United Kingdom 10.
Tungsten: Metal including alloys, unwrought				
	NA	1	NA	NA.
Uranium and thorium: Metal including alloys, all forms				
value, thousands	\$79	\$162	\$101	Japan \$1; unspecified \$60.
Zinc:				
Oxides	24	33	19	Italy 7; France 3.
Metal including alloys:				
Unwrought	1	1	1	
Semimanufactures	121	102	15	Peru 63; Mexico 18.
Other:				
Oxides and hydroxides	28	52	38	United Kingdom 12; Colombia 3.
Ashes and residues	value, thousands	\$22	\$1	\$1
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	6	249	1	Belgium-Luxembourg 248.

See footnotes at end of table.

TABLE 3—Continued

PANAMA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Abrasives, n.e.s.—Continued				
Grinding and polishing wheels and stones	NA	37	12	Brazil 15; West Germany 2.
Asbestos, crude	121	210	(²)	Mainly from Canada.
Barite and witherite	20	6	NA	Mainly from Peru.
Boron materials: Oxides and acids	26	7	7	
Cement	NA	3,552	6	Costa Rica 2,553; Republic of Korea 470; Colombia 250.
Chalk	1,022	1,162	60	Costa Rica 1,102.
Clays, crude	762	1,047	464	El Salvador 446; Guatemala 100.
Cryolite and chiolite	—	193	—	Peru 108; Costa Rica 60; France 25.
Diatomite and other infusorial earth	316	454	247	Mexico 193; West Germany 7.
Feldspar, fluorspar, related materials	1,517	38	—	Italy 20; Canada 18.
Fertilizer materials:				
Crude, n.e.s.	value, thousands	—	\$1	NA
Manufactured:				
Ammonia		51	157	147
Nitrogenous		(⁴)	53,092	9,705
Phosphatic		2,497	4,723	4,058
Potassic		7,918	16,982	1,661
Unspecified and mixed		6,634	3,421	189
Lime		301	367	118
Magnesium compounds: Magnesite, crude		1	140	—
Mica:				
Crude including splittings and waste		2	5	5
Worked including agglomerated splittings				
	value, thousands	—	\$2	\$2
Phosphates, crude	do.	\$2	\$1	\$1
Pigments, mineral: Iron oxides and hydroxides, processed		NA	35	10
Precious and semiprecious stones other than diamond:				
Natural	value, thousands	\$61	\$88	—
Synthetic	do.	\$10	\$9	\$2
Salt and brine		NA	278	66
Sodium compounds, n.e.s.:				
Soda ash, manufactured		5,502	6,571	4,194
Sulfate, manufactured		(²)	3,502	23
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked		689	177	—
Worked		102	738	1
Gravel and crushed rock		435	2	2
Quartz and quartzite		2	6	—
Sand other than metal-bearing		4,176	4,927	4,826
Unspecified		13,045	308	263

See footnotes at end of table.

TABLE 3—Continued

PANAMA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
INDUSTRIAL MINERALS—Continued					
Sulfur:					
Elemental:					
Crude including native and byproduct	84	45	5	Colombia 36; Netherlands 4.	
Colloidal, precipitated, sublimed	—	47	—	All from United Kingdom.	
Sulfuric acid	3,708	3,792	3,761	Netherlands 19; West Germany 12.	
Talc, steatite, soapstone, pyrophyllite	375	367	230	Peru 82; Hong Kong 26.	
Other:					
Crude	7	4	2	West Germany 2.	
Slag and dross, not metal-bearing	—	16	16		
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural	62	26	7	France 19.	
Carbon black	21	—			
Coal: Anthracite	15,045	9,055	63	Colombia 8,991.	
Coke and semicoke	24	43	43		
Peat including briquets and litter	10	—			
Petroleum:					
Crude	thousand 42-gallon barrels	6,848	6,244	376	Ecuador 3,787; Venezuela 1,045; Mexico 700.
Refinery products:					
Liquefied petroleum gas	do.	601	541	115	Venezuela 258; Netherlands Antilles 161.
Gasoline	do.	(⁶)	1,453	524	Netherlands Antilles 647; Venezuela 85.
Mineral jelly and wax	42-gallon barrels	(⁷)	15,480	3,054	Japan 2,739; West Germany 2,306.
Lubricants	do.	161	231	56	West Germany 133.
Bituminous mixtures	do.	467	1,194	739	Venezuela 236; Mexico 145.

NA Not available.

¹Table prepared by H. D. Willis.²Quantity not available valued at \$852,000.³Less than 1/2 unit.⁴Quantity not available valued at \$8,046,000.⁵Quantity not available valued at \$587,000.⁶Quantity not available valued at \$35,499,000.⁷Quantity not available valued at \$913,000.

There were 12 active metal exploration concessions and 16 applications pending. Additionally, there were 59 active surface reconnaissance permits.

Most of the mineral industry ownership was private. However, the Government had a 50% interest in Empresa Estatal de Cemento "Bayano" and a 40% interest in Petroterminal de Panama, S.A., the crude oil transshipment and pipeline activity. The Government was considering divesting itself of its 51% interest in the Cerro Colorado porphyry copper project. The Government and RTZ Corp. PLC, which held the remaining 49%, maintained the project in caretaker status.

COMMODITY REVIEW

Metals

Gold mining in Panama included small scale placer operations in Darien Prov. The Remance underground mine and carbon-in-pulp plant of Transworld Exploration of Panama and Minera Remance of Peru began operations during the year. Sociedad de Inversiones IXTAPA, S.A. was working the Espiritu Santo de Cana mine in Darien Prov. An exploration concession was granted for the Rio Tuquesa placer deposit in Darien Prov. An exploration concession applica-

tion was submitted for the Rio Pito area.

Boliden Canada Ltd. (51%) and Greenstone Resources Ltd. (49%) of Toronto purchased the Panamanian mining assets of New Orleans-based Freeport McMoRan Inc. This included the Santa Rosa and Cerro Alto de la Mina prospects, 40 km north of Santiago. Freeport had defined a 12.4 million ton deposit grading 2.1 grams per ton gold with a 30,023 m drilling program.

Greenstone will operate the Santa Rosa and Cerro Alto de la Mina prospects through the joint venture's Panamanian subsidiary, Minas Santa Rosa S.A. Environmental permitting has been completed. Production from the open pit, heap leach operation was slated

TABLE 4

STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual Capacity
Cement	Empresa Estatal de Cemento "Bayano"	Calzada Larga, Panamá Prov.	300
Do.	Cemento Panamá S.A.	Quebrancha, Panamá Prov.	310
Gold	Transworld Exploration S.A.	Remance Mine, Veraguas Prov.	293 kg
Petroleum products	Refinería Panamá S.A.	Las Minas, Colón Prov.	36 ¹
Silver	Transworld Exploration S.A.	Remance Mine, Veraguas Prov.	855 kg

¹Million 42-gallon barrels.

to begin in 1992. The overburden stripping ratio was reportedly less than 2:1. Output was projected to reach 3 tons of gold per year.

The joint venture continued exploration of the concession with a 38,000 m drilling program around Santa Rosa and Cerro Alto de la Mina and 14 stepout targets. This program resulted in the discovery of the continuation of the Santa Rosa Deposit at Las Huacas, 3 km south of the Santa Rosa pit.

Industrial Minerals

Industrial mineral production supplied the demand generated by increased building activity. Construction was up 24.2%, primarily in Panama City.

Energy and Mineral Fuels

Panama's public electric power capacity was rated at 848 megawatts (MW), of which 65% was hydroelectric based. Private capacity and the Canal Commission generators added another 265 MW to the country's total capacity. Some energy was obtained from the use of biomass residues and fuel wood. A geothermal energy region in southwestern Panama had an estimated potential of 400 MW.

The electrical generating system was operating at approximately 70% capacity, owing to lack of investment, lack of spare parts,

and maintenance problems. In September, power was rationed to 4 hours a day. The IDB has promised \$34.3 million to help revitalize the electrical system. Proposed projects include raising the height of the Fortuna Dam and the construction of an 80 MW plant at Bahía Las Minas. A 150-MW coal fired plant has been proposed for 1997.

During 1990, Texaco Exploration Panama Inc. obtained exploration rights on two blocks along the northwest coast. The contacts were expected to be ratified early in 1991.

INFRASTRUCTURE

Oceangoing ships with beams up to 32.3 m can transit the 82-km Panama Canal. Normal maximum transit draft was 12 m tropical fresh water.

There were 238 km of railroad track in the country. Paved highways accounted for 2,745 km of the approximately 8,500 km of roads. The remainder consisted of gravel or earthen surfaces.

Crude oil was transshipped through a 130-km pipeline extending from Puerto Armuelles on the Pacific coast to Chiriqui Grande on the Atlantic coast. Pipeline capacity was about 800,000 barrels per day. Minor modifications would be needed to reverse flow direction.

OUTLOOK

Industrial mineral development is expected to continue to dominate Panama's mineral industry. With the Government's emphasis on promoting the country's mineral resources, the U.S. dollar-based economy, and incentives provided by Law No. 3, there could be an increase of foreign investment in the precious metal area. The approval and funding of the 150 MW coal-fired generating plant would hasten the development of the country's coal reserves.

¹Where necessary, values have been converted from Panamanian balboas (B) to U.S. dollars at the rate of B1.00=US\$1.00.

OTHER SOURCES OF INFORMATION**Agency**

Dirección General de Recursos Minerales (DGRM)
Ministerio de Comercio e Industrias
Apartado 8515
Panama 5, Panama
Telephone: (507) 36-1823
Fax: (507) 36-3173

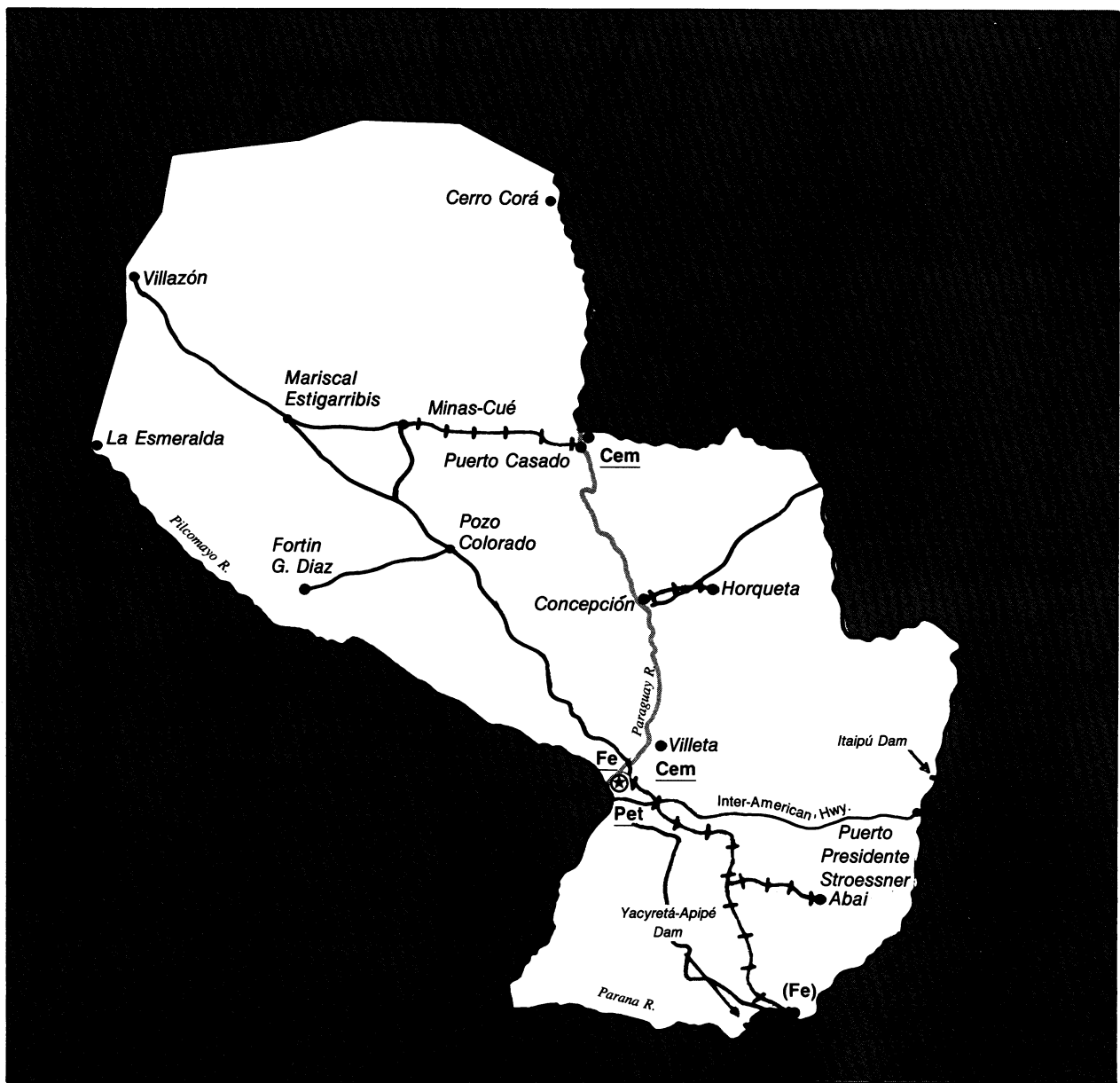
Publications

Dirección de Estadística y Censo, Panama:
Panama en Cifras (annual).
Dirección General de Recursos Minerales,
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Resources, Results from the National
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PARAGUAY

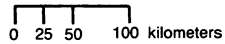
AREA 407,000 km²

POPULATION 4.5 million



- LEGEND**
- International boundary
 - Capital
 - City
 - Railroad
 - Road
 - River
 - Undeveloped resources

See table for mineral symbols.
Underlined symbol indicates plant.



PARAGUAY

By Alfredo C. Gurmendi

Mining accounted for about 0.4% of Paraguay's gross domestic product (GDP), compared to 20% of the agricultural sector. Minerals produced in Paraguay included clays, glass sand, gypsum, kaolin, limestone, pigments, small amounts of iron oxide, stone, and talc. Mineral processing activities included manufacture of cement and lime from indigenous raw materials, pig iron, steel, and refined petroleum from imported raw materials. Paraguay's petroleum needs were supplied by Algeria. Exploration for hydrocarbons in Paraguay was limited and none of the discoveries proved viable. Paraguay's economic performance continued to improve in 1990 with a gross domestic product (GDP) growth of 4.5% to \$6.9 billion.¹ Inflation reached 45% (highest rate ever recorded), foreign debt decreased to \$1.7 billion, unemployment increased to 13%, and the country's international reserves increased to \$620 million.

The Paraguayan work force in 1990 reached 1.4 million. Employment was distributed as follows: 49% in agriculture, 32% in industry (minerals, cement, and petroleum refining included) and commerce, 16% in services, and 3% in Government.

Paraguay's mineral resources did not increase because of extremely limited exploration, as a result of inadequate infrastructure, large fiscal and trade deficits, scarcity of foreign exchange, and limited private investment. However, business opportunities appeared to exist for developing natural resources such as hydropower, iron ore, limestone, manganese, and timber. The Government announced that projects such as the Yacyreta hydroelectric dam, road paving, rural settlements, and electrification would be open to bidding by U.S. firms.

The Paraguayan economy showed some strength with established export industries of cotton, soybeans, cattle, and electricity, and lucrative, yet volatile, petroleum refining and cement industries.

GOVERNMENT POLICIES AND PROGRAMS

Paraguay was involved in three multilateral negotiations: 1) Argentina, Brazil, Paraguay, and Uruguay were negotiating the terms for entering into the southern cone common market (Mercosur) by the end of 1994; 2) The four partners of Mercosur were negotiating with the U.S. Geological Survey on a framework agreement on trade and investment to ease the flow of trade and capital among the five countries; and 3) Paraguay also was negotiating to become a contracting party to the General Agreement on Tariffs and Trade (GATT). This process was expected to be completed after the GATT's Uruguay Round talks end in early 1991, and Paraguay be accepted as a member of the GATT during 1991.

In late 1990, the U.S. Government moved to restore Paraguay's trade benefits under the U.S. Generalized System of Preferences (GSP), suspended in 1987. The restoration of trade benefits was in recognition of improvements in the protection of workers' rights. The decision to restore GSP benefits created the conditions for the Overseas Private Investment Corporation (OPIC) to resume its operations in the country.

Paraguay promulgated a new investment code under Decree Law No. 19 of April 28, 1989. It was amended by Decree Law No. 27 in January and ratified by the Parliament in December 1990. This law established legal criteria for access to investment incentives equally for domestic and foreign investors. The law provided exemptions in taxes and custom duties for 5 years. The most significant reform to date was to unify the exchange rate, substituting a "floating exchange rate" based on market conditions for the previous multiple rates and official export prices.

Tax evasion was widespread in Paraguay. The Ministry of Finance spent much of 1989 and early 1990 working on a series of tax simplification measures presented for pub-

lic comment in mid-1990. The proposals included, for the first time, a personal income tax and a value-added tax (VAT). A revised tax package will be reintroduced after Parliament reconvenes in April 1991.

Opposition from within the Government and the ruling Colorado Party forced a retreat from initial proposals to privatize the Industria Nacional del Cemento (INC), the largest state corporation. The Administración Nacional de Combustibles, Alcohol y Portland's fuel alcohol plant was turned over to Petr6leos Paraguayos (Petropar), the state petroleum company. The remaining rum distilling and retail operations were targeted for sale. In December 1990, Parliament approved the establishment of a commission to oversee the transfer of the company.

PRODUCTION

Mineral commodities produced in Paraguay included clays, glososand, gypsum, kaolin, limestone, and stone for internal consumption only. Inadequate infrastructure was a major constraint on both exploration and mineral development in Paraguay. Production of petroleum refinery products for domestic consumption was about 70% of apparent refinery capacity. Rolled steel production was 55,000 tons and pig iron 62,000 tons in 1990. To date none of the petroleum discoveries proved viable.

TRADE

Exports in 1990 amounted to \$980 million. Lower production of cotton and soybeans, which accounted for 2/3 of exports, coupled with lower prices for soybeans resulted in reduced value of exports. The United States maintained a healthy trade surplus with Paraguay amounting to about \$200 million. The value of Paraguayan mineral exports in 1990 was negligible. Imports of crude oil and petroleum products amounted to \$200 million. Argentina and

TABLE 1

PARAGUAY: PRODUCTION OF MINERAL COMMODITIES¹

Commodity ²	1986	1987	1988	1989 ^e	1990 ^e
Cement, hydraulic thousand metric tons	179	261	321	326	326
Clays:					
Kaolin metric tons	55,000	72,000	76,000	74,000	74,000
Other thousand metric tons	1,650	1,898	1,910	1,860	1,900
Gypsum metric tons	2,800	3,100	3,600	4,500	4,500
Iron and steel:					
Pig iron do.	—	50,278	62,724	63,000	61,000
Steel, crude do.	—	13,167	62,273	62,500	63,000
Lime do.	88,290	92,500	96,000	103,000	100,000
Petroleum refinery products:					
Liquefied petroleum gas do.	40	91	96	100	100
Gasoline thousand 42-gallon barrels	382	494	512	560	560
Jet fuel do.	162	152	146	160	160
Kerosene do.	21	33	38	40	40
Distillate fuel oil do.	640	821	675	740	740
Lubricants:					
Oil do.	—	14	19	20	20
Grease do.	—	2	5	5	5
Residual fuel oil do.	254	350	323	350	350
Refinery fuel and losses do.	89	NA	21	25	25
Total do.	1,588	1,957	1,835	2,000	2,000
Pigments, mineral: Natural, ocher metric tons	250	285	310	320	330
Sand, including glass sand thousand metric tons	1,659	1,893	1,926	1,939	2,000
Stone:					
Dimension do.	58	65	73	65	70
Crushed and broken:					
Limestone (for cement and lime) do.	387	507	550	566	600
Other do.	1,720	1,990	2,070	1,960	2,000
Marble metric tons	450	600	750	730	750
Talc, soapstone, pyrophyllite do.	130	180	210	200	200

^eEstimated. NA Not available.

¹Includes data available through mid-June 1991.

²In addition to the commodities listed, common gravel undoubtedly was also produced, but output was not reported, and available information is inadequate to make reliable estimates of output levels.

Brazil were the primary sources for refinery products and Algeria for crude oil. There were plans for all of Paraguay's fuel needs to be supplied from the Formosa Oilfield in Argentina with savings in freight estimated at \$7 per ton. The total value of Paraguayan imports was \$1.4 billion.

STRUCTURE OF THE MINERAL INDUSTRY

The main mineral activities were the Government-owned cement plants and petroleum refinery. The limestone deposits along the Paraguay River were worked by INC for cement production. The Puerto Vallemí plant in Concepción Department had a 400,000-ton-per-year capacity and the Itapucumi clinker at Villeta Department had

a 600,000-ton-per-year capacity. The Paraguayan national steel corporation, Aceros del Paraguay S.A. (Acepar), operated a plant at Villa Hayes, 20 kilometers (km) north of Asunción. Production was based on iron ore and coal imported from Brazil. The Villa Hayes steel plant cost \$290 million and was a joint venture of Brazil and Paraguay. During 1990, the Government-owned company, Petropar, produced in excess of 1,825,000 barrels of refined petroleum products for domestic consumption at its Santa Elisa refinery in Asunción.

COMMODITY REVIEW

Metals

Shortages of raw materials continued to affect output by Acepar. The Villa Hayes

plant was only able to supply reinforcing bars and some wire. Imports of rolled steel increased by about 10% to 45,000 tons in 1990. Other minerals known to occur included copper, lateritic iron ore, lignite, manganese, peat, pyrite, and uranium. Discussions between the Governments of Bolivia and Paraguay continued about imports of 500,000 tons per year of iron ore from the Mutún Mine near the Bolivian border.

Mineral Fuels and Energy

Exploration for hydrocarbons in Paraguay was very limited. Dependency on foreign sources of petroleum continued. Only two U.S. petroleum corporations were active in Paraguay. Occidental Petroleum Company identified a potential oil and

TABLE 2
PARAGUAY: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons)

Commodity	1988	Principal destinations
Cement	1,000	Brazil 750; Argentina 250.
Iron and steel: Metal:		
Scrap	3,500	Argentina 2,000; Uruguay 1,500.
Pig iron, cast iron, related materials	16,401	Argentina 15,801; Uruguay 600.
Steel, primary forms	6,825	Argentina 5,825; Uruguay 1,000.
Semimanufactures: Bars, rods, angles, shapes, sections	2,450	All to Argentina.
Stone, sand and gravel: Dimension stone, crude and partly worked	141,827	Argentina 141,750; Republic of Korea 77.

¹Table prepared by H. D. Willis. Export data for 1987 and 1989 were not available at time of publication.

natural gas-bearing structure in northwestern Paraguay, near Villazón. Texaco Company continued with geophysical surveys in southern Paraguay near the Argentinean border.

The Itaipú Dam complex, a joint Brazilian-Paraguayan hydroelectric powerplant on the Paraná River, will be operating at full capacity in 1992 with 12,600 megawatt (MW) output. The Yacyretá-Apipé Dam, a joint Argentinean-Paraguay hydroelectric project 320 km downstream from Itaipú will become operational in mid-1993 with a capacity of 2,760 MW.

Reserves

There are large resources of limestone along the Paraguay River. Lateritic iron ore

TABLE 3
PARAGUAY: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
METALS			
Aluminum:			
Oxides and hydroxides	424	1	Brazil 413; Uruguay 9.
Metal including alloys:			
Unwrought	20	—	All from Brazil.
Semimanufactures	397	1	Brazil 168; Argentina 114; Switzerland 63.
Chromium: Oxides and hydroxides value, thousands	\$3	—	Brazil \$1; United Kingdom \$1.
Copper: Metal including alloys, semimanufactures	740	(?)	Chile 613; West Germany 95; Brazil 28.
Iron and steel:			
Iron ore and concentrate: Pyrite, roasted	50,863	—	Brazil 50,809; Republic of South Africa 53.
Metal:			
Scrap	244	—	Brazil 141; West Germany 102.
Pig iron, cast iron, related materials	57	—	Brazil 50; Argentina 7.
Ferroalloys:			
Ferromanganese	399	—	Mainly from Brazil.
Ferrosilicon	149	—	Do.
Unspecified	804	—	Do.
Steel, primary forms	3,008	47	Brazil 2,606; Spain 135; Republic of South Africa 91.
Semimanufactures:			
Bars, rods, angles, shapes, sections	7,902	—	Brazil 3,890; Argentina 2,409; Spain 1,068.
Universals, plates, sheets	13,763	—	Brazil 7,313; Republic of South Africa 6,080; Argentina 360.
Hoop and strip	968	—	Brazil 882; Argentina 64; Republic of South Africa 13.
Rails and accessories	2	—	Mainly from Brazil.
Wire	79	—	Argentina 50; Brazil 27; Spain 1.
Tubes, pipes, fittings	3,569	47	Brazil 1,546; Argentina 881; Republic of South Africa 865.
Castings and forgings, rough	199	6	Brazil 106; France 17; Italy 17.
Lead:			
Oxides	1	—	All from West Germany.
Metal including alloys, semimanufactures			
value, thousands	\$1	\$1	
Manganese: Oxides	4	—	All from West Germany.

See footnotes at end of table.

TABLE 3—Continued

PARAGUAY: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988		
		United States	Other (principal)	
METALS—Continued				
Mercury	value, thousands	\$4	\$1	West Germany \$3.
Nickel: Metal including alloys, semimanufactures	do.	\$3	—	Argentina \$2; Japan \$1.
Platinum-group metals: Metals including alloys, unwrought and partly wrought, unspecified	do.	\$3	—	All from West Germany.
Titanium: Oxides		207	5	Mexico 142; West Germany 50; Republic of South Africa 10.
Zinc:				
Oxides		3	—	West Germany 2; Spain 1.
Metal including alloys:				
Unwrought		99	—	All from Peru.
Semimanufactures		11	—	All from Brazil.
Other: Oxides and hydroxides		3	(?)	Mainly from Brazil.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.		149	—	Mainly from Argentina.
Grinding and polishing wheels and stones		44	(?)	Brazil 38; West Germany 3; Spain 1.
Asbestos, crude		302	—	Brazil 301; West Germany 1.
Boron materials: Oxides and acids		4	—	All from West Germany.
Bromine, fluorine and iodine		243	—	Uruguay 149; Brazil 92; West Germany 1.
Cement		3,817	—	Brazil 3,655; Argentina 162.
Chalk		127	—	All from Argentina.
Clays, crude		589	101	Brazil 324; Spain 57.
Diatomite and other infusorial earth		34	30	Chile 4.
Feldspar, fluorspar, related materials		83	—	Argentina 55; Brazil 28.
Fertilizer materials:				
Crude, n.e.s.		709	—	All from Brazil.
Manufactured:				
Ammonia		60	—	Brazil 48; West Germany 10; Argentina 2.
Phosphatic		15,136	18	Brazil 14,359; Uruguay 705; Netherlands 30.
Unspecified and mixed		13,066	—	Brazil 12,207; Belgium-Luxembourg 300; West Germany 300.
Graphite, natural	value, thousands	\$1	—	All from Italy.
Gypsum and plaster		5,070	—	All from Argentina.
Lime		1,000	—	All from Brazil.
Magnesium compounds: Magnesite, crude				
	value, thousands	\$2	—	All from Argentina.
Nitrates, crude		4,024	—	Brazil 3,848; Argentina 101; Uruguay 50.
Phosphates, crude		138	2	Chile 136.
Pigments, mineral: Iron oxides and hydroxides, processed		114	—	Brazil 87; Argentina 22; Belgium-Luxembourg 5.
Potassium salts, crude		1,039	—	Uruguay 601; Brazil 367; Argentina 70.
Salt and brine		1,774	—	Argentina 1,744; Brazil 26; West Germany 4.
Sodium compounds, n.e.s.:				
Soda ash, natural and manufactured		3,293	6	Spain 1,181; Romania 1,080; Poland 433.
Sulfate, natural and manufactured		459	—	Brazil 405; United Kingdom 51; West Germany 3.

See footnotes at end of table.

TABLE 3—Continued

PARAGUAY: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
INDUSTRIAL MINERALS—Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	386	—	Brazil 277; Argentina 105; West Germany 3.
Worked	143	—	Brazil 84; Italy 48; West Germany 11.
Sand other than metal-bearing	13	—	All from Brazil.
Sulfur:			
Elemental:			
Crude including native and byproduct	1,593	22	Canada 1,100; West Germany 338; Uruguay 338.
Colloidal, precipitated, sublimed	171	—	All from West Germany.
Sulfuric acid	3	—	Mainly from Brazil.
Talc, steatite, soapstone, pyrophyllite	253	—	Brazil 168; Argentina 56; Italy 29.
Other:			
Crude	140	(²)	Mainly from Brazil.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,151	—	Argentina 915; Brazil 236.
Carbon black	9	1	Brazil 6; West Germany 2.
Coal: Anthracite	65	—	Brazil 50; Argentina 14.
Coke and semicoke	1,993	—	All from Argentina.
Gas, natural: Gaseous	cubic meters	1,389,725	—
			Brazil 1,319,963; Argentina 69,762.
Petroleum:			
Crude	42-gallon barrels	1,923,570	—
			All from Algeria.
Refinery products:			
Mineral jelly and wax	do.	685	165
			Brazil 323; West Germany 150.
Distillate fuel oil	do.	2,113,171	4,573
			Argentina 1,305,821; Brazil 770,588; Netherlands 16,688.
Lubricants	do.	588	21
			Brazil 273; West Germany 133; Netherlands 63.
Bitumen and other residues	do.	51,201	—
			Argentina 50,080; Brazil 1,121.
Bituminous mixtures	do.	6,824	—
			Argentina 6,072; Brazil 715; Uruguay 30.

¹Table prepared by H. D. Willis. Import data for 1987 and 1989 were not available at time of publication.²Less than 1/2 unit.

TABLE 4

PARAGUAY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons per year unless otherwise specified)

Commodity	Major operating companies (ownership)	Location of main facilities	Annual capacity
Cement	Industria Nacional del Cemento	Puerto Vallemi, (finished cement) (Government, 100%) Concepcion Department	200
		Villeta, (finished cement) Central Department	300
		Itapucumi (clinker), Central Department	600
Steel products	Aceros del Paraguay S.A. (ACEPAR) (Government, 60%; Siderurgica Paraguaya S.A.-Sidepar, 40%)	Villa Hayes, President Hayes Department (20 kilometers north of Asuncion)	150
Petroleum products ¹ thousand barrels	Petroleos Paraguayos S.A. (PETROPAR) (Government, 60%; Refineria Paraguaya S.A., 40%)	Santa Elisa, Asuncion (near Asuncion)	2,738

¹Effective capacity is reportedly only 2,190,000 barrels per year.

along the Paraná River near Encarnación were estimated at 300 million tons with 35% iron. Other minerals known to occur included azurite, barites, gypsum, lignite, malachite, mica, peat, pyrite, pyrolusite, soapstone, and uranium.

INFRASTRUCTURE

The transportation system in Paraguay improved somewhat in 1990, but remained generally inadequate. The country is linked to the outside world via air and inland river transport. There were 886 airports, of which 768 were usable; 6 had permanent surface runways ranging from 1,220 to 3,700 meters. Other transportation modes comprised inland waterways, 3,100 km; railways, 970 km; and highways, 21,960 km. The most important commercial transportation connections with Argentina and the shipping lanes on the Atlantic Ocean were the navigable Paraguay and Paraná Rivers in this landlocked country. The inland waterways and the Río de la Plata handled about 65% of Paraguay's foreign trade with Argentina, Brazil, Chile, Europe, Japan, and the United States. Most of Paraguay's exports and imports are transshipped to Buenos Aires, Argentina, or Montevideo, Uruguay. The main port of Asunción and nine minor ports on the inland rivers are managed by the Administración Nacional de Navegación y Puertos, a Government-owned corporation.

OUTLOOK

The economic slowdown in Japan, the United States, and parts of Europe will lessen demand for Paraguay's main exports,

leading to downward pressure on prices. Approval by the International Monetary Fund (IMF) of Paraguay's standby program would allow Paraguay access to sizable new multilateral credits. Also, tax and financial reforms in Paraguay will ease loans from the World Bank linked to approval of Paraguay's IMF programs. The decision to restore the U.S. GSP benefits will create favorable conditions for OPIC to resume its operations in Paraguay leading to capital availability for Paraguay's economic development.

Mineral surveys have identified the presence of iron ore, uranium, and other minerals in Paraguay, particularly lateritic iron ore on the Paraná River near Encarnación. Geophysical surveys have identified oil and natural gas potential in the El Palma Largo and Gran Boquerón Chaco regions in northwest Paraguay. Paraguay's accession to GATT would provide an opportunity to expand its trade position worldwide.

¹Where necessary, values have been converted from Paraguayan guaraníes (G) to U.S. dollars at the average market rate of G1,200=US\$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Aceros del Paraguay S.A. (ACEPAR)
Azara 179, Asunción
Paraguay
Administración Nacional de Combustibles,
Alcohol y Portland
Asunción, Paraguay
Palma 1084 y Hernanderías, Asunción
Paraguay

Administración Nacional de Navegación y Puertos (ANNP)
Plazoleta Isabel La Católica y Colón,
Asunción
Paraguay
Dirección General de Recursos Minerales (DGRM)
Oliva y Alberdi, Asunción
Paraguay
Industria Nacional del Cemento (INC)
Humaitá 357, Edificio Humaitá 5^o Piso,
Asunción
Paraguay
Ministerio de Industria y Comercio
Ave. España 477 (Esq. Estados Unidos),
Asunción
Paraguay
Ministerio de Obras Públicas y Comunicaciones
General Días (Esq. Alberdi), Asunción
Paraguay
Petróleos Paraguayos S.A. (PETROPAR)
Edificio Bank of América
4^o Piso, Oliva 299, Asunción
Paraguay

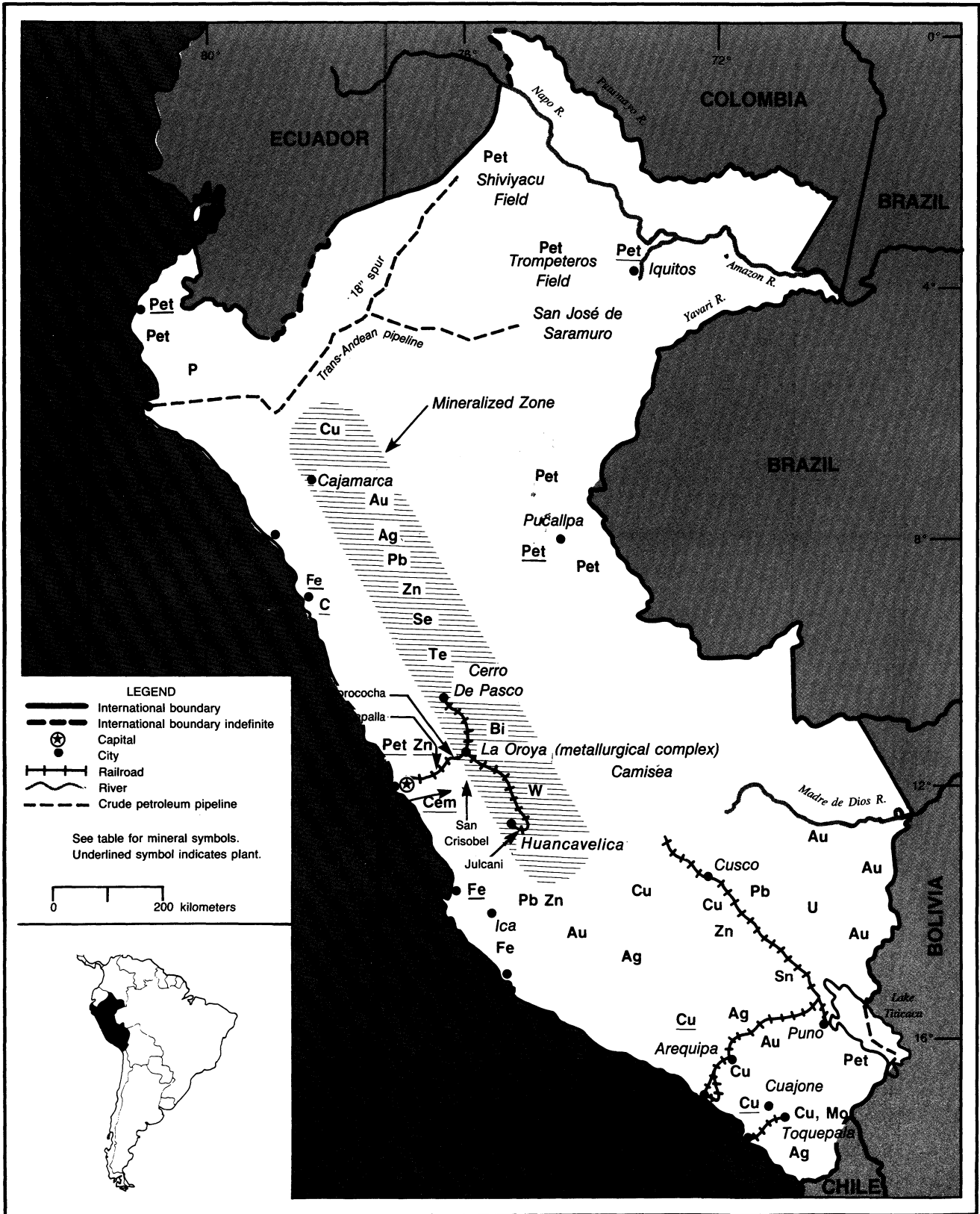
Publications

Administración Nacional de Combustibles, Alcohol y Portland, Asunción, Paraguay: Memoria y Balance (annual report).
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Siderurgia Latinoamericana, monthly.

PERU

AREA 1,285,200 km²

POPULATION 21.9 million



PERU

By Philip M. Mobbs

Peru was one of the more important mining countries of the world. More than 19 metallic and 23 industrial minerals were produced or processed within the country. Peru was a major world source for arsenic, copper, lead, molybdenum, silver, tellurium, and zinc. For 1990, mine output of most metals lagged behind 1989 levels. Mineral exports were buffeted by reduced production and with few exceptions, most noticeably lead, lower prices. Minerals accounted for 46% of the total value of exports. Mineral export income dropped to \$1,513 million.¹

During the first half of the year, monthly inflation ranged from 30% to 43% peaking at 397% in August, the month after the new Government was inaugurated. By November, the monthly inflation rate was down to 6%. The annual inflation rate for 1990 was 7,650%.

GOVERNMENT POLICIES AND PROGRAMS

Most mining activity falls under Legislative Decree No. 109, the General Mining Law, signed on June 12, 1981.

The Central Bank's 1989 program of purchasing domestic silver at a 5% premium over world prices was extended 2 months from January 1990 until the end of March.

In the attempt to control terrorist activities, portions of 12 departments containing more than 60% of Peruvian territory were declared in a state of emergency, thus operating under military control.

In June, the legislature passed a law that legalized collective bargaining across the entire mining industry. Previously, separate agreements had been reached with the unions representing each mine. By early July, the Ministry of Labor ordered mining companies to negotiate with the Peruvian Miners' Federation. However, small- and medium-sized companies maintained that they could not afford the same wage scales as the large state-owned corporations. The

courts subsequently condoned the mining companies unwillingness to enter industrywide arbitration. The Miners' Federation responded with an October 15 strike call, which affected a major copper company.

The Government's multitiered exchange rate system was simplified in August. In October, import and export tariffs were reduced, and Peru resumed payments to the World Bank.

A new Environmental and Natural Resources Law, Decree Law 611, was signed in September. The law required an Environmental Impact Study for each phase of mining and petroleum activity. The Government was looking at reducing the impact of waste streams from all mineral industry activities.

The administration proposed to revive the mining industry by attracting foreign investment. Additionally, the Government planned to privatize some of the 161 state companies. However, a new administrative layer for mining concerns was created when the departments were reorganized into regions. Some regional governments continued to advance the pro-state natural resources policies that the national Government was moving away from.

In November, Congress consented to the Bureau de Recherches Géologiques et Minières' (BRGM) request to operate the Tambo Grande Project. The deposit was within the 50-km belt along the Ecuadorean frontier where foreign company operations were routinely discouraged.

In December, the Government signed an agreement with the World Bank's Multilateral Investment Guarantee Agency (MIGA). An agreement with the Overseas Private Investment Corp. (OPIC) was under consideration.

PRODUCTION

Production for most metals dropped off from that of 1989. The overall trend of lower

metal prices, continued exchange rate dissatisfaction, the industry's poor financial condition, and increased terrorist attacks on both operational sites and electrical distribution grids helped to frustrate production.

Low silver prices were especially bothersome for most of Peru's medium-sized mines. Companies responded by decreasing staffs, reducing new investment in operations, and high-grading production. Many companies appeared to be trying merely to survive.

After a relatively quiet 1989, the Miners' Federation increased labor actions in 1990. Large mining companies lost between 26 and 53 days to strikes during the year. Strikes against medium-sized companies tended to be less lengthy, although most companies lost some production. Even transshipment of products was affected when workers walked out at nine ports for 9 days in March.

TRADE

Mineral commodities dominated the country's exports. Copper accounted for 22% of the \$3,276 million export market. Zinc garnered 13% of the value of exports. Lead and silver each secured 4% of the value of export activity. The United States remained a significant destination for exports.

Imports reached \$2,885 million. Imports from the United States accounted for 28% of Peru's official purchases.

STRUCTURE OF THE MINERAL INDUSTRY

In Peru, the major mining companies, such as Empresa Minera del Centro del Perú (Centromin Perú), Empresa Minera del Perú (Mineroperú), Empresa Regional Minera Tintaya S.A. (Tintaya), and Empresa Minera del Hierro del Perú, S.A. (Hierro Perú), were state-owned. Southern Perú Copper Corp. (SPCC), another large mining company, was privately owned. Large

TABLE 1
PERU: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^a	1990 ^a
METALS					
Antimony:					
Mine output, Sb content	^a 670	590	^a 420	519	560
Metal	356	318	246	304	² 313
Arsenic, white ³	1,273	1,757	828	563	500
Bismuth:					
Mine output, Bi content	605	412	363	687	555
Metal	569	387	341	646	² 521
Cadmium:					
Mine output, Cd content	463	461	368	472	² 378
Metal	387	351	303	352	² 265
Chromium, mine output, Cr content	—	461	368	^a 430	400
Copper:					
Mine output, Cu content	370,899	391,050	316,355	368,168	² 317,706
Sulfate (Cu content)	<u>5,612</u>	<u>5,218</u>	<u>3,185</u>	<u>4,663</u>	<u>3,500</u>
Metal:					
Smelter	<u>327,198</u>	<u>323,009</u>	<u>246,879</u>	<u>241,424</u>	² 195,539
Refined	¹ 197,740	¹ 199,390	158,466	204,608	² 165,483
Electrowon	28,976	26,520	21,126	19,652	² 16,307
Total refined	<u>226,716</u>	<u>225,910</u>	<u>179,592</u>	<u>224,260</u>	² 181,790
Gold:					
Mine output, Au content	8,846	8,486	9,164	9,898	10,000
Metal	2,615	2,021	2,392	2,923	² 3,448
Indium	3,333	3,890	2,120	3,026	² 2,801
Iron and steel:					
Iron ore and concentrate:					
Gross weight	5,036	5,019	4,171	^a 4,300	² 3,246
Fe content	3,356	3,305	2,839	2,923	² 2,147
Metal:					
Pig iron ⁴	216	185	202	209	117
Ferroalloys	739	2,362	1,621	^a 1,600	1,600
Steel ingots and castings	487	503	481	401	284
Semimanufactures	377	396	390	222	243
Lead:					
Mine output, Pb content	194,378	203,950	149,037	192,213	² 188,937
Metal	66,417	71,333	56,523	73,402	² 69,305
Manganese, mine output, Mn content ^c	² 119	200	146	150	150
Molybdenum, mine output, Mo content	3,484	3,353	2,444	3,177	2,410
Selenium, metal, refined	12,035	11,430	4,937	¹ ^a 9,000	² 8,913
Silver:					
Mine output, Ag content	1,926	2,054	1,552	1,840	² 1,728
Metal, refined	667	662	510	658	² 623
Tellurium, metal	9,836	7,457	4,078	¹ ^a 8,000	² 7,842
Tin, mine output, Sn content	4,817	5,263	4,181	5,082	² 5,134
Tungsten, mine output, W content	742	205	432	970	1,536
Zinc:					
Mine output, Zn content	597,576	612,477	485,429	597,413	² 576,799
Metal	155,811	144,169	123,125	126,698	² 120,631

See footnotes at end of table.

TABLE 1—Continued

PERU: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^a	1990 ^a	
INDUSTRIAL MINERALS						
Barite	9,945	8,354	^r 40,000	^r 45,000	82,000	
Boron materials, crude (borates)	22,557	22,710	^e 15,000	^e 18,000	15,000	
Cement, hydraulic	thousand tons	2,207	2,584	2,514	2,105	2,185
Chalk ^e	470,000	470,000	470,000	470,000	470,000	
Clays:						
Bentonite	33,080	16,194	50,741	^r 40,000	40,000	
Fire clay	^e 5,000	50	5,880	^r 5,000	5,000	
Kaolin	6,328	626	8,449	^e 200	8,000	
Common clay	406,587	1,083,528	94,098	^r 100,000	100,000	
Diatomite	8,905	20,916	29,650	^r 20,000	20,000	
Feldspar	19,467	64,749	2,378	^r 10,000	10,000	
Gypsum, crude	171,347	228,845	^e 150,000	^e 160,000	150,000	
Lime ^e	35,000	12,500	13,000	13,000	13,000	
Mica ^e	550	550	² 93	¹ 100	100	
Nitrogen, N content of ammonia ^e	100,000	80,000	95,000	91,000	90,000	
Phosphates, crude	5,167	60,713	115,343	^e 13,000	20,000	
Salt, all types	399,387	444,894	125,500	^r 200,000	200,000	
Stone, sand and gravel:						
Stone:						
Dolomite	^e 2,000	60	9,200	^r 9,000	9,000	
Flagstone ^e	² 467,766	400,000	300,000	300,000	300,000	
Granite	—	64,296	1,647	^r 2,000	2,000	
Limestone	thousand tons	2,935	1,657	3,650	^r 3,000	3,000
Marble	7,258	9,926	35,996	^r 20,000	20,000	
Onyx	143	577	350	^e 500	500	
Quartz and quartzite (crushed)	^e 2,200	848	50,000	^r 40,000	40,000	
Shell, marl ^e	² 5,437	5,000	4,000	4,000	4,000	
Slate ^e	18,000	18,000	18,000	18,000	18,000	
Travertine	4,082	6,524	^e 5,000	^e 5,000	5,000	
Sand and gravel:						
Construction	thousand tons	4,847	8,013	3,877	5,000	5,000
Silica sand	do.	99	76	158	75	100
Sulfur:						
Elemental:						
Native ^e	100	100	100	100	100	
Byproduct of metallurgy ^e	66,300	66,000	66,000	66,000	66,000	
Sulfuric acid, gross weight	207,462	181,054	173,722	^e 180,000	150,000	
Talc and related materials:						
Talc	1,754	1,447	1,450	^r 1,500	1,500	
Pyrophyllite	7,354	705	9,200	^r 7,500	7,500	
Total	9,108	2,152	10,650	^r 9,000	9,000	
MINERAL FUELS AND RELATED MATERIALS						
Carbon Black	5,439	5,877	7,081	5,028	5,000	
Coal:						
Anthracite, run-of-mine ^e	90,000	90,000	¹ 101,000	¹ 100,000	125,000	
Bituminous, run-of-mine	61,077	107,501	49,200	^r 50,000	50,000	
Total	151,077	197,501	^r 150,200	^r 150,000	175,000	
Coke, all types ^e	10,000	10,000	10,000	10,000	10,000	

See footnotes at end of table

TABLE 1
PERU: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^p	1990 ^e
MINERAL FUELS AND RELATED MATERIALS—Continued					
Gas, natural:					
Gross million cubic meters	1,416	1,395	1,359	1,125	1,100
Marketed do.	<u>626</u>	<u>493</u>	<u>435</u>	<u>283</u>	<u>280</u>
Natural gas liquids:					
Natural gasoline and others ⁵ thousand 42-gallon barrels	240	335	368	^e 240	226
Propane do.	69	29	24	^e 20	93
Butane do.	6	9	5	^e 5	6
Total do.	<u>315</u>	<u>373</u>	<u>397</u>	<u>^e265</u>	<u>325</u>
Petroleum:					
Crude do.	<u>65,262</u>	<u>59,730</u>	<u>51,717</u>	<u>47,597</u>	<u>47,050</u>
Refinery products:					
Liquefied petroleum gas do.	1,577	1,620	1,649	1,685	² 1,471
Gasoline, motor do.	11,702	11,425	11,694	10,916	² 10,476
Jet fuel do.	2,551	2,260	1,991	1,970	² 2,034
Kerosene do.	6,940	6,464	7,404	6,484	² 5,699
Distillate fuel oil do.	10,577	10,444	9,503	8,547	² 8,578
Lubricants do.	61	63	54	48	² 38
Residual fuel oil do.	27,441	28,829	27,306	24,751	² 24,762
Asphalt do.	333	446	1,009	871	² 134
Other ⁶ do.	1,132	399	291	298	² 888
Total do.	<u>62,314</u>	<u>61,950</u>	<u>60,901</u>	<u>55,570</u>	<u>²54,080</u>

^eEstimated. ^pPreliminary. ^rRevised.

¹Table includes data available through December 1991.

²Reported figure.

³Output reported by Empresa Minera del Centro del Perú S.A.

⁴Excludes sponge iron production as follows, in tons: 1986—55,500; 1987—50,891; 1988—51,000; 1989—45,700 (revised); and 1990—29,400.

⁵Includes hexane.

⁶Includes refinery fuel and losses.

TABLE 2
PERU: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Destinations, 1988	
		United States	Other (principal)
METALS			
Aluminum: Metal including alloys, unwrought	1	—	All to Chile.
Copper:			
Ore and concentrate	141,036	—	Japan 51,510; West Germany 24,288; Sweden 22,490.
Matte and speiss including cement copper	53,543	—	United Kingdom 23,560; Japan 18,546; Netherlands 3,817.
Metal including alloys:			
Unwrought	143,399	19,514	Italy 24,839; Netherlands 23,496; United Kingdom 21,912.
Semimanufactures	8,863	1,826	Colombia 3,007; Costa Rica 1,285.
Iron and steel:			
Iron ore and concentrate including roasted pyrite value	\$5,000	—	Israel \$4,000; Japan \$1,000.

See footnotes at end of table.

TABLE 2—Continued

PERU: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Destinations, 1988	
		United States	Other (principal)
METALS—Continued			
Iron and steel—Continued			
Metal: Semimanufactures:			
Bars, rods, angles, shapes, sections	344	—	Bolivia 343; Ecuador 1.
Universals, plates, sheets	42	—	All to Bolivia.
Rails and accessories value	\$1,000	—	Do.
Wire	141	—	Chile 131; Bolivia 10.
Tubes, pipes, fittings	146	12	Bolivia 118; Switzerland 14.
Castings and forgings, rough	4,540	—	Chile 3,862; Bolivia 390; Colombia 258.
Lead:			
Ore and concentrate	193,945	40,442	Belgium-Luxembourg 52,767; Mexico 25,495.
Oxides	5,503	90	Venezuela 2,114; Colombia 1,828; Nicaragua 477.
Metal including alloys:			
Unwrought	33,606	501	Venezuela 8,618; Italy 7,360; Japan 3,910.
Semimanufactures	227	—	Mainly to Cuba.
Nickel: Ore and concentrate	29	—	All to United Kingdom.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	\$13,033	\$4,032	United Kingdom \$6,824; Spain \$1,764.
Tin:			
Ore and concentrate	11,501	2,647	United Kingdom 8,335; West Germany 519.
Metal including alloys:			
Unwrought	18	—	Colombia 10; Costa Rica 4; Chile 3.
Semimanufactures	11	(?)	Guatemala 9; Ecuador 2.
Tungsten: Ore and concentrate	1,017	803	Japan 136; West Germany 77.
Zinc:			
Ore and concentrate	716,914	37,452	Belgium-Luxembourg 192,978; Japan 162,796; Brazil 60,036.
Oxides	5,604	2,549	United Kingdom 883; Japan 514.
Blue powder and other powder and flakes	5	—	All to Ecuador.
Metal including alloys:			
Unwrought	88,792	10,400	Venezuela 27,981; Japan 16,829; Colombia 12,786.
Semimanufactures	7,695	2,907	U.S.S.R. 3,796; Costa Rica 505.
Other:			
Ores and concentrates:			
Of base metals	3,406	—	Netherlands 1,173; United Kingdom 879; Chile 674.
Of precious metals, n.e.s.	17,890	5,225	Belgium-Luxembourg 7,894; Sweden 2,583.
Oxides and hydroxides	742	189	Brazil 159; Denmark 139.
Ashes and residues	3,887	—	Spain 3,801; Uruguay 48; United Kingdom 38.
Base metals including alloys, all forms	677	194	Japan 219; Netherlands 177.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones	4	—	Bolivia 3; Japan 1.
Barite and witherite	50,110	—	Venezuela 23,709; Netherlands 21,003; Colombia 3,001.
Boron materials:			
Crude natural borates	10,671	—	Brazil 9,925; Colombia 741; Mexico 5.
Oxides and acids	324	—	Ecuador 156; Colombia 142; Venezuela 26.
Bromine, fluorine, iodine	67	—	All to Colombia.
Cement	2,257	—	Ecuador 1,871; Chile 386.
Clays, crude	780	—	Chile 405; United Kingdom 203; Colombia 141.

See footnotes at end of table.

TABLE 2—Continued

PERU: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Destinations, 1988	
		United States	Other (principal)
INDUSTRIAL MINERALS—Continued			
Diamond, natural: Gem, not set or strung value, thousands	\$38	\$2	Israel \$12; West Germany \$7; Italy \$5.
Feldspar, fluorspar, related materials	70	—	All to Ecuador.
Fertilizer materials:			
Crude, n.e.s.	27	27	
Manufactured:			
Nitrogenous	562	—	All to Bolivia.
Unspecified and mixed	137	—	West Germany 109; Belgium-Luxembourg 28.
Graphite, natural	39	—	Chile 21; Argentina 18.
Gypsum and plaster	1,200	—	All to Ecuador.
Mica: Crude including splittings and waste	13	—	Do.
Pigments, mineral: Iron oxides and hydroxides, processed	94	—	All to Colombia.
Pyrite, unroasted	277	109	Italy 102; France 17.
Sodium compounds, n.e.s.: Soda ash, natural and manufactured value	\$1,000	\$1,000	
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	8,532	18	Colombia 8,171; Venezuela 309; Italy 19.
Worked	752	122	Colombia 626; France 2.
Dolomite, chiefly refractory-grade	100	—	All to Ecuador.
Quartz and quartzite	21	9	United Kingdom 7; France 2.
Sulfur: Sulfuric acid	14,056	—	Chile 11,945; Ecuador 2,111.
Talc, steatite, soapstone, pyrophyllite	155	—	Panama 125; Chile 30.
Other:			
Crude	10	2	Italy 3; West Germany 2.
Slag and dross, not metal-bearing	2	2	
MINERAL FUELS AND RELATED MATERIALS			
Coal: Anthracite	1,000	—	All to China.
Petroleum:			
Crude 42-gallon barrels	411,413	411,413	
Refinery products:			
Distillate fuel oil do.	186,396	—	Ecuador 5,043; unspecified 181,353.
Lubricants do.	1,708	—	Ecuador 49; Bolivia 21; unspecified 1,638.
Residual fuel oil do.	13,043,856	12,619,415	Mexico 335,198; unspecified 89,243.
Bituminous mixtures do.	24	—	All to Bolivia.

¹Table prepared by H. D. Willis. Export data for 1987 and 1989 were not available at time of publication.²Less than 1/2 unit.

TABLE 3
PERU: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
METALS			
Alkali and rare-earth metals	26	24	West Germany 2.
Aluminum:			
Ore and concentrate	2,504	74	Guyana 2,430.
Oxides and hydroxides	2,237	56	West Germany 1,250; Colombia 54.
Metal including alloys:			
Scrap	12	12	
Unwrought	4,106	260	Venezuela 3,163; Argentina 340.
Semimanufactures	2,742	962	Brazil 604; West Germany 275.
Beryllium: Metal including alloys, all forms	value	\$7,000	\$7,000
Chromium:			
Ore and concentrate	3,246	3,000	Republic of South Africa 246.
Oxides and hydroxides	36	3	Mexico 25; West Germany 6.
Cobalt: Oxides and hydroxides	8	7	Belgium-Luxembourg 1.
Copper: Metal including alloys:			
Unwrought	4	1	United Kingdom 2; West Germany 1.
Semimanufactures	780	96	Chile 254; West Germany 165; Brazil 138.
Iron and steel:			
Iron ore and concentrate: Pyrite, roasted	6	—	All from Switzerland.
Metal:			
Scrap	127,157	112,553	Chile 12,027; Panama 1,273.
Pig iron, cast iron, related materials	519	274	Sweden 138; Brazil 83.
Ferroalloys:			
Ferromanganese	1,851	1	Republic of South Africa 1,414; Brazil 174; Mexico 102.
Ferrosilicon	644	(²)	Brazil 511; Chile 88; Argentina 27.
Unspecified	3,857	12	Republic of South Africa 2,020; Chile 1,005; Mexico 602.
Steel, primary forms	16,965	—	Venezuela 11,868; Republic of Korea 4,934; Mexico 163.
Semimanufactures:			
Bars, rods, angles, shapes, sections	50,578	750	Brazil 16,845; Republic of South Africa 10,790; Japan 7,396.
Universals, plates, sheets	90,569	493	West Germany 23,077; Japan 22,854; Republic of Korea 19,135.
Hoop and strip	2,283	329	West Germany 742; Japan 580; Canada 365.
Rails and accessories	2,776	1,703	United Kingdom 362; Japan 354.
Wire	3,382	36	West Germany 1,213; Republic of South Africa 481; Belgium-Luxembourg 366.
Tubes, pipes, fittings	14,818	1,151	Brazil 3,453; Mexico 3,028; Spain 2,857.
Castings and forgings, rough	356	251	Spain 103; Japan 1.
Lead: Metal including alloys, semimanufactures	1	1	
Magnesium: Metal including alloys:			
Unwrought	60	60	
Semimanufactures	2	1	Denmark 1.
Manganese:			
Ore and concentrate: Metallurgical grade	580	—	Mexico 576; West Germany 4.
Oxides	652	47	Greece 487; United Kingdom 56.
Mercury	25	3	Netherlands 9; Algeria 6; China 6.
Molybdenum: Metal including alloys:			
Unwrought	value	\$3,000	\$3,000

See footnotes at end of table.

TABLE 3—Continued

PERU: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
METALS—Continued			
Molybdenum: Metal including alloys—Continued			
Semimanufactures	3	—	Mainly from Netherlands.
Nickel: Metal including alloys:			
Unwrought	233	221	Netherlands 8; United Kingdom 4.
Semimanufactures	67	11	Netherlands 26; West Germany 14.
Platinum-group metals: Metals including alloys, unwrought and partly wrought			
value, thousands	\$12	\$4	West Germany \$8.
Silver: Metal including alloys, unwrought and partly wrought			
do.	\$32	\$3	Sweden \$29.
Tin: Metal including alloys:			
Unwrought	270	120	Bolivia 145; United Kingdom 5.
Semimanufactures	7	1	Unspecified 6.
Titanium: Oxides			
	62	22	West Germany 23; United Kingdom 14.
Tungsten: Metal including alloys:			
Unwrought	value	\$2,000	\$2,000
Semimanufactures	1	(²)	Mainly from Netherlands.
Zinc:			
Ore and concentrate	value	\$1,000	NA
Oxides	2	—	France 1; West Germany 1.
Metal including alloys, semimanufactures	3	3	
Other:			
Ores and concentrates	152	1	Australia 151.
Oxides and hydroxides	233	78	West Germany 72; Italy 42.
Ashes and residues	5	—	All from West Germany.
Base metals including alloys, all forms	16	1	Australia 8; Bolivia 3; France 2.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc.			
value, thousands	\$127	\$91	Netherlands \$24; West Germany \$11.
Artificial:			
Corundum	350	8	Brazil 322; West Germany 20.
Silicon carbide	151	8	Brazil 89; Argentina 42.
Dust and powder of precious and semi-precious stones			
value, thousands	\$3	—	All from Spain.
Grinding and polishing wheels and stones	111	6	Brazil 42; Italy 31; Japan 11.
Asbestos, crude	3,506	868	Canada 1,864; France 674.
Barite and witherite	42	—	All from Brazil.
Boron materials: Oxides and acids	18	2	Netherlands 11; West Germany 4.
Bromine, fluorine, iodine	2	(²)	Chile 1; West Germany 1.
Cement	5,509	103	Cuba 5,000; France 162; Yugoslavia 147.
Clays, crude	5,606	4,110	United Kingdom 1,342; Japan 66.
Cryolite and chiolite	1	—	All from Denmark.
Diamond, natural: Unsorted	value, thousands	\$149	\$78
			India \$71.
Diatomite and other infusorial earth	1,607	1,090	Mexico 434; Chile 55.
Feldspar, fluorspar, related materials	766	—	Canada 387; Mexico 323; France 56.

See footnotes at end of table.

TABLE 3—Continued

PERU: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
INDUSTRIAL MINERALS—Continued			
Fertilizer materials: Manufactured:			
Nitrogenous	135,584	20,397	Romania 32,578; Mexico 25,961; Belgium-Luxembourg 21,000.
Phosphatic	35,122	24,672	Romania 10,450.
Potassic	52,288	29,176	U.S.S.R. 15,750; Canada 7,350.
Unspecified and mixed	34,484	34,117	West Germany 227; Belgium-Luxembourg 102.
Graphite, natural	16	14	Canada 1; West Germany 1.
Gypsum and plaster	7	2	Japan 5.
Lime value	\$1,000	—	All from West Germany.
Magnesium compounds: Magnesite, crude	7,145	23	Brazil 7,010; Czechoslovakia 103.
Mica:			
Crude including splittings and waste	23	15	Switzerland 6; Greece 2.
Worked including agglomerated splittings	6	1	Belgium-Luxembourg 2; Japan 1; Spain 1.
Nitrates, crude	124	—	Chile 93; Brazil 31.
Phosphates, crude	2	—	Austria 1; Ireland 1.
Pigments, mineral: Iron oxides and hydroxides, processed	438	23	West Germany 346; Brazil 52.
Salt and brine	1,175	879	United Kingdom 261; West Germany 31.
Sodium compounds, n.e.s.:			
Soda ash, natural and manufactured	37,972	35,087	West Germany 1,625; France 511.
Sulfate, natural and manufactured	682	2	Chile 309; West Germany 204; Mexico 100.
Stone, sand and gravel:			
Dimension stone: Crude and partly worked	18	—	All from Italy.
Dolomite, chiefly refractory-grade	527	—	All from Spain.
Quartz and quartzite	4	—	All from Mexico.
Sand other than metal-bearing	12,104	11,999	Republic of South Africa 79; Sweden 16.
Sulfur:			
Elemental:			
Crude including native and byproduct	7,783	6,271	Colombia 1,512.
Colloidal, precipitated, sublimed	42	33	West Germany 9.
Sulfuric acid	14	9	Netherlands 2; Sweden 1.
Talc, steatite, soapstone, pyrophyllite	618	339	Italy 87; China 81.
Other:			
Crude	40	5	West Germany 31; United Kingdom 3.
Slag and dross, not metal-bearing	15	12	Belgium-Luxembourg 3.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	3	3	
Carbon: Carbon black	331	36	West Germany 134; Belgium-Luxembourg 112; Colombia 48.
Coal:			
Anthracite	53,517	—	All from Colombia.
Bituminous value	\$2,000	—	All from Canada.
Lignite including briquets	162	162	
Coke and semicoke	117,168	22,037	Australia 91,260; Colombia 3,871.
Petroleum:			
Crude 42-gallon barrels	1,227,278	—	All from Ecuador.
Refinery products:			
Liquefied petroleum gas do.	21,298	93	Ecuador 21,205.

See footnotes at end of table.

TABLE 3—Continued

PERU: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988		
		United States	Other (principal)	
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum—Continued				
Refinery products—Continued				
Gasoline	42-gallon barrels.	706	366	West Germany 340.
Mineral jelly and wax	do.	95,077	5,769	Brazil 61,488; Argentina 17,125.
Kerosene and jet fuel	do.	818,602	400,923	Venezuela 220,240; Ethiopia 196,827.
Distillate fuel oil	do.	1,576,141	1,109,750	Chile 176,272; Colombia 169,029.
Lubricants	do.	338,751	46,585	Venezuela 280,182; Colombia 3,836.
Residual fuel oil	do.	18,588	18,588	
Bitumen and other residues	do.	109	109	
Bituminous mixtures	do.	588	291	Mexico 127; Colombia 109.
Petroleum coke	do.	803	803	

NA Not available.

¹Table prepared by H. D. Willis. Import data for 1987 and 1989 were not available at time of publication.²Less than 1/2 unit.

companies produced 93% of the nation's copper, 35% of the lead, 24% of the silver, and 35% of zinc output.

Medium-sized companies accounted for 5% of copper production, 54% of lead, 66% of silver, and 57% of zinc output. Private companies dominated the medium and small mining sectors. Most private companies were controlled by local interests.

The state company, Empresa Comercializadora de Productos Mineros (MINPECO S.A.), marketed ores, metals, and minerals produced by other state-run mining companies. It also had arrangements to market the production from many of the regional and private mining companies.

Petroleum activities were administered by the state-owned *Petróleos del Perú* (Petroperú). An increasing number of domestic and foreign firms were participating in exploration contracts with Petroperú.

COMMODITY REVIEW

Metals

The vitality of the Peruvian metal mining sector continued to deteriorate. Only five mining companies, SPCC, Cía. Minera Orcopampa, S.A. (Orcopampa), Cía. Minera Milpo, S.A. (Milpo), Sociedad Minera San Ignacio de Morococha, S.A. (Simsa), and Minas de Arcata, S.A. (Arcata), were reported to have made a profit for the year. The adverse effects of

inflation, the old Administration's unrealistic exchange rate policy, and the new Government's overvalued exchange rate were compounded by continued labor problems and the general lack of credit. Most mining companies were reeling under high debt loads and negative cash-flows. Because of these difficulties, many companies were unable to pursue exploration or expansion programs. Routine maintenance and equipment upgrade programs were deferred. Security costs for companies operating in the Central Mining District continued to mount. The Government's deemphasis of road maintenance resulted in higher transportation costs for the mining companies.

Copper.—Copper production dropped by almost 13% from 1989 levels. SPCC continued to dominate the nation's copper production, with 61% of total copper output. The company endured a 53-day strike from March 12th to May 4th, resulting in a 16% decline from last year's output. Despite the strike, SPCC's Cuajone Mine led the nation with production of 113,696 tons of copper, 36% of Peru's copper output. SPCC's Toquepala Mine accounted for 80,316 tons, 25% of Peru's copper production.

During the year, SPCC studied heap leaching of Cuajone's oxides and Torquepala's secondary sulfides. The Government's contention that SPCC remitted an extra \$72 million from its Cuajone investment remained an issue.

Empresa Minera Especial Tintaya S.A. became Empresa Regional Minera Tintaya S.A. during the year as part of the regionalization process. Tintaya was Peru's second largest copper producer, with 13% of the nation's total production. Operations were hampered early in the year, when the Miners' Federation went on strike for 26 days. The company expanded its concentrator to 10,000 mt/d in July. Also, during the middle of the year, Tintaya received seven BelAz dump trucks. With the new equipment, the company planned to expand its pit to mine higher grade ore.

The company proposed to add an electrowinning plant to treat 26,000 mt/d of oxides from an 8-Mmt stockpile that has accumulated since the mine opened in 1985. Design of the new operations was based on *MineroPerú's* Cerro Verde plant. However, there was concern that migrating clays in the Tintaya heaps would plug pore throats and result in significantly less-efficient leaching.

Financing of the electrowinning project crumbled earlier in the year owing to Tintaya's financial situation. The project was subsequently offered to private investors. At the same time, Tintaya attempted to place up to 75% of the Coroccohuayco prospect with domestic and foreign investors. The project was registered as a new company, Cía. Minera Especial Coroccohuayco, rather than a Tintaya project to help new investors avoid exposure to Tintaya's debt.

TABLE 4

PERU: STRUCTURE OF THE MINERAL INDUSTRY IN 1990.

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Antimony	tons	Empresa Minero del Centro del Perú (Centromin Perú)	Smelter at La Oroya, Region Andres A. Caceres	1'300
Barite		Barmine S.A.	Santa Cruz de Cocachacra, Region Lima	NA
Bentonite		Minerales Andinos S.A.	Vichayal Mine, Region Grau	9
Bismuth	tons	Centromin Perú	Refinery at La Oroya	1'515
Copper		Southern Perú Copper Corp. (SPCC)	Cuajone, Region Jose Carlos Mariategui Toquepala, Region Jose Carlos Mariategui	300
Do.		Centromin Perú	Smelter at Ilo, Region Jose Carlos Mariategui	300
Do.		Centromin Perú	Cobriza, Region Libertadores-Wari; Casapalca and Yauricocha, Region Lima; Morococha, Region Andres A. Caceres	60
Do.		Centromin Perú	Smelter at La Oroya	62
Do.		Centromin Perú	Refinery at La Oroya	58
Do.		Empresa Regional Minera Tintaya	Tintaya, Region Inka	60
Do.		Empresa Minera del Perú S.A. (Mineroperú)	Cerro Verde, Region Arequipa	33
Do.		Empresa Minera del Perú S.A. (Mineroperú)	Refinery at Ilo	175
Dolomite		Minera Baribent S.A.	Esperanza, Region Chavin	25
Gold	kilograms	Cía. de Minas Orcopampa S.A.	Orcopampa, Region Arequipa	2,000
Do.	do.	Cía. Minera Poderosa S.A.	Poderosa, Region San Martin La Libertad	1,600
Do.	do.	Centromin Perú	Refinery at Patatz, Region San Martin La Libertad	4,800
Do.	do.	Centromin Perú	Refinery at La Oroya	1,200
Do.	do.	Cía. Aurífera Río Inambari S.A.	Río Caichive, Region Inka	2'200
Iron ore		Empresa Minero del Hierro del Perú	Marcona, Region Los Libertadores-Wari	13,000
Lead		Centromin Perú	Cerro de Pasco, Casapalca, San Cristóbal, Morococha, Yauricocha, and Andaychagua Mines	85
Do.		Centromin Perú	Smelter at La Oroya	93
Do.		Centromin Perú	Refinery at La Oroya	95
Do.		Cía. Minera Milpo S.A.	El Porvenir Mine, Region Andres A. Caceres	24
Do.		Cía. Minera Atacocha S.A.	Atacocha, Region Los Libertadores-Wari	16
Do.		Fundición de Concentrados S.A.	Smelter at Oyón, Region Lima ¹	24
Molybdenum		SPCC	Cuajone and Toquepala Mines	NA
Petroleum, crude	thousand 42-gallon barrels	Occidental Petroleum Corp. del Perú	Northeastern jungle, Region Amazonas	33,000
Do.	do.	Petroleos del Perú (Petroperu)	Onshore Talara Area, Region Grau; Ucayali Area, Region Ucayali; Marañon area, Region Amazonas	25,000
Do.	do.	Petroleos del Mar S.A.	Offshore Region Grau	10,500
Petroleum products	do.	Petroperu	Refineries at Talara, Lima, Iquitos, Marsella, and Pucallpa	67,000
Silica sand		Minera Baribent S.A.	María G. and Martín I., Region Andres A. Caceres	27
Silver	tons	Centromin Perú	Casapalca, Cerro de Pasco, Cobriza, Morococha, San Cristóbal, Yauricocha, and Andaychagua Mines	466
Do.	do.	Centromin Perú	Refinery at La Oroya	809
Do.	do.	Cía. de Minas Buenaventura S.A.	Julcani Mine, Region Los Libertadores-Wari; Uchucchacua Mine, Region Lima	187
Do.	do.	Cía. de Minas Orcopampa S.A.	Orcopampa Mine, Region Arequipa	161
Steel		Empresa Siderúrgica del Perú	Chimbote, Region Chavin	550
Do.		Empresa Lamidora del Pacífico S.A.	Pisco, Region Los Libertadores-Wari	180
Tellurium	tons	Centromin Perú	Refinery at La Oroya	12
Tungsten	do.	Minera Regina S.A.	Palca XI, Region Puno	1,400
Do.	do.	Fermín Málaga Santolalla	Pasto Bueno, Region Chavin	1,000
Zinc		Centromin Perú	Casapalca, Cerro de Pasco, Morococha, San Cristóbal, Yauricocha, and Andaychagua Mines	235
Do.		Centromin Perú	Refinery at La Oroya	70

See footnotes at end of table.

TABLE 4—Continued

PERU: STRUCTURE OF THE MINERAL INDUSTRY IN 1990.

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Zinc	Minero Perú	Refinery at Cajamarquilla	102
Do.	San Ignacio de Morococha	San Vicente Mine, Region Andres A. Caceres	70
Do.	Perubar	Santa Cruz de Cocachacra, Region Lima	65

NA Not available.

¹Operations suspended during 1989.

Tintaya also completed geological studies of the Las Chabukas copper deposit. The company's transfer to the Region Inka government may have delayed the feasibility study originally planned for 1991.

Centromín Perú produced 11% of Peru's copper from the Casapalca, Cobriza, Morococha, and Yauricocha Mines and from ore treated at the Mahr Tunnel concentrator. Centromín Perú weathered four separate week-long strikes spaced throughout the year. Additionally, the company's operations continued to be hampered by a spare parts shortage. In November, Boliden AB of Sweden made an unsuccessful bid to purchase the company from the Government.

Mineroperú accounted for 8% of Peru's copper production from Cerro Verde in Arequipa. The Cerro Verde complex includes the Cerro Verde and Santa Rosa Mines, three heap-leaching pads, and a concentrator. Mineroperú expanded the Cerro Verde II secondary sulfide concentrator from 1,500 to 2,500 mt/d during the first half of the year. The downturn in the industry reportedly allowed the company to expand by modifying equipment obtained from closed mines. Santa Rosa was opened during the year to increase the volume of ore available for processing.

Mineroperú also operated a copper refinery at Ilo. During 1990, the refinery operated at less than optimum capacity owing to power shortages. The regional drought reduced reservoir levels at the Charcani V and the Aricota hydroelectric plants, both of which provided electricity to the refinery.

Cía. Minera Pativilica, S.A. accounted for 2% of Peru's production from its Raúl Mine, 98 km south of Lima. Of the 23,097 tons of concentrates produced, 5,735 tons of copper was recovered. A dedicated 2,130-kW thermal plant began providing power in May. Concentrator operations were expanded from 1,000 to 1,400 mt/d during the year. The company lost a total of 38 days of production to power shortages and

emergency repairs. The company also installed a satellite communications system and began raising its tailings dam by 1.5 m.

The Mineroperú subsidiary, Cía. Minera Condestable, S.A., produced 3,353 tons of copper or 1% of the country's output. More than 25 additional companies reported copper production.

Gold.—The region between Ica and Arequipa and the Pataz area, a 130-km strip along the east side of the Río Marañón, were Peru's main sources of vein gold production. Placer gold production was concentrated in Regions Inka and Puno, although gold was recovered from streams throughout the jungle. Gold was also recovered as a byproduct from the concentrates of the nation's polymetallic mines. Orcopampa, the country's largest producer of gold, totaled 1,919 kg output during the year. The company's 14,206 tons of concentrate also yielded 161 tons of silver, the third highest production in the country. In 1990, Orcopampa, a subsidiary of Cía. de Minas Buenaventura, S.A. (Buenaventura), started up a 30- to 40-mt/month cyanidation plant, resulting in gold bar production of 1,151 kg. Orcopampa planned to increase the plant's capacity to 100 mt/month and process third-party gold concentrates. Power generation was augmented with the installation of a third turbine at the Hacarama Hydroelectric plant.

Orcopampa pursued an aggressive exploration program. Work continued on level 3,750 of the Calera Vein, on the Blanca-Aserruta structure, and on the Santiago Vein.

Cía Minera Poderosa, S.A.'s Marañón cyanidation plant at Pataz recovered 1,600 kg of fine gold, a 23% increase over that of 1989. During the year, the company expanded the plant's capacity to 350 mt/d.

A new hydroelectric plant provided 550 kW to the company when the first turbine was installed. Poderosa planned to reach an installed generating capacity of 1,600

kW in 1991, when the second turbine was scheduled to go on-line. Work also continued on a thermal backup plant because the hydroelectric plant could only generate 400 kW during the dry season.

Poderosa reported 281,000 tons proven reserves assaying 17.58 g gold per ton.

Also at Pataz, about 350 km east of Trujillo, Minera Aurífera Retamas, S.A. (Marsa), operated a mine midway between the old Parcoy and Buldibuyo Mines. Marsa produced 8,000 tons of ore per day, which were processed by its 250-mt/d concentrator. Gold-pyrite concentrates were reportedly exported to Brazil and yielded about 1,200 kg fine gold.

Centromín Perú produced 1,203 kg refined gold.

Asesoría Contable Minera S.A. produced 570 kg from the Ocona, Santa Clarita, Explorero, and Molino de Oro Mines in Region Arequipa.

Cía. Minera Shila, S.A., a joint venture of Buenaventura and the Cía. de Exploraciones, Desarrollo e Inversiones Minera, S.A. (Cedemin), started up a flotation plant in February. The French company, BRGM, had 65% interest in Cedemin. The Shila Mine and a 150-mt/d concentrator were south of the Orcopampa Mine on the slopes of the Ampato Volcano.

The Japanese Government's Metal Mining Agency confirmed gold discovery in veins 700 km northeast of Lima at Juimarca and Chontari. Exploratory drilling was planned for 1991.

Placer production was calculated on the basis of gold purchases by Banco Minero, which had exclusive rights on gold marketed in Peru. However, many placer operations sold their gold production privately, thus bypassing the official production tally.

Cía. Aurífera Río Inambari S.A. (CARISA) washed 121 kg of gold from its concession on the Caichive River, a tributary of the Inambari River in Region Inka. The company was 84% owned by Bolivia's Cía. Minera del Sur, S.A. (COMSUR) and

16% by Cía. Aurífera Claudia, a private Peruvian company. The company halted washing plant operations on September 27, when the concession was overrun by chichiqueros, the local placer miners. Bucket-line dredging operations were suspended on October 26th to comply with an adverse resolution passed by the regional assembly. Neither operation had resumed at yearend.

Mineroperú recovered 67 kg of gold during 1990. The company ran the San Antonio de Poto placer pilot plant at Ananea, about 70 km north of Lake Titicaca.

Cía. Aurífera El Sol, S.A. moved a dredge upstream to its concession in Region Inka. The dredge, near the convergence of the Madre de Dios and Los Amigos Rivers, was 85% assembled by the end of 1990.

Iron and Steel.—Hierroperú produced iron pellets, pellet feed, and sinter feed. The company sold pellets to Argentina, Japan, the Republic of Korea, and Yugoslavia. Sinter feed was sold primarily to Pohang Steel Co. (POSCO) of the Republic of Korea. The sinter's high sulfur content precluded its use by many steel companies. At yearend, 230,000 tons of sinter feed was scheduled to be shipped to the Baoshan Iron and Steel Works, Shanghai, China.

Lead and Zinc.—Both lead and zinc production were down with respect to those of 1989. Fundición de Concentrados, S.A. (Fundeconsa), shut down the Monty 1 lead smelter in 1989 owing to legal problems. Quimecsa temporarily closed its zinc oxide plant in September 1990, and Cía. Minera Del Madrigal, S.A., closed the Madrigal Mine in November. Regional terrorist activities in the Central Mining District resulted in the loss of life, heavy material damage, and substantial extra security costs. The drought continued, forcing companies to depend on thermal generating equipment to generate electricity, thus increasing operations costs. Landslides in the Colquijirca open pit of Sociedad Minera El Brocal, S.A. (El Brocal) and at Cía. Minera Colquirrumi, S.A.'s pit, also reduced lead-zinc production.

Centromín Perú was again the leading lead-zinc producer, accounting for 35% of both metals.

Milpo operated a lead-zinc-silver deposit in the Central Mining District. Milpo's production ranked it second in the nation in lead, fifth in silver, and fourth in zinc. Production records were set in 1990. Milpo increased lead concentrate production to 33,519 tons and zinc concentrates to 65,033

tons. Lead concentrates were shipped to Centromin Perú's La Oroya smelter, to Japan, or to Belgium. Japan also received zinc concentrates that Mineroperú's Cajamarquilla refinery was unable to process. Concentrates yielded 23,469 tons of lead, 99,056 kg of silver, and 37,435 tons of zinc.

SIMSA operated the San Vicente Mine in the central jungle. This private company was the country's second largest zinc producer, with 11% of the nation's total output. Labor difficulties included a 7-day strike in July.

SIMSA produced 103,497 tons of zinc concentrates and 2,931 tons of lead concentrates from 713,563 tons of ore; 65,251 tons of zinc were recovered. SIMSA started a tolling agreement with MINPECO for the sale of metallic zinc.

Cía. Minera Atacocha, S.A. (Atacocha) also operated in the Central Mining District. Atacocha produced 16,078 tons of lead concentrates, 39,010 tons of zinc concentrates, and 4,864 of bulk concentrates. The company ranked third in lead production and eighth in zinc production for 1990. At the end of the year, the company began to expand daily production to 2,700 tons per day.

Perubar, S.A. was third in zinc and sixth in lead output for the year. The Marc Rich subsidiary operated lead-zinc and barite mines in Region Lima. In 1990, the company produced 10,570 tons of lead concentrates and 102,471 tons of zinc concentrates from 350,000 tons of ore. The company was also responsible for the production of 67,000 tons of barite.

Cía. Minera Santa Luisa, S.A. operated the Hunzala Mine in Region Caceres, northeast of Lima. The company was wholly owned by Japanese mining interests. In 1990, the company produced 73,749 tons of lead-silver and zinc concentrates. The company deferred expansion of its concentrator owing to the industry's economic situation.

El Brocal worked a polymetallic deposit in the Central Mining District. During 1990, the company opened Tajo Principal, an open pit mine. Reserves had been lost with the landslide at Colquijirca. The company also expanded its concentration plant to 2,000 mt/d. El Brocal generated 9,387 tons of lead, 38,351 kg of silver, and 20,488 tons of zinc from 62,179 tons of bulk concentrates, ranking it fifth in lead and ninth in zinc for the year.

Cía. Minera Huaron, S.A. barely weathered a financial crisis during the year and hoped to turn things around in 1991. The company's lead-zinc-silver deposit in

the Central Mining District produced 3,965 tons of copper concentrates, 9,266 tons of lead concentrates, and 21,325 tons of zinc concentrates from 383,345 tons of ore. Huaron ranked eighth in lead production and within the top 15 in both copper and zinc production. It was also the seventh leading silver producer in the nation, with 73,529 kg.

Cía. Minera Raura, S.A. increased production when it opened a new open pit during 1990. This Central Mining District lead-zinc-silver-copper producer processed a record 472,201 tons of ore in 1990. The new open pit, on-line since June, accounted for 96,494 tons.

Before the company curtailed exploration and investment programs, it completed a diamond drilling program. Proven and probable reserves were increased to 8.1 Mmt, assaying 0.68% copper, 2.0% lead, 125 g silver per ton, and 5.9% zinc based on the drilling.

Corporación Minera Nor Perú, S.A. installed a secondary copper treatment plant and deepened a satellite shaft at its Quiruvilca operations, 100 km east of Trujillo. The company ranked within the top 10 producers of lead, silver, and zinc, recovering 3,044 tons of copper concentrates, 9,505 tons of lead concentrates, and 30,459 tons of zinc concentrates. Asarco controlled 80% of the company's shares.

Centromin Perú and two German firms, Metall-U Farbwerke GmbH of Goslar, Federal Republic of Germany, and Reiner Kossman International of Krefeld, Federal Republic of Germany, through its subsidiary, Reko International Peru, S.A., formed Zinc del Perú, S.A. (Zipesa) in September. The company planned to build a zinc oxide plant near Pisco with a 3,600-mt/a capacity.

There were 11 other zinc oxide plants in the country, many of which purchased zinc from Centromin Perú.

Peruvian zinc alloys exported to the United States, formerly a 19% tariff item, became duty free under the General System of Preferences (GSP) in August.

Mineroperú's zinc refinery at Cajamarquilla, outside Lima, suffered through a year of power cuts and curtailed operations.

Platinum.—INVESCO began feasibility studies on Peru's first platinum-group metals prospect, 1,000 km south of Lima, near the Cerro Verde copper mine. The deposit appeared to be a meteor crater, 500 m deep and 8 km in diameter. The company declared there were 500,000 tons of

proven reserves containing 2 g of gold per ton, 1.5 g of platinum per ton, 1 g of palladium per ton, and 0.5 g of rhodium per ton.

Silver.—Silver production reached 1,728 tons during 1990, of which the medium-sized companies accounted for 66%. Large mining companies furnished 24% of total output, and small companies contributed the remaining 10%. Silver producers had to cope with plummeting prices during the last half of the year in addition to the multitude of problems that challenged the Peruvian mining sector.

Centromín Perú led silver producers with 349,051 kg, 20% of the nation's total silver output. Buenaventura and its subsidiary, Orcopampa, dominated the medium-sized silver mining sector with 18% of the country's total silver production. Buenaventura worked the Julcani Unit in Huancavelica and the Uchucchacua deposit near Cerro de Pasco. At Julcani, the company was developing the Nueva Herminia area and looking at deeper sections of older workings. The deposit was originally developed as a gold prospect, but low prices resulted in the development of the presently exploited silver veins. With the prevailing depressed silver prices, the company was looking to develop other areas, especially the unit's central district, where the ore was known to have higher gold content.

During 1990, Buenaventura produced 6,344 tons of lead concentrates at Julcani, which yielded 1,022 tons of lead, 662 tons of copper, 100 tons of bismuth, 62,736 kg of silver, and 96 kg of gold. This represented an 82% increase in gold production and 54% increase in lead production from those of 1989.

Despite 27 days lost to strikes, the company produced 14,297 tons of lead concentrates and 3,574 tons of zinc concentrates at Uchucchacua. These concentrates yielded 94,866 kg of silver, 1,779 tons of lead, and 3,574 tons of zinc.

Arcata was the fourth largest silver producer in 1990, operating its lead-zinc-silver deposit in Arequipa. The company produced 10,524 tons of silver concentrates from 311,000 tons of ore. From these concentrates, 109,795 kg of silver and 377 kg of gold was recovered. The company also produced 2,508 tons of lead concentrates and 4,068 tons of zinc concentrates, which yielded 126,828 kg silver. The company lost 2 days of production in May to a strike.

The company had obtained 41% of its electrical needs from hydroelectric plants.

Because of the regional drought, the company bought two additional generators to satisfy power requirements.

At the end of the year, the company had 1.87 Mmt of ore reserves, averaging 547 g of silver per ton.

Cía. Minera Caylloma, S.A. operated a silver mine in Arequipa, which processed 187,460 tons of ore despite being the target of short strikes during May and June. This tonnage yielded 65,784 kg of fine silver and 253 kg of gold.

Twelve% of the operation's electricity came from hydroelectric plants. The company deferred new investments in exploration and equipment owing to the financial climate. Ore reserves declined to 414,130 tons with 493 g of silver per ton.

Minera Pachapaqui S.A. operated a polymetallic deposit 380 km north of Lima. The company expanded daily production to 1,000 tons as the first phase of an expansion program. However, during August, the company directed its efforts toward more base metal production, leaving the main silver veins behind. It also shut down its silver circuit. From the concentrates the company produced, 32,839 kg of silver, 822 tons of copper, 4,367 tons of lead, and 5,653 tons of zinc were recovered.

Tin.—Minsur, S.A. was Peru's only tin producer. Production from its San Rafael and Santa Bárbara deposits during 1990 included 11,707 tons of tin concentrates and 4,013 tons of copper concentrates. The concentrates relinquished 1,035 tons of copper, 5,134 tons of tin, and 1,722 kg of silver. The 1,300 mt/d San Rafael operation was the company's only active plant after the 20 mt/d plant at Santa Bárbara was shut down at yearend.

Industrial Minerals

Cement.—Increases in the prices of both electricity and oil adversely impacted the cement industry. Cemento Andino, Cemento Lima, and Cementos Norte Pacasmayo experimented with modifying their oil-fired lines to accommodate burning coal. Cementos Lima increased clinker capacity from 1 Mmt to 1.5 Mmt.

Phosphate.—In 1990, Mineroperu shipped 27,068 tons of a 100,000-ton contract to Norphos International Ltd, Auckland, New Zealand. Another 6,000 tons of the Bayovar phosphates was shipped to Chile.

Expansion of the recently renamed Empresa Minera Grau-Bayovar plant from

an annual capacity of 90,000 tons to 400,000 tons was delayed because of questions on Mineroperu's status. While Mineroperu has managed the plant since 1979, the Bayovar works was transferred to the Grau regional government as part of the regionalization law, so there apparently were questions about who should control plant operations and product sales.

Mineral Fuels

A 75-MW plant at Carhuaquero, 70 km east of Chiclayo, came on-line in October. Only about 4% of Peru's estimated 74,000-MW total hydroelectric potential was utilized. The unexploited potential remained so owing to high initial investments associated with building hydroelectric plants.

Power distribution continued to be a problem. Guerrillas increased their attacks against transmission lines. During the 1980's, it was reported that 1,196 of the country's 5,000 transmission towers had been damaged during attacks.

During the year, VG Exploración-Producción proposed to develop a 50-MW geothermal project between Moquegua and Arequipa.

Coal.—Mineroperu began producing coal at the Callacuyan Mine during March. This anthracite mine in the Alto Chicama Field was 130 km northeast of Trujillo. The initial 50 mt/d output was expected to be increased to 1,000 mt/d by the end of 1991.

Mineroperu was promoting coal's use as a replacement for petroleum, especially by brick, cement, lime, and steel operations along the northern coast. Empresa Promotora del Carbón, S.A. resumed studies of a 50-MW coal-fired generating plant at Callacuyan. The project had been rejected 15 years earlier owing to lack of funding.

Petroleum and Natural Gas.—Petroleum production averaged 128,904 bbl/d, a drop from that of 1989. Petroperu's financial problems continued to delay payments for production to Occidental Petroleum Corporation del Perú (Oxy) and the Oxy-Bridas consortium. Petroperu negotiated and the legislature ratified a number of contracts with local and foreign petroleum firms during 1990.

GMP, a subsidiary of the Peruvian construction company Graña y Montero, S.A., signed a 30-year contract to operate fields north of Talara. The concession included the Zorritos Field where the first well in Latin America was drilled in 1863.

VG Exploración-Producción S.A., a subsidiary of the general contractor Vera Gutiérrez S.A., contracted for Block S-2 covering 500,000 hectares in the Titicaca basin. Much of the prior production was from shallow wells. During the year, Sojuskarta of Moscow, U.S.S.R., started geochemical studies for both GMP and VG Exploración-Producción.

Cavaelcas del Perú was awarded a tender, but had not signed a contract with Petroperu.

Mobil Exploration and Producing Perú Inc. began seismic work in March. Fieldwork ceased on December 10th, when the base camp run by Seral, a subsidiary of Halliburton Geophysical Services Inc. of Houston, Texas, was destroyed by the Sendero Luminoso (Shining Path).

Petromineros del Perú, S.A., a wholly owned subsidiary of Edward Callan Interests, Houston, Texas, contracted for work on Block 50 in Santiago Basin in the northern jungle.

At yearend, the national Government indicated that it may allow Royal Dutch Shell to again participate in the Camisea project. Shell Exploración y Productora del Perú BV had discovered natural gas and condensate at the San Martín and Cashiriari prospects, but development plans were torpedoed when the company's contract was withdrawn by the Government in 1988.

Also at yearend, Petroperu was negotiating exploration contracts for Block 61 in the northern jungle with Texas Crude Exploration of Houston and with American International Petroleum Corp. of Denver, Colorado, for the offshore Block Z-2.

INFRASTRUCTURE

The country had 1,876 km of railroads and 56,645 km of roads. Power and telecommunications lines, railroads, and roads in the mountains were subject to damage by landslides and terrorist actions. The lack of road maintenance has increased transportation costs due to the deterioration of the nation's highways.

Peru had 8,600 km of navigable waterways associated with the Amazon River and Lake Titicaca. Important mineral industry

ports included Iquitos on the Amazon and Callao, Ilo, Matarani, and Talara on the Pacific Ocean. There was also a petroleum depot at Bayóvar, the terminus of the 800-km Trans-Andean crude oil pipeline.

OUTLOOK

Mineral industry output in 1991 is expected to increase primarily owing to the large amount of production lost during strikes in 1990.

In the past, the industry's problems were tempered somewhat for the 31 state-owned companies involved in mining or cement. Now the Government is unable to continue to bail out faltering companies. Privatization and foreign-funded joint ventures are the most obvious means to infuse new capital. However, with the liberalization in Africa, Asia, eastern Europe, and Latin America, Peru is being forced to compete with the rest of the world for new capital.

Many small mines have closed. The medium sector is having severe problems. If the industry collapses, there will be widespread social repercussions, as mining companies traditionally provide housing, medical care, and education for its employees.

The Ministry of Mines and Energy is actively promoting minerals development. There is a large backlog of interesting investment projects available if the country's economic and security problems are satisfactorily resolved.

¹Where necessary, values have been converted from Peruvian intis (I/) to U.S. dollars using the average exchange rate for 1990 of 1/205,014=US\$1.00.

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Avenida de Las Artes
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Lima 27, Peru

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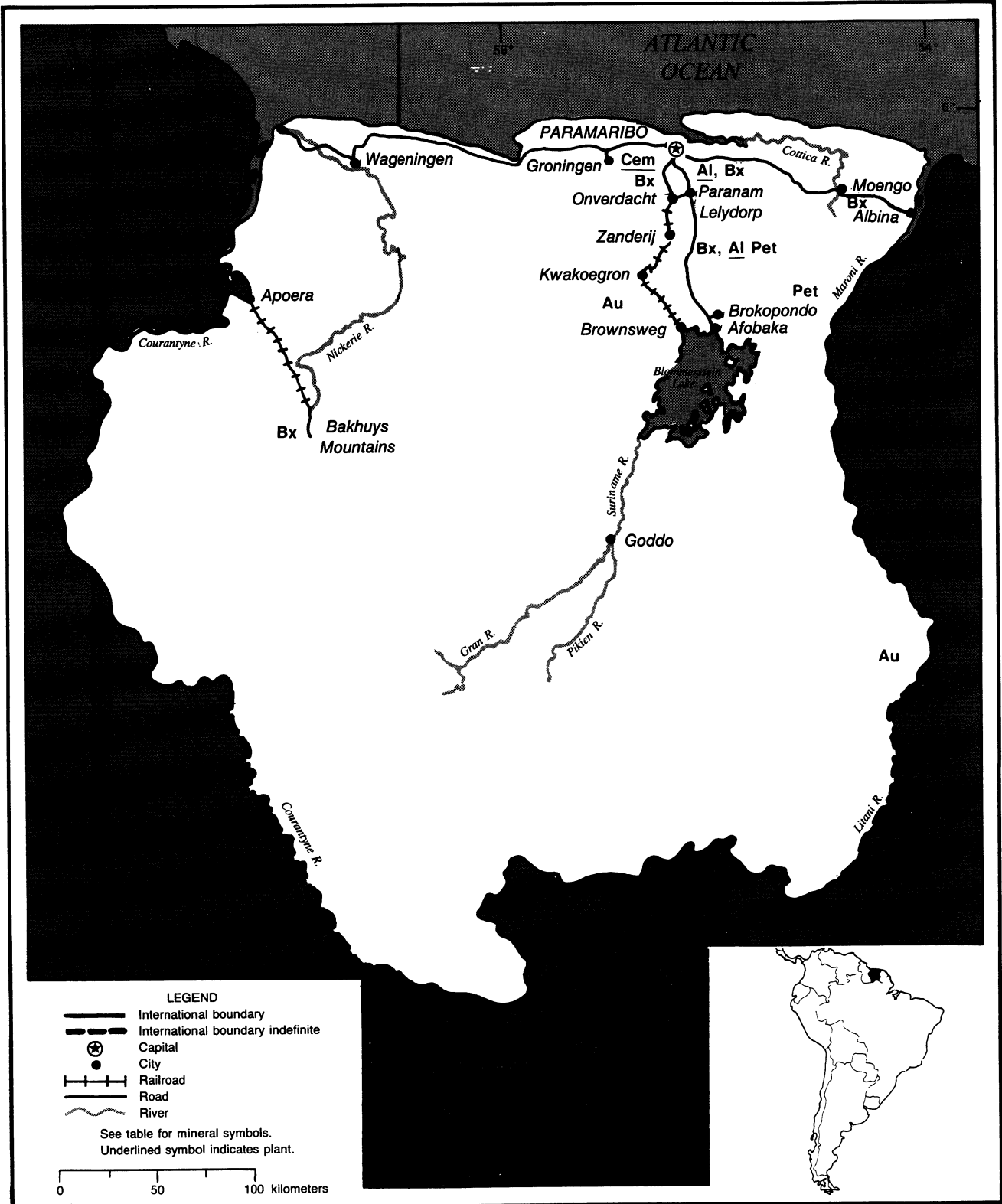
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SURINAME

AREA 163,265 km²

POPULATION 401,500



SURINAME

By Philip M. Mobbs

Suriname's economy continued to decline in 1990 buffeted by political malaise, the demands of a swollen public sector, and the resuspension of development aid from the Netherlands. The growth of the gross domestic product for 1990 was negligible. Lower world prices for the country's exported raw materials and foodstuffs, coupled with higher costs for petroleum imports, resulted in an intensification of the chronic foreign exchange shortage. The major mineral commodities produced were alumina, bauxite, cement, and petroleum.

GOVERNMENT POLICIES AND PROGRAMS

New foreign investment legislation was being considered by the National Assembly prior to the military takeover of the Government in December. The proposed

legislation would have extended the length of mining and petroleum concessions and enhanced tax incentives. The former civilian Government hoped to attract new foreign investment and develop a more diverse mineral industry.

PRODUCTION

Bauxite production dropped slightly, affected by the insurgent activity in the Moengo area. Crude petroleum production showed a slight increase. Mineral commodity production data are shown in table 1.

TRADE

The Netherlands and the United States supplied approximately 60% of the value of Suriname's imports and garnered over 40% of exports. In 1990, Suriname's bauxite companies exported more than 1.5 mil-

lion tons of alumina to Canada, the Netherlands, Norway, and the United States, in descending order of tonnage. The Suriname Aluminum Company (Suralco) exported 28,000 tons of aluminum to Norway, accounting for another 30% of the value of Suriname's export trade.

STRUCTURE OF THE MINERAL INDUSTRY

Bauxite formed the basis of Suriname's industrial activity. Private bauxite mining and alumina and aluminum processing traditionally accounted for about 70% of the country's export earnings. The Government was involved in promotion of the undeveloped western bauxite reserves and with the development and production of petroleum. Gold was produced by numerous small placer operators. Summary information on major commodity operations is shown in table 2.

TABLE 1

SURINAME: PRODUCTION OF MINERAL COMMODITIES¹

(Thousand metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^a	1990 ^a
Aluminum:					
Bauxite, gross weight	3,847	2,522	3,434	3,530	3,000
Alumina	1,471	1,363	1,632	1,567	³ 1,532
Metal, primary ²	29	2	10	28	28
Cement, hydraulic	50	50	50	50	50
Clays, common ^a	15	16	16	16	16
Gold, mine output, Au content kilograms	19	^a 22	^a 22	31	30
Petroleum, crude thousand 42-gallon barrels	600	956	1,400	^a 1,442	1,500
Sand and gravel:^a					
Gravel	25	³ 19	³ 35	35	35
Sand, common	160	³ 156	160	160	160
Stone, crushed and broken	³ 50	50	50	50	50

^aEstimated. ^bPreliminary.

¹Includes data available through Mar. 22, 1991.

²Data represents exports.

³Reported figure.

TABLE 2

SURINAME: STRUCTURE OF THE MINERAL INDUSTRY

(Thousand tons per year unless otherwise specified)

Major commodity	Major operating companies	Location of main facilities	Capacity
Alumina	Suriname Aluminum Company (Suralco), (Aluminum Co. of America {Alcoa}, 100%), 55% and NV Billiton Maatschappij Suriname (BMS), (Royal Dutch/Shell Group, 100%), 45%	Paranam (refinery), District of Para	1,600
Aluminum	Suralco, 100%	Paranam (smelter), District of Para	66
Bauxite	Suralco, 100%	Moengo (mine), District of Marowijne	1,800
	BMS, 76% and Suralco, 24%	Onverdacht (mine), District of Para	2,500
Cement	Vensur NV, (private, 100%)	Paramaribo, District of Para	60
Petroleum 42-gallon barrels per day	Staatsolie Maatschappij Suriname NV, (Staatsolie) (Government, 100%)	Tambaredjo Field, District of Saramacca	4,400

COMMODITY REVIEW

Metals

NV Billiton Maatschappij Suriname (BMS) provided about 55% of the feedstock for the Paranam alumina refinery from its Onverdacht Mine, about 6 kilometers northeast of Onverwacht. The remaining feedstock was traditionally shipped from Suralco's mine in Moengo. Mining operations in the Moengo area had been intermittently disrupted for several months, culminating with the region being overrun by insurgents. The Moengo Mine resumed full operations in August, after being closed during June and July. Bauxite was imported from the Dominican Republic during the last half of the year to replace the refinery's depleted stocks.

Miners went on strike at the Onverdacht mine for 2 days in September. Their 2-year union contract had expired in May. After returning to work, miners participated in a work slowdown until a new contract was approved in October. Production was estimated to have been reduced to less than 10% of normal activity during the slowdown.

Site preparations continued at Coirmotibo, 10 km northeast of Moengo. Suralco planned to phase in this new bauxite mine during early 1991, to replace the exhausted Moengo operation. BMS' Accaribo Mine, a proposed 1-million-ton-per-year operation near Paranam, was expected to be on-stream by 1992. BMS imported a 600-

ton bucket wheel excavator in December and planned to have it installed by midyear 1991.

Suriname bauxite and alumina suffered on the world market, owing to their high production cost. High labor expenses and the refining of marginal ore from Moengo contributed to the higher cost.

Mineral Fuels

Suriname's bauxite industry and the energy sector were closely entwined. The country had an installed electrical generating capacity of about 450 MW. Petroleum-fired thermal plants owned by the Government energy company accounted for more than 50% of the country's installed generating capacity. Suralco owned and operated the 189 MW hydroelectric plant at Afobaka. A minimum of 40 MW had been sold to the Government annually since the facility started up in 1964. Insurgent activity near the Afobaka dam resulted in a number of power disruptions during the year.

The December change of Government delayed the proposed foreign investment law. Pecten (Houston, Texas) was expected to sign an agreement with the Government on an offshore license upon passage of the pending mineral legislation and publication of associated regulations.

INFRASTRUCTURE

Guerrilla operations during midyear badly damaged 40 km of road between

Moengo and Paramaribo. Lack of maintenance on roads, canals, and port facilities, resulted in degraded infrastructure and higher local transportation costs. Transportation costs represented a crucial aspect of the marketing of Suriname's bulk commodities of alumina, bauxite, and rice.

The country's exports were shipped in seagoing vessels with drafts of less than 7 meters. Vessel drafts were limited by the depth of water over shifting rivermouth bars and channel depths shallowing to almost 4 meters at upriver docks. A proposed channel-dredging program was under review.

OUTLOOK

There was no mine development between 1983 and 1988. Higher grade mines are projected to be coming on-stream over the next 5 years, and old mines will be phased out as they are exhausted. Production costs may remain static with higher labor expenses offsetting decreased operating costs.

Suralco is studying the feasibility of mining kaolin from the Moengo pit. The Government plans to promote the development of the country's granite resources.

Staatsolie continues with its planned expansion of the Tambaredjo field. Projected output is planned to reach 6,300 bbl/d by 1992.

¹Where necessary, values have been converted from Surinamese guilders (Sf) to U.S. dollars at the rate of Sf1.7850=US\$1.00.

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P.O. Box 4069
Paramaribo, Suriname

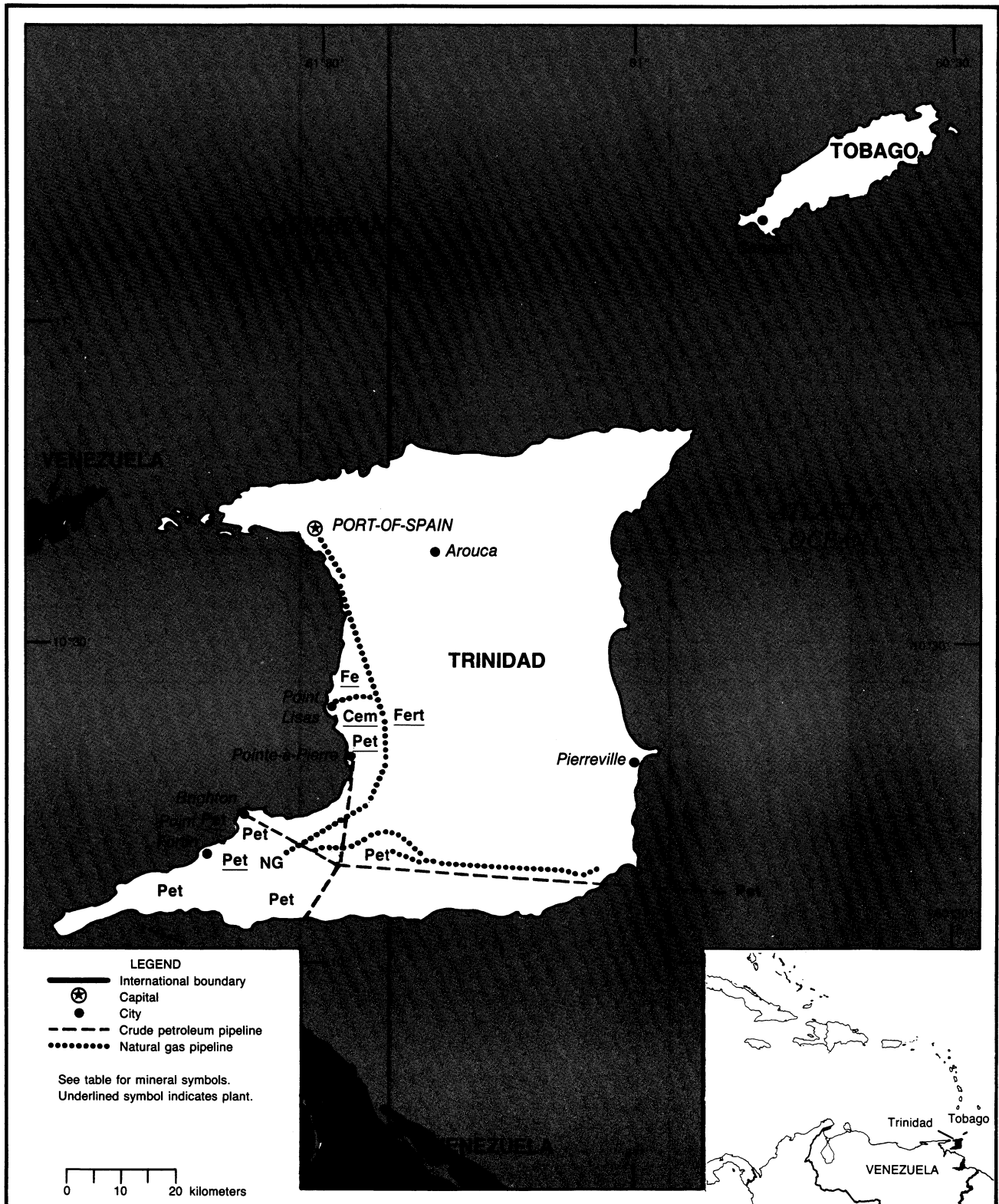
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TRINIDAD AND TOBAGO

AREA 5,130 km²

POPULATION 1.2 million



LEGEND

- International boundary
- ⊛ Capital
- City
- - - Crude petroleum pipeline
- Natural gas pipeline

See table for mineral symbols.
Underlined symbol indicates plant.

0 10 20 kilometers

TRINIDAD AND TOBAGO

By Alfredo C. Gurmendi

Trinidad and Tobago is the smallest producing nation of oil, gas, and refinery products in the Western Hemisphere. Its economy has been based on rich oil and gas deposits. Oil revenues allowed the country to embark on a modest and expanding industrial infrastructure. In 1990, Trinidad and Tobago ranked third in GDP per capita in the Western Hemisphere, after the United States and Canada. Crude exports in 1990 provided 66% of trade revenues; if petrochemical exports were included, hydrocarbon-based exports accounted for 80% of the country's export earnings and more than 25% of GDP of \$4.9 billion.¹ By 1990, Trinidad and Tobago's economy showed signs of recovery from a lengthy depression. Its 1990 real GDP growth rate increased to 0.7% from 0.2% the previous year; however, unemployment remained about 20.6% and inflation about 11.4%.

GOVERNMENT POLICIES AND PROGRAMS

Trinidad and Tobago is a "mixed economy" in which Government investments in state corporations played a major role. The Government's foreign debt reached an alltime high of \$2.5 billion in 1990. The austerity measures put in place have reduced Government capacity to import U.S. goods and services in the short term; however, they should enhance prospects for increased trade with the United States in the years ahead. Government's strong interest in increasing oil reserves has led to increased exploration coupled with a favorable oil tax regime. The Government has established an "export processing zone" or free trade zone adjacent to the Point Lisas industrial complex. Trinidad and Tobago was increasingly turning to foreign direct investment as a funding source for its downstream petrochemical industry via joint ventures. Foreign holdings of up to 100% ownership were considered on a case-

by-case basis. The coordination of foreign investment has been entrusted to the Industrial Development Corp. (IDC). The IDC has set up a one-stop shop to expedite the necessary reviews and approvals that investors need from the various ministries and statutory boards.

The 1990 legislation repealed and replaced the restrictive foreign land and business ownership by a more liberal foreign investment act (FIA). Under FIA, no license was required to purchase equity in a privately owned company up to a cumulative foreign ownership of 49% or to acquire equity in a public company up to a cumulative ownership of 30%. However, beyond these limits, foreign investors must obtain approval through the Ministry of Industry, Enterprise, and Tourism. In some cases, management control by minority interests was allowed. The Government guarantees repatriation of profits and capital, provided all capital and equipment brought into the country were registered in advance with the Central Bank under the terms of the exchange control act of 1990. A tax information exchange agreement between the United States and Trinidad and Tobago came into effect in February 1990. Thus, Trinidad and Tobago become a major recipient of 936 funds (financing feature of Puerto Rico). A total of \$80 million in 936 financing was used for the Phoenix Park gas processing plant. Potential American investors are encouraged to consider the option of 936 funding for commercial enterprises in Trinidad and Tobago.

PRODUCTION

Trinidad and Tobago produced oil and refined products, natural gas, anhydrous ammonia, steel, and construction materials, and it ranks 10th in the world in oil production per capita. Offshore supply accounts for 75% of total oil production. One-half of Trinidad and Tobago's oil supply was produced by its state-owned oil

companies, and AMOCO produced the other half. Total production of oil for 1990 was 54.5 Mbbl. In general, mineral activity remained at about the same level as that of the previous year with significant variations in output of cement, sponge iron, crude oil, and refinery products.

TRADE

The United States continued to be Trinidad and Tobago's major trading partner. Principal commodities exported to the United States in 1990 included crude oil, anhydrous ammonia, methanol, diesel fuel, and urea for a total value of \$860 million, which represented more than 54% of the country's total exports. From the United States, Trinidad and Tobago imported goods and services valued at \$610 million, representing 49% of the country's total imports. Major items included oil and gas drilling equipment and parts, soybeans, plastics, wheat, rice, chemicals, and maize.

Mineral fuels and petrochemicals exports represented 80.4% of Trinidad and Tobago's total revenues for 1990. The country's annual sales of iron and steel increased by 15% and 21%, respectively, compared with those of 1989. In 1990, total exports of anhydrous ammonia represented about 85% of domestic production. The United States received 50% for a value of \$105 million.

STRUCTURE OF THE MINERAL INDUSTRY

The mineral industry was controlled by joint ventures between the private sector and the Government. Mineral and petroleum operations were state-owned, with participation of private entities. W.R. Grace & Co., through its subsidiary Federation Chemicals (FEDCHEM), owned an anhydrous ammonia plant in Point Lisas. FEDCHEM was the minority participant

TABLE 1
TRINIDAD AND TOBAGO: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^a	1990 ^a
Asphalt, natural	27,000	^a 26,000	21,000	^a 27,231	19,155
Cement, hydraulic	327,000	327,000	360,000	380,000	^a 437,954
Gas, natural:					
Gross million cubic meters	6,427	7,646	^a 7,700	^a 7,146	7,000
Marketed ^{a,3} do.	3,750	3,820	^a 4,000	^a 3,833	3,750
Iron and steel:					
Iron, sponge	208,000	475,000	593,000	^a 612,000	^a 697,000
Steel, crude	326,000	361,000	361,000	^a 294,000	^a 372,000
Semimanufactures (wire rod)	217,000	291,000	251,000	250,000	290,000
Lead, refined (secondary) ^a	2,000	1,800	1,800	1,800	1,800
Natural gas liquids ^a thousand 42-gallon barrels	40	40	40	40	40
Nitrogen: N content of ammonia thousand tons	1,141	1,127	1,388	1,550	1,850
Petroleum:					
Crude thousand 42-gallon barrels	61,435	56,621	56,476	^a 56,189	^a 56,000
Refinery products do.	^a 30,860	31,392	31,123	^a 28,225	^a 28,130
Stone: Limestone	580,000	^a 600,000	^a 600,000	600,000	600,000
Sulfur, byproduct of petroleum ^{a,4}	5,000	5,000	5,000	5,000	5,000

^aEstimated. ^bPreliminary. ^cRevised.

¹Table includes data available through May 15, 1991.

²Reported figure.

³Excludes natural gas used in field operations. In 1989, 2,344 million cubic meters was used in field operations.

⁴Sulfur as a byproduct of natural gas may also be produced, but information is inadequate to make reliable output estimates.

TABLE 2
TRINIDAD AND TOBAGO: 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	1,112	2,058	1,415	United Kingdom 643.
Unwrought	—	31	31	
Semimanufactures	48	55	37	United Kingdom 12; Guyana 4.
Chromium: Oxides and hydroxides kilograms	1,425	2	—	All to Jamaica.
Copper:				
Matte and speiss including cement copper	15	—		
Sulfate kilograms	—	50	—	All to Guyana.
Metal including alloys:				
Scrap	180	234	165	United Kingdom 69.
Unwrought	81	42	—	All to United Kingdom.
Semimanufactures	37,587	638	630	Jamaica 4; United Kingdom 4.
Iron and steel: Metal:				
Scrap	16,063	10,075	133	Indonesia 9,910; Netherlands 18.
Pig iron, cast iron, related materials	151,568	235,734	2,577	Venezuela 169,948; Indonesia 58,325; Saudi Arabia 3,052.
Steel, primary forms	47,546	13,705	1,975	Jamaica 5,210; Indonesia 3,970; El Salvador 2,546.
Semimanufactures:				
Bars, rods, angles, shapes, sections	272,335	376,980	54,978	Barbados 117,977; Canada 36,826.
Universals, plates, sheets	341	182	(^c)	Grenada 68; Barbados 39; Guyana 21.

See footnotes at end of table.

TABLE 2—Continued

TRINIDAD AND TOBAGO: 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: Metals—Continued					
Semimanufactures—Continued					
Hoop and strip	value	\$52	\$485	—	Grenada \$249; St. Vincent and the Grenadines \$235.
Wire		678	608	—	Antigua and Barbuda 415; Barbados 99; Grenada 36.
Tubes, pipes, fittings		255	1,979	1,666	Jamaica 112; Guyana 45.
Castings and forgings, rough-kilograms		60	1,815	—	Guyana 1,800; Grenada 15.
Lead:					
Oxides		93	(²)	—	All to Jamaica.
Metal including alloys:					
Scrap		2,253	1,286	13	Brazil 870; United Kingdom 220; Panama 133.
Unwrought		100	—	—	
Semimanufactures		(³)	1	—	All to Barbados.
Magnesium: Metal including alloys, semimanufactures					
		1	—	—	
Nickel: Metal including alloys, scrap					
		—	6	—	All to St. Lucia.
Silver:					
Waste and sweepings ⁴	kilograms	—	3	3	
Metal including alloys, unwrought and partly wrought					
	do.	5	31	—	All to Canada.
Titanium: Oxides					
		4	8	—	All to Grenada.
Zinc: Metal including alloys, semimanufactures					
	kilograms	150	1,620	—	Barbados 1,000; St. Kitts and Nevis 345; Guyana 200.
Other:					
Oxides and hydroxides	do.	1,750	257	—	Barbados 226; Jamaica 20; Grenada 11.
Ashes and residues		—	160	80	Netherlands 80.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.: Grinding and polishing wheels and stones					
	kilograms	269	15,939	75	St. Vincent and the Grenadines 15,000; Guyana 408; Barbados 351.
Asbestos, crude	value	—	\$282	—	All to bunkers.
Barite and witherite	do.	—	\$295	—	All to Barbados.
Cement		141,688	175,539	(²)	Guadeloupe 33,251; St Lucia 31,981; Guyana 20,950.
Chalk		3	6	—	Mainly to Barbados.
Clays, crude		1	1	—	All to Grenada.
Fertilizer materials: Manufactured:					
Ammonia	thousand tons	1,353	1,569	878	Belgium-Luxembourg 191; France 159.
Nitrogenous		544,408	484,759	168,341	France 49,701; Dominican Republic 46,751.
Potassic	value	\$1,431	\$5,222	—	All to St. Vincent and the Grenadines.
Unspecified and mixed		4	1	—	Mainly to Grenada.
Gypsum and plaster	value	\$312	\$416	—	All to Grenada.
Lime		8	752	—	St. Lucia 750; Dominica 1; Grenada 1.
Pigments, mineral: Iron oxides and hydroxides, processed					
	kilograms	—	302	—	Jamaica 242; St. Kitts and Nevis 60.
Salt and brine					
		201	106	—	Barbados 82; Dominica 20; Grenada 2.
Sodium compounds, n.e.s.:					
Soda ash, manufactured	kilograms	(²)	(²)	—	All to United Kingdom.
Sulfate, manufactured	do.	50	(²)	—	Do.

See footnotes at end of table.

TABLE 2—Continued

TRINIDAD AND TOBAGO: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Destinations, 1989		
			United States	Other (principal)	
INDUSTRIAL MINERALS—Continued					
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked	value	\$187	\$318	—	All to Grenada.
Worked		68	(²)	—	All to Dominica.
Gravel and crushed rock		12,629	23,108	—	St. Vincent and the Grenadines 7,044; St. Lucia 5,474; Guyana 3,995.
Sand other than metal-bearing		7,038	8,311	—	St. Lucia 4,088; St. Kitts and Nevis 2,000; Barbados 1,063.
Sulfur: Sulfuric acid	kilograms	540	126	—	Guyana 121; Grenada 5.
Talc, steatite, soapstone, pyrophyllite		7	2	—	Barbados 1; Jamaica 1.
Other:					
Crude		2	—		
Slag and dross, not metal-bearing		54	—		
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		32,632	41,669	4,339	Martinique 6,021; West Germany 5,242.
Coke and semicoke		2	—		
Petroleum:					
Crude	thousand 42-gallon barrels	27,073	26,722	26,722	
Refinery products:					
Liquefied petroleum gas	do.	132	174	—	Barbados 29; Antigua and Barbuda 23; Guadeloupe 18.
Gasoline	do.	2,872	2,449	581	Barbados 319; Suriname 251.
Mineral jelly and wax	do.	(²)	(²)	—	Mainly to Antigua and Barbuda.
Kerosene and jet fuel	do.	2,834	2,340	698	Barbados 502; French Guiana 176.
Distillate fuel oil	do.	3,965	4,927	2,253	French Guiana 439; Suriname 272.
Lubricants including nonlubricating oils	do.	18	19	(²)	Suriname 8; Jamaica 3; Barbados 1.
Residual fuel oil	do.	17,118	14,123	6,330	Cuba 1,210; Suriname 1,202.
Bitumen and other residues	do.	2	2	—	Mainly to British Virgin Islands.
Bituminous mixtures	do.	59	14	—	St. Lucia 4; St. Vincent and the Grenadines 4; Guyana 3.

¹Table prepared by H. D. Willis.²Less than 1/2 unit.³Quantity not available valued at \$521.⁴May include other precious metals.⁵Quantity not available valued at \$556.

TABLE 3

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS				
Aluminum:				
Ore and concentrate	282	500	500	
Oxides and hydroxides	152	111	33	United Kingdom 67.
Metal including alloys:				
Scrap	—	5	(²)	St. Vincent and the Grenadines 2; United Kingdom 2; Grenada 1.
Unwrought	60	—		
Semimanufactures	5,086	1,498	715	Jamaica 376; Venezuela 211.

See footnotes at end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
METALS—Continued				
Chromium:				
Ore and concentrate	2	—		
Oxides and hydroxides	2	67	66	West Germany 1.
Columbium and tantalum: Tantalum metal				
including alloys, all forms	kilograms	30	—	
Copper:				
Matte and speiss including cement copper	122	—		
Sulfate	9	13	8	United Kingdom 5.
Metal including alloys:				
Scrap	1,738	170	169	Grenada 1.
Unwrought	4	3	—	United Kingdom 2; Netherlands 1.
Semimanufactures	3,184	6,872	5,055	Japan 1,172; Sweden 498.
Iron and steel:				
Iron ore and concentrate	thousand tons	474	1,338	—
				Brazil 1,000; Venezuela 337.
Metal:				
Scrap	77	10,590	6,943	Curacao 1,803; Dominican Republic 1,227.
Pig iron, cast iron, related materials	11	8	4	West Germany 2; Netherlands 2.
Ferroalloys:				
Ferromanganese	198	460	100	Mexico 360.
Ferrosilicon	306	1,264	1,114	Venezuela 150.
Unspecified	3,003	931	203	Venezuela 550; China 161.
Steel, primary forms	2,137	524	—	West Germany 482; United Kingdom 42.
Semimanufactures:				
Bars, rods, angles, shapes, sections	8,103	7,347	2,358	United Kingdom 2,773; Brazil 1,440.
Universals, plates, sheets	159,856	39,108	3,441	Netherlands 17,462; United Kingdom 8,839.
Hoop and strip	133	542	499	United Kingdom 43.
Rails and accessories	41	9	1	West Germany 4; Belgium-Luxembourg 3.
Wire	1,487	5,183	3,040	Venezuela 1,098; Brazil 415.
Tubes, pipes, fittings	49,454	82,621	44,170	Jamaica 22,635; Argentina 4,252.
Castings and forgings, rough	kilograms	503	28	28
Lead:				
Oxides	17	14	(^c)	Mexico 9; United Kingdom 4.
Metal including alloys:				
Scrap	144	39	—	Mainly from Barbados.
Unwrought	9	13	—	Mexico 9; United Kingdom 4.
Semimanufactures	924	1,671	534	Belgium-Luxembourg 730; Venezuela 371.
Magnesium: Metal including alloys, semimanufactures				
		2	8	8
Manganese: Ore and concentrate				
		2,111	3,071	832
				Venezuela 1,100; Brazil 1,000.
Nickel:				
Matte and speiss	value	—	\$611	\$611
Metal including alloys, semimanufactures				
	kilograms	1,113	1,173	48
				United Kingdom 1,125.
Platinum-group metals: Metals including alloys, unwrought and partly wrought				
	do.	10	50	50
Silver: Metal including alloys, unwrought and partly wrought				
	do.	5,934	798	207
				Canada 591.

See footnotes at end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: 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	2	6	—	United Kingdom 5; Belgium-Luxembourg 1.
Semimanufactures	8	9	2	United Kingdom 4; Colombia 3.
Titanium: Oxides	524	855	256	United Kingdom 285; Finland 164.
Tungsten: Metal including alloys:				
Unwrought	kilograms	732	102	102
Semimanufactures	do.	91	4,635	4,633
Zinc:				
Oxides	88	88	9	United Kingdom 52; France 21.
Metal including alloys:				
Unwrought	35	12	—	All from United Kingdom.
Semimanufactures	23	149	63	Canada 40; United Kingdom 39.
Other:				
Oxides and hydroxides	202	160	44	United Kingdom 41; Sweden 20.
Ashes and residues	21	311	311	
Base metals including alloys, all forms	40	10	9	United Kingdom 1.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.	31	5	5	
Grinding and polishing wheels and stones	461	1,203	1,176	Czechoslovakia 6; Switzerland 6.
Asbestos, crude	18	18	—	All from Canada.
Barite and witherite	28,684	48,304	—	Morocco 48,287; Netherlands 15; United Kingdom 2.
Boron materials: Crude natural borates	2	6	5	Netherlands 1.
Cement	25,695	5,280	899	West Germany 3,985; Denmark 204.
Chalk	377	321	2	United Kingdom 215; France 92; West Germany 12.
Clays, crude	9,738	2,992	2,736	Guyana 151; United Kingdom 103.
Diamond, natural:				
Gem, not set or strung	carats	420	354	3
Industrial stones	do.	5,000	—	India 347; Canada 4.
Diatomite and other infusorial earth	68	73	73	
Feldspar, fluorspar, related materials	113	12,072	—	United Kingdom 12,045; Netherlands 26; Canada 1.
Fertilizer materials:				
Crude, n.e.s.	value	\$171	—	
Manufactured:				
Ammonia	6	9	8	Netherlands 1.
Nitrogenous	222	2,681	1,891	Dominican Republic 505; West Germany 105.
Phosphatic	295	982	715	Guyana 266; Dominican Republic 1.
Potassic	1,583	3,461	2,814	Dominican Republic 531; Guadeloupe 90.
Unspecified and mixed	6,289	3,129	613	Belgium-Luxembourg 1,000; West Germany 980.
Graphite, natural	1	123	121	China 2.
Gypsum and plaster	12,224	13,925	40	Barbados 5,008; Dominican Republic 4,772; Venezuela 2,538.
Lime	2,532	11,347	—	Netherlands Antilles 6,298; United Kingdom 3,079; Venezuela 1,970.
Magnesium compounds: Magnesite, crude	50	252	1	Venezuela 251.
Mica:				
Crude including splittings and waste	53	43	(²)	Norway 33; United Kingdom 10.

See footnotes at end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Mica—Continued				
Worked including agglomerated splittings				
kilograms	20	2,248	1,245	United Kingdom 1,003.
Phosphates, crude	63	226	226	
Pigments, mineral: Iron oxides and hydroxides, processed	50	49	(²)	Spain 15; Canada 13; West Germany 10.
Precious and semiprecious stones other than diamond:				
Natural	value, thousands	\$749	\$590	—
Synthetic	do.	\$3	\$30	\$10
				India \$265; Belgium-Luxembourg \$201; Canada \$115.
				India \$18; France \$2.
Salt and brine		89,309	153,628	74
				Jamaica 138,305; Netherlands Antilles 15,248.
Sodium compounds, n.e.s.:				
Soda ash, manufactured		5,844	8,684	8,419
				France 78; United Kingdom 78.
Sulfate, manufactured		1,787	2,575	49
				Belgium-Luxembourg 2,451; Netherlands 42.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked		14	5	4
				United Kingdom 1.
Worked		66	827	811
				Denmark 10; Belgium-Luxembourg 6.
Dolomite, chiefly refractory-grade		584	1,195	1,194
				United Kingdom 1.
Gravel and crushed rock		2,752	4,622	4,493
				France 50; Italy 43.
Limestone other than dimension		102,458	33,423	843
				Netherlands Antilles 16,284; Jamaica 7,581; Curacao 6,643.
Quartz and quartzite		92	(²)	(²)
Sand other than metal-bearing		36,914	393	332
				Guyana 45; United Kingdom 9.
Sulfur:				
Elemental:				
Crude including native and byproduct		37	46	—
				All from United Kingdom.
Colloidal, precipitated, sublimed	kilograms	1,789	23,027	172
				United Kingdom 20,805; Netherlands 1,850; U.S.S.R. 200.
Dioxide	do.	351	3	—
				All from United Kingdom.
Sulfuric acid		1,181	4,137	4
				Spain 3,795; Jamaica 328; Belgium-Luxembourg 6.
Talc, steatite, soapstone, pyrophyllite		2,813	604	336
				Norway 174; United Kingdom 91.
Other:				
Crude		3,954	5	5
Slag and dross, not metal-bearing		33	58	58
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural		3	18,228	18,228
Carbon: Carbon black		911	886	2
				Venezuela 778; West Germany 98; Canada 5.
Coal:				
Anthracite		—	536	535
				Canada 1.
Lignite including briquets	value	—	\$3,287	\$3,287
All grades including briquets		5	5	(²)
				Mainly from United Kingdom.
Coke and semicoke		272	89	89
Peat including briquets and litter		85	81	5
				Canada 42; Ireland 12; New Zealand 12.
Petroleum:				
Crude	thousand 42-gallon barrels	4,670	2,047	—
				Nigeria 1,551; Suriname 496.
Refinery products:				
Liquefied petroleum gas	42-gallon barrels	81,865	21,493	33
				Venezuela 21,435; Italy 14.
Gasoline	do.	503,015	22,926	13
				Curacao 12,353; Panama 10,560.

See footnotes at end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	1989	Sources, 1989		
			United States	Other (principal)	
MINERAL FUELS AND RELATED MATERIALS—Continued					
Mineral jelly and wax	42-gallon barrels	4,290	4,361	1,330	United Kingdom 1,203; China 689.
Kerosene and jet fuel	do.	76,220	7,743	—	All from Haiti.
Distillate fuel oil	do.	501,411	932,062	247,580	Curacao 651,008; Netherlands Antilles 33,468.
Lubricants including nonlubricating oils	do.	41,164	95,378	4,147	Curacao 63,617; Jamaica 12,926; Netherlands Antilles 12,268.
Residual fuel oil	do.	1,321,973	178,096	96,712	Bahamas 81,384.
Bitumen and other residues	do.	36	—	—	—
Bituminous mixtures	do.	303	479	285	United Kingdom 170; Canada 24.
Petroleum coke	do.	418	660	—	All from West Germany.

¹Table prepared by H. D. Willis.²Less than 1/2 unit.

(49%), and the Government owned 51% of Tringen I and Trigen II ammonia plants. The ISPAT steel group of India has operated the state-owned Iron and Steel Co. of Trinidad and Tobago (ISCOTT) under a 10-year lease agreement since May 1989. The cement operation, Trinidad Cement Ltd., was 35% owned by the Government. The largest producer of natural gas and crude oil was Amoco Trinidad Oil Co. Ltd., a subsidiary of Amoco International Oil Co. Ltd. In the country, about 50% of crude oil was produced by the state-owned companies, Trinidad and Tobago Oil Co. Ltd. (TRINTOC) and Trinidad and Tobago Petroleum Co. Ltd. (TRINTOPEC), and the other 50% of crude oil was produced by AMOCO.

COMMODITY REVIEW

Metals

Caribbean Ispat Ltd. (CIL), a subsidiary of the ISPAT Steel Group of India, operated the ISCOTT complex since May 1989. Iron ore pellets for the operation were acquired from Brazil and Venezuela. CIL exported wire rod to Canada, the Caribbean, Central America, Japan, Taiwan, South America, and the United States. ISPAT invested \$10 million in upgrading ISCOTT, including \$2.5 million for an electric ladle furnace in 1990; long-term plans call for a \$300 million investment. A voluntary restraint agreement (VRA) signed between the United States and Trinidad and Tobago in 1990 significantly boosted U.S. import quotas, 74.5% of which the Government earmarked for ISPAT.

Industrial Minerals

Ammonia.—Trinidad and Tobago was the world's third largest exporter of fertilizers after Canada and the U.S.S.R. It had a 1.8 Mmt of rated capacity per year. Ammonia production increased about 19% from that of 1989 and exceeded rated capacity by about 3%.

Cement.—Cement production in 1990 was 438,000 tons or about 15% higher than that of the previous year. The construction sector slumped further in 1990, and sales of cement on the local market decreased by 10%. The cement industry's decline came despite two major infrastructure projects, a deepwater harbor in Tobago and extension of Tobago's airport runway.

Mineral Fuels

Liquefied Petroleum Gas.—The joint venture among CONOCO, Pan West of Texas, and the state-owned National Gas Co., Phoenix Park Gas Processors Ltd., built a plant with a capacity of 18 Mm³/d to extract gas liquids, primarily butane and propane for exports.

Natural Gas.—Trinidad and Tobago produced about 7 billion m³ of natural gas per year. More than 80% was produced by AMOCO; the remainder came from Trintomar, a joint venture of TRINTOC, TRINTOPEC, the National Gas Co., and Trinmar. The latter represents a consortium of TRINTOC (33 1/3%), TRINTOPEC (33 1/3%), and TEXACO (33 1/3%). About

70% of production went to Trinidad and Tobago's natural gas-based ammonia, methanol, and urea plants; state-owned steel mill ISCOTT and the country's electric utility represented the domestic demand. The other 30% was used in the oil recovery process or was flared. Trinidad and Tobago did not export natural gas.

Petroleum.—The country produced about 55 Mbbl. of oil in 1990. Marine production accounted for 75% of this. A joint venture for exploration and production between Mobil and TRINTOPEC was in place. Pecten (U.S. division of Shell Oil Co.) signed a joint agreement with TRINTOC. Exxon, Chevron, and Total (U.S. division of Compagnie Francaise de Petroles, a French company) entered also into an agreement with both TRINTOC and TRINTOPEC to explore for oil at deeper horizons on land in the southern region of Trinidad. Finally, UNOCAL and Broken Hill Petroleum of the United States tendered bids for two of four offshore blocks offered by the Government in a bid that ended in January 1990. Negotiations were delayed by the mid-1990 coup attempt.

Reserves

Trinidad and Tobago ranked 10th in the world in oil production per capita, and the country was endowed with proven oil reserves of about 600 Mbbl. Proven natural gas reserves as of December 1990 were 278 billion m³ (10 trillion ft³), and probable reserve estimates averaged about 580 billion m³ (21 trillion ft³).

TABLE 4

TRINIDAD AND TOBAGO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Major commodity	Major operating companies	Location of main facilities	Annual capacity
Anhydrous ammonia ¹	Trinidad Nitrogen Co. Ltd.	Point Lisas, Caroni Co.	370.
	Tringen I	do.	450.
	Tringen II	do.	710.
	Do.	Fertilizers of Trinidad and Tobago Ltd.	230.
Do.	Federation Chemicals	do.	60.
Asphalt	Lake Asphalt of Trinidad and Tobago (1978) Ltd.	Brighton, St. Patrick Co.	540 cement, 600 clinker.
Cement	Trinidad Cement Ltd.	Claxton Bay, Caroni Co.	900 sponge iron, 700 steel, 600 wire rod.
Iron and steel	Iron and Steel Co. of Trinidad and Tobago	Point Lisas, Caroni Co.	95,000. ²
Petroleum: Crude	Amoco Trinidad Oil Co. Ltd.	Poui, Samaan, Teak, and Cassia Fields, offshore, east of Guayaguayare.	20,000. ²
Do.	Trinidad and Tobago Oil Co. Ltd.	Point Fortin, Ortoire, Penal Forest Fields, offshore, east of Guayaguayare.	40,000. ²
Do.	Trinidad Northern Areas Ltd. ³	Soldado Fields, offshore in Gulf of Paria.	24,000. ²
Do.	Trinidad and Tobago Petroleum Co. Ltd. ³	Soldado Field, onshore; Galeota Field offshore (exported).	80,000. ²
Products	Trinidad and Tobago Oil Co. Ltd.	Point Fortin, St. Patrick Co. Pointe-a-Pierre, Victoria Co. ⁴	220,000. ²

¹Capacity based on 340-day operation year.²Barrels per day.³Formerly Trinidad-Tesoro Petroleum Co., 49% owned by Tesoro Petroleum Co.⁴Formerly owned by Texaco (Trinidad) Inc.

INFRASTRUCTURE

There is 8,000 km of roads, 4,000 of which is paved. Crude oil is transported through a 1,032-km pipeline, and 1,904-km natural gas pipeline distributes natural gas to residential, commercial, and industrial consumers. Trinidad has three major ports: Port-of-Spain, Point Lisas, and Pointe-a-Pierre.

OUTLOOK

In June 1990, the Enterprise for the Americas Initiative was launched to foster free market reform throughout Latin America and the Caribbean. The elements

of the proposal were regional trade liberalization, investment facilitation through economic policy reform, and reduction of foreign debt. Trinidad and Tobago, by meeting investment reforms under an Inter-American Development Bank loan program and liberalizing its investment regime, can apply for reductions in its foreign debt. Such reductions would be applied to debt for equity or debt for natural resources swaps, thus reducing its interest and inflation rates. A planned major upgrading of its airport and several major projects in the housing, petrochemical, refining, and medical sectors will significantly increase construction activity over the coming years. The country's economic base, dominated by oil production and refinery products, will be broadened by the above activities.

¹Where necessary, values have been converted from Trinidad and Tobago's dollar (TT\$) to U.S. dollar at the rate of TT\$4.25=US\$1.00.

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Agency

Ministry of Energy
Level 11
Riverside Plaza
Besson Street
Trinidad

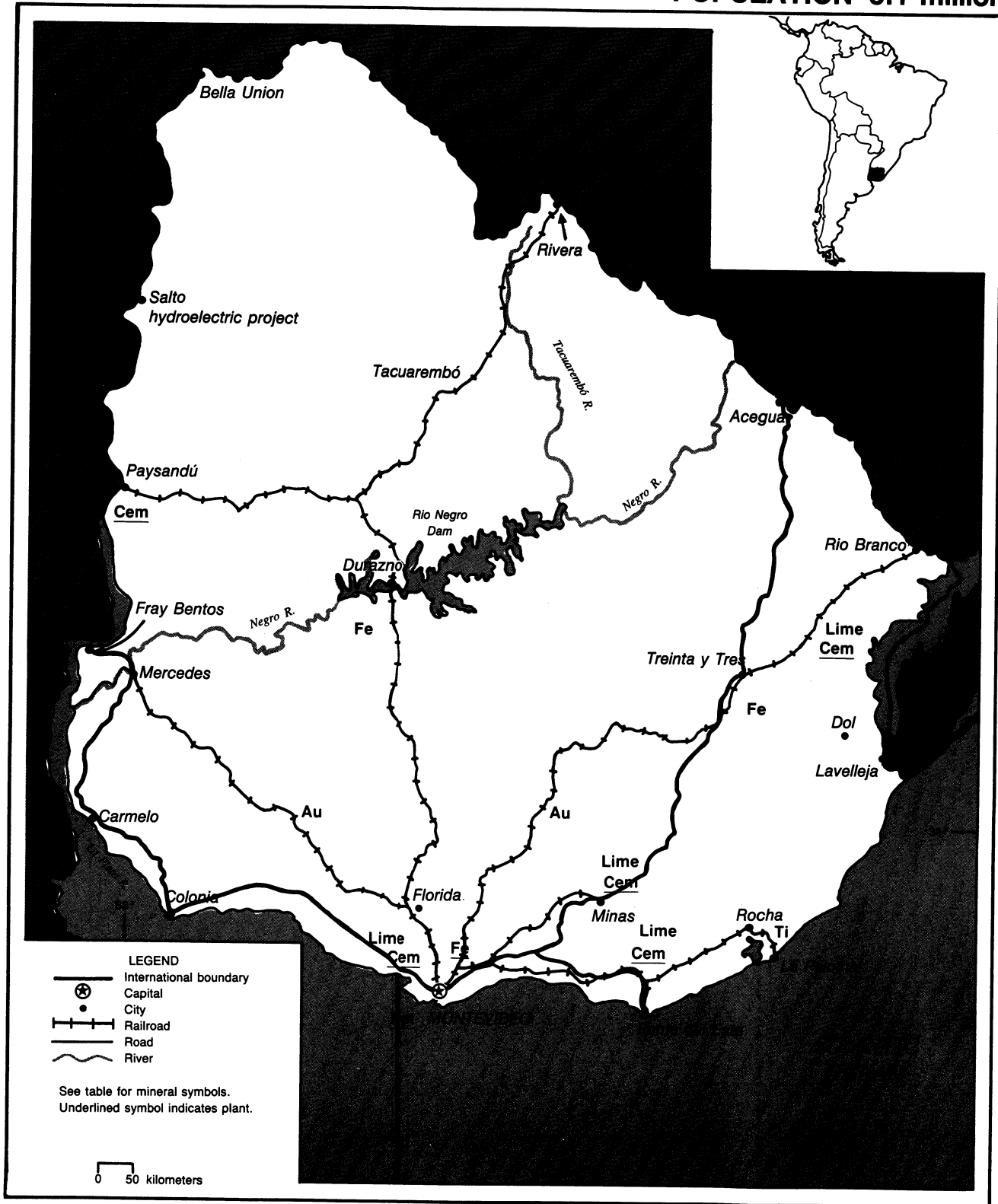
Publication

Ministry of Energy, Petroleum Industry, monthly bulletin.

URUGUAY

AREA 176,000 km²

POPULATION 3.1 million



URUGUAY

By Alfredo C. Gurmendi

Uruguay is a country with a largely agrarian economy and limited mineral reserves. Its limited mineral industry made a negligible contribution to the economy in 1990. Industrial mineral production for domestic consumption and exports was confined to dimension stone, dolomite, granite, gypsum, limestone, quartz, and sand and gravel. Uruguayan marble is considered to be of excellent quality. Uruguay has no known oilfields and continued to be heavily dependent on imported crude oil. Natural gas reserves remained uneconomical, and coal was of poor quality. The gross domestic product grew by 0.9% to \$8.2 billion,¹ while the rate of inflation was 129% by yearend, which was 40% higher than that in 1989 and the highest recorded for any year since 1967. The foreign debt was reduced to \$4.5 billion, while unemployment reached 9.3%. The mineral sector employed less than 1% of the total 1.4 million labor force of Uruguay in 1990. The Uruguayan Government was seeking to increase exports by relaxing regulations on participation of foreign investors in the mineral industry.

GOVERNMENT POLICIES AND PROGRAMS

The Uruguayan Congress has not approved reforms, which led the Government to contemplate constitutional reforms during 1990. Monetary and exchange rate policy changes were aimed at curbing inflation. Privatization of main state-owned concerns was debated at yearend. Economic growth recovered slightly in 1990. On March 1, 1990, Uruguay started to carry out a program of economic reform, providing a sound basis for future growth. The Government implemented a fiscal adjustment program to reduce its fiscal deficit. The program included an increase in taxes and a reduction in expenditures, including elimination of tax reimbursements to ex-

porters and a reduction in Government outlays. The Government has plans to regulate the "right to strike" and to provide for a secret ballot in union elections. Privatization and labor reform, were still pending legislative approval.

The growth of the services sector was based largely on the strength of Uruguay as a regional financial center and its serving as a capital refuge for Argentinean and Brazilian investors, who were lured by the free-floating exchange rate, absence of capital controls, and traditional banking secrecy. The impressive response to the Government's recent offer of debt-equity indicated that private investment was recovering, though public investment remained low because of budgetary reasons. Uruguay continued to maintain its liberal import policy and unrestricted foreign exchange market. Uruguay's market share of U.S. exports has excellent opportunities to increase in the 1990's. In 1990, the United States maintained its third place among exporters to Uruguay. The Export-Import Bank offers a full range of financing and credit insurance programs for exports to the Uruguayan market. The Trade Development Program offers financing grants for major project prefeasibility studies to enhance the competitiveness of U.S. bidders in the Uruguayan mineral industry. Uruguay receives loans from the World Bank, the Inter-American Development Bank, and other multilateral institutions for major energy, agricultural services, and mining industries. The Uruguayan Government encourages foreign investment through its Foreign Investment Act and the Industrial Promotion Act of 1974. There exist tariff exemptions for imports of capital goods, accelerated depreciation, and export financing. Restrictions on foreign investment in Uruguay are not existent. In December 1987, Uruguay passed a law creating "free trade zones" particularly meant to improve trade. Uruguay's debt-equity program offers incentives for foreign investment; included are no time restrictions on profit

repatriation. The "Treasury Bonds" issued by the Central Bank in the repurchase of the external debt notes were competitively traded in Uruguay at no discount rate. Recent debt swaps amounted to \$400 million. A growing number of companies took advantage of Uruguay's liberal foreign investment policies, which increased mineral exploration activities.

In November 1990, the Uruguayan Government issued Decree No. 516/990 authorizing the Administración Nacional de Combustibles, Alcohol y Portland (ANCAP) to call for tenders from companies interested in offshore drilling. The mining companies that took advantage of the new investment climate and new decree were San José Mining Co., a subsidiary of Canada's Bond International Gold Ltd., and Stell S.A., a subsidiary of Brazil's Mineracao e Participacao S.A. It was expected that more companies would follow.

Uruguay and Brazil paved the way for the Mercado Común del Cono Sur (MERCOSUR) by eliminating a wide range of bilateral trade restrictions during 1990.

PRODUCTION

Uruguay has no internationally significant mineral resources, but has significant hydropower potential. The country is heavily dependent on imported crude oil. Uruguay's quarrying and mining was for construction minerals such as clays, dimension stone, dolomite, granite, gypsum, limestone, marble, quartz, and sand and gravel. About 18,000 mt/a of dolomite was mined in Lavalleja, 250 km east of Montevideo, for use in the glass and construction industries, steel, and in refractories. Limestone was produced in Cerro Largo, Lavalleja, Maldonado, and Paysandú Departments, principally for portland cement production. Various clays were mined in Durazno, Maldonado, Montevideo, and San José Departments for producing brick, pipe, tile, and whiteware. Talc was mined

in Colonia and Lavalleja Departments for use in the paper industry and in ceramics, cosmetics, insecticides, and pharmaceuticals. Feldspar was mined in Florida Department for the ceramics industries and glass. Uruguay was noted for the quality of its marble mined in Lavalleja, Maldonado, and Soriano Departments. Agate and amethyst were produced from Artigas Department.

TRADE

During 1990, Uruguay exported clays, gravel, limestone, precious stones, and sands valued at \$12 million. Imports of crude oil, lubricants, and petroleum products were estimated at \$280 million. ANCAP imported crude oil and refined petroleum from Argentina, Brazil, Colombia, Iran, Mexico, Nigeria, and the U.S.S.R. ANCAP and Petro-Canada renewed efforts to explore Uruguay's outer continental shelf and were reprocessing seismic data from previous exploration activities.

Imports from the United States amounted to \$137 million. Ammonium phosphate for fertilizer was valued at \$20 million. Mineral products, sulfur, lubricants, and petroleum byproducts and chemicals were valued at \$65 million. Uruguay's exports to the United States were valued at \$163 million.

STRUCTURE OF THE MINERAL INDUSTRY

The Instituto Nacional de Minería y Geología (INMG) of Uruguay delineated 14 areas with precious-metal and base metal potential. Investment in prospecting and mining increased as a result of favorable legislation designed to relax regulations of foreign companies in the minerals sector. San José Mining Co., a subsidiary of Canada's Bond International Gold (BIG), and Stell S.A., a subsidiary of Brazil's Mineracao e Participacao, were planning to invest \$36 million in precious-metal and other metal exploration. BIG was developing a 930 kg/a gold mine at Mahoma, 130 km from Montevideo. Two gold refineries with a combined output of 4 and 5 kg/d of gold started operations at the end of 1990. One at Mahoma Sur in San José Department owned by Australia's BIG Resources Management Pty. Ltd. and the other at Mines de Corrales in Rivera Department operated by Brazil's Stell S.A.

ANCAP operated its cement plants at more than 90% capacity. Uruguay contin-

ued its dependency on imports of petroleum and natural gas. During 1990, 80% of its fuel energy requirements was refined by ANCAP at its Teja plant in Montevideo. Minas de Talco Narancio S.A. produced talc in Colonia and Lavalleja Departments for use in the paper industry and in ceramics, cosmetics, pharmaceuticals, and insecticides. Industria Nacional Laminadora S.A. produced 54,000 tons of rolled steel products at its plant near Montevideo, Montevideo Department.

COMMODITY REVIEW

Metals

Uruguay has provided BIG with exclusive rights to explore and develop Mahoma leases in San José Department. Operations had begun at the end of 1990 with a series of open pits. The gold ore will be processed in a conventional mill using gravity separation and carbon-in-pulp recovery at an initial rate of 300 mt/d of ore and 5 kg/d of refined gold. The U.S. company Gold Standard Inc. of Salt Lake City, Utah, continued exploration at its San Juan Hills gold leases in the San José area of San José Department. Big Pony Gold Inc. of Salt Lake City, Utah, 50% owned by Gold Standard, continued exploration over a large tract of Archaen greenstone, locating several gold occurrences. Big Pony's subsidiary, Tormin S.A., continued exploring encouraging prospects near Montevideo. The iron ores at Valentines in Florida and Treinta y Tres Departments and at Zapucay in the northern Department of Durazno were marginally viable.

Industrial Minerals

Uruguay's main quarrying and mining activities included production of clays, dimension stone, dolomite, granite, gypsum, limestone, quartz, and sand and gravel. Uruguay is noted for the excellent quality of its marble, mined in Lavalleja, Maldonado, and Soriano Departments, which is exported to Western Europe and Canada. The country is also well known for its production of agate and amethyst from Artigas Department. Large reserves of dolomite occur at Lavalleja, 250 km east of Montevideo. About 18,000 mt/a of dolomite was mined in Lavalleja and Maldonado Departments for use in construction, glass, in the steel industry, and in refractories. ANCAP produced limestone in Cerro Largo, Lavalleja, Maldonado, and

Paysandú Departments. Titanium-bearing sands suitable for the extraction of ilmenite and monazite were surveyed, and a feasibility study continued in the Rocha Department. Corundum was produced for natural abrasive applications, although demand in the optical lens grinding field continued to be limited.

Mineral Fuels

Exploration did not delineate any oilfields of economic value in 1990. Natural gas reserves remained unquantified, and coal continued to be of poor quality. Recently, ANCAP and Petro-Canada renewed efforts to explore Uruguay's outer continental shelf. In an effort to reduce its heavy dependence on crude oil imports, Uruguay maintained a well-developed hydroelectric power system, as well as the potential for alternative energy sources from small uranium deposits.

In 1990, total installed electric power capacity was about 1,700 MW, of which 32% was generated by thermal plants and 68% by hydroelectric plants. The energy industry has eased Uruguay's trade problem with the opening of the 1,890-MW-capacity Salto Grande hydroelectric plant, a cooperative project with Argentina, on the Uruguay River in Salto Department. Uruguay shared 32% of Salto Grande's production and 34% of the El Palmar powerplant in Salto Department.

Reserves

Uruguay's mineral reserves are not regarded as important compared to some other mineral-producing countries in South America. Bond developed a 930-kg/a gold mine at Mahoma in Canelones Department, 130 km from Montevideo containing an estimated 330,000 tons of ore grading 8.9 g of gold per ton. Uruguay has two iron ore deposits; each has proven reserves of 45 Mmt of 40% iron. They are in Florida and Treinta y Tres Departments. In addition, there is the Zapucay deposit in the northern Department of Durazno, with 400 Mmt of iron ore containing 40% iron.

INFRASTRUCTURE

The mineral production, including mineral fuels, is transported primarily by road and rail system. In 1989, there was 49,900 km of roads, of which 6,700 km was paved, 3,000 km was gravel, and 40,200 km was dirt.

TABLE 1
URUGUAY: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^p	1990 ^e
Aluminum, secondary	51	56	65	^e 42	42
Barite ^e	² 15	15	15	15	15
Cement, hydraulic	340,000	401,000	434,000	^e 560,000	500,000
Clays, unspecified ^e	150,000	150,000	² 130,170	150,000	150,000
Coke, gashouse ^e	8,000	8,000	8,000	8,000	8,000
Corundum ^e	40	40	² 45	⁴ 45	45
Feldspar ^e	1,000	1,000	² 787	² 2,000	2,000
Gem stones, semiprecious ^e					
Agate	90	90	² 142	90	100
Amethyst	20	20	² 79	20	80
Gypsum ^e	100,000	100,000	² 145,105	100,000	145,000
Iron and steel:					
Iron ore	—	—	2,545	5,000	5,000
Metal:					
Ferroalloys: Electric-furnace ferrosilicon crust ^e	250	250	250	250	250
Steel, crude	30,987	30,200	28,700	47,285	40,000
Semimanufactures	34,348	43,500	18,000	^e 18,000	18,000
Lime	<u>10,000</u>	<u>13,000</u>	<u>10,000</u>	<u>^e12,000</u>	<u>12,000</u>
Petroleum refinery products:					
Liquefied petroleum gas					
thousand 42-gallon barrels	459	580	^e 600	^e 600	² 698
Gasoline do.	1,660	1,540	^e 1,550	^e 1,550	² 1,849
Jet fuel do.	182	264	^e 300	^e 300	² 201
Kerosene do.	415	457	^e 500	^e 500	² 409
Distillate fuel oil do.	2,324	3,290	^e 3,300	^e 3,300	² 2,963
Lubricants do.	49	56	^e 60	^e 60	² 60
Residual fuel oil do.	2,434	2,418	^e 2,500	^e 2,500	² 2,573
Unspecified do.	225	826	^e 800	^e 800	² 501
Refinery fuel and losses ^e do.	² 22	20	20	20	² 29
Total do.	7,770	9,451	^e 9,630	^e 9,630	² 9,283
Sand and gravel ^e :					
Sand, common thousand metric tons	1,500	1,500	² 1,240	1,500	1,500
Gravel do.	500	500	500	500	500
Stone ^e :					
Dimension	8,000	10,000	10,000	10,000	10,000
Crushed and broken:					
Alum schist	8,000	8,000	8,000	8,000	8,000
Dolomite	3,000	3,000	² 18,990	3,000	3,000
Limestone	700,000	700,000	² 749,636	² 750,000	750,000
Marble	4,000	5,000	² 2,557	⁴ 4,000	4,000
Marl	7,000	7,000	7,000	7,000	7,000
Quartz	300	300	² 279	300	300
Other, including ballast-thousand metric tons	1,900	2,000	2,000	2,000	2,000
Sulfur, elemental, byproduct ^e	2,000	2,000	2,000	2,000	2,000
Talc, soapstone, pyrophyllite ^e	1,500	1,500	² 1,460	1,500	1,500
Tuff: Tufa ^e	3,500	3,500	3,500	3,500	3,500

^eEstimated. ^pPreliminary. ^rRevised.

¹Includes data available through July 31, 1991.

²Reported figure.

TABLE 2

URUGUAY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Administracion Nacional de Combustibles, Alcohol y Portland	Minas and Paysandu Plants, Montevideo	1,000
Dolomite	do.	Lavalleja, 250 kilometers east of Montevideo	30
Gold kilograms	Bond International Gold	Mahoma, 130 kilometers from Montevideo	930
Do. do.	BIG Resources Management, Pty. Limited	Mahoma Sur, San Jose Department	1,800
Do. do.	Stell S.A.	Minas de Corrales, Rivera Department	1,440
Petroleum products thousand 42-gallon barrels	Administracion Nacional de Combustibles, Alcohol y Portland	Refineria de la Teja, Montevideo	13,400
Steel	Industria Nacional Laminadora S.A.	Planta Pandos and Barros Arana near Montevideo	60
Talc	Minas de Talco Narancio S.A.	Minas de Talco in Colonia and Lavalleja Departments	1,460

In 1986, IDB approved a loan of \$36 million to help finance a project that consisted of two sections of highway, Routes 1 and 5, and a main artery, which now funnels traffic to Montevideo and its port areas. There is 3,000 km of railroad in the country, all standard gauge (1.4 meters) and owned by the Government.

The major ports are Montevideo on the Atlantic Ocean, Colonia on the Río de la Plata, and Fray Bentos and Paysandú on the Uruguay River. Virtually all of Uruguay's industry and about 44% of the population are located within the Montevideo Province.

OUTLOOK

The country encourages free-market policies to reactivate its economy in addition to policies of gradual reduction in import tariffs and private investment with foreign participation.

Uruguay has no known gasfields or oilfields and only poor-quality coal. Most of the country's energy requirements will be supplied by hydroelectric plants; however, potential alternative energy resources could be provided by small uranium deposits for nuclear power and biogas generation using garbage. Unless exploration reveals significant exploitable mineral deposits or hydrocarbons, Uruguay's mineral sector is

expected to remain of minor importance to the economy.

¹Where necessary, values have been converted from Uruguayan new pesos (N\$) to U.S. dollars at the average market rate of N\$1,171=US\$1.00.

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Montevideo, Uruguay

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VENEZUELA

AREA 911,700 km²

POPULATION 19.3 million



VENEZUELA

By H. Robert Ensminger

The petroleum industry dominated the Venezuelan mineral industry in 1990 as it has for many years. The revenue from petroleum accounted for about 23% of the GDP while the mining sector contributed an estimated 1%. In 1990, the GDP increased by about 7% to \$47 billion at current prices.¹ Beginning in 1989, an increased emphasis was placed on the expansion of production and export of aluminum, gold, iron ore, and iron and steel in an effort to create a more diversified mineral industry that is less dependent on petroleum. This program was continued in 1990. In 1990, Venezuela ranked among the leaders in Latin America in the production of aluminum, cement, diamond, ferroalloys, gold, iron ore, iron and steel, petroleum, and natural gas, and petroleum products.

GOVERNMENT POLICIES AND PROGRAMS

In early 1990, the Ministry of Energy and Mines prohibited the use of mercury and high-pressure water hoses in the mining of gold. Small miners were given a 1-year grace period to switch to alternative systems.

In July, the new mining law was passed by the lower chamber of the Venezuelan Congress. When approved by the Senate and signed by the President it would provide for:

- Flexibility in allowing concession title to be used to secure bank loans;
- Expedited nondiscretionary procedures for approval of concessions (must be granted in less than 150 days);
- A maximum of 90 days for the Government to approve exploration agreements;
- Authorization for "Associations" (Co-operatives) of no less than 20 miners who are Venezuelan citizens or legal permanent residents;
- Reaffirmation of the Ministry of Energy and Mines as the entity responsible for mining activities;

- Establishment of rules governing direct foreign investment and special rules for the mining of gold; and
- Reduction of royalties to 2% as the only mining tax (in addition to the 30% corporate tax).

Other elements of the new mining policy aside from the new mining law being considered by the Venezuelan Government were:

- A national cadastre;
- Domestic and foreign investment;
- Research and development; and
- Improvement in mining classification, training of small miners, and tax collection mechanisms.

In November, the Government of Venezuela proffered a proposal for a loan for a maximum of \$300 million to the Inter-American Development Bank. The loan is to be used for a program of reform for companies in the public sector and in the preparation of studies on the privatization and sale of companies in the public sector.

At yearend, the Minister of Energy and Mines assigned to Corporacion Venezolana de Guayana (CVG) the rights of exploration, development, and production (exploitation) of gold and diamond deposits in the entire Guayana region. CVG must annually submit plans of development to the Ministry as well as report on biyearly activities accomplished. CVG is charged with providing the infrastructure while the Ministry will carry out its responsibilities (functions) of inspections, discharge of fiscal duties, and control of the assigned area.

PRODUCTION

In 1990, the volume of mining production in Venezuela increased by about 4% over that of the previous year. Metallic mineral production increased by about 3% while industrial mineral production increased by approximately 4%. The production of mineral fuels showed an increase of about 5% over that of 1989. The total value of

mining production was \$338.3 million exclusive of industrial minerals and production by small informal operators.

Aluminum (primary), bauxite, cement, diamond, gold, iron ore, natural gas, petroleum, and petroleum products showed substantial growth in 1990 while most of the remaining major mineral commodities such as alumina, coal, and iron and steel remained near 1989 output levels or declined.

TRADE

Venezuela's trade balance for 1990 showed a surplus of \$10.8 billion that was principally the result of petroleum and petroleum product exports of \$14.0 billion. The trade balance increased by \$4.9 billion over the balance of \$5.9 billion of the previous year. The volume of petroleum exports showed an increase of approximately 40% over that of 1989. Venezuela exported 85% of its petroleum production in 1990 as crude and as refined petroleum products.

In 1988 (the last year for which there is information), the major mineral commodity exports, exclusive of petroleum and petroleum products, were aluminum, cement, coal, ferrosilicon, fertilizer, pig iron, and steel.

The major mineral commodity imports in 1988 were barite, copper, ferromanganese, fertilizer, gypsum, manganese, petroleum coke, pig iron, residual fuel oil, soda ash, steel (semimanufactures), and zinc.

STRUCTURE OF THE MINERAL INDUSTRY

In Venezuela, the major mineral producing companies are predominantly State-owned. In the past, unprofitable State-owned enterprises often were retained for employment and political reasons. However, the new Government that came to

TABLE 1
VENEZUELA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^a	1990 ^a
METALS					
Aluminum:					
Alumina	1,296,000	1,360,000	1,284,000	^e 1,350,000	¹ 1,293,000
Bauxite	—	² 245,157	521,504	701,770	² 771,422
Metal, primary, unalloyed	⁴ 18,078	⁴ 28,013	436,703	539,647	² 590,379
Gold, mine output, Au content	² 2,510	³ 3,417	3,502	3,867	² 7,700
Iron and steel:					
Iron ore and concentrate	¹ 16,753	¹ 17,782	<u>18,932</u>	<u>18,390</u>	<u>²20,365</u>
Metal:					
Pig iron	⁴ 93	473	503	489	² 314
Direct-reduced iron	2,938	3,151	2,710	2,773	² 2,346
Total	<u>³4,31</u>	<u>3,624</u>	<u>³2,13</u>	<u>3,262</u>	<u>²2,660</u>
Ferrous alloys:					
Ferrosilicomanganese	29	28	34	^e 30	29
Ferrosilicon ³	51	52	51	^e 55	55
Total	80	80	85	^e 85	² 84
Steel, crude	³ 4,02	³ 2,97	3,165	2,941	² 2,677
Semimanufactures, hot-rolled	2,315	3,081	2,994	2,734	² 2,669
Lead, secondary, smelter	19,000	18,000	10,000	13,000	² 14,000
INDUSTRIAL MINERALS					
Amphibolite	² 97	² 61	174	144	² 188
Cement, hydraulic	5,747	6,110	6,199	4,510	² 5,230
Clays:					
Kaolin	15	³ 0	28	15	² 12
Other	<u>¹1,966</u>	<u>²1,176</u>	<u>2,239</u>	<u>1,903</u>	<u>²3,057</u>
Diamond:					
Gemcarats	⁴ 6,388	37,880	53,704	69,724	85,000
Industrial	¹ 65,343	<u>67,767</u>	<u>74,701</u>	<u>184,846</u>	<u>248,000</u>
Total	² 11,731	105,647	128,405	254,570	² 333,000
Feldspar	³ 7	⁴ 3	97	97	² 91
Gypsum	² 58	² 47	221	332	² 201
Nitrogen, N content of ammonia	530	577	481	532	² 648
Phosphate rock	¹ 74	⁹ 9	^e 100	237	² 165
Pyrophyllite ^e	² 25,000	32,000	32,000	32,000	32,000
Salt, evaporated ^e	² 511,421	500,000	500,000	500,000	² 430,000
Serpentinite, crushed ^e	² 553,550	580,000	580,000	550,000	550,000
Stone, sand, and gravel:					
Stone:					
Dolomite	³ 03	257	313	383	² 300
Granite	⁵ 30	418	353	440	² 262
Limestone	¹ 5,686	¹ 7,520	16,775	15,371	² 12,563
Marble	(4)	(4)	101	(4)	—
Sand and gravel	⁶ 5,545	⁷ 2,226	7,305	5,789	² 5,332
Silica, sand	³ 49	⁴ 55	455	378	² 443
Sulfur, byproduct of petroleum and natural gas ^e	99,380	125,000	125,000	125,000	² 105,760
MINERAL FUELS AND RELATED MATERIALS					
Carbon black ^e	41	61	60	60	60
Coal, bituminous	⁵ 6,700	² 37,600	1,072,200	2,113,300	² 1,89,500

See footnotes at end of table.

TABLE 1—Continued

VENEZUELA: PRODUCTION OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1986	1987	1988	1989 ^a	1990 ^a
MINERAL FUELS AND RELATED MATERIALS—Continued					
Gas, natural:					
Gross million cubic meters	36,270	36,600	^a 28,500	38,097	² 40,516
Marketable ^c do.	² 16,321	13,180	12,750	14,160	² 15,600
Natural gas liquids:^{e 5}					
Natural gasoline thousand 42-gallon barrels	² 6,687	6,500	6,500	6,500	6,500
Liquefied petroleum gas do.	² 15,007	15,000	15,000	15,000	15,000
Total do.	² 21,694	21,500	21,500	21,500	21,500
Petroleum:					
Crude ⁶ do.	<u>664,125</u>	<u>664,125</u>	<u>690,916</u>	<u>696,407</u>	<u>²770,133</u>
Refinery products:					
Liquefied petroleum gas do.	2,824	2,768	^a 3,000	^a 3,000	² 2,920
Gasoline:					
Aviation do.	277	286	^a 260	^a 275	300
Motor do.	88,470	76,884	^a 85,000	^a 85,000	100,000
Naphtha do.	15,750	18,760	^a 15,000	^a 15,000	22,000
Jet fuel do.	20,770	21,229	^a 20,000	^a 20,000	21,000
Kerosene do.	32,060	32,640	^a 30,000	^a 32,000	32,000
Distillate fuel oil do.	87,470	76,884	^a 85,000	^a 85,000	63,000
Lubricants do.	2,453	2,566	^a 2,000	^a 2,300	2,300
Residual fuel oil do.	96,620	89,760	^a 90,000	^a 95,000	91,250
Asphalt and bitumen do.	11,980	11,983	^a 10,000	^a 11,500	11,500
Refinery gas ⁷ do.	9,862	7,400	^a 8,000	^a 9,000	9,000
Unspecified do.	<u>22,330</u>	<u>22,640</u>	<u>^a20,000</u>	<u>^a22,000</u>	<u>22,000</u>
Total do.	<u>390,866</u>	<u>363,800</u>	<u>^a368,260</u>	<u>^a380,075</u>	<u>377,270</u>

^aEstimated. ^bPreliminary. ^cRevised.¹Table includes data available through Jan. 24, 1992.²Reported figure.³Figures represent combined 45% silicon content and 75% silicon content production.⁴Revised to zero.⁵From nonassociated natural gas only.⁶Includes associated natural gas lease condensate and natural gasoline. Lease condensate is included as follows, in thousand 42-gallon barrels: 1986—51,830; 1987—60,225; 1988—68,620; and 1989—58,400; and 1990—13,505. Natural gasoline is included as follows, in thousand 42-gallon barrels: 1986—35,405; 1987—34,310; 1988—35,770; 1989—39,420; and 1990—41,610.⁷Liquid equivalent.

TABLE 2

VENEZUELA: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Destinations, 1988	
		United States	Other (principal)
METALS			
Aluminum:			
Oxides and hydroxides	366,856	184,731	Norway 118,142; Brazil 43,895.
Metal including alloys:			
Scrap	358	358	
Unwrought	287,925	42,107	Japan 174,996; Netherlands 38,532.
Semimanufactures	80,557	38,670	Netherlands 26,626; Colombia 5,658.
Copper: Metal including alloys:			
Unwrought	138	98	Netherlands 39.
Semimanufactures	867	42	Colombia 794; Peru 12.

See footnotes at end of table.

TABLE 2—Continued

VENEZUELA: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Destinations, 1988	
		United States	Other (principal)
METALS—Continued			
Gold: Metal including alloys, unwrought and partly wrought kilograms	14,495	—	All to Switzerland.
Iron and steel: Metal:			
Pig iron, cast iron, related materials	376,762	109,356	Trinidad and Tobago 238,123; Turkey 24,258.
Ferroalloys:			
Ferrosilicon	40,305	31,471	Japan 6,000; Turkey 2,500.
Unspecified	4,498	2,000	Trinidad and Tobago 2,006; Colombia 492.
Steel, primary forms	155,530	43,136	Ecuador 24,269; Colombia 20,292.
Semimanufactures:			
Bars, rods, angles, shapes, sections	243,675	21,880	Algeria 44,477; Honduras 18,679.
Universals, plates, sheets	279,162	63,785	Costa Rica 58,328; Colombia 50,233.
Hoop and strip value	\$1,000	\$1,000	
Wire	12,458	5,099	Jamaica 1,515; Panama 862.
Tubes, pipes, fittings	139,531	22,719	Canada 21,410; Colombia 19,608.
Nickel: Metal including alloys, semimanufactures	4	4	
Silver: Metal including alloys, unwrought and partly wrought value, thousands	\$40	—	Colombia \$35; Cuba \$4; Costa Rica \$1.
Zinc:			
Oxides	43	—	All to Trinidad and Tobago.
Blue powder and other powder and flakes	250	—	All to Colombia.
Metal including alloys, semimanufactures	1	—	All to Netherlands Antilles.
Other: Ashes and residues	1,422	255	Netherlands 1,150; Japan 17.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones	2	—	All to Trinidad and Tobago.
Asbestos, crude	6	—	All to Netherlands Antilles.
Cement	993,499	571,605	Haiti 72,435; U.S. Virgin Islands 70,053.
Clays, crude	170	—	Colombia 100; Guyana 40; Trinidad and Tobago 30.
Fertilizer materials: Manufactured:			
Ammonia	66,161	29,666	Cuba 22,179; Colombia 14,316.
Nitrogenous	349,375	129,710	Colombia 92,823; Chile 41,104.
Graphite, natural	3	—	All to Trinidad and Tobago.
Lime	1,570	—	Trinidad and Tobago 970; Guyana 540; Mexico 60.
Sodium compounds, n.e.s.:			
Soda ash, natural and manufactured	30	—	All to Colombia.
Sulfate, natural and manufactured	17	17	
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	71,310	66,000	Bahamas 5,000; Netherlands Antilles 310.
Worked	57	45	Netherlands 12.
Gravel and crushed rock	33,026	25	Colombia 32,777; Netherlands Antilles 164; Trinidad and Tobago 60.
Sand other than metal-bearing	16,139	—	Costa Rica 16,000; Colombia 139.
Other:			
Crude	67	20	Colombia 29; Netherlands Antilles 18.
Slag and dross, not metal-bearing	58	58	

See footnotes at end of table.

TABLE 2—Continued

VENEZUELA: EXPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Destinations, 1988		
		United States	Other (principal)	
MINERAL FUELS AND RELATED MATERIALS				
Carbon: Carbon black	11,002	—	Chile 5,383; Guatemala 1,461; Ecuador 1,393.	
Coal: Anthracite	964,629	187,669	Finland 239,524; Sweden 187,936.	
Petroleum:				
Crude	value thousands	\$4,566,723	\$1,904,896	West Germany \$392,739; Canada \$143,273.
Refinery products:				
Distillate fuel oil	do.	\$3,319,600	\$2,274,974	Canada \$165,690; Netherlands \$157,997.
Lubricants	42-gallon barrels	42	7	Dominican Republic 35.

¹Table prepared by H. D. Willis. Export data for 1987 and 1989 were not available at time of publication.

TABLE 3

VENEZUELA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988		
		United States	Other (principal)	
METALS				
Alkali and rare-earth metals	80	38	Japan 39; Brazil 2.	
Aluminum:				
Ore and concentrate	thousand tons	3,086	4	Brazil 2,048; Netherlands Antilles 485; Guyana 331.
Oxides and hydroxides		9,985	6,917	West Germany 1,434; Brazil 526.
Metal including alloys:				
Unwrought		3	—	Mainly from United Kingdom.
Semimanufactures		30,455	14,600	West Germany 6,608; France 5,084.
Beryllium: Metal including alloys, all forms	value, thousands	\$5	\$5	
Chromium:				
Ore and concentrate		7,072	—	Republic of South Africa 7,000; France 60.
Oxides and hydroxides		682	246	Argentina 139; West Germany 128.
Cobalt: Oxides and hydroxides		28	11	Belgium-Luxembourg 8; West Germany 5.
Columbium and tantalum: Tantalum metal including alloys, semimanufactures		1	1	
Copper:				
Matte and speiss including cement copper	value, thousands	\$3	\$3	
Metal including alloys:				
Unwrought		31,777	1,523	Chile 11,449; Peru 8,762; Mexico 5,368.
Semimanufactures		10,600	3,803	Canada 2,216; Belgium-Luxembourg 1,428.
Gold: Metal including alloys, unwrought and partly wrought	kilograms	14	10	Panama 4.
Iron and steel:				
Iron ore and concentrate: Pyrite, roasted		337	337	
Metal:				
Scrap		383,797	254,220	Cuba 129,577.
Pig iron, cast iron, related materials		129,110	2,652	Trinidad and Tobago 110,326; Brazil 13,694.
Ferroalloys:				
Ferromanganese		37,948	10	France 27,000; Brazil 9,973; Republic of South Africa 793.

See footnotes at end of table.

TABLE 3—Continued

VENEZUELA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
METALS—Continued			
Iron and steel—Continued			
Metal—Continued			
Ferroalloys—Continued			
Ferrosilicon	34	10	West Germany 13; Italy 11.
Unspecified	2,292	1,058	United Kingdom 380; West Germany 318.
Steel, primary forms	46,725	11	Brazil 45,089; Japan 548; France 540.
Semimanufactures:			
Bars, rods, angles, shapes, sections	83,615	1,511	Japan 26,895; Brazil 18,539; Spain 14,261.
Universals, plates, sheets	213,937	5,469	Brazil 60,034; Belgium-Luxembourg 30,568; West Germany 26,785.
Hoop and strip	6,828	2,129	Brazil 1,600; West Germany 857.
Rails and accessories	2,699	1,063	West Germany 831; Belgium-Luxembourg 469.
Wire	2,530	400	Brazil 1,451; West Germany 304.
Tubes, pipes, fittings	29,662	3,467	West Germany 10,756; Japan 5,083.
Castings and forgings, rough	8	7	Spain 1.
Lead:			
Oxides	3,242	67	Peru 1,968; Mexico 1,102.
Metal including alloys:			
Scrap	6,217	5,973	Mexico 243.
Unwrought	8,721	103	Peru 8,618.
Semimanufactures	239	24	Colombia 155; West Germany 39.
Magnesium: Metal including alloys:			
Scrap	19	19	
Unwrought	1,793	637	Norway 1,072; West Germany 68.
Semimanufactures	264	262	West Germany 2.
Manganese:			
Ore and concentrate: Metallurgical grade	80,413	—	Brazil 47,849; Mexico 32,564.
Oxides	816	473	West Germany 137; Belgium-Luxembourg 102.
Mercury	66	11	Netherlands 36; West Germany 6.
Molybdenum: Metal including alloys, semimanufactures			
	5	5	
Nickel:			
Ore and concentrate	1	—	All from West Germany.
Metal including alloys:			
Unwrought	243	99	Canada 87; West Germany 51.
Semimanufactures	323	120	West Germany 126; Netherlands 40.
Platinum-group metals: Metals including alloys, unwrought and partly wrought			
value, thousands	\$252	\$105	Switzerland \$70; United Kingdom \$37.
Silver: Metal including alloys, unwrought and partly wrought			
do.	\$9,832	\$133	Peru \$9,397; Italy \$127.
Tin:			
Ore and concentrate	do.	\$3	\$3
Metal including alloys:			
Unwrought	1,472	319	Netherlands 524; Switzerland 292.
Semimanufactures	36	32	Italy 1; Netherlands Antilles 1.
Titanium: Oxides			
	1,227	274	Belgium-Luxembourg 248; West Germany 164.

See footnotes at end of table.

TABLE 3—Continued

VENEZUELA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
METALS—Continued			
Tungsten:			
Ore and concentrate value, thousands	\$9	\$9	
Metal including alloys:			
Unwrought including waste and scrap	1	NA	NA.
Semimanufactures	9	3	United Kingdom 4; Italy 1.
Uranium and thorium: Oxides and other compounds value, thousands	\$2	\$2	
Zinc:			
Oxides	36	(?)	Mainly from Italy.
Blue powder and other powders and flakes	809	344	West Germany 190; Mexico 129.
Metal including alloys:			
Unwrought	33,922	23	Peru 30,557; Canada 2,464; Mexico 732.
Semimanufactures	77	73	Unspecified 4.
Other:			
Ores and concentrates	946	104	Republic of South Africa 653; Italy 136.
Oxides and hydroxides	3,620	1,562	West Germany 744; Italy 611.
Ashes and residues	1	1	
Base metals including alloys, all forms	820	765	Canada 26; Republic of Korea 8.
Precious metals waste and scrap kilograms	13	—	All from Italy.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc.	1,155	140	Ecuador 811; Italy 117.
Artificial:			
Corundum	3,088	73	Brazil 2,446; West Germany 374.
Silicon carbide	977	82	Switzerland 367; Brazil 180; West Germany 103.
Dust and powder of precious and semi-precious stones value, thousands	\$10	\$2	Spain \$7; Belgium-Luxembourg \$1.
Grinding and polishing wheels and stones	174	39	Italy 62; West Germany 26.
Asbestos, crude	8,572	380	Canada 6,950; Switzerland 1,242.
Barite and witherite	92,731	12,126	Morocco 23,818; Peru 23,705; Republic of South Africa 20,470.
Boron materials:			
Crude natural borates	507	210	Italy 154; Netherlands 80.
Oxides and acids	2,328	1,895	Italy 217; Turkey 100.
Bromine ³	32	16	West Germany 7; Spain 4.
Cement	81,643	8,181	Poland 32,901; Cyprus 29,709.
Clays, crude	45,628	41,112	Colombia 1,268; Brazil 921.
Cryolite and chiolite	20	—	All from Germany.
Diamond, natural:			
Gem, not set or strung value, thousands	\$88	\$19	Switzerland \$20; West Germany \$17.
Unsorted do.	\$274	\$241	Italy \$18; France \$7.
Diatomite and other infusorial earth	7,330	4,854	Mexico 2,377; West Germany 38.
Feldspar, fluorspar, related materials	2,290	897	Mexico 431; West Germany 237.
Fertilizer materials: Manufactured:			
Ammonia	25,968	12,901	Norway 13,057; United Kingdom 7.
Nitrogenous	4,949	2	France 4,080; Trinidad and Tobago 616; Austria 247.
Phosphatic	15,376	—	All from Morocco.
Potassic	150,725	50,802	Canada 83,813; France 10,525.

See footnotes at end of table.

TABLE 3—Continued

VENEZUELA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988	
		United States	Other (principal)
INDUSTRIAL MINERALS—Continued			
Fertilizer materials: Manufactured—Continued			
Unspecified and mixed	570,671	113,963	Denmark 111,881; Romania 97,594.
Graphite, natural	1,560	525	Republic of South Africa 205; Netherlands Antilles 203.
Gypsum and plaster	94,885	936	Spain 67,322; Jamaica 23,238; Guadeloupe 1,004.
Magnesium compounds: Magnesite, crude	80,304	7,642	Austria 38,597; Brazil 14,781; Netherlands 8,050.
Mica:			
Crude including splittings and waste	492	444	West Germany 21; France 13.
Worked including agglomerated splittings	17	8	Spain 3; France 2.
Phosphates, crude	68,365	503	Republic of South Africa 67,640, West Germany 198.
Pigments, mineral: Iron oxides and hydroxides, processed	242	150	Netherlands 47; West Germany 30.
Precious and semiprecious stones other than diamond: Synthetic value, thousands	\$471	\$343	United Kingdom \$105; Italy \$10.
Pyrite, unroasted	232	229	Italy 3.
Salt and brine	196	148	West Germany 48.
Sodium compounds, n.e.s.:			
Soda ash, natural and manufactured	149,869	141,520	Bulgaria 6,631; Poland 1,546.
Sulfate, natural and manufactured	81,211	40,540	Mexico 26,652; Canada 7,992.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	10,136	—	Italy 9,251; Portugal 543; Greece 160.
Worked	1	NA	NA.
Dolomite, chiefly refractory-grade	18,538	18,336	Italy 191; Norway 11.
Gravel and crushed rock	209	64	Dominican Republic 91; France 40.
Quartz and quartzite	73	3	Brazil 65; Italy 5.
Sand other than metal-bearing	1,488	1,456	Italy 20; West Germany 2.
Sulfur:			
Elemental:			
Crude including native and byproduct	82	82	
Colloidal, precipitated, sublimed	34	30	West Germany 3; Spain 1.
Sulfuric acid	24,570	9,669	Japan 7,514; Spain 7,386.
Talc, steatite, soapstone, pyrophyllite	12,680	9,509	Brazil 3,084; France 86.
Other:			
Crude	6,799	1,311	Poland 2,122; United Kingdom 568.
Slag and dross, not metal-bearing	236	4	Mexico 232.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	815	815	
Carbon: Carbon black	350	190	West Germany 160.
Coal:			
Anthracite	40,973	23,459	Colombia 17,514.
Bituminous	7	—	All from Colombia.
Lignite including briquets	885	885	
Coke and semicoke	61,927	2,105	Colombia 38,725; United Kingdom 15,305; France 5,791.
Petroleum:			
Crude 42-gallon barrels	37	37	
Refinery products:			
Liquefied petroleum gas do.	592	580	Unspecified 12.

See footnotes at end of table.

TABLE 3—Continued

VENEZUELA: IMPORTS OF MINERAL COMMODITIES¹

(Metric tons unless otherwise specified)

Commodity	1988	Sources, 1988		
		United States	Other (principal)	
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum—Continued				
Refinery products—Continued				
Gasoline	42-gallon barrels	233,342	227,358	Netherlands 4,658; Switzerland 790.
Mineral jelly and wax	do.	26,711	8,728	Japan 6,650; West Germany 5,092.
Kerosene and jet fuel	value, thousands	\$2	\$1	West Germany \$1.
Distillate fuel oil	42-gallon barrels	107,797	—	All from Netherlands Antilles.
Lubricants	do.	69,923	49,630	Netherlands 7,196; Belgium-Luxembourg 6,034.
Residual fuel oil	do.	2,574,796	2,571,826	Netherlands Antilles 2,964.
Bitumen and other residues	do.	1,091	1,091	
Bituminous mixtures	do.	4,248	1,218	United Kingdom 1,866; Colombia 873.
Petroleum coke	do.	965,828	884,417	Argentina 81,406.

NA Not available.

¹Table prepared by H. D. Willis. Import data for 1987 and 1989 were not available at time of publication.²Less than 1/2 unit.³Includes fluorine and iodine.

power in January, 1989 set about to privatize many of the companies. A special commission was set up to speed up the privatization of the more than 450 companies under State ownership. Private participation in the basic mineral sectors (aluminum, coal, and petrochemicals) may be increased. In addition, steel and petroleum may be opened up to private investors.

In 1990, the total Venezuelan labor force was approximately 6 million, with the industrial sector comprising 1.7 million. The minerals industry comprised approximately 6% of the industrial labor total. The minerals industry labor force was composed of 47,000 in petroleum, 29,000 in iron and steel, and 26,000 in mining and quarrying.

COMMODITY REVIEW

Metals

Alumina, Aluminum, and Bauxite.—Alumina production decreased slightly in 1990 while primary aluminum increased by approximately 9%. In both cases, production was at or near installed capacity. At the Los Pijiguaos Mine in the State of Bolívar, CVG's Bauxita Venezolana C.A. (BAUXIVEN) increased its production of bauxite by approximately 10% over that of 1989.

In 1990, the total capacity of Venezuela's two aluminum smelters, Aluminio del

Caroni S.A. and Industria Venezolana de Aluminio C.A., was increased to 666,000 tons from 540,000 tons. Commensurate with the capacity increase was a production increase from 539,647 tons to 590,379 tons. In 1990, approximately 65% of primary aluminum production was exported. In 1989, a team from Técnicos Mineros, the mineral exploration subsidiary of CVG, discovered three bauxite deposits between the Los Pijiguaos Mine and Puerto Ayacucho on the Orinoco River in the Territory of Amazonas. Officials estimated that there were up to 200 bauxite deposits in the mineral-rich Guayana region, but only about 2% were discovered.

In midyear 1989, it was announced that two new Venezuelan aluminum companies, Aleaciones Ligeras S.A. (ALISA) and Vexxal Aluminio S.A., were to receive a \$730,000 grant from the U.S. Trade and Development Program for feasibility studies. ALISA was a joint venture between private Venezuelan investors and CVG; Vexxal was a joint venture between Switzerland's Asea Brown Boveri and CVG. Both plants will be primary aluminum smelters. Two French banks, Banque Indosuez and Banque Francaise du Commerce Exterieur, have agreed to aid Venezuela in the financing of a new 180,000 mt/a potline that will upgrade Aluminio del Caroni S.A.'s installed capacity to 300,000 mt/a.

Construction was to begin on the two new

smelters, ALISA and Aluminio Guayana (ALUYANA), in 1990 or 1991. The ALUYANA project is a joint venture between CVG and two Italian companies, Cia. Tecnica Internacional and Italimpianti S.A.

Gold.—Total registered production was 7,700 kg, an increase of 99% over that of 1989 (this did not include unlicensed miner production). In 1989, the Monarch Resources Ltd. (United Kingdom) and CVG joint venture began trial operations at CVG's gold tailings facility in El Callao, State of Bolívar. The gold-processing venture known as Revermin II C.A. was 50% owned by CVG, 49% by Monarch, and 1% by private Venezuelan investors. The facility, when in full operation, will process 600,000 tons of tailings annually. The tailings dump at Mocupia Gorge is estimated to contain 4.6 Mmt of tailings grading over 1.34 g/mt of gold. The operation produced slightly less than 1,000 kg of gold in 1990.

Greenwich Resources Ltd. (United Kingdom), which began gold mining operations in Venezuela in 1985, began exploration of two private concessions and two joint ventures with CVG in the Guayana region in 1989. One of its pilot plants produced 20 kg of gold in 1990.

Iron and Steel.—Ferroalloys.—CVG Ferrosilicio de Venezuela C.A.

TABLE 4

VENEZUELA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1990

(Thousand metric tons unless otherwise specified)

Major commodity	Major operating companies	Location of main facilities	Annual capacity
Alumina	Interamericana de Alumina C.A.	Ciudad Guayana, Bolivar State.	1,300
Aluminum	Aluminio del Caroni S.A.	do.	300
Do.	Industria Venezolana de Aluminio C.A.	do.	366
Bauxite	C.V.G. Bauxita Venezolana C.A.	Los Pijiguaos, Bolivar State.	1,000
Cement	C.A. Venezolana de Cementos	Barquisimeto, Lara State Maracaibo, Zulia State Pertigalete, Anzoátegui	2,750
Coal	Carbones del Guasare S.A.	Paso Diablo, Zulia State	1,500
Iron ore	C.V.G. Ferrominera del Orinoco C.A.	Cerro Bolivar, El Pao, and San Isidro Mines, Bolivar State.	20,000
Petrochemical	Petroquímica de Venezuela S.A.	El Tablazo, Zulia State Moron, Carabobo State	2,350
Petroleum	Petroleos de Venezuela S.A. (PDVSA)	Fields in Anzoátegui, Apara, Falcon, Guarico, Monagas, and Zulia States.	¹ 1,822
Petroleum products	do.	Major refineries at Amuay Bay, and Cardon, both in Falcon State.	¹ 1,588
Steel	C.V.G. Siderurgica del Orinoco C.A.	Ciudad Guayana, Bolivar State.	4,300

¹Thousand barrels per day.

(FESILVEN), the State ferroalloy company, announced plans to modernize and enlarge its facilities. It will modernize two older furnaces and install two new furnaces that are designed to produce 25,000 mt/a of ferrosilicon and 13,500 mt/a of silicon metal. When all four furnaces are working at full capacity, FESILVEN will have a maximum production capacity of 75,000 mt/a. In 1990, FESILVEN and Hornos Electricos de Venezuela S.A. (HEVENSA) sold 90% of their ferrosilicon exports and 50% of their ferrosilicon-manganese exports to the United States. Colombia, Japan, and Trinidad and Tobago purchased the remainder.

Iron Ore.—CVG Ferrominera Orinoco C.A. iron ore production increased by 11% over that of the previous year; however, its exports declined by 6%. Domestic sales increased by 25% to 5.75 Mmt in 1990.

Ferrominera announced its corporate plan (called "Plan 40") for 1991-95. The plan calls for an increase in installed capacity from the current 20 Mmt/a to 40 Mmt/a. The expansion will be accomplished in 3 phases: phase 1—25 Mmt/a by 1992; phase 2—36 Mmt/a by 1995; and phase 3—40 Mmt/a by the year 2000. The total cost was estimated to be \$355 million.

Ferrominera announced it is studying plans to construct two pelletization plants, each capable of producing 3.3 Mmt/a of iron

ore pellets, by 1995. Should the plan come to fruition, it would be a joint venture with Kobe Steel of Japan.

Iron and Steel.—Cía. Siderúrgica del Guayana, a joint venture between Kobe Steel and CVG, was established in 1989 to set up an integrated steelworks in the Puerto Ordaz area to produce 1 Mmt/a of hot-briquetted direct-reduced iron and 950,000 mt/a of steel slabs for export. Investment for the project was estimated at \$1 billion with groundbreaking projected to take place in early 1991.

In 1990, Venezuela produced 2,346 Mmt of direct reduction iron briquettes. Five direct reduction plant capacity expansions or new plant construction were studied during the year.

Crude steel production declined almost 10% in 1990 while semimanufactured steel production decreased less than 3%. Steel product exports increased by 36% to 1,291,400 tons.

Apparent domestic consumption of steel products decreased by 20% to 1,542,300 tons in 1990.

Industrial Minerals

Cement production increased 14% over that of the previous year, but was still 19% below the figure of 1988.

At yearend 1989, the French cement group Lafarge Coppée announced it had

purchased 20% of the Venezolana de Cementos C.A. plant at Pertigalete in Anzoátegui State for \$27 million. The new capital will be used for plant expansion, aimed at raising output to 2.6 Mmt/a which would make it one of the largest plants in the Western Hemisphere. The plant should be ready for full production by late 1991.

Mineral Fuels

In 1990, Venezuela produced 54,660 Mkw.h of electricity from a total generating capacity of 19,733,000 kW. Of the total electrical energy produced, thermoelectric plants accounted for 56% and hydroelectric plants the remainder. The thermoelectric powerplant input was 59% natural gas, 34% residual fuel oil, and 7% gas-diesel oil. Consumption by sector in 1986 (the last year for which there is information) was energy, 9%; industry and construction, 47%; and households and other consumers, 44%.

Coal.—Coal production in 1990 totaled 2.190 Mmt, with 80% going for export. The Paso Diablo Mine, in the Guasare Basin in the State of Zulia, produced 1.57 Mmt. The mine was operated by Carbones del Guasare S.A., a joint venture between Carbones del Zulia C.A., a subsidiary of Petróleos de Venezuela S.A. (PDVSA) and AA Antilles Coal NV (itself a joint venture of the Atlantic-Richfield Co. of the United States and

AgipCoal SpA, an affiliate of the Italian ENI Group.) The long-term plan is to increase production to 6.5 Mmt/a during the 1990's, principally for export. The expansion project would require a large investment of between \$400 million and \$500 million. The partners hope that Venezuela's newly approved debt equity swap rules and devaluation of the bolívar would entice foreign investment.

In 1990, the State of Tachira produced 370,000 tons of coal while the State of Anzoátegui produced the remaining 249,000 tons of the 2.190 Mmt national total.

Natural Gas and Petroleum.—Crude petroleum production increased by about 10% over that of 1989. The increase in daily production was approximately 202,000 bbl. Natural gas production was 40.5 billion m³. This included 33% reinjected into petroleum reservoirs and 59% to the domestic market, including the petrochemical industry.

In 1986, PDVSA paid \$290 million for 50% interest in Citgo, the Tulsa, Oklahoma-based oil company, which included a 320,000 bbl/d refinery at Lake Charles, Louisiana. With the purchase of the remaining 50% of Citgo in early 1990, PDVSA positioned itself to become one of the primary marketers of gasoline in the United States. PDVSA also acquired 100% ownership of Champlin Refining and Chemicals Inc. (Corpus Christi, Texas). In 1983, PDVSA acquired a 50% interest in Veba Oel's Ruhr Oel refinery at Gelsenkirchen, Germany. In early 1986, the operation with Veba was expanded to give PDVSA one-half of other Veba refining and related operations in Germany. In Finland, PDVSA is a 50% partner with Neste Oy, and in Sweden, is a 50% partner with AB Nynas Petroleum.

At yearend 1989, the Minister of Energy and Mines announced that the Government was considering allowing foreign participation in exploration and refining operations in Venezuela for the first time since the petroleum sector was nationalized 14 years ago. In addition, the Government was seeking foreign financing to increase refining capacity. The Minister of Energy and Mines announced plans to build a \$1.3 billion refinery in association with foreign and private Venezuelan investors. The refinery, with its planned capacity of 180,000 bbl/d of crude petroleum, would meet demand for nonleaded gasoline, especially on the United States east coast.

Reserves

Venezuela has large reserves of bauxite, coal, gold, iron ore, natural gas, and petroleum. PDVSA increased its estimate of the effective recovery rate of Orinoco heavy and super heavy crude petroleum to 40% from 22% in 1989. The respective recoverable reserves were estimated to be 270 billion bbl. Venezuela's reserves of major minerals are included in table 5.

TABLE 5
VENEZUELA: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1990

(Thousand metric tons unless otherwise specified)

Bauxite	300,000
Coal	9,000,000
Gold	¹ 8,000
Iron ore	2,000,000
Natural gas	² 3,400,000
Petroleum	
Light and medium grades	³ 60,000
Heavy and superheavy grades	² 270,000

¹Thousand kilograms.

INFRASTRUCTURE

Corpoven S.A., an operating subsidiary of PDVSA, commissioned a \$228 million petroleum products transportation system in eastern Venezuela in 1989. The system will consist of 600 km of pipeline, storage, and distribution facilities linking the Puerto La Cruz refinery on the Caribbean to Puerto Ayacucho, Territory of Amazonas, in southeastern Venezuela.

The new floating iron ore transshipment station for the mouth of the Orinoco River that arrived in Venezuela in late 1988 began operation in 1989. The system, consisting of two ships, was built in Japan and was refitted by NKK Corp. on arrival. The station enabled FERROMINERA to reduce transport costs by using larger ships, which had before been unable to load at the Ciudad Guayana terminal because of the seasonally variable water depth of the river.

Venezuela had a total of 542 km of railroads of 1.435-m gauge. It contained a total of 77,785 km of roads, of which 22,780 km was paved, 24,720 km was gravel, 14,450 km was dirt, and 15,835 km was unimproved dirt. The country had 7,100 km of waterways navigable by oceangoing

vessels provided through Lake Maracaibo and the Orinoco River. The pipeline system was constituted of 6,370 km for crude petroleum, 480 km for refined products, and 4,010 km for natural gas. Of the total of 58 ships making up the merchant marine, 30 were available for the transportation of mineral products.

OUTLOOK

The Government, through the introduction of a series of austerity measures in 1989, removed the majority of the worst imbalances from the economy and laid a solid base for a sustained recovery. Additionally, through these efforts, the Government began to create a more conducive environment for future growth and foreign investment. Several of the more important changes were the following: (1) allowing foreigners to invest in gold mining without being forced into joint ventures, (2) allowing almost unlimited repatriation of profits and dividends, and (3) permitting foreign-owned companies to obtain financing on the local stock market.

Central to the Government's long-range minerals program was the diversification and expansion of the production and exportation of its major nonpetroleum minerals in order to cushion the vagaries of a petroleum driven economy. Considerable expansion has been projected for aluminum, bauxite, coal, and gold as well as substantial increases in iron, iron ore, and steel over the next 10 years. The aluminum industry was expected to become totally integrated within the next 10 years.

Construction material demand has contributed to expansion plans in the cement industry; however, despite the projected expansion, it appears that Venezuela may revert from a cement exporter to net importer by 1993.

¹Where necessary, values have been converted from Venezuelan bolívars (Bs) to U.S. dollars at the rate of Bs47.32=US\$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Dirección General Sectorial de Hidrocarburos
Ministerio de Energía y Minas
Caracas, Venezuela

Dirección General Sectorial de Minas
Ministerio de Energía y Minas
Caracas, Venezuela

Publications

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Carta Semanal, weekly.
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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	Cb
Copper	Cu
Corundum	Cn
Cryolite	Cry
Diamond	Dm
Diatomite	Dia
Dolomite	Ds
Emerald	Em
Feldspar	Feld
Ferroalloys	<u>FA</u>
Ferrochrome	<u>FeCr</u>
Ferromanganese	<u>FeMn</u>
Ferronickel	<u>FeNi</u>
Ferrosilicon	<u>FeSi</u>
Fertilizer	<u>Fz</u>
Fluorspar	F
Gallium	Ga
Gemstones	Gm

Germanium	Ge
Gold	Au
Graphite	Gr
Gypsum	Gyp
Indium	In
Iron and steel	<u>Fe</u>
Iron ore	Fe
Kaolin	Kao
Kyanite	Ky
Lapis lazuli	Laz
Lead	Pb
Lignite	Lig
Lime	<u>Lime</u>
Lime stone	Ls
Liquefied natural gas	<u>LNG</u>
Liquefied petroleum gas	<u>LPG</u>
Lithium	Li
Magnesite	Mag
Magnesium	<u>Mg</u>
Manganese	Mn
Marble and alabaster	Marb
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)	<u>N</u>
Oil Sands	OSs
Oil Shale	OSh
Olivine	Ol
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
Pumice	Pum
Pyrite	Py
Pyrophyllite	Pyrp

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

MAP LEGEND

Symbol	= Mine, including beneficiation plants, well
Circled symbol	= Group of producing mines or wells
<u>symbol</u>	= Processing plant or oil refinery, including smelters and metal refineries
(Symbol)	= Undeveloped resource

