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MINERAL INDUSTRIES OF

LATIN AMERICA AND CANADA

U.S.
DEPARTMENT
OF THE
INTERIOR

BUREAU
OF
MINES

1993

UNITED STATES DEPARTMENT OF THE INTERIOR • Bruce Babbitt, Secretary

BUREAU OF MINES

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 sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; 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 by encouraging stewardship and citizen participation in their care. 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

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Preface

This edition of the Minerals Yearbook records the performance of the worldwide minerals industry during 1993 and provides background information to assist in interpreting that performance. Content of the individual Yearbook volumes follows:

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

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

Volume III, Area Reports: International, contains the latest available mineral data on more than 175 foreign countries and discusses the importance of minerals to the economies of these nations. The reports also incorporate location maps, industry structure tables, and an outlook section.

The annual international 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 Central Eurasia, Mineral Industries of the Middle East, and Minerals in the World Economy. Due to budget constraints detailed mineral trade statistics by country will no longer be included in this publication. However, in the future abbreviated trade data for the major mineral trading countries will be made available by electronic or other means. For information on trade statistics call the Chief, Section of International Data at (202) 501-9700.

The U.S. Bureau of Mines continually strives to improve the value of its publications to users. Therefore constructive comments and suggestions by readers of the Yearbook are welcomed.

Rhea L. Graham, *Director*

Acknowledgments

The Country Specialists in the Division of International Minerals, U.S. Bureau of Mines, in preparing the International Review regional books of Volume III of the Minerals Yearbook, 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 also was obtained from reports of the U.S. Department of State, from United Nations publications, and from the domestic and foreign technical and trade press. Of particular assistance were the routine and special reports submitted by 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 U.S. Embassies worldwide. Their contributions are sincerely appreciated. Internal statistical support is provided by the staff of the Section of International Data, Division of Statistics and Information Services. The text and production, structure of the mineral industry, and reserve tables of this volume were prepared by the respective country author.

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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David B. Doan, geologist, with B.S. and M.S. degrees from Penn State University, spent 13 years with the U.S. Geological Survey in the Western Pacific and Asia; 6 years in operations research on development problems in Asia; and 22 years as an independent consultant to government and industry in the United States, Canada, Latin America, and Asia. Concurrently he was visiting professor of geology for 6 years at the University of Maryland at College Park. After 2 years as senior analyst in the Branch of Asia and the Pacific, he became the specialist for Canada in 1991 and, subsequently, Acting Chief of the Branch of Latin America and Canada.

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LATIN AMERICA

AREA 19.5 million km² **POPULATION 500 million**

MAJOR MINERALS IN LATIN AMERICA

THE MINERAL INDUSTRY OF THE

LATIN AMERICA AND CANADA

By David B. Doan[1] and Staff, Branch of Latin America and Canada

INTRODUCTION

This regional report covers 1993 mining and related activity in approximately 40 countries and territories of Canada, Latin America, and the Caribbean Basin. These countries of the Western Hemisphere, as with the United States, are endowed with a great variety of minerals, including metals, industrial minerals, and energy minerals. For most of these countries, such mineral production helps form foundations for their economies and earns export credits including hard currencies. Table 1 depicts an overall view of Latin America and Canada's production of its major mineral commodities in 1993; subsequent tables show the role of Latin America and Canada in world mineral production, trade, and import dependency on minerals from Latin America and Canada by the United States.

Overall, the picture emerges of a rich mineral diversity throughout the hemisphere, attracting increasing interest and investment, and complementing the mineral resources of the United States.

Position in the World Mineral Economy

By itself Latin America produced 20% to 30% of the world's total output of tin, silver, copper, bauxite, iron ore, and, with Canada, produced even greater proportions of copper, silver, aluminum, zinc, nickel, tin, gold, iron ore, and lead.[2]

Moreover, Latin America and Canada, separately and together, are of great significance to the world economy as producers of petroleum crude and natural gas, petroleum refinery products, and coal.

Canada led the world in production of uranium and zinc, with a strong showing in output of silver, gold, and nickel. Chile led the world in production of copper while Mexico led in the production of silver, sodium sulfate, and strontium. Brazil led in output of columbium and, although not the greatest producer of iron ore, was the largest exporter in recent years, as well as the eighth largest steel producer in the world, followed in the Western Hemisphere by Canada and Mexico as second and third largest producers there. Brazil was also the fifth ranking source of manganese in the world, followed by Mexico in Latin America. After Russia, Canada was the second largest world nickel producer, with other significant production in the hemisphere by Cuba and the Dominican Republic.

By including the United States in summary table 1 to show the position of the entire Western Hemisphere in world supply of mineral commodities, it is plain that this hemisphere produced more than one-half of the world's copper and silver, as well as more than 40% of the world's aluminum, 35% of world's zinc, and 33% of world's nickel. Among the industrial minerals, in 1993 the Western Hemisphere produced 42% of the world's sulfur, 37% of its salt, and 32% of its gypsum. Of the mineral fuels, this hemisphere produced 44% of the world's output of natural gas, 35% of petroleum products, 22% of crude, and 20% of coal.

Production Trends

Nonfuel Minerals.—For all of Latin America, the most significant production of the region in terms of share of world output includes tin, silver, copper, bauxite, iron ore, zinc, nickel, aluminum, lead, and gold, in order of importance, as shown in table 2. In recent years, exploration, investment, and development have taken various new discoveries to the point of production such that tin, copper, nickel, and aluminum have increased Latin America's world position in production of these metals. Some of this activity seemingly has been at the expense of silver, zinc, and lead, which have declined in terms of their proportion of world production, partly because of increased output in other countries. It may be noted that Latin America's world share of output of bauxite and gold has not changed much in the past 5 years, but conspicuous effort is being exerted in exploration and development for production of these minerals. Gold has been the center of attention in the Guyana Shield of Venezuela and Guyana as well as virtually all of the Andean countries. The bauxite industry has weathered the unusual surge of aluminum exports from the former Soviet Union during the early 1990's and is the object of increased interest in Brazil and Venezuela for domestic aluminum production. Jamaica, the biggest Latin American producer, exports virtually all of its production.

Energy Minerals.—World share of Latin American production of petroleum crude, natural gas, and petroleum products dropped in 1993 compared with a steady increase over a period of more than 10 years. In spite of this, however, new highs in output of crude were achieved by Bolivia, Colombia, and Cuba. The top seven producers were Mexico, Venezuela, Brazil, Argentina, Colombia, Ecuador, and Trinidad, representing 97.5% of the regional total.

Bolivia and Colombia also reached new highs in production of natural gas.

Canada likewise confirmed a new high in production of both crude and natural gas and, if combined with Latin America and the United States, showed the Western Hemisphere to represent 44% of the world's share of natural gas production and 22% of crude oil production.

Brazil, Venezuela, and Mexico led Latin American production of refinery products in that order and, with Canada and the United States, the region achieved a world's share of 35%.

Coal output in Latin America was led by Colombia, Mexico, and Venezuela, in that order, with products that were generally competitive in world markets while increasing local and regional market share over the past 10 to 20 years. These coals range from anthracite through semianthracite, bituminous, and subbituminous, depending upon the country, and some lignites used locally in most cases. Latin American coals are suitable for both metallurgical and thermal use, as is true for Canadian and U.S. coals. Together, the Western Hemisphere coal output amounts to a 20% world share.

Regional Mineral Trade

Latin American mineral commodity exports to the remainder of the world, including iron, steel, and fuels, represented an estimated total value of $47 billion in 1992. Roughly 44% of this went to North America, 21% to Western Europe, 14% stayed in Latin America, and 12% went to Asia. The final 9% or so went to Africa, the Mideast, former Soviet Union, Eastern Europe, and elsewhere. Corrected data for 1990 show a roughly similar total value, with Venezuela in the leading export position followed successively by Mexico, Brazil, Chile, Colombia, Trinidad and Tobago, Peru, Ecuador, Cuba, and Argentina for the top 10. In order of value, the most significant mineral exports were petroleum crude, silver, copper, gold, bauxite, zinc, and aluminum. Canada's leading export was natural gas into U.S. pipelines followed by, for world markets, aluminum, iron and steel, fertilizers, copper, and nickel.

Two noteworthy items involve Colombia and Venezuela in energy-mineral trade. Although Latin America is not a big coal producer in terms of world share, Colombia nonetheless has established a thriving export market in thermal ("steam") coal, starting from less than 1 Mmt/a in 1983 and increasing to more than 15 Mmt/a by 1992. The aim is a target of 35 Mmt/a into the export market by 2000. For its part, Venezuela, long an exporter of petroleum crude and refinery products, has now become an exporter of coal.

The United States has been the principal market for mineral exports by most of the countries in the region. The bordering countries of Canada and Mexico have traditionally sold the major part of their surplus mineral output to the United States, and the latter, in turn, has come to depend upon Canada and Mexico for a large variety of mineral commodities. Table 3 shows that for the period 1990-93, Canada was the principal foreign seller to the United States of cobalt, potash, antimony ore, iodine, gypsum, nitrogen, sulfur, iron ore, salt, lead, cement, and silver in order of U.S. net proportionate import dependency. From the other direction, Mexico was the principal source of graphite, strontium, magnesium compounds, and sodium sulfate. In addition, Brazil has been the primary source of columbium, tin, and silicon.

The United States imported petroleum crude from eight countries in Latin America in 1993, as depicted in table 4. The greater part of the crude came from Venezuela, Mexico, Colombia, Trinidad and Tobago, and Ecuador in order of import volume. Canada is the other principal supplier, ranking between Venezuela and Mexico in importance. For petroleum refined products, Venezuela remains the leading source with Canada again in second place, but the Netherlands Antilles becomes a strong third.

U.S. petroleum crude and products supplies from Latin America in 1993 represented 28% of total U.S. imports, but combined with purchases from Canada accounted for slightly better than 40% of total U.S. imports, or an estimated 15% to 17% range of total U.S. consumption for the year. Overall, the United States clearly relies heavily on Western Hemisphere sources of energy minerals. The import picture is not complete, however, without noting the increasing dependence by the United States on imports of natural gas from Canada, which supplies roughly 10% of U.S. natural gas consumption and all but a very few percent of total gas imports.

Trade Liberalization Developments

In an action of great historical significance, the United States, Canada, and Mexico ratified the provisions of the North American Free Trade Agreement (NAFTA), scheduled to go into effect on the first day of 1994. This agreement creates the largest and richest trading bloc in the world, including 370 million consumers and an annual output approximating $7 trillion. NAFTA automatically replaces the Free Trade Agreement between the United States and Canada after 5 years of generally successful operation. The excellent infrastructural connections between Canada, the United States, and Mexico, including railroads, highways, and pipelines, were expected to be a significant factor in the marketing of mineral commodities. Other Latin American nations, Chile in particular, viewed the possibility of eventually joining NAFTA, which would enable greater freedom of mineral trade and, ultimately, greater efficiencies of production. The phased reduction of tariffs under NAFTA should increase and strengthen the diverse trade in mineral raw materials and mineral-derived materials between the United States and both Mexico and Canada.

Other Latin American countries however, over the past 30 years or more, have entered trade agreements between themselves, such as the Southern Cone Common Market (MERCOSUR) including Argentina, Brazil, Paraguay,

and Uruguay; Chile's bilateral Free Trade Agreement with Mexico; the Venezuela and Colombia agreement with the Central American Common Market; Venezuela's agreement with Chile to begin phasing out tariffs over a 6-year period; and a free-trade pact between Colombia, Mexico, and Venezuela to phase out tariffs.

During MERCOSUR negotiations Brazil discussed measures to lower its average tariff to approximately 14% and abolish the 40% ceiling on foreign investor stockholdings in privatized companies. Brazil also signed an agreement with Peru to reduce tariffs on bilateral trade by 50%. Chile signed an agreement with Colombia to eliminate tariffs entirely by 1999. Also in 1993, Argentina signed a bilateral investment treaty with the United States guaranteeing U.S. investors the best of national or Most Favored Nation treatment, free transfer of profits, and access to international arbitration.

Privatization and Investment Interest

Many governments recognize that privatization of ownership and acceptance of foreign investment fosters vigorous growth, not least in the mining industry, leading to enhanced revenues and, for many countries, expanded overall economic strength in labor and wages. The year 1993 saw the continuation of a strong trend toward privatization in Latin America. A significant proportion of U.S. and Canadian interest, and mining development capital, was shifting to Latin America. The most popular geological exploration targets were the Cordillera and the Guyana Shield. The Cordillera extends southward through Mexico and Central America to the Andes of South America, virtually to Tierra del Fuego. The Guyana Shield comprises parts of northern Brazil and smaller countries between Brazil and the northern coast. The lure of rights to private ownership in Latin countries such as Argentina, Bolivia, Chile, Colombia, Ecuador, Guyana, Mexico, Peru, and Venezuela, attracted great interest in terms of the mineral endowment of those countries. Even Cuba, seeking sources of hard currency for its economy, increasingly accepted exploration efforts by foreign companies for metals and petroleum while entering negotiations to formalize its long-term processing of nickel matte in Canada.

Venezuela courted foreign exploration for metals, particularly gold, and encouraged joint efforts in petroleum operations. A true gold rush began around "Kilometre 88" on Highway 10 south of El Dorado, the site of the Las Cristinas (Placer Dome 70%, Government 30%) major gold project. Many other companies, mostly but not entirely U.S. and Canadian, acquired concessions throughout this area, roughly 30 km by 45 km. Although public concern remained high over mercury pollution in the Las Cristinas area from old garimpeiros' (illegal miners) panning operations, interest did not stop there. Many of the same companies explored for gold and diamonds toward the south and east, throughout the Guyana Shield but north of the Brazil border, through Guyana, Suriname, and French Guinea. Brazil, itself highly mineralized and a major player in the mining world, awaited elections and the possibility of a new president whose campaign platform declared in favor of constitutional amendments affording privatization of state-owned monopolies with the opening of oil and mining to foreign investment. Privatization of business ownership and operations advanced steadily in countries such as Bolivia, Chile, Colombia, Ecuador, and Peru, and was anticipated in others. After adopting new mining and environmental laws in 1992, Mexico continued its privatizing efforts. Chile's state-owned Comision Chilena del Cobre (CODELCO) opened negotiations on a joint venture with the Cyprus Amax Mineral Co. (U.S.) on the El Abra copper project, according to CODELCO. Commitments in the $4 billion to $6 billion range in major capital investments were being considered for this and a number of other new copper projects or expansions along with several new gold mining projects in Chile, which was on its way to becoming the most active mining country in the world. Similarly, the Peruvian Government negotiated the sale of its Cerro Verde copper project to the U.S. company Cyprus Mines, and began negotiation of the sale of the Tintaya copper mine to another U.S. company, Magma Copper. In 1992, the Chinese Shougang Corporation purchased Hierro Peru as part of a new Chinese strategy to take equity and/or ownership positions in long-term mineral supply sources.

The Corporacion Minera de Bolivia (COMIBOL), once the leading mineral producer in the country, began seeking private partners to operate its existing mines under joint-venture or other contracts.

In Canada, privatization was not a concern. That country recently has seen increasing environmental challenge to property development, mining, and closure or abandonment. The industry has striven to respond to responsible criticism by way of adopting environmentally acceptable methods of operation. However some companies have chosen to shift their interest elsewhere, particularly to Latin American countries. Otherwise, groups of Canadian citizens representing all views have combined in an extended "parley at the summit" to produce a preliminary but comprehensive statement attempting to reconcile conflicting interests between preservation and development. Called the *Whitehorse Initiative,* this effort brought together a coalition of Federal and local governments, native peoples, industry, labor unions, and non-governmental organizations to formulate a common policy integrating public land use, resource development, and the environmental and economic concerns of the nations people. Some progress was evident by yearend 1993, but much work remained.

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[1]Acting chief, Branch of Latin America and Canada, Division of International Minerals. Based on information available as of Dec. 1994.

[2]Unless otherwise noted, all listings of mineral commodities for enumerative or comparative purposes are stated in order of importance based on volumes produced, exported, or imported.

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.
Business International Corporation, New York: The New Latin America Market Atlas, 1992.
EMEP—Editorial Ltda. Sao Paulo, Brazil: Minerios Extração and Processamento, monthly.
G & T International (Chile): Latinominería, quarterly.
Institute of the Americas, La Jolla, California: HEMISFILE and News & Events and summary reports on all major conferences.
Instituto Latinoamericano del Fierro y el Acero (ILAFA), Santiago: Anuario Estadístico de la Siderurgia y Minería 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.
International Bauxite Association (IBA), Kingston, Jamaica: Review, quarterly.
International Lead and Zinc Study Group, London.
International Monetary Fund, Washington, DC: International Financial Statistics, monthly.
Annual Yearbook.
International Nickel Study Group, The Hague, The Netherlands: Occasional reports.
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.
Mexico and Central America Investment and Mining Guide, annual.
Latin American Newsletters Ltd., London: Weekly Report.
Commodities Report, biweekly.
Latin American Economic Report, weekly.
McGraw-Hill, Inc., New York: Engineering and Mining Journal, monthly.
Metals Economics Group, Nova Scotia, Canada: Latin America Gold-Transactions and Opportunities.
MllDa Limited, London: Latin American Mining Letter, biweekly.
Miller Freeman Publications, San Francisco: World Mining, yearbook.
Mining Journal Ltd., London: 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.
Organization of American States, CECON, Washington, DC: Trade News, monthly.
Organization of Petroleum Exporting Countries, Vienna, Austria: Annual Report. Annual Statistical Bulletin.
PennWell Publishing Co., Tulsa, Oklahoma: International Petroleum Encyclopedia.
Robertson, Andrew. Ed. Atlas of the Latin American and Caribbean Mineral Industry. Mining Journal Books. Kent, England, 162 pp.
Samim, Rome: Metalli Non Ferrosi, annual report.
United Nations, New York, NY: Chronicle of the United Nations Mineral Resources Exploration in Developing Countries 1988-93. Yearly updates.
United Nations Economic Commission for Latin America and the Caribbean: Preliminary Economic Overview, annual.
CEPAL News, monthly.
Statistical Office, U.N. Trade Statistics.
U.S. Agency for International Development: Latin America and the Caribbean-Selected Economic and Social Data, Apr. 1992.
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.
Business America, v. 113, No. 21, Oct. 19, 1992: U.S. Department of Commerce, Feature article on NAFTA.
U.S. Department of Energy, Office of International Energy Analysis: International Energy Annual, DOE/EIA-0219.
Petroleum Supply Annual v. 1 and 2. DOW/E1A-0340.
U.S. Department of the Interior, Bureau of Mines: Mineral Commodity Summaries, annual.
Minerals Yearbook, Annual Commodity Reports.
Mineral Perspectives Series: The Mineral Economy of Mexico, 1992.
U.S. Joint Publications Research Service, Arlington, Virginia: 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.
Weaver, Jean N. Coal in Latin America: 1992. U.S. Geological Survey, Open-File Report 93-239. 60 pp.
World Bank, Washington, DC: Bank news releases.
World Bureau of Metals Statistics, London: World Metal Statistics, monthly.
World Reports Limited, New York: The Latin American Times, monthly.

TABLE 1

PRODUCTION OF SELECTED MINERALS IN LATIN AMERICA AND CANADA, 1993

(Thousand metric tons, unless otherwise specified)

	Metals										
	Aluminum, metal	Bauxite	Copper, mine output	Gold (tons)	Iron ore, gross weight	Lead mine output	Nickel, mine output	Silver (tons)	Steel, crude	Tin, mine output	Zinc, mine output
Argentina	165	—	(1)	1	—	e19	—	e47	2,812	—	40
Bolivia	—	—	(1)	10	51	21	—	333	—	19	125
Brazil	1,200	9,357	44	79	159,000	4	30	155	25,200	26	170
Chile	—	—	2,055	33	7,379	(1)	—	961	1,063	—	29
Colombia	—	2	4	27	(1)	(1)	23	7	(1)	—	(1)
Costa Rica	—	—	—	(1)	—	—	—	(1)		—	—
Cuba	—	—	e2	—	—	—	30	—	(1)	—	—
Dominican Republic	—	—	e2	—	—	—	24	e13	e35	—	—
Ecuador	—	—	(1)	e12	—	—	—	—	e20	—	(1)
El Salvador	e2	—	—	—	—	—	—	—	e12	—	—
Guatemala	—	—	—	(1)	e3	(1)	—	—	—	—	23
Guyana	—	2,126	—	10	—	—	—	—	—	—	—
Honduras	—	—	1	(1)	—	e10	—	e45	e7	—	e27
Jamaica	—	11,391	—	—	—	—	—	—	e25	—	—
Mexico	26	—	301	10	e15,000	154	—	2,136	9,189	3	370
Nicaragua	—	—	—	1	—	—	—	2	—	—	—
Panama	—	—	—	(1)	—	—	—	(1)	—	—	—
Paraguay	—	—	—	—	—	—	—	—	e86	—	—
Peru	—	—	e369	10	2,848	82	—	691	338	10	124
Suriname	e30	e3,300	—	(1)	—	—	—	—	—	—	—
Trinidad and Tobago	—	—	—	—	—	—	—	—	e515	—	—
Uruguay	e42	—	—	—	—	—	—	—	e40	—	—
Venezuela	568	2,914	—	9	16,851	—	—	—	3,356	—	—
Other[2]	—	—	—	2	—	—	—	—	—	—	—
Total Latin America	2,033	29,000	2,778	204	201,132	290	107	4,930	42,698	58	908
Share of world percent	10	28	30	9	20	10	12	31	6	32	13
Canada	2,309	—	734	153	30,568	182	188	888	14,387	—	1,007
United States	3,695	W	1,801	331	55,700	362	5	1,645	88,793	(1)	513
Total Western Hemisphere[3]	8,037	29,090	5,313	688	287,400	834	300	7,463	145,878	58	2,428
Share of world percent	10	28	57	30	29	29	33	53	20	32	35
Total world	19,816	105,550	9,352	2,300	1,000,000	2,926	899	14,000	730,000	180	6,895

See footnotes at end of table.

TABLE 1—Continued

PRODUCTION OF SELECTED MINERALS IN LATIN AMERICA AND CANADA, 1993

(Thousand metric tons, unless otherwise specified)

	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 42-gallon barrels)	
									Crude	Products
Argentina	e44	5,647	e570	—	e1,001	—	e200	e27,200	e220,000	e133,077
Barbados	—	200	—	—	—	—	—	e35	e470	e2,200
Bolivia	—	480	4	—	(1)	1	—	5,593	8,116	9,812
Brazil	e70	e28,000	809	e27	e8,200	e339	4,565	e7,210	232,780	526,940
Chile	2	e2,600	511	15	1,443	386	1,793	4,020	5,208	48,600
Colombia	5	7,664	439	18	400	51	21,713	e5,350	165,380	84,303
Costa Rica	—	750	—	—	e45	—	—	—	—	e4,000
Cuba	—	e375	e125	—	e185	(1)	—	—	e7,320	e55,200
Dominican Republic	—	e1,300	e85	—	e12	—	(1)	—	—	e10,365
Ecuador	—	e2,200	e24	—	—	e14	—	e200	e126,000	e44,160
El Salvador	—	861	e5	—	30	—	—	—	—	e6
Guatemala	e2	e1,400	60	—	e100	—	—	e10	e1,700	e5,000
Honduras	—	e645	e26	—	e30	—	—	—	—	e1,900
Jamaica	—	451	153	—	e14	—	—	—	—	e7,000
Mexico	136	27,100	5,340	4501	7,491	1,666	10,215	e37,000	974,141	e585,400
Nicaragua	—	567	11	—	e15	—	—	—	—	4,631
Panama	—	e300	—	—	e20	—	—	—	—	e9,500
Paraguay	—	e326	e5	—	—	—	—	—	—	e2,000
Peru	17	2,089	35	18	238	66	94	1,200	42,298	85,600
Suriname	—	e50	—	—	—	—	—	—	e1,500	—
Trinidad and Tobago	—	e485	—	—	—	e5	—	8,200	43,600	30,000
Uruguay	e15	e500	e145	—	—	e2	—	—	—	—
Venezuela	—	6,842	224	—	e370	135	3,940	42,459	894,250	406,464
Other[5]	(1)	e505	—	e10	e500	e100	—	—	—	132,000
Total Latin America	291	91,337	8,571	589	20,094	2,764	42,520	142,477	2,695,763	2,188,158
Share of world percent	6	7	9	—	11	5	1	7	9	9
Canada	e59	6,672	8,097	—	11,169	e8,312	e65,000	e165,400	6614,697	e604,910
United States	335	72,400	15,812	35,494	38,615	10,959	857,674	649,249	3,225,140	5,527,000
Total Western Hemisphere[3]	685	170,409	32,480	36,083	69,878	22,035	965,194	957,126	6,535,600	8,320,068
Share of world percent	14	13	32	27	37	42	20	44	22	35
Total world	4,900	1,300,643	100,000	131,641	190,000	52,000	4,865,000	2,172,000	29,225,550	24,041,000

eEstimated. W Withheld to avoid disclosing company proprietary data.

[1]Less than 1/2 unit.

[2]Includes French Guiana.

[3]Excludes Greenland.

[4]Includes only output used to manufacture fertilizers.

[5]Includes Aruba, The Bahamas, Barbados, Guadeloupe (etc.) Guadeloupe, Haiti, Martinique, the Netherlands Antilles.

[6]Includes synthetic crude (from oil shale and/or tar sands).

TABLE 2

THE ROLE OF LATIN AMERICA IN WORLD MINERAL PRODUCTION

(Percent of total world output)[1]

Commodity	1985	1990	1991	1992	1993
Tin	25	28	26	31	32
Silver	35	35	34	34	31
Copper	26	26	27	28	30
Bauxite	20	24	30	28	28
Iron ore	17	21	20	21	20
Zinc	17	17	18	17	13
Nickel	e6	11	11	12	12
Aluminum	8	10	10	10	10
Lead	15	13	13	12	10
Crude oil	12	11	12	12	9
Gold	10	9	9	9	9
Petroleum products	7	9	9	9	9
Cement	7	7	7	7	7
Steel	5	5	5	5	6
Coal	.5	1	1	1	1

eEstimated.
[1]By volume.

TABLE 3

U.S. IMPORT DEPENDENCY ON WESTERN HEMISPHERE MINERAL SOURCES

(In Percent of total imports-1990-93)

Mineral commodity	Overall dependency percent	First rank		Second rank		Third rank		Fourth rank	
Arsenic	100	Other	(30)	Chile	(22)	Mexico	(15)	Other	
Bauxite	100	Other	(33)	Jamaica	(29)	Brazil	(14)	Guyana	(11)
Columbium	100	Brazil	(66)	Canada	(25)	Other		Other	
Graphite	100	Mexico	(29)	Canada	(27)	Other	(8)	Brazil	(4)
Maganese ore	100	Other	(53)	Other	(22)	Brazil	(11)	Other	
Strontium	100	Mexico	(99)	Other		Other		Other	
Fluorspar	89	Other	(43)	Mexico	(27)	Other		Other	
Tungsten	84	Other	(45)	Bolivia	(9)	Peru	(7)	Other	
Nickel	75	Other	(27)	Other	(23)	Canada	(16)	Other	
Tin	81	Brazil	(25)	Bolivia	(24)	Other		Other	
Cobalt	71	Canada	(91)	Other		Other		Other	
Potash	84	Canada	(51)	Other	(15)	Other	(10)	Dominican Republic	(6)
Cadmium	57	Other	(86)	Other	(4)	Mexico	(2)	Other	
Barite	51	Other	(57)	Chile	(43)	Other		Other	
Antimony ore	66	Canada	(37)	Mexico	(18)	Other		Other	
Iodine	46	Canada	(41)	Other		Other		Other	
Selenium	58	Other	(72)	Other	(19)	Mexico	(5)	Other	
Silicon	34	Brazil	(24)	Other	(15)	Canada	(13)	Venezuela	(11)
Gypsum	29	Canada	(21)	Mexico	(22)	Other		Other	
Magnesium compounds	26	Mexico	(46)	Peru	(24)	Canada	(20)	Other	
Zinc, ore and metal	25	Other	(76)	Ecuador	(7)	Mexico	(5)	Other	
Pumice	26	Other	(53)	Canada	(16)	Mexico	(8)	Other	
Nitrogen (ammonia)	15	Canada	(60)	Mexico	(39)	Other		Other	
Sulfur	15	Canada	(32)	Trinidad and Tobago	(30)	Other	(23)	Mexico	(12)
Iron ore	12	Canada	(44)	Mexico	(24)	The Bahamas	(12)	Chile	(6)
Iron and steel	12	Other	(31)	Canada	(21)	Other	(15)	Brazil	(8)
Salt	12	Canada	(53)	Brazil	(21)	Venezuela	(21)	Other	
Lead	11	Canada	(67)	Mexico	(24)	Peru	(6)	Other	
Cement	8	Canada	(37)	Mexico	(14)	Colombia	(9)	Other	
Copper	7	Canada	(49)	Chile	(15)	Mexico	(13)	Other	
Silver	1	Canada	(95)	Canada	(25)	Peru	(10)	Other	
Sodium sulfate	1	Mexico	(29)	Mexico	(4)	Other		Other	

Source: U.S. Bureau of Mines, Mineral Commodity Summaries 1993.

TABLE 4

U.S. DEPENDENCY ON IMPORTS OF PETROLEUM FROM LATIN AMERICA, 1993

(Thousand 42-gallon barrels)

Country	Crude oil	Percent share	Petrolum products[1]	Percent share	Total petroleum	Percent share
Venezuela	368,650	46.8	104,390	56.0	473,040	48.6
Mexico	314,995	40.0	10,220	5.5	325,215	33.4
Colombia	51,465	6.5	[2]10,585	5.7	62,050	6.4
Ecuador	20,075	2.6	6,935	3.7	27,010	2.8
Netherlands Antilles	—	—	28,105	15.1	28,105	2.9
Trinidad and Tobago	28,470	3.6	1,095	.6	29,565	3.0
Brazil	—	—	[2]8,030	4.3	8,030	.8
The Bahamas	—	—	11,315	6.1	11,315	1.2
Argentina	—	—	2,920	1.6	2,920	.3
Peru	4,380	.6	2,190	1.2	6,570	.7
Total	788,035	100.0	185,785	100.0	973,820	100.0
Total U.S. imports	3,038,990	100.0	389,090	100.0	3,428,080	100.0
From Latin America	788,035	25.9	185,785	47.8	973,820	28.4
From Canada	327,770	10.8	84,315	21.7	412,085	12.0
From Western Hemisphere	1,115,805	36.7	270,100	69.4	1,385,905	40.4

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

Note: Totals may not equal sum of components owing to independent rounding.
Source: U.S. Department of Energy, Energy Information Administration, Petroleum Supply Annual 1993. June 1994.

ARGENTINA

AREA 2.8 million km² **POPULATION 33.5 million**

THE MINERAL INDUSTRIES OF

ARGENTINA

By Pablo Velasco

Argentina, the second largest country in South America after Brazil, continued to be a modest producer of minerals. Its (mining activities, excluding) hydrocarbons, accounted for an estimated 0.3% or less of the country's 1993 gross domestic product (GDP) of about $261 billion.[1] Argentina's mining industry is relatively small, with an annual output of $300 million and a work force of about 16,000 people. Of a total of 12,500 registered mines, only 900 are being mined. In 1993, 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 7,081 MW of electric power to Argentina in 1993, or 12.6% of the total of 56,273 MW. The real GDP grew by about 5%, thus making 1993 the third year in a row of economic recovery. The Argentine economy has been stable since early 1991. However, the rate of economic growth has slowed. Argentina's real economy is still growing, though less rapidly than in 1991-92. Inflation has fallen from levels as high as 1,345% in 1990 to 7.4% in 1993. Since 1990 nearly every business unit controlled by the government has been transferred to the private sector through sales of ownership or service concessions. Among the companies or business units privatized were telephone services; electricity generation, transmission and distribution; natural gas transportation and distribution; all aspects of petroleum production and sale; railroad; highways; ports and port services; steel mills; petrochemical companies; and radio and television stations. By the end of July 1993, the privatization program had brought in $8.3 billion in cash and permitted the government to retire approximately $13 billion in debt paper. The program has assisted the government in reducing expenditure and improving the public accounts. Instead of draining public revenues to cover losses, the newly privatized companies are paying taxes. Privatization, in the broad sense of term, will continue after the remaining public enterprises have been turned over to the private sector. Licenses have been offered for services such as cellular telephones and for projects such as the construction of pipelines and bridges will appear in the near future. Parallel privatization programs in the provinces also will continue. According to government officials, the public and private demand for investment in infrastructure will reach $35 billion for the period 1993-2000.

Argentina's mineral production and trade remained almost negligible in terms of their contributions to the GDP and total exports. Total mineral sector exports in 1993, excluding hydrocarbons, declined to an estimated $50 million, 36% lower than those in 1992. Metallic mineral exports represented 60.5% and industrial minerals 39.5% of the total nonfuel mineral sector's exports figure.

GOVERNMENT POLICIES AND PROGRAMS

Foreign investment is virtually unrestricted in Argentina. The rules covering foreign investments are contained in the Foreign Investment law No. 21,382/76 as amended by law No. 22,208, law No. 23,696, and later by law No. 23,697 of August 1989. The law entitles foreign investors to the same rights and subject to the same obligations as domestic investors. Foreign investors are entitled without approvals or formalities, to repatriate capital and remit profits at any time and have unrestricted access to foreign exchange markets.

Several major regulations were enacted in 1993 to form a more comprehensive and growing body of mining legislation, hence, on May 24, 1993. The Government has promulgated a new Mining Investment Regulation Law (law No. 24,196), Mining Reorganization Law (law No. 24,224), and the Federal Mining Agreement (law No. 24,228) (El acuerdo Federal Minero). The Mining Investment Regulation Law is a promotional law based on tax incentives aimed toward (1) creating a stable business environment for mining activities, (2) alleviating the tax impact in the initial development stages, and (3) promoting the importation of mining equipment and machinery.

The Argentinean Mining Code was first enacted as law No.1919 in 1986. Subsequent amendments have been introduced to the Code and one of the most important is the law No. 22,259, of August 1980, which defines ownership and sovereignty and along with the Argentine Mining Code, regulates the rights and obligations arising from and procedures applicable to the acquisition, extraction and implementation. The mining code includes rules intended to attract leading companies to engage in mining operations through public tenders. Large-scale production may also be carried out through regular prospecting permits. There are no restrictions on the involvement of foreign companies in

mining and owning mining properties, nor is there any discrimination against them in obtaining local financing in dollars or local currency. Furthermore, there are no export duties on mining products. The law No. 24,196 instituted a new system for mining investment. To be eligible for this system, individuals and corporations must be domiciled in Argentina and register with the National Mining Department. The system will be applicable in all the provinces that have ratified it.

The system specifically excludes oil and gas activities, as well as the manufacture of cement, tiles, ceramics, sand, pebbles and gravel. In addition, it guaranteed tax stability for 30 years, stable foreign exchange and customs treatment, income tax deductibility of the full amount of prospecting and exploration outlays, income tax deductibility of an environmental conservation allowance up to a maximum of 5% of operating costs for extraction of minerals and smelting, accelerated depreciation rates on income taxes for investments made in carrying out new mining prospects or extending the productive capacity of existing operations, in line with the new guidelines, income tax exemption for profits, exemption from import duties, statistical taxes and other taxes on import of capital goods, and equipment and spare parts.

Under the New Reformed Mining Code, private output of minerals, including metallic, industrial minerals, and mineral fuels, would not be taxed if exported. Article 2,342 of the Argentine Civil Code declares that gold, silver, copper, and fossil substances are the state or provinces' properties despite possession of the land by persons or corporation. The mining code states that mineral resources belong either to the state or the provinces, depending on location. The state and the provinces grant mining concessions and control the fulfillment of obligations and duties outlined by the law. Equipment can be imported tax free, and Federal taxes on multinational companies would be maintained at existing levels. The Argentine Government intends that the private sector, not the state, has the leading role in promoting mining development.

Argentina is a member of the Latin American Integration Association (ALADI) and the Southern Region Common Market Treaty (MERCOSUR). In 1993, senior mining officials from Argentina and Chile signed an agreement to integrate the mining industries of the two countries. Several Provincial governments were very active in promoting joint-venture explorations in 1993. The governments of Catamarca (Bajo La Alumbrera, gold/copper project), San Juan (El Pachon, copper project), Neuquén (Rio Colorado, potash project) and San Juan Provinces reorganized into more flexible organizations that were at liberty to form joint ventures. At yearend, Musto International Musto Exploration Ltd. had completed its feasibility study on the copper/gold Bajo la Alumbrera deposit in Catamarca and was soliciting offers for a joint-venture partner. At yearend Musto announced that on February 2, the Ministry of Economy and Public Works of Argentina will announced the 50-50 joint-venture project with Mount Isa Mines (MIM). CRA of Australia also has completed an option agreement with YAMIRI Company of La Rioja to explore the well known Famatina copper deposit in northwest Argentina. Broken Hill Pty. Co. Ltd. (BHP), Anglo-American Corp., Río Tinto Zinc Corp. Ltd. (RTZ)., American Resources Corp., F.M.C. Lithium International, Pacific Rim Mining Corp., Placer Dome Inc., and San Jose Argentina (LAC Minerals of Canada and other foreign companies) were carrying out exploration programs throughout the country.

ENVIRONMENTAL ISSUES

Argentina has initiated a number of measures to regulate, monitor, and improve its environmental standards. Until recently, Argentina's environmental protection applied primarily to the provinces. In 1992, the Government established the National Secretariat of the Environment pursuant to a presidential decree calling for a balance of economic development with natural resource conservation, environmental improvements and pollution prevention and remediation. Critical environmental issues facing Argentina include water and air pollution and hazardous-waste disposal. Local, provincial and national authorities are moving toward more stringent enforcement of environmental laws.

Argentina recently adopted environmental regulations requiring industrial companies to meet stricter environmental standards, which are comparable to those in the United States and the European Community. These regulations establish a general framework for environmental protection, including fines and criminal penalties. The Government also has established a national registry of producers and handlers of hazardous wastes. These companies must pay annual fees based on the volume of hazardous waste they handle and the earnings they generate.

PRODUCTION

Argentina continued to be the world's third largest producer and exporter of boron minerals and byproducts after the United States and Turkey. It also produced modest quantities of base metals such as cadmium, copper, lead, silver, manganese, and zinc; other industrial minerals such as asbestos, barite, boron, bentonite, clays, celestite, diatomite, feldspar, fluorspar, graphite, gypsum, kaolin, marble, sodium carbonate, vermiculite, and others. Mineral fuels such as coal, coke, crude oil, and natural gas, and uranium also were produced.

Production of precious metals was limited; gold output in 1993 reached 1,350 kg, almost the same as in 1992. Smelter and refinery production of most metals, including ferroalloys, generally remained at about the same level as that of 1992. Argentina's major nonferrous metals industries aluminum, copper, and zinc like the steel industry, were impacted by import-export regulations. Argentina's only primary aluminum producer,

Aluminios Argentinos, S.A.I.C. (ALUAR), produces about 165,000 mt/a of aluminum ingot, billet, and slab and exports 60% to 65% of these products, mostly to Japan. Crude steel production in Argentina increased slightly in 1993 to about 2.95 Mmt, while domestic consumption increased to 2.1 Mmt from 1.9 Mmt in 1992. The biggest producers of steel in Argentina were Sociedad Mixta Siderurgica Argentina (SOMISA) and ACINDAR-Industria Argentina de Aceros S.A. which were privatized in 1993. Production of crude oil and refinery products maintained the same level in 1993 compared with that of the previous year. *(See table 1.)*

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 $50 million, a decrease of 36% compared with that of 1992. The export value of crude oil and refinery products increased 38.3% to $848 million in 1993. Small quantities of both commodities were exported to the United States. The following principal nonfuel mineral exports were classified in five groups based on their export value: (1) borates, 25.9%, of which boron minerals were 2.2%; boric acid, 10.3%; and sodium borate, 13.4%; (2) metals, 23.5%, of which refined zinc was 23.0% and refined lead 0.5%; (3) metallic minerals, 22.5%, of which lead minerals were 19.4% and zinc minerals 3.1%; (4) granites, 12.0%, of which manufactured was 11.6% and granite in blocks 0.4%; and (5) others, 16.1% (mostly of perlite was 2.9%; and bentonite 2.6%). In 1993, the nonfuel mineral and mineral-related products exported went to almost 51 countries, including as follows: Brazil, 30.5%; the United States, 15.1%; Belgium, 12.7%; Japan, 8.6%; Chile, 6.1%; Uruguay, 5.1%; Morocco, 4.7%; and Bolivia, 1.1%.

The total amount of steel imported reached 1,281,000 tons, 65% from Brazil, 10% from Poland, 5% from South Africa, and the remainder from other countries. In 1992, the steel industry had to import about 1.8 Mmt of iron ore and concentrate for a total value of $61.1 million and 993,000 mt of coal for the coke plants for the amount of $66.4 million.

STRUCTURE OF THE MINERAL INDUSTRY

The Secretariat of Mines is a unit under the Ministry of Economy and Public Works and Services, one of the eight ministries of the National Executive Branch. The Secretariat of Mines defines and controls the tasks performed by the National Mining Board and the National Geological Service Board. The Mining Subsecretariat promotes and coordinates the mining technology policy, establishes the development and incorporation of new technologies, and monitors and preserve the single data bank of mining and geological information. The National Mining Board's responsibility concerns programming and supervising the country's mining policy with regard to exploration and production of mining resources through the corresponding surveys. The Mining Evaluation Board evaluates mining projects and draws up economic mining profiles of field and mining projects. The Mining Development Board proposes engineering, benefit, and mineral treatment projects, and promotes the incorporation of new technologies. It also is responsible for mine operating cost studies and proposing mine health and safety rules.

The National Geological Services Board is responsible for examining the geology of nonrenewable resources of the national territory and ensuring the availability of geoscientific information and technical expertise required to promote the efficient use of natural resources. The following boards, developing specific tasks, depend on the National Geological Services Board: The Regional Geology Board, The Mining Geological Resources Board, and The Environmental and Applied Geology Board.

The Comisión Nacional de Energía Atómica (CNEA) controls Empresa Nuclear Mendoza's uranium production from the Sierra Pintada Mine and provides the uranium needed for the Atucha I and the Embalse nuclear powerplants in Buenos Aires and Córdoba, respectively.

Between 1989 and 1993, Argentina privatized the majority of the public enterprises controlled by the national Government. The process was expected to be completed by yearend. In 1993, the privatization of provincial energy, water, and other services will continue. The sale of shares in the National Oil Co. YPF will also continue in 1993. This process has brought in significant resources to reduce the public debt and to bring order to the finances of the State. The financial results of the privatization program, 1990-93 were as follows: in cash, $5.44 billion; in debt paper at market prices, $4.42 billion; and in debt transferred, $1.57 billion for a total $11.43 billion. The distribution of assets of privatized companies, according to country of origin of purchasers, is as follows: local companies, $4.61 billion or 27.9%; foreign companies, $6.82 billion or 41.2%; and the national Government, $5.10 billion or 30.9%. Total asset were value at $16.53 billion.

The mineral industry in the private sector was composed of several mining and manufacturing companies, such as ALUAR, Cementos Loma Negra C.I.A.S.A., Cia. Boroquímica SAMICAF, Cía. Minera Aguilar S.A., Cía. Minera Tea SAMICAF, 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 nationwide, of which 12% were in agriculture, 31% in industry, and 57% in services. Of the total labor force, approximately 3 million, or 28%, was organized in labor unions. Approximately 8.6% of the labor force was unemployed in 1993. Of the total labor force employed in industry, 7,000 were in the cement industry, 36,000 in the metallurgical plants, 16,000 in the

mining sector, and 21,000 in the oil and gas industry. *(See table 2.)*

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 170,000 mt/a of primary aluminum.

At yearend, the confrontation at ALUAR over downsizing and pay cuts had all the makings of a test case for the Government's new labor legislation which allows employers to adjust wage and employment levels to market conditions.

Copper.—International Musto Exploration Ltd. of Canada, was awarded the right by Yacimientos Mineros Agua de Dionisio (YMAD) to carry out a feasibility study and bring the project to production. Pursuant to the award agreement dated January 15, 1992, International Musto has committed to carry out a final feasibility study of the Bajo La Alumbrera project. Upon payment of $1 million, exclusive tenancy to the Bajo La Alumbrera deposit was granted to Musto on May 8, 1992, with the condition that the final feasibility be completed by November 8, 1993. Upon submitting a positive feasibility study with a mine development program, Musto must also pay YMAD $2 million, to be followed by an additional $2 million upon achieving commercial production. Geological reserves, as determined by Mineria Tecnica Consultores Asociados, MINTEC of Tucson, Arizona, in 1992 were estimated to be 450 Mmt averaging 0.50% copper and 0.62 g/mt of gold to a depth of 300 m. The deposit is open at depth and potential exists for geological reserves of 750 Mmt or more at similar grades. Proven and probable minable reserves using a 0.20% copper only cutoff are estimated to be 337 Mmt averaging 0.534% copper and 0.698 g/mt of gold to a depth of 300 m.

Musto has engaged the engineering firm of Wright Engineers to perform a final feasibility study on the Bajo La Alumbrera deposit, with a scheduled completion date of July 1993. At the end of 1993, International Musto Exploration Ltd. had completed it feasibility study on the Bajo de la Alumbrera deposit in Catamarca and later formed a 50-50 joint venture with Mount Isa Mines (MIM). The development of the mine and infrastructure, including a significant improvement of the rail system from Belen in Catamarca to the port in Rosario (1,300 km) would require an investment of $580 million. MIM will be the operator and has begun with engineering and some site preparation activities. Bajo de la Alumbrera will produce 90,000 mt/a of copper concentrate and about 1,500 kg of gold in early years by mid-1997, the copper concentrate will be shipped to smelters in Chile, (Codelco's El Salvador Div. 10%), Brazil, Europe, and Japan.

Gold and Silver.—The main sources of gold and silver production currently are the Angela Mine in Chubut Province in southern Argentina and the Farallón Negro Mine in the northwestern Province of Catamarca, and other properties in the mining district owned by Yacimientos Mineros de Agua de Dionisio (YMAD), a quasi state-owned company. The Angela Mine is an underground operation owned by Cerro Castillo S.A. it produces silver as well as gold, plus some base metals and annual ore production is believed to be of the order of 240,000 mt. This year a $2 million loan was provided by the Inter-American Development Bank towards the cost of a $23-million-expansion program to double ore production capacity over a 5-year period. Farallon Negro Mine has been operating since 1978 and is owned by YMAD; high grade gold and silver veins are mined by underground methods and ore is treated at the surface by heap leaching. Annual production is about 490 kg. An exploration program launched in 1986 between YMAD and the Japan International Cooperation Agency (JICA) centered on the adjacent Alto de la Blenda vein complex deposit which has similar characteristics to Farallon Negro in that it blocked out some 1.1 Mmt of ore grading 6 g/mt of gold and 117 g/mt of silver in five veins, in addition YMAD has focused its attention on this deposit because it represented the future continuity of production for several years to come. The exploration efforts for this deposit were accomplished with the assistance of the Japanese International Cooperation Agency (JICA) through a $1.5 million grant to YMAD initially for 3 years and extended in July 1990 for 2 more years owing to the successful results found mainly in the lower level of the Alto de la Blenda deposit.

At yearend, Anglo-American of South Africa and Argentina's Perez Companc signed a joint-venture contract to continue prefeasibility studies at the Cerro Vanguardia gold deposit in the Province of Santa Cruz, Patagonia, where a resource containing some 62,000 kg of gold and 498,000 kg of silver has been identified. A $23.8 million exploration and production feasibility program was underway.

Toronto-based Sikman Gold Resources Ltd. has signed an agreement with the Government of Neuquen Province to develop an alluvial gold deposit along the Neuquen River. Under the agreement, Sikman and the Government joint-venture partner must complete a $4.6-million-exploration program by May 1995 and begin production by May 1997. The area was estimated by the Government of Neuquen to contain a potential resource of 373 tons recoverable gold (based on an average grade of 0.4 grams of gold per cubic meter). Sikaman and its partner will each own a 45% interest in the project until they have recouped a 110% return on their investment. Thereafter, they will each hold a 29% interest and the original license's interest will increase from 10% to 22%.

Canadian-based Monk Gold & Resources has signed an agreement with DSE Resources of Barbados to acquire DSE's 27% interest in the Cerro Mayal gold placer deposit in the Neuquen Province of Argentina. Mining at the

Cerro Mayal project is expected to commence in August. The other share holders in the project are Sikaman Gold Resources and Aldermines International.

LAC Minerals Ltd and Argentina Gold Co., both of Canada, are on the verge of solving a dispute over Argentina's Carmen and Veladero gold deposits, a senior Argentine official said. The two companies have been locked in a dispute over the deposits concession since the Government of northwestern San Juan Province awarded the mining rights to Argentina Gold Co.

A $500,000 grant from the U.S. Trade and Development program will fund feasibility studies in a 64.3 km-wide stretch along the Chilean border roughly from the middle of Catamarca Province to the middle of San Juan Province in northwest Argentina. The Government of the Province of San Juan, through its company IDEEMSA, was preparing to invite bids on properties near the Chilean border in what appears to be a continuation of the belt containing Chile's El Indio gold mine. However, San Juan will delay the call for bids pending completion of the studies.

Avocet Ventures and its equal partner, Stagger Excavations (a Chilean mining contractor), have formalized the acquisition of the Hualcamayo gold property in San Juan, Argentina, from Minera Min-Corp., an Argentinean subsidiary of Anglo American Corp. Anglo outlined a reserve of 540,000 tons of ore grading 5.7 g/mt of gold. Anglo retains a 5% royalty. Results of column leach test on a 1-ton ore sample are expected by the end of July, but so far tests indicate that the sulfide and oxide ores could be crushed and agglomerated to provide 65% recovery. The partners are currently considering a 150-mt/d operation for an investment of $2.3 million.

American Resource Corp. (ARC) has acquired the 298-km^2 Campana Mahuida Prospect in the Neuquén Province of southern Argentina. The area is said to contain drill-indicated copper mineralization and numerous gold-copper exploration targets. Following the Argentine Government's decision to privatize domestic mineral resources nationalized within the past 40 years, ARC is one of the first mining companies to become involved in the privatization program. The area under acquisition, to the northwest of Zapala, is believed by ARC to have potential for a large porphyry copper development as well as gold vein possibilities. Campana Mahuida and ARC will spend a minimum of $1 million on exploration in the first year and will pay 5% for production to the provincial mining authority. Three other copper-gold projects recently have been acquired by ARC as part of the Argentinean Government's privatization program. One of them is the Mi Vida copper-gold prospect in Catamarca Province. Preliminary tests indicate that it contains about 40 Mmt of ore grading 1% to 2% copper and up to 4 g/mt of gold. ARC has acquired this prospect on condition that it would invest about $1 million in exploration over the next year, after which the prospect can be purchased for $9 million payable over 6 years. The company also has reached an agreement to acquire the exclusive rights to control both the Capillitas and the Cerro Atajo prospects. The potential and prospects for resuming operation at the Capillitas Mine have to be reassessed following a period of inactivity since 1988. The third prospect, Cerro Atajo, contains sulfide copper and vein gold. ARC recently has improved transportation links to the area and now will carry out tests to establish levels of gold and copper reserves.

Iron and Steel.—Production of iron ore in Argentina was limited to small amounts. In 1992-93 output was maintained at about 4,000 mt all from Hierro Patagónico de Sierra Grande (HIPASAM) in Río Negro Province. In 1993, Argentina imported 1.8 Mmt of iron ore from Brazil. Crude steel production in Argentina increased to 2.8 Mmt from about 2.7 Mmt the previous year, while domestic consumption increased to 3.5 Mmt from 2.3 Mmt in the previous year.

In accordance with the Economic Plan of 1991 and the Privatization Program of Companies organized by the State in 1992, only two integrated steel companies, Altos Hornos Zapla and Sociedad Mixta Siderurgica Argentina (SOMISA) were identified for privatization. The first plant is located in the town of Palpala, Province of Jujuy and was transferred to private hands on July 1, 1992, for the amount of $33.3 million under the new name of Aceros Zapla S.A. The new company invested more than $50 million over 10 years. Aceros Zapla S.A. agreed to rehire up to 900 steel workers of the total of 1,600 that the former State company had providing that they will rehire the remaining in the future for the reforestation of more than 8,000 hectares. The new company intends to produce special types of steel, given more emphasis to quality. The second privatized steel company, SOMISA was sold to Aceros Parana S.A. for the total amount of $152.1 million, $140 million base price in cash and the remaining $12.1 million in Argentine debt paper. The purchase was by a consortium led by the Techint Group. Techint was represented by Propulsora Siderurgica S.A. and SIDERCA, associated with the Brazilian companies USIMINAS and Conpanhia Vale Do Rio Doce, and the Chilean company Compania de Aceros del Pacifico (CAP), and a Western Chartered foreign bank, and other minor share holders. Twenty percent of the Capital of Aceros Parana S.A., will pass to the company personal through an employee stock-sharing program. The new company will give special attention to the local production of rolled steel products to be marketed with Propulsora Siderurgica S.A.

Uranium.—Preliminary figures released by the Secretaría de Hidrocarburos indicate that the production of yellow cake (U_3O_8) in 1993 remained at the same level as the previous year. The Argentina's Congress in 1993 ratified the 1967 Tlatelolco Treaty banning Nuclear Non-Proliferation in Latin America, breaking with its previous conviction that the treaty discriminated against developing countries' nuclear programs. The ratification, is part of

Argentina's wider, prowestern foreign policy strategy. Argentina and Brazil had attempted to develop independently nuclear capabilities in the 1960's and 1970's, when both countries were ruled by military Governments. However, technical and financial limitations aborted the programs. In November 1990, Argentina and Brazil agrees to bilateral procedures for accounting for nuclear materials and inspections of each other's installations, in addition to safe-guards by the Vienna-based international Atomic Energy Agency. They agreed to ratify the Tlatelolco Treaty after its inspection clauses were modified to protect industrial secrets.

The Foreign Minister says Argentina also plans to sign the Nuclear Non-Proliferation Treaty, which controls nuclear materials at world levels like Tlatelolco. Argentina has two small nuclear power stations and a struggling civilian nuclear industry. The Government plans to privatize the Atucha I and the Embalse power stations as well as the Atucha II unit once construction is completed. A National Atomic Energy Commission report to the President on the situation in the nuclear area emphasized that the nuclear powerplants were operating "efficiently" because with only 7% of installed energy capacity in the country they produced more than 15% of the energy consumed in the country.

INDUSTRIAL MINERALS

Boron.—Argentina ranked third in the world in terms of boron mineral production with output of borates amounting to about 143,000 mt in 1993. The main deposits are located in the provinces of Jujuy, Salta and Catamarca on the Argentine Andes, at up to 4,000 m above sea level. The main borate deposits are: Salar de Cauchari; Salar de Olaroz; Laguna de Guayatayoc; Cayaguayma and Salinas Grandes in Jujuy Province; Salar Diablillos, Salar Centenario, Salar Ratones, Salar Pozuelos, Salar Pastos Grandes, Salar del Rincon, Tincalayu and Sijes in Salta Province; and Salar del Hombre Muerto in Catamarca Province.

The most abundant borate in this region is ulexite which is found in the form of nodules or plates accompanied by sand, salt and clays. It is usually extracted by manual methods and after removal of the main gang materials is sun dried, the final product obtained grades about 22%-25% B_2O_5. Despite the abundance of ulexite, the main production of borates in Argentina is from low grade tincal (sodium borate mineral). The tincal is processed by Cia. Boroquimica SAMICAF (a wholly owned subsidiary of RTZ Corp.) to obtain borax. The largest boron mineral producers in the country, Boroquímica SAMICAF and Industrias Químicas Boradero S.A., were both located in the Province of Salta.

The total installed boric acid production capacity in Argentina is about 30,000 mt/a but currently most of the plants are on stand by. At present, the main producer is Norquimica S.A. with 5,400 mt/a. Exports of boric acid were 12,000 mt in 1993.

Cement.—Production of cement increased 12% in 1993 over the previous year to 5.6 Mmt. For the year, the cement industry operated at 53% of its installed capacity. According to the Portland Cement Manufacturer's Association, the average consumption of cement per capita increased from 100 tons in 1982 to about 150 tons in 1993. Total installed production capacity of about 12 Mmt/a is far in excess of the present domestic requirements. A number of expansion projects and new schemes have been suspended because of the unexpected continuation in market decline. In terms of structure, the industry has remained virtually unchanged during the past 5 years and comprises seven companies. Total industry employment was about 6,200 people, despite poor market conditions. In 1991, there were 19 cement plants belonging to 7 companies operating in Argentina. Of these, the leading operator, Cementos Loma Negra CIASA, with six plants, had a total installed capacity share of 43.3% (5.2 Mmt) from six cement plants and one grinding operation.

Lithium.—Reportedly, at yearend, the Provincial government of Catamarca and FMC-LITHCO of the United States reached a final agreement to explore and develop the Salar del Hombre Muerto in northwestern Argentina. FMC anticipates production will begin in less than 3 years and expects to invest in excess of $45 million. Production will use solar evaporation for brine concentration to 6% lithium and the company reports that suitable underlying clays have been discovered in the Salar. The facility is anticipated to produce 7,000 to 15,000 mt/a of lithium carbonate equivalent. FMC has been operating a pilot solar pond since April 1992 and evaporation rates have been greater than anticipated. Reserves were estimated to be sufficient for 70 years. The salar reaches a recoverable depth of 40-70 meters with an effective porosity reportedly better than that of neighboring salares and a uniform brine concentration of 600 ppm lithium. FMC plans to ship the lithium to its Bessemer City, North Carolina processing facility. It expects to transport material to one of the four ports-Antofagasta, Iquique or Irca in Chile or Porteitis in Argentina.

Potassium.—The Río Colorado Potash project involved the development of a significant unexploited mineral deposit that would have a pioneering development impact on Argentina's modest mining sector. It would introduce new mining technology to Argentina and result in a new product for export. According to Potasio Rio Colorado S.A. officials, exploratory drilling and tests suggested that the Río Colorado Potash deposit could become one of the best potash deposits in the world, with sufficient reserves for significant future expansions. The International Finance Corporation (IFC) Board of International Development Bank (IDB) approved a new loan of $3 million to Potasio Río Colorado, S.A. for phase 2 of a mining project to exploit the rich potash deposits of the Río Colorado sedimentary basin in the Provinces of Mendoza and Neuquén. The IFC had approved a loan of $6 million for phase 1

of the project on October 29, 1993. The IFC's financing scheme includes an option to convert up to $3 million of loans into share capital of the company. The objective of phase 1 was to confirm the availability and quality of potash ore reserves in the mining area, to demonstrate the use of solution mining technology, to build a pilot plant, to confirm market potential, and to develop a feasible financial plan. Phase 2 will include the construction of the mine and all other required infrastructure for the commercial production of potash. The pilot plant has been successfully implemented. An IFC review of the first phase of the project confirmed the technical, market, and financial feasibility of proceeding with the second and commercial phase of the operation to produce 250,000 mt/a of potash with an estimated project cost of $58.4 million. Potasio Río Colorado can supply 100% of Argentina's potash requirements, all of which are currently imported, with less than 10% of its production. More than 90% of the company's production will be exported, principally to Brazil, generating estimated foreign exchange earnings and/or savings of $560 million over the next 25 years. It also will generate 100 new jobs. Minera TEA, the primary project sponsor, was a small private mining company with 30 years of experience in nonmetallic mineral mining and processing. It would be assisted by international solution-mining experts whose services have been obtained. The Grupo TEA was a group of interrelated Argentine companies, most significantly Minera TEA S.A., Excavaciones de Roca S.A., Boratos S.A., Pucara S.A., and Los Tilianis S.A.

Mineral Fuels

In 1992, Argentina's estimated production of commercial energy totaled about 78.4 Mmt of standard coal equivalent. Of the total energy produced, solid fuels accounted for only 0.23%, liquid fuel oils, 54.2%; natural gas, 39%; and hydropower, 6.4%.

Energy consumption data were not available for the years subsequent to 1992, when the total consumption was 66 Mmt of standard coal equivalent. Solid fuels provided 1.7%; liquid fuels, 39.5%; natural gas, 50.8%; and hydropower, 8.1%.

Of the total installed electrical generating capacity of 17,326 MW in 1992, 56.9% was thermal, 37.2% was hydroelectric, and 5.9% was nuclear. In that year, the latest for which complete data were available, a total of 56,273 kW•h was produced, 52.6% by thermal plants, 34.8% by hydroelectric plants, and 12.6% by nuclear plants. Atucha II, still under construction, also will utilize the same source of uranium (U_3O_8) fuel for its power reactor when completed. In 1993, total electric power output increased 4.2% compared with that of 1992.

Coal.—Production of bituminous coal decreased about 5.7% to 200,000 tons compared with that of 1992 in continuation of a notable decreasing trend. YCF, the state-owned coal company, produced coal from the Río Turbio Mine in Santa Cruz Province. YCF production declined owing to lack of sufficient financial resources to make investments. The company's deficit runs at over $50 million and there have been delays in salary payments. Yacimientos Carboníferos Fiscales (YCF), temporarily shut down for technical problems was producing coal in limited quantities. The company was lacking financial capacity to make additional investment in machinery for the mine and was having delays in salary payments to mine workers, consequently the exploitation of the Rio Turbio coal was subject to possible privatization of YCF. Dirección General de Fabricaciones Militares (DGFM) and the Altos Hornos Zapla smelter were sold to Aceros Zapla S.A. The Ministry of Economy, Public Work and Services has issued a tender for the concession to work the Rio Turbio coal mine and railway linking the mine to the ports of Punta Loyola and Rio Gallegos in Patagonia. The mine and transportation are currently operated by YCF, the state-owned coal company. This is the second tender for the concession; the first round did not yield a candidate able to satisfy the tender requirements. There will be a personnel restructuring, which will affect the non mining sector, since out of 2,300 people employed by YCF, only 800 are miners. Once the restructuring is completed, the privatization process will start.

Natural Gas.—Natural gas production in 1993 increased almost 24% to about 27 billion m^3 setting up a new historical record of recent past years. During 1993, Argentina's proved reserves of natural gas were reported at about 744 trillion m^3. As a result of this reassessment of natural gas reserves, future shortages of natural gas were likely to develop in certain regions of the country, depending on the availability of transport and gas distribution systems. Most natural gas produced in Argentina was controlled by the formerly state run oil company, YPF. About 53% of the gas was produced by YPF and the rest either imported from Bolivia or produced under service contracts with private production companies. Gas imports from Bolivia in 1993 amounted to almost 2 billion m^3 valued at $90 million, which were paid directly by Gas del Estado, the state-owned gas distribution company.

Argentina has found a ready market for both oil and natural gas in neighboring Chile (piped from fields in the north Patagonian province of Neuquen) and is looking hard at prospects elsewhere. One major project involves developing the gas in northwestern fields, close to the border with Bolivia, for export to Brazil, complementing the supply from Bolivia to that market. Another project involves piping gas from those selfsame fields in Argentina, and from Bolivia, through Chile to the coast of the Pacific—and then, as LNG to markets in the Far East. Yet a another project has been floated since TOTAL reported the existence of a huge gas deposit off-shore of Tierra del Fuego (a figure of 5 trillion m^3 has been mentioned); initial flows have reached 485,000 m^3/d. It involves building a second gas pipeline from the south of the country, also with a view to reaching the Brazilian market. The construction of a

700-km natural gas pipeline from Neuquen to Chile is expected to get underway during 1994 and be completed by 1996. The consortium that will build the pipeline consist of YPF, Astra, Bridas, San Jorge and Pluspetrol. The group expects to export 5 million cubic meters of natural gas each day through the pipeline and eventually export liquified natural gas from Chile's Pacific Ocean ports. The group has already signed a contract with Chile's ENAP to sell the gas at a rate of $1.35 per million Btu. The operator of the trunk pipeline will be Tenneco from the United States, while British Gas will be in charge of the urban distribution network within Chile. The new agreement extended the current natural gas contract until December 31, 1993.

Petroleum.—Crude oil production increased 8.3% in 1993 compared with that of 1992. The state company, which accounted for 56% of the total production, gave different central and secondary areas to the private sector which, encourage by free availability, gave a dynamic trend to sectorial investments. At present, private operators account for 52% of the total production and YPF the remaining 48%. The results of the 1991 deregulation plan were beginning to show. Oil prices began to be determined by a free market, areas underexplored were producing free disposable crude for private companies, central areas were being exploited by private companies, secondary areas were producing oil for its concessionaires, downstream and transport sectors were being deregulated, and the natural gas industry was in its privatization process. The announcement in the fall of 1992 by the Government of a new exploration licensing round, known as the "Plan Argentina," at the World Petroleum Congress held in Argentina, triggered an unprecedented wave of interest in the opportunities. After more than a year, Congress approved the law for the privatization of YPF, Argentina's biggest oil company. In 1993, YPF was privatized, becoming the first oil giant in a developing country to be returned to the private sector. Now, with a market capitalization of $8.6 billion, YPF wants to become an oil multinational in its own right and was forced to sell 40% of its reserves and one-half its annual production. YPF had more than 50,000 employees at the end of 1990. By yearend 1993, it was reduced to only 6,000 workers. Having lost $6 billion from 1981 to 1989, YPF made a net profit of $706 million in 1993. Before privatization, YPF's field were producing less oil and gas than they could because the company had fallen badly behind in maintaining its oil-production equipment. But cutting this backlog of maintenance, YPF increased its production of crude from 289,000 bbl/d in 1992 to 326,000 bbl/d in 1993. Bids for YPF's commercial network started in January 1993, with an expected investment of $80 to $180 million. The country is divide in six areas with similar consumption, and YPF will keep the Buenos Aires and neighboring areas. The companies involved in refining and sales are investing in improving the quality of their products and services in order to be competitive in the market.

Shell Argentina is building one of the most modern lubricant manufacturing plant in the country with an investment of $30 million, including a gas station chain for another $30 million. Shell also announced plans to invest $1 billion in its operation throughout the country by the end of the century. The company also announced a $290-million-investment program for 1993 and 1994 for expansion of the company's activities in exploration and production. Esso Argentina announced plans to invest $80 to $90 million through the end of the decade increasing its refinery capacity and its offshore activities and replacing two tankers. In February 1994, the Presidents of Argentina and Chile were scheduled to inaugurate a 425 km oil pipeline which links their two Nations. The binational pipeline, built in 14 months, will move 107,000 bbl/d of crude through a 41-cm pipe diameter. The pipeline is owned and operated by an Argentine/Chilean consortium, the Trans Andean pipeline Company. The Chilean Oil Co., ENAP, owns 12.25%, YPF (about 50% is now owned by American stockholders) owns 57.75%, and Banco Rio de La Plata 30%. The total investment was over $220 million. The Chilean part (225km) cost $105 million to build, while the Argentine portion (200 km) cost $115 million.

INFRASTRUCTURE

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 km 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 4,090 km of pipelines to transport crude oil and 2,900 km for refined products and 9,918 km 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. When completed in early 1994, a 410-km oil pipeline will be available to transport crude oil from Argentina's Neuquén Basin to Concepción, Chile, across the Andean Range. Natural gas was imported from Bolivia by a gas pipeline through Yacuiba-Pocitos at the border to the northern provinces and Buenos Aires. The existing Argentine railroad network owned and operated by the state enterprise Ferrocarriles Argentinos, covered approximately 34,172 km.

OUTLOOK

Argentina's energy resources are abundant and diverse. They include crude oil, natural gas, hydropower, and fair amounts of coal and uranium, with a potential not fully determined. There is optimism about the development of potential nonfuel mineral projects and the discovery and development of new onshore and offshore oilfields and gasfields as future production sources. New investments in Argentina are being directed toward several promising areas including copper, gold, crude oil, natural gas, petrochemicals, and gas pipelines.

Foreign investment are welcome in mining and both National and provincial laws encourage the development of mining by private enterprises, including mineral deposits in secondary areas. The national government is not permitted to develop mines itself and may only undertake exploitation on unexceptional basis through state entities operating on aprivate enterprise basis. Many of these entities are being privatized.

The Southern Cone Common Market (Mercosur) that is being formed by Argentina, Brazil, Paraguay, and Uruguay is also expected to increase trade and investment opportunities in Argentina. Mercosur offers additional opportunities in the form of a four-country common market with a total population of 200 million and a combined GDP of $600 billion.

[1]Where necessary, values have been converted from Argentine pesos to U.S. dollars at the rate of 0.99 peso = US$1.00, the average exchange rate in 1993.

OTHER SOURCES OF INFORMATION

Agencies

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Publications

Estadística Minera de la República Argentina Subsecretaría de Minería, Buenos Aires: Annual report.
Latin American Mining Institute, Washington, DC: The South American Investment and Mining Guide, annual.
Panorama Minero, Capital Federal, Argentina: Monthly magazine.
Tendencias Económicas (Business Trends), Buenos Aires: Annual report.

TABLE 1
ARGENTINA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
METALS							
Aluminum:[e]							
Primary		162,000	165,608	165,000	165,000	165,000	166,000
Secondary		5,300	6,000	6,000	6,000	6,000	7,500
Beryllium: Beryl concentrate:							
Gross weight		89	34	e34	e34	35	85
BeO content		10	3	e3	e3	3	10
Cadmium: Smelter		60	55	e49	e37	40	60
Columbium: Columbite concentrate:[e]							
Gross weight	kilograms	116	100	90	95	95	120
Cb_2O_5 content	do.	87	75	67	70	70	90
Copper							
Mine output, Cu content		653	357	409	e300	350	660
Refined[e]		15,000	10,900	12,000	15,000	15,000	15,000
Gold: Mine output, Au content	kilograms	1,150	1,199	1,510	e1,300	1,350	1,550
Iron and steel:							
Iron ore and concentrate:							
Gross weight	thousand tons	1,017	992	259	r—	—	1,050
Fe content	do.	539	681	171	2	5	540
Metal:							
Pig iron	do.	2,062	1,883	1,366	r966	e994	2,100
Sponge iron (direct reduction)	do.	1,166	1,034	954	r1,027	e1,156	1,170
Total	do.	3,228	2,917	2,320	r1,993	e2,150	3,270
Ferroalloys, electric-furnace:							
Ferromanganese		24,441	24,344	26,337	r4,524	5,000	26,400
Ferrosiliconmanganese		21,160	21,805	14,564	r30,790	31,000	31,000
Ferrosilicon		35,667	23,641	14,437	r8,073	10,000	35,700
Silicon metal		5,603r	r5,930	r5,025	r3,403	3,500	6,000
Other		r202	r380	r375	r197	200	400
Total		r87,073	r76,100	r60,738	r46,987	49,700	99,500

See footnotes at end of table.

TABLE 1—Continued

ARGENTINA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
METALS—Continued							
Steel, crude	thousand tons	r3,883	3,636	2,972	r2,680	p2,812	3,900
Semimanufactures[4]	do.	3,844	3,451	2,797	r2,411	p2,784	3,900
Lead:							
Mine output, Pb content		26,650	23,365	23,697	e18,000	18,500	26,700
Metal:							
Smelter, primary		11,500	5,500	e11,000	14,597	14,600	14,600
Refined:							
Primary		13,650	e10,000	e10,000	14,597	15,000	15,000
Secondary		e13,000	13,365	13,697	e15,000	14,500	15,000
Total		26,650	23,365	23,697	29,597	29,500	30,000
Manganese ore and concentrate:							
Gross weight		5,532	e3,500	4,943	3,842	3,900	5,600
Mn content		1,080	727	965	e750	760	1,100
Silver:							
Mine output, Ag content	kilograms	83,126	75,798	69,920	e46,000	46,500	83,200
Metal, smelter[e]	do.	106,000	112,000	109,000	107,000	107,500	112,000
Tin:							
Mine output, Sn content		405	123	—	—	—	450
Metal, smelter		311	e180	240	e140	145	350
Tungsten, mine output, W content		20	6	8	e8	9	20
Uranium, mine output, U308 content	kilograms	73,000	13,000	25,000	e140,000	140,000	170,000
Zinc:							
Mine output, Zn content		43,155	38,664	39,253	e41,000	40,000	43,200
Metal: Smelter							
Primary		31,567	31,517	35,766	34,494	35,000	36,000
Secondary[e]		2,700	2,700	2,800	2,800	2,800	2,800
Total		34,267	34,217	38,566	37,294	37,800	38,800
INDUSTRIAL MINERALS							
Asbestos		225	275	270	1,093	1,000	1,100
Barite		57,558	36,597	61,094	44,170	44,000	61,100
Boron materials, crude		261,308	123,492	113,123	142,580	143,000	261,400
Cement, hydraulic	thousand tons	r4,449	r3,612	r3,399	r5,051	p5,647	6,300
Clays:							
Ball clay (plastic clay), n.e.s.	do.	307	82	80	e100	100	350
Bentonite		89,189	123,254	135,569	81,534	90,000	136,000
Foundry earth[e]		100,000	100,000	100,000	90,000	90,000	174,000
Fuller's earth (decolorizing clay)[e]		2,000	2,000	2,000	1,500	1,600	10,000
Kaolin		45,598	72,421	145,098	90,545	90,600	146,000
Laterite (aluminous)		67,200	7,060	23,881	31,902	33,000	67,500
Refractory		32,111	32,761	30,903	e31,000	32,000	40,000
Other[5]	thousand tons	2,889	2,170	2,350	2,610	2,700	2,900
Diatomite		6,301	6,789	10,981	5,227	5,300	11,000
Feldspar		23,688	15,091	23,065	17,948	20,000	39,500
Fluorspar		23,317	23,727	28,925	23,157	20,000	55,000
Graphite[e]		p100	100	100	90	100	250
Gypsum, crude		402,399	615,540	78,188	566,943	570,000	650,000

See footnotes at end of table.

TABLE 1—Continued

ARGENTINA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued:							
Lithium: Spodumene, amblygonite, gross weight		84	67	305	126	130	350
Mica:							
Sheet		327	243	313	e290	300	340
Waste and scrap		e500	684	533	e450	450	630
Nitrogen: N content of ammonia		74,000	70,000	e75,000	e72,000	72,000	80,600
Phosphates: Thomas slage[6]		50	55	50	50	50	60
Pigments, mineral, natural: Ochere		r578	600	600	600	600	1,100
Pumince and related volcanic materials (perlite, pozzolan, and toba, etc.)		89,223	118,101	69,216	e61,000	65,000	120,000
Salt:							
Rock[e]	thousand tons	r1	1	1	1	1	1
Solar	do.	1,185	595	678	937	1,000	1,200
Total	do.	1,186	596	679	938	1,001	1,201
Sand and gravel:							
Sand:							
Construction	do.	8,740	10,171	11,038	12,800	13,000	13,000
Silica sand (glass sand)	do.	344	325	374	307	350	380
Gravel	do.	3,700	5,885	6,432	7,500	7,000	7,500
Soda ashe		r350	300	300	290	300	350
Stone:							
Basalt	thousand tons	1,900	737	548	635	650	2,600
Calcareous:							
Calcite, nonoptical		5,300	6,789	7,520	7,100	7,000	7,500
Calcium carbonate (chalk)		58,500	17,600	8,325	8,585	9,000	58,500
Dolomite		e250,000	278,302	416,438	e300,000	300,000	420,000
Limestone	thousand tons	9,190	7,588	9,243	e10,800	10,000	12,000
Marble:							
Aragonite, broken		1,882	1,118	1,140	e1,100	1,000	5,500
Onyx, in blocks and broken		4,809	1,631	2,553	e1,500	1,700	4,900
Travertine, in blocks and broken		3,467	5,710	18,693	e13,000	12,500	19,000
Unspecifed, in blocks and broken		35,122	24,918	23,140	e15,000	17,000	35,200
Flagstone		77,913	72,784	92,882	e90,000	85,000	93,000
Granite:							
In blocks		39,347	46,279	59,697	e45,000	46,000	60,000
Crushed	thousand tons	4,168	3,525	4,316	e5,000	4,500	5,000
Quartz, crushed		140,538	76,149	81,613	e96,420	90,000	140,600
Quartzite, crushed	thousand tons	691	476	538	e400	450	700
Rhodochrosite		40	67	20	e30	25	70
Gamestone (agate, amatist, apolo, turmalin, etc.)	kilograms	5,000	14,970	43,385	e30,000	28,000	43,500
Sandstone[e]		300	300	250	e240	240	300
Serpentine, crushed		11,333	13,748	19,921	e20,000	19,500	30,000
Shell, marl		285,630	328,970	240,462	e250,000	240,000	286,000
Tuff, (tosca)	thousand tons	2,006	2,061	2,050	e2,000	2,000	9,000
Strontium minerals: Celestite		1,193	3,112	e1,200	e1,200	1,500	3,200
Sulfates, natural:							
Aluminum (alum)		66,844	6,930	23,369	20,849	21,000	66,900

See footnotes at end of table.

TABLE 1—Continued

ARGENTINA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued:							
Sulfates, natural—Continued:							
Magnesium (epsomite)[e]		7,000	7,000	6,500	6,500	6,400	7,000
Sodium (Mirabilite)		10,281	12,677	13,520	9,788	10,000	15,000
Talc and related materials:							
Pyrophyllite		1,310	2,687	4,925	5,012	5,000	5,100
Steatite[e]		250	250	250	240	240	250
Talc		26,658	26,206	24,766	22,774	23,000	26,700
Total		28,218	29,143	29,941	28,026	28,240	32,050
Vermiculite		590	3,334	3,951	4,451	4,500	10,000
Water, mineral-containing		142,229	140,000	e140,000	e140,000	140,000	172,000
Zeolite[e]		r100	r100	r90	r95	90	110
MINERAL FUELS AND RELATED MATERIALS							
Asphalt and bitumen, natural (asphaltite)		824	2,480	5,852	994	1,000	5,900
Coal, bituminous	thousand tons	441	270	294	212	200	505
Coke, all types, including breeze[e]	do.	800	800	830	820	800	930
Gross	million cubic meters	21,992	e21,800	e22,000	r21,964	27,200	28,000
Marketed[7]	do.	18,993	18,094	17,913	r19,066	24,200	25,000
Natural gas liquids:[e]							
Butane	thousand 42-gallon barrels	3,384	4,196	4,200	r3,770	3,803	4,400
Propane	do.	5,300	5,000	5,000	r4,558	4,597	5,300
Total	do.	9,684	9,196	9,200	r8,328	8,400	9,700
Peat, agricultural (turba)		2,481	3,800	3,726	2,308	2,500	3,800
Petroleum:							
Crude	thousand 42-gallon barrels	167,949	175,836	180,034	r203,199	220,000	220,000
Refinery products:							
Gasoline	do.	40,311	34,615	35,909	r30,706	31,205	40,400
Kerosene	do.	3,364	3,634	3,770	r2,605	2,401	3,800
Jet fuel	do.	5,566	6,123	6,352	r4,540	4,666	6,400
Distillate fuel oil	do.	56,108	58,776	60,974	r48,788	48,671	62,000
Lubricants	do.	1,669	1,354	1,405	r1,164	1,281	1,700
Residual fuel oil	do.	30,232	25,636	26,595	r28,649	27,804	30,300
Other	do.	13,762	13,185	13,678	r17,723	17,049	16,500
Refinery fuel and losses	do.	13,745	25,781	26,745	r1,036	—	26,750
Total	do.	164,757	169,104	175,428	r135,211	133,077	187,850

[e]Estimated. [r]Revised.

[1]Table includes data available through Nov. 1994.

[2]In 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.

[3]Reported figure.

[4]Hot-rolled semimanufactures only; excludes castings and cold-rolled semimanufactures produced from imported hot-rolled semimanufactures.

[5]Includes plastic, semiplastic, and/or ferruginous clays used totally in the manufacture of portland cement.

[6]Thomas slag production was estimated from the Thomas crude steel reported in La Siderurgia Argentina annual, published by the Instituto Argentino de Siderurgia.

[7]Includes natural gas imported from Bolivia.

TABLE 2

ARGENTINA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

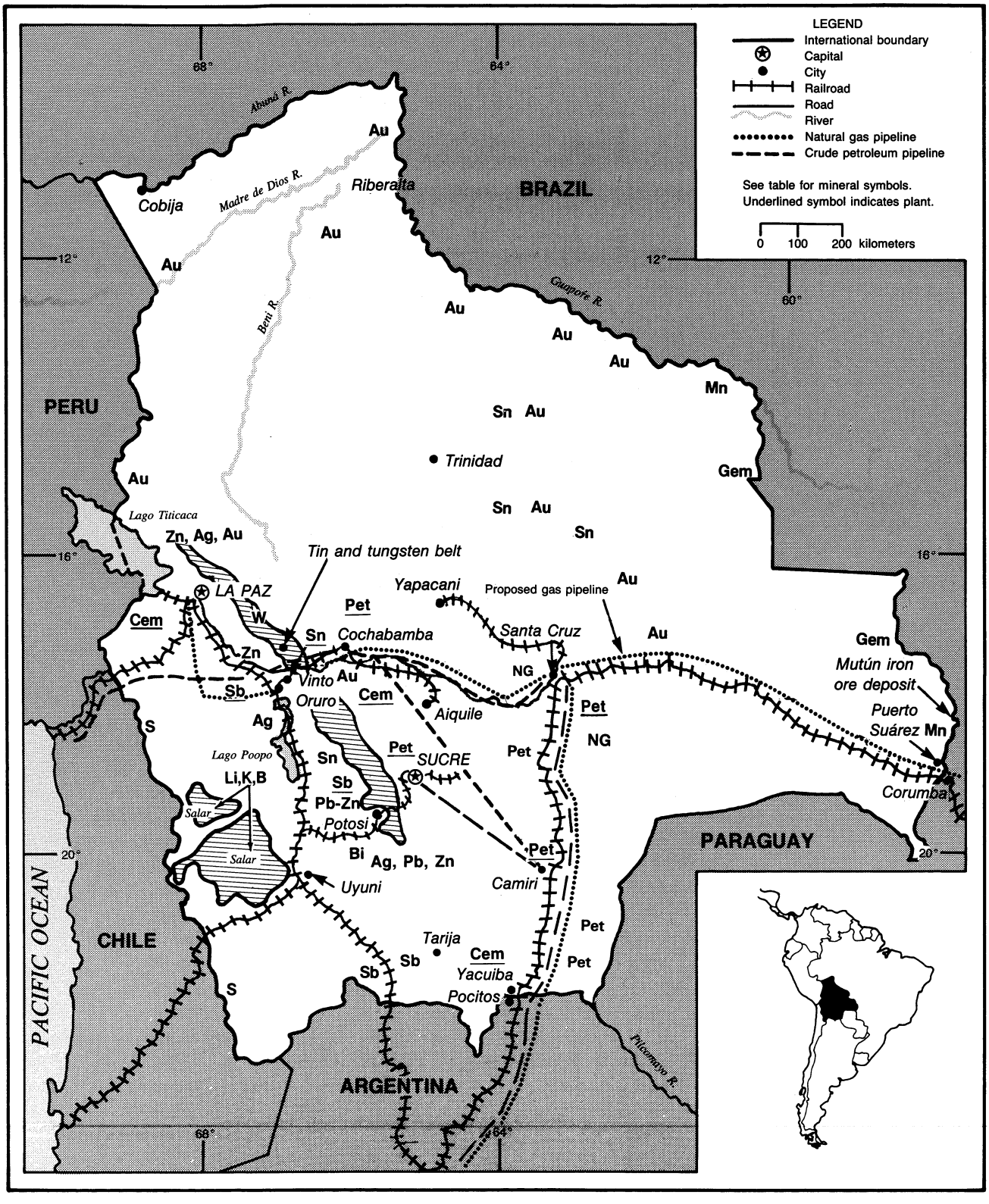
(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Aluminios Argentinos S.A.I.C. (ALUAR) (State, 52.1%; private 47.9%)	Puerto Madryn, Chubut Province	170.
Boron		Cia. Boroquimica S.A.M.I.C.A.F., (owned by Rio Tinto Zinc Corp. Ltd.)	El Porvenir Mine, Jujuy Province; Tincalayu and Campo Quijano, Salta Province	300.
Cement		Cementos Loma Negra C.I.A.S.A., #1; Juan Minetti, S.A., #2; Corporacion Cementera Argentina, S.A.,#3(100% private)	Buenos Aires, Cordoba, Corrientes, Salta San Juan, Mendoza, and Jujuy Provinces	6,000.
Coal		Yacimientos Carboniferos Fiscales (Government, 100%) (Shutdown partially in 1991)	Rio Turbio, Santa Cruz Province	300.
Gold, silver	kilograms	Yacimientos Mineros de Agua de Dionisio (YMAD)(Government, 100%), Angela Mine (private, 100%)	Farallon Negro, Hualfin & Belen Departments Gastre Department, Chubut Province	1,300 Au. 50,000 Ag.
Iron ore		Hierro Patagonico de Sierra Grande, S.A. Minera (HIPASAM) (Government, 100%) (Shutdown partially in 1991)	Sierra Grande, Rio Negro Province	5,000.
Lead, silver, zinc	kilograms	Cia Minera Aguilar, S.A. (A Bolivian Consortium Cia. Minera del Sur, (COMSUR), 100%)	Estacion Tres Cruces, El Aguilar, Jujuy Province	49,800 Ag. 24,000 Pb. 30,000 Zn.
Natural gas	million cubic meters	Gas del Estado owned by Yacimientos Petroliferos Fiscales (YPF) (It was privatized 100% in 1992)	Neuquen Santa Cruz, Tierra del Fuego, Salta, and Rio Negro Provinces	22,000.
Petroleum	million barrels	Yacimientos Petroliferos Fiscals (YPF)1	Chubut, Santa Cruz, Neuquen, Rio Negro, Mendoza, Salta, Tierra dl Fuego, Jujuy, La Pampa, and Formosa Provinces	179.
Steel		Sociedad Mixta Siderurgica Argentina (SOMISA) (Privatized in 1992; owned by Aceros Parana, S.A., 79.9%; Government, 20.1%)	7 km from San Nicolas de los Arroyos, Buenos Aires Province	2,850
Do.		ACINDAR-Industria Argentina de ACEROS, S.A. (private, 100%)	Plant Nos. 1. and Buenos Airs Province; Plant No. 2. near Rio Parana, Santa Fe Province	1,500.
Uranium (ore)		Empresa Nuclear Mendoza, subsidiary of Comision Nacional de Energia Atomica (Government, 100%)	Siera Pintada, San Rafael, Mendoza Province	150.
Zinc, refinery		Cia. Sulfacid S.A.C.I. y F (50% C.M.A.S.A.; private, 50%)	Near Rosario on the Parana River, Santa Fe Province	35.

[1]By Decree No. 2778/90 was no longer a state owned company, but a corporation ruled by law No. 19,500.

BOLIVIA

AREA 1.1 million km² **POPULATION 7.3 million**



THE MINERAL INDUSTRY OF

BOLIVIA

By Pablo Velasco

During 1993, Bolivia's mining industry continued to play a dominant role in support of the economic life of the country, primarily because the Government-owned mining companies account for much of the output. The new Government economic program outlined in the "Plan de Todos" (Plan for All), aims to achieve economic growth, enhance democracy, and reduce poverty levels through capitalization of public enterprises and massive public investment in social projects. If the Government's capitalization program succeeds in turning over the six largest state-owned companies to private investors, its role in the economy will be sharply reduced.

Investment decisions by the Government have a large impact on the economy because public investment has consistently been larger than private investment over the past several decades. In 1993, public investment came to about $450 million[1] while private investment was about $220 million.

For the past 3 years Bolivia's trade deficit has grown sharply. The contribution of the mineral sector to the national economy in 1993 remained substantial at 6.2% of gross domestic product (GDP) or about $6.8 billion. More revealing was the contribution of minerals to Bolivia's exports: in 1993, 60%, or about $452 million of the country's legitimate earnings from trade, came from the mineral sector, including hydrocarbons. Although the total value was below that of the previous year (1992, $503.4 million), the substantial contraction in the value of the other export staples underlined the importance of the industry. However, in 1993 the nontraditional export value increased more than 13% compared with that of 1992. The decrease of income from natural gas sales of almost 27% during the year meant that gold, silver, and zinc concentrates became Bolivia's most valuable export commodities in 1993. Zinc overtook tin as the country's most important commercial metallic mineral 5 years before.

The reversal of Government policy in 1985, away from state ownership and toward the private sector, has been strongly reflected in the mining industry, and no changes are expected in the macroeconomic policies that have been in place since 1985. These policies have been designed to increase private investment as well as capital and labor productivity.

The state mining entity, Corporación Minera de Bolivia (COMIBOL), formerly the largest mineral producer in the country, continued trying to attract private firms to operate its mines under joint-venture or other contracts and reopened some mines to boost its mineral output in 1993. Producing only 14.2% of the value of Bolivian mine production in 1993, COMIBOL was responsible for two-thirds of the country's total 10 years before. By November 1993, the corporation's labor force had been reduced to 4,400 compared with 6,000 in 1992 and 27,500 in 1985; these miners face an uncertain future. The Government intends to reduce COMIBOL to a holding company, employing perhaps two dozen people solely engaged in supervising the corporation's interest in joint-venture agreements with private partners. Only nine of COMIBOL's existing mines were being worked directly, not all of which are likely to attract private investors. Thirteen properties were rented to mining cooperatives whose members scavenge what they can from old workings, and eight mines are abandoned. The World Bank was helping to fund the dismantling of the corporation and so relieve the state of what has been for many years an unprofitable responsibility. The president of COMIBOL recently anticipated a current account deficit of $11.6 million for 1993 versus about $5.3 million in 1992. Although the miners' union opposed privatization of the mines, there seemed no other way to obtain the capital and expertise needed to keep them open.

The private mining sector, comprising medium- and small-scale mining entities and cooperatives, maintained its position as the leading producer of antimony, gold, lead, tin, tungsten, and zinc in the country. However, some antimony, tin, and tungsten mines, closed in previous years, stayed shut as market prices remained low. Overall, however, the private mining sector continued increasing its national economic importance relative to the reduced output of COMIBOL.

According to the National Statistical Institute (INE), the country's GDP grew by 3.5% in 1993, similar to the 3.4% growth registered in 1992. Inflation in the country and the public debt continue under control. The consumer price index rose by 9.3% compared with 10.7% the previous year. The economic decline resulted from a decrease in the price of Bolivia's principal exports, minerals and natural gas. The GDP in real terms grew to about $6.8 billion, up from $6.3 billion in 1992.

Preliminary data showed a negative trade balance of $561 million as imports increased by 18% to $1,169 million. Exports increased by about 5.4% to $748.4 million, owing to increases in nontraditional export products, while mineral exports and natural gas declined by 4.6% and 26.5%, respectively. The nonfuel mineral sector contributed about $362 million of the total exports. Bolivia urgently needed a new market for its

natural gas. The future of the hydrocarbon sector will depend on continuation of exports to Argentina, the implementation of the natural gas export project to Brazil and (possibly) Chile, and greater domestic use of natural gas.

GOVERNMENT POLICIES AND PROGRAMS

On September 17, 1993, the technical and institutional role of the Ministry of Mines and Metallurgy was downgraded to become the National Secretary of Mining, under the umbrella of the Ministry of Finance and Economic Development. The National Secretary of Mining has an overall responsibility for the Government's mining policy as well as issuance of sectoral regulations and general supervisory duties for the nation's mining industry.

In 1993, the Bolivian Government enacted several laws, Supreme Decrees (D.S.), and Supreme Resolutions (S.R.) regulating various activities of the mining industry. A list of the most important legal ordinances (laws and Supreme Decrees) issued during the year follows:

1. Law No. 1783, March 10, 1993—Authorizes the transfer of the housing facilities in E.M., Catavi and E.M. Colquechaca to workers and former workers of the Catavi and Colquechaca Mines.

2. Law No. 1784, April 6, 1993—Authorizes the transfer of COMIBOL's housing facilities of E.M. Unificada and Quechisla to former COMIBOL workers and mining cooperatives of these two mines.

3. D.S. 23394, February 3, 1993—Approves a 3% tax on gross value of all exports and sales of gold produced in the country.

4. D.S. 23439, March 25, 1993—The National Registry for Minerals and Metals Traders was created.

5. D.S. 23440, March 25, 1993—The National Secretary of Mining was authorized to contract with the U.S. company ICR to explore the Uyuni salt flats (Salar de Uyuni).

6. D.S. 23553, July 21, 1993—The mining cadastral program was restarted.

7. D.S. 23558, July 21, 1993—The time period of S.D. 23369 was extended from December 22, 1992 to December 30, 1993 for payment of the minimum royalty of 2.5% of the net mineral sales.

8. D.S. 23639, September 10, 1993—Approves the sum of $15.3 million paid by COMIBOL for severance payments made to workers until March 31, 1993.

The Bolivian Government free-market policies have become well entrenched. Originally established via supreme decrees issued by the Executive Branch, which can be changed by the same Executive Branch or that of a subsequent administration, most of the policies have been incorporated into laws, approved by Congress, and are changeable only by Congress.

The new Government economic program outlined in the "Plan for All" was organized around six main programs:

(1) Capitalization and democratization of public enterprises, a new form of privatization in which companies are not sold to private investors but investors are invited to subscribe additional capital, up to 50% of the shares, and granted management control, the rest of the shares being handed out to all adult Bolivian citizens, through pension funds. The six big public enterprises that will be capitalized, include: Yacimientos Petroliferos Fiscales Bolivianos (YPFB), Empresa Nacional de Telecomunicaciones (ENTEL), Lloyd Aereo Boliviano (LAB), Empresa Nacional de Electricidad (ENDE), Empresa Nacional de Fundiciones (ENAF), and Empresa Nacional de Ferrocarriles (ENFE). It is expected that investment related to capitalization will be equivalent to 60% of Bolivia's gross domestic product; i.e., more than $2 billion.

(2) Export and integration channels designed to facilitate rapid and competitive access to foreign markets and connect the extensive Bolivian territory.

(3) Expansion and diversification of exports and promotion of tourism.

(4) Implementation of the project to export natural gas to Brazil, which will produce annual revenues of about $230 million and (expectably) attract foreign investment in oil and gas development.

(5) Agricultural programs designed to transform agribusiness into one of the main engines of economic development and a means of overcoming rural poverty in the medium term.

(6) Civil service program to upgrade the human resources in the public administration while substantially reducing their number.

ENVIRONMENTAL ISSUES

The National Environmental Secretariat (Secretaria Nacional del Medio Ambiente) developed Environmental Impact Assessment (EIA) and Environmental Quality (CA) regulations applicable to new mining projects in Bolivia, similar to others in developed countries. However, this environmental project, financed by the World Bank plus a Swedish donation, lacked prior consultation with the productive private sector of Bolivia. A Swedish Mission prepared a preliminary report indicating criteria for establishment of levels and limits of permissible contamination in the mining and industrial sectors. The Government, concerned about environmental remediation of old mining sites in various parts of the country, prepared to follow through with backing by the International Development Bank and in consultation with the U.S. Bureau of Mines.

PRODUCTION

Official figures for 1993 indicated that the value of Bolivia's nonfuel mineral production increased by about 3% to $406 million compared with $396 million in 1992. The tin industry showed a decrease of 3% in value even though primary tin output increased by 13% to 18,634 tons in 1993. Although COMIBOL's overall mineral output declined in 1993 for the fifth consecutive year, mine output of the private mining sector surpassed previous levels in 1993.

During the past 4 years, the Bolivian mining industry has tried to diversify its mineral production away from tin by increasing production of gold, lead, and

silver. Production of zinc reached a figure of almost 123,000 tons, but decreased 33% in value to about $118 million compared with that of 1992.

Lead output maintained almost the same level of production as that of the previous year, or about 21,000 tons of lead in concentrate. Silver production increased 18% over that of the previous year. Officially recorded gold production increased 122% from 4,688 kg in 1992 to about 10,400 kg in 1993. This increase, according to the Ministry of Mining and Metallurgy, was largely due to the gold price rise and higher production by the Empresa Minera Inti Raymi, the largest gold producer in the country. It is assumed that 5,000 to 6,000 kg of unregistered production was sold internally or smuggled to neighboring countries. Only registered gold sales or exports had to pay the 1.5% mining tax. The best official record continued to be that of gold, produced as precipitates in heap-leaching operations and exported as such.

COMIBOL's efforts were concentrated on privatization programs, to attract private firms to operate its mines under joint ventures or operating contracts. Crude oil and natural gas are produced by YPFB and its contractors. YPFB's production in 1993 represented 80% and the contractors 20% of the country's total production. Natural gas extraction increased 1.5% in 1993 compared with that of 1992. *(See table 1.)*

TRADE

Nonfuel minerals and mineral fuels (oil and gas) continued to be Bolivia's leading exports; in combination they contributed about 61% of Government revenues. Exports of nonfuel minerals in 1993 decreased 4.6% in value, compared with those of 1992, to $362 million, amounting to less than one-half of total exports. Mine output, which started to grow in 1989, was strongly affected in the past 4 years by low international mineral prices. Consequently, primary mine output in 1993 decreased by $18 million. In 1993, Bolivia's mining exports to the United States dropped by 10.5% to $73.6 million. Mineral exports to European countries decreased by 7.3% to $250 million. Gold, tin, and zinc continued to lead nonfuel mineral exports by value, along with a strong performance by silver. Tin export earnings, historically Bolivia's most important mineral export, decreased about 15% in value to $83.3 million in 1993. Zinc exports, the rising star among Bolivia's mineral exports, likewise decreased 12% from 142,021 tons to 123,900 tons and in dollar value went down almost 31% to $120,000 million. Gold exports increased by 249% to $76.3 million in 1993. All other minerals decreased in export value with the exception of ulexite and other nonmetallic minerals.

The medium-size mining group was, for the fourth straight year, the largest exporter within the mining sector. This group's exports went up 21% in value in 1993 compared with those of 1992, and represented about 50% of Bolivia's total mineral exports. The small miners and mining cooperatives accounted for 17% of the country's total mineral exports and the smelters 26%. The nonfuel minerals sector surpassed the hydrocarbon sector as the leading foreign exchange earner for the sixth consecutive year.

Empresa Metalúrgica de Vinto, formerly Empresa Nacional de Fundiciones (ENAF), the past foreign exchange leader in the mining sector, had another excellent year in 1993. Exports of metallic tin by Vinto increased in volume to 14,394 tons, although their dollar value decreased to $74.5 million from $77.8 million in 1992. Tin export value, including metallic tin, was down 23% to $83.3 million.

In 1993, hydrocarbons (natural gas and LPG) dropped to third place in Bolivia's export sector, after minerals and the nontraditional goods. Nevertheless, through taxes on exports and domestic sales, they contributed 50.1% of the national treasury's consolidated revenues. In 1993, hydrocarbons decreased from 17.3% the previous year to 12.5% by value of Bolivia's total exports. The value of exports to Argentina decreased to $99.4 million, compared with $123.7 million in 1992, owing to lower prices agreed to in May 1992 between the Governments of Bolivia and Argentina. Petroleum and refined products exports in 1993 continued to be minimal. *(See table 2.)*

STRUCTURE OF THE MINERAL INDUSTRY

The National Secretary of Mining and Metallurgy and the Secretary of Energy and Hydrocarbons, respectively, 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 Servicio Geológico de Bolivia (GEOBOL), the Instituto de Investigaciones Minero-Metalúrgico de Oruro, and COMIBOL as autonomous entities.

During 1993, COMIBOL continued to operate with just nine mines, three concentrating plants, and two smelting subsidiary companies. In October 1992, S.D. 23306 was issued restructuring COMIBOL into two large units: a Contracts Unit, for present and future contracts, and an Operative and Service Unit, managing current mine operations and preparing future transfer of mines to the Contracts Unit. The new administrative structure will be enforced in April 1994.

Despite the scaling down of its operations, COMIBOL was still the major single producer of minerals in the country and could become more productive after reorganizing.

In the private sector, there were 11 affiliated mining companies in 1993 under the National Association of Medium-Size Miners, 9 less than in the previous year. Bolivian Mineral Traders Ltd., Cia. Minera Salinas S.A., San Jose de Berque Ltda., Yana Mallcu Ltda., Grupo Minero Chojnacota S.A., Hormet S.A., International Mining Co., Cia. Minera Tierra Ltda., and Tiawanacu Ltda. were the companies that left the association.

The Small Miners Association, grouped under the Cámara Nacional de Minería, included 600 small mines

operating in the country in 1993, a decrease of 50 compared with that of 1992. Mining cooperatives are organized under the Federación Nacional de Cooperativas Mineras (FENCOMIN) and included most of the gold mining cooperatives of Tipuani, Guanay, Mapirí, and Conzata. According to the National Institute of Cooperatives (INALCO), there were more than 320 mining cooperatives in the country, grouped under the wing of Federación Regional de Cooperativas (FERRECO), of which about 40% were mining gold in 1993, mainly in the Province of Larecaja, La Paz Department (Tipuani area).

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

In addition there are other small, private smelters such as the tin fuming plants of Funestano Oruro and Hormet, the lead smelter of Hormet, the Palala antimony smelter and refinery of the Bernal Brothers, and Comco and Yana Mallcu silver smelters using precipitates produced in their leaching plants. *(See table 3.)*

COMMODITY REVIEW

Metals

Antimony.—Bolivia's antimony output continued to decline in 1993, falling about 31% below that of 1992, the lowest production since 1980. Bolivia's antimony production was entirely in the hands of the private sector. Approximately 77% was produced by the medium-size group of mines, 17% by the small-size group of mines, and the remainder by cooperatives. Empresa Minera Unificada S.A. (EMUSA), with its Chilcobija and Caracota Mines, remained by far the largest Bolivian antimony producer, closely followed by Empresa Minera San Juan Ltda. The Empresa Minera Bernal Hnos. no longer produced primary ore. In 1993, Bolivia exported 5,893 tons of antimony, a 16% decrease in volume and a 17% decline in value compared with that of 1992. Of the total amount of antimony exported, 16% was in concentrates and 76% was as antimony trioxide, with the remaining 8% as antimony alloys. Of the total antimony exported, 36% went to Europe, 50% went to the United States, and the remaining 14% went to Argentina, Chile, and Mexico.

The private Palala antimony smelter of Hermanos Bernal in Tupiza, Department of Potosí, produced 116% more antimony trioxide than in 1992.

Antimony concentrate prices have been coming under pressure, with Chinese material appearing at $11.50 to $12.50 per ton. The Bolivian material is more commonly sold in oxide form, with antimony concentrate sales becoming rarer as consumers fail to buy the large volumes of old concentrates.

Gold.—Official gold production in Bolivia increased in volume and value 122% and 134%, respectively, to 10,403 kg. Legal gold exported totaled 6,575 kg, a increase of 235% compared with that of the previous year. From this total 6,414 kg was exported as gold bars and 161 kg as concentrated gold. Private exporting of gold was legalized in August 1985 by D.S. No. 21060. A large but unknown volume of gold continued to be smuggled by gold miners and illegal traders to neighboring countries. It was assumed by the U.S. embassy officials in Bolivia that about 5,000 to 6,000 fine kg of unregistered gold was sold internally or was sold to foreign traders without being registered.

Gold in Bolivia is produced mainly from alluvial deposits but also one open pit mine by heap leaching ore from an epithermal subvolcanic gold-silver deposit. This operation belongs to Inti-Raymi mining company, 85% owned by the U.S. firm Battle Mountain Gold Co. and 15% owned by the Bolivian-based Zeland Mines Co., whose major shareholder is the local company, EMUSA. The Kori Khollo volcanic plug was mined out of the shallow oxide cap of approximately 5 Mmt of ore, which was processed in the old leaching facility. Inti-Raymi no longer uses the sodium-cyanide heap-leaching method to recover gold and silver from the upper highly altered country rock and instead has constructed a 14,500-mt/d carbon-in-pulp facility at a cost of $163 million. Construction of the facility started in January 1992; completion of the expansion was achieved by MINPROC in December 1992, with the first doré pour occurring only 13 months after the start of construction.

The richest and most productive alluvial gold deposits are on the Tipuani, Mapirí, Kaka, and Challana Rivers, all in the northern area of the Department of La Paz. The second most important alluvial mining is in the Araras area in the northeast part of the country on the border with Brazil, where gold has been recovered from the Madera and Madre de Dios Rivers.

In the medium-size mining sector, Empresa Minera Inti-Raymi S.A., the largest U.S.-based mining company in the country, has become the largest private gold producer in Bolivia. Battle Mountain Gold Co. of Houston, Texas, the major shareholder, bought Westworld Resources Inc. and part of Zeland Mines.

Among other U.S. mining companies involved in Bolivia exploring the altiplano and alluvial gold deposits in the Tipuani-Guanay-Mapirí region are ASARCO Incorporated and Specialty Metals of Denver, Colorado, through its wholly owned Bolivian subsidiary, Compañía Minera S.A. COMINESA. The latter signed COMIBOL's first joint-venture contract in late 1992. However, Specialty Metals in late 1993 sold COMINESA to Corrientes Resources of Vancouver, Canada. Still other companies were MINPROC Bolivia S.A., a United States-Australian company, and Tipuani Development Co., S.A., which purchased the gold dredge of South American Placers Inc. (SAPI), a subsidiary of Compañía Minera del Sur S.A. (COMSUR).

U.S. companies exploring or looking at possibilities in the Altiplano and

alluvial gold deposits in the Tipuani-Mapiri area included Arimetco International, Renison Goldfields, Inc., Canyon Resources Corp., Echo Bay Mines, Santa Fe Pacific Gold, Nevada Goldfields Inc., and Newmont Gold Co. In addition to these large- and medium-sized operations, there are a few small gold operations involving U.S. small investors in the Tipuani-Guanay area that have operating contracts with local gold mining cooperatives.

Iron Ore.—Production and exports of iron ore in 1993 decreased almost 9% and 21%, respectively, below the 1992 levels. Empresa Minera del Oriente (EMEDO), a subsidiary of COMIBOL, continued mining and exporting iron ore from the rich Mutún 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 contracting to supply 177,000 tons of iron ore (62% iron). ACEPAR receives 12,000 mt/month of iron ore at $12.50 per ton f.o.b. Puerto Ladario in the Paraguayan River. In 1993, EMEDO exported 27,283 tons of iron ore to Paraguay, compared with 34,600 tons in 1992. The iron ore exported was worth about $570,000. As was the case in 1991 ($648,000) and 1992 ($500,000), respectively, ACEPAR did not buy enough iron ore in 1993 to fulfill its contractual obligations.

Lead, Silver, and Zinc.—Production of lead ore and concentrate increased 6%, silver increased 18%, and zinc dropped 15% compared with output in 1992. Production of metallic lead, including alloys, recovered by 106% from the depressed level of previous years. Output of metallic silver increased 12% above that of 1992. The medium-size mining sector was the dominant lead and zinc producer, with 64% of total lead and 66% of total zinc. In this sector, the major producers were Cía. Quioma, S.A., COMSUR, and Caballo Blanco S.A. All the production of COMSUR came from the Porco lead-silver-zinc mine. Other lead and zinc producers were El Caballo Blanco, S.A. and Tiahuanacu Ltda. In 1992, about 85% of COMIBOL's zinc production came from the Colquiri Mine in La Paz; the remainder came from the San Vicente Mine in Quechisla, the Santa Fe Mines in Oruro, and the Unificada Mine in Potosí. Bolivia does not have a zinc smelter, and all past metallic production came from Vinto's tin refinery. COMIBOL was attempting to interest Boliden Contech (Swedish-Bolivian company) in a joint venture to solve the problems of the ill-fated Karachipampa lead-silver smelter near Potosi. In the meantime, a consortium of zinc producers, including COMSUR, Tiawanacu, Tuntoco, and COMIBOL, were negotiating with MINPROC Technology of Denver, Colorado, to assess the feasibility of building a 100,000-mt/a zinc smelter in Bolivia. Currently, Bolivia's zinc concentrates are smelted in western Europe.

COMIBOL mines are no longer the largest silver producers in the country. The medium-size mines produced 54% and the small mines 42% of total silver. COMSUR, Bolivia's largest private-sector mining firm, was replaced by Inti-Raymi S.A. as the largest private silver producer in Bolivia in 1993.

COMIBOL's zinc production was 18% of the country's total zinc production; the medium-size mines contributed 64% and the remaining 18% was by the small-size mines. Zinc concentrate exports decreased 2% in 1993 to 124,639 tons (metallic content). No exports of metallic zinc were made in 1993.

Tin.—Bolivia's relative position as a world tin producer remained in fourth place after China, Brazil, and Indonesia. In 1990, Bolivia's tin production lost first place, held since the turn of the century, as the most important mineral commodity produced in the country. In 1993, as tin prices improved slightly, tin output increased about 13% to 18,614 tons from 16,516 tons in 1992, partly due to COMIBOL's increased output of 21% to 6,971 tons and to the continued good performance of the small miners and mining cooperatives. Tin output amounted to 23% of the country's total 1993 minerals export value, compared with zinc exports that decreased to 15.8% of the total export mineral value. The largest production increase in the private sector was by the small-size mines and cooperatives, which for the seventh consecutive year replaced COMIBOL as the leading tin-producing sector and in 1993 accounted for about 59% of Bolivia's tin production. The COMIBOL mines produced about 37% of the total mining sector.

COMIBOL's efforts continued to be centered on a privatization program to attract private capital for operation of its mines under contracts or joint-venture agreements. COMIBOL's signed joint-venture contracts led to stiff opposition from the miners' unions, including strikes and work stoppages in the already crippled COMIBOL mines. The future of COMIBOL remains in doubt; in 1993 it lost about $11.6 million, compared with $5.3 million lost in 1992 and $2.6 million in 1991. If COMIBOL is not fully privatized in the near future, it will have a hard time maintaining the current low level of mineral production. In spite of this, COMIBOL's tin production in 1993 increased to 6,871 tons from 5,662 tons the year before. COMIBOL's silver production in 1993, including metallic silver produced in PLAHIPO smelter, dropped to 27.5 tons from 99 tons produced in 1992. Most of COMIBOL's longstanding joint-venture contracts with local and foreign companies were not fulfilled. During 1993, four new joint-venture contracts were signed with: 1) COMSUR (Bolivia) for the exploitation of the Bolivar mine; 2) Downer Mining Ltd.-AUSTPAC Gold N.L. (Australia) to exploit COMIBOL's alluvial gold deposits in the northeast of Bolivia; 3) AUSTPAC Gold, N.L. (Australia) for the Escala Mine, and 4) SEBOL (BRGM-France) for the Asientos ore body. The World Bank has determined to work only on a privatization program with COMIBOL. COMIBOL's Huanuni Mine became the largest and the richest tin mine in the country since its reopening in September

1988. The state-owned Vinto tin smelter (formerly operated by ENAF) increased its exports to 14,394 tons of metallic tin (99.95% average tin content) in 1993 and, to Bolivian customers, sold 118 tons (worth about $812,278) of metallic tin. About 83.5% of Bolivia's metallic tin exports went to the United States and the rest to six Latin American countries, Holland, and Spain. Crude alloys were not exported after 1991. It may be noted that, for the second time, Vinto exported approximately 84.3 tons of metallic lead. Tin alloys with metals such as antimony, bismuth, copper, and lead were sold by companies that included Bera of Bolivia, BATEBOL, Base Metal Synergy and Metal Co., Fundiciones Hormet, COMCO, and Sarah Importaciones S.R.L. The Vinto smelter projected production of about 14,000 tons of metallic tin in 1993, but owing to a larger local primary tin output plus the availability of Peruvian tin, Vinto was able to produce 18,500 tons, including 4,010 tons for MINSUR, Peru, under a toll contract. The smelting was done in the high-grade smelter's furnaces, and the refining occurred in the low-grade smelter units.

Auction sales of tin from the U.S. Government strategic stockpile continued to be a source of great concern to the Bolivian tin producers as well as Government authorities. Surplus material available for future disposal has added to concern about possible market disruption. During 1993, Vinto smelted 4,600 tons of antimony in concentrates received from Laurel Industries to produce 3,289 tons of antimony trioxide. The plan for 1993 was to smelt 4,600 tons of ore to produce 3,200 tons of antimony trioxide. Vinto's labor force in December 1993 amounted to 463 workers (not including 110 part-time workers), down from 940 (plus 120 part-timers) in 1992 and noticeably down from the more than 2,000 workers in 1985.

Tungsten.—Bolivia's production of tungsten concentrate (WO_3), heavily dependent on international prices, decreased to 330 tons in 1993 from 1,073 tons in 1992. The mines that were closed in previous years, owing to severe ore depletion and high operating costs, did not resume operations. Production came from the medium- and small-size mines and cooperatives that have small deposits with high ore grades and low labor costs. Output of the medium-size mining sector decreased by 17% compared with that of 1991, and production by the small-size mining sector decreased about 21.5% to 701 tons (WO_3 content). In 1992, International Mining Co. (IMCO) of the private sector became once again the single largest tungsten producer in the country. As in previous years, all of IMCO's production came from its Chojlla tin-tungsten mine, which was being operated by cooperatives formed by its former mine workers. All of Chojlla's production is bought back by the company. Empresa Minera San José de Berque is now the second largest producer of tungsten with its Esmoraca, Pueblo Viejo, Española, and La Argentina mining groups in Sud Chichas, Potosí Department. The Chicote Grande Mine of Churquini Enterprises Inc., a subsidiary of Anschutz Mining Corp. of the United States, stopped its tungsten production in 1992. Churquini was purchased by COMSUR in February 1992 and probably will start some tungsten production in 1994.

Industrial Minerals

Cement.—Cement in Bolivia was produced by four plants in different regions of the country having a total production capacity of about 750,000 mt/a. Two plants, Fábrica National de Cementos S.A. (FANCESA) and Fábrica de Cementos El Puente (EL PUENTE), are state-owned. Under the current Government's privatization policy, the two plants were offered for sale under an international bid. The Compañía Boliviana de Cementos S.A.M., located in Irpa Irpa, Department of Cochabamba, with a production capacity of 150,000 mt/a, is a mixed-capital company (state and private shareholders). The FANCESA plant, which is now part of the Regional Development Corp. of Chuquisaca, is for sale. The third plant, EL PUENTE, in the Méndez Province of the Department of Tarija, with a 60,000-mt/a capacity, is owned by the Development Corp. of Tarija. The Sociedad Boliviana de Cementos S.A. in Viacha, Department of La Paz, with a capacity of 210,000 mt/a, was the only wholly privately owned cement plant in the country. During 1993, total cement sold in the country was about 510,000 tons, the same as that in 1992. During 1993, production of cement was maintained at about the same level as that in the previous year.

Lithium.—The most disappointing event in the recent history of Bolivia's attempts to attract private exploitation of mineral reserves was the abandonment of a prospective agreement between the state agency Complejo Industrial de los Recursos Evaporiticos del Salar de Uyuni (CIRESU) and the U.S. company Lithium Corp. of America (LITHCO) (one of the two major world producers of lithium and a subsidiary of Food Machinery Corp., FMC) to extract lithium from the Uyuni Salar in the western Altiplano. Negotiations had been under way for 5 years. In February 1992, the Republic of Bolivia signed a contract, whose terms anticipated an annual income to the state of $30 million for the 40 years' life of the contract. In July 1992, the Bolivian National Congress approved the contract with some modifications. FMC-LITHCO did not accept the modifications and was ready to pull out of the deal. At the request of the Bolivian Government, the deadline was extended by FMC-LITHCO for another 30 days. After internal controversy between the executive branch and congressional members, and a negative press on the project, FMC-LITHCO sent a letter to the Ministry of Mining and Metallurgy ending its long negotiation to explore and exploit the brines of the Salar de Uyuni. By then, FMC-LITHCO was exploring the Salar del Hombre Muerto in northern Argentina and was negotiating with American Metal Climax (AMAX) over a mineral concession in the Salar de Atacama in northern Chile. FMC-LITHCO decided to drop its bid to exploit lithium in the

salt flats of Uyuni, thus ending an affair that has troubled Bolivian officials for the past 4 years.

Mineral Fuels

Bolivia continued to be self-sufficient in crude oil, natural gas, and refined petroleum products. In 1993, crude oil production increased by 4.7% to 8.1 Mbbl compared with that of 1992. In 1993, Bolivia's oil and gas industry continued in third place in the Bolivian export sector, after nonfuel minerals and nontraditional goods. In 1993, hydrocarbons decreased from 17.6% to 12.8% by value of Bolivia's total exports. The sector accounted for 6.3% of the GDP and it employed about 4,980 persons out of a total work force estimated at 2 million. The Ministry of Hydrocarbons and Energy was restructured to National Secretariat under the Ministry of Economic Development and Finance. The National Secretariat of Hydrocarbons and Energy delineates global policies and guidelines and enforces the 1990 Hydrocarbon Law, the basic legislation for the sector, through its agency Yacimientos Petrolíferos Fiscales Bolivianos (YPFB).

YPFB conducts exploration, production, transportation, and marketing; it signs "operational contracts" or "petroleum services contracts" and is authorized to form joint ventures with other parties. In 1993, YPFB signed 1 operational contract for a total of 38 operational contracts since 1973. In May 1993, Pan Andean Resources PLC, an Irish-British company, signed a 30-year operational contract with YPFB to explore the Chapare-Moxos Block on the borders of the Departments of Cochabamba, Beni, and Santa Cruz.

Occidental Boliviana, Inc. (now 75% owned by Diamond Shamrock Corp. of Dallas, Texas), Tesoro Bolivia Petroleum Co., and Maxus Bolivia, Inc. are three U.S.-based oil companies producing hydrocarbons in the country. All of their production is sold to YPFB. Other U.S. companies operating in Bolivia are as follows:

1) Mobil Boliviana de Petroleos, Inc. Since 1988, Mobil and Occidental Boliviana, Inc. have been exploring the Madre de Dios Tract, block 18, of the Madre de Dios basin, in the northwest of the Departments of Pando and La Paz.

2) Santa Fe Energy Resources of Bolivia, together with Norcem (Canada) and Monument Oil and Gas PLC, had two contracts since August 1990, the Hito Villazon and the Carandaigua Blocks (Tarija, Sucre, and Santa Cruz). The Hito Villazon Block was turned into Texaco Exploration Boliviana Chaco, Inc.

3) Chevron International Ltd. (Bolivia) with Pecten International Co., in Bolivia since August 1990, is operating in the Caipipendi Block (Santa Cruz, Sucre, and Tarija). The two companies are exploring the Southern Sub-Andean and Chaco basins. 4) Esso Exploration (Bolivia), Ltd., together with Marathon Petroleum Bolivia Ltd., has been exploring since March 1991 the Poopo Norte and Poopo Sur Blocks in the Altiplano Central basin.

5) Texaco Exploration Azero, Inc., jointly with Sun Oil Bolivia Ltda., agreed in 1991 to explore the Azero Block in the Central basin of the Sub-Andean Zone.

6) Texaco Exploration Boliviana Subandini, Inc. (as the operator), Mobil Boliviana de Petroleos, Inc., and Shell Exploradora y Productora de Bolivia, BV, together with Bolivia Andina Petroleum Co. (subsidiary of Anschutz Corp.), have held since June 1991 the Madidi Block in the North Sub-Andean basin/trust fault.

7) Phillips Petroleum Co. Bolivia signed an operational contract in 1992 to explore the Curahuara de Carangas Block in the Altiplano Northern basin.

8) BHP Petroleum (Bolivia), Inc. has been exploring in the Chapare Block (Central Sub-Andean basin of Cochabanba and Beni Departments) since 1992.

The Argentine firms operating in Bolivia are as follows: 1) Empresa Naviera Perez Companc together with Sacfic of Argentina and Pemsa Co. of Bolivia; and 2) Plus Petrol and Petrolec, S.A., of Bolivia.

The wholly owned Bolivian firms having operational contracts with YPFB are: 1) Compania Petrolera de Exploracion y Explotacion, S.A. (Petrolex), and 2) Sociedad Petrolera del Oriente, S.A. (Sopetrol). In 1993, the contractors surveyed 350 km of geological cross sections together with 1,175 km of new seismic lines; more than 3,364 km of old seismic lines were reprocessed. A total of 4,505 geochemical samples were also taken. In addition, the contractors drilled six exploration wells totaling 19,297 m. Two development wells also were drilled totaling 5,745 m. No new commercial fields were found. During 1993, YPFB continued to negotiate exploration contracts with: Bolipetro of Bolivia, Mobil (operator), and Diamond Shamrock (OBI); Oceanic Exploration and Development Corp.; Phillips Petroleum Co.; Petrobras of Brazil; a consortium formed by the U.S company Harken Bolivia Oil Co., Mendez Corp.-Legado Inc., and the Bolivian Co. Boliviana de Inversiones S.A. (BOINSA). Also included were Reosol S.A.-Elf Aquitaine, Maxus Bolivia Inc., BHP Petroleum Corp., and YPF S.A. of Argentina.

Natural Gas.—Production of natural gas increased 1.3% from that of 1992 to 5,593 Mm^3. Of the total production of natural gas, 74% was produced from YPFB gasfields and 26% by private contractors. YPFB's Vuelta Grande Gasfield continued to be Bolivia's largest natural gas producer; its production increased 6.1% compared with that of 1992. Rio Grande's output was YPFB's second largest natural gas producer, decreasing 6% in 1993. Production from the new fields of Sirari and Vibora increased 17.6% and 53.7%, respectively. YPFB's total natural gas production increased 10.1% as the contractors' production, on the other hand, dropped 17.2%. Occidental Boliviana's Porvenir Gasfield and Tesoro Bolivia's La Vertiente Gasfield decreased 35.2% (continuing the downtrend started 6 years ago) and 5.6%, respectively.

Bolivia's domestic consumption of natural gas continued to be minimal at 608 Mm^3, marking an increase of 5.7% of the total produced compared with that

of 1992. This increase in consumption was made by a large number of factories in the Altiplano (La Paz, El Alto, Viacha, and Oruro) as the main pipeline and distribution lines to industrial centers were completed. Most of the natural gas continues to be consumed in the city of Santa Cruz. The major consumer of natural gas in 1993 was the Empresa Nacional de Electricidad (ENDE), which consumed more than 50% of national production to generate electricity at Santa Cruz, Sucre, Potosí, and recently in Tarija (La Tablada and Yacuiba) and Cochabamba (Valle Hermoso). Other large consumers included the cement plants of Cochabamba, Sucre, and La Paz and the sugar mills in Santa Cruz. In 1993, Bolivia's LPG consumption increased 28.3% from 1.72 Mbbl in 1982 to 2.33 Mbbl in 1993. About 17,000 barrels of LPG, valued at $238,200, was exported to Chile.

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 6 years. Bolivia's natural gas export agreement with Argentina ended in April 1992. However, on March 20, 1992, an agreement was signed that commits the Argentine Government to continue buying natural gas from Bolivia at the same volume as the previous contract for an additional 20 months but at a much lower price. The new agreement fixed the price at $1 per million Btu from May 1, 1992, through March 1994, or about one-third the price that Argentina paid during 1991. During 1993, Bolivia exported to Argentina 2,092 Mm^3, a decrease of 1.6% compared with that of 1992. Revenues from gas exports, at $90.2 million, were 26.5% lower than in the previous year.

Of the total natural gas produced in Bolivia, 37.4% was exported to Argentina; 23.4% was consumed domestically; 27.4% was reinjected into the gasfields; 11.1% was vented, flared, or lost; 1.9% was consumed as fuel by YPFB; and the remainder was converted into LPG. As a result of YPFB's program of substituting gas products for liquids, domestic consumption of LPG increased from about 2.5 Mbbl in 1992 to 3.9 Mbbl in 1994. In 1992 and 1993, several natural gas pipelines were installed and a larger volume of natural gas was consumed domestically, mostly in the city of Santa Cruz. YPFB operated four LPG plants at Río Grande, Colpa, Camiri, and Vuelta Grande in the Department of Santa Cruz, all of which also produced natural gasoline.

About 13.5 Mbbl of liquids (crude oil plus condensates), 5.6 Mbbl of finished products, and 1,251 Mm^3 of natural gas are transported between major distribution centers in Bolivia via the 5,600 km of pipelines owned and operated by YPFB. All the pipelines are reversible, with the exception of an export pipeline to Arica, Chile. On February 17, 1993, in Cochabamba, the Bolivian President and the Brazilian counterpart attended the signing of the "final sale/purchase contract" agreed to by YPFB and Petroleo Brasileiro S.A. (Petrobras). The "final contract" expands on the preliminary contract signed on August 17, 1992, in Santa Cruz. The initial price for the dry natural gas will be $0.90 per million Btu at the entrance to the pipeline in Rio Grande, Santa Cruz. The price will be adjusted automatically each quarter according to a formula that uses spot market prices for fuel oil in three international markets to modify the price up or down. The volume of the gas deliveries will start at 8 Mm^3/d, when the pipeline is completed; the volume will be doubled sometime between the 7th and the 10th year after the completion of the pipeline through the end of the 20-year contract. Petrobras will have to pay for the full amount under the terms of this "take or pay" contract. The final contract will include an article stipulating that the terms may be extended an additional 20 years if both parties agree. Another article will define penalties if either side fails to comply with the contract. The most important new article establishes the contract as null and void if financing is not arranged within 18 months. Some of the technical parameters agreed to in the final contract are the following: Petrobrás and YPFB agreed to construct 557 km of 71-cm-diameter gas pipeline from the Rio Grande Gasfield in Santa Cruz to Puerto Suárez (total cost $421.6 million), then from Puerto Suárez to Campinas (Brazil), 1,240 km ($901.2 million); and from Campinas to Curitiba, Brazil 430 km ($225.6 million). The total estimated cost was $1,548.4 million. Financing for the pipeline is still far from certain, but a group of 10 Bolivian businesspersons have formed a company called GASBOL to build the Bolivian portion. YPFB has offered to take 10% to 30% of the equity in the Bolivian section, but would prefer just 15%. It will depend on negotiations with the potential investors under the Capitalization Law to determine YPFB's future share in the pipeline. The ENRON Development Corp. of Houston indicated its willingness to enter into an agreement for joint venture with YPFB to build a $400 million, 563-km natural gas pipeline in Bolivia, which will be part of a larger development valued at up to $2 billion that eventually will carry Bolivian natural gas to a growing market in Brazil. According to officials, YPFB will own 60% of the company, with the remainder held by ENRON. The joint venture will develop, finance, and operate the pipeline for the export of Bolivian natural gas to Brazil.

Trans-Andean Partners, Inc., a consortium of U.S. firms, BHP, and others, presented to the Bolivian Government a proposal for the construction and operation of a natural gas pipeline from Tarija (Bolivia) to Tocopilla (Chile). The proposed project is to build an 800-km, 51-cm-diameter gas pipeline that would transport 4.25 Mm^3/d of natural gas purchased from YPFB. The proposed pipeline would feed a projected Trans-Andean Partners 500-MW thermoelectric plant in the city of Tocopilla, on the northern coast of Chile. The cost of the pipeline was estimated at about $250 million, and the cost of the thermoelectric plant would be about $350 million.

Petroleum, Crude.—The total average daily production of crude oil decreased 5% to 221,237 bbl in 1993 from 21,180 bbl in 1991. Of the total crude produced,

the YPFB share was almost 80%, and the remainder was produced by Occidental Boliviana, Tesoro Bolivia, and others.

During 1992, YPFB and two U.S. contractors were active in exploration drilling. YPFB drilled 23,925 m, 1.1% more than that in the previous year. YPFB made two new oil discoveries, the Patujusal and Yuquis. A third new find was made by the Bulo Bulo X-3, which discovered a new deeper natural gas/condensate-bearing formation in the old Bulo Bulo Field.

YPFB's first successful well in 1993 was the new field Patujusal X-1 wildcat, 2,000 m deep, spudded on December 29, 1992, and concluded on March 27, 1993. Patujusal was financed by the IDB, and it was estimated that this oilfield could produce about 1,500 bbl/d of crude oil and natural gas from the upper Oligocene Petaca Formation after development is completed. The second successful well was the new field Yuquis X-1 wildcat, spudded on April 27, 1993. It went to a depth of 3,125 m.

Domestic consumption of refined petroleum products increased about 1.5% above that of 1992 to 26,470 bbl/d, including LPG and lubricant sales. The domestic prices for refinery products were raised to world and regional average levels. Premium gasoline prices went up from $0.63 per liter at the end of 1991 to $0.66 in January 1992 and remained the same until December 1993. Internal sales of finished products, including LPG and natural gas, totaled the equivalent of $458.2 million compared with $488.9 million in 1992.

Reserves

COMIBOL's mine reserves for lead, silver, tin, and zinc at the "nucleus mines" were revised in 1989 for the 5-year plan. Mineral reserve estimates for lead, silver, tin, tungsten, and zinc were recalculated and revised for greater accuracy, not only for the large mines but also for the medium- and small-size mining sectors. In view of the widespread occurrence of both lode and placer gold in Bolivia, gold reserves have not yet been projected. YPFB estimated that the total Bolivian proven crude oil reserves, plus lease condensate as of yearend 1993, were 134.93 Mbbl. YPFB's proven reserves total 89.58 Mbbl or about 66.4% of the total crude oil proven reserves.

The contractors' crude oil proven reserves amounted to 45.36 Mbbl or 33.6% of the total. Bolivia's crude oil reserves at current production and consumption could last for another 13 to 14 years. YPFB estimates that, of the total crude oil reserves, about 45% are crude oil and 55% lease condensate stored in natural gas fields. Bolivia's original reserves were about 438.9 Mbbl.

According to YPFB, Bolivia's natural gas reserves as of December 1993 were 123.43 billion m^3, of which 45.87 billion m^3 is proven (remanent) reserves. YPFB's proven natural gas reserves are 73% of the total proven reserves, while the contractor's total amounted to 27%.

INFRASTRUCTURE

The development of communication and transportation systems in Bolivia has been impeded by the rugged topography of the Andean Range, a very difficult barrier separating the western and eastern regions of the country. Alignments of railroad lines and highways are curvy, and during the rainy season mud avalanches may block them temporarily. In the eastern plains the flooding of rivers is a serious problem, preventing deliveries of supplies and food to consumers. Nevertheless, Bolivia has a reasonably well-developed infrastructure. The transportation network is composed of a total of 38,836 km of highways, of which 1,300 km is paved, 6,700 km is gravel, and 30,836 km is unimproved earth. The Pan-American highway linking Argentina and Peru crosses Bolivia from south to northwest. As a landlocked country, Bolivia has no ocean ports but does have access to ports in Chile (Arica and Antofagasta) and Peru (Matarani).

The railroad system consisted of 3,652 km of 1.000-m gauge and 32 km of 0.760-m 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 Argentine and Brazilian consumers. Bolivia has 10,000 km of commercially navigable waterways that connect the eastern region of the country with the Amazon basin.

About 13.5 Mbbl of crude oil and condensates, 5.6 Mbbl of refined oil products, and 121 Mm^3/d of natural gas are transported between major distribution centers in Bolivia through the 5,600 km of pipeline owned and operated by YPFB. Bolivia has 26 product terminals throughout the country. Several other pipeline construction projects are under way. The generation, transmission, and distribution of electrical power in Bolivia was carried out by both state and private companies. An estimated 2,051 GW • h of electricity was produced in 1993, a decrease of 15% from that of 1982. The average consumption was 260 kW • h per capita. Bolivia had an installed electrical generating capacity of 756 MW, of which 308 MW or about 40.8%, was generated by hydroelectric plants and the remaining by thermoelectric plants. ENDE has an installed generating capacity of 468.2 MW or 62% of Bolivia's total. The privately owned Bolivian Electric Power Co. (COBEE-BPC), originally Canadian, has 142.2 MW of installed capacity or 19% of the country's total. COBEE-BPC supplies electricity to the cities of La Paz, including El Alto and Oruro.

In 1988, ENDE drilled five wells at the geothermal field of Laguna Colorada. The field is in Sud Lipez, Potosi, about 220 km southwest of the town of Uyuni and about 11 km east of the Bolivian-Chilean border.

OUTLOOK

The Bolivian Andean mineral belts and the eastern Precambrian shield hold substantial mineral resources and are largely untapped. Nevertheless, the mineral base already identified is

extensive enough to be able to generate significant mineral production within a relatively short time, depending upon international mineral market prices and investment vigor.

Prospects for Bolivia's mineral industry continued to improve in 1993. Foreign investment in exploration has accelerated since August 1993, along with confidence that the economic reforms introduced by the Government in 1985 would endure. The investment law and the new Mining Code approved in early 1991 have also helped to ensure potential foreign investors that the Bolivian Government's free-market policies will endure. The mining sector has received numerous proposals and inquiries from potential investors from Australia, Canada, China, New Zealand, South Africa, the United Kingdom, and the United States. Available information shows that the foreign companies now operating in Bolivia are exploring for gold, silver, and base metal deposits in the altiplano and the Precambrian shield. Despite the drastic reduction in COMIBOL operations, the streamlined COMIBOL is offering large unexplored areas in Los Lipez south of Potosi under joint-venture contracts. More than 62 requests were received by the company for the terms of reference. Most of Bolivia's gold was produced from alluvial deposits, and several firms were investigating further investment in gold extraction from epithermal volcanic and subvolcanic intrusions of their gold- and silver-bearing sulfide and oxide ores. Sulfur production in the western Cordillera also was expanding. Nevertheless, Bolivia's economy remained vulnerable to price fluctuations for its limited exports, mainly nonfuel minerals and natural gas. The economy is expected to continue to be heavily dependent on internal sales of petroleum products and foreign exchange earnings from natural gas exports. Nonfuel minerals and hydrocarbons continued to lead Bolivia's exports. Because the 20-year gas sales contract with Argentina expired in early May 1992, it has become critical for YPFB, and the country as a whole, to continue gas exports to Argentina and to look for new markets.

Natural gas is considered to have the greatest potential for sustained long-term growth. The base metal sector appears to be recovering as a result of COMIBOL's rehabilitation program and privatization efforts. The World Bank is providing assistance through the International Development Association (IDA), to implement its mining sector strategy.

Foreign private investors look at Inti Raymi's success as an example to emulate. For example, the Australian company AUSTPAC Gold, N.L., in a joint venture with COMIBOL, is exploring the Escala ore body, in the southern Altiplano, which shows great potential as a heap-leaching gold target. Billiton signed a joint-venture contract with EMUSA to quantify reserves at the copper-gold Don Mario deposit in Santa Cruz Bolivia. The COMSUR-RTZ joint venture continues with its exploration program in the Altiplano and the Precambrian. EMUSA is joint venturing with ORVANA Minerals Corp. of Vancouver, Canada, to explore the disseminated gold prospect of San Bernardino in Challapata, near Oruro.

Future resource development is likely to focus on continued expansion of the hydrocarbon sector, as well as the development 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-Brazil energy integration agreement includes the selling of electricity generated by a natural gas-fired thermoelectric plant; urea and high-density polyethylene from a proposed plant to be installed in Puerto Suárez, Department of Santa Cruz; and the construction of the 563-km gas pipeline between the Santa Cruz Gasfields and Puerto Suárez, near the Brazilian border.

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 occur near Laguna Colorada.

[1]Where necessary, values have been converted from bolivianos ($b) to U.S. dollars at the rate of $b4.3=US$1.00.

OTHER SOURCES OF INFORMATION

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Publications

Secretaria Nacional de Minas y Metalurgia, La Paz City: Boletín Estadístico Minero Metalúrgico, monthly.
Asociación Nacional de Mineros Medianos, La Paz City: Minería Mediana-Memoria 1993, annual.
U.S.G.S. Report on the "Geology and Mineral Resources of the Altiplano and Cordillera Occidental." Consultant's Report—(Yellow Book) U.S. Embassy, La Paz, Bolivia: Bolivian Mining Industry-Development and Outlook-1993; Bolivian Petroleum Industry-Development and Outlook-1993; July 1993.
U.S. Embassy,-La Paz, Bolivia: Annual Petroleum and Natural Gas Questionnaire, Bolivia, for calendar year 1993 (SPR-4255).
Annual Minerals questionnaire for Bolivia, calendar year 1993 (SPR-4291).

TABLE 1
BOLIVIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
METALS[3]							
Antimony:							
Mine output, Sb content		9,189	8,454	7,287	6,022	4,155	10,700
Metal including Sb content of trioxide		1,236	1,046	3,548	5,670	4,467	6,000
Arsenic: Mine output, arsenic trioxide, arsenic sulfide		338	300	463	633	663	700
Bismuth:							
Mine output, Bi content		41	68	—	—	—	170
Metal, smelter		—	137	—	30	7	140
Cadmium: Mine output, Cd content[4]		79	102	115	71	4	120
Copper: Mine output, Cu content		298	157	30	101	94	300
Gold: Mine output, Au content[5]	kilograms	[6]3,595	[6]5,198	[6]3,501	4,688	10,403	10,500
Iron ore:[7]							
Gross weight		14,254	125,264	101,642	55,486	[e]51,000	130,000
Fe content		8,980	78,916	72,148	34,956	32,118	80,000
Lead:							
Mine output, Pb content		15,728	19,913	20,810	20,010	21,220	21,500
Metal, smelter		12	117	213	261	537	500
Manganese: Mine output, Mn content		100	3,778	215	100	—	250
Silver: Mine output, Ag content[8]	kilograms	267,084	310,543	375,702	282,350	332,768	380,000
Tantalum, tantalite	do.	—	583	3,735	2,722	3,535	3,800
Tin:							
Mine output, Sn content		15,849	17,249	16,830	16,516	18,634	18,000
Metal, smelter		9,448	12,567	14,663	14,393	18,551	19,000
Alloys		—	832	261	75	94	850
Tungsten: Mine output, W content		1,118	1,014	1,065	851	261	1,200
Zinc: Mine output, Zn content		74,789	103,849	129,778	143,936	124,638	150,000
INDUSTRIAL MINERALS							
Barite		—	300	1,277	368	—	1,300
Bentonite		—	—	825	454	368	900

See footnotes at end of table.

TABLE 1
BOLIVIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued							
Calcite (limestone)		e500	300	480	e500	37	500
Cement, hydraulic		505,426	560,446	591,630	600,288	480,000	600,500
Gemstone, amethyst:							
Polished	kilograms	—	50	254	3	15	300
Rough	do.	—	—	32,147	47,234	248	47,500
Gypsum, crude[e]		100	100	4,000	6,000	4,000	6,100
Marble		70	81	37	67	37	100
Onyx	kilograms	—	—	10,800	104	133	11,000
Pumice[e]		200	100	100	100	80	200
Quartz	kilograms	—	—	—	100	816	600
Salt		60	155	255	e260	e200	260
Sandstone		—	—	—	119	—	120
Slate		84	104	14,820	e5,000	163	15,000
Sodalite	kilograms	—	—	4,170	e3,000	—	4,200
Sulfur, native		8,167	2,101	2,782	15	1,050	8,200
Ulexite		9,609	3,076	14,226	23,244	10,046	23,500
MINERAL FUELS AND RELATED MATERIALS							
Gas, natural:							
Gross	million cubic meters	5,291	5,276	5,432	r5,522	5,593	5,600
Marketed	do.	2,565	2,203	2,178	r2,126	2,092	2,600
Natural gas liquids:							
Natural gasoline	thousand 42-gallon barrels	627	732	814	r775	772	850
Other (consumption)	do.	r1,578	r1,845	r1,900	r1,816	1,809	2,700
Petroleum:							
Crude including condensate	do.	7,274	7,635	8,094	r7,752	8,116	8,200
Refinery products:							
Liquefied petroleum gas	do.	1,106	e1,200	570	r511	513	1,200
Gasoline	do.	3,504	e3,400	3,297	r3,224	3,235	3,550
Jet fuel	do.	631	e600	683	r669	741	750
Kerosene	do.	317	e300	269	r262	231	320
Distillate fuel oil	do.	2,252	e2,560	2,828	r2,848	2,635	2,850
Lubricants	do.	75	e100	90	r70	31	110
Residual fuel oil	do.	106	e90	816	r202	330	850
Unspecified	do.	164	e200	1,217	r1,933	e2,000	2,000
Refinery fuel and losses	do.	—	e50	—	—	96	100
Total	do.	8,155	e8,500	9,770	r9,719	9,812	11,730

[e]Estimated. [r]Revised.

[1]Table includes data available through June 1994.

[2]In 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.

[3]Unless otherwise specified, data represent actual production by COMIBOL and small- and medium-size mines.

[4]Cadmium contained in zinc concentrates produced by COMIBOL. (Cadmium is not recovered in elemental form in Bolivia.)

[5]Includes production of metallic gold.

[6]Small- and medium-size mines output sales to BAMIN, and COMIBOL exports (small- and medium-size mines cannot legally export gold).

[7]Data represent exports and are regarded as being equal to production.

[8]Includes production of metallic silver.

TABLE 2

BOLIVIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Antimony		Empresa Minera Unificada S.A. (EMUSA) (private, 100%)	Caracota, Chilcobija, and Espíritu Santo Mines, Potosí Department	2.7.
Do.		Empresa Minera San Juan Ltda. (private, 100%)	Candelaria Mine, Potosí Department	2.1.
Antimony trioxide		Empresa Minera Hermanos Bernal S.A. (private, 100%)	Palala smelter, Tupiza, Potosí Department	1.0.
Gas, natural	million cubic meters	Yacimientos Petrolíferos Fiscales Bolivianos (YPFB) (Government, 100%)	Río Grande, Vuelta Grande, and Sirari Gasfields, Santa Cruz Department	1,348.0.
Do.	do.	do.	San Roque, Víbora, and Yapacani Gasfields, Southern District	683.
Do.	do.	do.	Cascabel, Naranjillos, Carrasco, Camiri, Monteagudo, Santa Cruz Gasfield Central, and Southern Districts	441.
Do.	do.	Occidental Boliviana Inc., Tesoro Bolivia Petroleum Co. (United States) and Empresa Naviera Pérez-Compac-Sacfic (Argentina) contractors (private, 100%)	El Porvernir, La Vertiente, Gasfields, Santa Cruz Department	66,100.
Gold	kilograms	Cooperatives (some with U.S. equity) (private, 100%)	Tipuani, Guanay, Mapiri, Huayta, Kaka and Teaponte Rivers, La Paz Department	2.2.
Do.	do.	Empresa Inti-Raymi S.A. (private, 100%) (Battle Mountain Gold Mining Co., 85%; EMUSA, 15%)	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, Cachuela Esperanza gold dredging, Pando and Beni Departments	6.0.
Lead		Empresa Minera Quioma S.A. (COMSUR S.A.) (private, 100%) (Formerly owned by ASARCO Incorporated of the United States)	Asientos, lead-silver-zinc mine at Mizque, Cochabamba Department	6.0.
Do.		Corporación Minera de Bolivia (COMIBOL)	Santa Fe, Tatasi, Animas-Inocente, and San José Mines, Potosí Department	3.2.
Do.		Empresa Metalúrgica de Karachipampa (Government, 100%) (Autonomous subsidiary company of COMIBOL) Lead/silver smelter (continued shutdown for lack of operating capital and shortage of ore-feed	Karachipampa, Potosí Department	24.0.
Petroleum	thousand barrels	Yacimientos Petrolíferos Fiscales Bolivianos (YPFB) (Government, 100%)	La Pena, Vuelta Grande, Río Grande, San Roque, and Víbora Oilfields Santa Cruz Department	8,116.
Do.	do.	Occidental Boliviana Inc. and Tesoro Bolivia Petroleum Co., both U.S. companies and other contractors (private, 100%)	Porvenir, La Vertiente, Bermejo, Caígua, and Colpa Oilfields	1,662.
Silver	kilograms	Corporación Minera de Bolivia (COMIBOL) Cía. Minera de Oruro, Cía. Minera Quechisla, and Cía. Minera de Potosí subsidiaries (Government, 100%)	San José, Bolívar, Poopo, Santa Fe, San Vicente, Tatasi, Animas-Inocente, and Unificada Mines at Oruro, and Potosí Departments	99,000.
Do.	do.	Cía. Minera del Sur, S.A. (COMSUR) (private, 100%) (RTZ of the United Kingdom, shareholder)	Martha, Huari, Porco, and Milluni Mines La Paz, Department	38,000.
Tin		COMIBOL: Cía. Minera de Oruro, Cía. Minera Quechisla, Cía. Minera de Potosí, and Cía. Minera La Paz (Government, 100%)	Huanuni, Colquiri, Caracoles, Viloco, and Chorolque Mines, at Oruro, Potosí, and La Paz Departments	95.0.
Do.		COMSUR, Barrosquira, International Mining Co., Yana Mallcu and Avicaya companies (private, 100%)	Martha, Cerro Grande, Milluni, and Berenguela tin mines	2.4.
Do.		Small miners and cooperatives (private, 100%)	Catavi-Siglo XX, Caracoles, Bolívar Viloco, Colquiri, and Colquechaca Mines	6.4.

TABLE 2
BOLIVIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Tin, refined	Empresa Metalúrgica de Vinto (COMIBOL's subsidiary) (Government, 100%)	Vinto, Oruro Department	9.0.
Do.	Fundestano de Oruro S.A. (private, 100%)	City of Oruro, Oruro Department	5.0.
Do.	Cía. Metalúrgica Industrial y Comercial-Hormet S.A. (private, 100%)	City of La Paz, La Paz Department	.2.
Tungsten	COMIBOL-Cía. Minera La Paz (Government, 100%)	Kami, Tasna, and Bolsa Negra Mines, La Paz Department	Closed in 1987.
Do.	International Mining Co. (IMCO) (private, 100%)	Chojlla Mine, La Paz Department	.5.
Do.	Empresa Minera San José Berque (private, 100%)	Esmoraca, Pueblo Viejo, Española, and La Argentina Mines, Sudchichas Province, Potosí Department	.2.
Zinc	COMIBOL, Cía. Minera de Oruro, Cía. Minera Quechisla, Cía. Minera de Potosí (Government, 100%)	Santa Fe, Colquiri, San Vicente, Tatasi, Animas-Inocente, and Unificada Mines at Oruro, Potosí, and La Paz Departments	416.0.
Do.	COMSUR S.A., Maragua Ltda., Caballo Blanco S.A. (private, 100%)	Porco, Asientos, Maragua, Huari-Huari Monserrat, and Monte Blanco Mines at Cochabamba, Oruro, and Potosí Departments	50.0.

TABLE 3
BOLIVIA: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1993

(Metric tons unless otherwise specified)

Commodity		Reserves
Antimony, metal content		35,000
Lead, metal content		25,965
Lithium carbonate	thousand metric tons	5,500
Natural gas	billion cubic meters	122
Petroleum	million 42-gallon barrels	134,900
Silver, metal content		1,378
Tin, metal content		274,774
Tungsten, metal content		5,300
Zinc, metal content		935,497

BRAZIL

AREA 8.5 million km² **POPULATION 156.6 million**

THE MINERAL INDUSTRY OF

BRAZIL

By Alfredo C. Gurmendi

During 1993, Brazil produced bauxite, columbium, gemstones, gold, iron ore, kaolin, manganese, tantalum, and tin from world-class deposits and exported them to the global marketplace. In Latin America, particularly the Southern Cone Common Market (MERCOSUR), Brazil continued to be the leading producer of aluminum, cement, ferroalloys, gold, iron ore, manganese, steel, and tin. The country was engaged in an ambitious exploration program to expand reserves and reduce its dependence on oil imports, which were approximately 40% of its crude oil requirements during 1993.

In 1993, the country of continental dimensions with a population near 160 million, had a gross domestic product (GDP) of $428 billion.[1] Foreign exchange reserves are about $40 billion. Its tremendous known and potential natural resources help make it one of the most dynamic markets in the world, ranking ninth in the global economy and constituting one-third of the Latin American economy.

Brazil, the largest debtor in the developing world, recently completed an agreement with its creditor banks to reduce its $49-billion foreign debt with lower interest rates and longer-term loans. This accord is crucial to Brazil's efforts to liberalize further its economy, attract more foreign investment, and stabilize prices. Brazil's total debt burden, including loans from banks and from other governments, amounted to $93 billion at the end of 1993.

The Government continued to utilize tight monetary policy and high interest rates with the objective of curbing inflation from the current 45% (5,000% for the year of 1993) per month to one digit and preventing price explosion.

GOVERNMENT POLICIES AND PROGRAMS

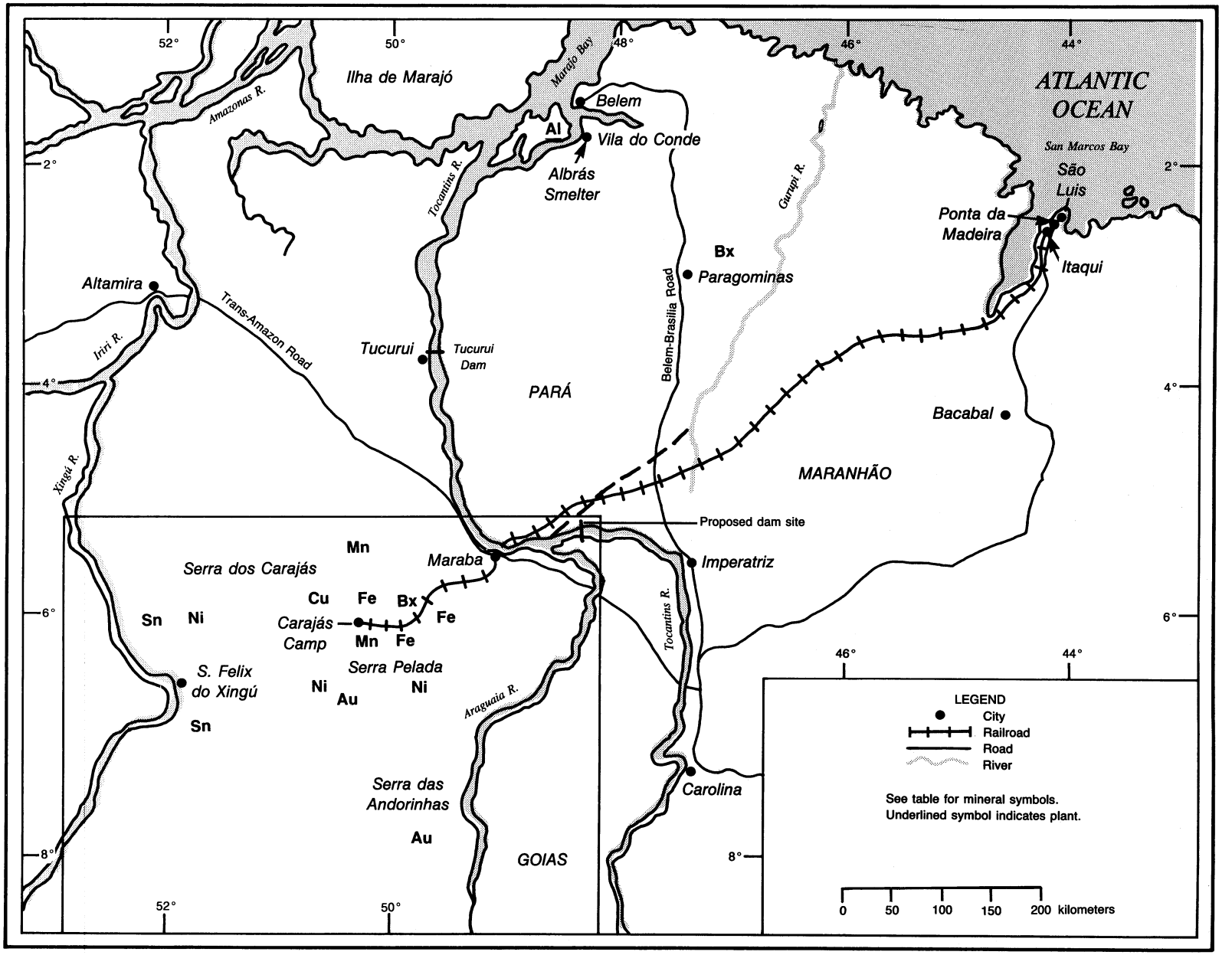
The Government might well accept the policy of a balanced budget as a premier condition to economic stabilization and a firm monetary policy, based on hard currency reserves, and privatization of state-owned monopolies. Foreign capital flow into Brazil has grown during the last 3 years, reversing almost a decade of net capital flight. In 1993, the country experienced a favorable inflow of $29 billion with $1.3 billion of direct investment in productive operations.

Brazil's efforts to review its 1988 Constitution by both houses of Congress begun in the last quarter of 1993. Significant measures were undertaken by the Brazilian Government, reduced import duties from an average of 42% to 14% during 1992 and 1993 and eliminated governmental red tape affecting trade. Also, in September 1993, Presidential decrees were signed with the intent to reduce taxes and tariffs and allow 100% of equity ownership via privatization and expatriation of profits. These significant measures were undertaken by the Government to overcome existing economic problems and to create a favorable and positive environment to attract both domestic and foreign investments. As the barriers to foreign investments continue to fall, foreign interests will increase, because Brazil is a country with the greatest mineral potential in the globe. The Amazon region alone is considered to be a vast area of the planet with real possibilities for major discoveries of mineral wealth, as indicated by the large reserves of iron ore, manganese, bauxite, gold, and tin in Carajás, Pará, already under production.

Privatization of state-owned firms has led to lower employment levels and more efficiency. Since yearend 1991, the State has sold 30 companies worth $5.25 billion, mostly in the chemical, fertilizer, and steel sectors. Another $13 billion is expected from the remaining 35 corporations of the first phase of Brazil's privatization process. Sales of Government minority holdings would provide an additional $2.5 billion. When the auctioning of the large state-owned mining, telephone, and petroleum firms takes place, $20 billion could be added, bringing a total revenue of about $40 billion. The realization of this revenue, however, would need removal of all trade barriers and constitutional review to privatize Brazil's monopolies in the petroleum, telecommunication, and energy sectors. The Brazilian privatization program also has been considering concession of public utilities as an alternative, and to build and manage railroads, ports, and hydroelectric powerplants in joint ventures with the private sector.

A Trade Pact of MERCOSUR was moving steadily toward its scheduled initiating date of January 1, 1995. At that time, the four participating nations, Argentina, Brazil, Paraguay, and Uruguay, would eliminate import duties for their trade and harmonize trade policies and tariffs from nonmember countries. In the case of Brazil, the sectors that are likely to seek exempted status include autos, computers, electronics, specialty chemicals, and textiles. MERCOSUR is an extension of the Argentina-Brazil integration that began in 1986. On March 26, 1991, the Treaty of Asunción was signed, including Paraguay and Uruguay in MERCOSUR. When fully implemented, the treaty would allow unrestricted movement of

BRAZIL — MINERAL PROVINCE OF CARAJÁS



labor, goods, and services among the four countries. Already, MERCOSUR has had its impact on trade among the nation members, which has increased annually by 35%, reaching $8 billion in 1993. Trade between Argentina and Brazil alone increased from about $2 billion in 1989 to $6.2 billion in 1993.

In 1992, the President of Brazil reorganized the Executive Branch of Government. The Ministry of Mines and Energy was no longer part of the Ministry of Infrastructure, and the National Department of Mineral Production (DNPM) became an autonomous Federal agency by the end of 1993. DNPM will continue with specific responsibility over mining and will be able to operate much more efficiently and cost effectively.

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 1988 Constitution, which 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 were permitted to appeal the decision before the concessions were offered for sale at auctions.

ENVIRONMENTAL ISSUES

In 1983, Brazil enacted Law No. 6938 which established the National Environmental Council (CONAMA) as an advisory agency in the executive branch. Under CONAMA's resolution 001/86 an environmental license was required for all mining activities in Brazil. In 1986, Law No. 88351 established the National System for the Environment (SISNAMA), composed of representatives of the Federal, State, and local governments and private foundations involved in environmental protection and improvement.

The 1988 Constitution, Article 225, stipulated that mining operators reclaim the degraded environment. Later detailed legislation was passed with a goal of harmonizing mining activities with the environment, such as the Plan for Recovery of Degraded Areas and the Environmental Control Plan. 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 affected were those in the Pantanal and Amazon regions.

Resolution 010 of December 6, 1990 dictated that all mining operations required environmental licenses leading to the granting of mineral rights by the DNPM. As environmental problems increased, antipollution measures were enacted to eliminate the sources of pollutants and mitigate their effects on the environment.

PRODUCTION

The total value of minerals produced in 1993 was about $7.3 billion, or almost 2% of GDP. Brazilian minerals production increased approximately 3% over that of 1992, caused mostly by iron ore output increase of about 9%. Increases also were recorded in production of kaolin, 6%; nickel, 7%; zinc, 11%; and manganese, 12%. However, gold production decreased by almost 8% because of depletion of shallow gold deposits and environmental constraints on garimpeiros. *(See table 1.)*

TRADE

In 1993, the total value of exports was approximately $40.2 billion versus the total value of $27.3 billion for imports. The trade surplus amounted to $12.9 billion. During 1993, Brazil sold 13% of its exports to the other MERCOSUR members and 8% to the other countries in South America. Total mineral imports were valued at $4.5 billion, while total exports were $3.2 billion or about 6% above the 1992 mineral exports, mostly because of the increase in exports of iron ore, gold, and dimension stone. The negative trade balance in the minerals sector for 1993 was heavily influenced by the value of petroleum imports. In addition to petroleum, other major mineral imports, in alphabetical order, were coal, copper, lead, natural gas, potash, sulfur, and zinc.

During 1993, Brazilian exports of steel were 12,237,000 tons, up from 11,787,000 tons in 1992. Exports were valued at $3.6 billion, an increase of about $75 million from 1992. Imports were about 193,900 tons at a value of $211 million, representing an increase from 177,900 tons valued at $208 million in 1992.

STRUCTURE OF THE MINERAL INDUSTRY

The major portion of the mineral industry of Brazil was partially or wholly owned by private Brazilian investors, Brazilian corporations, and foreign companies in 1993. 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 1993, 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 Mineração, S.A. (PETROMIN), the mining company. PETROBRAS is the domestic operator. The Government-owned steel holding company, Siderúrgica Brasileira, S.A. (SIDERBRAS), was eliminated in 1990. The Government was determined to proceed with the privatization of its steel industry and had pledged since January 1991 to sell all of its mills by 1994. Brazil began the privatization effort on October 24, 1991, when it sold 75% of the common stock in Brazil's second largest steel mill, Usinas Siderúrgicas de

Minas Gerais, S. A. (USIMINAS), to a variety of stockholders for $1.17 billion. The share auction for Cía. Siderúrgica do Nordeste (COSINOR) took place on November 24, 1991, and specialty steel maker Aços Finos Piratini, S.A. (PIRATINI) was auctioned on January 28, 1992. Additional mills were privatized: Cía. Siderúrgica de Tubarao (CST), a slab producer, in March 1992; Aços Minas Gerais, S.A. (ACOMINAS), a structural and rail producer, in mid-1992; Cía. Siderúrgica Nacional (CSN), Brazil's largest mill, the second half of 1992; and Cía. Siderúrgica Paulista (COSIPA), a carbon steel sheet and plate producer was sold the first half of 1993. 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 1993, there were 42 cement companies operating 51 cement plants and 7 grinding plants with a clinker capacity of 36.6 Mmt and an utilization rate of 65.3%. In the same year, there were 34 separate iron ore mining companies operating 80 mines.

The five major integrated steel works (ACOMINAS, CSN, COSIPA, CST, and USIMINAS), which were privatized between 1991 and 1993, produced about 17.5 million tons of the total Brazilian steel production of 25.2 Mmt during 1993. CVRD produced approximately 60% of the iron ore. Mineração Río 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 production of 1.2 Mmt in 1993.

Brazil's total labor force was nearly 60 million in 1993. Of the total, services comprised 42%; agriculture 31%; and industry, 27%. The minerals sector comprised approximately 4% (650,000) of the industry total of 16 million. This did not include the 500,000 to 1 million garimpeiros active in Brazil. Employment in the mining sector continued its downward trend in 1993 because of Brazil's economic recession and the impact of privatization, particularly in the steel sector. *(See table 2.)*

COMMODITY REVIEW

Metals

Alumina, Aluminum, and Bauxite.—In 1993, primary aluminum production amounted to 1.2 Mmt of metal, which remained at the same level as in 1992, and bauxite production remained at about 9.4 Mmt for the same period. Also, alumina production remained at the 1992 level. Apparent consumption of primary aluminum for 1993 was 360,000 tons.

CVRD announced plans to construct a 1.1-Mmt/a alumina refinery near Paragominas, Pará, to process the bauxite from the 850-Mmt deposit there. It will be known as the Jabuti Project at a cost of $875 million and is scheduled to enter into production in 1995. In 1993, about 25% of primary aluminum was produced by Albras-Aluminio Brasileiro S. A. (ALBRAS), a joint venture of CVRD (51%) and Japan's Nippon Amazon Aluminum Corp. (NAAC, 49%). ALCOA accounted with 24% of total primary aluminum output.

Other producers included Billiton Metais S.A. with 18.1%, CBA with 17.9%, ALCAN with 10%, and ALUVALE with 0.5%. Valesul Alumínio, S.A. (VALESUL), a joint venture of ALUVALE (49.7%), Billiton Metais (41.5%), and Companhia Força e Luz Cataguazes (8.8%), produced 92,600 tons.

Mineração Rio do Norte, S.A. (MRN), the world's third largest bauxite producer and exporter, decreased its production during 1993 by about 14.4% to 7.3 Mmt compared with 8.5 Mmt in 1992. MNR was planning to invest $60 million to open a new mine in Trombetas, Pará in 1997, with a capacity of 2 Mmt/a; thus, MNR's total bauxite production capacity will increase from 8 to 10 Mmt/a. Brazil's second largest aluminum smelter, ALBRAS, will 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 to export them to Latin American markets. This was announced in early 1993 by Reynolds Metals of the United States, the holding company. Alto Brazil Mineração (ABM) is a joint venture of Alcoa Aluminio, S.A. (60%) and Billiton Metais, S.A. (40%) to mine their bauxite deposit in the Amazon region. It proposed to mine the Oriximina deposit near the Trombetas River and the MRN mine in Pará. When in operation, it will supply the feed to the Alcoa Aluminio, S.A. refinery at São Luís, Maranhão. The Brazilian exports of primary aluminum increased to 816,000 tons, or 3.7% over those of 1992. These exports represented about 70% of total Brazilian production.

Columbium and Tantalum.—Brazil is the world's most significant producer and supplier of columbium to the global economy. In 1993, Brazil produced about 79% of the world's total with approximately 17,800 tons of concentrate; 17,700 tons of alloys; and 600 tons of oxides. Brazil's most important Columbium plant is in Barreiro, Minas Gerias operated by the Brazilian Metallurgy and Mining Company (CBMM-Cía. Brasileira de Metalurgia e Mineração). CBMM is owned by Moreira Sales Group of Brazil, 55%; and Molycorp of the USA, 45%. 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 Araxá, Minas Gerais. The plant will have a capacity of 22,800 mt/a and will cost $15 million. Columbium also was produced in Ouvidor, Goiás.

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 was found in the São Gabriel da Coxoeira, Amazonas, and contains approximately 2.9 billion mt of

columbium ore.

Tantalum production in Brazil was 50 tons compared with 60 tons in 1992. Brazil was third in tantalum concentrate production in 1993, following Australia and Malaysia. The Araxá deposit, considered to be the world's largest and the most economically viable ore body, contains columbite and tantalite.

Copper.—Brazilian copper concentrate production amounted to 43,568 tons (Cu content) in 1993. Total primary metal production amounted to 161,950 tons, which was produced by Caraíba Metais from the Caraíba deposit in Jaguari, Bahia (75.5%), and the Brazilian Copper Company's operations in Camaquã, Rio Grande do Sul (24.5%). Secondary metal production increased to 53,700 tons or 2.7% over that of 1992. CVRD and its partners, Mineração Morro Velho, S.A. (MMV), a company controlled by the South African group Anglo American and the Brazilian group Bozano Simonsen, had concluded feasibility studies for the Salobo deposit in Carajás, Pará, proving 1.3 billion mt of reserves having a grade of 0.86% copper with associated gold, molybdenum, and silver. Production is planned at the rate of 150,000 mt/a of copper metal. The expected production of gold and silver is about 8 mt/a and 20 mt/a, respectively. CVRD announced plans to build a $345 million, 225,000-mt/a copper refinery near its Salobo Mine. This important project was expected to go on-line sometime in 1998.

Copper-consuming companies in Brazil imported approximately 78,000 tons of copper in 1993. Exports were 98,100 tons or 2% over those of 1992. Brazil's 1993 metallic copper production was used primarily in construction and in automobile manufacturing. In 1993, the installed capacity of Brazil's copper concentrators and refineries had the potential to supply 39% and 108% of the domestic apparent consumption, respectively.

CPRM, the State mineral resources prospecting company, announced plans to invest $1.5 million in an extensive survey of the national copper reserve that covers an area of 546,000 km^2 straddling the States of Amapá and Pará. The reserve created in 1984 has never been properly surveyed.

Gold.—Gold production in 1993 was approximately 79 tons, which represented a decrease of about 8% with respect to 1992. MMV produced 12,231 kg of gold in 1993. The second largest producer of gold in Brazil was CVRD with 11,280 kg. Igarapé Bahía in Pará produced 4,856 kg and Rio Tinto Zinc Mineração (RTZ), a British concern associated with Eike Batista, produced 5,220 kg from the Paracatu Mine in Minas Gerais. Another important increase from 1,948 kg in 1992 to 2,463 kg in 1993, was that of Caraíba Metais, the largest copper producer in Brazil, which produced gold as a byproduct.

In early 1993, the Minas Gerais Environment Policy Commission closed a garimpo (cooperative of independent miners) alluvial gold mining operation on the Paracatu River. Health checks on the 2,000 garimpeiros (independent miners) that worked there revealed an excessive exposure to mercury. Many had absorbed mercury into their bloodstreams at more than 200 times the permissible levels.

São Bento Mineração, 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 early 1994. 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 1993, ferroalloy production decreased to 937,005 tons or 8% from that of 1992. For the year, exports increased from those of 1992 and reached 473,900 tons, while imports decreased from 25,000 tons to 16,700 tons. In 1993, Brazil was the fourth largest ferroalloy producer in the world and the third largest exporter. Apparent domestic consumption was approximately 693,000 tons.

Indústria e Comercio de Minerios (ICOMI) announced in early 1993 that ferromanganese production had begun at its new plant at Porto de Santana, Amapá State. The plant, with a capacity of 20,000 mt/a, was operated by Cía. Ferroligas do Amapá, 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 Metalúrgicos, S.A. to build a 160,000-mt/a ferromanganese plant. The plant, to be installed in Marabá, Pará State, will be 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.

Eletrovale, S.A. Indústria e Comércio [ELETROVALE-CVRD (44.01%), Mitsubishi (25.5%), Kawasaki Steel (25.5%), and Florestas Rio Doce, S.A. (4.99%)] was contemplating building a silicon ferroalloy plant in Nova Era, Minas Gerais State, with an installed capacity of 48,000 mt/a.

Iron Ore.—Brazil's 1993 production of iron ore, reportedly 159.4 Mmt, increased by 9.2% over that of 1992. CVRD produced 89.3 Mmt and exported 67.5 Mmt, representing 63.7% of the total iron ore exports. The remaining major producers, in order of descending output, were Minerações Brasileiras Reunidas S/A (MBR), 20 Mmt; Ferteco Mineração, S.A., 10 Mmt; S.A. Mineração da Trindade (SAMITRI), 10 Mmt; and Samarco Mineração, S.A. (SAMARCO), 8 Mmt.

The total iron ore exports for 1993 was about 116 Mmt, which represented an increase of almost 4% compared with 1992. Total export revenues of $2.8 billion also increased by about 7% when compared with 1992. The major importers of Brazilian iron ore were Japan (25.5%) and Germany (19.3%). In 1993, the United States imported 4% of Brazil's total iron ore exports.

MBR, Brazil's second largest iron ore producer, announced plans to invest $1 billion during 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 23 Mmt/a by the end of the decade.

SAMARCO, controlled by BHP-Utah and SAMITRI, continued its expansion plans at Mariana Mine, Minas Gerais State, and at Anchieta Mine in Espírito Santo State, and opened its Alegría Mine in Minas Gerais State to produce 3 Mmt/a, which required an investment of $70 million.

Pig Iron.—Brazil produced 23.9 Mmt of pig iron, which was 3% higher than that of 1992, and exported 2.5 Mmt valued at $287 million; approximately one-third of the pig iron traded in the world. The Brazilian environmental laws stipulated that by 1992 a minimum of 50% of the charcoal used in pig iron production had to come from reforested areas rather than the virgin forests. A maximum of 20% of the charcoal usage was allowed to be purchased from third parties. It also was stipulated that the percentage of charcoal used by the pig iron producers from their own reforestation programs must grow by 10% per year until it reaches 100% by 1995.

Steel.—Brazil's 1993 steel production totaled 25.2 Mmt, which increased about 5% in comparison to 1992, placing the country eighth in world ranking. Steel exports amounted to 12.2 Mmt valued at $3.6 billion. The major recipients of those exports were Asia, 5 Mmt; Latin America, 2 Mmt; and the United States, 1.4 Mmt. Steel imports were 194,000 mt valued at $211 million. Thus, Brazil enjoyed a very positive balance in its steel trade. The Instituto Brasileiro de Siderurgia (IBS) stressed that the Brazilian steel industry no longer received subsidies or enjoyed tariff protection that it once had and that the industry became more efficient than ever because of the major changes it has made via privatization. Brazil would be allowed to continue to sell its steel products to the United States without a VRA quota or countervailing duty.

Privatization has changed the Brazilian steel industry, fundamentally in efficiency and employment levels. Vertical integration was evident as suppliers and customers of the steel companies participated in the auctions. For instance, CVRD acquired significant minority holdings in CST, CSN, and USIMINAS. CVRD supplied iron ore to these companies and will provide them with railroad, port, and shipping facilities as well.

The Government's privatization program has identified Brazil's steel industry as one of the first sectors for auction, via the stock exchanges of Rio de Janeiro and São Paulo. Beginning with USIMINAS sold in October 1991, the State-owned steel companies are to be privatized. The last companies sold in 1993 were COSIPA and AÇOMINAS. The decline in employment in the steel industry from 174,000 in 1989 to 133,000 in 1990 probably came about because of the economic recession in Brazil, while the employment reduction from the 1990 levels to 102,300 in 1993 reflected, in part, the effects of privatization. State-owned companies expecting to be privatized reduced employment levels in anticipation of the process.

In 1993, Brazil exported almost 50% of its steel production as a result of its recessionary and weak economy; however, this share could change in the foreseeable future as the Brazilian economy improves.

Manganese.—Brazilian production in 1993 was about 1.9 Mmt, which was about the same level as that of 1992. ICOMI, controlled by the CAEMI group, was the principal Brazilian producer with 939,000 tons of ore and reported shipments of 221,000 tons and 160,000 tons to foreign and domestic markets, respectively. ICOMI's Serra do Navio Mine near Macapá, Amapá, was the largest producer of manganese in Brazil. CVRD continued operating its high-grade manganese mine, Igarapé Azul, in the Carajás complex. The high content of aluminum in the ore, about 8%, may be a negative factor affecting the marketability of the Igarapé Azul ore. CVRD's production declined by 33.8% to 574,400 tons; however, sales increased by 5% to 384,800 tons for foreign markets and by 44% to 284,100 tons for the domestic market. The other producers' (SAMITRI, SMML, and URUCUM) output was 393,000 tons with shipments of 358,000 tons and 210,000 tons to foreign and domestic markets, respectively.

Tin.—Brazil no longer continued to be the leading tin producer in 1993. Tin production decreased from 50,200 tons in 1989 and 27,500 tons in 1992 to 25,900 tons in 1993. The reduction in Brazilian output was attributed to the closing of some high-cost operations and the decline in tin prices. Brazilian tin exports in 1993 declined to 19,400 tons compared with those of 1992. Domestic consumption was about 6,300 mt/a, a small increase over that of 1992.

Paranapanema, S.A. Mineração, Industría e Construção, Brazil's largest tin-mining company, reported that its tin output was 15,000 tons from its high-grade Pitinga Mine, with byproducts of columbium, tantalum, zirconium, hafnium, thorium, and chryolite, in order of importance. In 1993, the legal dispute for the mining rights continued. Garimpeiros continued smuggling tin ore to Bolivia. Empresa Brasileira de Estanho, S.A. (EBESA, 49 2/3%; PARANAPANEMA and a pool of Brazilian tin mining companies, 50 1/3%) has a $20-million expansion plan for its Bom Futuro tin mine in Mato Grosso State. The outputs of garimpos and small mines in Minas Gerais State and other small mines in Rondônia and Pará States were 26% and 9% of Brazilian production, respectively.

Titanium.—In 1993, CVRD invested in the production of titanium sponge and an advanced titanium compound used in the space, shipbuilding, and chemical industries. 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 dioxide sizing and packaging facility at Uberaba, Minas Gerais. The plant began operations in early 1993.

Industrial Minerals

Gemstones.—For many years, Brazil has been an important producer and exporter of gemstones in the world. This ranking has applied in terms of volume as well as variety. The large proportion of gemstones produced was mined by garimpeiros. For this reason gemstone reserves are unknown, but Brazil appears to have high potential.

In 1993, the total value of gemstone (including diamond) exports remained at the same level as that of 1992. Exports of uncut gemstones have declined since 1990 despite the removal of some export barriers.

Quartz.—A consortium of CVRD, Nisso Iwai (Japan), and Telequartz began production of quartz powder in 1990. 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 1993, Brazil produced 3,100 tons and continued to be 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.—Potassium production in 1993 more than doubled that of 1992, from 85,000 tons to 173,400 tons. Brazil imported 57,000 tons of potash in 1993.

Production of phosphate rock concentrate amounted to almost 3 Mmt, an increase of 5% over the 1992 output. Production was highly concentrated in three mining companies, Fertilizantes Fosfatados, S.A. (FOSFERTIL), Arafertil, S.A. (ARAFERTIL), and Goiasfertil, S.A. (GOIASFERTIL), representing 70% of the total domestic output. The reported domestic consumption was 3.1 Mmt/a. Seventy-three percent of the phosphoric acid was used in the fertilizer industry, 25% in the chemical industry, and the rest in other uses. The industry has changed because of the privatization process and elimination of trade barriers; the Government has privatized GOIASFERTIL and FOSFERTIL. The import tariff for phosphate rock was set at 5%, indicating that the sector must be more efficient and cost effective to compete with foreign sources.

Mineral Fuels

In 1993, the total amount of energy produced was 152.4 Mmt of oil equivalent. The primary sources, in order of importance, were hydraulic energy, firewood, petroleum, sugarcane bagasse, natural gas, steam coal, metallurgical coal, and uranium. Imported energy sources were 78.2 Mmt of oil equivalent. Total energy consumption was 162.4 Mmt of oil equivalent. Export, variations in inventory, nonutilized, and reinjected energy totaled 10.1 Mmt of oil equivalent. The transportation sector consumed 32.6 Mmt of oil equivalent and the industrial sector 69.2 Mmt of oil equivalent. Consumption, in the mineral industry, by category and in order of importance, was pig iron and steel, 17.5 Mmt of oil equivalent; nonferrous and other metals, 8.2 Mmt of oil equivalent; cement, 2.8 Mmt of oil equivalent; mining and pelletization, 2.6 Mmt of oil equivalent; and ferroalloys, 2.6 Mmt of oil equivalent.

Coal.—The Brazilian coal industry is not a large component of the minerals industry. Coal production is concentrated in the southern States of Santa Catarina, 60%; Rio Grande do Sul, 36%; and Parana, 3%, with minor production from Minas Gerais. Brazil's total coal production in 1993 was about 4.7 Mmt/a, which is about 8% higher than the 1992 output. About 20% was metallurgical coal and the remainder was for power generation.

Most Brazilian coal is of lower quality than Colombian coal. Total Brazilian coal reserves were estimated at 23.7 billion mt. Imports increased by more than 4% to approximately 11.4 Mmt/a, which was almost entirely composed of metallurgical coal. The United States exported an estimated 5 Mmt of metallurgical coal to Brazil in 1993.

Natural Gas and Petroleum.—The gas pipeline linking the Enchova platform in the offshore Campos Basin to Macaé, Río de Janeiro has added 5 Mm^3/d of gas flow to the Río de Janeiro and São Paulo markets.

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

Petroleum production was about the same level of 1992, or averaged 702,000 bbl/d (about 330 working days), while natural gas production increased about 5%. In 1993, Brazil's imports of petroleum were 209 Mbbl at a cost of $3.5 billion. Petroleum imports by PETROBRAS were as follows: Saudi Arabia, 180,000 bbl/d; Argentina, 120,000 bbl/d; Kuwait, 80,000 bbl/d; Nigeria, 80,000 bbl/d; and Algeria, 70,000 bbl/d.

The Enchova platform in the Campos Basin went back into production in early 1990, only 18 months after being almost completely destroyed by fire.

Nuclear.—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 have not been announced. Brazil contains the fifth largest uranium reserves in the world. Reserves in 1993 amounted to about 163,000 mt of U_3O_8 and 92,000 mt of inferred reserves. Private interests are permitted to participate in uranium exploration and production in Brazil

through State-owned joint ventures; however, there is a restriction that no more than 20% of the country's uranium reserves may be exported.

Reserves

In 1993, Brazil was among the world leaders in reserves of the following mineral commodities, by rank: columbium (1); tin (3); bauxite (4); iron ore (4); talc and pyrophyllite (4); and manganese (5). *(See table 3.)*

INFRASTRUCTURE

In 1993, Brazil's railroads comprised 25,268 km of 1.000-m gauge, 4,339 km of 1.600-m gauge, 74 km of 1.600- to 1.000-m gauge, 13 km of 0.760-m gauge, and 2,308 km electrified; a total of 32,002 km. The country contained a total of 1,448,000 km of roads: 48,000 km paved and 1,400,000 km gravel and dirt. There was 50,000 km of navigable inland waterways. The major shipping ports were Belém, Manaus, Porto Alegre, Recife, Río de Janeiro, Río 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 1992, 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.

Power investment negotiations were under way between the Brazilian Government and five companies, four of which were foreign subsidiaries. The companies involved were Alcan Aluminio do Brasil, S.A. (Canada), Alcoa Aluminio, S.A. (United States), Billiton Metais, S.A. (Netherlands), Dow Química, S.A. (United States), and the Brazilian company Camargo Corréa 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 Maranhão and Tocantins States. A Billiton spokesperson 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 Tucurui 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 the early 1980's. Another study found that the lack of proper maintenance of Brazilian roads added 10% to 15% to the total transportation costs in the country.

A study by 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 Vitória, the costs exceeded $10.00 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 so great that Brazilian importers paid almost $300 million in penalties charged by ships that had to wait in line to be unloaded.

Constran, S.A. Construção e Comércio of the Itamaraty Group, of the private sector of Brazil, plans to construct 1,718 km of additional railroads linked to the existing railroad system. The initial 311 km of railroad, at a cost of about $300 million, was expected to be completed by the end of 1994. The cost of the new system was projected to be $2.5 billion. This addition will connect to the existing system, which runs through Vitória, Espírito Santo; Belo Horizonte, Minas Gerais; Santos, São Paulo; and Chapadao do Sul, Mato Grosso do Sul. The new railroad system will run from Chapadao do Sul, Mato Grosso do Sul, to Cuiabá, Mato Grosso, and Santarem, Pará, branching from Cuiabá, Mato Grosso, to Porto Velho, Rondônia.

OUTLOOK

Brazil's GDP increased by 5% in 1993, a much improved change from the decrease of about 1% in 1992. Not only does this indicate sustainable growth, but it also may signal an end to the recession. Efforts to keep inflation under control would support continued economic growth. The public deficit needs to be reduced along with improvements in its external debt. A factor that may have a negative effect over the longer term is the environment, especially in the Amazon rain forest. Much depends on what approaches are used to protect the environment and to continue within a path of sustainable development.

Next July 1, 1994, Brazil wants to adopt a new currency, the sixth in 10 years, called the "Real." The change is expected to curb inflation from the current 50% per month to about one digit. The Government's economic plan for stabilization "Plano Real," based on Constitutional review and privatization of state-owned monopolies to increase capital flow into the country, and strict control of the domestic deficit, issuance of a new currency, stable foreign exchange rates, renegotiation of its international debt on favorable terms, and reduction of tariffs and non-tariff barriers should position Brazil for a brighter future.

Improvements and additional infrastructures will have a major, direct bearing on Brazilian industries in the foreseeable future. For example, the planned Ferronorte railroad system and modernization of existing ports will augment Brazil's ability to increase industrial production and competitiveness. The sectors most likely to be impacted are those that depend most heavily on electricity and transportation facilities. The aluminum, auto, steel, petrochemical, and pulp and paper industries, which depend heavily on energy and on exports, will benefit most from improved infrastructures. If a

positive rate of economic growth is sustained into 1994 and beyond, the steel sector, for instance, should continue its recovery as the demand for cars and other steel intensive goods increase.

Privatization of State-owned firms has led to lower employment levels and greater efficiencies. As a result, the Brazilian economy became more competitive in the global economy. Privatization, constitutional review to lift restrictions on foreign investments in Brazil's mining industry, dismantling all trade barriers, and increased exports to the world markets will continue to be important, allowing continued inflow of fresh capital into the Brazilian economy. The Government needs to redress the balance between guaranteeing the national interest and encouraging the foreign investments necessary to stimulate economic growth to allow Brazil to achieve its full potential.

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[1]Where necessary, values have been converted from Brazilian cruzeiros (C z$) to U.S. dollars at the rate of Cz$25,121=US$1.00 the average rate for 1992.

OTHER SOURCES OF INFORMATION

Agencies

Comissão Nacional de Energia Nuclear (CNEN)
Rua General Severianao
90 Botáfogo-ZC-02
22290-Rio de Janeiro-RJ-Brasil

Companhia de Pesquisa de Recurso Minerais (CPRM)
Avenida Pasteur 404-Anexo, 2° Andar, Pria Vermelha
22290-Rio de Janeiro-RJ-Brasil

Conselho de Não-Ferrosos e de Siderurgia (CONSIDER)
Esplanados dos Ministerios-Bloco 6-5° Andar
70053-Brasilia-DF-Brasil

Conselho Nacional do Petróleo (CNP)
SGAN-Q.603 Modulos J, I e H
70830-Brasilia-DF-Brasil

Instituto Brasileiro de Mineração (IBRAM)
Avenida Afonso Pena, 3880 3°, 4° e 5° Andares
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Petróleo Brasileiro, S.A. (PETROBRAS)
Avenida República do Chile, 65
20035-Río de Janeiro-RJ-Brasil

Rio Doce Geológica e Mineração, S.A. (DOCEGEO)
Avenida President Wilson 11° Andar
22030-Rio de Janeiro-RJ-Brasil

Publications

American Consulate General, Rio de Janeiro: Periodic economic and industrial outlook reporting.

American Embassy, Brasilia: Foreign Economic Trends Report, annual.

Associação Brasileira dos Produtores de Ferroligas (ABRAFE), Sao Paulo: ABRAFE Yearbook, annual.

Departamento Nacional da Produção Mineral, Brasilia: Anuario and Sumario Mineral, annual.

Fairchild Publications, New York: American Metal Market, weekly.

Instituto Latinoamericano del Fierro y el Acero (ILAFA), Santiago: Monthly and annual reports.

Latin American Mining Institute, Washington, DC: The South American Investment and Mining Guide, annual.

Metal Bulletin Journals Ltd., London: Metal Bulletin, semiweekly.

Metal Bulletin Monthly, monthly.

Miída Ltd., London: Latin America Mining Letter, weekly.

Mining Journal Ltd., London: Mining Annual Review, annual.

Mining Journal Ltd., London: Mining Journal, weekly.

PenWell Publishing Co., Tulsa: Oil and Gas Journal, weekly.

Petróleo Brasileiro, S.A., Rio de Janeiro: Petrobrás News, quarterly.

U.S. Central Intelligence Agency (CIA), Washington, DC: World Factbook, annual.

TABLE 1

BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993e	Annual capacitye (Jan. 1, 1994)
METALS							
Aluminum:							
Bauxite, dry basis, gross weight		8,665,300	9,678,203	10,413,900	r9,366,000	r9,356,900	11,500,000
Alumina		1,632,000	1,654,800	r1,742,500	r1,833,000	r1,833,100	1,900,000
Metal:							
Primary		889,500	930,600	1,139,600	r1,193,300	1,200,000	1,250,000
Secondary		66,000	60,000	e62,000	e66,000	62,000	72,000
Beryllium: Beryl concentrate, gross weight		800	e850	e850	850	850	900
Cadmium: Metal, primary		283	e200	e200	200	200	300
Chromium:							
Crude ore		829,000	e810,000	e890,000	900,000	900,000	980,000
Concentrate		182,877	102,968	r142,460	r198,000	134,000	265,000
Marketable product[3]		e225,000	256,453	306,900	307,000	r322,902	323,000
Cobalt:e							
Mine output, Co content by hydroxide		r300	r400	r400	r400	400	400
Metal, electrolytic		r70	r240	r240	r240	240	240
Columbium-tantalum ores and concentrates, gross weight:							
Columbite and tantalite		481	342	e320	320	175	500
Djalmaite concentrate e		10	10	10	10	10	10
Pyrochlore concentrate, Cb_2O_5 content		29,023	27,142	28,449	28,500	13,900	30,000
Copper:							
Mine output, Cu content		47,439	36,441	37,947	r39,845	r43,568	50,000
Metal:							
Primary		153,378	152,117	141,443	r157,950	r161,950	162,000
Secondary		54,426	r49,628	37,035	r52,244	53,700	60,000
Gold:							
Mine output	kilograms	22,849	30,098	r34,053	r39,044	36,000	45,000
Garimpos (independent miners)	do.	29,678	71,815	55,525	r46,818	43,000	55,000
Total	do.	52,527	101,913	r89,578	r85,862	79,000	100,000
Iron and steel:							
Ore and concentrate (marketable product):[3]							
Gross weight	thousand tons	157,900	152,300	r151,500	r146,000	159,400	160,000
Fe content e	do.	102,300	99,900	r98,750	r95,200	103,900	105,000
Metal:							
Pig iron[4]	do.	24,363	21,141	r22,695	r23,152	23,931	25,000
Ferroalloys, electric furnace:							
Chromium metal		135	37	37	37	37	135
Ferrocalcium silicon		33,020	27,520	21,708	r22,756	22,000	35,000
Ferrochromium		113,267	83,753	82,225	r91,100	r83,892	115,000
Ferrochromium silicon		8,938	4,973	4,524	r6,759	4,500	10,000
Ferrocolumbium		16,378	16,643	18,959	r16,303	19,000	20,000
Ferromanganese		180,668	170,504	169,103	r e182,000	169,000	182,000
Ferromolybdenum		332	69	47	r—	47	350
Ferronickel		34,997	34,257	34,069	r33,470	34,000	35,000
Ferrophosphorus		1,928	1,278	864	800	800	2,000
Ferrosilicon		286,994	229,408	191,423	r243,838	190,000	290,000
Ferrosilicon magnesium		15,864	10,340	10,168	r10,585	10,000	15,000

See footnotes at end of table.

TABLE 1—Continued

BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]	1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1, 1994)
METALS—Continued						
Metal—Continued:						
Ferroalloys, electric furnace—Continued:						
Ferrosilicon zirconium	1,392	503	102	r104	102	1,500
Ferrotitanium	430	125	126	r4	126	500
Ferrotungsten	22	6	1	r—	1	25
Ferrovanadium	302	44	41	r—	—	300
Inoculant	12,098	11,461	24,431	r20,949	24,500	25,000
Silicomanganese	208,262	216,779	272,046	r e294,700	273,000	295,000
Silicon metal	116,779	131,614	106,002	r93,734	106,000	135,000
Total	1,031,806	939,314	935,876	r1,017,139	937,005	1,161,810
Steel, crude, excluding castings thousand tons	25,055	20,567	22,616	r23,934	25,200	25,200
Semimanufactures, flat and nonflat do.	32,537	29,450	e25,000	25,000	25,000	35,000
Lead:						
Mine output, Pb content	13,970	9,291	7,273	r4,421	4,000	15,000
Metal:						
Primary	32,522	30,118	22,023	r24,533	25,000	35,000
Secondary	53,295	45,330	42,000	r38,267	42,000	55,000
Magnesium metal:e						
Primary	6,200	6,500	6,500	6,500	6,500	6,500
Secondary	1,500	1,600	1,600	1,600	1,600	2,000
Manganese ore and concentrate, marketable, gross weight[3]	1,904,000	2,300,000	2,000,000	r1,992,554	1,900,000	2,300,000
Nickel:						
Mine output, Ni content	18,826	r22,819	r26,376	r29,372	r32,154	30,000
Ferronickel, Ni content	9,445	8,847	8,620	r8,742	r8,683	9,500
Rare-earth metals: Monazite concentrate, gross weight	r1,377	r911	r719	r e770	770	2,500
Silver[6] kilograms	114,117	171,052	154,000	r162,000	155,000	200,000
Tin:						
Mine output, Sn content	50,232	37,580	r29,253	r27,500	25,900	50,000
Metal:						
Primary	44,240	37,580	25,776	r27,000	30,000	45,000
Secondary e	250	250	250	250	250	250
Titanium concentrates, gross weight:						
Ilmenite	144,212	114,117	69,064	r76,558	70,000	150,000
Rutile	2,613	1,814	1,094	r1,798	1,800	3,000
Tungsten, mine output, W content	679	316	223	r205	250	700
Zinc:						
Mine output, Zn content	178,439	158,025	130,000	r149,000	r171,800	180,000
Metal, smelter:						
Primary	155,846	149,483	157,462	r180,414	200,000	160,000
Secondary	6,409	4,603	5,538	r7,000	7,000	7,000
Zirconium: Zircon concentrate, gross weight[7]	32,970	16,907	18,590	r16,874	20,000	35,000
INDUSTRIAL MINERALS						
Asbestos:						
Crude ore e	3,500,000	3,940,000	3,950,000	r2,900,000	3,950,000	4,000,000
Fiber	206,195	205,081	237,000	r170,451	r184,918	250,000

See footnotes at end of table.

TABLE 1—Continued

BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued							
Barite:							
Crude		63,665	64,923	50,978	r72,172	70,000	72,000
Beneficiated		51,407	55,576	46,784	r54,490	50,000	60,000
Marketable product[3]		57,741	68,188	e65,000	e65,000	65,000	70,000
Calcite		45,130	13,368	45,710	45,000	45,000	45,000
Cement, hydraulic	thousand tons	25,926	25,848	27,490	r24,920	28,000	30,000
Clays:							
Bentonite (beneficiated)		188,260	179,646	130,000	r131,180	130,000	200,000
Kaolin:							
Crude		2,187,919	1,624,529	1,838,000	r1,900,000	1,850,000	2,200,000
Beneficiated		714,647	658,927	746,000	r790,000	836,000	840,000
Marketable product[3]		1,022,415	930,753	1,089,000	1,100,000	1,100,000	1,100,000
Diamond:e							
Gem	thousand carats	350	600	600	r653	700	700
Industrial	do.	150	r942	900	r665	600	900
Total[8]	do.	500	r1,542	1,500	r1,318	1,300	1,600
Diatomite:							
Crude e		35,000	r34,000	r32,000	35,000	35,000	35,000
Beneficiated		15,618	13,311	12,446	r14,669	15,000	16,000
Marketable product[3]		15,759	13,313	e13,100	e13,100	13,100	16,000
Feldspar:							
Crude		140,651	104,647	r119,286	r e140,000	120,000	145,000
Feldspar, marketable product[3]		142,893	111,206	121,957	r122,000	122,000	145,000
Leucite, marketable product e [3]		5,000	5,000	5,000	5,000	5,000	5,000
Sodalite, crude, marketable product e [3]		500	500	500	500	500	500
Total e		148,393	116,706	127,457	127,500	127,500	150,500
Fluorspar:							
Crude e		r393,000	r239,000	r300,000	r250,000	400,000	400,000
Concentrates, marketable product:							
Acid-grade		56,973	47,724	52,415	r61,432	67,350	70,000
Metallurgical-grade		38,550	22,659	28,898	r22,264	30,000	40,000
Total		95,523	70,383	81,313	81,000	97,350	110,000
Graphite:							
Crude e		650,000	650,000	650,000	650,000	650,000	650,000
Marketable product:							
Direct-shipping crude ore		13,005	8,400	7,298	7,000	7,000	15,000
Concentrate		31,650	28,890	26,965	r29,414	27,000	30,000
Total		44,655	37,290	34,263	r36,414	34,000	45,000
Gypsum and anhydrite, crude		860,620	823,688	966,651	r887,742	808,822	1,000,000
Kyanite:e							
Crude		700	750	750	750	750	750
Marketable product[3]		600	600	600	600	600	600
Lime, hydrated and quicklime	thousand tons	5,730	r4,900	r5,000	r5,240	5,700	6,000
Lithium: Concentrates		1,471	475	1,560	1,600	1,600	2,000

See footnotes at end of table.

TABLE 1—Continued

BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993[e]	Annual capacity[e] (Jan. 1, 1994)
INDUSTRIAL MINERALS—Contined							
Magnesite:							
Crude		1,385,565	1,432,741	879,477	r1,001,724	1,000,000	1,500,000
Beneficiated		259,508	257,159	242,256	r273,014	280,000	300,000
Mica, all grades[e]		3,700	5,000	5,080	7,000	7,000	7,000
Nitrogen: N content of ammonia		935,400	937,500	e940,000	e940,000	940,000	950,000
Phosphate rock including apatite:							
Crude:[e]							
Mine product	thousand tons	27,000	27,000	27,000	27,000	27,000	30,000
Of which, sold directly	do.	535	35	35	35	35	—
Concentrate:							
Gross weight	do.	3,655	2,968	3,280	r2,825	52,967	4,000
P_2O_5 content	do.	727	625	650	650	650	1,000
Pigments, mineral: Other, crude[e]		r5,072	r3,230	r3,000	r2,500	2,000	5,000
Potash: Marketable product (K_2O)		96,945	65,735	100,667	r85,035	5173,368	174,000
Precious and semiprecious stones except diamond, crude and worked:[e]							
Agate		3,000	3,000	3,000	3,000	3,000	3,000
Amethyst		1,000	1,000	1,000	1,000	1,000	1,000
Aquamarine		20	20	20	20	20	20
Citrine		100	100	100	100	100	100
Emerald		90	90	90	90	90	90
Opal		500	500	500	500	500	500
Ruby	value	$10,000	$10,000	$10,000	$10,000	$10,000	—
Sapphire	do.	$15,000	$15,000	$15,000	$15,000	$15,000	—
Topaz		50	50	50	50	50	50
Tourmaline		80	80	80	80	80	80
Other		e500	e500	500	500	500	500
Quartz crystal, all grades		3,174	r2,291	r1,930	r1,620	3,100	3,200
Salt:							
Marine	thousand tons	2,355	4,170	3,703	r4,030	3,700	4,000
Rock	do.	1,298	r1,204	r1,200	r1,231	4,500	4,500
Silica (silex)	do.	r2,024	r1,834	r1,600	r1,600	1,600	3,361
Sodium compounds:[e]							
Caustic soda		r1,007,000	r1,049,000	r1,050,000	r1,050,000	r1,050,000	1,050,000
Soda ash, manufactured (barilla)		200,000	200,000	200,000	200,000	200,000	200,000
Stone, sand and gravel:[e]							
Dimension stone:							
Marble, rough-cut	cubic meters	150,000	r179,514	200,000	200,000	200,000	200,000
Slate		50,000	50,000	50,000	50,000	50,000	50,000
Crushed and broken stone:							
Basalt	cubic meters	1,000,000	r1,251,264	r e1,300,000	r e1,200,000	1,200,000	1,300,000
Calcareous shells		450,000	450,000	450,000	450,000	450,000	450,000
Dolomite	thousand tons	3,500	3,500	3,500	3,500	3,500	3,500
Gneiss	cubic meters	51,039,829	r1,833,717	1,000,000	1,000,000	1,000,000	1,800,000
Granite	thousand cubic meters	60,000	r50,348	60,000	60,000	60,000	60,000
Limestone	thousand tons	60,000	60,000	60,000	60,000	60,000	60,000
Quartz[9]		250,000	250,000	250,000	250,000	250,000	250,000

See footnotes at end of table.

TABLE 1—Continued

BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993[e]	Annual capacity[e] (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued							
Stone, sand and gravel—Continued:							
Quartzite:							
Crude		400,000	r582,882	400,000	400,000	400,000	400,000
Processed		200,000	r223,783	200,000	200,000	200,000	200,000
Sand: Industrial		2,700,000	2,700,000	2,700,000	2,700,000	2,700,000	2,700,000
Sulfur:							
Frasch		5,721	r5,644	r5,456	r18,182	6,000	18,000
Pyrites		71,740	r46,215	r66,447	r24,684	10,000	90,000
Byproduct:							
Metallurgy		163,724	r165,891	r163,576	r184,057	229,000	229,000
Petroleum		60,121	r58,322	r46,826	r58,513	94,000	94,000
Total		301,306	r276,072	r282,305	r285,436	339,000	431,000
Talc and related materials:							
Talc:							
Crude		393,012	296,338	292,270	r e261,000	290,000	400,000
Marketable product[3]		895	1,597	1,957	r1,500	2,000	2,000
Pyrophyllite: Crude		231,000	174,000	186,000	r e169,000	170,000	240,000
Vermiculite:							
Concentrate		20,523	23,340	r11,031	r14,000	15,000	25,000
Marketable product[3]		6,917	10,080	1,965	2,000	2,000	10,000
MINERAL FUELS AND RELATED MATERIALS							
Coal, bituminous, marketable[3]	thousand tons	7,186	r4,167	r4,254	r4,081	4,565	7,200
Coke, metallurgical, all types	do.	1,006	535	162	r143	200	1,000
Gas, natural: Gross	million cubic meters	6,105	6,278	6,597	r6,973	7,210	7,300
Natural gas liquids	thousand 42-gallon barrels	e9,500	13,073	12,935	13,000	13,000	13,000
Petroleum:							
Crude	do.	217,272	238,211	235,680	r228,125	232,870	240,000
Refinery products:[10]							
Gasoline	do.	149,078	145,649	e145,649	145,700	145,700	150,000
Jet fuel	do.	22,746	20,445	e20,445	20,500	20,500	25,000
Kerosene	do.	2,417	1,536	e1,536	1,540	1,540	2,000
Distillate fuel oil	do.	174,061	170,658	e170,658	170,700	170,700	175,000
Lubricants	do.	4,830	4,871	e4,871	4,900	4,900	5,000
Residual fuel oil	do.	93,054	90,857	e90,857	90,900	90,900	98,000
Other	do.	63,946	68,949	e68,949	69,000	69,000	70,000
Refinery fuel and losses	do.	22,008	23,730	e23,730	23,700	23,700	25,000
Total	do.	532,140	526,695	e526,695	526,940	526,940	550,000

eEstimated. rRevised.

[1]Table includes data available through Nov. 29, 1994.

[2]In 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.

[3]Direct sales and/or beneficiated.

[4]Includes sponge iron as follows, in thousand metric tons: 1989—239; 1990—260; 1991—270; and 1992—270 (estimated).

[5]Reported figure.

[6]Officially 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: 1989—58,000; 1990—52,000; 1991—40,000 (preliminary); and 1992—40,000 (estimated).

[7]Includes baddeleyite-caldasite.

[8]Figures represent officially reported output plus official Brazilian estimates of output by nonreporting miners.

[9]Apparently includes crude quartz used to produce quartz crystal (listed separately in this table) as well as additional quantities of common quartz.

[10]Figures represent officially reported production to the United Nations (Energy Statistics Yearbook) by the Ministry of Mines and Energy of Brazil.

TABLE 2

BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
METALS			
Aluminum	Albras-Aluminio Brasileiro, S.A. (ALBRAS) [Government, 26%; private, 25%; Nippon Amazon Aluminum Co. (NAAC), 49%]	Belém, Pará State (smelter)	160 (metal).
Do.	Alcan Aluminio do Brasil, S.A. (Alcan Aluminium Ltd., 100%)	Saramenha, Minas Gerais State (refinery)	150 (alumina).
Do.	Alcan Aluminio Poços de Caldas (ALUCALDAS) (Alcan Aluminio do Brasil, S.A., 100%)	Poços de Caldas, Minas Gerais State (mine)	1,000 (bauxite).
Do.	Alcoa Aluminio, S.A. (ALUMAR) (Aluminum Co. of America, 60%; Billiton International Metals B.V., 40%)	Poços de Caldas, Minas Gerais State (mine) São Luís, Maranhão State (refinery) (smelter)	400 (bauxite). 550 (alumina). 174 (metal).
Do.	Aluminio do Brasil Nordeste, S.A. (Alcan Aluminum Ltd., 100%)	Aratu, Bahía State (smelter)	58 (metal).
Do.	Billiton Metais, S.A. (Billiton International Metals B.V., 100%)	São Luís, Maranhão State (refinery)	375 (refinery).
Do.	Compahnia Brasileira de Aluminio (CBA) (private, 100%)	Poços de Caldas, Minas Gerais State (mine)	1,000 (bauxite).
Do.	do.	Sorocaba, São Paulo State (refinery) (smelter)	170 (alumina). 170 (metal).
Do.	Compahnia Geral do Minas (private, 21%; Aluminum Co. of America, 79%)	Poços de Caldas, Minas Garais State (refinery) (smelter)	275 (alumina). 90 (metal).
Do.	Mineração Rio do Norte, S.A. (MRN) (Government, 24%; private, 32%; Alcan Empreendimentos Ltda., 24%; Billiton International Metals B.V., 10%; Norsk Hydro Comercio e Indústria, 5%; Reynolds Aluminio do Brasil, 5%)	Oriximina, Pará State (mine)	8,000 (bauxite).
Chromite	Coitezeirio Mineração, S.A. (COMISA) (private, 75.4%; Bayer do Brasil, S.A., 24.6%)	Campo Formosa, Bahía State (mine)	50 (ore).
Do.	Companhia de Ferro Ligas da Bahía (FERBASA) (private, 100%)	Campo Formoso, Bahía State (mine) (beneficiation plant)	370 (ore). 292 (concentrate).
Columbium	Companhia Brasileira de Metalurgia e Mineração (CBMM) (private, 55%; Molycorp, Inc., 45%)	Araxa, Minas Gerais State (mine) (beneficiation plant)	1,200 (ore). 44.
Do.	Mineração Catalão de Goiás Ltda. (private, 68.5%; Anglo American Corp. do Brasil, 31.5%)	Ouvidor, Goiás State (mine)	500 (ore).
Copper	Companhia Brasileira do Cobre (CBC) (private, 100%)	Cacapava do Sul, Rio Grande do Sul State (mine) (beneficiation plant)	1,000 (ore). 1,800 (concentrate).
Do.	Mineração Caraiba Ltda. (Government, 100%)	Jaquarari, Bahía State (mine) (beneficiation plant)	3,000 (ore). 5,700 (concentrate).
Ferroalloys	Companhia Brasileira Carbureto de Calcio (CBCC) (private, 100%)	Santos Dumont, Minas Gerais State (plant)	54.
Do.	Companhia Ferro Ligas de Bahía, S.A. (FERBASA) (private, 100%)	Pojuca, Bahía State (plant)	194.
Do.	Companhia Ferro-Ligas Minas Gerais (MINASLIGAS) (private, 100%)	Pirapora, Minas Gerais State (plant)	58.
Do.	Companhia Paulista de Ferro-Ligas (private, 100%)	Barbacena, Caxambu, Jeceaba, Passa Quatro and Passa Vinte, Minas Gerais State; Corumbá, Matto Grosso do Sul State; and Xanxere, Santa Catarina State (seven plants)	326.
Do.	Italmagnesio, S.A. Indústria e Comercio (private, 100%)	Bragança Paulista, São Paulo State; and Varzeada Palma, Minas Gerais State (two plants)	63.

TABLE 2—Continued

BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
METALS—Continued:				
Gold	kilograms	Companhia de Mineração e Participações (CMP) (private, 100%)	Lourenço, Amapá State (mine) Currais Novos, Rio Grande do Norte (mine)	300.
Do.	do.	Mineração Morro Velho, S.A. (private, 50%; Anglo American Corp. do Brasil, 50%)	Novo Lima, Raposos, and Sabara, Minas Gerais State; and Jacobina, Bahía State (four mines)	2,000.
Do.	do.	São Bento Mineração, S.A. (Gencor Indústria e Comercio Ltda., 49%; Amcor, S.A., 29.4%; Amcor Metais Ltda, 21.6%)	Santa Barbara, Minas Gerais State (mine)	500.
Iron ore		Companhia Vale do Rio Doce (CVRD) (Government, 51%; private, 49%)	Serra dos Carajás, Pará State; and Itabira, Ouro Preto, and Santa Barbara, Minas Gerais State (four mines)	91,000.
Do.		Ferteco Mineração, S.A. (Ferteco) (Exploration und Bergbau Gmbh, 100%)	Ouro Preto and Brumadinho, Minas Gerais State (two mines)	12,800.
Do.		Minerações Brasileiras Reunidas (MBR) (private, 85.3%; Mitsui e Co. Ltd., 14.7%)	Novo Lima and Itibirito, Minas Gerais State (two mines)	31,500.
Do.		Samarco Mineração, S.A. (SAMARCO) (private, 51%; Broken Hill Properties Ltd., 49%)	Mariana, and Alegria Mines, Minas Gerais State, Anchieta Mine, Espírito Santo State	11,700.
Do.		S.A. Mineração da Trindade (SAMITRI) (private, 100%)	Mariana, Rio Piracicaba, Itabira, Ouro Preto and Sabara; Minas Gerais State (five mines)	9,300.
Lead		Mineração Boquira, S.A. (private, 100%)	Boquira, Bahía State (mine) (Beneficiation plant)	300 (ore). 310 (concentrate).
Manganese		Companhia Vale do Rio Doce (CVRD)	Corumbá, Minas Gerais State (mine) Serra dos Carajás, Pará State (beneficiation plant)	500 (ore). 1,000 (concentrate).
Do.		Indústria e Comercio de Minerios, S.A. (ICOMI) (private, 100%)	Macapá and Mazagão, Amapá State (two mines) (beneficiation plant)	1,500 (ore). 800 (concentrate).
Nickel		Companhia Niquel Tocantins (private, 100%)	Niquelandia, Goiás State (mine)	150 (ore).
Steel		Aço Minas Gerais, S.A. (AÇOMINAS) (private, 100%)	Rodovia, Minas Gerais State	2,000.
Do.		Companhia Siderúrgia Nacional (CSN) (private, 100%)	Volta Redonda, Rio de Janeiro State	4,600.
Do.		Companhia Siderúrgica Paulista (COSIPA) (private, 100%)	Cubatão, São Paulo State	3,900.
Do.		Companhia Siderúrgica de Tubarão (CST) (other, 74%; Kawasaki Steel Corp.,13%; Societa Finanziaria Siderúrgia-Finsider, 13%)	Serra, Espírito Santo State	3,000.
Do.		Usinas Siderúrgicas de Minas Gerais, S.A.(USIMINAS) (others, 86%; Nippon Usiminas, 14%)	Ipatinga, Minas Gerais State	4,400.
Do.		Companhia Aços Especiais Itabira (AÇESITA) (Government, 90.9%; private, 9.1%)	Timoteo, Minas Gerais State (stainless steel plant)	600.
Do.		Companhia Siderúrgica Belgo - Mineira (private, 100%)	João Monlevade, Minas Gerais State	1,000.

TABLE 2—Continued

BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
METALS—Continued:			
Tin	Mineração Jacunda Ltda (private, 100%)	Santa Barbara, Novo Mundo, and Potosí; Rondônia State (six mines) (three beneficiation plants)	108 (ore). 450 (concentrate).
Do.	Paranapanema, S.A. Mineração, Indústria e Construção (private, 100%)	Aripuana, Mato Grosso State; Ariquemes, Rondônia State; Novo Aripuana and Presidente Figueiredo, Amazonas State; and São Felix do Xingu, Pará State (five mines) (two beneficiation plants) Piraporada Bom Jesús, São Paulo State (refinery)	5,420 (ore). 1,400 (concentrate). 25 (metal).
Titanium	Rutilo e Ilmenita do Brasil, S.A. (RIB) (private, 100%)	Mataraca, Paraíba State (mine) (two beneficiation plants)	4,200 (ore). 120 (concentrate).
Zinc	Companhia Minera de Metais (CMM) (private, 100%)	Vazante, Minas Gerais State (mine) (beneficiation plant)	800 (ore). 48 (concentrate).
Do.	do.	Tres Marias, Minas Gerais State (refinery)	72 (metal).
Do.	Mineração Areiense, S.A.-MASA (MASA) (private, 100%)	Vazante, Minas Gerais State (mine)	400 (ore).
Zirconium	Nuclemon Minero-Química Ltda. (Government, 100%)	São João da Barra, Rio de Janeiro State (mine)	660 (ore).
Do.	do.	Itapemirim, Espírito Santo State (mine)	90 (ore).
Do.	do.	Prado, Bahía State (mine) (three beneficiation plants) (three separation plants)	90 (ore). 123 (concentrate). 90 (concentrate).
INDUSTRIAL MINERALS			
Asbestos	SAMA-Sociedade Anonima Mineração de Amianto (SAMA) (private, 100%)	Minacu, Goiás State (mine) (beneficiation plant)	9,000 (ore). 230 (concentrate).
Cement	Cimento Santa Rita, S.A. (private, 100%)	Itapevi, São Paulo State (plant) Salto de Pirapora, São Paulo State (plant)	1,000. 1,200.
Do.	Companhia Cimento Portland Itau (private, 100%)	Itau de Minas, Minas Gerais State (three plants)	2,400.
Cement	Companhia de Cimento Portland Paraiso (private, 100%)	States of Espírito Santo, Goiás, Minas Gerais and Rio de Janeiro (five plants)	4,000.
Do.	Companhia de Cimento Portland Rio Branco (private, 100%)	Rio Branco do Sul, Paraná State (two plants)	5,000.
Diamond	Mineração Tejucana, S.A. (private, 100%)	Diamantina, Minas Gerais State (mine)	100.
Fluorspar	Mineração Nossa Senhora do Carmo Ltda. (private, 100%)	Morro da Fumaça and Pedras Grandes, Santa Catarina State (four mines) (two beneficiation plants)	180 (ore). 220 (concentrate).
Do.	Mineração Santa Catarina Ltda. (private, 100%)	Morro da Fumaça and Pedras Grandes, Santa Catarina State (four mines) (beneficiation plant)	100 (ore). 120 (concentrate).
Do.	Nacional de Grafite Ltda. (private, 100%)	Itapecerica and Pedra Azul, Minas Gerais State (three mines) (two beneficiation plants)	840 (ore). 720 (concentrate).
Gypsum	CBE-Companhia Brasileira de Equipamento (CBE) (private, 100%)	Codo, Maranhão State and Ipubi, Pernambuco State (two mines)	100.
Do.	Companhia de Cimento Portland Paraiso (private, 100%)	Ipubi, Pernambuco State (mine)	50.

TABLE 2—Continued

BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
INDUSTRIAL MINERALS—Continued				
Kaolin		Caulim da Amazonia, S.A. (CADAM) (private, 100%)	Mazagão, Amapá State (mine) (beneficiation plant)	720 (ore). 360 (concentrate).
Do.		Empresa de Mineração Horii Ltda. (Horii) (private, 100%)	Biritiba and Mogi das Cruzes, São Paulo State (two mines) (two beneficiation plants)	200 (ore). 180 (concentrate).
Limestone		Companhia de Cimento Portland Paraiso (private, 100%)	States of Goiás, Minas Gerais, and Rio de Janeiro (five mines)	2,000.
Do.		Companhia de Cimento Portland Rio Branco (private, 100%)	Rio Branco do Sul, Paraná State (three mines)	5,500.
Do.		S.A. Indústrias Votorantim (private, 100%)	States of Rio de Janeiro, and São Paulo (four mines)	1,000.
Magnesite		Magnesita, S.A. (private, 100%)	Brumado, Bahía State-(one major mine and numerous small mines) (two beneficiation plants)	770 (ore). 820 (concentrate).
Phosphate rock		Arafertil, S.A. (ARAFERTIL) (Government, 33.33%; private 66.67%).	Araxa, Minas Gerais State (mine)	5,000.
Do.		Copebras, S.A.(Copebras) (private, 90.55%; Anglo American Corp. do Brasil, 9.45%)	Ouvidor, Goiás State (mine)	4,400.
Do.		Fertilizantes Fosfatados, S.A. (FOSFERTIL) (private, 100%)	Tapira, Minas Gerais State (two mines)	10,500.
Do.		Serrana, S.A. de Mineração (Serrana) (private, 100%)	Jacupiranga, São Paulo State (mine)	6,000.
Salt (rock)		Mineração e Química do Nordeste, S.A. (Dow Produtos Químicos Ltda., 100%)	Vera Cruz, Bahía State (mine)	1,000.
MINERAL FUELS				
Coal		Carbonífera Criciuma, S.A. (private, 100%)	Circiuma and Sideropolis, Santa Catarina State (two mines)	4,000.
Do.		Companhia Carbonífera de Urussanga (CCU) (private, 100%)	Criciuma, Sideropolis, and Urussanga; Santa Catarina State (three mines)	7,200.
Do.		Companhia de Pesquisas e Lavras Minerais-Copelmi (COPELMI) (private, 100%)	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) (Government, 81.4%; private, 11.8%; public, 6.8%)	99 fields in the States of Alagoas, Amazonas, Bahía, Ceará, Espírito Santo, Rio de Janeiro, Rio Grande do Norte, Pará, Maranhão, and Sergipe States	220,000.
Petroleum products	do.	do.	11 refineries in the States of Amazonas, Bahía, Ceará, Minas Gerais, Paraná, Rio de Janeiro, Rio Grande do Sul, and São Paulo	503,000.
Do.	do.	Refinaria de Petroleo Ipiranga, S.A. (private, 100%)	Ipiranga, Rio Grande do Sul	3,400.
Do.	do.	Refinaria de Petroleos de Manguinhos, S.A. (private, 100%)	Manquinhos, Rio de Janeiro State	3,650.

TABLE 3

BRAZIL: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1993

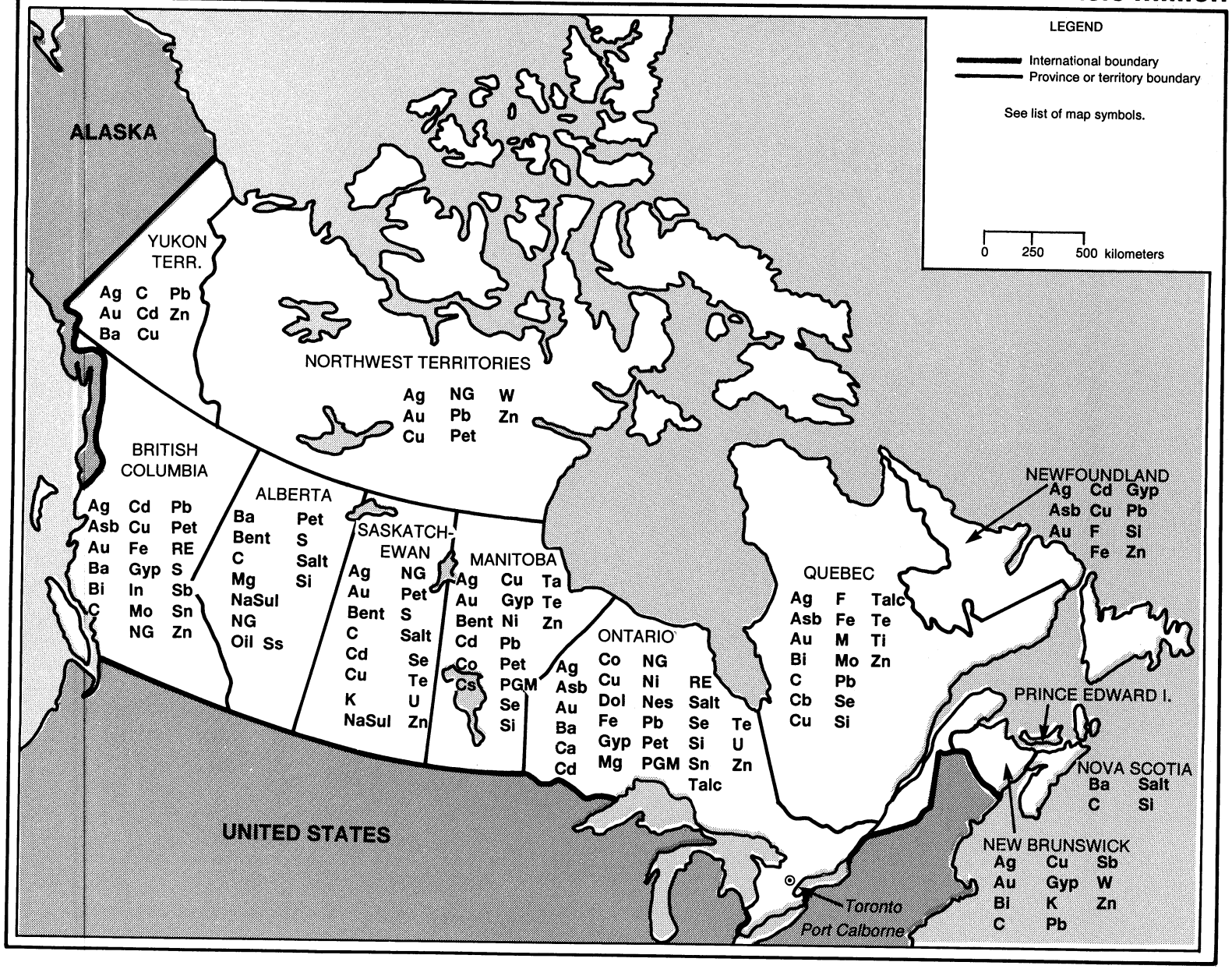
(Thousand metric tons unless otherwise specified)

Commodity	Reserves
Asbestos, fiber	3,034
Bauxite, ore	2,700,000
Chromite, Cr_2O_3 content	4,310
Coal, all types	30,976,000
Columbium, pyrochlore, and columbite ore	3,629
Copper, metal content	11,600
Fluorspar, ore	8,000
Gold, metal metric tons	760
Graphite, ore	28,000
Gypsum	677,576
Iron ore, 60% to 65% Fe content	19,200,000
Kaolin	1,550,000
Lead, metal content	366
Magnesite	180,000
Manganese, metal content	55,832
Natural gas[1] million cubic meters	123,776
Nickel, metal content	6,082
Petroleum[2] thousand 42-gallon barrels	9,800,000
Phosphate rock	300,000
Talc and pyrophyllite	123,000
Tin, metal content metric tons	645,060
Titanium, TiO_2 content	3,850
Uranium, U_3O_8 metric tons	163,000
Zinc, metal content	5,000
Zirconium, ore	1,738

[1]Petroleo Brasileiro, S.A. (PETROBRAS), 1992 Annual Report, p. 13.
[2]World Oil, Apr. 1994, p. 11.

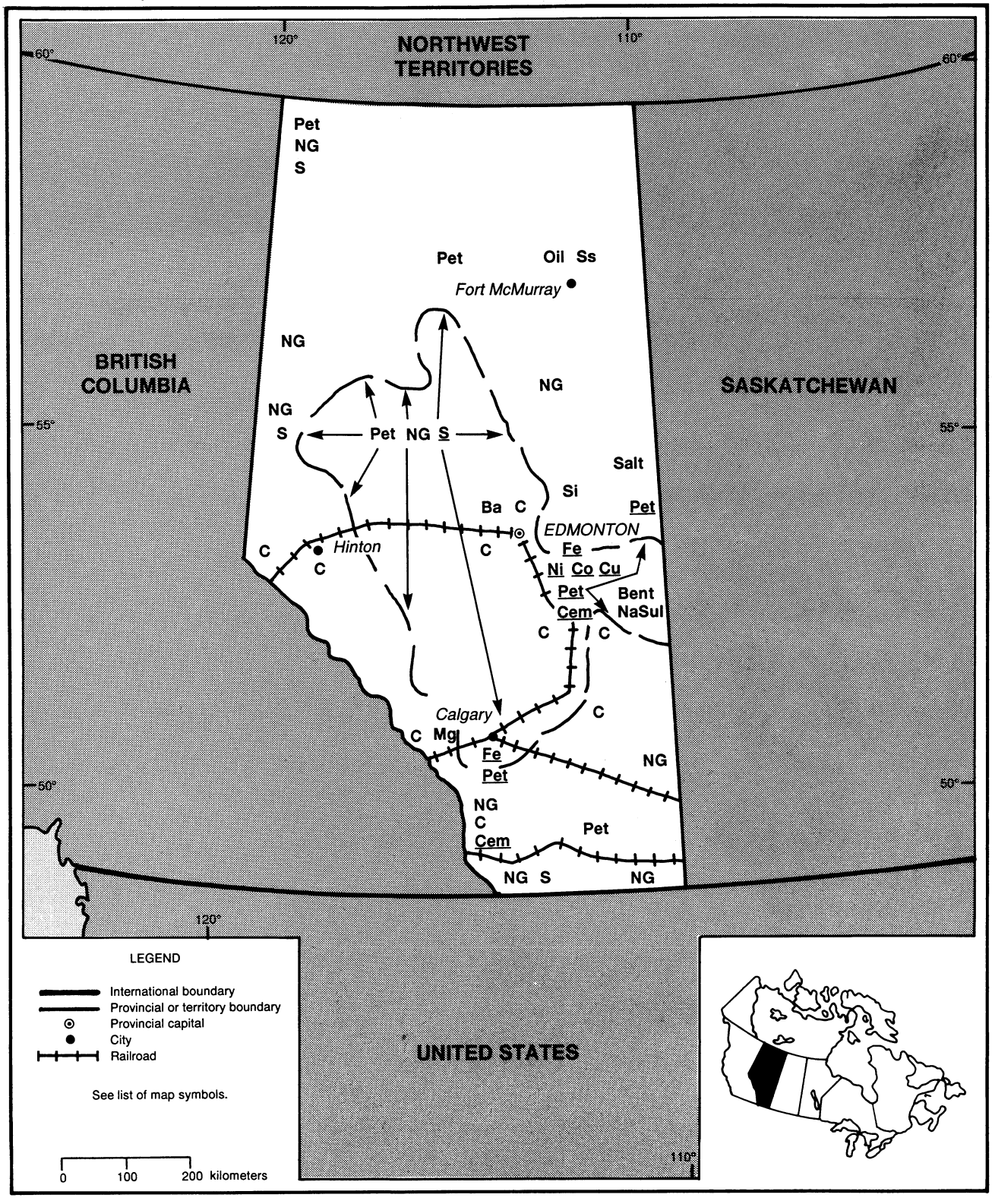
MAJOR MINERALS IN CANADA

AREA 9,976,140 km² **POPULATION 28.8 million**



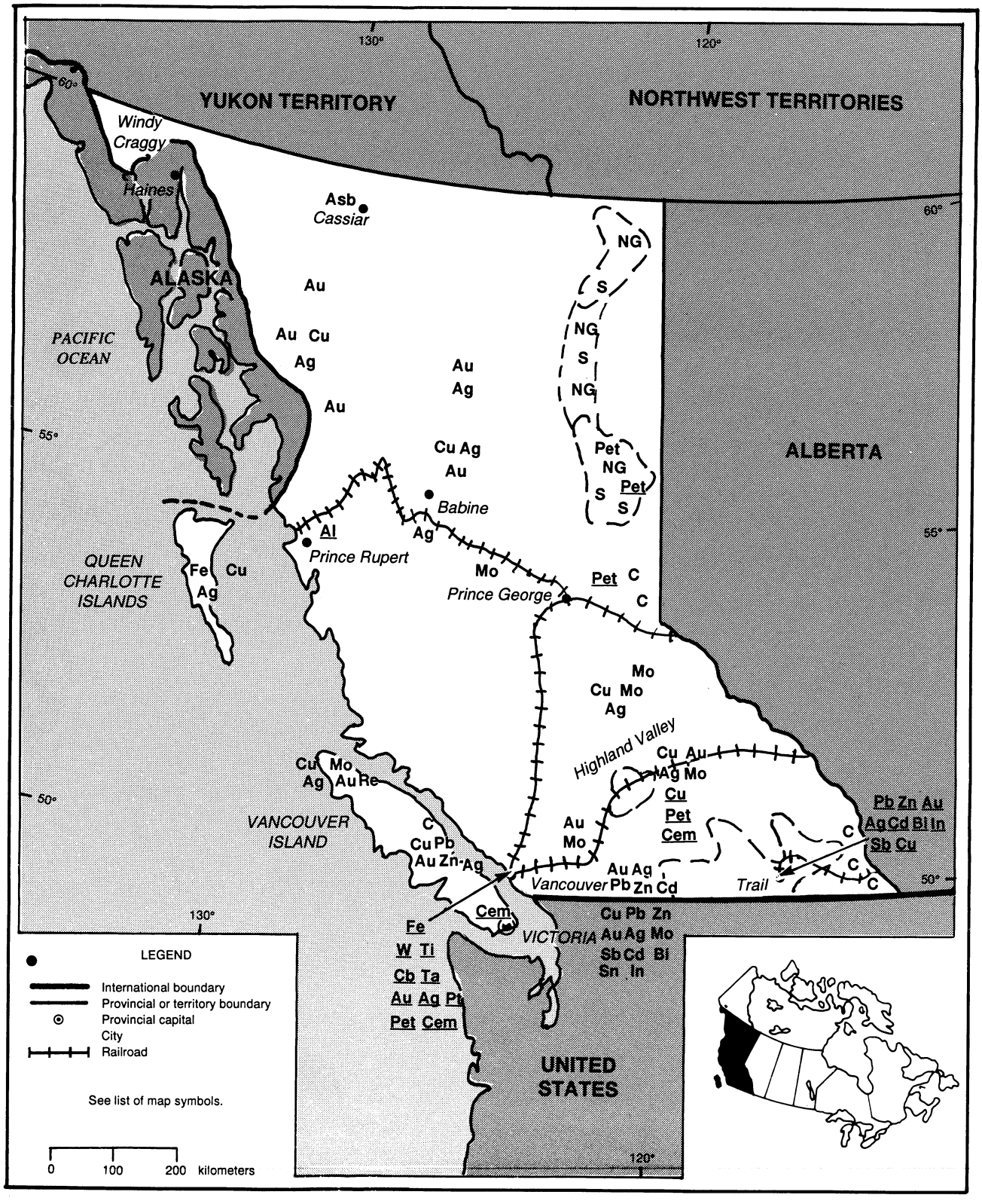
ALBERTA

AREA 661,200 km² **POPULATION 2.7 million**



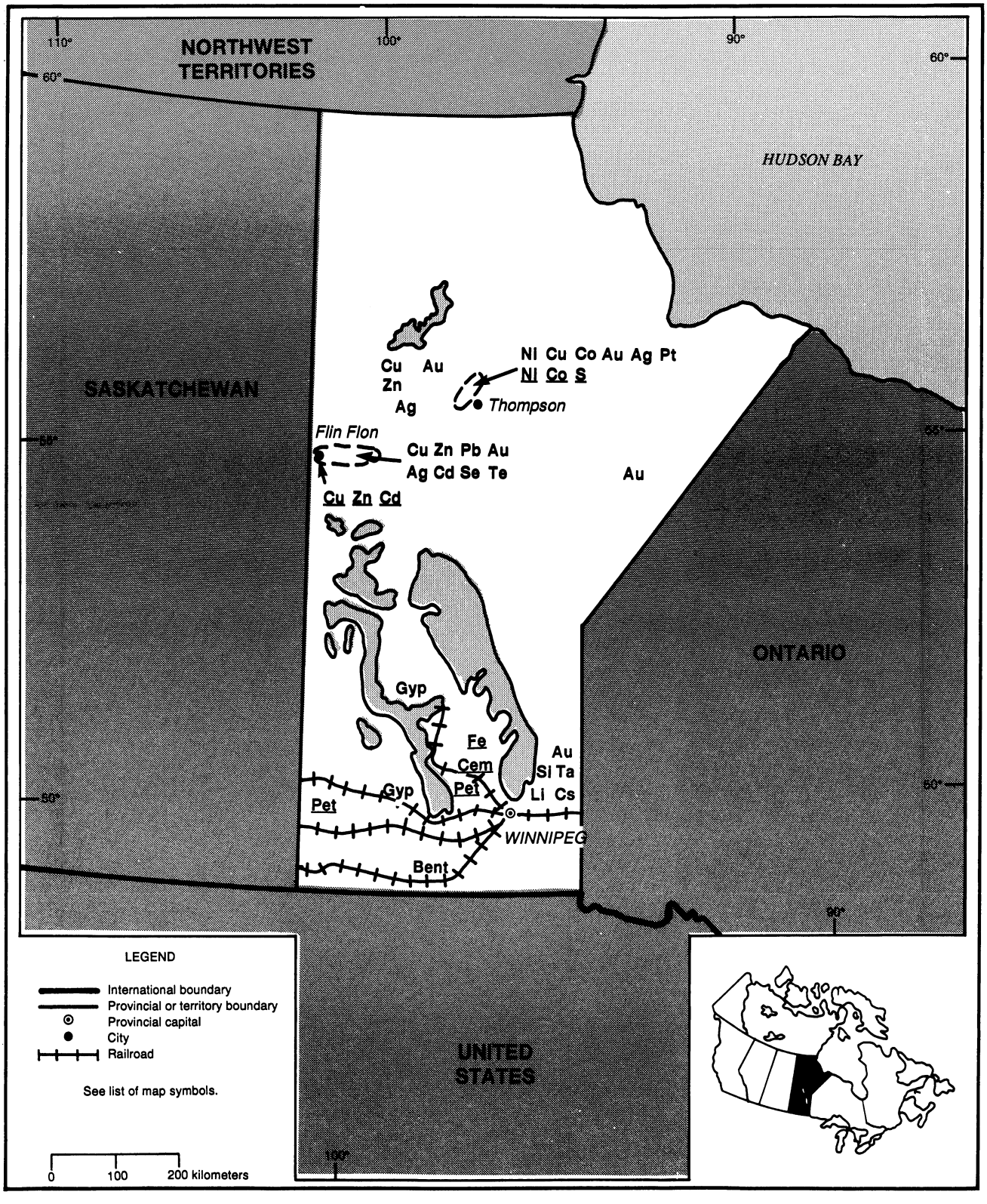
BRITISH COLUMBIA

AREA 948,600 km² **POPULATION 3.5 million**



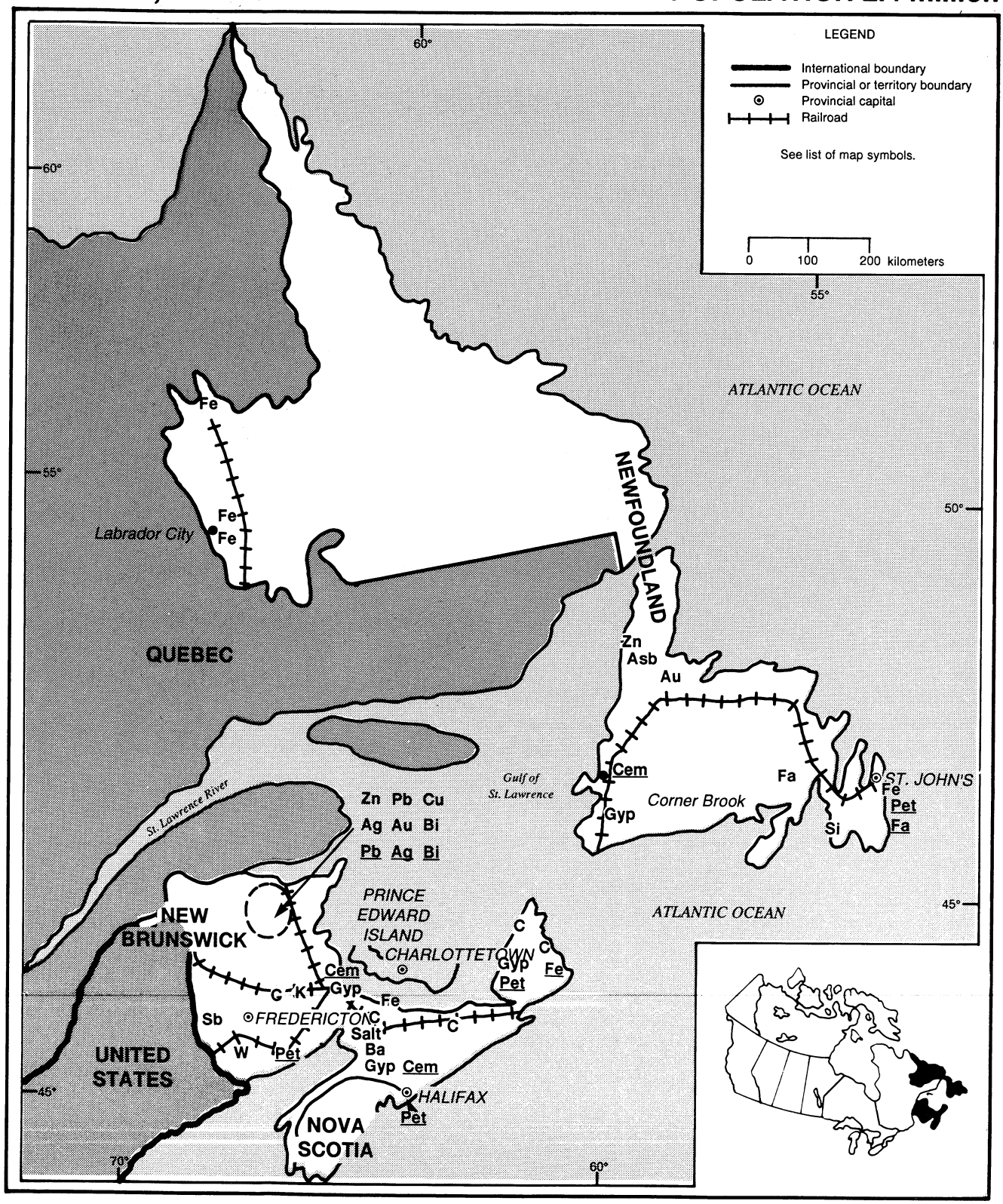
MANITOBA

AREA 650,100 km² **POPULATION 1.1 million**



NEWFOUNDLAND, NEW BRUNSWICK, NOVA SCOTIA, AND PRINCE EDWARD ISLAND

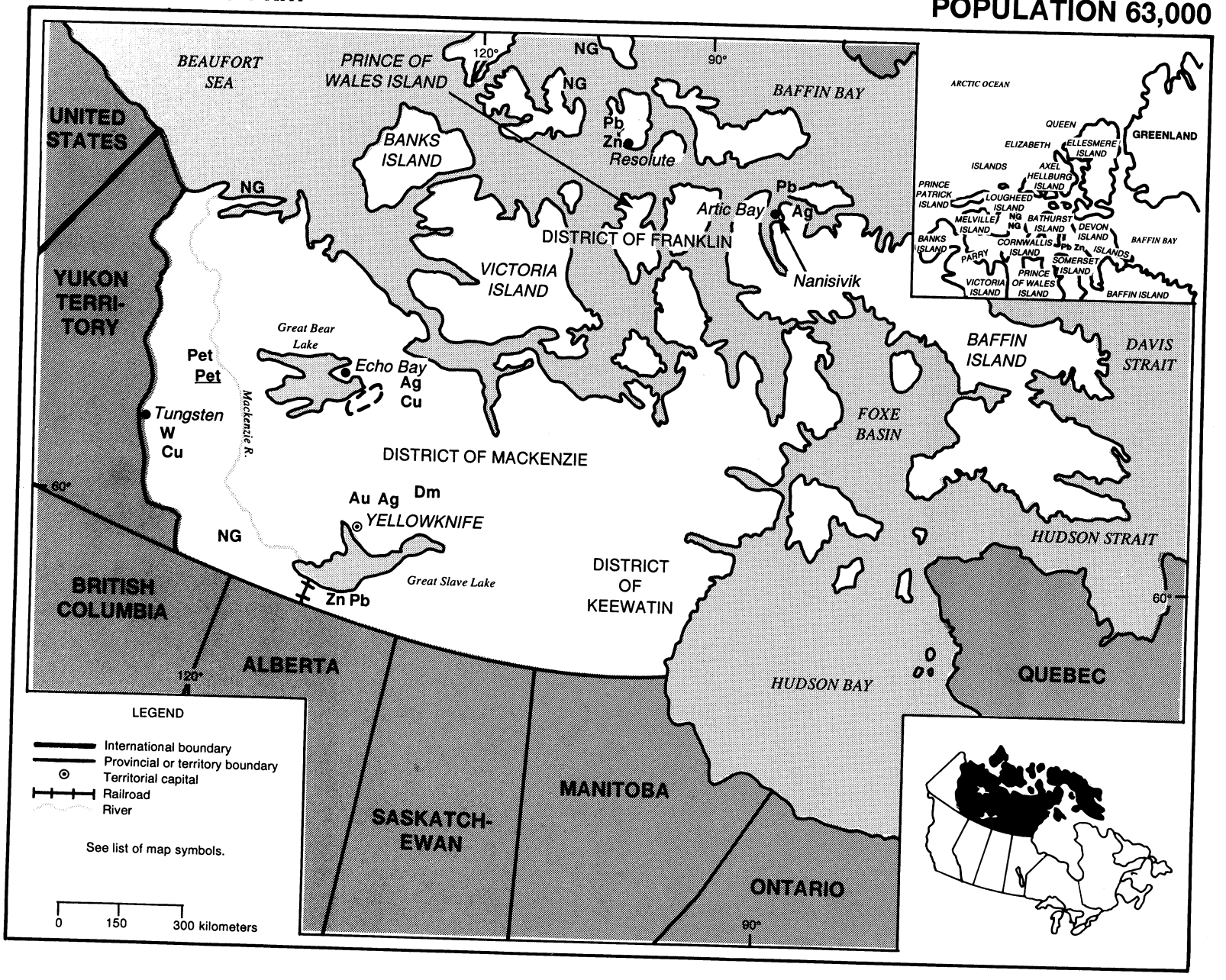
AREA 465,700 km² **POPULATION 2.4 million**



NORTHWEST TERRITORIES

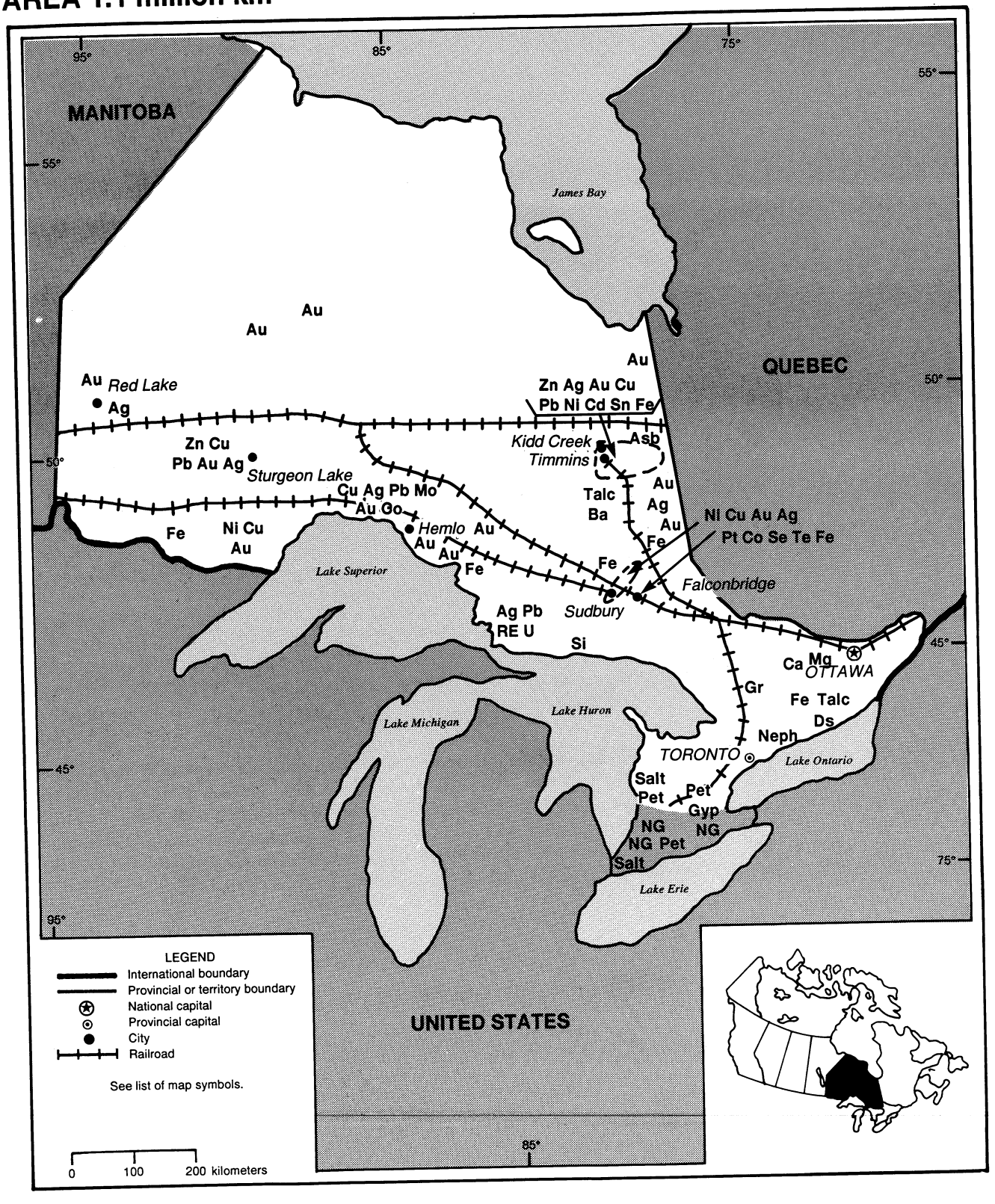
AREA 3.4 million km²

POPULATION 63,000



ONTARIO
(MINERAL DEPOSITS)

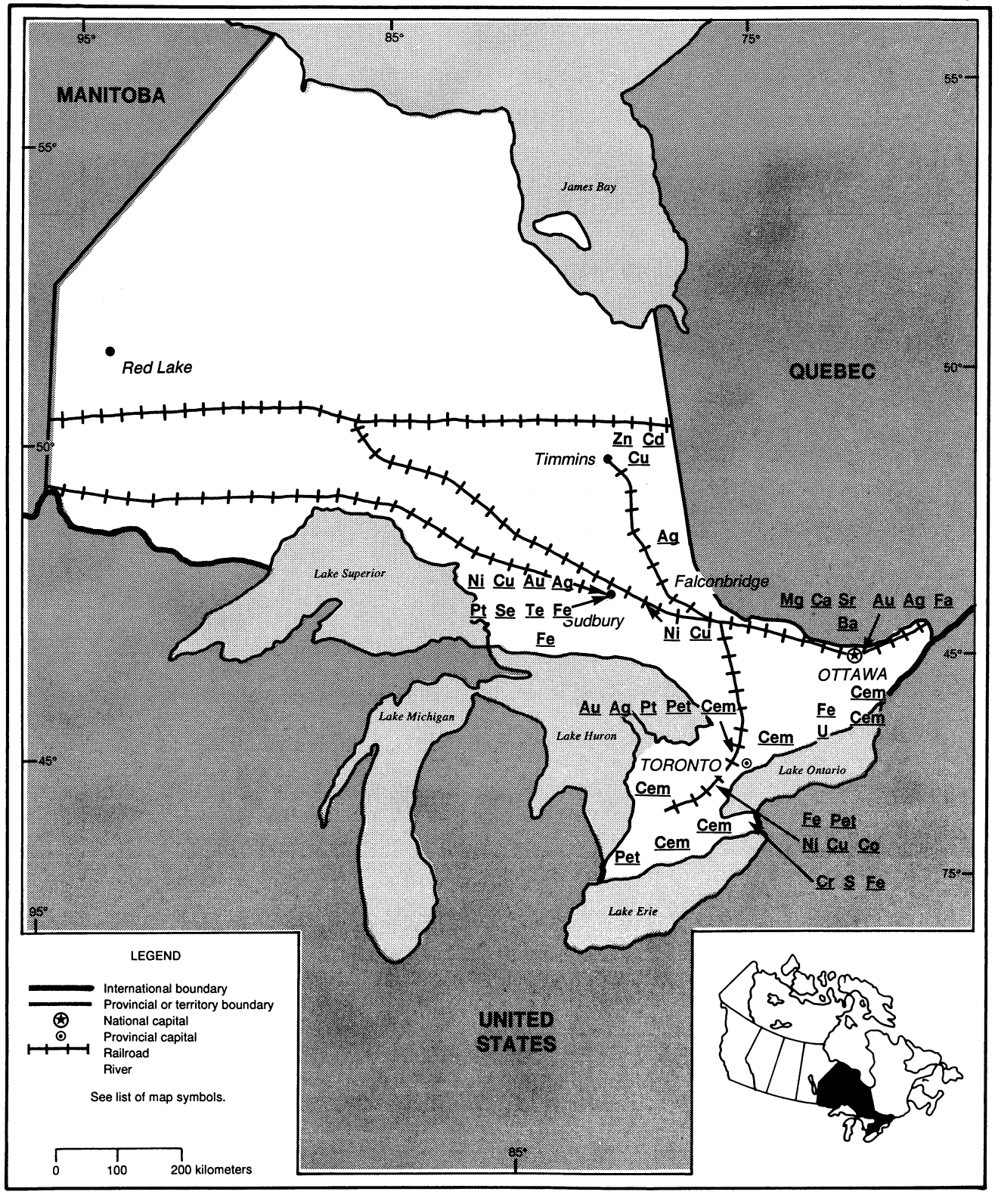
AREA 1.1 million km² **POPULATION 10.7 million**



ONTARIO

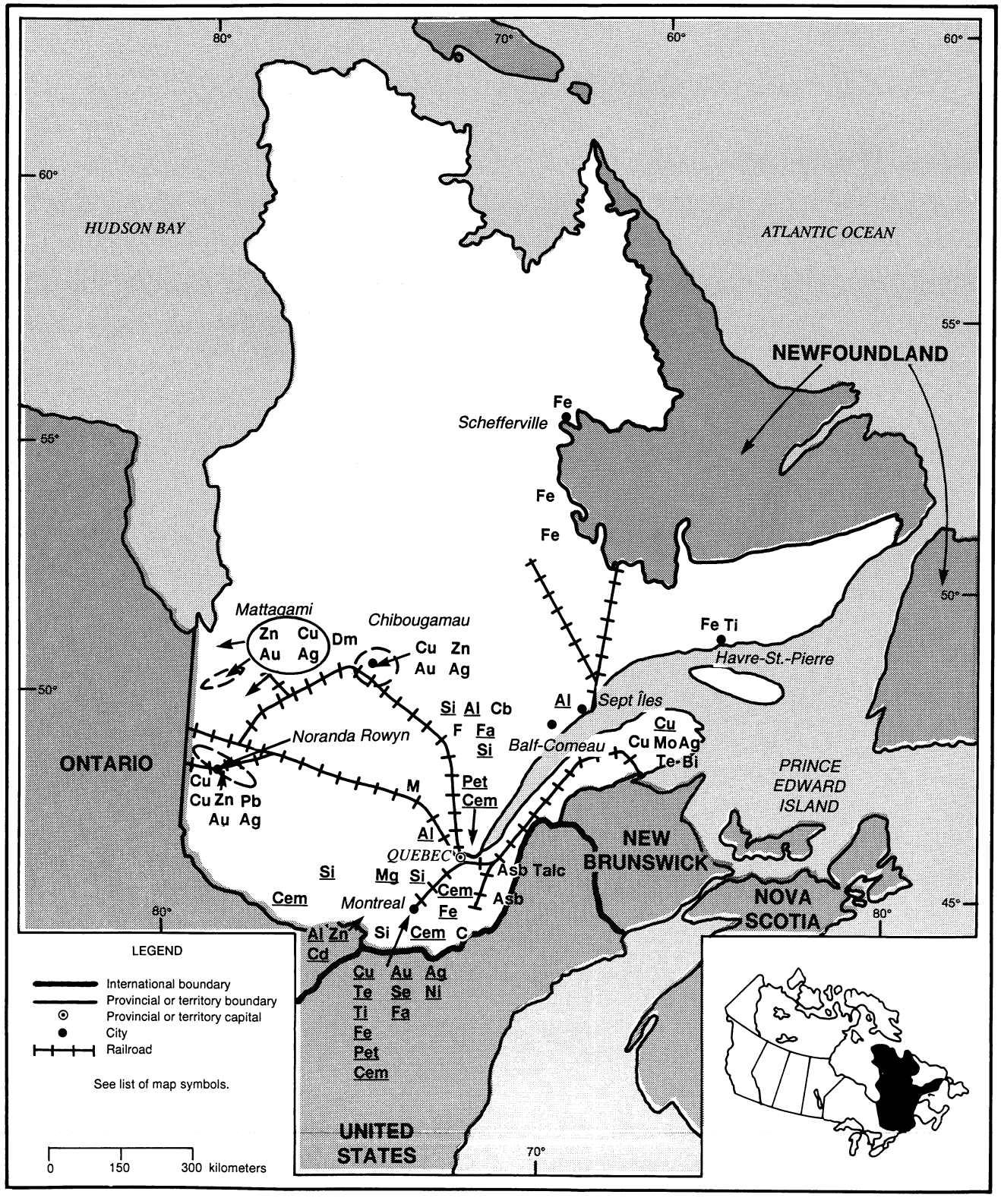
(SMELTERS AND REFINERIES)

AREA 1.1 million km² **POPULATION 10.7 million**



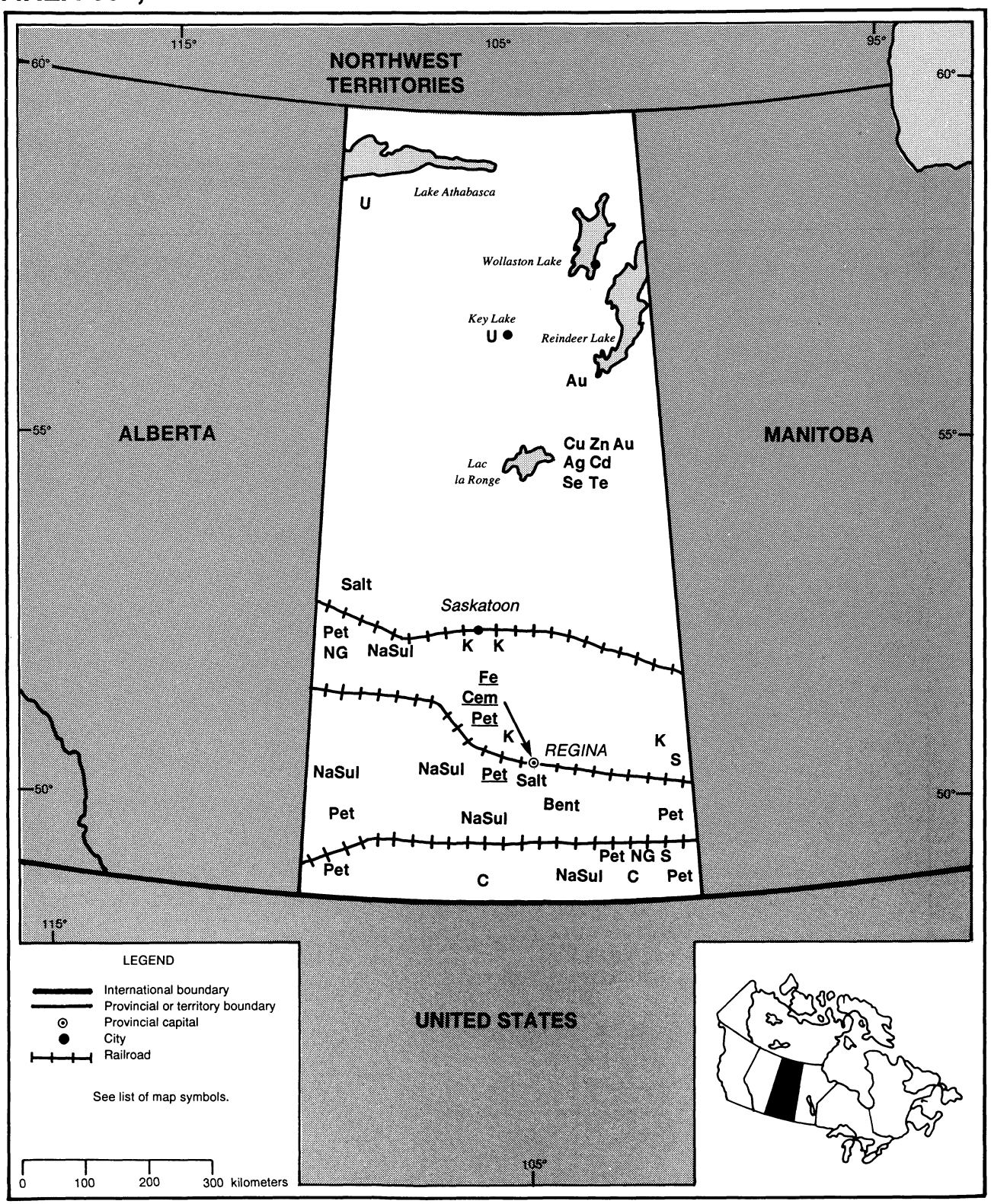
QUEBEC

AREA 1.5 million km² **POPULATION 7.2 million**



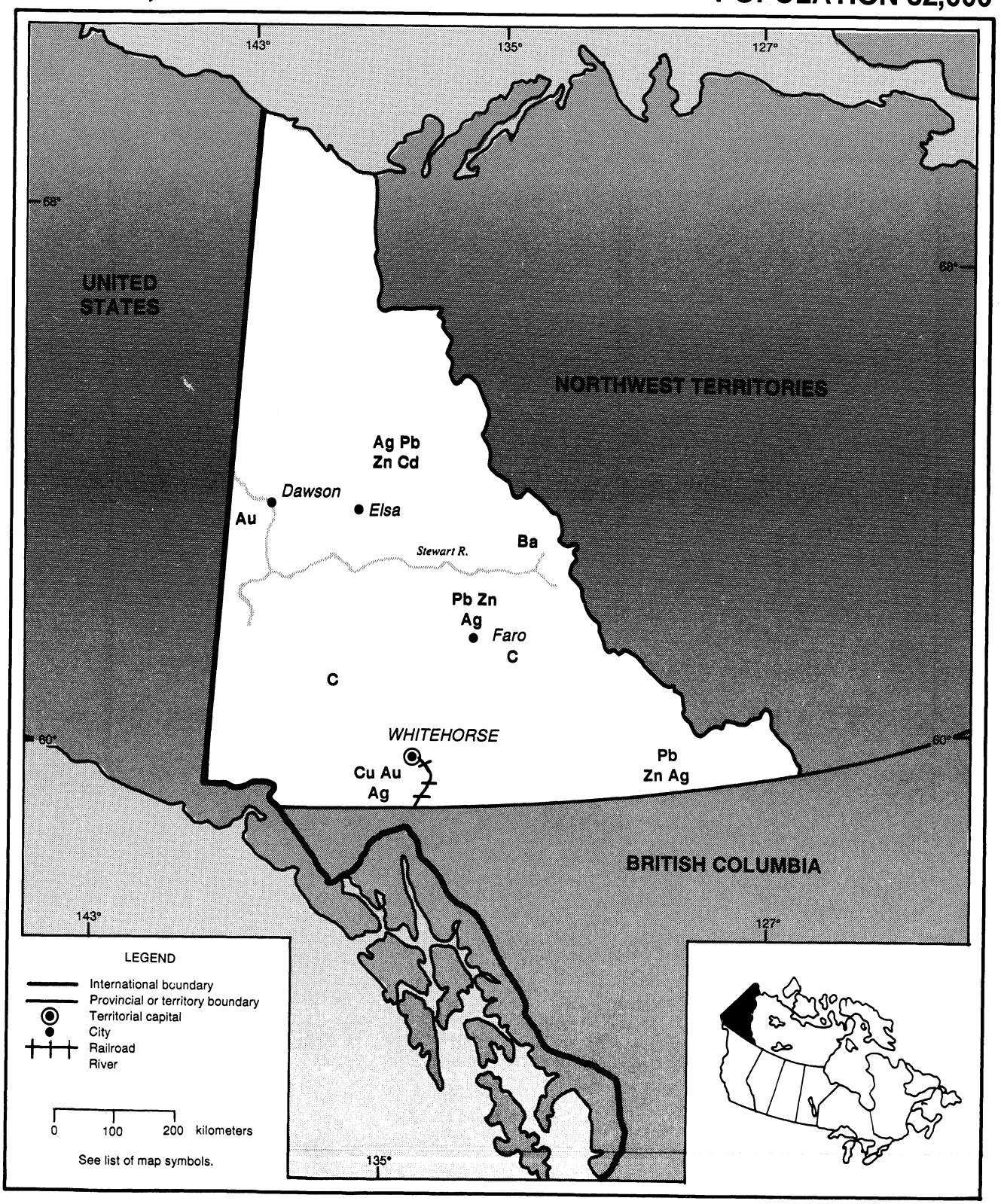
SASKATCHEWAN

AREA 651,900 million km² **POPULATION 1.0 million**



YUKON TERRITORY

AREA 482,500 km² **POPULATION 32,000**



THE MINERAL INDUSTRY OF

CANADA[1]

By Michael Mir Heydari

In 1993, minerals and metals contributed slightly more than 4% to Canada's GDP, and accounted for about 2.5% of national employment and over 15% of Canada's total domestic exports. The mineral industry, defined to encompass mining and concentrating, smelting and refining, as well as the minerals and metals-based semi-fabricating and fabricating industries, faced another challenging year in 1993. While prices for many of the nonmetals and industrial minerals increased or remained stable, most base-metal prices slowly declined as the year progressed.

The Canadian mineral industry did achieve some growth in 1993. According to preliminary estimates by Natural Resources Canada, the total value of production of all mineral commodities, including mineral fuels, rose from $35.4 billion in 1992 to $36.1 billion in 1993,[2] an increase of nearly 2%. This improved performance was, however, totally attributable to an 11% gain in the value of output of natural gas and the other mineral fuels.

Environmental concerns continued to influence mineral exploration and development activity in Canada, and some companies began to look elsewhere for projects. British Columbia's Government ruled against the development of the Windy Craggy deposit, the country's largest underdeveloped source of copper and cobalt. The area will be permanently protected as a class "A" provincial park.

Increasingly, Canadian mining companies looked toward Latin America in terms of exploration and development because mining and foreign mine ownership, with reasonable controls, has been newly welcomed there. Canada, meanwhile, mounted a strong effort to define the permissible versus the impermissible in terms acceptable to both the mineral industries and the concerns of environmental conservation and preservation.

GOVERNMENT POLICIES AND PROGRAMS

Provincial governments have jurisdiction over mineral resources in Canada. The main exception is in the Yukon and Northwest Territories, where the federal Government is in the process of conveying resource management responsibilities to territorial governments.

Federal and provincial policies are generally stable and have traditionally been favorable to mineral research and information services in the mining industry. It also has negotiated multi-year Mineral Development Agreements with provincial governments. These agreements funded various initiatives intended to strengthen the mining industry in each region. The federal Government is in the process of establishing a Canadian Geoscience Information Center, which will provide centralized access to the Government's technical information on Canada's geology.

There are some unsettled federal-provincial jurisdictional issues in the area of environmental policy, and the federal Government has been slow to produce regulations implementing new environmental assessment legislation passed in 1992. In its February 1994 budget, the federal Government proposed to allow tax deductions for funds set aside for eventual cleanup of closed mine sites. This measure would bring federal tax law into harmony with provincial reclamation requirements.

Some industry representatives have used the recent shift of international mining investment away from Canada to press for changes to Canadian regulatory and tax regimes affecting the mining industry. The industry has been critical of the regulatory process for approving new mines in the province of British Columbia, where mining has traditionally been a major activity. In response, the province has promised to speed up the mine approval process. In its 1994 budget, the province also announced a variety of measures to boost the industry. These included a tax incentive for capital spending on mines, and a 3-year exploration grant program.

PRODUCTION

While gold and the platinum-group metals (PGM) recorded modest increases in value of production of 5.8% and 6.6%, respectively, the leading base metals, on the other hand, experienced declines. As a result, the value of production for the metals group overall fell by 13.7%, from $10.2 billion in 1992 to $8.8 billion in 1993. The overall value of production for nonfuel minerals declined from $14.7 billion in 1992 to $13.1 billion in 1993, a decrease of 10.8%.

Based on value of production, the top nonfuel commodities in 1993 were gold ($2.3 billion), copper ($1.8 billion), zinc ($1.2 billion), nickel ($1.2 billion) and iron ore ($1.0 billion). Coal contributed a further $1.8 billion to the total value of production. Nonfuel minerals, including coal, accounted for slightly more than 40% of Canada's total mineral production in 1993.

The value of output of the nonmetallics, including minerals such as asbestos, peat, potash, salt, and sulphur,

declined from $2.2 billion in 1992 to $2.0 billion in 1993. Of the leading nonmetallics, salt and peat recorded gains in production values, while asbestos and potash recorded decreases.

The value of production of structural materials, including clay products, sand and gravel; stone, cement, and lime, increased marginally by 0.6% to remain at approximately $2.3 billion in 1993. The continued weakness in overall construction activity resulted in lower production of sand, gravel, and stone, while cement production increased, buoyed by rising cement exports. *(See table 1.)*

TRADE

The value of exports of nonfuel minerals and coal was estimated at $19.4 billion for the first 9 months of 1993, an increase of about 5% over the corresponding period in 1992. These exports included crude minerals, smelted, and refined products. The United States was the main destination for 66% of Canada's exports of nonfuel minerals and coal, while the European Union (EU) and Japan received 11.1% and 8.4% respectively.

Imports of nonfuel minerals and coal for the first 9 months of the year were estimated at nearly $12 billion, or 9.5% of total Canadian imports, resulting in a trade surplus for nonfuel minerals and coal of about $7.5 billion for the first three quarters of the year. The trade surplus for the full year was expected to be about $10 billion.

Canada's main nonfuel mineral exports were crude materials, including iron ore, potash, and sulfur to the United States; copper concentrates to Japan; iron ore and zinc concentrates to the EU; smelted and refined metals, including 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 EU. Coal exports went mostly to Japan.

Total trade between the United States and Canada exceeded that of any other two countries in the world, amounting to more than $200 billion in 1993, with further growth expected. The Economic Council of Canada, a research organization of the federal Government, forecast that, by 1998, free trade would bring a net gain of 250,000 jobs to Canada, increasing employment by almost 2% and Canada's gross national product by 2.5%.

STRUCTURE OF THE MINERAL INDUSTRY

The Canadian mineral industry, during 1992-93, comprised as many as 3,000 domestic and perhaps 150 foreign companies. Companies whose corporate voting rights were at least 50% non-Canadian were considered foreign, although other distinctions could apply in some large companies. About 320 mine sites were active, including coal but excluding sand, gravel, and other construction materials. At least 40 smelters were in operation, as well as other processing plants in the iron and aluminum industries. In general, foreign companies were subject to all of the same taxes as domestic companies, but repatriation of earnings was unimpeded. Predominantly, the Canadian mineral industry is privately owned, with the exception of some Government participation in potash and petroleum, but even these were largely in transition to private ownership. Some companies, such as Potash Corp. of Saskatchewan Inc. and Saskatchewan Oil & Gas Corp., were owned in part by the Province of Saskatchewan. Moreover, The Province of Alberta owned part of Alberta Energy Co. Ltd. Although the proportion of Government ownership was changeable, the trend was toward privatization. Petro-Canada was owned partly by federal and partly by provincial governments, but was expected to become completely privatized. A large proportion of the total number of mining and petroleum companies were partly public-owned, with their shares trading on various exchanges in Canada and, in many cases, the United States.

Overall, the mineral industry in Canada consisted of underground mines, open pits, leaching operations, concentrators, smelters, and refineries, as well as drilling and production operations characteristic of the petroleum industry. Table 2 depicts the structure of the mineral industry for sectors of the major mineral commodities.

Preliminary employment estimates for 1993 indicated that total employment in mining and mineral manufacturing, including coal, was about 335,000, down 3.5% from that of 347,000 in 1992. This decrease reflected the fragile state of the economy and the continued weakness in labor markets, particularly in the goods-producing sectors. The industry accounted for 2.5% of total national employment in 1993. The total number of employees in metal mining, nonmetal mining, quarrying, and coal mining was estimated at 57,000, down from 61,000 in 1992, while employment in nonferrous smelting and refining, estimated at 61,000, was also down marginally from the level recorded the previous year. Employment in the semi-fabricating and fabricating mineral industries dropped from 224,000 in 1992 to about 217,000 in 1993, a decline of about 3%. Approximately 7,900 people were employed in diamond drilling and other services incidental to mining operations.

COMMODITY REVIEW

Metals

Aluminum.—Canadian production of primary aluminum in 1993 increased to 2.31 Mmt from 1.97 Mmt in 1992. Work was completed in the last of the new aluminum smelter projects in Québec, raising Canada's aluminum smelter capacity to just under 2.3 Mmt. Canadian exports of primary smelter products during the first 9 months of 1993 rose to 1.38 Mmt, compared with 1.17 Mmt for the same period in 1992.

Alcan Aluminum Ltd. (Alcan), announced a loss for 1993 of $104 million, despite achieving its target of reduction of total debt. Alcan cited increased aluminum exports from the former U.S.S.R. as the main cause of weak market prices, which contributed to

Alcan's losses. In Canada, losses narrowed for the year, mainly owing to lower smelter production costs and improved fabricated product volumes.

In early January 1994, Alcan announced temporary production cuts of 156,000 mt/a of primary aluminum production capacity from its worldwide operations. The closures announced were in addition to the 102,000 mt/a closed in 1991 and 1992. Together the closures, totaling 258,000 mt/a, reduced Alcan's operating rate to 85% of its world capacity. Alcan is scheduled to cut 60,000 mt/a in the United States, 18,000 mt/a in the United Kingdom, and 8,000 mt/a in Brazil. Reductions in Canada include 30,000 mt/a at the Kitimat smelter in British Columbia and 40,000 mt/a at various locations in Alcan's Québec smelter system.

The suspension of work on Alcan's half-built Kemano Completion Project near Kitimat, British Columbia, continued pending the outcome of the British Columbia Utilities Commission's review of the project. The $1 billion project is the second phase of Alcan's hydroelectric development of the Nechako River System and was scheduled to add 540 MW to Alcan's Kemano Generating Station by 1994. The Supreme Court of Canada ruled in February 1993 that further arguments on the applicability of the Federal Environmental Assessment review Process Guidelines Order to Kemano would not be heard. Alcan has stated that it will not restart construction until all uncertainties surrounding the project have been resolved.

Aluminerie Lauralco Inc., completed the start-up phase of its new smelter at Deschambault, Québec, in the first quarter of 1993. The $1 billion plant is owned by a U.S. company, Alumax Inc. The smelter began operations in February 1992, using the energy-efficient Pechiney 300 KA technology.

Cobalt.—Canada's mine output of cobalt in 1993 was 12.5% higher than in 1992, while the output of refined cobalt totalled 2,695 tons, an increase of 22% from 1992. However, the value of the 1993 mineral production, $89.8 million, is 31.6% less than in 1992. Lower earnings were due to a major cobalt price slump that started in 1992, reaching a low of $11.60 per pound in November 1993, and lasting until mid-December 1993, when prices increased up to $17 per pound. The slump was a result of slack demand caused by the worldwide recession and relative abundance of supplies on the market.

Inco's 1993 mineral production of cobalt at 1,544 tons was up 8% from that of 1992, while its production of refined cobalt increased 2%, despite Christmas and summer shutdowns totaling 6 weeks. In the Sudbury area, Inco opened the Lower Coleman and Garson Mines to reduced its overall production costs and to replace existing operations at the Little Stobie and Frood mines, which will soon close. The Levack Mine, Inco's highest-cost producing mine, was shut down indefinitely during the summer. In Manitoba, development of the Thompson 1-D Mine moved toward initial production in 1994.

An agreement on a 3-year contract was reached in September between Inco and workers at its Thompson, Manitoba operations. Included are a new profit-sharing plan that will replace the nickel price bonus, and several added or amended contract clauses, but no wage or vacation increases.

In 1993, Falconbridge Ltd.'s Canadian mineral production of cobalt reached 826 tons, up 4% relative to 1992, while operations were shut down for 7 weeks during the Christmas and summer vacation periods. The company proceeded to cut 10% of its workforce through early retirements and layoffs to improve productivity. Finally, a feasibility study in the Raglan project was completed in 1993; however, no financing or production decision will be made until the nickel market firms up and permitting is reasonably assured.

Sherritt Gordon Inc. increased its production of refined cobalt by 74% to 1,192 tons as a result of the operational start-up of the redesigned processing system, modernized at a cost of $60 million. The company expects to produce 1,800 tons of refined cobalt in 1994, close to its new capacity of 2,050 tons.

Copper.—Copper output from Canadian mines in 1993 declined to about 734,000 tons from 769,000 tons in 1992. During 1993, refined copper production increased to 561,590 tons from 539,302 tons in 1992. The reduction of mine output of copper resulted from a number of temporary mine closures for economic reasons, the closures of the Myra Falls Mine in British Columbia owing to labor problems, and several permanent mine closures due to the exhaustion of ore reserves.

In June 1993, British Columbia announced the creation of the Tatshenshini-Alsek Wilderness Park in the northwestern part of the province and stated that it would seek to have the park designated as a World Heritage Site. For the mining industry, the creation of the park will prevent the potential development of the large Windy Craggy copper deposit owned by Royal Oak Ltd., as well as a number of other potentially attractive deposits in this area. Negotiations between the government of British Columbia and the mining companies, whose mineral claims have been expropriated, are expected to begin in 1994.

At the Gibraltar copper mine in central British Columbia, low copper prices forced Gibraltar Mines Ltd. to suspend mining and milling operations on December 1, 1993. The closure, which forced the company to lay off 125 of the 196 full-time employees, did not affect the operation of the solvent extraction-electrowinning (SX-EW) facility at the Gibraltar site. At the time of shutdown, it was reported that unit operating costs at the mine were about $0.90 per pound of copper. Despite the closure, the company planned to continue with a feasibility study for a $35-million expansion of the mine that would lower production costs. The project, which could be completed in 1995, would increase capacity by 50%.

Princeton Mining Corp. implemented a temporary closure at its Similco copper mine, near Princeton, on November 30. The company estimated its unit operating

costs at between $0.90 and $1.00 per pound of copper.

As a result of the continuation of depressed nickel markets, Inco Ltd. announced plans for production cutbacks in 1994. It is expected that these cutbacks will reduce Inco's Canadian copper output in 1994 by about 10%, or roughly 10,000 tons.

In October, Falconbridge Ltd., announced that underground exploration had indicated major extensions at its Kidd Creek orebody in Timmins, Ontario. While exploration work will continue, the results indicate at least 10 Mmt of additional reserves at the mine, which will provide several additional years of mine operation.

During 1993, development continued on the Louvicourt deposit near Val d'Or, Québec, with production scheduled to begin in July 1994. During its expected 18-year operating life, Louvicourt will have an average annual output of 50,000 tons of contained copper and 20,000 tons of zinc, as well as significant amounts of gold and silver. Diluted mining reserves of the deposit total 24 Mmt, grading 3.9% copper, 2.0% zinc, 31 g/mt silver, and 1.2 g/mt gold. The Louvicourt deposit is owned by Aur Resources Inc., 30%; Novicourt Inc., 45%; and Teck Corporation, 25%.

In February, MSV Resources Inc. acquired the Copper Rand and Portage Mines in the Chibougamau area, Québec, from Westminer Canada Ltd. The company subsequently reopened the two copper-gold operations that had been closed since November 1992.

During 1993, Thermal Exploration Co. and Western Copper Holdings continued work on their Carmacks deposit, formerly Williams Creek, 230 km north of Whitehorse, Yukon. Diluted open-pit reserves at the site total 11.3 Mmt, grading 1.15% copper, and 0.5 g/mt gold. Development plans of this property envisage a SX-EW operation that would produce up to 14,000 mt/a of copper cathode. Development costs for the project are estimated at about $40 million.

Pacific Sentinel Gold undertook significant exploration work in 1993 at its Casino copper-gold-molybdenum property in the southern Yukon. Geologic reserves are estimated at about 530 Mmt, grading 0.26% copper, 0.025% molybdenum and 0.3 g/mt gold. Within this total, there exists a supergene enriched zone containing an estimated 86 Mmt, grading 0.43% copper, 0.031% molybdenum, and 0.4 g/mt gold.

During 1993, Metall Mining Corp. began work on a feasibility study of its Izok Lake deposit, about 360 km northeast of Yellowknife, Northwestern Territories. Minable ore reserves are now estimated at 16.6 Mmt, grading 2.2% copper and 11.5% zinc, plus lead, silver and gold.

Gold.—After a decade of rapid growth, Canada's gold production decreased for the second consecutive year to 152.9 tons in 1993 from 161.4 tons in 1992 and a record 176.6 tons in 1991. By surpassing Russia's production in 1993, Canada became the fourth largest gold producer behind South Africa, the United States, and Australia.

There were about 50 primary gold mines in Canada at the end of 1993, and they accounted for 89% of the gold produced, with the remainder coming from base-metal mines. Two mines closed, while six opened during the year. Total employment in primary gold mines decreased to about 8,700 from 9,400 in 1992. Employment figures in the gold industry have been declining steadily from the 1988 peak of 12,600. British Columbia's gold production decreased to 14.4 tons in 1993 from 16.8 tons in 1992.

Eskay Creek gold mine in northwestern British Columbia is expected to start production in 1995 at a rate of 8 mt/a of gold. The mine is one of the highest-grade precious metal deposits in the world, with reserves of 1 Mmt, grading 70 g/mt gold and 3,210 g/mt silver. The ore also contains 5.6% zinc and 0.77% copper. The capital cost at Eskay Creek is estimated at $294 million, with cash operating costs of $108 per ounce of gold equivalent. Prime Resources Group Inc. is assessing the possibility of shipping the ore directly to a smelter. Should this approach prove to be successful, it would reduce capital costs by about $150 million to $200 million; however, operating costs would increase.

Wheaton River Minerals bought Homestake's 85% interest in North American Metals Corp.'s Golden Bear Mine in the extreme northern part of British Columbia, near the border with Yukon. In 1993, North American Metals, which remains the mine operator, mainly processed stockpiled ore while conducting exploration to delineate additional reserves.

Gold production in the Yukon and Northwest Territories decreased slightly from 17.3 tons in 1992 to 16.4 in 1993. After 18 months, the labor-management dispute at the Giant Mine, near Yellowknife in the Northwestern Territories, owned by Royal Oak Mines Inc., was settled following a decision by the Canadian Labor Relations Board. Some unsettled issues, such as the rehiring of dismissed workers, will be resolved through an arbitration process.

Miramar Mining Co. acquired the Con Mine, near Yellowknife, from RTZ Corp. plc's subsidiary NERCO Minerals Co. The Con Mine, which has been in operation for 55 years and has produced 150 tons of gold, reportedly has reserves of 55 tons representing 8 years of production.

Royal Oak Mines acquired the Colomac Mine from Neptune Resources Corp. for $10 million. The Colomac Mine, near Yellowknife, was closed in 1991 because of high operating costs. Production start-up at the Colomac Mine was expected by the middle of 1994, at a rate of 5 mt/a of gold. Current reserves reportedly are sufficient for 7 years of production.

Despite financial difficulties, production continued at the Claude Resources Inc.'s Seabee gold mine in central Saskatchewan. Proven reserves at the Seabee Mine are 200,000 tons, grading 10.5 g/mt.

An update to the 1992 feasibility study of the Contact Lake property, in central Saskatchewan, owned by Cameco and Uranerz Exploration, was conducted in

1993. Contact Lake has geological reserves of 1.6 Mmt, grading 9.6 g/mt. In 1994, Cameco will drive a decline to access the orebody to confirm the reserve estimate. If the estimated reserves are confirmed, Contact Lake could start production in 1995 at a rate of about 2.5 tons of gold annually for 5 years.

In Manitoba, Cazador Resources Ltd. started production at the Keystone Mine in the Lynn Lake area. Subsequently, Cazador merged with Granduc Mines Ltd. to form Granduc Mining Corp. The Keystone open pit mine has reserves of 1.2 Mmt, grading 2.8 g/mt. Annual gold production is 1.3 tons. The ore from the Keystone Mine is trucked to the Lynn Lake Mill.

Ontario's gold production in 1993 totalled 72 tons, a decrease from the 1992 total of 74.3 tons. Production at the three mines in the Hemlo area accounts for nearly 50% of Ontario's total production.

Deak Resources Corp./GSR Mining resumed operations at the Kerr Mine in Virginiatown, Ontario. The company discovered 400,000 tons of ore, grading 7.6 g/mt. Northfield Minerals Inc. (78.5%) and Towerland Properties Inc. (21.5%) continued preproduction work at the Cheminis gold mine in Kirkland Lake area, Ontario.

In 1994, production was expected to start at the Holloway project of Hemlo Gold Mines Inc., Freewest Resources Ltd., and Teddy Bear Valley Mines Ltd. Total reserves at the Holloway project are 5 Mmt, grading 9.3 g/mt.

Placer Dome Inc. announced that the Dome open pit mine, located in Timmins, Ontario, would be developed. The company has outlined proven and probable reserves of 32.5 Mmt, grading 2.4 g/mt. Production was expected to increase from 6 to 10 mt/a. Québec's gold production decreased by 6% from 44.6 tons in 1992 to 41.9 tons in 1993.

The Portage and Rand Mines near Chibougamau, Québec, reopened following their purchase by MSV Resources Inc., from Westminer Canada Ltd. Westminer had put the mines on care and maintenance in late 1992. Reserves at the Portage and Rand Mines are estimated at 1 Mmt, grading 4.1 g/mt.

The Sleeping Giant Mine, owned by Aurizon Mines Ltd., in Val d'Or, Québec, which closed in 1991 because of low gold prices, reopened in May 1993 with Cambior Inc. as the operator. Cambior earned a 50% interest in the property after completing a 3-year, $12 million exploration program to delineate new reserves at the Sleeping Giant Mine estimated at 350,000 tons, grading 7.5 g/mt. Annual production was expected to be 1 ton. Cambior Inc. also announced the closures of the Beliveau and Pierre Beauchemin Mines due to exhaustion of reserves.

The Astoria Mine, owned by Deak Resources Corp./GSR Mining Corp., in Rouyn-Noranda, Québec, was brought into production. The mine was producing 10,000 mt/month of ore that was being trucked to the company's Virginiatown mill. Reserves at the Astoria Mine are 1 Mmt, grading 7 g/mt.

KWG Resources started production at the Granada Mine in Rouyn-Noranda. Reserves are 3.7 Mmt, grading 5.1 g/mt. Production at the Casa Berardi Est Mine of TVX Gold Inc. and Golden Knight Resources Ltd. was reactivated following an inflow of overburden material into the mine.

Production at the Hope Brook Mine in Newfoundland continued following its purchase by Royal Oak Mines Inc., from BP Resources Canada Inc., in 1992. Royal Oak reopened the mine in July 1992 after a 1-year shutdown. Reserves at the Hope Brook Mine are estimated at 10 Mmt, grading 3.5 g/mt. The mine is expected to produce about 3 mt/a of gold at full production.

Iron Ore.—Canadian production of iron ore decreased from 32.7 Mmt in 1992 to 30.57 Mmt in 1993. This total was composed of concentrates, pellets, and sinter from hematite and siderite ores.

Iron ore in Canadian blast furnaces increased to 13.47 Mmt in 1993 from 13.25 Mmt in 1992. Iron ore imports, mainly from the United States, totaled 3.51 Mmt in the first 9 months of 1993.

The Iron Ore Co. of Canada reduced a planned summer shutdown of operations at its Carol Lake Division from 56 to 36 days because of improved markets in the United States and Japan. Production in 1993 increased by about 1 Mmt, with operations running at about 75% of production capacity. A new high-grade magnetic separator that improves recovery and produces a low-silica pellet operated for most of the year. Labrador City employees agreed, in mid-December 1993, to a 3-year contract that did not provide wage increases.

Wabush Mines shipped 4.8 Mmt of pellets containing 1% to 2% manganese and 141,000 tons of concentrate, fluxed, or standard pellets. Six distinct products were made. The company continued research on improving iron ore recovery rates and on producing a 60% manganese concentrate.

Québec Cartier Mining (QCM) also reduced the length of a planned summer shutdown because of improved demand. QCM shipped 14.7 Mt of ore, of which 7.8 Mmt was concentrate destined mainly for Europe; the balance was both low-silica pellets for direct reduction and acid pellets for blast furnaces. The company continued research on magnetic separation and column flotation of tailings to improve iron recoveries.

The Algoma Ore Division produced 1.16 Mmt of superflux and fluxed sinter for Algoma Steel using about two-thirds mine ore and one-third reverts from the steel mill.

Lead and Zinc.—Canadian lead and zinc mine production declined in 1993 by 47% and 24%, respectively, from the 1992 totals of 343,808 tons of lead and 1,324,675 tons of zinc. Canadian lead-metal output from secondary and primary smelters in 1993 decreased by about 33,000 tons to 219,959 tons. Zinc metal production in 1993—at 661,881 tons—was about 10,000 tons lower than in 1992.

Curragh Inc.'s Faro and Sa Dena Hes Mines in the Yukon, and the Stronsay deposit in British Columbia, were placed in receivership in September. The Sa Dena Hes Mine had closed in December 1992 and the Faro operation ceased

milling ore in March. Capacity at the two mines totaled 250,000 mt/a of zinc in concentrate. Cominco Ltd. and Teck Corp., with Korea Zinc Co. Ltd. and Samsung Corp., agreed in December to purchase the Sa Dena Hes Mine and the Stronsay deposit. By yearend, no buyers had yet been found for the Faro operation.

Cominco abandoned the QSL smelting technology at its Trail metallurgical complex in British Columbia. The 160,000 mt/a QSL smelter began operation in December 1989 but closed in March 1990 owing to design and mechanical problems. Extensive tests by the German manufacturer, Lurgi GmbH, aimed at resolving these problems were unsuccessful. Cominco is reviewing the Russian Kivcet process as a possible alternative, but no final decision on installation of the process has been made.

Cominco closed its Trail, British Columbia, metallurgical complex, including its existing 135,000 mt/a capacity lead smelter for the month of April due to low lead and zinc prices. The company also closed its Sullivan lead/zinc mine near Kimberley, British Columbia, from June 26 to September 12.

Hudson Bay Mining and Smelting (HBMS) completed the zinc pressure leach facility at its Flin Flon, Manitoba, smelting complex in July. The plant, which replaces the conventional roasting and leaching circuits in the zinc refinery, reached its full capacity of 95,000 mt/a of zinc metal at the end of August. The new plant will reduce sulfur dioxide emissions by 25% and particulate emissions by more than 50%.

Falconbridge Ltd. intersected ore-grade mineralization in deep drilling at its No. 3 Mine at Kidd Creek. Because of feed shortages, Tonolli Canada closed its 35,000 mt/a capacity secondary lead plant in Toronto during April.

Les Mines Selbaie closed the underground mine at its Selbaie operation near Joutel at yearend. The company plans to maintain production of 7,600 mt/d by increasing tonnages from the A-1 zone open pit and two satellite pits. Modifications were made to the concentrator and ore-handling system to treat the additional open pit material. Development continued throughout the year on the Louvicourt copper-zinc deposit.

Brunswick Mining & Smelting closed its 72,000-mt/a-capacity Belledune, New Brunswick, lead smelter from November 22, 1993 to January 3, 1994, owing to a shortage of lead concentrate. This was caused by a 4-week closure of the company's nearby Brunswick lead/zinc mine resulting from weak market conditions. Meanwhile, the company announced that it was cutting its 1,140 member workforce by 112 by yearend in an effort to save $5.6 million.

Other temporary and permanent mine closures included Treminco Resources Ltd.'s Silvana Mine in British Columbia, HBMS' Stall Lake and Chisel Lake Mines and Snow Lake Mill (the latter two by early 1994) in Manitoba, and Brunswick's Heath Steele Mine and Stratabound Minerals' CNE Mine, both in New Brunswick.

Nickel.—Canadian nickel mine production increased to 188,378 tons from 186,384 tons in 1992. Inco Ltd. closed its Canadian operations for 7 weeks in 1993, 3 weeks at the beginning of the year and 4 weeks during its annual summer shutdown. Inco completed, at a cost of nearly $650 million, its Sudbury, Ontario, sulfur dioxide abatement program which began in 1988. The program included the installation of a pyrrhotite rejection phase in the mill and the construction of two new flash smelters. The company now captures 90% of the sulfur contained in its Sudbury ores, compared with 70% previously.

In early 1993, Inco commenced production at its Lower Coleman Mine at Sudbury, which was scheduled to be working at a full capacity of 8,000 mt/a in 1994. Inco also reopened its Garson Mine in Sudbury at a cost of $40 million. Production at Garson is scheduled to begin in 1994, with full production planned for 1995. Mining was suspended at the Levack Mine, the company's highest-cost mine in Sudbury.

Shaft-sinking was nearly completed in 1993 at the Manitoba Division's 1-D Mine. This mine, which will cost Inco about $227 million to develop, was scheduled for initial production in 1994, with full production of nearly 17,000 mt/a planned for 1997.

Falconbridge Ltd., closed its Canadian operations for 6 weeks ended January 31, 1993, and reduced its previously planned summer shutdown from 10 weeks to 2 weeks. Falconbridge's Craig Mine, which cost $265 million, commenced production in 1993. Once in full production, the mine was scheduled to produce more than one-half of Falconbridge's Sudbury nickel.

A $30 million feasibility study was completed on Falconbridge's Raglan nickel deposit in northern Québec. The cost of the project was estimated at $400 million, but development was not scheduled to begin until the price of nickel exceeded $4.25 per pound. An estimated 20,000 mt/a nickel in concentrate will be produced annually for the operation.

Falconbridge has gradually increased its mining grades for nickel to 1.7% from 1.36% in 1989, and has increased its productivity. Together, these factors have resulted in operating costs of less than $2.00 per pound at Falconbridge's Sudbury operation.

Sherritt Gordon Ltd. completed Phase II of its Fort Saskatchewan, Alberta, refinery expansion early in 1993. The expansion increased the company's annual cobalt refining capacity to around 4.5 million pounds and nickel capacity to 24,000 mt/a. Sherritt also obtained additional feed that will permit increased production through at least 1996. The Namew Lake Mine, Manitoba, owned jointly by HBMS and Outokumpu Canada was mined out in 1993.

Industrial Minerals

Asbestos.—In 1993, Canadian asbestos mines operated at an average of 90% of capacity as average prices increased by 3.5% to 4%. Production in 1993 was 515,341 tons, valued at $213.1 million, compared with 1992 revised figures of

590,641 tons, valued at $231.0 million. The decrease in production reflected a softening of some markets due to the present world recession and did not affect producers equally, given differences in markets. The reappearance of some international producers, such as Greece, also had some effect.

Canadian employment in asbestos mining and milling stabilized for the first time in a few years as no closures took place since the 1992 bankruptcy of Cassiar Mining Corp.

Export volumes for 1993 were estimated to be about 477,000 tons, a 20.5% decrease from the previous year. Exports in the January-to-September 1993 period totaled 357,991 tons, valued at $210.1 million, compared with 434,908 tons, valued at $253.8 million, for the same period in the previous year. Marked declines in exports occurred in Europe and Africa where drops of about 32% to 34% were observed. Other major markets declined by about 17%.

Canadian asbestos imports into the United States in 1993 are estimated at about 33,000 tons compared with 30,683 tons in 1992. The 7.5% increase suggested a strengthening of demand in the wake of the revoking by a U.S. court of the asbestos ban rule by the U.S. Environmental Protection Agency (EPA).

At Cassiar, British Columbia, a joint venture group comprising Minpro Pty Ltd., Cliff Resources Corp., and Black Hill Minerals Ltd., considered opening a wet milling process. At JM Asbestos Inc., mine workers invested $2 million in their company and the government of Québec guaranteed a $25 million loan for its development phase. At Lab Chrysotile, workers at the Bell Mine were locked out by management for a 6-week period. Settlements were subsequently concluded at the Bell and British Canadian Mines. The contract for the Black Lake Mine was scheduled to expire in early 1994.

Mazarin repaid about one-half of the purchase price for the Québec government assets. The Asbestos Institute signed a new agreement with Québec and the producers, providing funds for the next 5 years. In Newfoundland, Black Hill Minerals Ltd. purchased 50% of Princeton Mining Corp.'s interest in Teranov Mining Corp. A project to use the old Baie Verte pit as a repository site for asbestos-containing materials is under study.

The publication on November 5, 1993, of the clarification notice by the U.S. EPA was expected to have a positive impact on Canadian markets in developing countries. The stabilization of the U.S. market was also a very positive sign. Asbestos cement products were still favored by many users and were expected to continue for the coming year despite increasing competition by substitute fibers and steel. Asian countries were still the main markets for Canadian fibers. A marginal gain was observed in South America. The European market was expected to continue its downward trend at least until the economies of the eastern European countries show some signs of improvement. Canadian production was expected to remain stable in 1994, or to increase slightly.

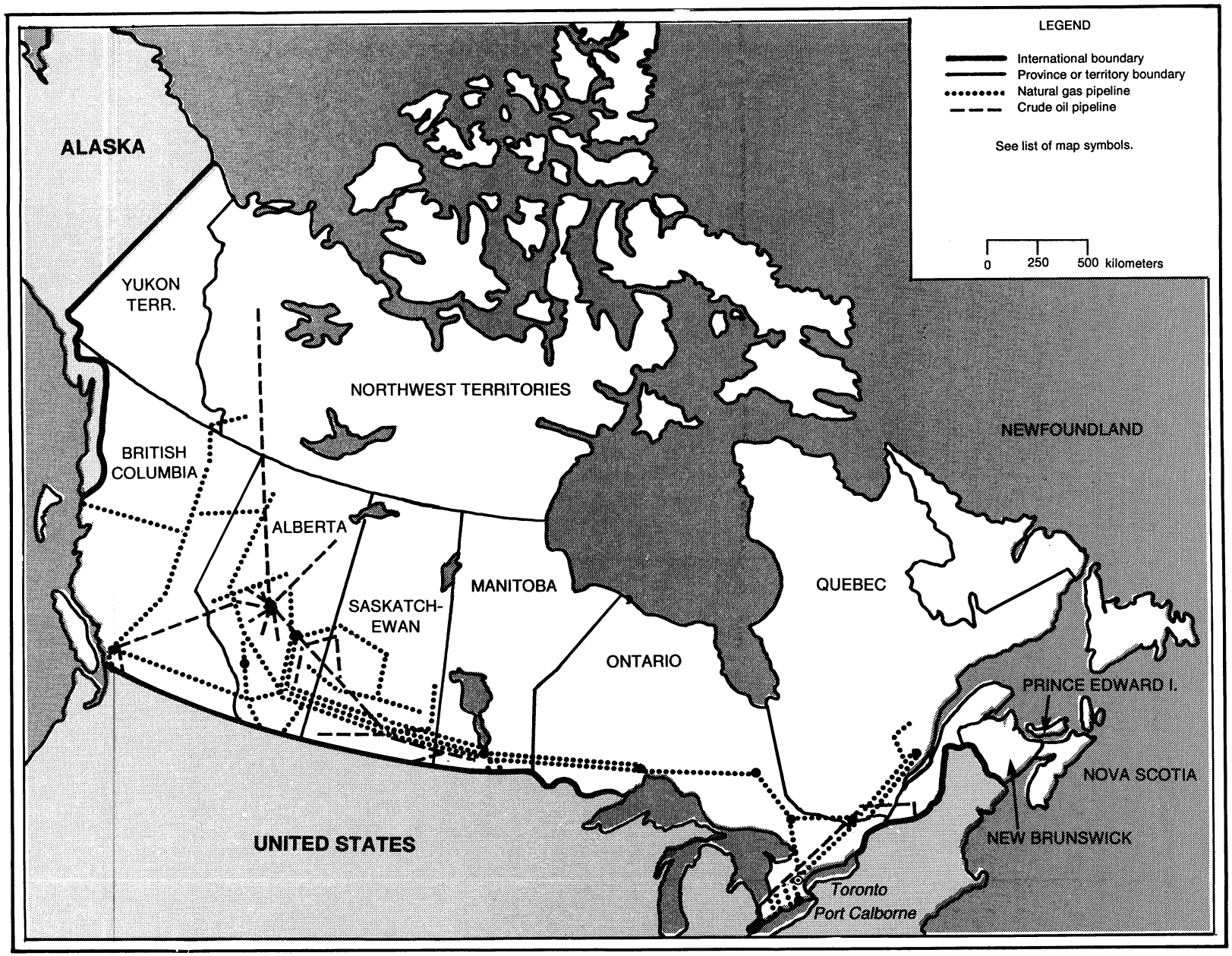
Diamond.—Diamond exploration expenditures in 1992 totaled about $19 million, up from $7.1 million in 1991, $7.6 million in 1990, and $5.1 million in 1989. In 1992, exploration expenditures for diamond were $13.2 million in Northwest Territories, $2.6 million in Ontario, and less than $2 million in Alberta. Foreign-based companies accounted for 21% of diamond exploration in Canada. In 1993, Dia Met Minerals Ltd. and Broken Hill Pty. (BHP) Minerals Canada released results of an evaluation of 3 kimberlite pipes sampled near Exter Lake, 25 to 30 km northwest of the original Point Lake discovery on their Lac de Gras property, Northwest Territories. These companies also obtained evaluations for the diamonds recovered from the Point Lake and Pipe 1 kimberlites, but Dia Met officials said that values obtained for those two pipes were too low to justify further exploration. A heavy-media bulk-sample plant was constructed at the Lac de Gras site, reportedly to test bulk samples for Pipes 3 and 4. The Fox Lake and Koala Lake kimberlite pipes were to be tested, according to the company, but it was not clear whether these pipes were the same ones as Pipes 3 and 4. A decline, started at Fox Lake in September 1993, to a vertical depth of 250 m was expected to yield a 5,000 tons bulk sample, with 3,500 tons also to be taken from the Koala Lake Pipe using a 36-inch diameter drill operating from lake ice.

In 1993, BHP spent some $11 million in the Lac de Gras area. By September, twenty-six kimberlite intrusions had been identified on the property. Several other intrusions also were described as diamondiferous and yielded encouraging drill results. Bulk samples of drill core, each said to be about 200 tons, were being taken to better assess their diamond contents. Using available information, Canadian brokerage firms have calculated that Pipe 4 contains in the range of 80 to 150 Mmt grading an average 1.247 carats of diamonds per ton at a mean value of $112 per carat.

A total of about 100 kimberlite intrusions already have been confirmed by drilling in the Lac de Gras region, at least 25 of which contain diamonds. About 35 km to the southeast of Point Lake, drilling by Kennecott Canada Inc., with its partners Aber Resources Ltd., Southern Era Resources Ltd. and Commonwealth Gold Corp., intersected two closely adjacent diamondiferous intrusions, named the Tli Kwi Cho discovery, on the property of DHK Resources (one-third owned by Dentonia Resources Ltd., Horseshoe Gold Mining Inc., and Kettle River Resources Ltd.).

Public information concerning diamond content is limited, but apparently is encouraging because Kennecott was taking a joint 5,000-ton bulk sample from the kimberlites, using an underground decline, to be trucked by winter road to a pilot plant at Yellowknife. Diamond exploration was going on elsewhere in Canada: further to the east in the Northwest Territories; in Alberta, where at least 16 diamonds, some gem quality—the largest 0.8 carat but poor quality—had been discovered in glacial drifts and in stream gravels; in southeastern British Columbia; near Fort

CANADA: CRUDE OIL AND NATURAL GAS PIPELINES



à la Corne, Saskatchewan; and in Manitoba, Ontario, and Québec. As yet, no discoveries of obvious economic importance, other than those at Lac de Gras, have been announced.

Graphite.—During 1993, graphite was produced commercially by Stratmin in Québec and Applied Carbon Technology Inc. (previously known as Cal Graphite) in Ontario. Graphicor Resources Inc. remained inactive during the year.

Although world demand for graphite was weak during most of the year, Canada's production increased slightly from 21,714 tons in 1992 to an estimated 22,257 tons in 1993; however, total shipments decreased from 21,437 tons in 1992 to an estimated 20,443 tons in 1993. Stratmin sold nearly 16,000 tons during the year. The company reported that its Lac-des-Iles Mill had operated at full capacity (24,000 mt/a of concentrates) since October, mainly as a result of a stronger U.S. economy. Also, the company reported that, since November, Stratmin is "ISO 9003 certified," an internationally recognized standard of quality product assurance.

Victoria Graphite Inc., with a deposit near Portland, Ontario, announced that it planned to start a pilot plant in early 1994, which was to be followed by full-scale production during the summer of 1994. Mill capacity was 2,500 mt/a of concentrates. Prices of crystalline flake graphite continued to decrease owing to very strong competition. During the past 3 years, published prices of some grades of flake graphite had decreased by nearly 55%.

Potash.—In 1993, world potash supply continued to exceed world demand; several producers reduced their output to achieve a better balance between supply and demand. As in the past, inventory shutdowns occurred in Canada, both in Saskatchewan and New Brunswick, but were also reported in the United States, Germany, and the Middle East. On an annualized basis, Canadian mines ran at about 57% of capacity in 1993 (60% in 1992), while other major world producers (excluding the former U.S.S.R. which operated at less than 47% in 1993), operated at 75% to 95% levels. Capacity was curtailed in the United States and the former U.S.S.R., while some developments were pursued in Argentina, Canada, Chile, China, and Thailand. The merging of the former East and West German potash industries proceeded with the announcement of a major restructuring and closure of up to four mines by 1994-95.

During the year, several commercial issues affected producers: evaluation of dumping charges against the former U.S.S.R., both in the EU and the United States; extension of the suspension agreement between U.S. and Canadian potash producers; and allegations of price-fixing in North America by several U.S. and Canadian potash producers.

In 1993, Canadian potash production decreased 6% from 7.27 Mmt to 6.84 Mmt K_2O; declines in potash output were registered both in Saskatchewan and in New Brunswick, with the latter accounting for 15% of total Canadian production. Canadian potash shipments declined to 7.0 Mmt K_2O due to reduced shipments to offshore markets. Potash Corporation of Saskatchewan Inc. (PCS) purchased all the potash assets of Potash Company of America.

During the year, PCS extended for another year its offshore marketing agreements with several U.S. potash producers in New Mexico. On average, prices for Canadian potash in offshore markets in 1993 declined for a second consecutive time since December 1992 by 3.6% to $106 per ton, f.o.b. Vancouver, for standard grade, as a result of weaknesses in the world potash demand and increasing competition from low-priced former U.S.S.R. exports.

Sulfur.—In 1993, world consumption of elemental sulfur declined for a fourth consecutive year to 33.5 Mmt, a 6% drop over the previous year. Consumption decreased as a result of a 6% fall in phosphate fertilizer production in Western Europe, the former U.S.S.R., and the United States, while increases were reported in Central Europe. Worldwide, consumption of phosphate-based fertilizers rose slightly despite a major drop registered in China as a result of monetary changes and subsidy reductions on fertilizers. Consumption of elemental sulfur in industrial uses declined 4% to 3.9 Mmt; increases were reported in Central Europe, and decreases in North America, Western Europe and the former U.S.S.R.

In 1993, world elemental sulfur production rose marginally to 35.9 Mmt. A 24% decrease in world Frasch sulfur production was offset by an 8% increases in output from recovered sulfur. Major declines in Frasch sulfur occurred in Mexico, Poland, and the Ukraine. Increases in production of recovered sulfur were registered in Canada, Japan, Kuwait, United States, and Western Europe.

Canadian production of sulfur in 1993 increased by 14%. Increases were reported in all sectors: gas processing, tar sands and oil refining. Shipments of elemental sulfur declined sharply by 1.2 Mmt, or 19%, to 5.0 Mmt as sales to the United States and offshore dropped owing to very weak prices prevailing in these markets.

Total Canadian sulfur stocks increased by 2.3 Mmt, reaching 5.5 Mmt to 5.6 Mmt by yearend. In 1993, several Canadian sulfur producers faced an administrative review of Canadian sulfur exports to the United States during the period from December 1991 to November 1992. In Alberta, Shell Canada commissioned its new gas-related 1.5 Mmt/a sulfur plant at Caroline in March 1993. In 1993, f.o.b. Vancouver prices for Canadian sulfur declined from $30/mt to $40/mt in January to $28/mt to $30/mt in December.

Mineral Fuels

Coal.—The year 1993 was better for the Canadian coal industry than 1992, and 1994 was predicted to surpass 1993. Production of 68.6 Mmt, valued at $1.8 billion, was expected to be achieved in 1993, increases of 4.6% and 6.8%, respectively, over 1992.

The increase in production followed

the resolution of problems at three mines in southeastern British Columbia. The mines, closed for much of 1992 on account of labor and financial difficulties, were brought back into production in early 1993.

Canadian coal consumption in 1993 was forecast to be about 49 Mt, 2 Mt lower than 1992. The decrease was attributable to Ontario Hydro, which increased its electrical generation from nuclear facilities but also experienced an overall drop in demand.

Notable in 1993 was the commissioning of the environmentally advanced Belledune coal-fired power station in New Brunswick. This was the first powerplant in Canada with a commercial wet limestone scrubber that captures about 90% of sulfur dioxide. The plant also controls nitrogen oxides via staged combustion.

Coal consumption by the steel industry and the industrial sector in 1993 was expected to be similar to the previous year, at about 4.8 Mmt and 1.5 Mmt, respectively.

Coal imports were down considerably in 1993, from 12.8 Mmt in 1992 to an estimated 9 Mmt in 1993, the lowest in many years. The drop was accounted for by Ontario Hydro. While the utility burned about 4 Mmt of imported coal, about 2 Mmt of this amount came from its stockpiles. As a result, Ontario Hydro actually imported only about 2 Mmt of coal, compared with about 6 Mmt in 1992.

Canada has maintained its position as the world's fourth largest coal exporter, despite 2 years of difficulties. Peaking in 1991 at 30 Mmt, exports declined in 1992 to 27 Mmt, reflecting the difficulties in British Columbia mentioned earlier. Exports were expected to rebound to nearly 29 Mmt in 1993 and to exceed 30 Mmt in 1994.

Traditionally, more than 80% of Canada's coal exports is coking coal, sold mostly to Japan. However, Japanese steel production, and therefore its coal requirements, was expected to decline in the last few months of 1993 and the first quarter of 1994. If this occurred, it would put downward pressure on both coking and steam coal prices because the Japanese steel industry is the largest coal purchaser in the world.

World benchmark prices for traded coking and steam coal toward the end of 1993 averaged about $50/mt and $36/mt, respectively, f.o.b. the port of export. In January 1994, contract coking prices for the 1994 coal year were forced down by $3.85/mt. Steam coal contract prices for the 1994 year also were expected to decline.

Steel production in other Asian countries importing Canadian coal, such as South Korea and Taiwan, remained strong. Additionally, Canadian coking coal exports to Brazil and the United States, traditionally the third and fourth largest markets for Canadian coal, were up in 1993.

About 70% of Canadian steam coal exports were to Japan and South Korea. Future sales to the South Korean market may be higher due to the strong performance of the Korean economy and its increasing demand for energy.

Natural Gas.—Canada still ranked third in the world, after the former U.S.S.R. and the United States, in output of natural gas. Once again, the production of natural gas played a major role in the mineral economy of Canada. In 1992, the last year for which complete data were available, production rose to a gross output of 158 billion m^3 and production of marketable gas was 118 billion m^3. Marketable gas is gross (total) production minus reinjected gas and producer consumption. A probable world-class natural gas discovery in the Monkman Pass-Sukunka region of British Columbia by BP Canada Inc. (BP) found an estimated 28.337 billion m^3 of gas (one trillion ft^3) in two producing zones approximately 3,050 m deep, with the potential for 198.357 billion m^3 (7 trillion ft^3). Fewer than 5% of gas fields in North America have that capability, and the Monkman Pass field was recognized as having the best reserve and deliverability potential of any player in western Canada, if not North America. BP was joined by Amoco Canada, Ocelot Energy, Westcoast Energy, Esso Resources Canada Ltd., and Sceptre Resources Ltd. in various arrangements participating in drilling and production. Gas production was from folded carbonate shelf deposits in separate pools 1.5 to 3 km wide and 18 km long forming a field 45 km wide and possibly three times that in length.

Canada exported 56.673 billion m^3 (2 trillion ft^3) of natural gas to the United States during 1992, which was about 10% of the U.S. supply. Gas exports were expected to increase by at least 10% in 1993, anticipating the increasing inability of domestic production to meet demand. Disputes between Canadian producers and California consumers continued through the year, with the Canadian National Energy Board ruling that decisions by the California Public Utilities Commission had hurt Alberta producers sufficiently that exports of gas were prohibited that had not already been contracted for by the Alberta and Southern Gas Co. Ltd. for sale to the Pacific Gas Transmission Co., both of which were subsidiaries of Pacific Gas and Electric Co.

Petroleum Crude.—Production of crude was 585 Mbbl in 1992, the last year for which complete data was available, marking an alltime high but barely exceeding the 584 Mbbl produced in 1988.

After the announcement in 1990 that the immense Hibernia petroleum prospect offshore Newfoundland would be developed, with a commitment of federal monies, enabling legislation was passed in late 1991. The Hibernia Development Act released Ottawa's contribution of $2.36 billion to the $4.55 billion project. A discordant note was sounded when Gulf Canada Resources Ltd., a member of the Hibernia consortium, announced that it sought a buyer for its 25% stake in the project on grounds that the company could not afford to pay its share of the capital costs. Although there were predictions that the entire project would die, the hope was that the Government would permit new foreign investment to come into the project in particular and, for that matter, Canada in general. After the Federal Energy Minister conceded

that foreign money could be accepted under the right circumstances, investment was sought in serious efforts across North America and Pacific Rim countries by the remaining partners—Mobil Oil Canada, Petro-Canada, and Chevron Canada Resources. Near the end of the year, amidst scoffing by some observers that the project would ever get under way because the cost-per-barrel produced would be too high, the Gulf Canada 25% was finally taken up in pieces by other companies. The Federal Government saved the project by taking up the remaining 8.5% of Hibernia, that could not be sold elsewhere, for about $226 million. Murphy Oil, a U.S. company, agreed to pay about $200 million for 6.5%. The existing partners, Mobil and Chevron, put up $150 million apiece to increase their positions by 5% each to 33.1% and 26.9%, respectively. Petro-Canada would stay at 25%. No one, including the major companies with money at risk, doubted that Hibernia would be a difficult project, out at sea not far from where the *Titanic* went down amidst the icebergs, but new and successful technologies have never developed in a vacuum. When and if completed, the Hibernia project would represent a milestone in applied science and engineering.

The Athabasca oilsands north of Fort McMurray, Alberta, played an increasingly important role in Canadian oil production. Output in 1002 was about 88 Mbbl of light "sweet" (non-sulfur containing) crude, or slightly more than 15% of the nation's total for the year. Technological development and increased operating efficiencies have steadily reduced production costs by the two major operators, Suncor Inc. and Syncrude Canada Ltd., at their two sites in northern Saskatchewan. The National Energy Board predicted that the oilsands could contribute 50% of national production by the year 2010. Athabasca, Peace River, and other bitumen and heavy oil deposits in Alberta amount to 2.5 trillion bbl of oil in place, about 40% of the world's known bitumen.

Reserves

At the beginning of 1993, Canadian reserves of copper, gold, lead, molybdenum, nickel, silver, and zinc contained in proven and probable minable ore at operating mines and in deposits committed to production were lower than at the beginning of the previous year.

Three provinces dominated Canada's reserves position: New Brunswick has 52% of the lead, 38% of the zinc, and 40% of the silver; Ontario had 74% of the nickel, 55% of the gold, and 46% of the copper; and British Columbia had all of the molybdenum and 34% of the copper. Based on the current mix of precious-metal and base-metal deposits, the expected aggregate recovery in concentrates of Canadian gold reserves is about 85%; it is roughly 90% for both copper and zinc, 85% for nickel, 80% for lead, 70% for silver, and 65% for molybdenum.

Reserves of major metals have been falling for more than a decade, except for those of gold, which grew yearly from the late-1970s until early 1989. At current production rates, the apparent life of current reserves is about 24 years for nickel, 12 for copper, 10 for zinc and molybdenum, 9 for lead and silver and 8 for gold. These estimates do not take into account inferred extensions to reserves at current mines or gross additions that will accrue to current reserves from the likely development, in the foreseeable future, of known orebodies for which a production decision has yet to be made.

Several projects, not yet counted in Canadian reserves, are expected to improve Canada's current reserves position. With respect to gold, Placer Dome announced in January 1994 that it will expand, at a cost of $150 million, the open pit at its Dome operations in Timmins, Ontario; that pit has estimated reserves of 53 tons of gold (1.7 million ounces), comparable to those of the present underground operation. In the case of zinc, deep underground exploration conducted by Falconbridge Ltd., is reported to have discovered an extension to its Kidd Creek orebody that is equivalent to 3 to 4 years of output at current production rates.

During 1992, Inco Ltd., added to its Ontario reserves 6.2 Mmt of ore from the McCreedy East deposit which grades 9.9% copper and also contains nickel and precious metals; more reserves are expected to come from McCreedy East, which is not yet fully developed. Inco also is planning a $60-million program for the deep Victor, Ontario, deposit where some 36 Mmt of rich nickel-copper-platinum-group mineralization is indicated. In December 1993, Falconbridge intersected, at its Nickel Rim property, an exceptionally rich horizon containing copper, nickel, platinum, and palladium which may be the downdip extension of the Victor deposit. *(See Table 3.)*

INFRASTRUCTURE

With a total land area of about 9,221,000 km^2, 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. John's (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 1,416 airports, 1,168 of them usable. Of these, 455 have permanent-surface runways, 4 with runways longer than 3,659 m; 30 with

runways 2,440 to 3,659 m long; and 338 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, natural gas, and nuclear fuels as well as massive hydroelectric facilities. Total capacity is approximately 106,464 MW. About 480 million MW•h, or 17,872 kW•h per capita, was produced in 1991. Pipelines included 23,564 km for crude oil and refined products as well as 74,980 km for transmission of natural gas, but the total length grows yearly in that more is added than subtracted. Alberta's network represents the greatest length for any province.

OUTLOOK

Largely as a result of the continuing strength of exports, particularly to the United States, Canada's GDP growth is forecast to be in the 3.0% to 3.7% range in 1994. Business investment spending in machinery and equipment is likely, however, to remain the only other area to show robust growth in 1994, as corporations emerging from the recession replace outdated technology. Inflation will probably remain low but interest rates, on the other hand, may edge up, mainly as a result of the impact of a weaker Canadian dollar. Constrained consumer spending, large government deficits at all levels, and continuing high rates of unemployment will remain major areas of concern. The unemployment rate may edge down to less than 11%, but this will still be far from its pre-recession low of 7.5%.

Factors related to the strength of the economy, both domestically and internationally, will continue to generate uncertainty for Canada's mineral producers. On the international front, world mineral supply and demand will be affected by political and economic developments in markets, such as Japan, continental Europe, former U.S.S.R., China and South Africa. Domestically, there is concern about the impact of increasing environmental regulation and taxation practices that are viewed by the industry as unfavorable to mineral investment.

On a more optimistic note, there were hopeful signs, early in 1994, of a continuing export-driven economic recovery in Canada. The predicted expansion of the U.S. economy in 1994 augured well for the Canadian economy, as about 80% of Canada's exports overall—and close to 66% of Canada nonfuel mineral exports—are destined for U.S. markets. Longer-term global economic growth, especially in the developing world, could help to reverse the downward trend in base-metal prices.

Another difficult year for the industry may lie ahead, but continued efforts to modernize and compete aggressively on an international basis will enable Canada's mineral industry to maintain its position as an important contributor to Canada's economy.

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[1]For more detailed information on the mineral industry of Canada, see the Canadian Mineral Yearbooks for 1992 and 1993, prepared by the Mining Sector, Natural Resources, Ottawa, Canada, which were used extensively as source material for this report. The U.S. Department of the Interior, U.S. Bureau of Mines, has arranged to have these Canadian publications placed in selected depository libraries of the 50 States and Puerto Rico. Please note that any datum or statistic in the text not referenced elsewhere may be assumed to be from either the Yearbook or the related series of separate, preliminary, topical periodicals containing information compiled by Statistics Canada and issued by Natural Resources Canada.

[2]Where necessary, values have been converted from Canadian dollars (CAN$) to U.S. dollars at an average rate of CAN$1.2944=US$1.00 for 1993 and CAN$1.2083=US$1.00 for 1992. All values in this report are expressed in U.S. Dollars.

OTHER SOURCES OF INFORMATION

Agencies, Federal

Natural Resources Canada
460 O'Connor Street
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Canada

Mining Sector
Geological Survey of Canada
Surveys, Mapping, and Remote Sensing
Sector Canada Centre for Mineral and
Energy Technology

Energy Sector (CANMET)
Statistics Canada
Tunney's Pasture
Ottawa, Ontario
Canada

Department of Indian Affairs and Northern Development
Les Terrasses de la Chaudière,
Ottawa, Ontario K1A 0H4
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Environment Canada
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27th Floor
10 Wellington St.
Ottawa, Ontario K1A 0H3
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Agencies, Provincial (West to East)

Ministry of Energy, Mines and Petroleum Resources
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Victoria, British Columbia V8V 1X4
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Department of Energy
Petroleum Plaza, North Tower, 9945 108 St.
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Administration of Mining Lands
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Publications

Canadian Geoscience Council, annual report.
Canadian Institute of Mining and Metallurgy, monthly.
Canadian Mineral Analysts, monthly.
Canadian Mining Journal, Canada's Top Mining Companies, monthly.
Natural Resources, Canada:
Canadian Minerals Yearbook, annual.
Canadian Mineral Industry Reports, monthly.
Canadian Mines: Perspective for 1990, Production, Reserves, Development, and Exploration, annual.
Mineral Policy Sector, Canadian Minerals, annual.
Mining and Mineral Processing Operations in Canada, Annual Mineral Bulletin.
Production of Canada's Leading Minerals, monthly.
Geological Association of Canada, Geoscience Canada, quarterly.
Indian and Northern Affairs Canada, Mines and Mineral Activities, annual.
Industrial Minerals of London, World of Minerals, monthly.
International Mining of London, Canadian Mining, monthly.
The Journal of Commerce (U.S.) newspaper, weekdays.
Maclean Hunter Publication, Rock Products Register, annual.
Metal Industry, Trends and Outlook, monthly.
Mining Journal Ltd., London, Mineral Markets and Mining Finance, monthly.
Mining Journal Ltd., London, Mining Journal, weekly.
Northern Miner Press Inc.:
Canadian Mines Handbook 1990-91, annual.
Canadian Oil & Gas Handbook, 1990-91, annual.
The Northern Miner, weekly
Penn Well Publishing Co.:
Worldwide Natural Gas Industry Directory, annual.
Oil and Gas Journal, Worldwide Report, monthly.
International Petroleum Encyclopedia, 1990.
Prospectors and Developers Association of Canada, monthly.
Québec Prospectors Association, monthly.
Répertoire des Etablissements Menant des Opérations Minières Au Québec, annual.
Statistics Canada:
Coal and Coke Statistics, monthly.
Crude Petroleum and Natural Gas Production, monthly.
International Trade Division, Imports by Commodity, yearly; Exports: Trade Merchandise, yearly.
U.S. Embassy, Ottawa:
Periodic Economic and Industrial Outlook reporting United Nations, Energy Statistics Yearbook, annual.
The Wall Street Journal, newspaper, daily.
Information Respecting Securities Laws-Corporate Annual Reports of individual mining companies.

TABLE 1

CANADA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993	Annual capacity (Jan. 1, 1994)
METALS							
Aluminum:							
Alumina, gross weight	thousand tons	1,048	1,087	1,131	1,104	1,182	1,200
Metal:							
Primary		1,554,753	1,567,395	1,821,642	r1,971,843	2,308,868	2,500,000
Secondary		77,000	67,659	67,660	67,680	e68,000	80,000
Antimony[2]		2,821	658	469	r948	741	2,800
Arsenic trioxide		1,825	485	e236	e250	e250	1,800
Bismuth		r205	r87	65	r224	173	250
Cadmium:							
Mine output, Cd content[2]		r1,911	r1,528	1,787	r1,630	1,412	2,000
Metal, refined		1,620	1,470	1,829	1,963	1,944	2,000
Calcium	kilograms	W	W	W	W	W	W
Cobalt:							
Mine output, Co content[2]		r6,167	r5,470	r5,274	r5,102	5,738	6,500
Metal:							
Shipments[3]		2,344	2,184	2,171	2,223	2,370	3,200
Refined, including oxide		2,110	2,063	2,248	2,210	2,695	3,400
Columbium and tantalum:							
Pyrochlore concentrate:							
Gross weight		5,443	5,272	5,230	r5,100	5,320	5,500
Cb content		r2,449	r2,373	2,354	r2,295	2,393	2,500
Tantalite concentrate:e							
Gross weight		r310	r350	r380	r200	130	400
Ta content		r76	r86	r93	r48	31	100
Cb content		12	14	15	8	5	20
Copper:							
Mine output, Cu content[2]		723,052	793,735	811,134	r768,582	733,606	850,000
Metal:							
Smelter:							
Primary, blister		462,324	475,596	505,425	515,026	535,891	550,000
Secondary and scrap		37,829	47,399	26,757	37,408	40,432	50,000
Total		500,153	522,995	r532,182	r552,434	576,323	600,000
Refined		515,216	515,835	538,339	539,302	561,590	600,000
Gold, mine output	kilograms	159,527	169,412	176,552	r161,402	152,929	200,000
Iron and steel:							
Ore and concentrate:							
Gross weight	thousand tons	r40,509	r34,855	36,383	r32,697	30,568	41,000
Fe content	do.	r25,924	r21,959	22,921	21,506	e20,000	27,000
Metal:							
Pig iron	do.	10,139	7,346	8,268	8,621	8,633	10,000
Direct-reduced iron	do.	710	730	553	639	758	800
Ferroalloys, electric arc furance:e							
Ferromanganese and silicomanganese	do.	185	185	45	—	—	120
Ferrosilicon	do.	r95	r95	r75	55	55	63
Silicon metal	do.	r20	r20	r20	20	20	29
Ferrovanadium	do.	2	2	2	2	2	2
Total	do.	r302	r302	r142	r77	77	214
Crude steel	do.	15,458	12,281	12,987	13,924	14,387	16,000

See footnotes at end of table.

TABLE 1—Continued

CANADA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993	Annual capacity (Jan. 1, 1994)
METALS							
Lead:							
Mine output, Pb content		276,065	241,277	276,528	r343,808	182,234	350,000
Metal, refined:							
Primary		157,330	87,180	106,420	151,252	150,852	160,000
Secondary		85,515	96,465	r105,948	r101,633	69,107	110,000
Total		242,845	183,645	r212,368	r252,885	219,959	270,000
Lithium: Spodumene		14,000	12,000	12,000	18,500	18,500	19,000
Magnesium metal, primary[e]		7,000	e26,726	e35,512	25,700	23,300	49,000
Molybdenum, mine output, Mo content		14,073	11,994	11,329	e9,405	10,098	14,500
Nickel:							
Mine output, Ni content[5]		r200,899	196,225	192,259	r186,384	188,378	200,000
Refined[6]		r142,800	r134,700	r131,500	r135,200	123,139	130,000
Platinum-group metals, mine output	kilograms	10,389	11,709	11,708	r11,907	13,807	14,000
Selenium, refined[7]	do.	270,000	341,650	207,286	294,057	295,000	300,000
Silver:							
Mine output, Ag content	do.	1,370,737	1,501,451	1,338,799	r1,215,388	888,050	1,400,000
Refined	do.	1,136,159	941,468	1,001,722	1,027,965	1,011,956	1,200,000
Tellurium, refined[7]	do.	8,000	9,859	12,374	21,776	e31,000	25,000
Tin:							
Mine output, Sn content		2,790	2,828	4,455	—	—	4,000
Refined, tin in lead-tin alloys		34	7	—	—	—	40
Titanium: Sorel slag[8]		1,040,000	1,046,000	701,000	753,000	e750,000	750,000
Uranium oxide (U_3O_8)		13,475	10,342	9,624	r10,965	10,876	13,500
Zinc:							
Mine output, Zn content		1,216,139	1,203,161	1,156,582	r1,324,675	1,007,257	1,350,000
Metal, refined, primary		669,677	r591,786	660,552	671,702	661,881	700,000
INDUSTRIAL MINERALS							
Asbestos		r732,192	r724,620	r639,008	r590,641	515,341	750,000
Barite		r47,000	r41,000	50,000	r37,000	e59,000	60,000
Cement, hydraulic[9]	thousand tons	12,591	11,745	9,396	r5,698	6,672	12,000
Clay and clay products[10]	value, thousands	$200,138	$143,072	$119,838	$117,326	e$120,000	$200,000
Diatomite[e]		4,200	4,100	8,000	10,000	10,000	12,000
Fluorspar		50,794	21,400	—	—	—	60,000
Gemstones, amethyst and jade		975	455	542	1,335	1,251	1,400
Graphite (exports)		6,000	10,200	6,200	17,400	e17,000	20,000
Gypsum and anhydrite	thousand tons	r9,179	r8,790	6,830	r7,566	8,097	8,500
Lime	do.	2,552	2,341	2,375	r1,456	1,495	3,000
Magnesite, dolomite, brucite		150,000	150,000	e180,000	e180,000	e180,000	180,000
Mica, scrap and flake[e]		e12,000	16,000	17,000	17,500	17,500	18,000
Nepheline syenite		r552,000	r535,000	r484,000	r554,000	503,000	600,000
Nitrogen: N content of ammonia		4,100,000	3,053,566	3,016,247	3,104,119	e3,100,000	4,200,000
Potash, K_2O equivalent	thousand tons	r7,333	r6,989	r7,406	r7,270	6,841	7,500
Pyrite and pyrrhotite, gross weight[e]		5,000	5,000	5,000	5,000	5,000	5,000
Salt	thousand tons	r11,021	r11,261	11,993	r11,171	11,169	11,500
Sand and gravel	do.	r273,238	r243,232	r214,410	r238,134	e228,500	300,000
Silica (quartz)[11]	do.	r2,491	r2,081	r1,495	r1,754	e1,600	2,500
Sodium compounds, n.e.s.:							
Sodium carbonate (soda ash)[e]		325,000	315,000	310,000	305,000	305,000	330,000
Sodium sulfate, natural[12]		r323,000	r345,000	332,000	r282,000	315,000	350,000
Stone[13]	thousand tons	r135,398	r128,435	r102,986	r104,549	94,746	150,000
Sulfur: Elemental byproduct:							
Metallurgy	do.	r836	r899	r872	r931	912	950
Natural gas	do.	r5,115	r5,181	r5,488	r5,769	e6,500	6,500
Petroleum[e]	do.	200	207	230	235	300	300
Tar sands	do.	500	503	540	552	e600	600
Talc, soapstone, pyrophyllite		r150,000	r148,000	123,000	r104,000	e103,000	150,000

See footnotes at end of table.

TABLE 1—Continued

CANADA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993	Annual capacity (Jan. 1, 1994)
MINERAL FUELS AND RELATED MATERIALS							
Carbon black		180,000	178,212	157,115	161,218	e161,000	180,000
Coal:							
Bituminous and subbituminous	thousand tons	60,085	58,924	62,149	55,335	e55,000	65,000
Lignite	do.	10,915	9,407	8,981	10,027	e10,000	12,000
Coke, high-temperature	do.	4,414	3,708	r3,666	3,711	e3,700	4,500
Gas, natural:							
Gross	million cubic meters	114,661	138,358	144,987	158,067	e160,000	165,000
Marketed	do.	92,530	98,773	105,201	118,925	e120,000	125,000
Natural gas liquid: Gross							
Ethane	thousand 42-gallon barrels	42,352	44,694	47,414	45,953	e46,000	50,000
Propane	do.	41,302	42,448	42,393	45,304	e45,000	50,000
Butane	do.	22,194	21,621	23,557	24,878	e25,000	25,000
Pentanes plus	do.	43,414	41,567	43,392	48,069	e48,000	50,000
Condensate	do.	1,871	976	1,217	1,396	e1,400	2,000
Total	do.	151,133	151,306	157,973	165,600	e165,400	177,000
Peat		r797,000	715,776	856,000	r740,000	e830,000	900,000
Petroleum:							
Crude[14]	thousand 42-gallon barrels	583,827	566,978	563,985	585,076	614,697	700,000
Refinery products:							
Liquefied petroleum gas, propane, and butane	do.	20,700	17,224	16,538	17,293	e17,000	22,000
Gasoline:							
Aviation	do.	1,059	813	759	706	e710	1,100
Other	do.	28,298	231,545	229,665	229,316	e230,000	240,000
Petrochemical feedstocks	do.	29,080	31,345	31,942	30,721	e31,000	32,000
Jet fuel	do.	26,980	33,288	28,592	24,668	e25,000	28,000
Kerosene	do.	15,546	2,792	3,493	2,015	e2,000	10,000
Distillate fuel oil, diesel and light	do.	166,731	174,588	169,184	163,159	e163,000	180,000
Lubricants including grease	do.	7,372	6,549	6,176	5,363	e5,400	7,500
Residual fuel oil, heavy	do.	53,903	56,673	54,081	50,131	e50,000	60,000
Asphalt	do.	17,018	16,894	15,922	15,221	e15,200	17,000
Petroleum coke	do.	([15])	5,398	5,692	6,307	e6,300	6,500
Unspecified	do.	40,072	33,730	30,791	30,322	e30,300	45,000
Refinery fuel and losses[16]	do.	32,726	26,537	24,697	29,140	e29,000	35,000
Total	do.	639,485	637,376	617,532	604,362	e604,910	684,100

eEstimated. rRevised. W Withheld to avoid disclosing company proprietary data.

[1]Table includes data available through Sept. 1994.

[2]Metal content of concentrates produced.

[3]Cobalt content of all products derived from ores of Canadian origin, including cobalt oxide shipped to the United Kingdom for further processing and nickel-copper-cobalt matte shipped to Norway for refining.

[4]Reported figure.

[5]Nickel content of concentrate.

[6]Nickel contained in products of smelters and refineries in forms which are ready for use by consumers. Natural Resources Canada has revised all nickel refined figures to conform with International Nickel Study Group guidelines.

[7]From all sources, including imports and secondary sources. Excludes intermediate products exported for refining.

[8]Refined sorel slag contained 80% TiO_2 in 1989-90. TiO_2 content in 1991-93 is not reported.

[9]Cement shipped and/or used by producers.

[10]Includes bentonite products from common clay, fire, stoneware clay, and other clays. Values are in current Canadian dollars.

[11]Producers' shipments of quartz.

[12]Excludes byproduct production from chemical plants.

[13]Crushed, building, ornamental, paving, and similar stone.

[14]Including synthetic crude (from oil shale and/or tar sands).

[15]Combined with "unspecified" category.

[16]Refinery fuel represents total reported production of still gas, including a small amount sold.

TABLE 2

CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	Alcan Aluminum Ltd.	Smelter, Montreal, Quebec	
Do.	do.	Smelter, Laterriere, Quebec	200.
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	232.
Do.	do.	Smelter, Kitimat, British Columbia	268.
Do.	Aluminiere de Becancour Inc. (Pechiney Corp., 25%; Government Quebec, 24.95%)	Smelter, Beaconcour, Quebec	360.
Do.	Canadian Reynolds Metals Co. Ltd. Reynolds Metals Co., 100%)	Smelter, Baie Comeau, Quebec	400.
Asbestos	LAB Chrysotile Inc. [Lac d'Amiante du Quebec, Ltee (LAQ), 555; Societe Nationall de l'Amiant (NSA), 45%]	Black Lake, Quebec	160 (fiber).
Do.	JM Asbestos Inc.	Jeffrey Mines, Asbestos, Quebec	300 (fiber).
Do.	Cassiar Mining Corp. (Princeton Mng. Corp., 100%)	Cassiar, British Columbia	100 (fiber).
Cement	Lafarge Canada Inc.	Bath, Montreal, Quebec	1,000 (dry-process cement).
Do.	do.	Exshaw, Alberta	1,184 (dry-process cement).
Do.	Ciment St. Laurent Inc. (St. Lawrence Cement, 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	927 (dry-process cement).
Coal	Brinco Coal Corp. (Consolidated Brinco Ltd., 100%)	Quinsam Coal Mine, Campbell River, British Columbia	14,400 (open-pit underground).
Do.	Cape Breton Development Corp. (Government of Canada, 100%)	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.	Higvale Mine, Seba Beach, Alberta	11,610 (open pit).
Do.	do.	Utility Mine, Estevan, Saskatchewan	3,600 (open pit).
Do.	Smoky River Coal Ltd. (Smoky River Holdings Ltd., 100%)	Grande Cache, Alberta	3,600 (underground and open pit).
Copper	Brenda Mines Ltd. (Noranda Inc., 69%)	Peachland, British Columbia	10,800.
Do.	Broken Hill Proprietary Co. Ltd. (BHP Holdings Inc., 100%)	Island Copper Mine, Port Hardy, British Columbia	16,200.
Do.	Cassiar Mining Corp. (Princeton Mining Corp., 100%)	Similco Mine, Princeton, British Columbia	9,000.
Do.	Falconbridge Ltd. (Noranda Inc., 50%; Trelleborg AB, 50%)	Subdury Operations, Sudbury, Ontario	4,250.
Do.	do.	Strathcona and Timmins operations, Timmins, Ontario	4,860.
Do.	do.	Smelter, Timmins, Ontario	440.
Do.	Gibraltar Mines Ltd. (placer Dome Inc., 68.14%)	McLease Lake, British Columbia	13,070.
Do.	Highland Valley Copper (Cominco, 50%; Rio Algom Ltd., 33.5%; Teck Corp., 11.5%; Highmont Mining Co., 5%)	Logan Lake, British Columbia	4,500.
Do.	Inco Ltd.	Sudbury and Shebandowan, Ontario Thompson District, Manitoba	20,250 (mine).
Do.	do.	Smelter, Sudbury, Ontario	500.

See footnote at end of table.

TABLE 2—Continued

CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper—Continued:	Noranda Inc.	Refinery, Subdury, Ontario	170.
Do.	do.	Bell Copper Mine, Babine Lake, British Columbia	5,550.
Do.	do.	Smelter Horne, Noranda, Quebec	770.
Gold	Agnico-Eagle Mines Ltd.	Joutel, Quebec	590 (ore).
Do.	American Barrick Resources Corp. (The Horsham Group, 21.1%)	Camflo Div., Val d'Or, Quebec	436 (ore).
Do.	Cassiar Mining Corp. (Acquired by Princeton)	Similco Mine, Princeton, British Columbia	450 (kg metal).
Do.	Eastmaque Gold Mines Ltd.	Kirkland Lake, Ontario	949 (ore).
Do.	Echo Bay Mines Ltd.	Lupin Mine, Contwoyo Lake; Northwest Territories	612 (ore).
Do.	Royal Oak Mines Inc.	Giant Mine, Yellowknife, Northwest Territories	407 (ore).
Do.	do.	Gaint 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. (Noranda, Inc., 50.8%)	Golden Giant Mine, Marathon, Ontario	1,080 (ore).
Do.	Hope Brook Gold Inc. (BP Canadian Holdings Ltd., 75.7%)	Hope Brook Mine, Conteau Bay, Newfoundland	1,090 (ore).
Do.	LAC Minerals Ltd.	Page Williams Mie, Hemio, Ontario	2,100 (ore).
Do.	Hudson Bay Mining and Smelting Co. (Inspiration Resources Corp., 100%)	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	400 (ore).
Do.	do.	Detour Lake Mine, Northeast Ontario	900 (ore).
Do.	do.	Dome Mine, South Porcupine, Ontario	1,300 (ore).
Do.	do.	Sigma Mine, Val d'Or, Quebec	500 (ore).
Do.	do.	Kiena Mine, Val d'Or, Quebec	500 (ore).
Do.	do.	Equity Silver Mine, Houston, British Columbia	3,500 (ore).
Do.	Teck-Corona Corp. (Teck Corp., 100%)	David Bell Mine, Hemlo, Ontario	456 (ore).
Gypsum	Domtar Inc.	Flat Bay, New Foundland	1,300.
Do.	Georgia-Pacific Corp.	River Denys, Sugar Camp, Nova Scotia	1,460.
Do.	Little Narrows Gypsum Co. Ltd. (USG Corp., 100%)	Little Narrows, Nova Scotia	1,640.
Do.	National Gypsum (Canada) Ltd. (Aancor Holdings Corp., 100%)	Milford, Nova Scotia	3,300.
Do.	Westroc Industries Ltd.	Windermere, British Columbia	1,170.
Iron and steel	Iron Ore Co. of Canada	Carol Lake, Labrador	8,800 (concentrate).
Do.	do.	do.	10,300 (pellets).
Do.	Quebec Cartier Mining Co. (Dofasco Inc., 50%)	Mount Wright, Quebec	16,950 (concentrate).
Do.	do.	do.	7,500 (acid pellets).
Do.	The Algoma Steel Corp. Ltd. (Dofasco Inc., 100%)	Sault Ste. Marie, Ontario	2,478 (pig iron), 3,135 (crude steel), 657 (sinter).
Do.	Dofasco Inc.	Hamilton, Ontario	3,642 (pig iron), 4,500 crude steel).
Do.	Stelco, Inc.	do.	2,733 (pig iron), 7,990 (crude steel), 560 (sinter).
Do.	Wabush Mines Ltd. (Inland Steel Industries, 18%; LTV Corp., 26.9%; IRI Italy, 11.38%)	Wabush, Labrador, and Pointe Noire, Quebec	6,200 (concentrate).

See footnote at end of table.

TABLE 2—Continued

CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Lead		Brunswick Mining and Smelting Corp. Ltd. (Noranda Inc., 64.8%)	No. 12 Mine, Bathurst, New Brunswick	72 (Pb contained).
Do.		Falconbridge Ltd. (Noranda Inc., 50%; Trelleborg AB, 50%)	Strathcona, Timmins, Ontario	212 (Pb-Zn contained).
Do.		Hudson Bay Mining and Smelting Co., Ltd. (Inspiration Resources Corp., 100%)	Flin Flon and Snow Lake, Manitoba	60 (Pb-Zn contained).
Do.		Cominco Ltd.	Trail, British Columbia	135 (refined lead).
Do.		Curragh Resources Inc. (Banco Español de Crédito, S.A., 100%)	Faro Mine, Yukon Territory	184 (Pb-Zn contained).
Limestone		Lafarge Canada Inc.	Steep Rock, Manitoba	906 (quarry limestone).
Do.		Scotia Limestone Ltd.	Iris Cove, Sydney, Nove Scotia	720 (limestone).
Do.		Inland Cement Ltd. (CBR Materials Corp. of Canada, 100%)	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	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 McCreed East and West, Shebandowan, Clarabell, Lower Coleman, Crean Hill, Murray, and Totten in Sudbury area, Ontario	106 (metal contained).
Do.		do.	Smelter, Sudbury, Ontario	110 (metal contained).
Do.		do.	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 Saskachewan, Alberta	24 (metal contained).
Petroleum[1]				
Gas	billion cubic meters	Bow Valley Industries Ltd. (British Gas Canada Ltd., 100%)	Edgerton, etc.	1.8.
Crude	million 42-gallon barrels	do.	do.	12.4.
Gas	million cubic meters	BP Canada Inc. (The British Petroleum Co. PLC London, 100%)	Noel Area, North Alberta; Chauvin, Sibbald, North Pembina, Alberta	47.
Crude	million 42-gallon barrels	do.	do.	1.2.
Do.		Gulf Canada Corp. (Olympia & York Developments, 80%; Gulf, 20%)	Fenn-Big Valley, Swan Hills, Goose River, Peerless, and Sene, Alberta	18.
Do.		Home Oil Co. Ltd. (Interhome Energy Inc. 100%)	Red Earth, Garrington, Cherhill, Medicine River, and Swan Hills, Alberta	11.5.
Gas	billion cubic meters	do.	do.	1.8.
Crude	do.	Imperial Oil Ltd. (Exxon Corp., USA, 70%; others, 30%)	Judy Creek, Cold Lake, Alberta, and Mackenzie Delta, Beaufort Sea, Yukon and Northwest Territories	670.
Gas	million 42-gallon barrels	do.	do.	36.4.
Crude	do.	Mobil Oil Canada Ltd. (Mobil Corp., United States, 100%)	Hibernia, Grand Banks, Southeast of Newfoundland and Sable Island, Saskatchewan, and British Columbia Nova Scotia, and others in Alberta,	26.1.

See footnote at end of table.

TABLE 2—Continued

CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum—Continued:				
Gas	billion cubic meters	Mobil Oil Canada Ltd. (Mobil Corp., United States, 100%)	Hibernia, Grand Banks, Southeast of Newfoundland and Sable Island, Nova Scotia, and others in Alberta, Saskatchewan, and British Columbia	3.0.
Crude	million 42-gallon barrels	Norcen Energy Resources Ltd. (Hollinger Inc., 59%; Hees International, 41%)	Pembina, Bodo, Majorville, Alberta	12.1.
Do.	do.	Oakwood Petroleums Ltd. (Sceptre Resources Ltd., 100%)	Grantham, Hays Ronalane, Peace River, Normandville, Randell, Alberta, and Grizzly Valley, British Columbia	24.6.
Do.	do.	PanCanadadian Petroleum Ltd. (Canadian Pacific Enterprises, 87%; others, 13%)	Rycroft, Wembley, Elk Point, Rio Bravo, Alberta	19.7.
Gas	billion cubic meters	do.	do.	3.53.
Crude	million 42-gallon barrels	Shell Canada Ltd. (Shell Investments, 79%; Others, 21%)	Dimsdale, Little Smoky Lake, Sousa, Alberta, Midale, Benson, Saskatchewan	22.2.
Gas	billion cubic meters	do.	do.	6.53.
Crude	million 42-gallon barrels	Suncor Inc. (Sun Co. Inc., United States, 75%; Ontario Energy Resources, 25%)	Kidney, Zama Lake, Cosway, Albersun Prevo, and Medicine River, Alberta, and Leitchville, Unwin, Saskatchewan	4.1.
Do.	thousand 42-gallon barrels	Texaco Canada Petroleum Inc. (Texaco Inc., United States, 78%; others, 22%)	Eaglesham, Virgo, Alberta, and Desan, British Columbia	158.
Gas	million cubic meters	do.	do.	67.3.
Crude	million 42-gallon barrels	UNOCAL Canada Ltd. (UNOCAL Corp. USA, 100%)	Calgary, Alberta	14.7.
Potash (K_2O equivalent):		Potash Corp. of Saskatchewan Inc. (private, 37%; Provincial government, 63%)	Lanigan, near Lanigan Saskatchewan	3,400 (KCl).
Do.		do.	Rocanville, southeast Saskatchewan	1,750 (KCl).
Do.		International Minerals & Chemical Corp. (Canada) Ltd. (IMC Fertilizer Corp., 100%)	Esterhazy, southeast Saskatchewan	1,814 (KCl).
Do.		Kalium Chemicals (Kalium Canada Ltd., 100%)	Potash Mine, 40 km west of Regina, Moose Jaw, Saskatchewan	2,040 (KCl).
Salt and brine operations		The Canadian Salt Co.	Pugwash, Nova Scotia	1,400 (rock salt and brine salt).
Do.		do.	Iles-de-la-Madeleine, Quebec	1,625 (rock salt).
Do.		do.	Ojibway, Ontario	2,600 (rock salt).
Silver		Cambior, Inc.	Quebec	396 (mill feed).
Do.		International Corona Corp. (Dundee Bancorp, 30%)	Nickel Plate Mine, Hedley, British Columbia	1,320 (mill feed).
Do.		Equity Silver Mines Ltd. (Placer Dome Inc. Bancorp, 30%)	Houston, British Columbia	2,970 (Ag-Au-Cu concentrate).
Do.		LAC Minerals Ltd.	Macassa Mine, Ontario	165 (mill feed).
Do.		do.	Bousquet Mine, Quebec	580 (mill feed).
Do.		Similco Mines Ltd.	Princeton, British Columbia	8,250 (Ag-Au-Cu concentrate).
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, United States, 100%)	Fort Saskatchewan, Alberta	524 (caustic soda).
Do.		do.	do.	476 (chlorine).
Do.		do.	Sarina, Ontario	350 (caustic soda).
Do.		General Chemical Canada Ltd.	Amherstburg, Ontario	363 (sodium carbonate).
Sulfur:				
Petroleum refinery capacities		Consumer's Cooperative Refineries Ltd. (Federated Cooperatives Ltd., 100%)	Regina, Saskatchewan	54.
Do.		Esso Petroleum Canada	Sarina, Ontario	50.
Do.		Sulconam Inc. (Petro Canada, 7.6%)	Montreal, Quebec	108.

See footnote at end of table.

TABLE 2—Continued

CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Main sulfur extraction plants (sour gas and oil sands)	Amoco Canada Petroleum Co., Ltd. (Amoco Corp. USA, 100%)	East Crossfield-Elkton, Alberta	650.
Do.	Canadian Occidental Petroleum, Ltd.	East Calgany-Crossfield, Alberta	610.
Do.	Chevron Canada Resources Ltd. (Chervon Corp. USA, 100%	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 nad H_2SO_4 production capacities	Canadian Electro Zinc Ltd. (CEZ) (Noranda Inc., 90.17%)	Valleyfield, Quebec	430 (H_2O_4).
Do.	INCO Ltd.	Copper Cliff, Ontario	950 (H_2O_4).
Do.	Falconbridge Ltd. (Noranda Inc., 50%; Trelleborg AB, 50%)	Kidd Creek, Ontario	690 (H_2O_4).
Do.	ESSO Chemical Canada (Imperial Oil, Ltd., 100%)	Redwater, Alberta	910 (H_2O_4).
Uranium	Denison Mines Ltd.	Elliot Lake, Ontario	1,319 (metal).
Do.	Cameo Corp. (Province of Saskatchewan, 61.5%; Government of Canada, 38.5)	Key Lake, Saskatchewan	4,976 (metal).
Zinc	Brunswick Mining and Smelting Corp. Ltd. (Noranda Inc., 64.3%)	Bathurst, New Brunswick	232 (Zn in concentrate).
Do.	Falconbridge Ltd. (Noranda Inc., 50%; Trelleborg AB, 50%)	Timmins Operations, Ontario	212 (Pb-Zn concentrated).
Do.	do.	Smelter	133 (slab zinc).
Do.	Hudson Bay Mining and Smelting Co., Ltd. (Inspiration Resources Corp., 100%)	Snow Lake concentrator, Manitoba	1,125 (Pb-Zn ore).
Do.	do.	Flin Flon Mine and smelter	85 (slab zinc).
Do.	Cominco Ltd. (Cominco, 55%; Pine Point Mines Ltd., 45%)	Sullivan Mine, Kimbreley, British Columbia	70 (Pb-Zn concentrated).
Do.	do.	Smelter, Trail, British Columbia	300 (slab zinc).
Do.	Curragh Resources Inc. (Banco Espanõl de Crédito, S.A., 100%)	Faro Mine, Yukon Territory	184 (Pb-Zn concentrated).

[1]Projections of annual capacity involve matching decline curves against new discoveries and are extrapolations only, based on data in Canadian Oil & Gas Handbook 1991, Northern Miner Press, Inc.

TABLE 3

CANADA: RESERVES OF MAJOR MINERALS, 1993

(Thousand metric tons unless otherwise specified)[1]

Abestos, fiber		e39,000
Coal, all types		e6,371,000
Copper, metal content		10,818
Gold, metal	metric tons	[2]1,367
Gypsum		e [3]500,000
Iron ore, iron content		e1,314,000
Lead, metal content		4,348
Molybdenum, metal content		163
Natural gas	billion cubic meters	[4]2,060
Nickel, metal content		5,605
Petroleum crude	million barrels	[4]6,766
Potash, K_2O equivalent	million tons	e14,000
Salt		[3]314,000
Silver, metal	metric tons	16,300
Sodium sulfate		[3]92,000
Sulfur		e140,000
Uranium		[5]271
Zinc, metal content		15,067

eEstimated.

[1]1993 Canadian Minerals Yearbook, Natural Resources Canada, unless noted.

[2]Excludes metal in placer deposits.

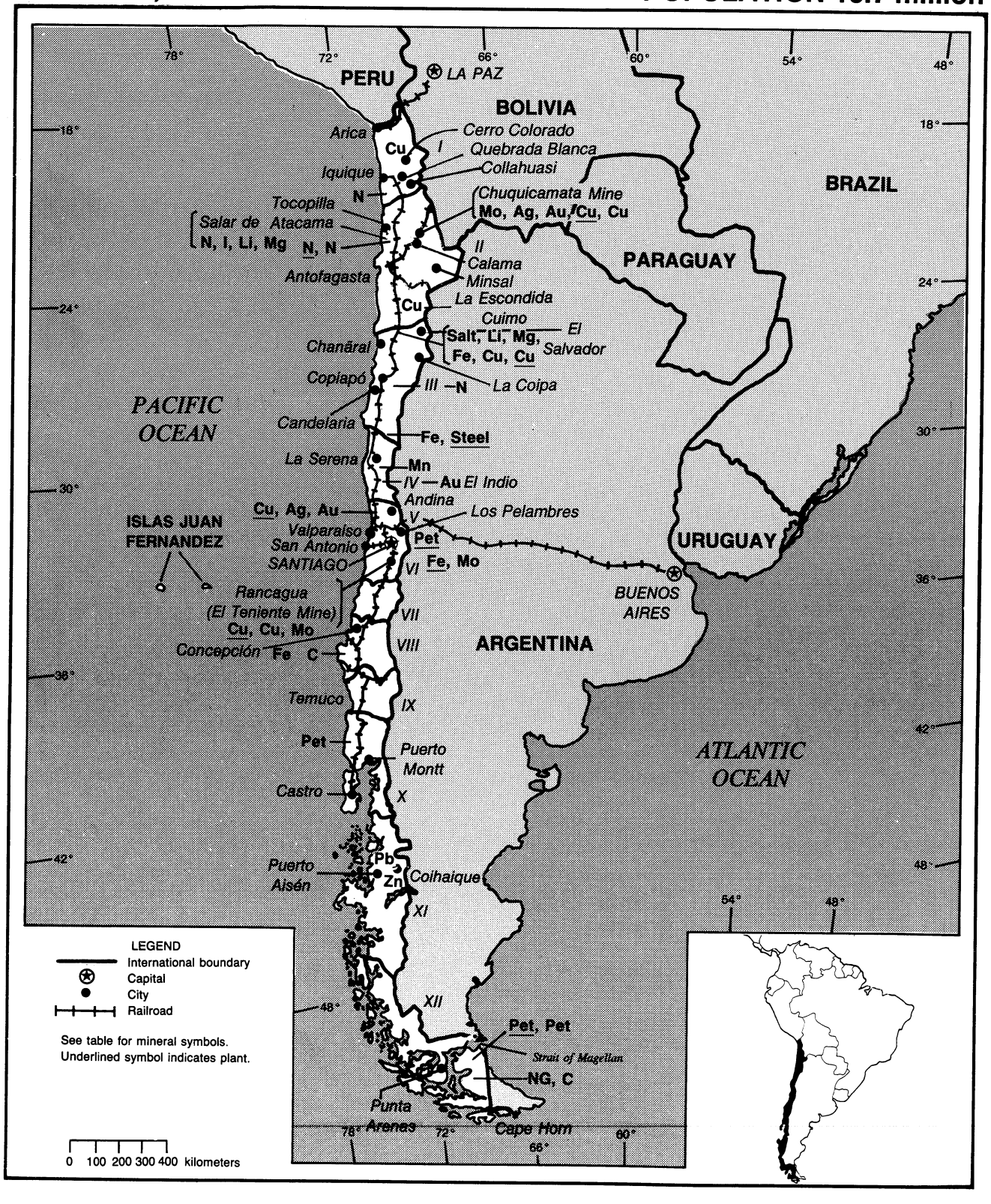
[3]Data in thousand short tons, unless noted.

[4]Extrapolated from 1991 Canadian Oil and Gas Handbook, The Northern Mines Press Ltd.

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

CHILE

AREA 756,950 km² **POPULATION 13.7 million**



THE MINERAL INDUSTRY OF

CHILE

By Pablo Velasco

In 1993, Chile continued to be the largest producer and exporter of copper in the world, with an output of 2.055 Mmt, of copper per year exceeding the 2 Mmt figure for the first time in Chile's history. Low copper prices in 1993 slowed some new projects, but does not seem to have affected copper mine expansion or investment in the precious metal sector. According to the Chilean Copper Commission (COCHILCO), copper exports totaled $3.3 billion, 15.2% lower than those in 1992.

Chile's copper production accounted for 22% of the total world output in 1993 and was expected to expand this lead in the foreseeable future. Chile was also one of the world's significant producers and exporters of potassium nitrate and sodium nitrate, ranking second in the world production of iodine, lithium, molybdenum, and rhenium after the United States.

Preliminary data indicated that the Chilean economy had slowed down in 1993. Gross domestic product (GDP) grew 6% compared with the 10.4% rate in 1992 to about $40.0 billion[1] in 1993, while per capita income increased to about $3,000.

GOVERNMENT POLICIES AND PROGRAMS

There are two laws regulating foreign investment in Chile: Decree Law No. 600, of 1974, also referred to as the "Foreign Investment Statute", the keystone on foreign investment legislation in Chile; and Title I, Chapter XIX (Compendium of Foreign Exchange Rules issued by the Central Bank of Chile), referred to as " Convenciones Relativas a Inverciones con Titulos de Deuda Externa" (Conventions on Investments Relative to Foreign Debt Papers) of November 1991. As stipulated by this law, foreign investors as individuals or corporations may use Chilean foreign-debt titles payable abroad, maturing within 365 days, to invest in the country. This law provided the legal framework guaranteeing the rights of foreign investors and established maximum tax rates, offshore accounts, and a minimum period after which profits and capital could be repatriated.

The Ministry of Mining's Environmental Unit, the National Environmental Commission (CONAMA) advises the Ministry: in the design of environmental policies and regulations; at controlling its implementation; and at diagnosing the sector's environmental impact on the deveoplment of general environmental objectives and policy responses.

An important example of this has been the enactment of Executive Decree D.S. No. 185 and the Law of Environmental Bases, enacted in January 1992, aimed at regulating SO_2 emissions, particulate material, and arsenic from fixed sources in the country.

The Chilean mining industry experienced another year of continued growth in 1993 as a result of new foreign investment, and the new expansion of the giant Escondida Mine in late 1993. According to the COCHILCO, most of the foreign investment in the mining sector was concentrated over the last 5 years in the following projects: (1) Cerro Colorado, ($286 million), Rio Algom/Canada (copper); (2) Quebrada Blanca, ($373 million) Cominco and the Teck Corp/Canada, Pudahuel and Enami/ Chile (copper); (3) Collahuasi, ($1 billion) Falconbridge/Canada; Shell/ United Kingdom; Minera Mantos Minorco/Luxembourg (copper); (4) El Abra, ($1 billion) Cyprus/AMAX/USA; CODELCO/Chile, (copper); (5) Ivan-Zar, ($36 million) RayRock/Canada, (copper); (6) Escondida, ($1.6 billion) BHP/Australia; RTZ/UK; JECO/Japan; IFC (7) Manto Verde, ($150 million) Anglo American/South Africa, (copper); (8) La Candelaria; ($538 million) Phelps Dodge/United States, Sumitomo/Japan, (copper); (9) Guanaco, ($70 million) AMAX Gold Inc./United States, (gold); (10) Refugio, ($130 million) Bema Gold/Canada, AMAX Gold Inc./United States, (gold); (11) Andacollo, ($50 million) Dayton Development Corp./Canada, (gold); (12) Fachinal, ($52 million) Coeur d'Alene Mines Corp./United States (gold, silver, lead/zinc); (13) Yolanda, ($45 million) Kap Resources Ltd./Canada; British Columbia Ltd./Canada, (nitrates, iodine); (14) La Coipa, Placer Dome/TVX mining ($400 million) (gold); (15) Marte, Cominco/Canada; Anglo American Chile Ltd./Mantos Blancos/Chemical Bank N.Y./USA $47 million (gold); (16) La Pepa, ($24 million), Bridger Resources Inc./Canada; Cluff Mineral Exploration/UK (gold); (17) Candelaria, ($538 million) Phelps Dodge/USA; Sumitomo/Japan (gold/copper); (18) Los Pelambres, Minera Anaconda/USA; Lucky Goldstar ($53 million) (copper/ molybdenum), and (19) Los Bronces, Exxon Minerals Int. Inc/USA ($400 million) (copper); (20) Lince, ($60 million) C. Michilla/ Outokumpu/Chemical Bank (copper); and (21) Zaldivar, ($310 million) Placer Dome Inc; Outokumpu; Copper Resources Chile B.V. (Copper). Some of these projects were recently initiated and are in advanced construction stages of production.

In the energy sector, the Special Operation Contract for the Exploration and Exploitation of Hydrocarbon's Law of 1975, as subsequently amended, established the rules for petroleum

operations contracts (POC's).

ENVIRONMENTAL ISSUES

Chile suffers from a host of environmental problems resulting from years of rapid development of its natural resources. The Chilean Constitution recognizes a broad right to live in an environment "free from pollution," but the courts have interpreted this right as essentially procedural. To remedy what was perceived as the absence of a viable regulatory framework, the Chilean Government passed the Environmental Framework Law (Decree Law 19,300) in December 1992.

The National Council on the Environment (CONAMA) under the Office of the Secretary of the President was form to develop and implement environmental standards that would require environmental impact statements for new projects and define civil liability and penalties. Regional Environmental Commissions (COREMA's) constituted under the legislation have been set up in each of Chile's 12 political Regions and will be responsible for monitoring and protecting the nation's biomass, marine and natural resources. The legislation established equal rights and responsibilities for both public and private enterprises. The Government intended to phase in the legislation's provisions gradually to minimize disruptions to the economy and to allow time to develop monitoring and enforcement capabilities. The Government has promulgated two decrees intended to reduce fixed-source air pollution and is implementing regulations covering disposal of waste in coastal zones. It also has taken some initial steps to contain and eventually reduce the more intractable problem of Santiago's severe air pollution.

At yearend 1993, Congress was still working on an ecologic master plan to cope with the country's sulfur dioxide problem. The legislation divides the country into two zones: 1) the mining district which covers more than one-half of the country, starting with Rancagua, where the El Teniente smelter is located and ending at the border with Peru, and 2) the agriculture-industrial part of the country which lies south of Rancagua, stretching down to Tierra del Fuego. The decree stipulates that Zone 1 must meet with U.S. emission standards, published by the Environmental Protection Agency, and Zone 2 must meet the considerably tighter air pollution standards in force in Scandinavia. The cost of enforcing this legislation particularly in Zone 1 falls on the State, as ENAMI and CODELCO smelt 90% of Chile's concentrates. To be in compliance, CODELCO must invest $300 million over the next 5 years to clean up the Chuquicamata stack gases by shutting down all reverberators and replacing them with Teniente type converters, to add a third sulfuric acid plant, and to expand oxygen production capacity. Pollution from arsenic emissions are a more serious problem as far as setting legal limits is concerned, as the Mining Ministry does not feel that there is an acceptable standard in place anywhere in the world. Consequently, the University of Chile has been given a contract (funded by CODELCO, Cia. Minera El Indio, and Refimet), to define the health hazards posed by arsenic exposure at the levels currently seen in the Chuquicamata/ Calama District. New mines, such as Escondida and Exxon in its expansion of the Chagres smelter and Disputada mines have voluntarily funded ecological impact studies, and designed its operations accordingly.

PRODUCTION

Servicio de Nacional Geología y Minería (SERNAGEOMIN), an agency under the Ministry of Mines, reported that gold production in 1993 decreased 2.6% to 32,904 kg (another record high for Chile) and silver production decreased 6.6% to 961 kg in 1993. The medium- and small-size mines produced 93.4% of the gold and 76.7% of the silver in the country, followed by the large-size mines of CODELCO, with 6.6% of the gold and 24.3% of the silver produced primarily as byproducts of its copper produced operation.

CODELCO-Chile accounted for all of the output of molybdenum in the form of molybdenum trioxide and concentrate. In addition, CODELCO-Chile was a major sulfuric acid producer.

TRADE

In 1993, Chile's total exports amounted to $9.97 billion and total imports, 9.24 billion, to yield a $749 million trade surplus, down 46.8% from a $1.58 billion surplus in 1991. In 1992, total exports increased 12% and imports increased 27% compared with those of 1991. In 1992, Chile's main export was copper, worth $3.3 billion (82.5% of the total mineral exports). Other metallic minerals exports were valued at $664 million (14%). Industrial minerals and others totaled $157.8 million (3.3%). Mineral exports from Chile totaled $4 billion or 40.5% of all exports for 1993. Besides copper, Chile's main minerals exports were precious metals (gold and silver), molybdenum oxide, iron ore, iron pellets, iodine, sodium nitrate, ferromolybdenum, lithium carbonate, potash, nitrate, and zinc. CODELCO-Chile shipped about 1,207,000 tons of fine copper in 1993, 3.8% lower than in 1992, of which 69.4% was electrolytic copper, 11.5% fire-refined, 10% blister, and 9.1% concentrates.

Revenues from copper sales by CODELCO in 1993 were $2.13 billion, $570 million lower than in 1992. Revenues from byproduct sales during 1993 were $350 million, an increase of 11.8% compared with the previous year. The most significant byproduct was molybdenum, sales of which amounted to $77 million for shipments of 15,210 tons, fine content. Doré metal sales were valued at $62 million. The United States was Chile's principal trading partner, accounting for about 17% of Chile's imports and 21% of Chile's exports. According to U.S. Department of Commerce data in 1992, U.S. exports to Chile amounted to $1.98 billion and U.S. imports from Chile totaled $1.65 billion.

STRUCTURE OF THE MINERAL INDUSTRY

The Chilean Government through the Ministry of Mines exercised dominant control over the mineral industry through three large state-owned mining companies and four regulatory agencies: Corporacion Nacional del Cobre de Chile (CODELCO-Chile); Empresa Nacional de Mineria (ENAMI); and Corporacion de Fomento de la Production (CORFO), which includes Cía. de Acero del Pacífico, S.A. de Inversiones (CAP), Empresa Nacional del Petróleo, S.A. (ENAP), Empressa Nacional del Carbón S.A. (ENACAR), Cía. Chilena de Electricidad, S.A. (CHILECTRA), and Sociedad Química y Minera de Chile S.A. (SOQUIMICH); and four regulatory agencies: Servicio Nacional de Geología y Minería (SERNAGEOMIN), Comisión Chilena del Cobre (COCHILCO), the Foreign Investment Committee, and Chile's Comision Nacional del Medio Ambiente (CONAMA).

CODELCO-Chile, the largest copper producer and exporter in the world, was composed of four divisions, Chuquicamata, El Teniente, Andina, and El Salvador, which produced over 50% of total Chilean copper production in 1993. CODELCO-Chile was also a producer of gold, metal doré, molybdenum (trioxide, concentrate), and silver, as well as sulfuric acid and ammonium perrhenate (rhenium). ENAMI, the second largest state-owned company, was created in the early 1960's to promote mining activities, to process and market copper and other minerals, and to provide services to the mining industry. To strengthen this position, ENAMI has established as part of its mission the promotion, development, and processing of Chile's small- and medium-size nonferrous metals mines output. ENAMI also purchased concentrates of copper, gold, and silver; precipitate minerals for direct smelting; and anodes and blister for its smelters and refineries. ENAMI served as a market regulating force by determining rates for minerals and mining products bought from producers in potentially attractive mining zones, provided credit to miners who lacked access to standard sources of financing, facilitated miners' access to banking sources, and provided training and support programs to small-size miners. Furthermore, ENAMI produced, sold, and distributed sulfuric acid; participated with private investors in the development of small- and medium-size mining projects; guarded against potential environmental harm from mining production; and bought ores for flotation and leaching at its own plants.

The total labor force, including staff and office personnel, working directly in the minerals sector numbered 78,000, representing about 2.3% of the total labor force (4,728,000) in the country. The metals sector's labor force was 61,000, about 79% of the mineral sector labor force total, of which 47,000 were copper workers. The industrial minerals sector labor force was 3,400, and the mineral fuels sector was 13,000 of which 85% were coal miners. CODELCO-Chile employed about 23,000 copper workers in 1993, or about 55% of the total metals sector employees.

COMMODITY REVIEW

Metals

Copper.—Chile's increased copper production in 1993 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 agencies COCHILCO and SERNAGEOMIN, Chile produced another record high of 2.06 Mmt of copper in 1993. The increase in copper production of 6.3% over that of the previous year was due to the additional output from the new private-sector La Escondida Mine that produced about 390,000 tons, an increase of 16%. CODELCO's copper production decreased by only 1.5% in 1993 compared with that of 1992, owing to the decline in the average grade of copper from 1.22% in 1992 to 1.18% in 1993, lower volume of ore treated, and lower prices for copper and precious metals in the world market. CODELCO's investments in 1993 were $410.5 million, 3.4% less than in 1992 and were distributed among the following projects: Research and feasibility studies $44.3 million, Exploration $15.5 million, Projects under development $216.2 million, Maintenance $68.7 million, Decontamination $52.1 million, and Labor, Safety, and Welfare $13.7 million. During 1993, CODELCO-Chile contributed $418 million to the National Treasury, about 47% less than in the previous year.

Important progress was made in 1993 in the application of law 19,137, also called the New Codelco Law for Joint Mining Ventures with Third Parties. Invitations were made to several mining companies in February to study the El Abra copper project and make offers for exploiting jointly with Codelco. In early October, the process for evaluating offers was concluded with the best offer being that presented by Cyprus Copper Co. and Lac Minerals Ltd. Other projects considered by CODELCO for joint venturing were: Cacao Norte (known also as Redeemer Tonic Mine, part of the Pampa Norte), 8 km north of the large Chuquicamata open pit mine.

El Abra's, feasibility study, was recently being completed by Pincock, Allen & Holt of the United States. The oxide ore body had reported reserves of about 400 Mmt grading about 0.7% copper. The feasibility study proposed development of a typical open pit heap-leaching operation producing 30,000 to 50,000 mt/d ore and a solvent extraction/electrowinning (SX-EW) plant which would cost about $400 million. Other projects being considered by CODELCO were the Quebrada Teniente at El Teniente Mine and the Andina Expansion at the Andina Mine. At a cost of about $500 million, the three projects should produce an additional 285,000 mt/a of fine content copper by 1997, thus compensating for the declining output from Chuquicamata's large open pit and rockburst-prone Sub-Level Six at El Teniente Mine. A significant part of this investment, unlike those in previous years, has been channeled into intensified

environmental cleanup plans.

Chuquicamata output reached 617,000 tons of fine copper in 1993, 1.8% less than that of the previous year and 54% of the total copper produced by CODELCO. CODELCO's other three mine outputs were as follows: El Teniente, 305,000 tons; El Salvador, 84,000 tons; and Andina, 305,000 tons.

Under study by ENAMI are the following projects: (1) smelter modernization; the feasibility study for the modernization of Las Ventanas and Paipote smelters and (2) North Area Smelter; the prefeasibility study was done in 1991 at a cost of about $850,000. The participation of ENAMI in the partnership for the "Fundition y Refineria del Pacifico," along with Lac Minerals, Arbi Participacoes, Acec Union Minerie, and South Metal Chile sought to stimulate the development of additional smelting and refining business with the participation of private capital to increase the value added of Chile's exports, making the best use of the availability of concentrates in Chile. ENAMI is developing an environmental protection plan, including: 1) The installation of a modified El Teniente Type Converter and a new electric furnace at Las Ventanas smelter. 2) Start-up of a sulfuric acid plant in Las Ventanas, which will permit a 30% reduction in gaseous emissions and a 60% in particulate. 3) Oxygen Plant the investment reached $14 million and produce 300 mt/a of SO_2 delivered to the smelter for concentrate treatment.

Government lending agencies in Finland, Germany, and Japan have given the go-ahead for a $284 million expansion of the La Escondida copper mine in Chile, already the world's second largest copper operation. According to officials, the expansion will increase Escondida's output and will play role in Chile's drive to add value to its copper riches. The expansion will lift output at Escondida from 336,000 tons in 1992 to 390,000 tons in 1993. Production will expand to 420,000 tons in 1994; 480,000 tons in 1995 and 800,000 mt/a by the end of this decade. A substantial amount of increased output will be derived from a new $164 million solvent extraction-electrowinning (SX-EW) cathode plant. The new facilities, to be built near the port of Coloso, 14 km from Antofagasta, will incorporate an ammonia leaching process developed by BHP, one of the partners in the joint venture.

Exxon's Disputada de las Condes in 1993 had a combined copper production from its El Cobre and Los Bronces Mines of 148,000 tons (up from 133,000 tons in 1992). Output in 1993, therefore, was expected to reach 200,000 mt/a of copper in concentrates after the the new 37,000 mt/d Las Tortolas concentrator and 56 km of slurry pipeline which are still under construction is fully completed, with 130,000 mt/a slurried ground ore coming from the expanded Los Bronces operation and 70,000 mt/a from El Cobre Mine. Because the ore averaged 0.016% molybdenum, Exxon planned to build a molybdenum recovery plant and was in the process of investing $180 million on modernizing and expanding the Chagres smelter by the addition of a flash smelter. To cope with this, the acid plant capacity has been increased from 66,000 mt/a to 300,000 mt/a. On completion of this investment in 1994, the smelter should be able to produce 125,000 mt/a of blister copper.

Empresa Minera Mantos Blancos, S.A., new Mantoverde SX-EW project, located 85 km southeast of the port of Chanaral,is based on sea water leaching of 5.4 Mmt of 0.9% copper oxide ore from an open pit mine and will produce 42,000 mt/a of copper cathodes. Mantos Blancos also has won a tender to buy Peru's unexploited Quellaveco copper deposit offered as part of Peru's privatization program. Peruvian officials indicated that Mantos Blancos's bid was $12 million for the deposit, $3.6 million down and $4.2 million per year for 2 years. The other bidder was Southern Peru Copper Corp., whose bid was $10 million for the deposit.

The Anglo American Corporation controlled Minorco and Mantos Blancos acquired a one-third interest in the Collahuasi copper project in northern Chile from Chevron Corp. of San Francisco for $190 million. The two Anglo American companies formed a new entity, Minera/Mantos Minorco, to complete the acquisition. Collahuasi has the potential to produce more than 300,000 mt/a of fine copper with an estimated investment of $1 billion. The other two partners in the project are Falconbridge Ltd. of Toronto, Canada, and the Shell Group. The property comprises two deposits, Ujina and Rosario. The Ujina deposit, totaling more than 100 Mmt and grading an average 2% copper, will be processed through a heap-leaching and SX-EW plant with startup slated for 1997.

Bechtel-Chile started a feasibility study on Mantoverde copper deposit in 1993. The deposit is estimated by the company to have reserves of 93 Mmt grading 0.82% copper and is expected to be in production by yearend 1995.

Compañía Minera Ojos del Salado S.A., a subsidiary of Phelps Dodge of the United States, was negotiating to use CODELCO's port installations at El Chanaral to ship copper concentrates from the Ojos del Salado deposit and from the main Candelaria ore body. Ojos del Salado inaugurated a major expansion of its facilities in Tierra Amarilla in November, doubling capacity to 3,500 mt/d at a cost of $20 million. This will raise output in 1993 to 23,000 mt/a of copper, up from 11,500 mt/a and to 75,000 mt/a in 1994. The copper will be shipped out in the form of concentrates.

La Candelaria in March 1993 initiated its construction of surface facilities and development of the open pit mine and company plans were to produce 28,000 mt/d of ore, and process the ore by conventional flotation methods to produce 385,000 mt/a of copper concentrate with a 30% copper content by yearend 1995. La Candelaria was seeking funds from Far Eastern and European sources. Sumitomo Corp. of Tokyo, the world's biggest copper trader, agreed to take a 20% ownership state in La Candelaria for $40 million and will support its share of debt financing. The Overseas Private Investment Corp. (OPIC), the U.S. Government insurance agency, has awarded a $50 million loan to La Candelaria. In addition, La Candelaria will obtain risk insurance coverage for

$100 million from OPIC. La Candelaria is near Copiapo on the southern edge of the Atacama Desert. The mine when completed will represent the biggest new copper investment since BHP-Utah's La Escondida Mine was inaugurated in early 1991. Proven reserves stand at 350 Mmt. The average ore grade is 1.14% copper.

Other copper projects that looked viable in 1993 included Quebrada Blanca, in northern Chile in Region I, about 170 km southeast of Iquique, at 4,300 m above sea level, which originally belonged to the state mining company ENAMI. It was tendered to Cominco Resources International Ltd. from Canada which had been granted the right, jointly with ENAMI, to develop the copper deposit. Cominco has an 85% interest in the project while ENAMI, the original promoter, holds a 10% stake in the project with the remaining 5% belonging to Sociedad Minera Pudahuel Ltda., a private Chilean mining concern that will contribute a new mining technology for the project. Quebrada Blanca reserves were estimated at 78 Mmt of copper with an average grade of 1.4%. An additional 250 Mmt of copper resource with an average grade of 0.5% also was reported. The project is expected to produce approximately 75,000 mt/a of fine copper. Cominco management stated in 1993 that it had obtained financing and is moving forward with construction of the project, which will entail an investment of $360 million and use bacterial leaching technology. Of the total investment, $110 million was financed directly by Cominco and the rest was raised in international capital markets.

Compañía Minera Cerro Colorado, S.A., the Chilean subsidiary of Río Algom Ltd., of Vancouver, Canada, hoped to complete before yearend 1993 a partial financial package of $150 million for the copper project east of Iquique, high on the northern plateau. The Nippon Mining Co. first explored the Cerro Colorado copper deposit in Region I between 1975 and 1980. Although the original project was based on the flotation of sulfide ores, the Rio Algom project is based on bacteria heap leaching with sulfuric acid. The Cerro Colorado, a porphyry copper deposit, has 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. Production will begin in 1994. Total planned investment was estimated at $290 million.

The Compañía Minera Doña Inés de Collahuasi S.A. owned by a consortium of Falconbridge Ltd., of Canada; the Shell Group, of the Netherlands; and Chevron Corp. of the United States was completing in 1993 a massive 40,000-m exploration drilling program aimed at mapping out one of the most promising ore bodies in the Andes. Collahuasi is 4,600 m above sea level on the Tarapaca plateau, 280 km from Iquique, in the vicinity of Quebrada Blanca and Cerro Colorado. In September 1993, Collahuasi decided to focus its exploration in and around Rosario, its main deposit, estimated to contain at least 200 Mmt of minable ore with an average grade of 1.2% copper. Preliminary estimates indicate the total deposit may be 4 to 5 times larger. The project was established on a minable resource of 30 to 40 Mmt of oxide and enriched sulfides aimed at producing 80,000 tons of copper. That alone would have meant an investment of $250 to $300 million, similar to the nearby Quebrada Blanca project. The total production for the project was estimated to be about 300,000 mt/a of copper in concentrates plus an additional 50,000 mt/a copper cathodes by the year 1999.

Compañía Minera Los Pelambres since 1992 has been mining a high-grade copper ore section of Los Pelambres, one of the world's largest low-grade deposits. Located on the eastend of the billion-ton porphyry copper deposit, the high grade zone has a reported reserve of 12.5 Mmt at an average grade of 1.63%. Later, operations will be expanded to a new ore body on the westend of Los Pelambres, where 24.5 Mmt of ore with an average grade of 1.47% has been outlined. Los Pelambres has built a 5,000-mt/d processing plant. In addition, the company is exploring the northern sector of the porphyry deposit to uncover other high-grade mineral formations. Constuction will cost about $60 million.

RAYROCK YellowKnife Resources Inc. of Toronto, Canada, expected to wrap up a $20 million finance package for Ivan-Zar, a copper project 35 km northeast of Antofagasta. Ivan-Zar is an SX-EW project from which production in a first stage would be 8,000 mt/a of copper cathodes. This is one of a number of small-sized copper deposits to come on-stream in the mid-1990's. Commercial production at Ivan-Zar was to commence by late of 1993.

Compania Minera Lince Ltda., began commercial production of copper cathode in December 1993, after successfully starting up its crushing circuit. The project uses an innovative seawater heap-leaching technology. Investment was estimated at $62 million. Output is to be 20,000 mt/a of copper cathodes.

Gold and Silver.—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 18.8%, followed by La Coipa owned by Placer Dome and TVX Gold of Canada 18.5%. Other medium and small-sized precious metal mines included Choquelimpie (Vilacollo), El Hueso (Homestake), San Cristóbal (Niugini), La Escondida, El Bronce de Petorca, and Guanoco owned by Amax Gold Inc. The largest producer of silver in Chile was the La Coipa Mine with silver as a byproduct of gold production. La Coipa's silver output was 428,142 kg in 1993, 44.3% of the country's total output, followed by CODELCO. Other important producers of byproduct silver were El Indio, La Escondida, and El Bronce de Petorca with 5.5%. Niugini heap-leach operations contributed 1,700 kg of gold in doré bars. CODELCO maintained its level of output of gold at 2,217 kg in 1993 compared with that of 1992 as a byproduct of its electrolytic copper refining.

SCM Vilacollo Ltda., the company formed by Shell, Citibank, and Northgate to operate the Coquelimpie Mine near the

Bolivian border, was seeking new reserves near the mine. La Coipa operated rated by Cia. Minera Mantos de Oro Ltda., was operating at its full capacity of 15,000 mt/d of ore by yearend. The SCM Vilacollo Ltda. and Cia Minera Mantos de Oro Ltda were reviewing financing plans to raise the required $135 million capital investment. According to the feasibility study, completed by Mineral Resources Development Inc., El Refugio has a minable reserve of 112 Mmt of ore grading 1 g/mt gold containing about 93.3 mt of gold. The ore extraction would require an open pit with an stripping ration of 1:1. The study recommends a plant with a processing rate of 33,000 mt/d. At that rate, Bema Gold Company would produce 7.2 mt/a of gold for 13 years.

Gold production from the Can Can deposit in Northern Chile was expected to begin in mid-1993. Developed at a capital cost of $12 million, the deposit should eventually produce 1,555 kg/a of gold and 3,732 kg/a of silver with an expected mine life of 6 years. Cia. Minera Can Can S.A. is owned 60% by Compania de Carbones de Chile S.A. COCAR and 40% by other Chilean investors. The deposits has proven reserves of 1.2 Mmt of ore grading 8 g/t of gold and 60 g/t of silver. However, potential resources could reach 5.5 Mmt of ore. It is scheduled to come on-stream in mid-1993 with a production of about 130 kg/month of gold.

Iron Ore, Manganese, and Steel.—Chilean iron production, including iron ore pellets, was 73 Mmt in 1993, an increase of 2.2% compared with that of 1992. Compania Minera del Pacifica S.A. (CMP) was the only Chilean producer of iron ore. Although there were many other deposits, current iron production came from the El Romeral Mines in Region IV, El Algarrobo in Region III, and the reactivated El Laco Mine in Region II. Proven reserves amounted to approximately 1 billion tons of iron ore, 45% of which was attributed to the above mentioned mines. El Romeral Mine, which had proven reserves of 56.5 Mmt grading 55.8% iron, produced about 3.6 Mmt of ore per year for direct exports mainly to Japan and Malaysia with the remainder for the Huachipato smelter.

Manganesos Atacama, S.A. (MASA), a subsidiary of CAP, a Swiss-Chilean Industrial Group, owned iron mines and Chile's largest steel plant, producing manganese, ferromanganese, and ferrosilicon alloys as well as steel cones for mills for the domestic market in a plant in Coquimbo. The company produced manganese ore at The El Corral Quemado and Los Loros Mine in Region IV; MASA also bought ore from other producers in the same region.

Most of the manganese produced by MASA was bought by the Huachipato smelter. The production of steel ingots at Huachipato amounted to 1,063,000 tons in 1993 compared with 1,013,000 tons in 1992. CAP reported that in order to increase the production capacity at its Huachipato smelter and reduced operating costs, the holding company was considering an investment of $350 million to modernize the plant between 1994 and 1998. In the last quarter of 1993, CAP reported that the costs at the Huachipato smelter decreased about 2% compared with the same period of 1992 and that it was one of the few smelters in the world to operate at a profit.

Lead and Zinc.—Lac Minerals-owned Sociedad Minera el Toqui in Chile continued in production despite problems resulting from low zinc prices. El Toqui, Chile's largest zinc miner, produced some 57,000 mt of concentrate in 1993 containing 28,000 mt of zinc. A temporary shutdown of El Toqui's zinc operations would cost the company some $5 million, so Lac has opted for continued production while at the same time reducing costs at the 1,500 mt/d concentrator at Coyhaique in the far south of Chile. Production of zinc decreased 0.1% in 1993 to 29,435 tons, of which 91% was from SCMT owned by Minera Lac Chile, S.A., a subsidiary of Lac Minerals of Canada. Lac completed an expansion program in 1993, which was largely responsible for the notable increase in Chilean zinc production over the past 3 years. However, low zinc prices have induced Lac to postpone its plans to expand its El Toqui zinc mine near Coyhaique.

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 1993 reached 10,369 tons, a 4.2% decrease compared with that of the previous year. Sociedad Quimica y Minera de Chilena S.A. (SQM), in Chile, has seen a significant increase in its share prices on the local exchange, which has translated into a market value of about $300 million. This encouraged SQM's management to list the shares on the New York exchange via American Depositary Shares (ADRs). The share flotation was very successful, with SQM netting over $90 million from the U.S. transaction. The total number of new shares issues were intended to raise $150 million for investment in the Sociedad Minera Salar de Atacama (MINSAL) project, and the transfer of SQM's nitrate plants to the Soronal mineral reserves in the Tarapaca Region, about 200 km north of the current operations. The Maria Elena deposit has 3 to 4 years' ore reserves, and Pedro de Valdivia 10 years at current operating rates. SQM will be using funds from the ADR sale for the construction of the MINSAL potassium chloride operations. The exact capacity planned for potassium chloride (kcl) is not clear. The agreement with CORFO calls for output values of $300,000 mt/a, for which $90 to $100 million are being budgeted, but SQM's domestic consumption of potassium nitrate is about one-half this amount. Lithium production, which is almost proportional to the KCL output, is apparently planned for 1997 or 1998. Cyprus Foot's Soc. Chilena del Litio's plant in the solar the Atacama has been operating at about the same rate as in 1992, with lithium carbonate production of 10,369 mt and coproduct KCl of 60,723 mt (which was sold to SQM).

Nitrates and Iodine.—Cia Minera Yolanda S.A., located in the Taltal zone, Region II was planning to produce roughly 300,000 mt/a of sodium nitrate, 357,000 mt/a of potassium nitrate and 180 mt/a of iodine using heap-leaching methods by utilizing sea water and solution concentration by solar evaporation in ponds before crystallization. The company planned that part or all of the sodium nitrate produced was going to be converted to potassium nitrate, utilizing an additional potassium chloride treatment and recrystalization, and from the residual waters iodine will be extracted. The required investment was estimated at $45 million, with production start-up scheduled for 1995.

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. form Canada, was retained as the operator and will receive a 10% share in the profits. North Lily Mining Co. reported that samples taken from its Yolanda property in northern Chile assayed an average sodium sulfate content of 9.3%.

The COSAYACH project owned by Cia. de Salitre y Yodo de Chile, planned to develop and produce potassium nitrate and iodine from existing reserves in the Pozo Almonte Zone (Region I) base on material already removed during the past (salitre) nitrate exploitation. The project proposed to extract 2.5 million mt/a of caliche by heap-leaching methods and concentration by solar evaporation. The company estimates that the production will reach 205,000 mt of potassium nitrate and about 1,000 tons of iodine. The investment required could reach $28.4 million. Currently, the company has a production capacity of 300 mt/a of iodine. The implementation of the current project was still under study. The SORONAL project contemplate the reopening of the current operations at Pedro de Valdivia and Maria Elena of SQM. This salitre field located south of Iquique has 500 million mt of caliche with a grade of 9% sodium nitrate and 500 parts per million of iodine. The process is based on heap leaching and concentrate in solar evaporation ponds. Both the Yolanda and Cosayach projects will increase Chile's production of nitrates by 500,000 mt/a above the current level 850,000 obtained by SQM.

Sulfur.—Chile has been an importer and producer of sulfur for many years. In 1993, Chile imported about 42,000 tons of sulfur, 27.5% more than that in the previous year, mostly for Bolivia, Canada, and United States, valued at $2.5 million. Chile's native sulfur production derived from caliche decreased almost 96% to 937 tons. Chile's total production of sulfur, including sulfur derived from smelters and oil refineries, was maintained at more than 385,000 tons. Its main use was as raw material to produce sulfuric acid. Condesa Mining Corp. of the United States has received authorization from the Foreign Investment Committee to carry out at $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.

The bioleach SX-EW copper projects being planned will strain the increased amounts of sulfuric acid that the Chilean mining industry will be consuming, despite a net increase in capacity of 800,000 mt/a, which will be in place by 1995. Chuquicamata, as part of a $323 million investment to reduce sulfur dioxide emissions by a factor of three, has added a new 620,000 mt/a acid plant (number 4) to replace the 180,000 mt/a old number 1 plant, for a total production of 1.3 million tons. Meanwhile, Refinadora Metalurgica (Refimet) will produce 90,000 mt/a of acid in its new copper smelter. Consumption of sulfuric acid in Chile amounted to 900,000 mt/a. Startup of new sulfuric acid plants using gases from the smelters will increase CODELCO-Chile's production of more than 1.8 Mmt/a. As a result, Chile will significantly lower sulfur imports. Sulfuric acid also was produced from gases from four copper smelters: Chuquicamata, Las Ventanas, Paipote (Hernan Videla Lira), and Chagres. These plants have a production capacity of 2 Mmt/a of which 1.3 million mt/a was from Chuquicamata; 290,000 mt/a from Las Ventanas; 60,000 mt/a from Paipote; and 330 mt/a from Exxon's Chagres smelter to replace its old 70,000 mt/a facility. There are also about 20 smaller sulfuric acid plants between Arica and Rancagua that use sulfur as raw material. The capacity of these plants adds up to approximately 500,000 mt/a.

Mineral Fuels

Coal.—Coal output in 1993 was 1.8 Mmt. The Chilean Government has encouraged greater domestic coal production as a means of reducing Chile's dependence on petroleum. Chile, with a population of more than 13.7 million, is a small coal market in which the most important consumers are electric utilities. Demand for electricity was concentrated in the central part of the country, where 93% of the population lives and in the northern area associated with mining and minerals refineries. The largest coal producer in Chile is Compania de Carbones de Chile, S.A. (COCAR), which strip mines subbituminous coal in Pecket, near Punta Arenas. It was reported that COCAR was still considering a number of plans for future coal output. Its current production from the Pecket Mine was 1.2 Mmt/a. COCAR has a long-term contract with CODELCO (expiring in 1997 but expected to be renewed shortly) to supply CODELCO's Tocopilla powerplant with 850,000 mt/a. However, Tocopilla is now taking all Pecket's output. Further potential power stations projects for later this decade; additional 150 MW plants at Huasco and Tocopilla and a possible 400 MW facility in the north of the country. By the end of the 1990's these could increase total coal demand to 4.5 Mmt/a. COCAR is examining a number of options. Pecket could be expanded by moving into an underground operation and it has been reported that prefeasibility studies have examined the development of a further 100 Mmt of reserves at Pecket

for an output of 1 Mmt/a. The second possibility is to develop the Isla Riesgo deposit (which would be an open pit), some 40 Km from Pecket on the other side of the Seno Otway.

The large number of direct electrowinning copper projects in the north of Chile will require new powerplants, which should come on-stream in the next 3 to 5 years. They include power unit 16 in Tocopilla to supply Chuquicamata's plant expansion; a grassroots unit in the iron ore port of Huasco, funded by CHILGENER, CAP and COCAR, operated as a joint venture named Guacolda, to supply Phelps Dodge's Candelaria expansion and all the new precious-metal mines in the Atacama District; and a third unit that probably would be built in Mejillones (a bay north of Antofagasta), essentially to supply Escondida's expanding needs.

COCAR, and its Pecket strip mine, will have to double its capacity to supply the additional demand for an output of 1 Mmt/a. The Chilean state Holding group CORFO was promoting the sale of its Rieso Island sub-bituminous coal deposit in the extreme south of the country. Plans have been drawn up to develop a 3 Mmt/a open pit mine but CORFO wishes to transfer the asset to a private company for development. Initial costs have been estimated at some $70 million.

Metallurgical coal has been imported by Chile for more than 40 years, originally only from the United States but today from Australia, West Canada, and a very small amount from the United States.

Natural Gas.—Natural gas production decreased slightly to 4,038 Mm^3, continuing the declining trend since 1982. Of the total production, about 51% was reinjected and 49% was marketed internally. The natural gas that was reinjected by Empresa Nacional del Petroleo (ENAP) in the straits of Magellan region in the past will now be used to produce 150,000 mt/a of ammonia and 570,000 mt/a of urea at Cabo Negro. The main natural gas reserves in Chile are at the straits of Magellan south of the country. During 1993, 55% of the natural gas produced was from offshore, 23% onshore, and 22% from Tierra del Fuego.

Construction of a 1,200-km gas pipeline between natural gas fields in southern Argentina and Santiago is coming closer to reality as negotiations continue to show progress. The $1 billion trans-Andean pipeline is being negotiated by a consortium formed by Chiletra and ENAP (Chile), Italgas and Snam (Italy), and Enagas (Spain). Construction was expected to start in 1993, and the pipeline was scheduled to be completed in early 1996. Prefeasibility studies for the pipeline have been completed, and the consortium has retained Chase Manhattan Bank as its financial adviser.

As ENAP's natural gas production from southern Chile has been committed as raw material for an existing methanol plant there, and future ammonia/urea complex, a natural gas pipeline is under construction from Argentina gas fields to supply natural gas to central Chile. The country also has plans to import natural gas from the neighboring countries in the north (Argentina and Bolivia) to supply natural gas for the large mining activities in the north of Chile.

Petroleum.—Chilean production of crude oil suffered a further decrease of 4% in 1993, to 5.2 Mbbl. Imports of crude oil in 1993 were 43.3 Mbbl compared with 39.1 Mbbl in 1992. Results of exploration programs in the north Salar de Atacama and in Tierra del Fuego have been disappointing, so ENAP has opted to invest in drilling in Argentina and Ecuador to earn a share of future production and has negotiated long-term crude and natural gas contracts with Argentina's recently privatized Yacimientos Petroliferos Fiscales (YPF).

The new 105,000 bbls/d, 450 km oil pipeline from the southwestern Argentine province of Neuquen to the Chilean port of San Vicente, on the Pacific Ocean is going to be inaugurated early in 1994. The most important private infrastructure project so far in the Southern Cone, the pipeline will provide Chile with more than two-thirds of its import needs. The pipeline also sets the stage for much wider energy integration in the southern cone region of South America.

The $220 million pipeline was built by Oleoducto Trasandino S.A. a company formed by Chile's state oil company ENAP and Argentina's Yacimientos Petroliferos Fiscales (YPF) and Banco de Rio de la Plata (Argentina). Banco Rio de la Plata provided all the credits for the project in the form of medium-term loans that will be refinanced into long-term credits with other banks. YPF holds 57.75% of the shares, Banco Rio holds 30%, and the balance is the hands of ENAP. The pipeline, scheduled to be completed in March 1994, will transport crude oil from Argentina's Puesto Hernandez oilfields to Chile's terminal in Talcahuano. Plans call for about 94,000 bbl of petroleum to be pumped daily into Petrox's terminal. Petrox is expected to process 37,700 bbl, and the remainder will be shipped out from Port of San Vicente to Chile's Concon refinery and to other countries on the Pacific.

Sipetro S.A. ENAP's international subsidiary will start production of crude oil in the Magellan A field in Argentina's waters near the straight of Magellan by yearend. The $170 million joint-venture project between YPF and Spitrol will produce about 14,000 bbls/d of crude. By yearend the company was in the process of installing four platforms in the Magellan A area. The total production of crude will go to ENAP. The percentage corresponding to YPF will be in payment for its share in the venture.

Reserves

Chile is mainly a copper producing country but also produces silver, gold, molybdenum, rhenium, sulfuric acid and other elements as byproducts of copper mining and processing. CODELCO produced more than 55% of the total copper produced in the country and holds more than 25,000 Mmt of copper resources with an average ore content of 0.71% including confirmed copper reserves at the El Abra deposit of 669 Mmt of copper oxide with an average ore content of 0.6% copper and 523 Mmt of

copper sulfide grading 0.60% copper.

Some of the private sector's reported copper reserves are listed as estimated figures as follows: Escondida 1,800 Mmt with an average grade of 1.59% copper; Cerro Colorado 105 Mmt with average grade of 1.3% copper; Quebrada Blanca 85 Mmt, of 1.3% copper and 250 Mmt with 0.5% copper; Zaldivar 316 Mmt with an average grade of 0.9% copper and 680 Mmt with a average grade of 0.57% copper Collahuasi deposit had three areas: Rosario 800 Mmt grading 0.8% copper, 0.25 Mmt grading 1.7%; Ujina more than 500 Mmt grading 0.8% and 200 Mmt grading 1.6% copper; and Huinquintipa 7 Mmt of oxide copper grading 1.2% copper. La Candelaria reports more than 360 Mmt of reserves grading 1.09% copper and 0.25 g/t of gold; Andacollo more than 25 Mmt grading 1.3 g/t of gold and 250 Mmt grading 0.6% copper; Manto Verde 93 Mmt grading 0.82% copper; and Refugio 112 Mmt grading 1g/t of gold.

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 Mountains. Chile is divided into 13 regions, including the Metropolitan region, which is not numbered like the other 12 regions, beginning with Region I at the northern border with Peru and continuing in sequence to Region XII at the south end, with each having a regional capital. Chile has three main geographical areas that vary dramatically in climate, resources, and population. The northern area from Region I to Region IV includes the Atacama Desert, one of the world's driest areas. Farming is limited to a few irrigatable area. 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 Region V to Region X 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's population. Industrial resources include large copper deposits, as well as coalfields and hydropower.

The southern Chile area from Region XI to Region XII is one of the wettest and stormiest parts of the world. Less than 2% of the population resides in this area. 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 serves all the important industrial, mining, and agricultural areas from Region I (Iquique) to Region X (Puerto Montt) for a total of 8,613 km. The pattern of Chile's highways is 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, Valparaiso, 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. In addition, a 450-km, 41 cm diameter oil pipeline is expected to transport crude oil from Argentina's Puesto Hernandez oilfields to Chile's Talcahuano terminal in the near future, and a 1,200-km natural gas pipeline between gasfields in southern Argentina and Santiago is coming closer to reality as negotiations continue to show progress.

OUTLOOK

Chile continues to be an outstanding example of how free trade policies and promotion of foreign investment can generate economic growth in Latin America. The country is attractive as an investment center, especially for export-related activities. The current prosperity of Chile is based on free-market initiatives and a stable political system. Foreign investment under Decree Law 600 (D.L. 600) reached $23.9 billion in 1993. Of this total, $15.6 billion, or a 65% were directed to the mining sector. Materialized investment in 1993 amounted to $9.9 billion. Of this total $5.2 billion or 53% were directed to mining activities. These figures indicated that mining has been the most successful sector in the Chilean economy attracting foreign investment and this is excepted to continued in the future. About two-thirds of the total authorized investment in mining was in the copper sector, followed by precious metals ptojects and exploration activities.

In 1994, Chile was to begin negotiations with Canada, Mexico, and the United States to be admitted into the North America Free Trade Agreement (NAFTA). Chile had organized a commission composed of mining related professionals under the direction of the current Minister of Mines and coordinated by the Ministry of Finance to study and coordinate the main mining related subjects in NAFTA.

The Chilean mining activities were concentrated in five mineral groups: 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 2.06 Mmt in 1993 to about 3.5 Mmt by the year 2000 an increase of nearly 75%. Gold is projected to increase from about 33,600 kg to 43,800 kg by 1996, representing an increase of nearly 30% and silver is projected to decrease slightly from 1.03 tons to about 0.96 tons during the same period.

The production of bentonite, boric acid, nitrates, diatomite, iodine, lithium carbonate, potassium chloride, potassium sulfate, and sulfuric acid also are expected to increase by significant amounts. Finally, in the energy sector, coal is expected to increase from 2 Mmt in 1993 to about 2.5 Mmt in 1994. The Pecket coal mining project and the Isla Riesco project in the Otway inlet north of Punta Arenas are expected to save Chile about $40 million in energy costs and an additional $100 million in oil imports.

The main foreign investment projects in mining copper starting in 1993-1998 are: 1) Cerro Colorado 2) Quebrada Blanca 3) Collahua 4) El Abra 5) Ivan-Zar 6) Zaldivar 7) Escondida and 8) Manto Verde.

The main foreign investment projects in mining precious metals and others are: 1) Guanaco 2) Refugio 3) Andacollo 4) Fachinal and 5) Yolanda.

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[1]Where necessary, values have been converted from Chilean pesos (Ch$) to U.S. dollars at the rate of Ch$404=US$1.00, the average exchange rate for 1993.

OTHER SOURCES OF INFORMATION

Agencies

Ministerio de Mineria
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Servicio Nacional de Geologia y Mineria (SERNAGEOMIN)
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Publications

COCHILCO: Estadisticas del Cobre y otros Minerales.
CODELCO: Annual Report

TABLE 1

CHILE: PRODUCTION OF MINERAL COMMODITIES1

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993[e]	Annual capacity[e] (Jan. 1, 1994)
METALS							
Arsenic trioxide		5,000	5,831	6,822	6,016	6,200	6,900
Copper:							
Mine output, Cu content[3]		1,609,300	1,588,400	1,814,300	1,932,700	r2,055,400	2,100,000
Metal:							
Smelter, primary[5]		1,266,600	1,328,500	1,296,100	1,326,500	r1,327,000	1,400,000
Refined:[6]							
Fire, primary refined[e]		163,600	113,900	141,000	r154,200	157,400	165,000
Electrolytic[e]		907,400	1,077,700	1,087,300	r1,088,100	1,110,800	1,135,000
Total		1,071,000	1,191,600	1,228,300	r1,242,300	r1,268,200	1,300,000
Gold, mine output, Au content	kilograms	22,559	27,503	28,879	33,774	r32,904	34,000
Iron and steel:							
Iron ore and concentrate:							
Gross weight	thousand tons	9,030	7,903	8,692	r7,224	r7,379	9,100
Fe content[e]	do.	5,478	5,035	r5,824	r5,540	5,660	6,100
Pig iron	do.	679	675	703	r873	r917	950
Ferroalloys:							
Ferrochromium		2,840	1,868	2,509	r2,110	2,140	2,850
Ferromanganese		7,492	3,587	r6,779	r7,460	7,500	7,500
Ferromolybdenum		2,990	2,283	2,673	r2,310	r2,300	3,000
Ferrosilicomanganese		180	985	1,674	r1,563	410	1,700
Ferrosilicon		6,370	4,662	5,516	r5,600	5,700	6,400
Total		19,872	13,385	r19,151	r19,043	18,050	21,450
Steel, crude[7]	thousand tons	800	772	805	r1,013	r1,063	1,100
Semimanufactures (hot-rolled)	do.	643	516	587	776	r816	850
Lead, mine output, Pb content		1,241	1,120	1,050	298	r343	1,250
Manganese ore and concentrate:							
Gross weight		43,806	39,697	43,767	49,857	r62,989	65,000
Mn content		13,865	12,450	12,500	r12,600	r15,920	16,400
Molybdenum:							
Mine output, No content		16,550	13,630	14,434	14,840	r14,899	16,600
Oxides		16,300	11,282	10,744	10,412	10,470	16,500
Rhenium, mine output, Re content[e]	kilograms	6,800	6,800	6,500	6,600	6,400	6,800
Selenium	do.	48,200	49,400	50,600	r50,000	49,500	51,000
Silver	do.	545,412	654,603	678,339	1,028,560	r961,000	1,030,000
Zinc, mine output, Zn content		18,370	25,056	30,998	29,730	r29,435	31,000
INDUSTRIAL MINERALS							
Barite		59,873	3,038	3,183	r2,514	r2,035	60,000
Bentonite		2,005	1,207	1,054	r1,081	r989	2,100
Borates, crude, natural (ulexite)		130,512	131,763	97,135	202,716	r117,072	203,000
Cement, hydraulic	thousand tons	2,010	2,115	2,251	2,645	2,600	2,700
Calcite (chalk)	do.	3,746	3,776	3,998	r4,890	r5,657	5,000
Clays							
Cimita		1,405	2,969	2,802	r405	—	3,000
Kaolin		58,512	32,416	63,063	r59,083	r66,939	67,000
Other (unspecified)		20,100	18,563	16,026	20,311	r17,011	20,400

See footnotes at end of table.

TABLE 1—Continued

CHILE: PRODUCTION OF MINERAL COMMODITIES1

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993[e]	Annual capacity[e] (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued							
Diatomite		3,315	3,877	5,557	r5,897	4,774	5,700
Feldspar		8,081	2,980	4,006	r5,740	4,149	8,100
Gypsum:							
Crude		277,276	253,744	335,678	423,659	4510,515	515,000
Calcined		104,300	105,786	e100,000	100,000	100,000	110,000
Iodine, elemental		r4,645	r3,981	r5,447	r5,839	5,550	6,100
Lapis lazuli	kilograms	e8,000	192	450	138	4250	450
Lime, hydraulice	thousand tons	1,300	1,300	1,200	1,300	1,300	1,300
Lithium carbonate		7,508	9,082	8,575	10,823	410,369	9,100
Nitrogen: Natural crude nitrates:							
Sodium ($NaNO_3$)		528,020	r496,900	r472,760	515,087	532,380	597,000
Potassium (KNO_3)		266,850	r292,000	r317,240	330,516	341,620	383,000
Total		794,870	r788,900	r790,000	845,603	874,000	980,000
Phosphates:							
Guano		3,127	1,452	1,308	139	—	3,200
Rock (apatite)		14,354	13,986	13,338	r17,546	414,560	17,600
Total		17,481	15,438	14,646	r17,685	414,560	20,800
Pigments, mineral, natural: Iron oxide		23,653	15,557	6,761	22,945	47,106	24,000
Potash, K_2O equivalent[e]		r45,000	r50,000	r55,000	r55,000	455,000	60,000
Potasium chloride (KCL)		r32,632	45,135	r58,021	r58,787	60,000	60,000
Pumice (include pozzolan)		299,834	305,147	320,928	384,744	4448,250	450,000
Quartz, common		477,497	541,714	486,351	479,202	453,481	550,000
Salt, all types	thousand tons	904	1,835	1,676	1,672	41,443	1,900
Sodium compounds, n.e.s.: Sulfate[8]		r57,315	r39,411	r33,796	r46,407	445,000	70,000
Sand and gravel (silica)[e]	thousand tons	300	300	300	300	300	300
Stone:							
Limestone (calcium carbonate)	do.	3,746	3,776	3,998	4,862	4,900	5,200
Marble		1,115	1,347	1,170	894	4872	1,350
Sulfur:							
Native, other than Frasch:							
Refined		15,963	28,582	16,884	24,034	4937	29,000
Caliche		e500	347	400	e450	450	500
Byproduct, (from smelters and oil refining)		r180,000	r187,000	r278,000	r306,000	4385,000	400,000
Total		r196,463	r215,929	r297,284	r330,484	4386,437	429,500
Talc		835	898	536	r1,493	45,058	5,100
MINERAL FUELS AND RELATED MATERIALS							
Coal, bituminous and lignite	thousand tons	2,404	2,729	2,741	2,106	1,793	2,800
Coke: Coke oven	do.	277	350	400	e300	350	400
Gas, natural:							
Gross	million cubic meters	4,236	4,198	4,067	r4,038	44,020	4,300
Marketed	do.	1,962	2,121	2,295	1,999	2,000	2,300
Natural gas liquids:							
Natural gasoline	thousand 42-gallon barrels	698	695	746	e690	680	890
Liquefied petroleum gas	do.	2,520	2,154	2,094	e1,999	1,970	2,420
Total		3,218	2,849	2,840	e2,689	2,650	3,250

See footnotes at end of table.

TABLE 1—Continued

CHILE: PRODUCTION OF MINERAL COMMODITIES1

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993[e]	Annual capacity[e] (Jan. 1, 1994)
MINERALS FUELS AND RELATED MATERIALS—Continued							
Petroleum:							
Crude	thousand 42-gallon barrels	8,063	7,157	[r]6,499	[r]5,424	[4]5,208	8,100
Refinery products:							
Liquefied petroleum gas	do.	2,849	2,774	2,497	7,736	[4]7,932	8,160
Gasoline:							
Aviation	do.	126	126	109	53	[4]53	55
Motor	do.	12,416	12,309	12,466	13,288	[4]13,623	14,015
Jet fuel	do.	1,705	1,767	2,289	2,378	[4]2,440	2,510
Kerosene	do.	1,648	1,365	1,647	2,189	[4]2,245	2,310
Distillate fuel oil	do.	13,259	14,410	15,165	17,922	[4]18,370	18,900
Residual fuel oil	do.	8,586	9,300	8,487	1,767	[4]1,813	9,300
Unspecified	do.	1,836	1,973	3,467	2,079	[4]2,124	3,500
Total	do.	42,425	43,970	46,127	47,412	[4]48,600	56,440

[e]Estimated. [r]Revised.

[1]Table includes data available through Nov. 1994.

[2]In addition to the commodities listed, pyrite is also produced, but available information is inadequate to make reliable estimates of output levels.

[3]Figures are the nonduplicate copper content of ore, concentrates, cement, copper, slags and minerals, copper as a byproduct of gold and silver products measured at the last stage of processing as reported by Comision Chilena del Cobre (COCHILCO). Mine production reported by Servicio (SERNAGEOMIN) was as follows, in metric tons: 1989-1,628,269; 1990-1,616,261; 1991-1,840,000; and 1992-1993 not available.

[4]Reported figure.

[5]Figures 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 now available and reported by the Intrernational Copper Study Group, Copper Bulletin (ICSG)-Feb. 1994 as follows, in metric tons: 1989-118.3; 1990-143.3; 1991-146.1; 1992-166.6; 1993-173.2.

[6]Figures are total refined copper distributed into two classes according to method of refining, fire-refined and electrolytic, which includes electrowon copper refined in Chile, fire-refined and electrolytic, which includes electrowon copper refined in Chile, as reported by the Chilean Copper Commission.

[7]Excludes castings.

[8]Includes natural sodium sulfate and anhydrous sodium sulfate, coproducts of the nitrate industry.

TABLE 2

CHILE: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

Thousand metric tons unless otherwise specified)

Major commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Coal (bituminous)	Empresa Nacional del Carbon, S.A. (ENACAR), CORFO's subsidiary (100% Government owned)	Carlos Cousino 199, Lota Province	2,000.
Do.	Carbonifera Schwagner, S.A. (61%; Agencias Universales, S.A., 39%; 1,500 private shareholders)	Recinto Schwager S/N, Coronel Province	250.
Do (subbituminous coal)	Cia. de Carbones de Chile, S.A. (COCAR) (Cia. de Petroleos de Chile, S.A., 81%; International Finance Corp. (I.F.C.) (U.S.), 10%; and Northern Strip Mining Ltd. (U.S.), 9%)	NA	1,300.
Copper	Corporacion Nacional del Cobre de Chile (CODELCO-Chile) (100% Government owned)	Mines:	
		Chuquicamata	620.
		El Teniente	310.
		Andina	140.
		Salvador	80.
		Total smelters	1,150.
Do.	Do.	Chuguicamata	460.
		El Teniente	360.
		El Salvador	140.
		Total refinery	960.
Do.	Do.	Chuguicamata (sulfides)	600.
		Chuguicamat a (oxide)	85.
		El Salvador SX-EW plants	130.
Do.	Do.	Chuguicamata (oxide)	130.
		El Salvador	1.
		El Teniente	2.
		Sulfuric acid plants:	
		Chuguicamat a (3 plants)	830.
		El Teniente	30.
Copper, gold, and silver	Empresa Nacional de Mineria (ENAMI) (100% Government owned)	Plants:	270.
		Taltal, Salado, Matta, Vellenor	
		Chancado	
Do.	Do.	Smelter:	
		Las Ventanas	145.
		Paipote	80.
Do.	Do.	Refinery:	200.
		Las Ventanas SX-EW plant:	
Do.	Do.	Vallenar, Chancado	20.
		Sulfuric acid plants	
		Vantanas	225.
Copper	Compaina Minera Disputada de las Condes S.A. (100% private-Exxon and Minerals Co.)	Plant:	
		Los Brences,	150.
		Las Torolas	
		El Soldado	
		Fundieion Chegres	
		Mines:	
		Mina Las Bronces	70.
		Mina El Soldado	60.
		Mina El Cobre	18.
		Smelter:	75.
		Chagres	
		Sulfuric acid plant:	
		Chagres	100.
		SX-EW plant:	
		Torloas	3.

TABLE 2—Continued

CHILE: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

Thousand metric tons unless otherwise specified)

Major commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper—Continued:		Empresa Minera de Mantos Blancos S.A. (private 100%; Anglo-American Corp., 88%; IFC, 12%)	Plant Mantis Blancos Smelter: Antofagasta SX-EW plant Mantos Blancos Sulfuric acid plant: Mantos Blancos (shutdown)	 90. 30. 20. 200.
Do.		Empresa Minera Escondida Ltda. (BHP, 57.5%, RTZ Corp. PLC, 30%; JECO, 10%; IFC, 25%)	Escondida, km 135 Caminoa Socompa, Antofagasta (Mine)	390 Cu, 2,200 (Kg, Au), 75,000 (Kg, Ag).
Do.		Cia Minera Mantos Blancos, S.A. (Anglo-American Corp., 88%; IFC, 12%)	Ave. Pedro de Valdivia 295, Providencia, Santiago (Mine)	100.
Gold	kilograms	Cia. Minera San Jose, Ltda. (El Indio Mine, owned by Lac Minerals of Canada, 83%)	Barrio Industrial, Sitio No. 58, Alto Panuelas, Coquimbo	6,300 Au.
Do.		CODELCO-Chile (byproduct from copper) (Government, 100%)		2,200 kg.
Do.		Cia Minera El Bronce de Petarca (private, 100%)	200 km N of Santiage	1,400 Au, 52,700 Ag.
Iodine	metric tons	Sociedad Quimica y Minera de Chile, SOQUIMICH, subsidiary of CORFO (Government, 35%; private, 65%)	Miraflores No. 222, Santiago	5,500.
Potassium nitrate		do.	Planta Maria Elena, Maria Elena	250.
Sodium nitrate		do.	Planta Pedro de Valdivia, Pero de Valdivia	600.
Sodium sulfate		do.	Oficinia Antofagasta, Anibal Pinto 3,228	70,000.
Iron ore		Cia. Minera del Pacifico, S.A., CAP's subsidiary (100% private)	Pedro Pablo Munoz 675, La Serena Province	8,400.
Iron ore pellets		do.	Minas El Romeral, El Algarrobo, Planta de Pellet, La Serena Province	4,000.
Lead and zinc		Soc. Contractual Minera El Toqui Ltda., (Lac Minerals of Canada, 100%)	Las Urbinas No. 53, Providencia, Santiago	1 lead, 31 zinc.
Lithium carbonate		Soc. Chilena de lITIO ITDA. (scl, subsidiary of Cyprus Foot Minerals Co. of the United States) (100% private)	Huerfanos 669, Santiago	8.6.
Molybdenum		CODELCO-Chile (byproduct from copper) (Government, 100%)	Huerfanos 1,270, Santiago	14.4.
Natural gas	million cubic feet	ENAP subsidiary of CORFO (Government, 100%)	Ahumada 341, Santiago	4.
Petroleum	million barrels	do.	do.	6.5.
Silver	kilograms	CODELCO-Chile (byproduct from copper)	Huerfanos 1,270, Santiago	235,000.
Do.	do.	Cia. Minera San Jose, Ltda. El Indio Mine, (Lac Minerals of Canada, 83%)	Barrio Industrial, Alto Panielas, Coquimbo	48,000.
Steel		Cia. Siderurgica de Huachipato S.A., CAP subsidiary (100%, private)	Huerfanos 669, Santiago	800.

COLOMBIA

AREA 1.14 million km² **POPULATION 34.9 million**

THE MINERAL INDUSTRY OF

COLOMBIA

By George A. Rabchevsky

Colombia is in the northwestern corner of South America and is the only South American country with coastlines on the Caribbean Sea and the Pacific Ocean. The majestic Andes Mountains transect the country from north to south in the western portion of the country; the lowland plains occupy the eastern portion.

Colombia, known worldwide for its coal, emeralds, and petroleum, was the leading producer of kaolin, platinum, and a major producer of asbestos, cement, ferronickel, and natural gas in Latin America. Mineral production in Colombia contributed about 5% to the gross domestic product (GDP) and about 45% to exports (coal contributed 9% to exports and the petroleum sector contributed about 19% to the Colombian economy). Colombia's GDP grew by 5.3% in 1993, while annual inflation slowed to about 21%.

GOVERNMENT POLICIES AND PROGRAMS

The 1989 mining law (Código Minero) facilitates and encourages mineral exploration and development, containing provisions to expedite the processing of claim applications, to improve the security of mineral concessions, and to establish a fund to provide financial assistance to small- and medium-scale miners. The Coinvertir agency, created in November 1991, promotes foreign investment. Government policy encourages the development of the Colombian coal industry and welcomes foreign investment.

The new Constitution, to replace the 1886 Constitution, became effective on July 5, 1991. Under article 332, the state retains the rights to all surface and subsurface nonrenewable natural resources. The new Constitution also created the position of Minister of Foreign Trade.

Law 9 of 1991 regulates foreign investment in Colombia. Resolutions 51 and 52 of 1991 and 53, 55, 56, and 57 of 1992 of the National Economic and Social Policy Council are integrated into the International Investment Statute (IIS), Decisions 291 and 292 of 1991, law 6 of 1992, and Decree 259 of 1992. The IIS is based on three principles: equal treatment for domestic and foreign investors, universality or unlimited investment, and simplification of foreign investment procedures. The new economic development is based on an outward-oriented strategy, thus opening up the economy to foreigners and eliminating many taxes and tariffs that existed in the past. The new regulation allows ownership of up to 100% by foreigners, permits payment of royalties to patentholders of new technology, and reduces withholding taxes. Foreign capital can be invested without limitation in all sectors of the economy.

Colombia's Department of National Planning released its study on September 1993 on the formulation of a new national hydrocarbon policy and on the restructuring of Empresa Colombiana de Petróleos (Ecopetrol). The study recommends that hydrocarbon policy, regulatory control and guidelines, and development plans would be handled by the Ministry of Mines and Energy. These functions are currently the responsibility of Ecopetrol. The proposed restructuring of Ecopetrol was minor and made no reference to any large-scale plan for privatization.

The Government adopted a Mining Development Plan in 1993 as proposed by Instituto Nacional de Investigaciones en Geociencias, Mineria y Quimica (Ingeominas), Empresa Colombiana de Carbon S.A. (Ecocarbon), and Minerales de Colombia S.A. (Mineralco). The plan includes seven points for revitalizing the mineral sector, such as a new simplified system for the granting of exploration and mining licences, provision of infrastructure in mining areas, and environmental control. The Government lifted its monopoly to sell gold, allowing anyone to purchase, sell, or export the metal.

ENVIRONMENTAL ISSUES

Searches for emeralds and gold are dangerous activities in Colombia. The extraction of these minerals from the ground degrades the surrounding environment, leaving behind waste piles and scars on the topography, and gold extraction also poisons the atmosphere, soil, and water with mercury. Three-quarters of production is alluvial gold. The alluvial placers along the Nechi and Cauca Rivers in the north of Antioquia Province have been exploited since colonial times. Environmental degradation as deforestation, silting of streams, and leaving sand fans is very clearly detected from the air but largely obscured at ground level by the lush vegetation. Colombia's crime, drug trafficking, and guerrilla activities also affect the business environment. Personal risk due to social violence and risks presented by the guerilla forces are very real but can be managed with proper planning. A plan for personal and personnel protection, participation in community involvement, and social awareness can provide the necessary level of security.

In the coal mining areas in the northwest of Colombia, coal is mostly extracted by open pit methods. Open pits, mine waste piles, and dust emanating from surface mining areas all contribute to the pollution of the ground and surface water reservoirs, coating the vegetation with coal dust and causing unhealthful environments for local inhabitants. However, that region is sparsely populated and is not considered a tourist haven. Reportedly, Colombia plans to pass an environmetal law in 1994 establishing the Ministry of the Environment.

In Colombia, more than 70% of the projects lack an environmental licence. Reportedly, oil companies are not concerned with environmental problems, as they divert rivers, chop down trees, and build new roads without any permission. Fuelwood gathering and commercial logging in many areas lead also to forest destruction. About 40% to 50% of the population relies on fuelwood for cooking and heating. About 80% of fuelwoods is used in households, while the rest is utilized by the sugar, brickmaking, and baking industries.

In 1992, Colombian guerrillas launched more than 100 attacks on oil pipelines, spilling about 230,000 bbl of crude oil and causing massive pollution in the countryside. The Government formed an army battalion at Yopal, the capital of Casanare, to protect British Petroleum Ltd. (BP) and its partners, Total Ltd. and Triton Ltd., from such attacks. Reportedly, local health officials also disrupted operations of the oil companies in the area, accusing them of violating environmental regulations. In December 1993, about 10,000 bbl of crude oil spilled from the Cano Limon-Covenas pipeline after it was bombed by guerillas. Oil spilled into the Catatumbo River and drifted toward Venezuela's Lake Maracaibo. Ecopetrol alerted Venezuelan authorities and was attempting to stop the oil spill.

PRODUCTION

Colombia was the world's 4th largest platinum producer and 10th largest gold producer. Gold production decreased 13% in 1993, following an 8% drop in 1992. Production of bauxite, copper, ferronickel, lead, manganese, and zinc remained about the same in 1993, while other metals increased slightly. Colombia ranked as the third largest coal producer in the Western Hemisphere after the United States and Canada. Output of steam coal reached another historic level and output of crude oil increased slighly to historic highs. Output of almost all industrial minerals remained about the same in 1993 as that in 1992, except salt decreased and emeralds increased slightly. *(See table 1.)*

TRADE

Colombia is a member of the Andean Pact and of General Agreement on Tariffs and Trade. It was also a beneficiary under the U.S. Generalized System of Preferences. In December 1991, it became eligible for broader access to the U.S. market as a beneficiary under the Andean Trade Preference Act and the Enterprise for the America's Initiative. Under U.S. trade policy, Colombia is entitled to most-favored-nation status, allowing its exports to enter the United States at tariff rates between 5% and 10% for most commodities.

Four Central American countries reached a framework agreement for free trade with Colombia and Venezuela. Reportedly, El Salvador, Guatemala, Honduras, and Nicargaua secured access to Colombian and Venezuelan markets by dropping trade barriers on Colombian and Venezuelan goods entering Central America within 5 to 10 years. Colombia now ranks as Venezuela's second largest trading partner, surpassing the European Community and Japan.

Exports of crude oil and refined products in 1993 by Ecopetrol were down 7% from those of 1992. Colombia exports about 250,000 bbl/d but is importing 230,000 bbl/d of refined products, mostly gaosline. Coal was the second largest export earner, following petroleum. Colombia was the fourth largest coal exporter in the world, at about 18 Mmt/a, mostly steam coal. In total, the country earned $571 million or 7.6% of the country's total export revenue from coal, or 3% more than that in 1992. The principal importers of Colombian coal continued to be Western Europe and the United States. Exports and sales of emeralds doubled in 1993 in Colombia.

STRUCTURE OF THE MINERAL INDUSTRY

Two Government agencies were created to administer mining exploration and development: Ingeominas, founded in 1919 for exploration activities, and Ecominas (now Mineralco), created in 1968 to implement mining projects and execute the national mining development plan. Additional Government entities were created to operate the coal, nickel, and nuclear industries. Ecocarbon is the new Colombian Government agency created to promote and develop the country's coal industry. Ecocarbon is also the advisor to the Ministry of Mines and Energy.

The major part of Colombia's mining industry was privately owned. Oil and natural gas exploration was funded primarily by private companies but the production was controlled by the Government agency Ecopetrol. Foreign investors could enter the mineral industry through fixed-term concessions or with an association contract with a state enterprise. *(See table 2.)*

COMMODITY REVIEW

Metals

Production of bauxite, copper, lead, and manganese ore is small in Colombia and there has been little evidence of investment to increase output. Lateritic bauxite was produced by small operations in the Upper Cauca Valley, southwest of Bogota. Copper was mined at El Roble, southwest of Medellin. Reportedly, the Carmen del Atrato Mine, Choco Department, was destroyed by guerrillas in early 1993. The mine was operated by a Colombian-Japanese consortium. Colombian lead and zinc mines are in

Antioquia Department, operated by Frontino Gold Mines.

Gold.—In Colombia, gold mining can be traced to pre-Columbian times. For 1,500 years, between 500 B.C. and 1000 A.D., a metal-working tradition spread through southwestern Colombia. The prosperity of the southwest declined toward the year 1000 A.D., when other groups populated the area. Gold production has been dropping in Colombia since 1986, except for an increase in 1991. In 1993, output was the lowest in the past 5 years. Mineralco plans to raise the output by offering up to 5,000 km^2 of land in the eastern jungles to explorers in the Choco, Guainia, Tolima, and Vaupes Provinces.

In 1993, Colombia ranked fourth in gold production in the Western Hemisphere after the United States, Canada, and Brazil. About 75% of Colombian gold output was produced from alluvial deposits. Gold mineralization is also associated with quartz veins in metasedimentary sections of the central Cordillera, as well as gold-copper-porphyries in the western Cordillera. The Department of Antioquía, Colombia's major source area for gold, produced about one-half of the nation's total output. About 10% came from placers of the Department of El Choco on the Pacific Coast, which also produced the country's platinum. Gold in Cordoba Department came from placers and in Bolivar Department from hard-rock mining. Those two Departments accounted for 30% of total gold production.

Mineros de Antioquia (MA) S.A. is the largest private gold producer in Colombia. The company started in 1974 after buying out Placer Development Co., which started in 1934 after purchasing Pato Mines Colombia Ltd. (which started in 1906). MA operates four bucketline dredges along the Nechi River. Most of the ground has been worked several times, and old dredge tailings can be seen clearly in many places along the banks of the river.

Frontino Gold Mines, Ltd. is the second largest gold producer at Segovia, extracting gold from hard rock. The company was in continuous operation since 1854.

Greenstone Resources Ltd., Toronto, Canada, operated the Oronorte gold mine near Zaragoza, Department of Antioquía. The company purchased the mine in 1986 and production started in December 1990. The mine produced about 318 kg of gold in 1993, or about 1% of Colombia's total gold production. Sales in 1993 from the Oronorte Mine totaled $4.5 million, compared with $3.6 million in 1992. The company formed a publicly owned Colombian company, Compania Minera Oronorte S.A., listing it on the Bogota and Medellin stock exchanges. The public will have a 43% interest in its shares.

Other companies active in gold production were Duval Resources Ltd. at El Carmen; Frontino Gold Mines Ltd. near Segovia; Mineros de Antioquía S.A. in the Rio Nechí in El Bagre-Zaragoza area; and Resources of the Americas of Washington, DC, at Giraldo, Antioquia Department.

A large gold deposit was discovered in southern Guainia in the area of the Serrania de Naquen. Mineralco built an airstrip near the discovery area, this being the only means to reach the Naquen deposit in the dense jungle.

Nickel.—Colombia was the world's fourth largest producer of ferronickel, after New Caledonia, Canada, and Japan. The Cerro Matoso Mine at Montelíbano, Department of Córdoba, is one of the world's largest nickel mines with a capacity of 23,000 mt/a nickel in ferronickel. Reserves of nickel ore were estimated at 20 Mmt grading 2.7% nickel. The deposit was discovered in the early 1970's during exploration for oil by the operating company Cerro Matoso S.A. (CM). CM is a joint venture between Billiton Overseas Ltd. (52.3%), a subsidiary of Royal Dutch Shell (the Netherlands), and Empresa Colombiana de Níquel (47.7%), a Government agency. The mine extracted about 900,000 tons of ore grading 2.7% nickel. The laterite ore was dried, calcined, and smelted in an electric furnace to produce ferronickel in ingots and granules. The planned smelter expansion to 30,000 mt/a was put on hold in early 1993. All production was exported, with 75% shipped to Europe.

Platinum.—Colombia was fourth worldwide in the production of platinum, with only 1.5% of total world production. Platinum production increased again in 1993, by 6% over that of the previous year. Almost all platinum production came from placer deposits, tributaries of the Atrato, Nechi, and San Juan Rivers in Chocó Department. Small amounts of gold, iridium, palladium, rhodium, and other metals also occur in those deposits.

Industrial Minerals

Colombia is well endowed with industrial minerals. Most asbestos is mined from the Campamentos Mine in the Department of Antioquía. Limestone is widely found in Colombia. The 17 cement plants are near limestone mines. About 20% of the cement output was exported. Gypsum was produced in Guainia Department in the central eastern area of the country and also was imported from Mexico and used in cement plants on the Caribbean Coast. Phosphate deposits in Colombia are along the Eastern Andes Range. Salt was produced from seawater evaporation basins on the north coast and from the Zipaquira underground mine north of Bogota. The only active sulfur mine in Colombia was the Mina El Vinagre near Puracé in Cauca Department.

Emeralds.—Colombia was the leading emerald producer, producing about 60% of the world's finest emeralds. Most of Colombia's emeralds came from mines in the Department of Boyacá north of Bogota, most notably in Chivór, Coscuez, Gachala, Muzo, Quípama, and Ubala. The Chivór and Muzo districts have been operating continuously for more than 500 years, since the colonial period. Emeralds are associated with hydrothermal breccias but their occurrence is sporadic and totally

unpredictable. Production comes from numerous open pits and underground mines.

Most emeralds were exported as uncut stones, a large portion illegally. Reportedly, Israel's Tel Aviv Precious Stone Exchange and its partner, the Bolso Mundial de Esmeraldas, will handle the emeralds, as well as gold and platinum from the Antioquia de Caldas Departments. The emeralds contributed about $400 million to Colombia's economy. Japan continued as the single largest market for emeralds (70%), followed by the United States, European countries, and others. Mineralco manages the emerald industry to maintain the quality and reputation of Colombian stones.

Mineral Fuels

Coal.—Colombia is rich in coal, natural gas, petroleum, and hydropower. Colombia is the third largest steam coal producer in the Western Hemisphere, after Canada and the United States, and was the eighth largest coal exporter with about 9% of the thermal coal market. More than 80% of Colombian coal produced, or 18.4 Mmt, was exported, accounting for about 12.5%, or $595 million, of Colombia's total export earnings in 1993. The United Kingdom was the largest importer of Colombian coal, accounting for about 20% of its total coal exports. Coal also was exported to Brazil, Denmark, France, Ireland, Italy, Japan, the Netherlands, Spain, and the United States. More than 75% of coal exported came from the Cerrejon's North Mine. Less than 30% of the total production was for domestic consumption. The coal industry employed about 29,000 workers, about 35% of which is located at the Cerrejon coal mine.

Colombia possessed the largest coal reserves in Latin America, principally of steam coal. Colombia had an estimated 6.5 billion tons of reserves of minable steam coal and 15 billion tons of inferred reserves. There was also about 19 Mmt of anthracite coal reserves. More than one-half of the country's reserves occurred along the north coast, concentrated in the La Guajira Peninsula, followed by Cesar (19%), Cundinamarca and Boyaca (9%), and Cordoba (8%).

About 60% of Colombian coal, or 13.5 Mmt, and 80% of exports, came from the Cerrejon Norte open pit. In 1993, 13.7 Mmt was exported from that mine, amounting to about $406 million. With reserves of 3 billion tons of high-quality steam coal, the open pit mine is the largest of its type in the world. The coal from this region is of excellent quality steam coal having a sulfur content of less than 1% and an ash content not exceeding 8%. In partnership with Carbones de Colombia S.A. (Carbocol), a state-owned company, Cerrejon Norte was operated by Colombia Resources Corp. The coal was transported on its own 155-km railroad to the Port of Bolivar. Carbocol employed about 440 workers, contributing about $215 million to the economy in 1993. Cerrejon Norte is part of the Cerrejon coalfield, divided into North, Central, and South sections. The south section has not been yet evaluated.

In 1993, the Government reorganized its coal industry by dividing Carbocol into two entities: a new Carbocol, which continues to administer the Government's 50% interest in the Cerrejon Norte coal mine, and the Ecocarbon. Ecocarbon is a regulatory agency that looks after the Government's interest in the coal industry outside of Cerrejon Norte, collects royalties, provides technical support, and administers safety regulations. All investments in new coal projects will be chanelled through Ecocarbon, but all must be 100% privately financed.

Carbocol is conducting a feasibility study for a new mine on the Pacific coast, Department of Vale, with an export port at Buenaventura. In addition to exports, the project will include a 150-MW coal-fired power station. Coal is now mined from small open pits. The region contains at least 5 billion tons of coal reserves. Carbocol plans to develop eight new coalfields throughout the country.

Prodeco S.A. is the largest private coal producer and exporter in Colombia. It has operated a number of steam and metallurgical (coking) coal plants in central Colombia since 1968. Proven reserves amounted to 150 Mmt of low-sulfur steam coal. Prodeco exported its production through its 3.5-Mmt/a facilities at Santa Marta. Prodeco also was contracted by Carbocol to work the Calenturitas project in the Department of Cesar.

Carbones del Caribe S.A. (CC), the other significant private coal producer, operated open pit mines at Puerto Libertador, Cordoba Department. Mine reserves were estimated at 300 Mmt. The company was established by Cementos del Caribe S.A. in 1981. The company used its coal as a fuel and the balance was exported. CC also extracted coal from one small underground mine and six open pits in La Jagua Province.

Drummond Ltd., a subsidiary of Drummond Coal Co., of Jasper, Alabama, continued to develop the La Loma open pit mine. The project is planned for incremental production development up to a capacity of 10 Mmt/a by 2001. In the latter part of 1993, Drummond announced that production of coal from the La Jagua de Ibirico deposit in Cesar Department will start in 1995. It was estimated that 25 Mmt of coal can be recovered from open pit operations and 70 Mmt by undergound mining. The deposit is expected to produce 10 Mmt/a of coal when fully developed. The main export markets will be France, Germany, Spain, Sweden, the United Kingdom, and the United States. Drummond negotiated with the newly created railway company Ferrovias S.A. for the upgrading of the 180-km railway link between the mine and the Caribbean port of Cienaga.

Colombia is planning to build a coal briquette plant using Chinese equipment and technology. The 10,000-mt/a-capacity plant, with a mine life of 20 years, will be located in Amaga, Antioquia Department. The regional government promotes the use of briquettes in areas that have no access to fuels other than firewood as a means of controlling deforestation.

Natural Gas and Petroleum.—More than 80% of natural gas produced in Colombia was used domestically. Only one gasfield has been developed in the Caribbean Basin, the Chuchupa Field, discovered in 1973 by Texaco oil company. Much of the nation's natural gas reserves are either offshore or on the La Guajira Peninsula and in the Department of Meta. Natural gas reserves in Colombia were estimated at 225 billion m^3. In 1993, Ecopetrol supported gas exploration along the Caribbean coast near Mompox and in Monserrate.

Oil seeps were reported in the Magdalena Valley as early as 1541. The first oil concession was granted in this region in 1905. The first commercial Infantas oilfield was discovered in 1918. Oil production started in 1921. In the 1980's, Occidental Petroleum Co. discovered the large Cano Limon Oilfield, thus transforming Colombia from a net importer of crude oil to a 200,000-bbl/d exporter. In 1993, Colombia was the third largest crude oil producer in Latin America. Production of crude oil in Colombia continued to increase to a historic high level in 1993. Oil represented about 22% of Colombia's export earnings and one-half of 1993 foreign investment. The country exported crude oil worth $1.7 billion in 1993. Investment in exploration activities in 1993 reached about $275 million, more than 85% of which was carried out by private companies, and the rest by Ecopetrol.

Colombia's proven oil reserves have doubled to at least 4 billion bbl, dispersed among the seven largest basins throughout Colombia. A significant part of the reserves lies in the eastern plains, principally in the Arauca basin that holds the huge Caño Limón Field. The Caño Limón Field was discovered in 1983.

The Casanare basin contained one-half of the country's total reserves, thus becoming the richest source of low sulfur oil in Colombia. BP continued exploration work in the Casanare area. Six other international companies were also doing exploration work in the area.

Occidental Petroleum Co. operated in the Caño Limón Oilfield, the country's largest producing oilfield, with a daily production of about 30,000 barrels. Crude oil was piped through a 760-km-long pipeline from Caño Field to the terminal at Covenas, on the Caribbean coast. The Caño Limón Oilfield transformed Colombia into an oil exporter in 1985. By 1993, exports of fuels accounted for about 30% of the total.

Ecopetrol released 14 blocks for bidding in the Llanos Oriental basin and adjoining Llanero foothills of the eastern Cordillera, each averaging about 2,100 km^2. Shell drilled the first exploration well in the Llanos Field in 1944 and Chevron discovered the first field, Castilla, in 1968. To date, 51 fields have been found, producing about 310,000 bbl/d.

Ecopetrol and their partners, BP, Triton Energy Ltd., and Total Petroleum Ltd., discovered a giant oilfield in eastern Colombia, known as the Cusiana-Cupiagua Field. The Cusiana and Cupiagua Oilfields are 200 km northeast of Bogota, in the Llano foothills. The Cusina Field is the largest discovery in the Western Hemisphere in the past 25 years. Both fields contain more than 85 billion m^3 of natural gas and 2 billion bbl of oil. The Cusiana Field has estimated reserves of 1.5 billion bbl oil and was declared commercial by BP in May, followed by Ecopetrol in June. Ecopetrol owns 50% of the Cusiana Field and covers 50% of the costs. About 438,400 bbl/d was produced in 1993. A pipeline is being built to transport crude oil from Cusiana to the Covenas terminal on the Caribbean coast. About 11,050 employees worked for Ecopetrol, generating about $1.5 billion of sales in 1993. Ecopetrol was ranked 60th out of 500 companies in 1992 by a private survey. In 1991, Ecopetrol was ranked 22d.

In the latter part of 1993, Ecopetrol offered for competitive tender exploration plots in the Upper Magdalena Oilfield. Exploration in the basin began in 1922, and in 1955 Texaco Oil Co. discovered oil in Ortega. Oil discoveries also were made by Esso and Lasmo oil companies in the field, and the deposits continue to be developed.

More than 50 petroleum companies were operating in Colombia, including Argosy Petroleum Ltd. of United Kingdom, Chevron, GHK, Hocol, and Texaco. Aviva Petroleum Co. and Garnet Resources Corp., Houston, Texas, also were exploring for oil. Argosy was drilling in two blocks in the Mocoa Field, Putumayo Department. GHK Inc. oil company, of the United States, was drilling two exploratory wells near Guaduas, in the Magdalena River Valley. In 1993, 62 oil wells were drilled and 80 wells were expected to produce in 1994.

The Putumayo Oilfield lies in southern Colombia, next to the Mocoa Field, covering 50,000 km^2, extending southward into Ecuador and Peru. About 3,500 km^2 of acreage, or 7% of the basin, was offered for licensing in the first licensing round by competitive tender. Exploration in the field began in 1941 with the first commercial discovery being made at Orito in 1963 by Texaco Petroleum Co. in association with Gulf Oil Co.

Ecopetrol operated refineries at Barrancabermeja, Cartagena, Orito, and Tibú. The largest refinery is at Barrancabermeja. Refining capacity was insufficient to supply the domestic market; therefore, 28,000 bbl/d of petroleum products was imported to make up the shortfall.

INFRASTRUCTURE

In Colombia, only 9,350 km was paved of the total 75,450 km of roads. Colombia contained 3,236 km of single-track railroads. The only significant rail traffic involved a few relatively short stretches, such as for transporting coal to the export terminals on the Caribbean coast, where most of the coal production is shipped.

Buenaventura, on the Pacific coast, was the country's largest port. Coal was exported through Puerto Bolívar and Santa Marta on the Caribbean coast. The nation's primary petroleum port was Coveñas. Cartagena and Tumaco also handled petroleum exports. Buenaventura and Santa Marta handled imports of

refined petroleum products.

There was a total of 5,890 km of pipeline consisting of 3,585 km for transporting crude petroleum, 1,350 km for refined products, 830 km for natural gas, and 123 km for natural gas liquids. Reportedly, the 470-km crude oil pipeline from the Cusiana area to Coveñas was completed in late 1993. On March 18, 1993, the Government approved a $700 million gas expansion plan, including the construction of the Ballenas-Barrancabermeja pipeline and several feeder lines to transport gas to Medellin, Bucaramanga, Cali, Bogota, and the southwest region in general.

Hydropower furnished about 80% of the total installed electrical generating capacity of 9,624 MW; the rest was supplied by thermoelectric powerplants (5% from coal and 15% from gas). Carbocol is planning to invest $2.6 billion on building eight new thermoelectric power stations northeast of Bogota. The eight stations should have a generating capacity of at least 1,600 MW. Reportedly, Empressa de Energia de Bogota S.A. committed $219 million in 1993 for the generation, distribution, and transmission projects. The El Guavio hydroelectric dam project was announced by the President on November 4, 1993. The five units are to generate 1,000 MW. The plant is linked to the national grid. The construction of another hydroelectric powerplant was started in Cordoba Province, north to the Cerro Matoso nickel deposit. The installed capacity of the plant will be 340 MW and is expected to be finished in 6 years.

OUTLOOK

The Colombian Ministry of Mines is undergoing a complete restructuring aimed at improving its level of technical expertise and efficiency. In the future, the Ministry will comprise three administrative units: a regulatory unit, a mining/energy unit, and an information center. The existing planning and legal divisions will be deleted from the new structure. The newly reorganized Ministry will transfer to regional Governments most existing contracts between the Government and private companies that deal with exploitation and exploration of nonrenewable resources, as well as those dealing with distribution and sale of petroleum products.

The privatization of Ecopetrol, a Government agency in charge of production of gas, oil, and petroleum products, will most likely not occur soon. The Government was interested in privatizing about 30 regional companies that generate or transmit electricity. Ecopetrol is planning to double its oil and gas production in the next 6 years, mostly from the Cusiana Field. The Government intends to spend $6 billion on developing the field. Ecopetrol is preparing to build a new refinery, which will make the country self-sufficient. The Colombian mining companies also are searching for investments to fund the upgrading equipment progam in their work stations.

[1]Where necessary, values have been converted from Colombian pesos (Col$) to U.S. dollars at the average rate for 1993 of Col$917.33=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

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Publications

A Country With New Opportunities for Investment—Foreign Investsment in Colombia, Republic of Colombia: National Planning Department, Mar. 1993.

Basic Laws for Foreign Investment in Colombia: Corporacion Invertir en Colombia (Coinvertir), Santa Fé de Bogota, Colombia, Nov. 1993.

Central Intelligence Agency, Washington, DC: World Factbook, annual.

Colombia—Coal, Gold, Emeralds, and Much Else: Engineering and Mining Journal, Chicago, Illinois, May 1994, pp. 47-52.

Colombian Geology—Much Potential Has Barely Been Touched: Engineering and Minig Journal, Chicago, Illinois, May 1994, p. 45.

Colombia Information Service, New York, New York: Colombia Today, monthly.

Latin American Mining Institute: The South American Investment & Mining Guide, Washington, DC.

Latin American Newsletters Ltd., London: Latin American Economy & Business, monthly.

Looking for an Investment Partner in Colombia, Bogota, Colombia: Instituto de Fomento Industrial, 1993.

Miida Ltd., London: Latin America Mining Letter, biweekly.

Oportunidades Estrategicas de Inversion. Petroleo y Mineria en Colombia: Departamento Nacional de Planeacion, Ministerio de Minas y Energia, Santafe de Bogota, Colombia, July 1993.

Riva, J. P., Exploration Opportunities in Latin America: PennWell Publishing Co., Tulsa, Oklahoma, 1992.

U.S. Department of Commerce: Foreign Economic Trends, annual.

TABLE 1

COLOMBIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993[e]	Annual capacity[e] (Jan. 1, 1994)
METALS							
Bauxite		1,500	1,640	1,716	[e]1,750	1,700	2,000
Copper, mine output, Cu content		—	304	3,643	3,935	4,000	4,000
Gold	kilograms	29,506	29,352	34,844	32,118	[2]27,845	45,000
Iron and steel:							
Iron ore and concentrate	thousand tons	573	628	[r]607	674	[2]715	800
Pig iron	do.	297	323	305	[r]308	[2]238	350
Steel, crude	do.	706	701	[r]652	[r]657	[2]715	800
Semimanufactures, hot-rolled	do.	598	592	581	[r]639	[2]636	700
Lead:							
Mine output, Pb content		394	331	611	[r,e]400	400	750
Refined (secondary)[e]		3,500	3,500	3,600	3,600	3,600	4,000
Manganese: Mine output, Mn content		3,600	500	552	[e]600	600	700
Nickel:							
Mine output, Ni content		21,425	22,439	20,590	23,063	23,300	24,000
Ferronickel, Ni content		16,939	18,424	20,194	20,195	20,200	23,000
Platinum-group metals	kilograms	973	1,316	1,603	1,956	[3]2,077	2,500
Silver	do.	6,847	6,591	8,036	8,291	[3]7,488	9,000
Zinc, mine output, Zn content		394	356	266	277	280	400
INDUSTRIAL MINERALS							
Asbestos:							
Mine output		158,149	159,600	160,332	170,000	160,750	162,000
Fiber[e]		7,900	8,000	[2]7,825	[2]7,900	8,000	9,000
Barite		5,460	5,380	9,288	9,380	9,400	10,000
Cement, hydraulic	thousand tons	6,643	6,253	[r]6,302	6,807	6,900	8,000
Clays:							
Bentonite		2,950	3,100	3,178	[e]3,500	3,500	4,500
Common clay	thousand tons	1,260	1,380	1,084	1,100	1,100	2,000
Kaolin[e]		540	540	900	900	900	2,000
Diatomite		3,600	3,100	3,890	4,356	4,400	5,500
Feldspar		40,850	34,800	45,575	[e]45,600	45,600	47,000
Fluorite[e]		300	[2]780	[2]894	900	900	1,000
Gemstones, precious and semiprecious: Emerald[3]	thousand carats	1,200	3,100	1,075	2,314	2,800	3,500
Gypsum	thousand tons	553	608	639	[r]671	640	750
Lime, hydrated and quicklime[e]	do.	1,300	1,300	1,300	[2]671	700	1,000
Magnesite		20,425	19,300	18,768	18,840	18,900	20,000
Mica		60	60	50	54	55	70
Nitrogen: N content of ammonia[e]		[2]91,800	90,000	90,000	90,000	90,000	100,000
Phosphate rock		31,200	[r]31,000	31,516	31,516	31,500	33,000
Salt:							
Rock	thousand tons	190	209	219	230	150	500
Marine	do.	470	478	482	317	150	700
Total	do.	660	687	701	547	300	1,200
Sodium compounds, n.e.s.: Sodium carbonate		[e]115,000	120,615	120,600	[e]121,000	121,000	200,000
Stone and sand:							
Calcite		12,060	7,208	5,758	[e]6,000	6,500	13,000
Dolomite	thousand tons	45	45	46	45	45	50
Limestone[e]	do.	12,000	[r]16,100	[2]15,660	[r]15,347	16,000	20,000
Marble		30,000	32,200	33,380	34,603	34,500	40,000

See footnotes at end of table.

TABLE 1—Continiued

COLOMBIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued							
Stone and sand—Continued:							
Sand excluding metal-bearing		e700,000	790,000	858,784	e860,000	850,000	950,000
Sulfur:							
Native (from ore)		45,575	31,686	37,563	39,178	39,200	46,000
Byproduct, from petroleum e		8,000	8,000	9,000	9,200	9,200	10,000
Total		53,575	39,686	46,563	48,378	48,400	56,000
Talc, soapstone, pyrophyllite		9,196	10,113	11,064	13,340	13,300	15,000
MINERAL FUELS AND RELATED MATERIALS							
Carbon black e		18,000	r20,400	20,000	23,600	23,800	30,000
Coal:							
Metallurgical e	thousand tons	650	700	800	900	950	1,200
Steam	do.	18,252	19,834	19,231	22,876	22,900	27,000
Total	do.	18,902	20,534	20,031	23,776	23,850	28,200
Coke, all types e	do.	550	r339	400	450	450	650
Gas, natural:							
Gross	million cubic meters	5,113	e5,600	5,202	e5,200	5,200	6,000
Marketed e	do.	4,100	4,500	r4,248	4,300	4,450	5,000
Natural gas liquids	thousand 42-gallon barrels	e1,400	e1,500	2,239	e2,300	2,300	3,000
Petroleum:							
Crude	do.	147,563	160,431	155,329	e160,600	160,500	180,000
Refinery products: e							
Liquefied petroleum gas (propane)	do.	4,500	4,500	r4,855	4,900	4,900	5,500
Gasoline:							
Aviation	do.	260	265	r301	320	300	400
Motor	do.	28,500	29,000	r32,120	32,200	32,000	35,000
Jet fuel	do.	3,800	4,000	r3,956	4,000	3,500	5,000
Kerosene	do.	2,200	2,300	r1,692	1,700	1,700	3,000
Distillate fuel oil	do.	14,300	14,300	r16,761	16,900	16,500	18,000
Lubricants	do.	750	750	r651	700	650	800
Residual fuel oil	do.	23,500	24,000	r26,900	27,000	27,000	29,000
Asphalt and bitumen	do.	1,100	1,100	r1,205	1,250	1,200	2,000
Refinery fuel and losses, and unspecified products	do.	3,500	3,500	r422	500	600	800
Total	do.	82,410	83,715	r88,863	89,470	88,350	99,500

e Estimated. r Revised.

[1] Table includes data available through Mar. 15, 1994.

[2] Reported figure.

[3] Based on registered exports by the Banco de la República.

TABLE 2

COLOMBIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Asbestos		Minera Las Brisas, S.A. (Eternit Colombiana, S.A., 70%)	Campamentos, Antioquia Department (mine)	9
Carbon black		Cabot Colombiana, S.A. (private, 100%)	Cartagena, Bolívar Department (plant)	NA
Do.		Productos Petroquímicos, S.A. (private, 100%)	Cali, Valle del Cauca Department (two plants)	12
Cement		Cía. Colombia de Clinker, S.A. (Colclinker) (private, 100%)	Cartagena, Bolívar Department (plant)	1,100
Do.		Cementos del Caribe, S.A. (private, 100%)	Barranquilla, Atlántico Department (plant)	1,000
Do.		Cementos del Valle, S.A. (private, 100%)	Yumbo, Valle del Cauca Department (plant)	1,200
Do.		Cementos Ríoclaro, S.A. (private, 100%)	Puerto Trifuno, Antioquia Department (plant)	1,000
Coal		Carbones de Colombia (CARBOCOL) [Government, 50%; S.A. and International Colombia Resources Corp. (INTERCOR); Exxon, 50%]	El Cerrejón Norte Mine, La Guajira Department	15,000
Do.		Drummond, Ltd. (Drummond Coal Co., 100%)	La Loma Mine, César Department	10,000[1]
Do.		Prodeco S.A. (private, 100%)	A number of mines in central Colombia	1,000
Do.		Acerías Paz del Río, S.A. (private, 100%)	Paz del Río, Boyaca Department (mine)	600
Copper		El Roble Exploración Y Explotación, S.A. (Minas El Roble, 51%; Nittetsu Mining, 44.1%; and C Itoh, 4.9%)	El Roble Mine, El Carmen, Chocó Department	4
Emerald		Minerales de Colombia, S.A. (Mineralco) (Government, 100%)	Chivor, Coscuez, Muzo, and Quípama Mines, Boyaca Department	NA
Gold	kilograms	Frontino Gold Mines, Ltd. (private, 100%)	El Silencio Mine, Segovia, Antioquia Department	1,500
Do.	do.	Greenstone Resources, Ltd. (private, 100%)	Oronorte Mine, Segovia, Antioquia Department	500
Do.	do.	Mineros de Antioquia, S.A. (private, 100%)	Rio Nechí, near El Bagre, Antioquia Department (mines)	2,000
Do.	do.	Small miners (Cooperatives and individual prospectors)	Río Nechí, Antioquia Department (mines)	NA
Iron ore		Acerías Paz del Río, S.A.	Paz del Río, Boyaca Department (mine)	800
Kaolin		Cerámicas del Valle, Ltda. (private, 100%)	Yumbo, Valle del Cauca Department (mine)	NA
Natural gas	million cubic meters	Empresa Colombiana de Petróleos (Ecopetrol) (Government, 100%)	North coast, Guajira Department (national gasfields)	3,500
Do.	do.	International Petroleum Colombia, Ltd. (International Petroleum Corp., 100%)	Barrancabermeja locale, Antioquia and Santander Departments	1,200
Nickel		Cerro Matoso, S.A. (Billiton Overseas Ltd., 52.3%; Government, 47.7%)	Cerro Matoso Mine, Montelíbano, Córdoba Department	23
Nitrogen		Abonos de Colombia (private, 100%)	Cartagena, Bolívar Department (plant)	100
Do.		Monomeros Colombo-Venezolanos, S.A. (private, 100%)	Barranquilla, Atlántico Department (plant)	85
Petroleum	thousand 42-gallon barrels	Ecopetrol	16 fields in various departments	70,000
Do.	do.	Houston Oil Colombiana, S.A. (HOCOL) (Royal Dutch Shell, 100%)	14 fields in various departments	36,500

See footnotes at end of table.

TABLE 2—Continued

COLOMBIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

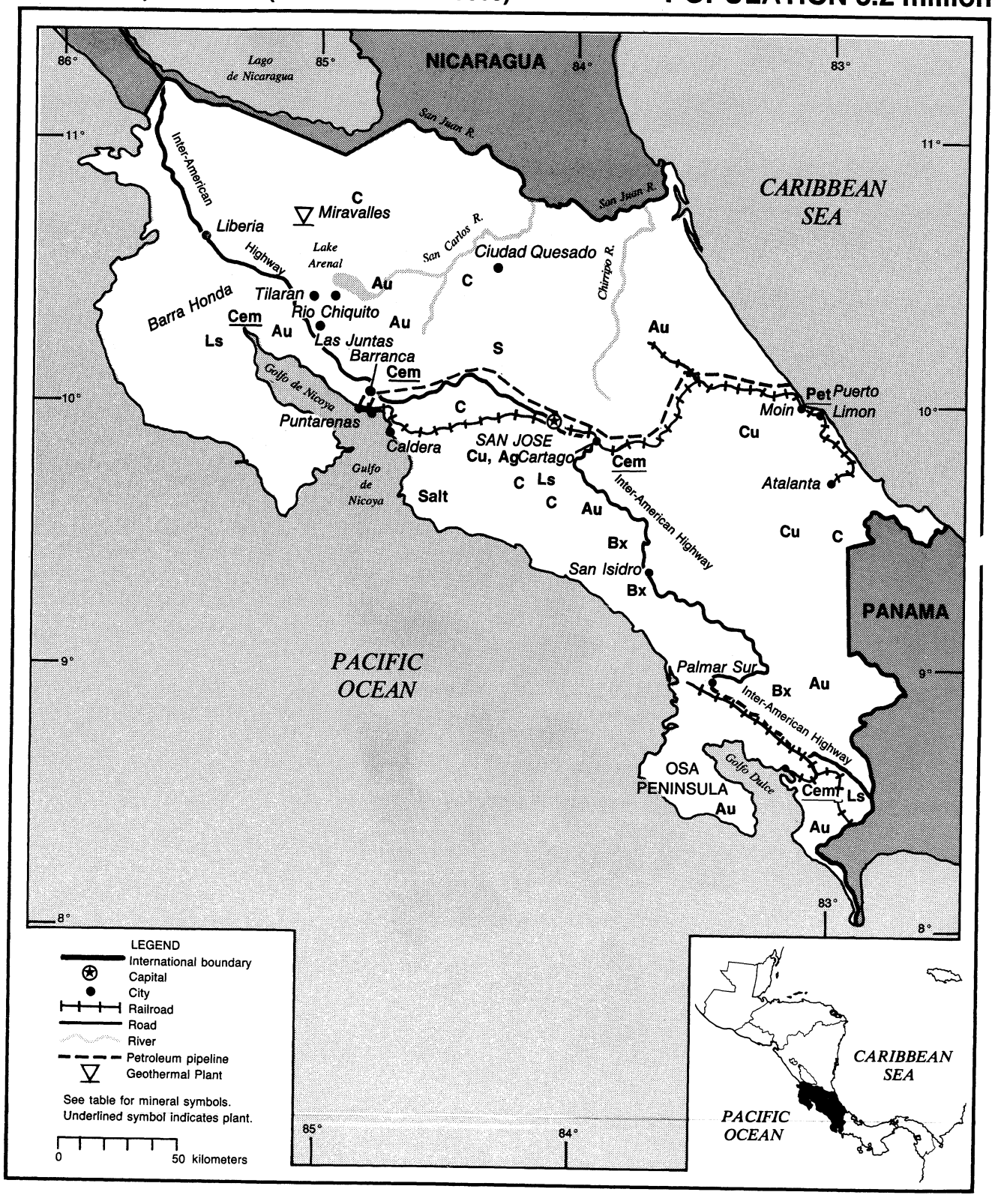
(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum products	thousand 42-gallon barrels	Ecopetrol	Barrancabermeja Refinery, Santander Department	71,400
Do.	do.	Do.	Cartegena Refinery, Bolívar Department	25,806
Do.	do.	Do.	Tibú, Norte de Santander Department	1,825
Do.	do.	Do.	Orito, Putumayo Department	875
Phosphate		Fosfatos de Colombia, S.A. (private, 100%)	Neiva, Huila Department	30
Do.		Fosfatos Boyaca, S.A. (Government, 100%)	Iza, Boyaca Department	20
Platinum		Small miners (Cooperatives and individual prospectors)	Río San Juan, Chocó Department	NA
Salt:				
Marine		Instituto de Fomento Industrial (IFI) (Government, 100%)	Manaure Salina, La Guajira Department	1,200
Rock		Concesión Salinas (Government, 100%)	Zipaquira, Cundinamarca Department	500
Silver	kilograms	Frontino Gold Mines, Ltd.	Segovia, Antioquia Department (mine)	2,500
Do.	do.	Small miners (Individual prospectors and cooperatives)	Río Nechí, Antioquia Department (mines)	2,000
Steel:				
Integrated plant		Acerías Paz del Río, S.A.	Belencito, Boyaca Department	400
Semi-integrated plants		Fundiciones Technicas, S.A. (private, 100%)	Medellín, Antioquia Department	NA
Do.		Siderúrgica del Boyacá, S.A. (private, 100%)	Bogotá, Federal District	NA
Do.		Siderúrgica de Medellín, S.A. (private, 100%)	Medellín, Antioquia Department	NA
Do.		Siderúrgica de Muña, S.A. (private, 100%)	Chusacá, Federal District	NA
Semi-integrated plants		Siderúrgica del Pacífico, S.A. (private, 100%)	Cali, Valle del Cauca Department	NA
Sulfur		Industrias Purace, S.A. (private, 100%)	El Vinagre Mine, Cauca Department	50
Do.		Ecopetrol	Barrancabermeja, Santander Department	29

NA Not available.
[1]Under development.

COSTA RICA

AREA 51,100 km² (includes Isla del Coco) **POPULATION 3.2 million**



THE MINERAL INDUSTRY OF

COSTA RICA[1]

By George A. Rabchevsky

The Republic of Costa Rica is a Central American country situated between Nicaragua on the north and Panama on the south. The east coast is bordered by the Caribbean Sea and the west coast by the Pacific Ocean. The size of the country is slightly smaller than the State of West Virginia, of the United States. The topography of Costa Rica is rugged from northwest to southeast and surrounded by plains on both coasts.

Despite a modest endowment of minerals and other natural resources, Costa Rica had a relatively prosperous economy. Agriculture, construction, manufacturing, and tourism were the primary industries in Costa Rica. In 1993, tourism became the country's first source of income, with an estimated income of $526 million in foreign exchange, reflecting a more than 150% growth between 1990 and 1993. Gross domestic product (GDP) in 1993 was estimated to grow by about 4%. Inflation was estimated to have decreased to 15% in 1993, and the unemployment rate was estimated at 6%.

The production of minerals in the country contributed less than 1% to the nation's GDP. Gold was the primary metallic mineral mined in the country, produced from the Golfo Dulce placer gold field in the south and from underground mines in the northwest. Silver was the only other metallic mineral produced in Costa Rica. Various industrial minerals were produced, with a value almost two times the value of gold production.

GOVERNMENT POLICIES AND PROGRAMS

The principal legislation governing mining was law 6797 of October 4, 1982. The Ministerio de Recursos Naturales, Energía y Minas was responsible for the control and development of Costa Rica's mineral resources through the Dirección de Geología, Minas y Hidrocarburos, the Minera Nacional, S.A. (MINASA), and the National Environmental Commission. The Government-owned Refinadora Costarricense de Petróleo, S.A. (RECOPE) controlled all oil refining operations. In Costa Rica it is not mandatory to register investments. Almost all operating companies in Costa Rica are privately owned. Gold companies pay 25% in taxes to the Government, and regulations are reported to be reasonable.

In 1900, the Costa Rican Government passed law 7200, permitting private-sector participation in the hydroelectric energy generation industry. Private-sector participation provides the Government with a new source of funding for its energy needs while lessening its present dependence on the higher priced imported fossil fuel alternative during the dry season.

ENVIRONMENTAL ISSUES

Tourism in Costa Rica promotes and supports the conservation of the environment. About 25% of the country's total territory is in protected areas such as natural parks, wildlife reserves, and refuges. Penalties were imposed on those who damage Costa Rica's natural resources.

The Arenal Volcano is one of the most active in the world. In 1980, Arenal Lake, northwest of the volcano, was dammed and flooded to create a hydroelectric reservoir and Costa Rica's largest freshwater lake. Many question the wisdom of building a hydroelectric dam so close to an active volcano. As required under law 7200, an environmental impact study must be performed before granting approvals for the construction of any energy plants.

Laws are being developed in Costa Rica for the protection of natural resources. The first study, "A Strategic Plan for Sustainable Tourism Development, 1993-1998," involves the technical assistance and backing of the European Community. The second study, "Management Plan and Visitor Capacity in the Most Important Protected Areas," is being produced by the University of Costa Rica and funded by the Costa Rican Tourist Board.

According to Ariel Resources, Ltd., the largest private gold producer in Costa Rica, the company exceeds environmental regulations to protect against degradation of the mining area.

PRODUCTION

Costa Rica produced gold, silver, and steel semimanufactures. Gold output continued to rise gradually, with encouragement from the Costa Rican Government. Industrial minerals production included cement, clays, diatomite, lime, pumice, salt, sand and gravel, and crushed stone. Crude oil was imported for the production of petroleum products in the domestic refineries. *(See table 1.)*

TRADE

The United States continued to be Costa Rica's most significant trading partner—one-half of its exports went to the United States. Total exports contributed $1,718[2] million to the economy in 1992, and total imports totaled $2,469 million, $239 million of which was for the country's fuel and energy needs. The country imported crude petroleum from Mexico and Venezuela under the San José Petroleum Accords. Crude oil also was imported

from Colombia and Ecuador. Because of falling prices, in recent years Costa Rica imported more than 50% of its oil requirements from other countries on the spot market. The majority of petroleum products was imported from Netherlands Antilles and the United States. Other trading partners were Germany, Guatemala, Japan, the Netherlands, and the United Kingdom. *(See tabels 2 and 3.)*

Six Central American countries, including Costa Rica, signed an agreement in October, intended to set them on course for free trade within the area and lay the foundation for deeper state harmonization. The agreement is presented in the form of a protocol to the original 1960 General Treaty on Central American Economic Integration, which created the Central American Common Market. Although the Costa Rican Government supported free trade in the region, it would not accept a customs union, the free movement of labor, or a commitment to a single currency.

STRUCTURE OF THE MINERAL INDUSTRY

MINASA was responsible for the coordination of mineral industry activities between other Government agencies and the private sector. It also assessed and developed mineral resources. RECOPE operated the country's oil refinery. Cement plants were owned by the Government and by private firms. Canadian and U.S. companies were primarily involved in a number of gold and silver exploration and mining operations. *(See table 4.)*

COMMODITY REVIEW

Metals

Alluvial gold is mined on the central Osa Peninsula dating back to 700 AD. New gold deposits were discovered in Costa Rica in about 1815. Most mining ceased during the 1920's owing to low gold prices and higher costs, but began reopening in the 1970's with rising gold prices. Open pit gold mining began in 1980 at Santa Clara, about 65 km west of San José. Gold and silver production in Costa Rica was primarily in the Central Gold Belt of the Tilaran Cordillera in the northwest, Abangares District.

One of Costa Rica's major gold producers was the Tres Hermanos underground mine. The mine was operated by El Valiente Ascari A.S., a subsidiary of Ariel Resources, Ltd. of Vancouver, Canada. Ariel became the largest gold producer in Costa Rica in the past few years, with 317 kg in 1992 and 293 kg in 1993. The Tres Hermanos Mine, just northeast of Las Juntas, was about 110 km northwest of San José. The minable gold reserves of the mine were estimated at 300,000 tons grading 0.23 oz/mt. The new primary crushing plant became operational in June 1993. The Matapalo mill, about 12 km southwest from the mine, was expanded to a capacity of 300 mt/d, and further expansion to 500 to 600 mt/d also was under consideration. An ecologically sound tailing impoundment area has in-place capacity for about 1 Mmt.

The San Martin Mine was purchased by Ariel in January 25, 1993, from state-owned Minas de Sierra Alta S.A. and became operational in November 1993. This newly acquired historic and underground mine, about 15 km north from the Matapalo mill and adjacent to the Tres Hermanos property, has 320,000 tons of minable gold reserves grading 0.23 oz/mt of gold. Ariel also acquired three gold properties in 1993, known as the Año Nuevo, Boston, and Gongolona, just northeast of the San Martin Mine. In addition, Ariel is exploring for gold deposits throughout the Costa Rican Gold Belt.

The El Recio small, medium-grade gold deposit in the Abangares gold mining district was held by Greenstone Resources Ltd., Ontario, Canada (incorporated in Costa Rica as Compañía de Recursos Minerales Piedra Verde S.A.). The deposit was discovered in 1987. Discussions were underway with a third party regarding possible financing alternatives for this project. In June 1993, Greenstone entered into an agreement with USA Gold Inc., a private U.S. company, that allows USA Gold to earn a 50% interest in the El Recio property by putting the project into production by the fourth quarter of 1994. Reportedly, the El Recio Mine produced about 155 kg of gold in 1993. USA Gold also has committed to spend $250,000 per year on surrounding exploration targets. Underground reserves include the Santa Ana deposit with more than 250,000 tons grading 7.9 g/mt of gold and the Palo Negro deposit containing 45,000 tons at 10.3 g/mt. Low-grade open pit reserves at Recio Norte totaled 650,000 tons at 1.7 g/mt and include 70,000 tons at 5.1 g/mt of gold.

The ownership of the Rio Chiquito open pit gold-silver mine reverted to Mallon Resources Corp., Denver, Colorado, from Newmont Mining Corp. late in 1992. Early in 1992, Newmont Corp. signed a preliminary agreement to explore gold on the 6,000-ha property in Rio Chiquito, Guancaste Province. Newmont indicated that proven reserves of the Rio Chiquito deposit did not meet its requirements. Polymet Resources Corp., subsidiary of Minproc Corp., signed a letter of intent to develop Mallon's property.

Minera Rayrock Inc., Toronto, Canada, obtained an exploration permit to search and develop a gold mine on the Bellavista property, northwest of San José. A new zone of mineralization was also discovered near the Bellavista gold project by Minera Rayrock.

Industrial Minerals

Costa Rica produced bentonite, cement, crushed rock, diatomite, lime, limestone and sandstone, sand and gravel, and pumice. Except for clays, fertilizers, and lime, most commodities were consumed internally. The largest producer of fertilizers in Central America was Costa Rica's Fertilizantes de Centro America, SA. The company was founded in 1964 by the Standard Oil Co. of New Jersey and is now Government-owned. Salt was produced by the solar evaporation of brine, primarily around the Golfo de Nicoya.

Cement.—Limestone was quarried primarily for the use in the manufacture of cement by Cementos del Pacífico, S.A. and Industria Nacional de Cemento S.A. (INCSA). About 20% of limestone was used to produce aggregate, dimension

stone, and lime. Cementfabrik Holderbank AG, Switzerland's cement producer, is the largest shareholder in INCSA. INCSA was established in 1963. Holderbank exercises considerable influence in INCSA in terms of corporate strategy, environmental controls, technological support, and cost accounting.

Diatomite.—The 13 known diatomite lacustrine deposits occur in a Quaternary belt stretching from Liberia to Cartago. The most productive diatomite quarries occur in the north, including Loma Camastro and Canas Dulces deposits. Only the Loma Camastro deposit, northeast of Liberia, is being mined.

Sulfur.—A sulfur mine was opened on January 1993 by Corporación de Azufre de Costa Rica S.A., at Gongora, Province of Guanacaste. The production capacity of the open pit mine is 90,000 mt/a. Sulfur will be available in pellets, granules, and flakes. Most of the products will be exported to the Caribbean or Central American countries.

Mineral Fuels

Coal occurrences have been reported at a number of localities in Costa Rica. Eight coalfields have been identified, three of which contain almost 50 Mmt of lignite and subbituminous coal. Geothermal wells were drilled on the Miravalles Volcano in the Guanacaste mountain range, in the northwestern part of the country. Production for both is insufficient for domestic use.

Crude oil and natural gas were not produced in the country. Costa Rica imported most of its oil requirements from Colombia, Ecuador, Mexico, and Venezuela. Several U.S. and Canadian companies were engaged in exploratory and prospecting work. The majority of petroleum products were imported from Netherlands Antilles and the United States, with the rest from Colombia, Ecuador, Mexico, and Venezuela. The only company in Costa Rica producing petroleum products was RECOPE. Its Moin refinery was in Limon Province, on the Caribbean coast.

INFRASTRUCTURE

Costa Rica has a well-developed transportation network. The principal routes of transportation are in a belt extending east and west across the country. The highway system also is best developed on the central plateau. More than 7,000 km of roads was paved, another 7,000 km was gravel roads, and about 1,400 km was dirt roads. The major ports in Costa Rica were Caldera, Golfito, Moin, Puerto Limon, and Puntarenas. There is a 730-km seasonably navigable inland waterway. There is 950 km of railroad tracks, linking the Puerto Limon on the Caribbean coast with Puntarenas, the major port on the Pacific coast. Petroleum was unloaded at the Moin oil refinery complex. RECOPE distributed petroleum products across the country by a 348-km pipeline network.

Electric power service in Costa Rica was governed by law 257 of 1941. The National Electricity Service, created under that law, is responsible for setting rates for the electric, telephone, and water utilities, as well as regulating service, including establishing quality guidelines. Costa Rica's total installed electrical capacity was 1,043.4 MW, 968.5 MW of which was operated by the Government-owned Instituto Costarricense de Electricidad (ICE) and the remaining capacity was owned by private companies. Hydropower accounted for more than 75% of energy generated. The 32-MW Sandillal hydroelectric plant became operational in 1993, and the construction of the 55-MW Miravalles geothermal plant continued. Preliminary work was begun on the 90-MW Toro hydroelectric complex. Two other installations include the 157-MW Arenal and the 174-MW Corobisi plants. Inter-American Development Bank financially aided the construction of all these plants. At the end of 1993, the International Finance Corp. granted a loan to INCSA for the construction of a 13-MW hydroelectric powerplant to be operated by Hidroeléctrica Aquas Zarcas S.A. Two streams are to be diverted through a 5-km-long canal to the power plant, housing two 6-MW turbines. Total cost was estimated at $16.7 million. This will become the first of Costa Rica's private-sector powerplants established within the framework of recent legislation providing for purchases by ICE from private energy generators. ICE also considered the construction of a 177-MW hydroelectric powerplant on the Reventazon River, about 50 km west of Moin; the construction of a 20-MW wind powerplant north of Lake Arenal; and the installation of power transmission lines. The Tejona project, the first of its kind in Central America, will produce electricity with minimal environmental impact. The project's total cost is projected at $515.4 million.

Hidroeléctrica Platanar S.A. (HP) proposed to construct a 15-MW hydroelectric powerplant on the Platanar River, 10 km north (downstream) of Ciudad Quesada, Alajuela Province, in the northeast of Costa Rica. Once approved, the project will be managed and operated by Empresa Eléctrica Matamoros S.A. (EM), which operates three small hydroelectric plants upstream from the proposed plant. The electricity generated by the proposed plant will be sold in its entirety to the Costa Rican Electricity Institute. HP was established in October 17, 1989, by EM as a special purpose vehicle to prepare the proposed hydroelectric power project.

OUTLOOK

Government privatization efforts again were emphasized for 1993. The state-owned mining corporation, MINASA, is soliciting proposals for gold exploration joint ventures. Foreign investors were encouraged to explore gold deposits, modernize old mines, open new mines, and explore for oil. Deposits of copper, gold, lead, silver, zinc, and other metals might be discovered if more exploration programs were carried out.

The Government's privatization program is expected to advance with divestments of several major state companies. The two largest companies slated to be privatized are the Fertilizantes de Centroamérica, S.A. and Cementos del Pacífico, S.A., both holdings of the government-owned Corporación Costarricense de Desarrollo S.A.

[1]Text prepared Apr. 1994.
[2]Where necessary, values have been converted from Costa Rican colones (@) to U.S. dollars at the rate of @151=US$1.00, the average rate for 1993.

OTHER SOURCES OF INFORMATION

Agencies

Instituto Costarricense de Electricidad Sabana Norte, San José, Costa Rica
Telephone: (506) 20-7720
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Minera Nacional, S.A.
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Telephone: (506) 53-7555
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Ministerio de Recursos Naturales, Energía y Minas, Dirección de Geología, Minas y Hidrocarburos
Apartado 10104, Zona 1000
San José, Costa Rica
Telephone: (506) 33-2360

Refinadora Costarricense de Petróleo, S.A.
Apartado 4351, Zona 1000
San José, Costa Rica
Telephone: (506) 33-0333
Fax: (506) 23-2748

Publications

Ariel Resources Ltd., Vancouver, Canada, 1993 annual report.
Central Intelligence Agency, Washington, DC: World Factbook, annual.
Latin American Mining Institute, Washington, DC: Mexico and Central America Investment and Mining Guide, annual.

TABLE 1
COSTA RICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1, 1994)
Cement		610,000	620,000	e700,000	e700,000	650,000	825,000
Clays, common e		[2]506,685	304,700	399,000	400,000	400,500	600,000
Diatomite e		4,500	4,400	12,000	12,000	10,000	15,000
Gold e	kilograms	[2]387	460	550	550	600	700
Iron and steel: Semimanufactures		86,619	91,373	89,757	e85,000	84,000	95,000
Lime e		10,000	12,700	[2]8,655	9,000	9,500	12,000
Petroleum refinery products e	thousand 42-gallon barrels	[2]4,724	4,500	2,500	3,000	4,000	6,000
Pumice e		[2]14,000	4,900	8,000	8,000	8,000	15,000
Salt, marine e		30,000	40,000	50,000	50,000	45,000	60,000
Silver e	kilograms	[2]194	200	370	400	450	600
Stone: e							
Crushed rock and rough stone	thousand tons	1,500	1,450	[2]944	1,000	900	2,000
Limestone and other calcareous materials	do.	[2]2,300	1,600	1,300	1,300	1,200	3,000
Sand and gravel	do.	1,400	1,020	[2]1,047	1,100	1,000	2,000
Sandstone		1,000	650	650	650	600	1,500

e Estimated.
[1]Includes data available through Mar. 1994.
[2]Reported figure.

TABLE 2

COSTA RICA: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
METALS					
Aluminum: Metal including alloys:					
Unwrought		111	139	136	Nicaragua 3.
Semimanufactures		4,249	4,118	2,328	Germany 1,064; Argentina 218.
Chromium: Oxides and hydroxides		—	1	—	All to Nicaragua.
Copper: Metal including alloys:					
Unwrought		747	894	876	Republic of Korea 18.
Semimanufactures		3	4	—	Nicaragua 2; Panama 2.
Gold: Metal including alloys, unwrought and partly wrought	kilograms	60	7,576	576	Canada 7,000.
Iron and steel: Metal:					
Scrap		10,093	3,180	18	Guatemala 1,448; El Salvador 1,225; Singapore 489.
Pig iron, cast iron, related materials	value, thousands	—	$1	—	All to Guatemala.
Steel, primary forms	do.	—	$1	—	All to Panama.
Semimanufactures:					
Bars, rods, angles, shapes, sections		1,292	982	112	Panama 422; Nicaragua 176; El Salvador 156.
Universals, plates, sheets		6,660	6,537	—	Nicaragua 2,577; El Salvador 2,061; Panama 1,211.
Hoop and strip		193	220	—	Panama 195; Dominican Republic 20; Honduras 5.
Wire		133	716	—	Guatemala 334; Honduras 151; Nicaragua 86.
Tubes, pipes, fittings		4,468	6,192	—	Panama 3,420; El Salvador 1,013; Guatemala 798.
Castings and forgings, rough		306	218	193	Guatemala 13; Nicaragua 8.
Magnesium: Metal including alloys, unwrought		9	3	—	Panama 1; unspecified 2.
Tin: Metal including alloys, semimanufactures		3	3	—	Guatemala 2; Nicaragua 1.
Titanium: Oxides		22	11	—	Nicaragua 6; Panama 4; El Salvador 1.
Zinc:					
Oxides		1	—		
Metal including alloys:					
Unwrought		161	164	42	Republic of Korea 122.
Semimanufactures including zinc dust		2	3	—	All to Nicaragua.
Other:					
Ores and concentrates	value, thousands	$66	$8	—	All to Japan.
Base metals including alloys, all forms		12	—		
Metalloids[2]		133	—		
INDUSTRIAL MINERALS					
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc.		44	234	—	Ecuador 127; Nicaragua 107.
Boron materials: Oxides and acids		20	40	—	All to Panama.
Cement		22,264	17,502	—	Cayman Islands 13,794; Panama 3,102; Colombia 452.
Chalk		350	450	—	All to Panama.
Clays, crude		5	288	—	Nicaragua 223; El Salvador 63; Panama 2.
Diatomite and other infusorial earth		20	118	—	All to Guatemala.
Feldspar, fluorspar, related materials		—	303	—	Nicaragua 206; Guatemala 97.
Fertilizer materials: Manufactured:					
Ammonia		—	5	—	All to Nicaragua.
Nitrogenous		24,013	37,485	—	Panama 15,414; Venezuela 10,044; Chile 9,543.

See footnotes at end of table.

TABLE 2—Continued

COSTA RICA: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Fertilizer materials: Manufactured—Continued:					
Phosphatic		20	—		
Potassic		659	33	—	Nicaragua 19; Panama 14.
Unspecified and mixed		18	67	—	Nicaragua 22; Panama 22; Guatemala 15.
Gypsum and plaster		5	1	—	All to Nicaragua.
Lime		17	10	—	Do.
Magnesium compounds: Magnesite, crude		5	1	—	Do.
Mica: Crude including splittings and waste	value, thousands	—	$2	—	El Salvador $1; Panama $1.
Phosphates, crude		85	13	—	All to Panama.
Pigments, mineral: Iron oxides and hydroxides, processed		1	1	—	Mainly to Nicaragua.
Salt and brine		161	533	265	Venezuela 169; Nicaragua 85.
Sodium compounds, n.e.s.: Sulfate, natural and manufactured		136	3	—	Nicaragua 2; Panama 1.
Stone, sand and gravel:					
Dimension stone: Worked		(3)	2	(4)	Mainly to Guatemala.
Limestone other than dimension		—	30	—	All to Panama.
Sand other than metal-bearing		27,237	—		
Sulfur:					
Elemental: Colloidal, precipitated, sublimed		2	1	—	All to Panama.
Sulfuric acid		3	—		
Talc, steatite, soapstone, pyrophyllite		3	14	—	Panama 11; Honduras 3.
Other: Crude		68	2	—	All to Nicaragua.
MINERAL FUELS AND RELATED MATERIALS					
Carbon black		3	—		
Petroleum refinery products:					
Gasoline	barrels	73,856	57,214	33,218	Canada 15,096; Panama 3,230.
Mineral jelly and wax	do.	79	40	—	Panama 24; Nicaragua 16.
Kerosene and jet fuel	do.	46	—		
Distillate fuel oil	do.	86,611	45,021	27,438	Germany 4,476; Italy 1,955.
Lubricants	do.	763	1,533	—	Nicaragua 1,302; El Salvador 84; Guatemala 63.
Residual fuel oil	do.	537,955	335,744	16,510	Dominican Republic 147,739; Germany 31,215.
Bituminous mixtures	value, thousands	—	$1	—	All to Nicaragua.

[1]Table prepared by H. D. Willis.
[2]Reported under SITC item number as "selenium, tellurium, phosphorus, arsenic, etc."
[3]Unreported quantity valued at $1,000.
[4]Less than 1/2 unit.

TABLE 3

COSTA RICA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS					
Alkali and rare-earth metals		12	1	1	
Aluminum:					
Oxides and hydroxides		165	196	30	Germany 158; United Kingdom 5.
Metal including alloys:					
Unwrought		7,707	4,235	94	Venezuela 4,009; Mexico 100.
Semimanufactures		3,356	2,690	954	Venezuela 454; El Salvador 386.
Chromium: Oxides and hydroxides		29	27	13	Germany 11; Mexico 2.
Cobalt: Oxides and hydroxides	value, thousands	$5	—		
Copper: Metal including alloys:					
Unwrought		9	8	8	
Semimanufactures		3,881	3,897	1,874	Peru 1,635; Mexico 321.
Gold: Metal including alloys, unwrought and partly wrought	kilograms	52,692	71	71	
Iron and steel: Metal:					
Scrap		121	67	25	Mexico 42.
Pig iron, cast iron, related materials		23	71	50	Germany 20; Italy 1.
Ferroalloys, unspecified		3	3	(e)	Mainly from Mexico.
Steel, primary forms		97,488	66,103	10,692	Chile 27,749; Venezuela 8,291.
Semimanufactures:					
Bars, rods, angles, shapes, sections		13,259	18,492	3,066	Brazil 4,590; Nicaragua 2,852.
Universals, plates, sheets		75,685	74,637	1,637	Venezuela 27,846; Brazil 17,986; Chile 10,708.
Hoop and strip		643	800	37	Brazil 519; Republic of Korea 171.
Rails and accessories		6	58	23	Colombia 32; Netherlands 3.
Wire		3,976	6,501	1,438	Brazil 2,918; Nicaragua 857.
Tubes, pipes, fittings		7,978	6,541	704	Guatemala 1,701; Mexico 1,525; Brazil 1,095.
Castings and forgings, rough		723	630	324	Mexico 100; Colombia 64.
Lead:					
Oxides		208	260	11	Mexico 140; Peru 41; Panama 35.
Metal including alloys:					
Unwrought		95	7	4	Mexico 3.
Semimanufactures		4	8	1	Netherlands 1; Peru 1; unspecified Asian countries 4.
Magnesium: Metal including alloys, semimanufactures	value, thousands	$1	$3	$2	Unspecified Asian countries $1.
Manganese: Oxides		1,039	1,047	31	Brazil 915; Japan 40.
Molybdenum: Metal including alloys, unwrought	value, thousands	$4	$7	$6	Unspecified Asian countries $1.
Nickel: Metal including alloys:					
Unwrought		(e)	2	(e)	Mainly from Sweden.
Semimanufactures		10	13	3	Canada 7; Finland 1.
Silver: Metal including alloys, unwrought and partly wrought	value, thousands	$108	$23	$6	Chile $17.

See footnotes at end of table.

TABLE 3—Continued

COSTA RICA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Tin: Metal including alloys:					
Unwrought		4	1	—	All from unspecified Asian countries.
Semimanufactures		26	13	(2)	Germany 3; unspecified Asian countries 10.
Titanium: Oxides		1,300	1,134	318	Mexico 447; Germany 293.
Tungsten: Metal including alloys, unwrought	value, thousands	$3	—		
Zinc:					
Oxides		483	443	74	Mexico 131; Venezuela 59.
Metal including alloys:					
Unwrought		4,741	3,623	20	Mexico 1,925; Peru 1,124; Argentina 275.
Semimanufactures including zinc dust		97	83	49	Peru 30; Italy 3.
Other:					
Ores and concentrates		47	91	—	Germany 55; Guatemala 36.
Oxides and hydroxides		161	38	10	Mexico 13; United Kingdom 6.
Base metals including alloys, all forms		32	15	1	Unspecified Asian countries 14.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		207	304	7	Guatemala 106; Austria 83; El Salvador 56.
Dust and powder of precious and semiprecious stones including diamond	value, thousands	$15	$9	$9	
Grinding and polishing wheels and stones		156	194	56	Germany 36; Italy 24.
Asbestos, crude	value, thousands	—	$1	$1	
Barite and witherite		3	9	(2)	Mainly from Mexico.
Boron materials:					
Crude natural borates		10	340	(2)	Mainly from Guatemala.
Oxides and acids		49	71	43	Chile 21; Argentina 5.
Bromine[4]		5	7	2	Germany 2; United Kingdom 2.
Cement		3,266	3,141	200	Republic of Korea 1,297; Belgium-Luxembourg 943; Colombia 462.
Chalk	value, thousands	$32	$11	—	France $10; Germany $1.
Clays, crude		6,152	5,309	4,301	Guatemala 550; El Salvador 413.
Diamond: Natural:					
Gem, not set or strung	value, thousands	$28	$56	$53	Uruguay $3.
Industrial stones	do.	$12	$2	$2	
Diatomite and other infusorial earth		316	143	36	Chile 63; Germany 24.
Feldspar, fluorspar, related materials		4,621	4,876	(2)	Guatemala 4,858; El Salvador 18.
Fertilizer materials:					
Crude, n.e.s.		58	65	64	Netherlands 1.
Manufactured:					
Ammonia		27,579	56,629	10,049	Mexico 20,996; Trinidad and Tobago 13,062; Canada 12,498.
Nitrogenous		69,368	61,892	29,781	Venezuela 11,660; Trinidad and Tobago 7,666.
Phosphatic		32,112	44,786	44,785	Germany 1.
Potassic		85,142	82,371	75,408	U.S.S.R. 6,927; Germany 35.
Unspecified and mixed		707	1,301	100	Netherlands 1,032; Germany 135.

See footnotes at end of table.

TABLE 3—Continued

COSTA RICA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1990	1991	Sources, 1991	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Graphite, natural	3	5	1	Germany 2; Japan 2.
Gypsum and plaster	28,290	30,225	8,073	Mexico 21,202; Guatemala 948.
Lime	—	3	1	Mexico 2.
Magnesium compounds: Magnesite, crude	2,231	3,230	13	Netherlands 3,028; Spain 140; United Kingdom 20.
Mica:				
Crude including splittings and waste	6	13	3	Norway 10.
Worked including agglomerated splittings value, thousands	$2	$3	$1	Mexico $1; United Kingdom $1.
Phosphates, crude	5,976	3,493	3,037	Belgium-Luxembourg 232; Netherlands 121.
Pigments, mineral: Iron oxides and hydroxides, processed	787	531	60	Germany 340; Colombia 48.
Precious and semiprecious stones other than diamond:				
Natural value, thousands	$64	$130	$130	
Synthetic do.	$4	$1	$1	
Salt and brine	4,819	4,045	119	Nicaragua 3,638; Canada 182.
Sodium compounds, n.e.s.: Sulfate, natural and manufactured	9,413	12,999	4,476	Mexico 4,651; Panama 2,235.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	91	130	—	Italy 81; Brazil 38; Guatemala 10.
Worked	75	163	19	Guatemala 72; Mexico 47; Italy 21.
Dolomite, chiefly refractory-grade	1,808	2,441	—	Honduras 1,252; Guatemala 1,169; Nicaragua 20.
Gravel and crushed rock	56	57	50	Canada 7.
Limestone other than dimension	2	—		
Quartz and quartzite	66	44	4	Guatemala 40.
Sand other than metal-bearing	28,097	27,109	7,400	Venezuela 11,616; Mexico 8,053.
Sulfur:				
Elemental:				
Crude including native and byproduct	85	420	65	Germany 157; Republic of Korea 102.
Colloidal, precipitated, sublimed	419	490	194	Belgium-Luxembourg 150; Venezuela 80.
Sulfuric acid	1,131	1,152	369	El Salvador 760; Mexico 20.
Talc, steatite, soapstone, pyrophyllite	1,235	1,097	507	Guatemala 156; Norway 40.
Other:				
Crude	222	99	80	Guatemala 18; Germany 1.
Slag and dross, not metal-bearing	2	(e)	(e)	
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	4,948	17,998	17,986	Colombia 9; Panama 3.
Carbon black	2,692	3,121	469	Mexico 2,113; Venezuela 473.
Coal:				
Anthracite	105	10	10	
Lignite including briquets value, thousands	$1	$2	$2	
Coke and semicoke	255	138	138	
Peat including briquets and litter	2	2	2	
Petroleum:				
Crude thousand 42-gallon barrels	2,985	2,586	(e)	Mexico 1,257; Venezuela 677; Colombia 336.

See footnotes at end of table.

TABLE 3—Continued

COSTA RICA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS—Continued					
Refinery products:					
Liquefied petroleum gas	42-gallon barrels	264,202	296,299	38,315	Mexico 257,613; Panama 232.
Gasoline	do.	1,561,246	2,350,488	1,294,176	Venezuela 1,023,247; Ecuador 31,552.
Mineral jelly and wax	do.	25,593	27,238	11,301	Germany 8,027; United Kingdom 1,196.
Kerosene and jet fuel	do.	1,263	1,465	1,457	Germany 8.
Distillate fuel oil	do.	2,293,308	2,803,207	1,144,461	Venezuela 1,474,424; Colombia 184,322.
Lubricants	do.	137,627	113,057	89,537	El Salvador 16,121; Panama 2,219.
Residual fuel oil	do.	418,654	367,439	31,961	Venezuela 167,899; Ecuador 166,693.
Bitumen and other residues	do.	29,833	39,045	39,032	Mexico 12.
Bituminous mixtures	do.	818	654	188	Mexico 406; El Salvador 36.

[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Unreported quantity valued at $10,000.
[4]Includes fluorine and iodine.
[5]Unreported quantity valued at $2,000.

TABLE 4

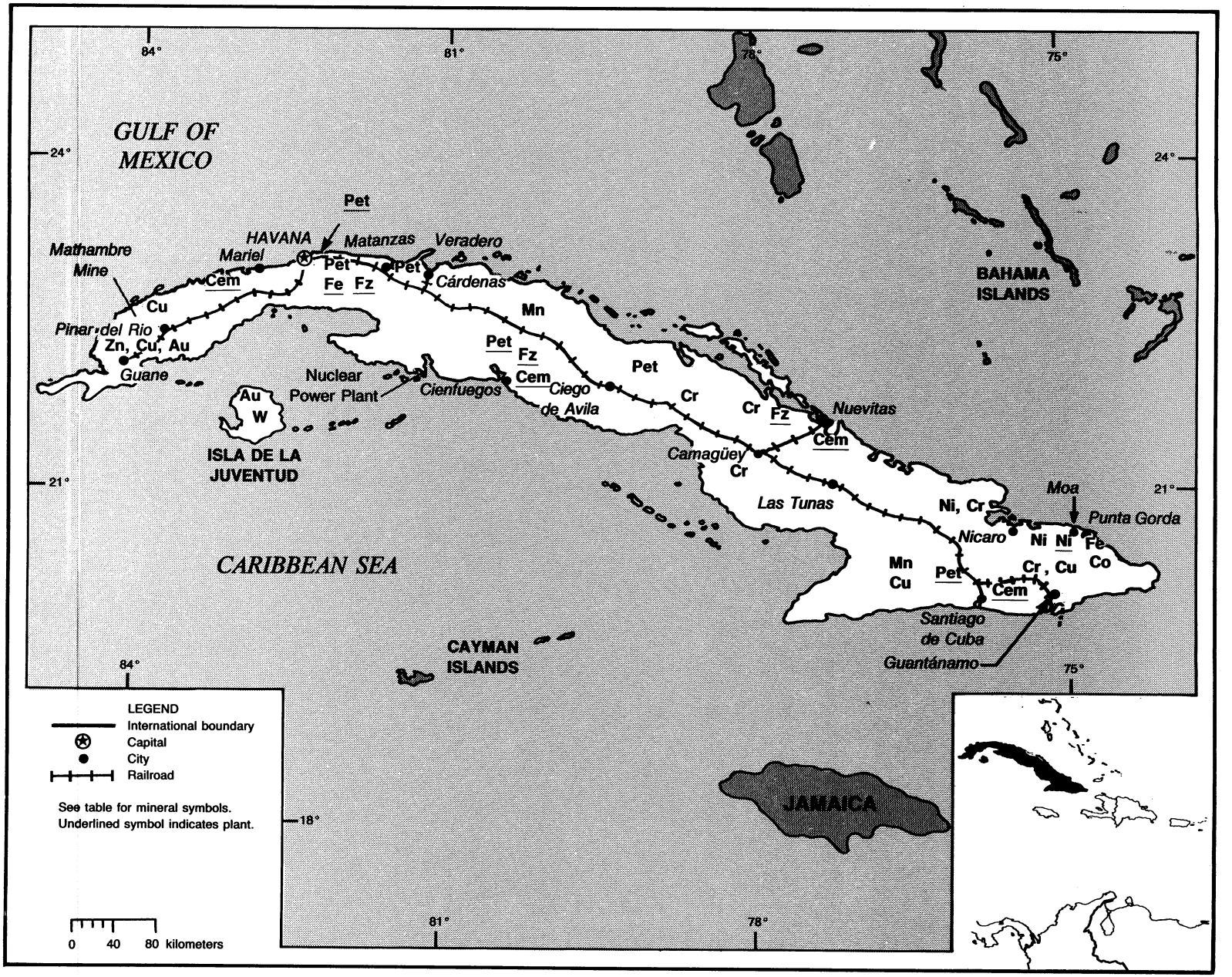
COSTA RICA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Industria Nacional de Cemento, S.A. (INCSA) (private, 100%)	Aguas Calientes, Cartago, Cartago Province	425
Do.		Cementos del Pacífico, S.A. (CEMPASA) (subsidiary of Corporacion Costarricense de Desarrollo, S.A., Government, 100%)	Near Colorado, Guanacaste Province	400
Clay		CEMPASA	Tajo Finca, near Platanar, Guanacaste Province	100
Gold	kilograms	El Valiente Ascari, S.A. (Ariel Resources, Ltd., Canada, 100%)	Tres Hermanos Mine, Las Juntas, Guanacaste Province	305
Do.	do.	Minera Macona, Ltda. (Equinox Resources, Ltd., 100%)	Santa Clara Mine, Puntarenas Province	160
Limestone		INCSA	La Chilena Quarry, near Cartago, Cartago Province	550
Do.		CEMPASA	Cerro Peña Blanca Quarry, Guanacaste Province	300
Petroleum products	thousand 42-gallon barrels	Refinadora Costarricense de Petróleo, S.A. (RECOPE) (Government, 100%)	Moin Refinery, Limón Province	5,760

CUBA

AREA 110,861 km² **POPULATION 10.7 million**



THE MINERAL INDUSTRY OF

CUBA[1]

By George A. Rabchevsky

About the size of Pennsylvania, Cuba is the largest island in the West Indies and lies on the northern boundary of the Caribbean Basin, about 145 km south of Key West, Florida. Including the Isla de la Juventud (the Island of Youth) and about 1,600 adjacent keys and islands, Cuba accounts for more than one-half of the West Indian land mass. The island was formed by volcanic activity about 40 millions years ago, during the Oligocene/Eocene Epoch. The northern half of the island consists mostly of shallow to deepwater marine sedimentary rocks that host most of the known oil deposits. The southern half consists essentially of a northern belt of mafic to ultramafic (ophiolite-type assemblages) juxtaposed against a southern area of thick sequences of Cretaceous, volcanic-arc and sedimentary rocks intruded by granitic bodies. Areas of complexity deformed metamorphic rocks also are exposed in the southern Province. Metallic and industrial mineral deposits are widespread in Cuba and occur in a variety of geological settings.

Sugar was still the country's largest source of foreign exchange, accounting for about 70% of all export earnings, or $900 million in 1993. Because of storm flooding in March, referred in Cuba as the "Storm of the Century," Cuba's 1993 sugar harvest was estimated at 4 Mmt, compared with 7 Mmt in 1992. Cuba's poor sugar harvest in 1993 also was blamed, at least in part, to Russia's failure to ship fertilizers, fuel, and spare parts on time. The electricity and oil shortages and the lack of raw materials led to the closure of a number of factories, including the decrease in the production of sugar. Cuba's transportation system also was crippled by the storm, shortages of fuel, and spare parts. The Cuban economy had decreased by at least 45% in 1993. The 32-year-old U.S. trade embargo was still in place. Tourism contributes little to the economy, because the hotel accommodations are not up to international standards. Canada was still the main source of foreign tourists, followed by Germany, Spain, Mexico, and Italy.

Mining has traditionally been Cuba's second most important industry after sugar exports. The first mining activity in Cuba dates back to 1512, for using bitumen to caulk boats. Gold followed and then copper in 1534, dug out in El Cobre, near Santiago. In the 1800's, deposits of barite, magnetite, manganese, nickel, salt, and zinc were discovered. Cuba's nickel reserves are among the world's largest and consist mainly of lateritic deposits. Production of industrial minerals included asbestos, cement, clays, fertilizers, gypsum, lime and limestone, marble, nitrogen, and sulfur. Although there has been minor petroleum production, Cuba imported its petroleum requirements from Latin American countries and Russia.

GOVERNMENT POLICIES AND PROGRAMS

The National Assembly of Popular Power changed the 1976 Constitution to make private and foreign investment legal and to open the country to foreign trade. The changes will not allow private ownership in primary production facilities. The law allows foreign investment in selected state enterprises, allows Cuban companies to export or import goods without central Government permission, and recognizes foreign ownership of property in joint-venture deals. The Government will continue to control prices, wages, and ration basic goods.

In 1982, the Cuban Government enacted law 50, providing a number of incentives to businesses to promote foreign investment. Such incentives include absence of gross revenue taxes, absence of restrictions on repatriation of profits, and taxes of 30% on net annual profits.

In July 1992, the Government approved constitutional amendments ending the Government's monopoly of foreign trade. The Constitution allowed foreign companies to hold more than 50% in petroleum joint ventures with local enterprises. Cuba began offering foreign investors to participate in joint oil exploration, drilling, and metal refining projects. Foreign investment also has been allowed in agriculture, biotechnology, pharmaceuticals, textiles, and tourism. The Constitution recognized the property rights of mixed business and economic societies and associations, private or public, formed in accordance with the law.

Self-employment became legal in Cuba in July 1993 and reportedly about 40,000 citizens have set up shop, primarily small businesses. Decree Law No. 140 allowed the possession of hard currency, signed on August 13, 1993, in the Palace of the Revolution, Havana, Cuba.

ENVIRONMENTAL ISSUES

One of the most polluting processes in Cuba is the reduction-ammonia leaching process for nickel and cobalt recovery because of extensive dust emission. All plants, including the Las Camariocas but not the Moa plant, are using the same process, in spite of the pollution problem. In the pilot plant at Punta Gorda (built in 1987), no measures were taken to eliminate these problems, while the Nicaro plant (built in 1943) was still

polluting the atmosphere. The problem could be eliminated easily by the introduction of a waste heat boiler and a bag filter between the cyclone leaving the furnace and the chimney. The H_2S acid, used in the Moa plant to precipitate nickel-cobalt, is simply disposed of untreated. Hydrogen sulfide precipitation of nickel and cobalt was introduced by the American designers in the Moa plant as a quick method to transfer the nickel value from Cuba to the United States. Leaks result in the escape of the toxic gas causing damage to the nearby vegetation. The gas also has a high solubility in water and is highly corrosive. Sulfide precipitation could be replaced by other nonpolluting methods, such as solvent extraction.

PRODUCTION

Cuba continued to produce all commodities from the previous year, but the outputs declined. The falling production was attributed to the lack of fuel, shortages in electrical energy, shortages in spare parts for machinery, shortages of chemical reagents, and the lack of incentives and motivation. Most of the production in Cuba was based on exports. The disappearance and changing patterns of trade have been in flux for the past several years, causing disruptions in Cuban production. Sugar and nickel continued to be the main commodities produced for trade. In the mineral industry, nickel is the only commodity whose production increased according to some sources. *(See table 1.)*

TRADE

International trade continued to be important to the Cuban economy. Cuba's imports regularly exceed its exports. Already hurt by the 32-year-old U.S. economic embargo, Cuba lost 85% of its foreign trade since the Soviet bloc collapsed. Imports decreased by more than 70%, and workers were put on short days, diverted to new jobs, or even left without work.

The main exports in Cuba's minerals section were chromite, nickel-cobalt ore, and nickel metallurgical products. The Cuban nickel sector has been one of Cuba's export areas affected by the U.S. trade embargo. The U.S. Treasury Department has prevented metals from any third country containing even a minimal percentage of Cuban nickel from entering the United States. In spite of the U.S. embargo, Cuba continues to sell its nickel to Canadian and Western European companies and has managed to attract foreign investment in its domestic production sector.

There was an increasing number of joint ventures with foreign companies. At least eight resource companies signed agreements with the Cuban Government, giving them the exclusive right to explore and develop deposits on what is thought to be one of the most geologically prospective islands in the Caribbean. Cuba's main trading partners included Austria, Canada, China, Finland, France, Germany, Ireland, Italy, Japan, Mexico, Russia, Spain, Venezuela, and other Latin American countries. In 1993, most Cuban trade was based on hard currency, a revolutionary change from 1988.

Cuba and Russia signed a memorandum on March 24, 1993, outlining joint trade, production, and investment initiatives in sugar, oil, machinery parts, and fertilizers. Virtually all petroleum was imported at subsidized prices, primarily from Russia. In 1993, imports of oil were down by 65% and imports of machinery and equipment were down by 85%. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

The mineral industry in Cuba was centrally controlled by the Government. The Government's Ministry, Ministerio de Industria Básica (MIB), managed all geological, mining, and petroleum operations since 1980. MIB is responsible for the exploration and production of all minerals, including natural gas and oil. Within the ministry, the organization known as Union de Empresas Geólogo-Mineras is responsible to develop the country's mining sector, with the exception of nickel. Union Empresas del Níquel (UEN) is responsible for nickel production in Cuba, which is under the jurisdiction of the MIB. The exploration and production of industrial minerals were under the Ministerio de Industria Materia Construcción. All mining joint ventures come under the auspices of Geominera S.A., a Government establishment. Geominera holds a 50% interest in all mining concessions granted to foreign companies.

The National Registry for Foreign Trade Commission Agents, attached to the Chamber of Commerce of Cuba, is in charge of registering firms interested in establishing offices in the country. These firms may work directly with Cuban enterprises or entities.

The State Committee for Economic Cooperation (SCEC) is responsible for the negotiation of all Cuban joint ventures except those related to tourism. SCEC works in conjunction with the Cuban Trade Ministry (CTM), the Banco Nacional, the Cuban Chamber of Commerce, and with the various Cuban enterprises. CTM has been assigned overall responsibility for resolving all questions regarding joint ventures to provide interested investors with rapid and definitive responses. The final approval for any joint ventures lies with the Executive Council of Ministers, usually chaired by the President. *(See table 4.)*

COMMODITY REVIEW

In 1993, The Ministry of Industry listed 37 mining areas for development, 16 of which became joint ventures. A Canadian company, Joutel Resources Ltd. Toronto, signed an exploration agreement with Geominera, the Cuban mining agency, in August 1993. This was the first western mining company dealing directly with Cuba, exploring three properties for metals, covering 4,662 km^2, including the Santa Clara (central Sancti Province), Camaguey (eastern Province), and Sierra Maestra (southeastern Santiago Province) properties. The Antonio deposit in Santa Clara reportedly contains 2.7 Mmt grading 1.64% Cu, 3.87% zinc, 20 g/mt silver, and some gold. Reportedly, Santa Clara has the potential to host large deposits of three types: copper-gold porphyry, copper-zinc-silver-gold, and epithermal gold. More than 200 occurrences have been catalogued in the Joutel concession. Joutel was given up to 4 years to carry out a regional exploration and prospecting program.

Caribgold Resources Ltd., another Canadian company, also signed a joint venture with Geominera, sharing costs equally by the Canadian and Cuban partners. The property is just northeast of Joutel Resources' Santa Clara lot.

Holmer Gold Mines Ltd. and Republic Gold Fields Ltd., Toronto, Canada, signed exploration agreements with Geominera. Holmer's San Fernando lot is surrounded by Joutel's property on the north and the Candida Francisco lot in the west. Copper was discovered in San Fernando in 1927, and production ceased in 1960 following the Cuban Revolution. A reserve of 1.8 Mmt averaging 2% copper and 3.5% zinc was defined at depth fewer than 150 m below the surface. Republic's Gaspar property is in the center of the island, while the Purial property (including the Elección copper deposit) is southeast of Santiago de Cuba. The Gaspar property covers 100 km^2, while the Purial property covers 2,000 km^2. The reserves of the Elección deposit were estimated at 3 Mmt, grading 1.9% Cu and also containing gold and nickel.

Other companies seeking exploration permits included Australia's Broken Hill Propriety Ltd., Canada's Inco Ltd. nickel producer, and the United Kingdom's Rio Tinto Zinc Ltd. Scintrex Ltd., Concord, Ontario, will be conducting airborne and other exploration-related services for mining companies active in Cuba, under a joint-venture agreement with Geominera. Reportedly, Heath & Sherwood International Ltd., Ontario, Canada, formed a joint venture, called Cubanex, with Geominera to provide contract exploration drilling services for the mining industry in Cuba.

Metals

Cobalt.—Cuba's reserves of cobalt were estimated to be the world's largest, accounting for 35% of world reserves. The lateritic deposits in the Moa Bay and Nicaro areas, Holguín Province, contain on average 0.1% cobalt. No metallic cobalt is produced yet in Cuba on a commercial scale, only chemical concentrates of sulfides. Cobalt was produced at the rate of 1,500 mt/a of contained metal in sulfide and oxide form as a byproduct of nickel ore processing at the Moa Bay and Nicaro plants. The potential cobalt production was as follows: Pedro Soto Alba plant in Moa with 2,000 mt/a, Rene Ramos Latour plant in Nicaro with 1,300 mt/a, and Ernesto Che Guevara plant in Punta Gorda with 1,800 mt/a. Previously, all cobalt was exported to the former U.S.S.R. and Czechoslovakia as nickel-cobalt sulfide, while a small fraction of cobalt contained in nickel-cobalt oxides was exported to Western countries. The cobalt concentrate from the Pedro Soto Alba plant was reportedly exported to Canada.

Copper and Gold.—Copper is the island's second largest metal industry after nickel. The only copper plant in Cuba, the Conrado Benítez Enterprise, in San Jose, was under construction. The plant will operate two furnaces with the capacity of 30,000 mt/a of copper. The equipment came from Italy and Britain, where the personnel were also trained. Cuba continued to be reliant on copper imports.

Miramar Mining Corp. of Canada and Matlock Mining Ltd. of Australia announced the acquisition of an interest in the Hierro-Mantua copper leach project and the Delita gold project. The copper project is in the western Province of Pinar del Rio, 285 km west of Havana. The proven and probable minable reserves of the copper deposit were estimated at 3.9 Mmt grading 3.47% copper. The feasibility study calls for an open pit development, production 20,000 mt/a of copper at an 80% recovery rate. The Delita gold deposit is on the Isla de la Juventud. The reserves of the gold deposit were estimated at 17 Mmt grading 3.5 g/mt Au and 31 g/mt Ag. The production was planned to start after receiving final approval from Cuba and the completion of project financing.

Canadian company McDonald Mines Exploration Ltd. signed a letter of intent with Cuba's Unión Minera Geológica to mine gold in the Florencia-Jojoba concessions, Camaguey Province in east-central Cuba. McDonald plans to build a mining facility and start surface and underground mines.

Iron and Steel.—Pig iron in Cuba is a byproduct from treatment of the nickel-cobalt laterite ores. The largest steel producer in Cuba was Antillana de Acero, in Cotorro, Havana Province. The capacity of the plant was estimated at 450,000 mt/a. The second largest steel producer in Cuba is Acinox in Las Tunas. Acinox was the first privately run steel company in Cuba. Acinox shut down one of its furnaces in 1993 and reduced capacity in the other because of power shortages. The plant's 60-ton electric arc furnace was supplied to Cuba under a long-term agreement with Italian plantmaker Danieli. S.p.A. Acinox was making agreements on slab supplies with Latin America, the Far East, and Europe.

Nickel.—In 1993, the Cuban nickel industry celebrated 50 years of existence. It was perhaps the only sector of the national economy that can claim to have a guaranteed market for all that it produced. The first nickel plant, Rene Ramos Latour in Nicaro, was built in December 1943 using the ammonia leaching process.

Cuba was the world's fifth largest producer of nickel. Reportedly, Cuba's nickel reserves were second only to New Caledonia, accounting for 37% of the world's known nickel ore reserves. Cuba's nickel ore reserves are on the island's northeast coast near the town of Moa. Cuba's estimated reserves of 19 Mmt of nickel ore, with metal content of 0.8% to 1.4%, is considered to be the first or second largest nickel deposit in the world. Other estimates of the lateritic ore amounted to 1 billion tons of nickel ore averaging 1.2% to 1.5% metal content, 80 Mmt of cobalt, 40 Mmt of manganese, and 18 Mmt of chromite. Most of the nickel produced was recovered from sulfide ores. The nickel deposits in Nicaro have been mined for the longest time, since 1943. The minable portions of the deposits covered about 325 km^2 in a mountainous region.

All Cuban plants produced nickel sulfate, powdered and granulated nickel sinter, and nickel oxide, with a total capacity of about 80,000 mt/a. UEN operated three plants in the Holguín Province of eastern Cuba. UEN reduced its entire work force from 18,000 to 16,000 people by the end of 1993. The Nicaro and Punta Gorda plants are based on the ammonium carbonate leaching

process to treat serpentine, and the Moa plant uses sulfuric acid to leach limonitic ore. In 1993, Sherritt Gordon invested $1.2 billion in a 5-year plan to renovate the Moa refinery and for the construction of a sulfuric acid plant at the same site. Reportedly, the Nicaro plant also was being renovated by European companies. The construction of the fourth nickel plant in Las Camariocas was 65% completed, based on the ammonia leaching process. The plant is near Moa, just about 10 km from the Punta Gorda refinery. The former U.S.S.R. and Comecon provided technical and financial aid to that plant, but now it is on hold because of developments in Russia and Eastern Europe. Forecast production capacity is 30,000 mt/a and an unspecified volume of cobalt. Reportedly, the Vice President of Cuba's Council of Ministers disclosed that Russia provided Cuba with a $350 million credit to be used for the development of the Camariocas nickel plant and 12 other industrial projects.

The refinery at Moa produced about 15,000 tons of nickel-cobalt sulfides. The Punta Gorda and Nicaro plants produced about 18,000 tons of nickel oxide sinter, with 4,000 and 14,000 tons from those plants, respectively. Davy International Ltd., United Kingdom, is to upgrade the Punta Gorda's smelter. The plant had problems since its production began in 1988. Improvements already have begun to reduce dust emissions and increase energy efficiency in the furnaces. The Moa plant exported about 10,000 tons of nickel matte to the Canadian nickel refiner Sherritt Gordon Ltd. and 3,000 tons of nickel matte to the Yuzhural Nickel Complex at Orsk in the Urals, Russia. Sherritt Gordon secured a 15-year contract for the supply of nickel matte from the Moa smelter. Reportedly, UEN began exporting its nickel to China, Europe (Italy, Spain), India, and Japan. About $350 million was expected from the sale of nickel by Cubans. In 1993, UNI was allowed to keep 50% of its profits, with the remainder going to the Government treasury.

UEN signed an agreement with Vitol Ltd., United Kingdom, to deliver oil supplies and to build a pipeline to allow larger tankers to dock.

Industrial Minerals

Cuba produced a small variety of industrial minerals, primarily for domestic use, such as clays, gypsum, limestone, salt, and sand and gravel. Kyanite, a natural silicate of aluminum, was quarried on the Isla de la Juventud to support a small ceramics factory, the wares intended for the tourist trade. Cuba identified at least 25 deposits of zeolites, and exports more than 100,000 mt/a to Canada, Colombia, Italy, Spain, Venezuela, and other countries. Four plants, each with a capacity of 150,000 tons, are close to the deposits in various parts of the country. Potential reserves of zeolite are 120 Mmt.

Reportedly, a large deposit of semiprecious stones, particularly opals, was discovered in the Sagua-Baracoa mountains near the nickel mining town of Moa. The deposit is being evaluated.

Cement.—The Ministry of Construction Materials operated six cement plants with a capacity of more than 3.5 Mmt/a. The largest plant is in Mariel, accounting for about 30% of total production. About 90% of Cuba's cement production has been for local consumption. The Ministry planned to export 400,000 tons of cement in 1993 and 1 Mmt in 1994. These exports represented 90% of the Ministry's sales. Cement plants were shut down occasionally because of shortages of fuel oil, electricity, and spare parts.

Marble.—In addition to the Isla de la Juventud, marble deposits occur in four other Provinces on the island. Among the latest findings are the deposits in La Guanábana on the Isla de la Juventud. Eleven quarries are producing a variety of different colored marble. The Cuban marbles come in black, green, lilac, pink, and red colors. The quarries on the island, such as in Mariel and in Bayamo, are equipped with modern technology. Production statistics and capacities of the marble quarries vary from 47,000 mt/a to 1 Mmt/a, respectively. Marble was exported to Colombia, Europe (primarily to Italy), and Mexico.

Mineral Fuels

Cuba is dependent on imported oil to meet its energy requirements. Until recently, the former U.S.S.R. supplied 95% of the island's oil needs under a sugar-for-oil trade deal. The dissolution of the U.S.S.R. greatly diminished technical aid to Cuba's oil sector. In 1993, Cuba imported about 6 Mmt of oil from Russia. Cubans attempted to find other oil suppliers, including China, Colombia, Ecuador, Kazakhstan, Nigeria, Venezuela, and others.

The problems with the electricity generation continued because of the fuel shortage. More than 90% of total electricity is generated in Cuba by using oil. There were 6 to 8 hours of power cuts per day in 1993 affecting all occupied buildings, except hospitals, schools, and some tourist hotels. About 25% of electricity was generated in Ciego de Avila Province alone using natural gas from oil wells as an alternative sources of energy. Biogas and windmills also were being explored as alternative sources of energy.

Cuba produced about 16,000 bbl/d of oil from about five major fields, Boca de Jaruco and Varadero being the largest cumulative producers. The Varadero Field produces 60% of oil in Cuba and has in situ reserves of 1.1 billion bbl. The Cuban oilfields supplied only 6% of domestic requirements. Of less importance were the Cristales, Jarahueca, Jatibonico, Matanzas, Pina, and Veradero Sur Oilfields. There are more than 120 active wells in the Matanzas basin.

Cuba's first international tender occurred on February 1993, soliciting bids for oil exploration and development. Cuba offered production-sharing contracts for 11 blocks—3 offshore, 7 onshore, and 1 onshore. Block sizes range from 1,400 km^2 to 6,000 km^2. Technical data were made available for inspection from Simon Petroleum Technology Ltd., Llandudno, United Kingdom. Cuba will receive 11% of all hydrocarbons produced from the blocks, and a tax of 30% will be levied on yearly net profits. Cubapetróleo, S.A. (Cupet), the only Cuban oil company, has been restrained by limited funds and technology.

Oil and gas exploration in Cuba dates

back to 1881 when the first field was discovered. Since then 25 oilfields and gasfields have been found. Most discoveries have been in the northern Province in pre-Upper Cretaceous Campanian deposits. The southern Province is part of the Caribbean plate. About 1,600 wells have been drilled in Cuba, most of them old and shallow. They are in areas covering less than 5% of the country's prospective sedimentary area. In 1993, Cuba continued its oil exploration program in the north of Matanzas Province and south of Camaguey Province. Brazil's Petroleo Brasileiros S.A. (Braspetro) suspended negotiations with Cuba for oil exploration on the north coast of Cuba in Mantanzas. French and Swedish oil companies are exploring for oil in several onshore and offshore sites. France's Total Co. is exploring for oil offshore north of the Cárdenas Bay in western Cuba, claiming that the deposit could yield up to 330 Mbbl/a. Another French company, Geopetrol S.A., is searching for oil with Cupet, west of Havana, covering 1,600 km^2. Geopetrol also is working on the improvement production of wells in the Yumuri Valley, Puerto Escondido Oilfields in northern Matanzas Province, and at Martin Mesa. Gas also was extracted from the Martin Mesa Oilfields, supplying gas to the glass factory in La Lisa, on the outskirts of Havana. Sweden's Taurus Petroleum AB holds a production-sharing contract covering three blocks off southern Cuba. It has processed and interpreted 2,500 line km of seismic data and plans more seismic work.

Cuba operated four oil refineries, Cabaiguan, Cienfuegos, Havana, and Santiago de Cuba, with a combined capacity of more than 220,000 bbl/d.

INFRASTRUCTURE

Cuba has about 14,400 km of paved roads. Less than 15,000 km was in railroad tracks. Cuba's railroads were used primarily by the sugar industry. In March 1993, the "Storm Of The Century" reportedly damaged about 500 km of roads, more than 40 km of railway, 40 bridges and sewers, 3 dams, and about 400 plants, including small factories and stores.

There are 16 significant ports in Cuba, including the Nueva Gerona port on the Isla de la Juventud. Principal ports in Cuba were Cienfuegos, Havana, Mariel, Matanzas, and Santiago de Cuba. The Havana port was the most important port in Cuba, handling about 40% of Cuba's cargo. At least 8 ports handle cement, fertilizers, and sulfur; 13 ports handled crude oil, petroleum products, and sulfuric acid. Cuba has a supertanker facility in the Matanzas Bay. The imported crude oil was offloaded in Matanzas, then transported to other cities on smaller coastal tankers. The 187-km oil pipeline also transported oil from the port to the Cienfuegos refinery.

OUTLOOK

The economy in Cuba in 1994 is forecasted to fall again, if the Government's policies would remain intact. The nickel industry in Cuba is expected to remain unchanged because of lack of fuel oil, lack of spare parts, and the uncertainty of the political situation. However, according to the Cuban news agency, Prensa Latina, Cuba plans to produce 80,000 tons of nickel by 1996, and 100,000 tons in the future. The modernization of three nickel plants is progressing slowly, and the completion of the fourth plant is still uncertain. The lack of fuel oil and capital will affect all mining and production facilities in Cuba. Russia will most likely continue trading oil for Cuban sugar. The Cuban Government is hoping to attract more foreign companies to explore for oil and gas, following its invitation to Canadian and European companies. Cuba expects to diversify its cooperation with Asia, Canada, the European Community, and Latin America over the near term. Latin America will be its primary focus. Tourism is being developed and promoted by the Castro regime, eventually becoming the main currency earner, thus foreign influences will be growing significantly in Cuba.

The United States is considering allowing U.S. telecommunications companies to expand service in Cuba. Other policy changes also were being studied. Once approved, it would allow private U.S. companies to do business with Cuba for the first time since 1961, when the United States imposed a trade embargo. Under the current policy, U.S. companies must apply for licenses to conduct any kind of business in Cuba or with the Cuban Government, but no licenses have been granted since the embargo was imposed.

[1]Text prepared Apr. 1994.

OTHER SOURCES OF INFORMATION

Agencies

Chamber of Commerce of Cuba
Calle 21, No. 661
Havana, Cuba
Telex: 51-1752

Ministerio de Industria Básica
Salvador Allende No. 666
Entre Soledad y Oquendo
Havana, Cuba
Telphone: (537) 76979
Telex: (537) 0511183

Unión de Empresas del Níquel
Moa Holguín, Cuba
Telphone: 67652
Telex: 21322 EUNI-CU

Publications

Anuario Estadístico de Cuba, Estatal de Estadísticas, Havana, Cuba, annual.

Center For Cuban Studies, New York, NY: Newsletter, quarterly reports; Cuba Update, special reports.

Cobalt News, Cobalt Development Institute, London, United Kingdom: Cobalt in Cuba, July 1993.

Granma International, Havana, Cuba, daily newspaper.

Granma Weekly Review, Havana, Cuba.

Organización Latinoamericana de Energía, Quito, Ecuador; Energía en Cifras, annual.

U.S. Central Intelligence Agency, Washington, DC: The World Factbook, annual.

TABLE 1

CUBA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
Cement, hydraulic	thousand tons	[3]3,138	3,000	2,000	2,000	2,000	3,500
Chromite	do.	[3]51	50	50	50	50	60
Cobalt[4]		[3]1,825	1,600	1,600	1,500	1,500	2,500
Copper, mine output, Cu content		[3]1,825	2,800	3,000	2,500	1,500	3,000
Gas, natural:							
Gross	thousand cubic meters	34,000	34,000	34,000	36,000	36,000	40,000
Marketed	do.	4,000	4,000	4,000	4,500	4,000	5,000
Gypsum	thousand tons	130	130	130	125	125	150
Iron and steel: Steel, crude	do.	[3]336	270	[r]250	[r]200	100	600
Lime	do.	180	180	180	160	180	200
Nickel:							
Mine output, Ni-Co content of oxide and sulfide		[3]46,509	42,000	34,000	[r]32,000	35,000	84,000
Metallurgical products, Ni content:[4]							
Granular oxide and powder		[3]14,354	11,000	10,000	[r]10,000	11,000	20,000
Oxide sinter		[3]11,856	11,000	10,000	[r]10,000	10,500	20,000
Sulfide		[3]18,475	16,400	16,400	[r]15,000	17,000	25,000
Total		[3]44,685	38,400	36,400	[r]35,000	38,500	65,000
Nitrogen: N content of anhydrous ammonia	thousand tons	[3]134	140	140	135	135	250
Petroleum:							
Crude[5]	thousand 42-gallon barrels	[3]4,775	[3]4,975	[3]5,150	5,300	6,000	12,000
Refinery products	do.	55,000	53,000	53,000	55,000	55,200	160,000
Salt	thousand tons	[3]206	200	200	185	185	250
Silica (industrial-sand and gravel)	do.	550	500	500	450	400	700
Sulfur, byproduct of petroleum	do.	6	5	4	5	5	8

[e]Estimated. [r]Revised.

[1]Table includes data available through Apr. 1994.

[2]In 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.

[3]Reported figure.

[4]Anuario 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.

[5]Cuba 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 COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Principal destinations, 1991
METALS				
Aluminum:				
Ash and residue containing aluminum		625	NA	
Metal including alloys, scrap		629	1,204	All to Netherlands.
Chromium:				
Ore and concentrate		10,312	3,060	All to Canada.
Oxides and hydroxides		NA	300	All to Venezuela.
Copper:				
Ash and residue containing copper		459	NA	
Metal including alloys:				
Scrap		2,548	3,403	All to Netherlands.
Semimanufactures		12	NA	
Gold:				
Waste and sweepings	kilograms	NA	117	All to Canada.
Metal including alloys, unwrought and partly wrought	do.	386	NA	
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite		5,064	NA	
Metal:				
Scrap		8,899	110,761	Italy 70,688; Greece 39,265; Netherlands 775.
Semimanufactures:				
Flat-rolled products:				
Of iron or nonalloy steel: Not clad, plated, coated	value, thousands	$11	NA	
Of alloy steel		1	5	All to Spain.
Bars, rods, angles, shapes, sections		1,753	1,736	All to Mexico.
Wire		127	NA	
Tubes, pipes, fittings		NA	2	All to Indonesia.
Lead: Metal including alloys:				
Scrap		1,923	655	All to Netherlands.
Unwrought		187	NA	
Semimanufactures		90	NA	
Lithium: Oxides and hydroxides		1	NA	
Nickel:				
Matte and speiss		4,107	14,007	Canada 10,727; Italy 3,019; Japan 241.
Oxides and hydroxides		NA	26	All to Austria.
Metal including alloys:				
Scrap		NA	1	All to Netherlands.
Unwrought		149	14	All to Austria.
Semimanufactures		7	5	All to Netherlands.
Platinum-group metals: Waste and sweepings	value, thousands	$2,617	$401	All to Canada.
Silver: Waste and sweepings	kilograms	NA	11,500	Do.
Titanium: Metal including alloys, semimanufactures		2	1	All to Italy.
Vanadium: Ash and residue containing vanadium		104	NA	
Zinc:				
Ore and concentrate		NA	1,178	All to Netherlands.
Metal including alloys, scrap		314	281	Do.
Other:				
Ores and concentrates		18	NA	
Oxides and hydroxides		44	15	Italy 14; Venezuela 1.
Ashes and residues		NA	1,502	All to Netherlands.

See footnotes at end of table.

TABLE 2—Continued

CUBA: APPARENT EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Principal destinations, 1991
INDUSTRIAL MINERALS				
Cement		NA	750	All to Colombia.
Clays, crude:				
Bentonite	kilograms	88	NA	
Unspecified		54	NA	
Diamond: Natural:				
Gem, not set or strung	value, thousands	NA	$751	All to Belgium-Luxembourg.
Industrial stones	carats	3,850	NA	
Fertilizer materials: Manufactured:				
Nitrogenous		1,985	10,569	All to China.
Phosphatic		NA	18	All to Italy.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked		2,378	2,612	Italy 1,094; Venezuela 760; Colombia 449.
Worked	kilograms	341,000	49,035	Netherlands 49,000; Mexico 35.
Gravel and crushed rock		500	NA	
Sand other than metal-bearing		NA	350	All to Spain.
Other:				
Crude		58	392	Colombia 374; United Kingdom 18.
Slag and dross, not metal-bearing		676	NA	
MINERAL FUELS AND RELATED MATERIALS				
Petroleum:				
Crude	thousand 42-gallon barrels	268	NA	
Refinery products:				
Gasoline	do.	85	586	Netherlands 366; Spain 220.
Lubricants	do.	5	5	All to Norway.
Residual fuel oil	do.	NA	100	All to Netherlands.

[p]Preliminary. NA Not available.

[1]Table 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. 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 1991.

TABLE 3

CUBA: APPARENT IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1990	1991[p]	Principal sources, 1991
METALS			
Alkali and alkaline-earth metals:			
Alkali metals	4	NA	
Alkaline-earth metals	11	NA	
Aluminum:			
Oxides and hydroxides	185	187	China 163; Japan 24.
Metal including alloys, semimanufactures	1,484	782	Brazil 495; Spain 129; Mexico 75.
Chromium: Oxides and hydroxides	NA	6	All from Japan.
Cobalt: Oxides and hydroxides	6	NA	
Columbium and tantalum: Ore and concentrate including vanadium	66	NA	
Copper:			
Oxides and hydroxides	11	NA	
Metal including alloys:			
Unwrought	22	8	All from Finland.
Semimanufactures	3,468	3,162	Yugoslavia 1,654; Mexico 1,060; Spain 143.
Gold: Metal including alloys, unwrought and partly wrought kilograms	1,216	17	Canada 16; Italy 1.
Iron and steel:			
Iron ore and concentrate excluding roasted pyrite	597	NA	
Metal:			
Pig iron, cast iron, related materials	13	2	All from Spain.
Ferroalloys:			
Ferrosilicomanganese	483	851	Mexico 351; Norway 300; France 200.
Ferrosilicon	NA	250	All from Mexico.
Unspecified	NA	108	Mexico 107; Brazil 1.
Steel, primary forms	9	NA	
Semimanufactures:			
Flat-rolled products:			
Of iron or nonalloy steel:			
Not clad, plated, coated	4,850	8,364	Brazil 4,387; Belgium-Luxembourg 1,878; Venezuela 909.
Clad, plated, coated	4,588	9,073	Venezuela 5,092; Colombia 1,637; Brazil 985.
Of alloy steel	1,631	902	Spain 418; Mexico 362; Belgium-Luxembourg 87.
Bars, rods, angles, shapes, sections	3,033	4,813	Belgium-Luxembourg 1,122; Brazil 1,114; Spain 838.
Universals, plates, sheets	3,960	NA	
Rails and accessories	NA	44	All from Portugal.
Wire	11,977	2,735	Mexico 1,809; Venezuela 434; China 340.
Tubes, pipes, fittings	8,868	12,519	Spain 6,489; Mexico 2,567; Venezuela 2,073.
Castings and forgings, rough	71	NA	
Lead:			
Oxides	66	137	China 100; Mexico 37.
Metal including alloys:			
Unwrought	933	966	Mexico 963; Belgium-Luxembourg 3.
Semimanufactures	144	23	Mexico 22; Spain 1.
Manganese:			
Ore and concentrate: Metallurgical-grade		22	All from Brazil.
Oxides	152	182	China 100; Brazil 82.
Metal including alloys, all forms	26	NA	
Mercury	15	NA	
Nickel: Metal including alloys: Unwrought	2	NA	
Semimanufactures	6	(2)	All from Brazil.

See footnotes at end of table.

TABLE 3—Continued

CUBA: APPARENT IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Principal sources, 1991
METALS—Continued				
Silver: Metal including alloys, unwrought and partly wrought	kilograms	(2)	2,491	Canada 2,434; Mexico 32; Japan 25.
Tin: Metal including alloys:				
Unwrought		53	45	Brazil 38; United Kingdom 4; Belgium-Luxembourg 2.
Semimanufactures		125	31	Italy 30; Mexico 1.
Titanium:				
Oxides		1	6	Canada 3; Mexico 3.
Metal including alloys:				
Semimanufactures		NA	1	All from Italy.
All forms		2	NA	
Zinc:				
Oxides		1,787	8	Mexico 5; United Kingdom 3.
Metal including alloys:				
Unwrought		118	23	All from Mexico.
Semimanufactures		6	1	Do.
Zirconium: Ore and concentrate		17	8	Do.
Other:				
Oxides and hydroxides	kilograms	(4)	420	All from Canada.
Ashes and residues		3	NA	
Base metals including alloys, all forms		3	NA	
Metalloids[5]		10	NA	
Precious metals waste and scrap	kilograms	12	NA	
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.		4	9	Mainly from Spain.
Artificial:				
Corundum		160	3	All from Japan.
Silicon carbide		1,038	43	All from China.
Grinding and polishing wheels and stones		80	8	Mexico 4; Spain 4.
Asbestos, crude		1,063	17	All from Italy.
Boron materials: Oxides and acids		201	NA	
Bromine		NA	7	All from Switzerland.
Cement		2,809	27	Belgium-Luxembourg 16; Mexico 6; Spain 5.
Clays, crude:				
Bentonite		300	NA	
Fire clay		NA	42	All from Mexico.
Fuller's earth		160	NA	
Kaolin		27	NA	
Diamond: Natural: Gem not set or strung	value, thousands	NA	$1	All from Colombia.
Diatomite and other infusorial earth		55	28	Mexico 24; Switzerland 4.
Feldspar		377	NA	
Fertilizer materials:				
Crude, n.e.s.		1	NA	
Manufactured:				
Ammonia		24	4	All from Switzerland.
Nitrogenous		59	NA	
Unspecified and mixed		NA	11	All from Canada.
Graphite, natural		1	NA	
Gypsum and plaster		357	18	All from Spain.
Iodine		5	NA	
Magnesium compounds: Oxides and hydroxides		50	190	Austria 164; Japan 26.

See footnotes at end of table.

TABLE 3—Continued

CUBA: APPARENT IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Principal sources, 1991
INDUSTRIAL MINERALS—Continued				
Mica:				
Crude including splittings and waste		22	20	All from France.
Worked including agglomerated splittings		64	1	All from Japan.
Phosphates, crude		NA	200	All from Venezuela.
Phosphorus, elemental	kilograms	1,018	NA	
Pigments, mineral: Iron oxides and hydroxides, processed		388	268	Spain 192; Mexico 74; Japan 2.
Precious and semiprecious stones other than diamond: Natural	value, thousands	$85	$31	All from Colombia.
Salt and brine		195	100	All from Canada.
Sodium compounds, n.e.s.:				
Soda ash, manufactured		9	2,005	All from Colombia.
Sulfate, manufactured		NA	2	All from Spain.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked		8	288	Mexico 285; Italy 3.
Worked		30	57	Spain 31; Venezuela 22; Mexico 3.
Quartz and quartzite		NA	50	All from Spain.
Sand other than metal-bearing		70	1	All from Mexico.
Sulfur:				
Elemental: Crude including native and byproduct		39,625	81,310	Mexico 40,109; Canada 20,701; France 20,500.
Sulfuric acid		3	NA	
Talc, steatite, soapstone, pyrophyllite		20	88	All from Canada.
Other:				
Crude		86	NA	
Slag and dross, not metal-bearing	value, thousands	$1	NA	
MINERAL FUELS AND RELATED MATERIALS				
Carbon: Carbon black		4,854	461	All from Mexico.
Coal:				
Briquets of anthracite and bituminous coal		NA	10	All from Spain.
Lignite including briquets		71	348	All from Mexico.
Coke and semicoke		1,300	NA	
Peat including briquets and litter		114	284	All from Colombia.
Petroleum:				
Crude	thousand 42-gallon barrels	NA	1,417	Algeria 487; Colombia 383; Netherlands Antilles 322.
Refinery products:				
Liquefied petroleum gas	do.	72	15,182	Netherlands Antilles 15,092; Mexico 90.
Gasoline	do.	36	114	Netherlands Antilles 85; Trinidad and Tobago 23; Netherlands 4.
Mineral jelly and wax	do.	11	7	Mainly from China.
Kerosene and jet fuel	do.	71	183	All from Mexico.
Distillate fuel oil	do.	523	1,353	Netherlands Antilles 597; Mexico 440; Netherlands 198.
Lubricants	do.	164	15,955	Netherlands Antilles 15,722; Mexico 77; Brazil 67.
Residual fuel oil	do.	1,561	4	All from Mexico.
Bituminous mixtures	42-gallon barrels	103	6	Do.
Unspecified	do.	NA	266	All from Canada.

[p]Preliminary. NA Not available.

[1]Table 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. Data have been compiled from United Nations information and data published by the partner trade countries. The United States reported no mineral commodity exports to Cuba in 1991.

[2]Unreported quantity valued at $12,000.

[3]Unreported quantity valued at $37,000.

[4]Unreported quantity valued at $9,000.

[5]Reported under SITC number as "selenium, tellurium, phosphorus, arsenic, etc."

TABLE 4
CUBA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

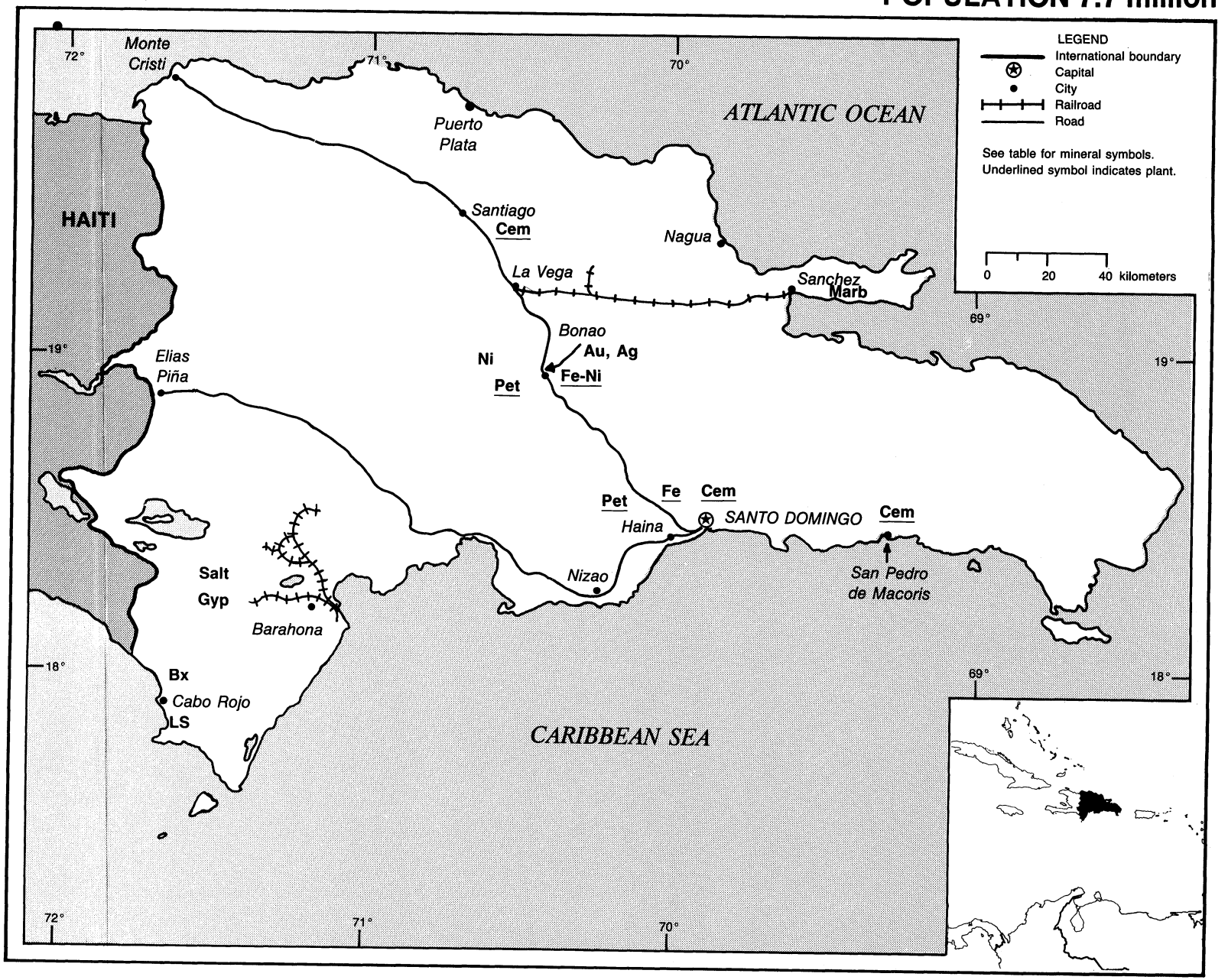
(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	Empresa del Cemento (Government, 100%)	Mariel, Pinar del Río Province Cienfuegos, Cienfuegos Province	3,500
Chromite	Ministerio de Industria (Government, 100%)	Mercedita Mine and plant, Holguín Province	60
Copper	Empresa Minera de Occidente (Government, 100%)	Mantua, Matahambre, and Jucard Mines, Pinar del Río Province Mina Grande, Santiago de Cuba Province	3
Nickel	Empresa Niquelífera Comandante Ernesto Che Guevara (Government, 100%)	Punta Gorda, Holguin Province	30
Do.	Empresa Niquelífera Comandante Pedro Soto Alba (Government, 100%)	Moa, Holguín Province	24
Do.	Empresa Niquelífera Comandante René Ramos Latour (Government, 100%)	Nicaro, Holguín Province	30
Petroleum:			
Crude 42-gallon barrels per year	Empresa de Perforación y Extracción de Petróleo (Government, 100%)	Northern coast area between Havana and Cárdenas	12,000
Refinery products do.	Instituto Cubano del Petróleo (Government, 100%)	Refineries at Cienfuegos, Havana, and Santiago de Cuba	160,000
Steel	Antillana de Acero (Acinox, 100%)	Cotorro, Havana Province	600
Do.	Acinox (Government, 100%)	Las Tunas, Las Tunas Province	150

DOMINICAN REPUBLIC

AREA 48,700 km²

POPULATION 7.7 million



THE MINERAL INDUSTRY OF

THE DOMINICAN REPUBLIC[1]

By George A. Rabchevsky

The Dominican Republic is a small, densely populated country in the eastern two-thirds of the island of Hispaniola, in the Caribbean Basin. The Dominican Republic shares Hispaniola with Haiti. The island of Hispaniola is 1,200 km southeast of Miami, United States, sandwiched between Cuba and Puerto Rico. The size of the country is slightly more than twice the size of New Hampshire of the United States. The Dominican Republic's terrain is mostly rugged highlands and mountains with fertile valleys interspersed.

Agriculture and tourism remained the most important sectors of the island's economy. The small mineral industry was involved in the production of cement, ferronickel, gold, gypsum, nickel, salt, and silver. All imported crude oil was refined on the island and exported to the neighboring islands. Unemployment was high, reaching about 35% in 1993.

GOVERNMENT POLICIES AND PROGRAMS

The Government introduced Decree 900 in March of 1983 for the purpose of redefining and clarifying the role of the state mining law, which was established by Mining Act 146 of June 1971. The mining laws were revised in 1987, through Decree 13-87, eliminating the previous requirement of fiscal reserves that effectively closed areas of mineralization to everyone except the Government or those with a special contract; Decree 13-87 now allows for renewed exploration and exploitation by foreign companies. Foreign companies are permitted to own private operations and open exploration offices in the country. High taxes and strict environmental standards have partly discouraged some investors from the Dominican Republic.

A number of foreign companies began investing in the Republic, including Battle Mountain of Texas and Canyon Resources of Denver, Colorado. Those companies signed contracts in 1992 with the Government to evaluate and develop precious- and base metal deposits.

ENVIRONMENTAL ISSUES

Tourism is very important to the Dominican Republic's economy. To attract tourists to the island, the Government and private companies must prevent environmental degradation. Mines and quarries must reclaim the mined land, hidden from view from the main thoroughfares, and dispose of waste materials in proper fashion. The Falcon B Ridge Dominicana C. por A. (Falcondo) nickel company continued to reforest the mined-out areas, cooling and cleaning the water drawn from the Yuna River to cool the nickel furnaces, and installed gas and dust emission filters at its nickel plant.

PRODUCTION

Output of all metals decreased slightly or remained about the same as in the previous year, as also did the industrial minerals. The search for gold deposits continued in 1993, but without any discoveries. Political uncertainties and economic instabilities in the neighboring country of Haiti contributed unsteadiness to the Dominican Republic. The country continued to produce ferronickel, gold, silver, and some steel. Industrial minerals produced included cement, gypsum, lime, limestone, marble, and salt. A limited amount of petroleum refinery products was produced. *(See table 1).*

TRADE

In 1993, total exports were about $800 million, while imports were $2.3 billion, with the United States being the most significant trading partner. The Dominican Republic has preferential access to the U.S. market under the Generalized System of Preferences program and under the Caribbean Basin Initiative. The Dominican Republic was the seventh largest importer of U.S. goods in Latin America. It also has preferential access to the European market under the provisions of the Lome Convention. The Dominican Republic was exploring the possibility of joining regional trade groupings with Central American countries and with Caribbean Community and Common Market in which it already has observer status.

The Dominican Republic exported ferronickel, gold, and silver for hard currency, mostly to the United States. Income from total gold export continued a downward slide, from $226 million in 1980, $104 million in 1985, $54 million in 1990, $37 million in 1991, to $24 million in 1992. Gypsum and limestone were exported to neighboring countries, primarily to Puerto Rico. The country relied almost totally on imports of its coal, crude oil, and some petroleum products. Crude oil came primarily from Venezuela and Mexico.

STRUCTURE OF THE MINERAL INDUSTRY

The Dirección General de Minería (General Directorate of Mining), under the Secretaría de Estado de Industria y Comercio (State Secretary for Industry and Commerce), is responsible for promoting mining and metallurgical development in the country. A

Government holding company, the Corporación Dominicana de Empresa Estatales (CORDE), controls most of the state mining activities. Gold is controlled by Rosario and Banco Central, while gypsum, salt, and steel production are controlled by the Government. The Government intends to privatize some of its holdings. Many companies, such as those that produce cement and nickel, are already owned by national citizens or foreigners. The oil refinery in Haina is jointly owned by the Government with the Netherland's Shell Internationale Petroleum Maatschappij B.V. Overall progress toward privatization has been extremely slow in the Dominican Republic. *(See table 2).*

COMMODITY REVIEW

BHP Minerals Canada, Ltd., Vancouver, British Columbia, opened an office in Santo Domingo to explore for minerals.

University professors from the United States held a field workshop with geologists from Cuba, Jamaica, and Puerto Rico in the Dominican Republic to study the island's Central Cordillera as part of stratigraphic/tectonic studies of the Caribbean Plate.

Metals

Gold and Silver.—Government-owned Rosario Dominicana, S.A., the only gold and silver company in operation, was mining ore at the Pueblo Viejo Mine, southeast of La Vega. The mine was privately owned in 1975, and in 1979 it was purchased by the Government. In 1975, the mine produced 7,650 kg of gold and 31,100 kg of silver. Mine output continued its downward trend because of the depletion of the oxidized ore and the extraction of a deeper transition ore proved more difficult. The reserves of the gold and silver deposit in sulfide ore are estimated to last for 30 years. In mid-1993, Rosario Dominicana laid off 70% of its employees and cut the salaries of the remainder due to a severe financial crisis. Rosario, with a debt of US$100 million, was losing US$170 per ounce due to high production costs.

Gold was discovered in the Cordillera Central south of Santiago, in the El Higo concession, with estimated reserves of 2.3 Mmt grading 5.1 g/mt. Minera Hispaniola, S.A. continued to evaluate environmental problems, the economic potential of the discovery, and was exploring for more gold sites. The company is owned by the Canyon Resources Corp. (40%) and Battle Mountain Gold Co. (60%), both U.S. companies.

Nickel.—Falcondo, a subsidiary of the Canadian company Falconbridge Ltd., was the only nickel producer in the country. During 1993, the total number of permanent employees decreased from 1,610 to 1,531. The company employed about 1,600 workers in 1992. The lateritic nickel ore has been mined since 1972 by open pit method near Bonao, in the center of the country. The mineral reserves at the end of 1993 were 34.1 Mmt grading 1.73% nickel. Laterite ore is smelted in a shaft, then sent to electric furnaces to produce ferronickel ingots. The capacity of the smelter is 35,000 mt/a Ni content of ferronickel ingots with 30% to 48% Ni. In response to significant market oversupply, the company shut down its furnaces on December 26, 1992, and reportedly full production resumed in April 1993. Production reached 23,863 tons of nickel in ferronickel. In 1993, the amount of nickel contained in ferronickel exported from the Republic by Falcondo was 25,618 tons, which represents a decrease of 6% compared to that of 1992. The average price received for nickel contained in ferronickel shipped in 1993 was $2.46/lb., compared with $3.09/lb. in 1992. The smaller Loma Ortega Mine became operational in July 1992. The ore was transported 40 km by truck to the processing plant. Falcondo also operates its own powerplant near the mine complex. Restoration of mined land to comply with environmental regulations was continued by the company. Surface exploration and diamond drilling for base metals were suspended in 1992, but drilling was planned to resume in 1993.

Industrial Minerals

Gypsum.—Cuba, the Dominican Republic, and Jamaica are the only sources of gypsum in the Caribbean. Even though Cuba and Jamaica produce about twice as much gypsum as does the Dominican Republic, the product of the latter is reportedly of higher quality. The only gypsum quarry in the Dominican Republic, government-owned Sal y Yeso C. por A., is in the southwest corner of the country, west of Barahona. Rock salt was mined from the same deposit. Gypsum and salt were mostly exported. A railroad is used to transport the gypsum and salt from the quarry to the port of Barahona. The rail and port facilities are reportedly being upgraded by the U.S. company Caribbean International Enterprise, Inc.

Limestone and Marble.—Limestone and marble were quarried from a number of deposits in the country, the most important being around Sánchez in the northeast and Barahona in the southwest. All production was consumed domestically. There were plans to expand production of limestone. Ideal Dominicana, S.A. operated a limestone quarry near Cabo Rojo with a sinter plant capacity of 350,000 mt/a. About 120,000 tons of limestone (98% calcium carbonate) was produced for use in the aluminum, cement, construction, and steel sectors. Polished marble was produced in Canoa, Samana, and San Cristóbal. Several countries expressed interest in importing finished marbles once the improved processing plants become operative.

Mineral Fuels

There was no domestic petroleum production. All hydrocarbons were imported as crude oil or refined product. Crude oil is imported primarily from Mexico and Venezuela. The Refinería Dominicana de Petróleo, S.A. operates the only refinery in the country northwest of Santo Domingo. Refined products also were imported by the refinery to satisfy

national demand. Falcondo imports semirefined crude for fuel to power generators at its nickel mine facilities. Exploration for petroleum continued by three companies: Mobil Dominican Exploration Inc., Petrolera Once-Once, S.A., and Consolidated Development Inc., the latter in the Cibao Basin and the offshore shelf in Samana Bay. Mobil has concentrated its effort offshore along the southern coast, in Ocoa Bay. Maxus Energy Inc. was evaluating its concession in the Enriquillo Basin, southeast of Cabo Rojo.

Reserves

Data on reserves of metallic and industrial minerals are limited in the Dominican Republic because of insufficient geological exploration projects in the country. Nickel reserves were estimated in 1992 at 35 Mmt, with an average grade of 1.73% nickel. Reserves increased to 56.8 Mmt grading 1.6% nickel at a lower cutoff grade, sufficient for 19 years of operation. Falcondo has begun evaluating technologies that would potentially enable it to economically process lower grade ores.

Reportedly, reserves of gold and silver at Rosario were estimated at least at 70 Mmt, grading 4 and 19 g/mt, respectively. The reserves of industrial minerals, such as limestone and gypsum, are considerable but have not been determined to date, while reserves of coal and rock salt are small and are being mined out rapidly. The quality and amount of reserves of the bauxite ore are low, explaining why the Government-owned Ideal Dominicana, S.A. ceased mining operations in 1991.

INFRASTRUCTURE

The Dominica Republic has only 5,800 km of paved roads, leaving the rest of the country inaccessible to auto traffic. The 1,600 km of railroad lines, with at least four different gauges, are used primarily for the local transport of bulk material, such as gypsum, limestone, marble, salt, and other commodities, to the ports. Major seaports include Barahona, Haina, Las Calderas, Puerto Plata, San Pedro de Macorís, and Santo Domingo.

The Government-owned electric power utility was not a reliable source of electricity. Reportedly, at least 15 powerplants were closed for repairs and others were not operating at full capacity. In the country, supposedly 37 plants were operating, 15 of which are hydroelectric, 14 are thermal, and the rest are operated by gas turbines. The estimated total capacity of the electrical plants was 1,525 MW. Most companies, such as Falcondo, have their own powerplants. The excess electricity was sold to the Government-owned electric utility.

Imported crude oil is transported by a pipeline from Las Calderas Port to the petroleum refinery in San Cristóbal. An oil pipeline from Haina Port delivers semirefined crude to the ferronickel mine near Bonao. Petroleum byproducts usually are transported overland by tank trucks from the refinery to Puerto Plata in the north, although some fuel is shipped by barge from Santo Domingo to Puerto Plata.

OUTLOOK

The Government is operating and controlling many of the mining operations, such as cement, gold, gypsum, salt, steel, and others. The Government is attempting to privatize some of its enterprises or enter into joint ventures with well-known companies. Even though the Government controls gold production, exploration projects by private companies for precious metals will eventually open new areas for development and provide job opportunities to local inhabitants. Prospects of finding large gas and oil deposits in the Dominican Republic are doubtful, but present exploration projects by private oil companies are finding smaller oil reservoirs. The General Directorate of Mines was expected to continue the geological mapping of the country in cooperation with foreign personnel. Many observers expect that 1994 will be a good year for the Dominican Republic in all sectors of the economy.

[1]Text prepared Apr. 1994.

[2]Where necessary, values have been converted from Dominican Republic pesos (RD$) to U.S. dollars at the assumed 1993 average rate of RD14.00=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Banco Central
Santo Domingo, República Dominicana
Telephone: (809) 688-2359
Corporación Dominicana de Empresas Estatales
Ave. Gral. Antonio Duverge
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Publications

Dirección General de Minería, Aptdo. de Correos 2630, Santo Domingo, República Dominicana: Hispaniola Report, quarterly.
Falconbridge Dominicana, C. por A., S.A., Santo Domingo, Dominican Republic 1993, annual report.
Latin American Mining Institute, Washington, DC: Mexico and Central America Investment and Mining Guide, annual (includes a section on the Dominican Republic).
Latin American Newsletter, London, United Kingdom: Latin American Economy and Business, monthly reports.
Miida Limited, London, United Kingdom: Latin American Mining Letter, weekly reports.
State Department, Washington, DC: Foreign Economic Trends and Their Implications for the United States. The Dominican Republic, 1993, semiannual reports.
U.S. Central Intelligence Agency, Washington, DC: The World Factbook, annual.
The World Bank, Washington, DC: Trends in Developing Economies 1993, annual.
World Reports Limited: The Latin American Times, New York, NY, quarterly reports.

TABLE 1

DOMINICAN REPUBLIC: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993[e]	Annual capacity[e] (Jan. 1, 1994)
Aluminum: Bauxite, dry equivalent, gross weight	thousand tons	151	85	7	—	—	200
Cement, hydraulic	do.	e1,600	1,060	1,231	r1,365	1,300	1,665
Coal, subbituminous[e]		600	600	600	600	600	600
Gold	kilograms	5,238	4,354	3,160	r2,375	2,000	5,000
Gypsum	thousand tons	171	78	118	83	85	200
Iron and steel:							
Ferroalloys, ferronickel		78,170	71,753	72,655	68,838	68,800	75,000
Steel, crude		54,855	35,772	39,102	e35,000	35,000	55,000
Lime		18,000	4,000	—	—	—	—
Limestone		1,127,397	491,265	448,654	r588,812	500,000	1,000,000
Mercury	kilograms	35	—	—	—	—	—
Nickel:							
Mine output, Ni content		31,264	28,700	29,062	27,535	3r23,863	35,000
Metal:							
Smelter, Ni content of ferronickel		31,264	28,700	29,062	27,535	27,500	35,000
Shipments, Ni content of ferronickel		28,944	28,696	28,028	r26,763	30,000	35,000
Petroleum refinery products:							
Liquefied petroleum gas	thousand 42-gallon barrels	378	272	318	e320	315	500
Gasoline, motor	do.	3,035	2,213	2,348	e2,350	2,300	4,500
Kerosene and jet fuel	do.	1,042	692	1,144	e1,150	1,150	1,500
Distillate fuel oil	do.	2,162	2,053	2,763	e2,800	2,800	4,000
Residual fuel oil	do.	2,619	2,686	3,728	e3,750	3,800	4,500
Total	do.	9,236	7,916	10,301	e10,370	10,365	15,000
Salt[4]		30,258	11,339	e11,400	e12,000	11,500	30,000
Sand	thousand tons	5,631	4,236	4,879	5,130	5,000	7,000
Silver	kilograms	22,614	21,630	21,954	r14,972	13,000	25,000

eEstimated. rRevised.

[1]Table includes data available through Mar. 15, 1994.

[2]In addition to commodities listed, crude construction materials (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.

[3]Reported figure.

[4]Rock salt only.

TABLE 2

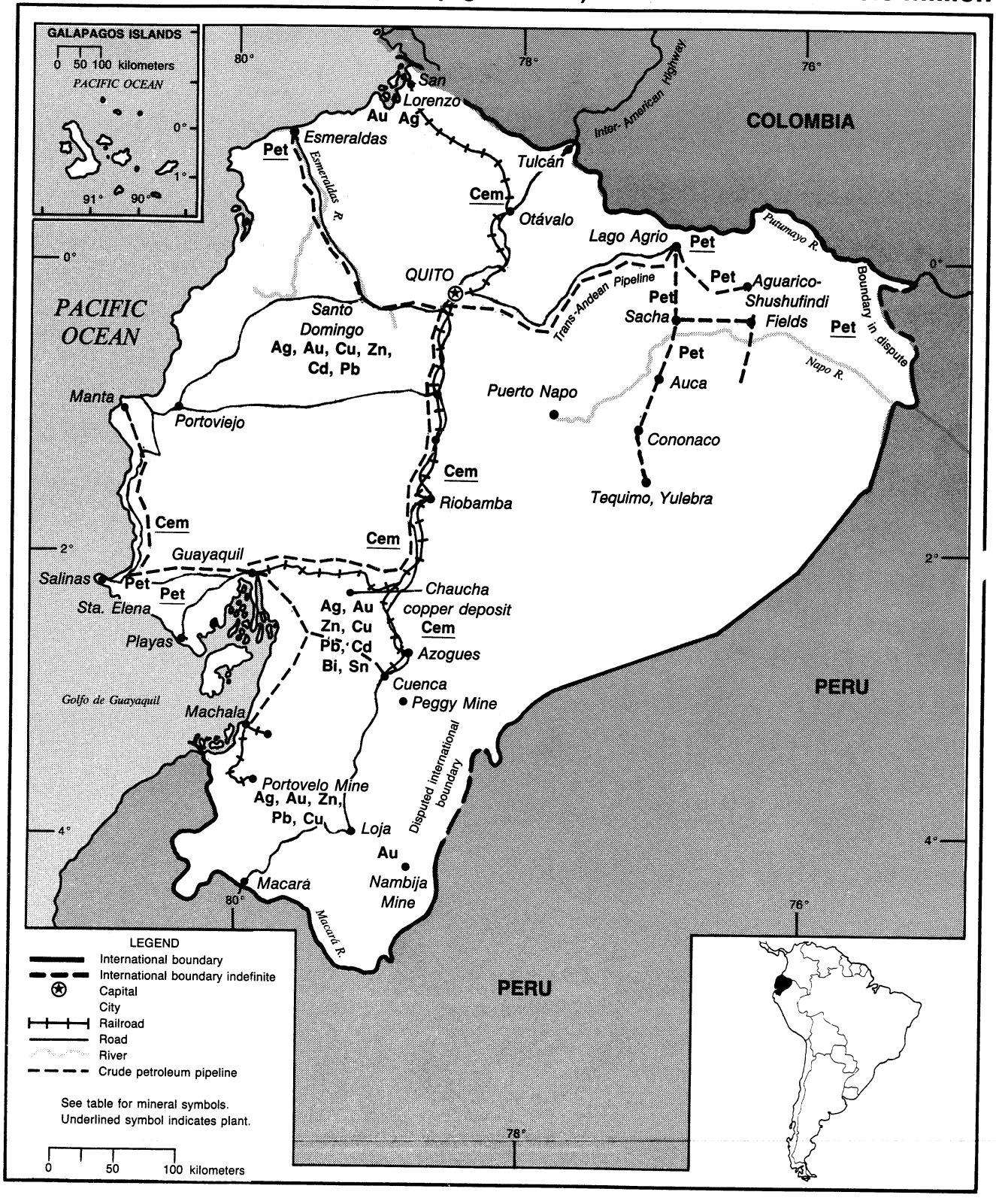
DOMINICAN REPUBLIC: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	Fábrica Dominicana de Cemento C. por A (Government, 78%; private, 22%)	Santo Domingo, Distrito Nacional	700
Do.	Cementos Cibao C. por A (private, 100%)	Santiago Province	400
Do.	Cementos Nacionales S.A. (private, 100%)	San Pedro de Macorís, San Pedro de Macorís Province	560
Doré (gold and silver) kilograms	Rosario Dominicana S.A. (Government, 100%)	Pueblo Viejo Mine, Cotui, Sánchez Ramírez Province	5,000
Gypsum	Sal y Yeso C. por A (Government, 100%; may privatize)	Barahona Province	200
Nickel	Falconbridge Dominicana C. por A (Government, 10%; Falconbridge Ltd., 90%)	Mine and plant at Bonao, La Vega Province	36
Petroleum products thousand 42-gallon barrels per day	Refinería Dominicana de Petróleo S.A. (Government, 50%; Shell Oil Co., 50%)	Haina, Distrito Nacional	15
Do. do.	Falconbridge Dominicana C. por A (Government, 10%; Falconbridge Ltd., 90%)	La Peguera, La Vega Province	3
Salt	Sal y Yeso C. por A (Government, 100%; may privatize)	Barahona Province	20
Steel	Metaldom (Government, 100%)	Santo Domingo, Distrito Nacional	100

ECUADOR

AREA 283,560 km² (including Galapagos Islands) **POPULATION 10.5 million**



THE MINERAL INDUSTRY OF

ECUADOR

By Philip M. Mobbs

The mineral industry of Ecuador continued to be dominated by the petroleum sector, which contributed more than 40% of the country's export revenues. The small mining sector was led by industrial mineral operations. In 1992, the last year for which data were available, the value of official nonfuel mineral production was about $119 million. However, the bulk of Ecuador's gold production comes from unofficial, small-scale operations in the Nambija, Bella Rica, and Portovello localities and was subject to illegal smuggling out of the country.

The Ecuadorian economy grew by approximately 2.0% in real terms during 1993, led by trade, manufacturing, foodstuffs, and mineral production. The inflation rate dropped to 31.7%, compared with 60.2% in 1992.

GOVERNMENT POLICIES AND PROGRAMS

The newly elected Government continued efforts to create a favorable climate for domestic and foreign investment in natural resources exploration and development. Privatization, additional reform of the country's mining legislation, and a hydrocarbon law were debated by the Congress.

The constitution granted rights to all mineral substances to the state, which alone was able to grant concessions. Mining activity fell under the Mining Law, Decree No. 126 of May 22, 1991 and regulations of Decree No. 2831 of October 24, 1991. This legislation established the relationship between the state and persons or entities engaged in all mining activities, excluding exploitation of hydrocarbons, reactive minerals, and medicinal waters.

The greatest weakness of the Mining Law from the point of view of potential investors was the imposition of a 3% royalty on gross production. This tax, which was put in at the insistence of Congress, had the effect of raising the ore grade that a deposit must have to be profitable. The Chamber of Mines, the chief industry lobbying group, hoped that legislation could be passed to lower this royalty to 1.5%. Ecuador had a 25% corporate income tax and profits remitted abroad were subject to an additional 11% tax.

The draft Hydrocarbon Bill would de-emphasize Petróleos del Ecuador (Petro Ecuador) influence. Production-sharing contracts were to be allowed in addition to the risk-service contracts under which foreign oil companies operated. Private companies would be authorized to build and operate the new Transecuadorian pipeline. The bill also would encourage the development of gas fields in the Gulf of Guayaquil. Locally, opposition was focused on the privitization aspects of the bill as an assault on Ecuador's sovereignty.

Ecuador withdrew from active membership in the Organization of Petroleum Exporting Countries (OPEC) at the end of 1992.

During the year, the Government agreed to pursue a 5-year technical assistance project with the World Bank to develop Ecuador's mining sector.

ENVIRONMENTAL ISSUES

The environmental impact of natural resource development was being addressed in Ecuador. Formerly, the emphasis of Ecuadorian environmental interests was limited and directed more at the petroleum industry. However, attention had turned to informal gold mining in districts, such as Nambija and Bella Rica. Local miners had deforested the area, and a number of remote mining district operations processed ore using mercury, which subsequently was lost into the environment. Besides mercury, arsenic, cadmium, copper, lead, and zinc tended to be lost in the rudimentary gold recovery operations. Contaminated process water discharged directly into streams was blamed partially for pollution problems in the coastal regions where aquaculture-raised shrimp had become a significant industry. The influx of people into the "gold rush" shanty towns also caused serious sanitary, social, health, and safety problems.

The controversy continued over development in sensitive rain forest areas. Projects requiring road building were subject to environmental concern and Governmental scrutiny in that the new roads provided farmers and miners access to the forest. Companies and the Government attempted to reduce the effects of operations on the indigenous population and the environment.

The Ministry of Energy and Mines' (MEM) Direccion Nacional de Medio Ambiente (DINAMA) administered and enforced the new mining law's environmental provisions. The 1991 mining code required an environmental impact statement be filed before any mining-related activity, which resulted in significant pre-exploration charges. There was an attempt to move the EIS requirement to a post-geological reconnaissance survey period.

PRODUCTION

The mining sector's primary output was industrial minerals which, with the

exception of some pumice exports, were consumed by the domestic construction industry. Mineral fuels and their derivatives accounted for most of the total value of production. Production of crude oil increased in 1993 to an average of 345,000 bbl/d. *(See table 1.)*

TRADE

Lower international petroleum prices resulted in the value of Ecuadorian exports dropping 3.4% to $2.9 billion in 1993. Total petroleum exports were valued at $1.25 billion. Total imports reached $2.3 billion. Increased sales to other members of the Andean Pact accounted for much of the increase in non-petroleum exports.

The United States continued as Ecuador's principal trading partner. During 1993, the value of exports to the United States reached $1.4 billion. Crude and processed petroleum exports to the United States were valued at $416.1 million. Gold exports to the United States increased from $9.6 million in 1992 to $24.4 million in 1993. Imports from the United States, primarily machinery, increased slightly to $1.1 billion in 1993.

STRUCTURE OF THE MINERAL INDUSTRY

The Ecuadorian Government regulated the mineral industry through the MEM's Subsecretaria de Minas, which administered the mineral industry through its three agencies: Corporación de Desarrollo e Inversión Geológico-Minero Metalúrgica (CODIGEM), DINAMA, and Direccion Nacional de Mineria (DINAMI).

CODIGEM, the Corporation for Geological, Mining and Metallurgical Research and Development, was responsible for development and maintenance of geologic, mapping, and mining databases. CODIGEM also provided technical assistance to miners, in addition to supporting mining, geological, metallurgical, and seismic research. DINAMA, the National Environmental Directorate, was concerned with environmental aspects of resource development. DINAMI, the National Mining Directorate, granted mineral concessions and appropriate exploration and exploitation permits.

Petro Ecuador, the state-owned petroleum holding corporation reorganized in 1992, and its subsidiaries produced, refined, stored, transported, and sold crude oil and petroleum products. Petro Ecuador's operating subsidiaries, Petro Amazonas and Petro Producción, were combined to form Petro Producción. The government proposed to privatize Petro Ecuador and sell off its refineries and pipelines. Appropriate laws were not passed owing to union opposition, oilfield ecological and anthropological issues, and the diminished legislative interest in reform.

International petroleum companies produced crude oil and natural gas under contract with the Government and were involved in downstream trade.

According to the 1992 membership list of the Ecuadorian Chamber of Mines, more than 150 small mining companies operated in the country. Additionally, more than 40,000 small-scale and informal miners were active, primarily in the gold sector. Much of the nation's gold output was being produced by these small, often illegal, operations. Informal miners either worked individually or in small groups. Cooperatives were formed, principally because cooperatives could obtain legal rights to the mining operation. Cooperatives were concentrated in the south in the El Oro, Azuay, and Zamora-Chinchipe Provinces, particularly around the areas of Portovelo-Zaruma, Nambija, and Ponce Enríquez.

Several major multinational mining companies, including Newmont Overseas Explorations Ltd. (Newmont), United States; Gold Fields of South Africa Ltd.; RTZ Corp. PLC, United Kingdom; Noranda Exploration Co., Ltd., Canada; and Placer Dome, Inc., Canada, were pursuing exploration programs. A substantial number of highly speculative ventures also were being actively promoted.

COMMODITY REVIEW

Metals

Copper.—Upon conclusion of Fluor Daniel Wright's preliminary study of the Chaucha copper prospect, Kookaburra Gold Corp. (Kookaburra) began metallurgical testing of the deposit. Kookaburra was working to earn up to 65% interest in the project from AG Armeno Mines and Minerals Inc. (Armeno). However, Kookaburra withdrew from the project and, at yearend, Armeno optioned 50% of its interest in the prospect to Armenex Resources Canada Inc. Also during the year, an access road to the property was completed.

Newmont began exploration work on the Fierro Urco copper prospect. Newmont optioned 60% of the project from Armeno and Trans Atlantic Enterprises Inc. Armeno also optioned 50% of its interest in the Peggy polymetallic prospect to Curlew Lake Resources Inc. upon conclusion of preliminary geochemical and geophysical studies.

RTZ suspended work at the San José de Salinas prospect. The planned exploratory drilling program was suspended when the local population threatened to burn the drill rig, which reportedly was moved to the Newmont concession in Guanazan.

Gold.—Small-scale, intermittently producing gold mining operations were spread throughout the country. Unofficial reports indicate that Ecuadorian gold production totaled approximately 11 to 12 mt/a. Ore was extracted from diggings and processed in small cyanidation plants. The primitive ore treatment plants only recovered between 50% to 70% of contained gold. Some gold was also obtained by amalgamation methods.

Alluvial gold operations also were numerous. The Australian company, Odin Mining & Investing Co., Ltd. reportedly was the largest formal gold producer in the country, recovering more than 600 kg of gold from its placer operations, the

Biron Mine and the Río Chico Mine.

Startigan Corp. of Vancouver, British Columbia, Canada, acquired Square Valley A.V.V. an Aruba-based company in Ecuador, and its two gold prospects. A 10,000-m drilling program was initiated in October on the Gaby property. During the year, mapping and sampling operations were undertaken on the Tres Chorreras deposit. Zappa Resources Ltd. of Vancouver assumed 100% ownership of the Ecuadorian company Prominex S.A., and its 14 gold concessions during July. Zappa evaluated samples recovered during an evaluation of the Ponce Enriquez prospect. Teck Corp. of Vancouver began an environmental management plan for Zappa's placer concession along the Río Aguarico as a preliminary move in acquiring 75% interest in the property.

Since its rediscovery in 1980, Nambija, an ancient Inca mine site, has been Ecuador's principal gold mining center. Approximately 2,000 to 3,000 informal miners worked the area, widely considered to be an ecological disaster. Although this unstructured, unregulated, and untaxed mining activity relieved unemployment, it had serious environmental and social drawbacks. The denuded mountainside was honeycombed by a profusion of ditches and tunnels (some to a depth of 300 m), which severely undermined the ground beneath the mining areas and the town. Government safety intervention would put thousands of informal miners out of work. In May, another landslide destroyed part of Nambija and buried an estimated 300 people. Concerned that the rest of the town would cave in, the Government requested that all mining activity cease. The Government also recommended that the miners move 8 km away to a safer area. The miners rejected the orders, remained on location, and continued to mine, claiming the need to defend continuously their small pits and shallow tunnels from claim jumpers. Miners also accused the Government of selling out their interest to foreign mining companies.

Gold Fields of South Africa Ltd. entered a joint venture on a cooperative's concession in the Nambija area. With the cooperative's consent, Gold Fields started exploration, but their access to the area was blocked by local citizens afraid that the international firm would swallow all of the region's operations, instead of working only on its concession area.

Industrial Minerals

The most significant industrial mineral operations were the cement and cement-related industries involving limestone and clays. Other industrial mineral operations included the marble quarries of Industria Marmolera Ecuatoriana S.A., Mármoles Andinos Cía. Ltda., Mármoles Santa Rosa Cía Ltda., and Marmolera Chimborazo; the calcium carbonate operations of Cecal. S.A.; Mineral M.D.K.'s and Mineral Bentonite Charasol's bentonite mines; and the barite pit of Mineral Bomboiza.

The Ministry of Agriculture, the National Development Bank, and the National Finance Corp. offered their 91.74% interest in FERTISA, the Ecuadorian fertilizer company, on the national stock exchanges during 1993.

Mineral Fuels

Estimated crude oil production in 1993 totaled 126,000 Mbbl, or 345,000 bbl/d, an increase of 7.8% from that of the previous year. During 1993, Ste. Nationale Elf Aquitaine and partners Braspetro S.A. and Yacimientos Petrolíferos Fiscales (YPF) began production on block 14. Occidental Petroleum Corp., Maxus Energy Co. (Maxus), and Tripetrol S.A. also were active in Ecuador. During June 1992, Petro Ecuador had absorbed Texaco's 37.5% interest in the Oriente region oilfields.

In late September, the seventh round of petroleum concession licensing was delayed until 1994. This round included blocks previously reserved for Petro Ecuador.

A 3.65 Mbbl/a capacity increase was proposed for the Amazonas and La Libertad refineries. La Libertad modification was to increase production of lighter products. The Esmeraldas refinery was being modified to take the heavier crude being produced in Ecuador, in addition to a 7.3 Mbbl/a expansion.

Reserves

Ore reserves of metallic minerals and industrial minerals were small in world terms, but considered significant in Latin America. Ecuador was believed to have significant undelineated gold reserves, as gold mining essentially stopped during the colonial era (16th and 17th centuries). Most of Ecuador's gold remained unexploited.

The country's proven crude oil reserves of 4.3 billion bbl. should last well into the next century at the present rate of production.

INFRASTRUCTURE

Ecuador's infrastructure was cited for restricting mineral sector development. Mine production was transported by truck on the nation's 28,000 km of highways or on the 965 km of state-operated rail to processing plants and shipping ports.

Petro Comercial, a subsidiary of Petro Ecuador, was responsible for the transportation of oil. Crude oil was transported from the oilfields in the Oriente region through the Ecuadorian Transandean oil pipeline system via Quito to Esmeraldas or Guayaquil for export or processing and domestic distribution. Pipeline throughput repeatedly exceeded design capacity during the year. Additional production was shunted through the Trans-Andean pipeline in southern Colombia to the export terminal at Tumaco. A new 150,000-bbl/d capacity pipeline parallel to the existing Ecuadorian pipeline from Lago Agrio to Esmeraldas was proposed. Maxus also had 352 km of product line under construction in the east.

OUTLOOK

The mining sector, especially gold, silver, and base metals, could supplement petroleum as important sources of national income. However, significant foreign investment would be needed to

create adequate infrastructure and the Government would need to boost investor confidence by maintaining and improving the fiscal and legal environment for mineral exploration and development.

Ecuador, which has long ignored its potential as a minerals producer, could be the site of important investments in the medium term. However, interest in gold projects, with their associated quicker return on investment, should dominate the short-term horizon. Junior and major multinational companies already have begun intensive exploration programs.

The Government eventually will deal with the social and political problems associated with the claim jumping of small-scale miners. These invasions of prospective mineral concessions assigned to others have delayed programs and frightened off domestic and foreign investment. Upgrading the recovery rate and discharge and emissions from primitive gold recovery operations also must be addressed. Environmental awareness and activism should become more entwined with natural resources development in Ecuador.

Petro Ecuador was expected to expand its production and transport capacity, most notably the construction of an LPG terminal and petroleum product pipelines. However, Petro Ecuador's mandated domestic sale of refined products at steeply subsidized prices will continue to encourage product smuggling and eventually enervate Petro Ecuador's competitive stance.

Increased booked reserves are expected, as is an eventual increase in oil production, given the active international exploration activity. Observers believed that Ecuador has additional petroleum potential, although possibly of smaller volume and of lower quality than currently producing oilfields.

[1]Where necessary, values have been converted from Ecuadorian sucres (S/) to U.S. dollars at the rate of S/1,900=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Ministerio de Energia y Minas
Subsecretaria de Minas
Santa Prisca 223 y Manuel Larrea
Quito, Ecuador
Telephone: 593-2-570-376
Facsimile: 593-2-570-350

Corporación de Desarrollo e Inversión Geológico-Minero Metalúrgica (CODIGEM)
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Quito, Ecuador
Telephone: 593-2-240-209
Facsimile: 593-2-463-861

Direccion Nacional de Medio Ambiente (DINAMA)
Casilla 23-A, Ave. 10 de Agosto #5540 y Villalengua
Quito, Ecuador
Telephone: 593-2-570-341
Facsimile: 593-2-583-719

Direccion Nacional de Mineria (DINAMI)
Casilla 23-A, Ave. 10 de Agosto #5540 y Villalengua
Quito, Ecuador

Petróleos del Ecuador (Petro Ecuador)
Alpallana y 6 de Diciembre
Edif. Alpallana P.O. Box 5007-8
Quito, Ecuador

Cámara de Minería del Ecuador
Ave. Rep. del Salvador #525
Edif. Rosanía, Ofic. 14
Quito, Ecuador

Publications

Banco Central del Ecuador—Division Técnica; Boletín Anuario.

U.S Embassy-Quito: Country Commercial Guide, annual.

Latin American Mining Institute, Washington D.C.: The South American Investment and Mining Guide, annual.

TABLE 1

ECUADOR: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	e1993	Annual capacity[e] (Jan. 1, 1994)
METALS							
Cadmium: Mine output, Cd content[e]	kilograms	300	250	200	260	260	300
Copper: Mine output, Cu content[e]		100	100	100	100	100	100
Gold: Mine output, Au content	kilograms	10,390	10,710	12,200	e12,000	11,500	12,500
Iron and steel:							
Steel, crude		23,370	19,798	20,464	e20,000	20,000	23,500
Semimanufactures		177,936	172,550	201,724	e190,000	190,000	210,000
Lead concentrate, Pb content[e]		200	200	200	200	200	200
Silver: Mine output, Ag content[e]	kilograms	60	60	60	60	60	60
Zinc: Mine output, Zn content[e]		100	100	100	100	100	100
INDUSTRIAL MINERALS							
Cement, hydraulic[e]	thousand metric tons	2,250	2,250	2,300	2,250	2,200	2,300
Clays:							
Bentonite		360	760	135	393	300	400
Common:							
For cement	thousand metric tons	4,836	3,886	3,243	e3,000	3,000	4,900
Other		370,780	372,000	280,000	277,789	280,000	380,000
Kaolin		14,660	7,883	16,217	6,835	7,000	17,000
Feldspar		7,463	8,127	5,010	3,251	3,300	8,200
Gypsum (for cement)		10,670	24,200	e24,000	e24,000	24,100	25,000
Sand:							
Silica (glass sand)		40,292	42,399	23,239	35,509	36,000	42,400
Ferruginous[e]		[2]15,334	10,000	10,000	15,000	10,000	15,400
Stone, sand and gravel:							
Limestone (for cement manufacture)	thousand metric tons	4,836	3,886	3,243	3,079	3,000	4,900
Marble		1,633	2,171	1,740	1,963	2,000	2,200
Pumice		144,836	e34,000	33,510	e35,000	35,000	145,000
Sulfur:[e]							
Native		4,300	4,000	4,000	4,000	4,000	4,300
Byproduct:							
From petroleum		5,000	5,000	5,000	5,000	5,000	5,000
From natural gas		5,000	5,000	5,000	5,000	5,000	5,000
Total		14,300	14,000	14,000	14,000	14,000	14,300
MINERAL FUELS AND RELATED MATERIALS							
Coal, lignite[e]		e5,000	e3,000	e3,000	e3,000	3,000	5,000
Gas, natural:							
Gross	million cubic meters	152	214	239	195	200	250
Marketed[e]	do.	100	100	90	90	90	100
Liquefied natural gasoline	thousand 42-gallon barrels	181	289	364	397	400	400
Petroleum							
Crude	do.	102,953	104,442	109,387	117,172	126,000	120,000
Refinery products:							
Liquefied petroleum gas	do.	1,368	1,714	2,234	2,548	2,550	2,550
Gasoline	do.	10,244	10,013	11,160	11,497	11,500	11,500
Jet fuel	do.	1,279	1,368	1,418	1,532	1,500	1,550
Kerosene	do.	1,871	1,402	1,140	786	800	1,900

See footnotes at end of table.

TABLE 1—Continued

ECUADOR: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	e1993	Annual capacity[e] (Jan. 1, 1994)
MINERAL FUELS AND RELATED MATERIALS—Continued							
Petroleum—Continued:							
Refinery products—Continued:							
Distillate fuel oil	thousand 42-gallon barrels	7,888	9,215	10,308	10,543	10,500	10,550
Lubricants	do.	184	151	208	256	260	260
Residual fuel oil	do.	14,834	17,439	17,996	16,628	16,650	25,160
Unspecified	do.	496	534	458	374	400	550
Total	do.	38,164	41,836	44,922	44,164	44,160	54,020

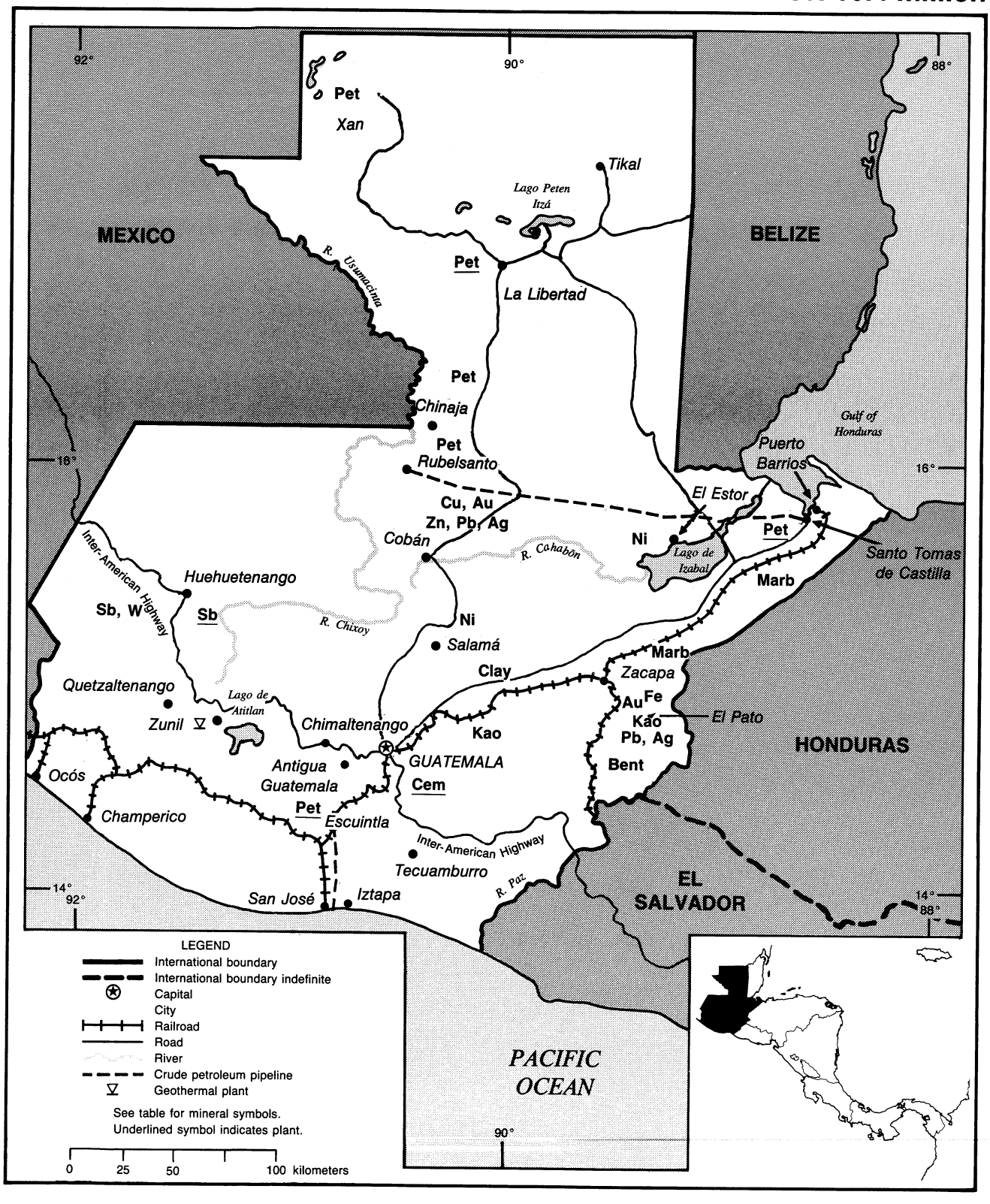
[e]Estimated. [r]Revised.

[1]Includes data available through Nov. 2, 1994.

[2]Reported figure.

GUATEMALA

AREA 108,900 km² **POPULATION 10.4 million**



THE MINERAL INDUSTRY OF

GUATEMALA[1]

By Pablo Velasco

Agriculture continues to dominate the Guatemalan economy, contributing roughly one-quarter of total output, two-thirds of exports, and one-half of employment. The agricultural sector grew 2.9% in real terms during 1993, followed by commerce and manufacturing, contributing 24% and 15% of total gross domestic product (GDP), respectively. Political unrest created by sporadic guerilla activity, high inflation, and a general lack of investment by the private sector continued to be a constraint to economic growth. In 1993, the inflation rate dropped to 8%. The GDP for 1993 was estimated at $11.9 billion[2] in current U.S. dollars, a 5% increase in real terms. The Government anticipated increased foreign investment in mining and petroleum during 1992-93. Economic growth could be stimulated by new investment in the mineral sector. In contrast, there was only very limited mineral production reported, which included antimony trioxide and arsenopyrite-gold from mines in Ixtahuacan in the district of Huehuetenango. Also produced were barite, bentonite, cement, crude oil, feldspar, gypsum, kaolin, marble, sand and gravel, and silica sand. Other minerals known to occur, but not currently worked commercially, include nickel and sulfur.

The Guatemalan Government invited mining companies to participate in the bidding process for the El Pato gold prospect identified by an exploration project of the United Nations Revolving Fund for Natural Resources Exploration (UNRFNRE). It has been estimated that the deposit contains about 2 Mmt of ore grading 7 g/mt of gold and to have attracted interest from several major international mining concerns.

Another official project was to reassess the economic feasibility of reviving the former Exploraciones y Explotaciones Mineras Izabal, S.A./Inco Ltda. of Canada (Exmibal/Inco) nickel facility.

Direct Government involvement in production is small and shrinking. The Government has plans to eliminate all subsidies of the 38 parastatal enterprises by 1995 and has begun to allow greater private participation in sectors such as energy. The value added and income taxes have been simplified and their bases broadened.

GOVERNMENT POLICIES AND PROGRAMS

The controlling legislation for mining was Decree Law 69-85 of July 12, 1985, as modified by Decree Law No. 125-85. Small-scale mining was covered by Decree Law 55-90 of December 3, 1990. They were reformed in conformity with article 125 of the Guatemalan Political Constitution by Congressional Decree Law No. 41-93 of November 29, 1993. The petroleum activity was covered by the Hydrocarbon Law, Decree Law 109-83, and associated regulations, especially Government Edicts 1034-83 and 203-84.

Implementation of the labor laws has been uneven. The U.S. Government was reviewing petitions claiming that Guatemala inadequately protects workers' rights. If that review determines that the Government of Guatemala is not taking steps to improve the protection of workers' rights, Guatemala could lose its access to programs under the Generalized System of Preference (GSP), Caribbean Basin Initiative (CBI), and the Overseas Private Investment Corp. (OPIC). In an effort to improved the 44-year-old law, in early 1993, the Government began to establish additional labor courts and to hire new labor inspectors. Labor leaders signed a tripartite agreement with the Government and business leaders to work together to improve labor relations.

U.S. and other foreign businesses are generally afforded national treatment in Guatemala. In fact, the Government is streamlining the registration process and otherwise producing a more attractive climate for foreign investors, exporters, and importers. Investment opportunities have been created, although there was still no investment code with the guarantees and incentives required by prospective foreign investors.

ENVIRONMENTAL ISSUES

Procedural regulations to the mining law were enacted through Governmental Agreement (G.A.) No. 1349-85, and modified by G.A. No. 1211-85. Article 12 of Chapter II—Fundamental Dispositions and Mining Regimes Advising on Technical Assistance, established in section (e) that The National Environmental Commission (CONAMA) will give technical and administrative assistance to interested persons on how to acquire mining rights and on how to protect the environment. Article 27 of Chapter IV—Mining Exploitation- (Obligations), section (f) of the mining law established also that the owner of a mine or mineral deposit must present to CONAMA a copy of the Environmental Impact Study prior to the start of mining exploitation.

Environmental conditions in the Chixoy River Basin will be improved with a $14.4 million loan from the Inter-American Development Bank. The program will introduce soil and water conservation techniques; improve farming, grazing, and forestry in the region; and reduce rates of deforestation, erosion, and sedimentation that might

affect the useful life of the Pueblo Viejo-Chixoy Hydroelectric plant. The loan was extended for 40 years, with a grace period of 10 years and 2% rate of interest thereafter.

PRODUCTION

Guatemala's mineral commodities that were major contributors to the total value of mineral production in 1993 were antimony, gold, iron and steel, and lead. Various industrial minerals formed the bulk of the country's production. These were primarily barite, cement, clays, dolomite, feldspar, gravel, gypsum, lime, limestone, marble, pumice and related materials, salt, stone, and talc, all primarily for domestic use. Guatemala continued as Central America's only crude oil producer. Oil production decreased significantly in 1993. *(See table 1.)* Basic Resources International, S.A. reported that the 5th Xan well recently completed is producing oil at a rate of 2,000 bbl/d from a depth of 2,321 m.

TRADE

Guatemala became the 103d member of General Agreement on Tariffs and Trade (GATT) when its Congress ratified the accession protocol in October.

Preliminary data indicated that the United States remained the primary destination for 35% of the $1.31 billion Guatemalan export market in 1993. Principal exports to the United States were coffee, sugar, garments, fruits, and vegetables. Growth in import demand has outstripped export growth for the past several years. As a result, the trade deficit has doubled in each of the past 2 years. Fortunately, as the stabilization program has taken effect, capital inflows have risen, offsetting the current account deficit. In addition to its stabilization program, the Government has undertaken a number of rigorous structural adjustment measures. The band of external tariffs has been narrowed and lowered. The value added and income taxes have been simplified and their base broadened. Energy subsidies were eliminated in 1993. Tariffs are being reduced and simplified, the maximum tariff being lowered to 20% as of January 1993. Nontariff barriers are being eliminated and price controls have been abolished. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

The mineral industry, like the overall economy, was dominated by the private sector. The Government had limited activity in the mineral sector. Its involvement in the mineral sector was limited to promotion and regulation of the industry. Policy for the mineral sector was set by the Ministry of Energy and Mines, including the requirement for environmental impact assessments. This Ministry also formulates policies for the petroleum and electrical power industries. The Ministry of Economy is the agency in charge of approving U.S. capital investment projects submitted under the Agreement on U.S. Capital Investment Guarantees entered into between Guatemala and the United States.

COMMODITY REVIEW

Metals

Guatemala was the third largest producer of antimony in Latin America, after Bolivia and Mexico. Antimony ore and concentrate were produced by Minas de Guatemala S.A. from the Anabella, Los Lirios, and Clavito Mines at Ixtahuacán, near the Department of Huehuetenango in the western region of the country. In addition to the recovery of 94% of the antimony values by flotation to produce antimony sulfide concentrates assaying an average of 65% antimony, the company recovers 65% arsenopyrite by gravity and flotation to produce a concentrate assaying an average 24% arsenic and 124 g/mt of gold. Output was exported mainly to METALEUROP in France. The company was considering the use of biotechnology methods to recover the maximum gold values from the mine ore.

The Government invited mining companies with the required technical and financial capacity to participate in the bidding process for the El Pato gold prospect identified by an exploration project of UNRFNRE. It has been estimated that the deposit contains at least 2 Mmt of ore grading about 7 g/mt of gold and that daily production was likely to be about 1,000 tons. It appears that there are larger, unexplored reserves in the area.

The technical report of UNRFNRE, together with a brief report on the legal and fiscal regime and status of the project and guidelines for bidding, will be made available at cost from the director of UNRFNRE in New York City.

Falling prices have again all but scupered hopes that Inco will soon restart its Guatemalan mining affiliate. Since Inco commissioned a report last year to consider the economic viability of restarting the mothballed nickel mine, the nickel price has fallen from about $6,000 per ton to $5,000 per ton.

News of the study raised hopes in Guatemala that operations were about to restart, and a visit by engineers to inspect the mine, which once employed 800, brought queues of hopefuls to the gates. But Exmibals's caretaker general manager has stated that the studies so far were "very preliminary" and that the company "does not want to raise false hopes."

Forced to close in late 1980 due to a slump in nickel prices, coincident with a jump in oil prices, the plant is in an ecologically sensitive area near Lake Izabel. Exmibal currently employs a skeleton staff of about 30 employees to maintain the kiln, generator, and other equipment. Between 1978 and 1980, the mine produced about 25 Mmt/a of ore. Exmibal does, however, have several 40-year contracts to mine in the Lake Izabel area, the first of which expires in the year 2005.

Industrial Minerals

The cement, ceramics, construction, and glass industries were the country's leading users of industrial minerals. Cement, clays, feldspar, gypsum, lime, and sand and gravel primarily were produced for the local market. Guatemala's Cementos Progreso, S.A. is the only cement producer in the country with two cement plants in operation, together capable of providing 1.4 Mmt/a of cement. Because cement consumption in the country is forecast to exceed the company's production capacity in coming years, Cementos Progreso has decided to import cement in the short term in the

range of 200,000 to 400,000 mt/a. Because it was not possible to find a suitable location for the new import terminal within Puerto Quetzal, a solution was chosen to convey cement out of incoming ships directly into bulk road trucks. These trucks will then transport the cement from the port to a warehouse facility about 5 km away.

Mineral Fuels

Northern Guatemala's Xan Field appears larger than first thought. Basic Petroleum International Ltd. has completed the 5 Xan well, producing about 2,000 bbl/d of 17° gravity oil from 2,321 m. Basic drilled the well based on a 1993 seismic survey that indicated the structure might be larger. New reserve estimates for Xan are expected to exceed its previous estimate of 37.6 Mbbl as of yearend 1992. Basic expects 5 Xan to add significantly to its reserves. It plans to drill one more well in the Xan Field in 1994.

The field's four wells, including 5 Xan, can produce more crude than can be trucked. Basic is seeking financing for a pipeline to its asphalt refinery at La Libertad, which began processing and upgrading Xan crude in late 1992. Pipeline startup is planned for mid-1995. Xan Field, discovered in 1985, produced more than 1.7 Mbbl in 1993. Cumulative production exceeds 4.5 Mbbl with only a few percentage points decline from original reservoir pressure of 48,215 kg/cm^2.

Crude oil production in Guatemala in 1992 reached a historical high of 2.05 Mbbl, of which 1.73 Mbbl was exported through the Port of Santo Tomás de Castilla on the Caribbean Sea. Imports of crude oil and finished products increase by 10% to 1.151 Mbbl compared to 1992. Imports of crude from Venezuela under the San Jose Accord totaled 1.76 Mbbl in 1992. That year, Guatemala also imported petroleum from Argentina, Colombia, and Ecuador.

Basic Resources started up a 2,000-bbl/d refinery in the Peten area of Guatemala. The plant processes Guatemalan Xan crude and produces asphalt, naphtha, kerosene, diesel fuel, and distillate fuel oil. Previously, all asphalt consumed in the country had to be imported. Juno-Grimm & Associates, Richardson, Texas, prepared all process and mechanical design, assisted in equipment procurement, provided field supervision during construction, and directed plant operations during startup for the 2-1/2-year project.

INFRASTRUCTURE

Guatemala has a moderatly developed infrastructure. Crude oil is transported from oilfields and refineries to domestic consumption centers and neighboring countries by a network of 283 km of pipeline for crude oil. There are two pipelines in Guatemala. The longest (235 km) runs from Rubelsanto in the southern Peten Oilfield to Puerto Barrios on the Caribbean coast, and a smaller pipeline (48 km), which runs from Puerto San José on the Pacific coast to Texaco's refinery at Escuintla. Together they have a combined maximum capacity of 65,000 bbl/d, with the addition of supplemental pumping stations.

Two utilities supplied electric power in Guatemala: Instituto Nacional de Electrificación (INDE) and Empresa de Energía de Guatemala (EEG). INDE generated power for use in all but 3 of the nation's 22 departments. EEG supplied electricity in the Guatemala, Escuintla, and Suchitepequez Departments. The country had an installed generating capacity of 803 MW. Hydroelectric facilities, primarily the Chixoy plant, accounted for about 59% of this capacity. About 15 MW of geothermal power was generated at the Zumil Field, south of Quetzaltenango. Per capita consumption of electricity was 266 kW•h.

The country also had 260 km of inland waterways available for year-round traffic; in addition, Guatemala had 730 km of inland waterway during the high-water season.

OUTLOOK

Mining activity should continue to grow from its current small base. 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. Peace talks between the Government and the guerrilla organization Unidad Revolucionaria Nacional Guatemalteca (URNG) began in April. Until peace terms are agreed upon, physical security problems in the northern part of the country are expected to continue to plague mineral exploration and production. The lack of adequate infrastructure also will need to be addressed.

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[1]Text prepared Apr. 1994.

[2]Where necessary, values have been converted from Guatemalan quetzals (Q) to U.S. dollars, at the rate of Q5.8=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

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Diagonal 17, 29-78, Zona 11
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Dirección General de Hidrocarburos
Diagonal 17, 29-78, Zona 11
Guatemala City, Guatemala
Telephone: (502) (2) 76-2044
Facsimile: (502) (2) 76-3175

Publications

Instituto Latinoamericano Del Fierro y el Acero (ILAFA), Santiago, Chile: Anuario Estadístico de la Siderurgia y Minería del Hierro de AmÉrica Latina, annual.
Ministerio de Energía y Minas, Guatemala: Informe Estadístico de Energía y Minas, annual.
Ministerio de Energía y Minas, Guatemala: Memoria de Labores, annual.
Organización Latinoamericana de Energía (OLADE), Quito, Ecuador: Energía en Cifras, 1992, annual.
U.S. Central Intelligence Agency, Washington, DC: The World Factbook, 1993, annual.
U.S. Department of Commerce, International Trade Administration: Foreign Economic Trends and Their Implications for the United States, annual.
U.S. Department of the Interior, Geological Survey, Reston, VA: Geological Survey Circular 925, Earth and Water Resources and Hazards in Central America, 1984, 40 pp.

TABLE 1

GUATEMALA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1, 1994)
METALS							
Antimony:							
Mine output, Sb content		1,335	1,068	609	582	600	1,900
Trioxide		—	—	41	23	30	45
Gold	kilograms	48	62	31	32	30	65
Iron and steel:							
Iron ore, gross weight		6,541	6,370	5,103	1,445	3,300	14,000
Steel, crude		22,460	20,680	23,034	e18,000	20,000	24,000
Steel, semimanufactures		49,401	64,198	79,293	e45,000	70,000	80,000
Lead metal, including secondary		150	110	28	49	50	150
INDUSTRIAL MINERALS							
Barite		3,995	421	—	1,723	1,500	7,500
Cement	thousand tons	1,613	1,675	1,442	e1,400	1,400	1,800
Clays:							
Bentonite		8,236	9,000	12,000	12,600	12,300	13,000
Kaolin		2,573	2,050	3,281	2,863	3,000	3,500
Unspecified		3,200	1,260	1,639	1,597	1,600	3,500
Feldspar		7,000	11,895	6,961	r8,048	7,500	12,000
Gypsum		57,268	65,560	51,519	67,612	60,000	68,000
Lime e		279,359	75,000	72,000	70,000	70,000	80,000
Pumice and related materials:							
Pumice	cubic meters	e100	e5,000	6,132	6,591	6,300	23,000
Volcanic ash e	do.	2,400	2,400	r 22,476	2,400	2,400	2,500
Volcanic sand e		137,000	2110,125	100,000	100,000	100,000	140,000
Volcanic scoria	cubic meters	r2,400	2,275	r9,500	re9,975	9,500	10,000
Volcanic tufa		596	610	2,476	2,600	1,900	2,600
Salt		63,100	r180,720	e100,000	e100,000	100,000	190,000
Stone, sand, and gravel:							
Dolomite		10,947	14,900	8,318	9,314	10,000	15,000
Limestone	thousand tons	1,460	1,415	1,442	1,756	1,500	1,800
Marble:							
Block		r11,729	r6,260	r e9,000	r e9,000	7,000	12,000
Chips and fragments		9,389	8,260	1,851	1,751	1,800	10,000
Sand and gravel	thousand tons	865	1,088	1,009	r758	950	1,200
Schist		292,000	260,000	e250,000	e250,000	250,000	300,000
Silica sand		31,000	e30,000	17,300	33,714	27,000	35,000
Stone, crushed e	thousand tons	21,414	1,300	1,000	1,000	1,000	1,500
Talc		650	545	861	1,320	800	1,350
MINERAL FUELS AND RELATED MATERIALS							
Gas, natural, gross e	thousand cubic meters	r 28,764	10,000	r10,000	r10,000	10,000	20,000
Petroleum:							
Crude	thousand 42-gallon barrels	1,328	1,439	1,352	r2,051	1,700	2,500
Refinery products	do.	4,249	e4,000	4,639	r5,696	5,000	6,000

eEstimated. rRevised.

[1]Table includes data available through Apr. 15, 1994.

[2]Reported figure.

TABLE 2

GUATEMALA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

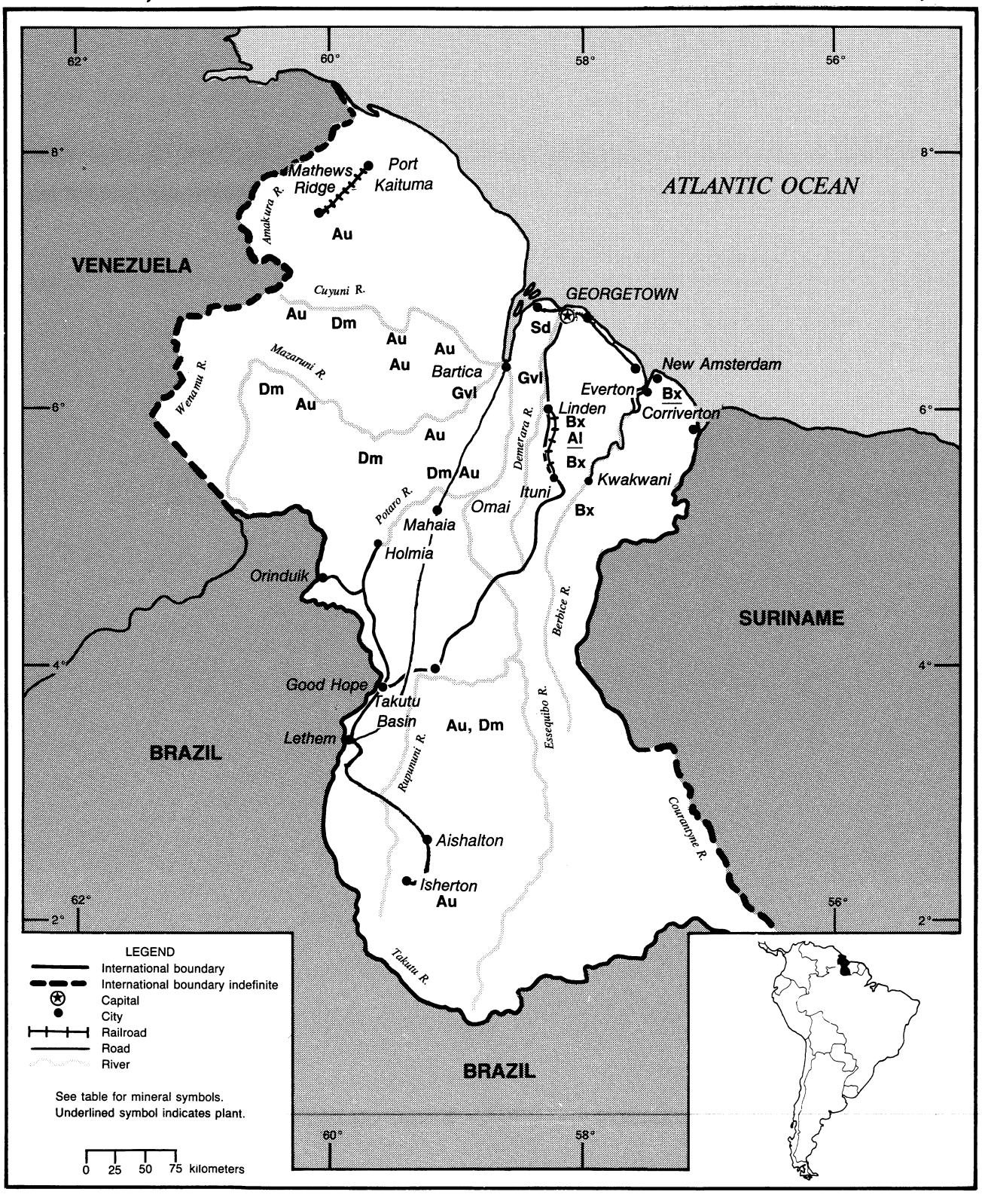
(Thousand metric tons unless otherwise specified)

Commodity		Major operating company and major equity owners	Location of main facilities	Annual capacity
Antimony		Minas de Guatemala, S.A. (private, 100%)	Los Lirios and Anabella Mines, Ixtahuacan, Huehuetenango Department	1.9
Cement		Cementos Progreso, S.A. (Lambert Freres et Cie. 69.8%; others 30.2%)	San Miguel Plant, Sanarate, El Progreso Department, and La Pedrera Plant, Guatemala City	1,800
Nickel		Exploraciones y Explotaciones Mineras Izabal, S.A. [(Exmibal) (Inco, 70%; Government, 30%)[1]]	Mine and processing plant near El Estor, Izabal Department[2]	9
Iron and steel (semimanufactures)		Hornos, S.A.	Guatemala City	80
Petroleum:				
Crude	thousand 42-gallon barrels	Basic Resources International, S.A. [(Basic) (private, 100%)]	Rubelsanto, West Chinaja Fields, Alta Verapaz Department, and Caribe, Tierra Blanca and Xan Fields, Petén Department	2,000
Products	do.	Texas Petroleum Co. (Texaco Inc., 100%)	Refinery at Escuintla, Escuintla Department	6,200
Do.	do.	Basic (private, 100%)	Refinery near Santa Elena, El Naranjo, Petén Department[3]	720

[1]Ownership equity change in 1991.
[2]Mine and processing plant closed Sept. 1980.
[3]Construction complete. Undergoing startup trials.

GUYANA

AREA 214,970 km² **POPULATION 741,000**



THE MINERAL INDUSTRY OF

GUYANA[1]

By David B. Doan

Guyana remained a significant producer of bauxite in 1993, estimates of output reaching 2.126 million tons, approximating about 2% of the world's bauxite output. Other mineral production included diamond and gold, the latter having increased sharply during the year. International attention to the Guiana Shield and investment in exploration for gold proceeded steadily, along with increasing interest in diamond.

The People's Progressive Party candidate was elected to be head of Government. A preliminary estimate of the increase in real gross domestic product (GDP) for 1993 put it at slightly more than 8% and projected about the same growth rate for 1994. GDP itself was approximately $352 million[2] according to Government projections early in the year, but probably exceeded this as gold production accelerated. Per capita income by the end of 1993 was about $600.

In that all mineral rights are vested in the state, concessions are negotiated with Government agencies such as the Bauxite Industry Development Co. Ltd. (BIDCO) for bauxite, the Guyana Geology and Mines Commission for gold and diamond, and the Guyana Natural Resources Agency for oil.

The Guyana Gold Board (GGB), established in 1982, has been the sole official buyer of unprocessed gold. Its rule that miners must carry their gold to a single point, Georgetown, to effect a sale has engendered difficulties. Offering a sale, smelting and assaying the metal, and certifying the result proved to be very time consuming. Changes for reducing hardship and increasing efficiency were under discussion by the GGB.

The Mining Act of 1989 reserved small- and medium-scale mining to Guyanese citizens, which led immediately to problems of definition of size. Foreigners were restricted to large-scale mining, except in the case where a claim operator specifically requested foreign technical assistance and the Guyana Geology and Mines Commission supported the work permit application. Foreigners caught illegally mining in the interior were subject to charges and forfeiture of all equipment. Although joint ventures between local and foreign companies were encouraged, 100% foreign ownership of Guyanese operations was allowed. The Government proposed to increase productivity, reduce debt, and tender the bauxite industry to local and foreign investors by 1994.

Environmental review of new projects was the responsibility of the Guyana Agency for Health Sciences Education, Environment, and Food Policy. Guyana's interior is sparsely populated and densely forested, with considerable expanses of attractive wilderness including rivers and streams. Emerging environmental problems included mercury contamination of soils and waters resulting from gold recovery by both individual entrepeneurs and dredges. Larger dredges tended to contaminate by silt and the disturbance of riverine habitat. Microbial contamination of rivers near mining camps has been detected, but is considered easily remedied and prevented.

Bauxite production dropped slightly compared with that of the previous year, but production was aided in part by the startup of the Aroaima Mine. Guyana was the fourth largest bauxite producer in Latin America after Brazil, Jamaica, and Suriname. *(See table 1.)*

Declared gold production (the amount sold to the GGB) soared compared with output of the previous year. Traditionally, miners had smuggled much of their recovered gold into Brazil or Venezuela. Since 1990, however, the GGB has paid miners for gold using the current exchange rate rather than the unrealistic old official rate (G$50=US$1 in 1990), thus reducing the attractiveness of smuggling. A small amount of silver, equivalent to approximately 5% of gold output, was recovered during refining of the gold.

Bauxite and gold accounted for about 40% of the country's exports. The Foreign Minister of Guyana prepared to help revive the Guyana-Brazil Joint Commission to discuss, among other topics, closer trade relations and the possibility of a free trade zone in Guyana exclusively for trade with Brazil.

The entire bauxite industry was overseen by BIDCO. Bauxite mining and processing were done by BIDCO's subsidiary Guyana Mining Enterprise Ltd. (Guymine) or under contract to Guymine; however, Minproc Engineering of Sydney, Australia, assumed management of the bauxite industry from Guymine in 1993. Guymine's operations were split into Linden Mining Co. (Linmine) and Berbice Mining Co. Several international companies were actively involved in the bauxite industry. The domestic private sector dominated the production of gold and diamond. Five companies held large-scale mining licenses. There were also 18 prospecting licenses for gold and precious stones and a number of license applications on file. Local subsidiaries of private foreign firms carried out petroleum exploration.

Linmine's Kara Kara and Northeast Dorabece bauxite mines were projected to

be mined out in not more than 2 years. Production of metallurgical bauxite dropped by more than 10% in 1993, although this was partly compensated by an increase of more than 25% in output of calcined refractory bauxite. Officials expressed concern over the potential release of Guyanese bauxite from the U.S. National Defense Stockpile and the effect on market prices.

Although most gold and diamond mined during early 1992 involved small-scale river dredging operations, Cambior Inc. and Golden Star Resources began larger scale production in 1993 at the Omai open pit mine, with the result that output soared to between three and four times that of the previous year. Besides Omai, Golden Star was pressing work on its placer deposit concession near Mahdia. South American Goldfields owned the Peter's Mine, Akaiwong, Aurora, Five Star, and Quartz Hill properties and merged with Golden Star to form Golden Star Resources Ltd. Sutton Resources Ltd. of Vancouver, British Columbia, pressed its drill work on the Marudi Hill prospect in southern Guyana.

During 1993, Golden Star continued work on its alluvial diamond evaluation program at Red Hill Loop, Eping, and Apaikwa.

Baracara Quarries and Toolsie Persaud Ltd. produced gravel near Bartica. The Government's Teperu-Itabu Quarry was being reopened in response to overwhelming demand for construction materials, and consideration was given to using Omai gold mine waste rock for aggregate and boulders.

Mobil Corp. continued exploratory work on its offshore concession and asked for assistance in resolving the Guyana-Suriname offshore border dispute in connection with establishing accurate limits to Mobil's exploration area.

Guyana's problems in maintaining its infrastructure severely limited the country's economic activity. Mining areas relied mainly on barges, helicopters, light aircraft, and riverboats for movement of material. Besides 6,000 km of navigable waterways, Guyana had 187 km of railroad, part of it connecting the Linden bauxite mines to the Linden plant, as well as 7,665 km of roads, mostly gravel or dirt. The country also had 252 MW of installed electrical generating capacity.

Guyana has diversified the formerly bauxite-oriented mineral industry by its 7-year gold and diamond promotion program. The intensive, internationally funded exploration activity has resulted in increased gold production, which is expected to rise further. Large-scale gold operations, such as those of the Omai Mine, will significantly boost the nation's economy.

[1]Text prepared Apr. 1994

[2]Where necessary, values have been converted from Guyanese dollars (G$) to U.S. dollars at the average exchange rate of G$130=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Bauxite Industry Development Co. Ltd. (BIDCO)
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Guyana Geology and Mines Commission
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Guyana Natural Resources Agency
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Stabroek
Georgetown, Guyana
Telephone: (592) 2-66549
Fax: (592) 2-71211

Publications

American Embassy, Georgetown: Minerals Questionnaire, annual.

Guyana Geology and Mines Commission: Mineral Resources of Guyana, 1985, 14 pp.

International Bauxite Association: IBA Quarterly Review, quarterly.

U.S. Department of Commerce, International Trade Administration: Foreign Economic Trends and Their Implications for the United States, Guyana, annual.

TABLE 1

GUYANA: PRODUCTION OF MINERAL COMMODITIES[1]

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan 1, 1994)
Aluminum bauxite, dry equivalent, gross weight	thousand metric tons	1,321	1,424	2,204	r2,376	2,126	2,600
Diamond	carats	7,842	17,842	21,909	r44,763	50,004	53,000
Gold, mine output, Au content	kilograms	r e1,300	r e1,500	r1,844	r2,475	9,614	10,000
Stone, crushed	metric tons	37,820	e42,000	e55,000	r72,504	e75,000	76,000

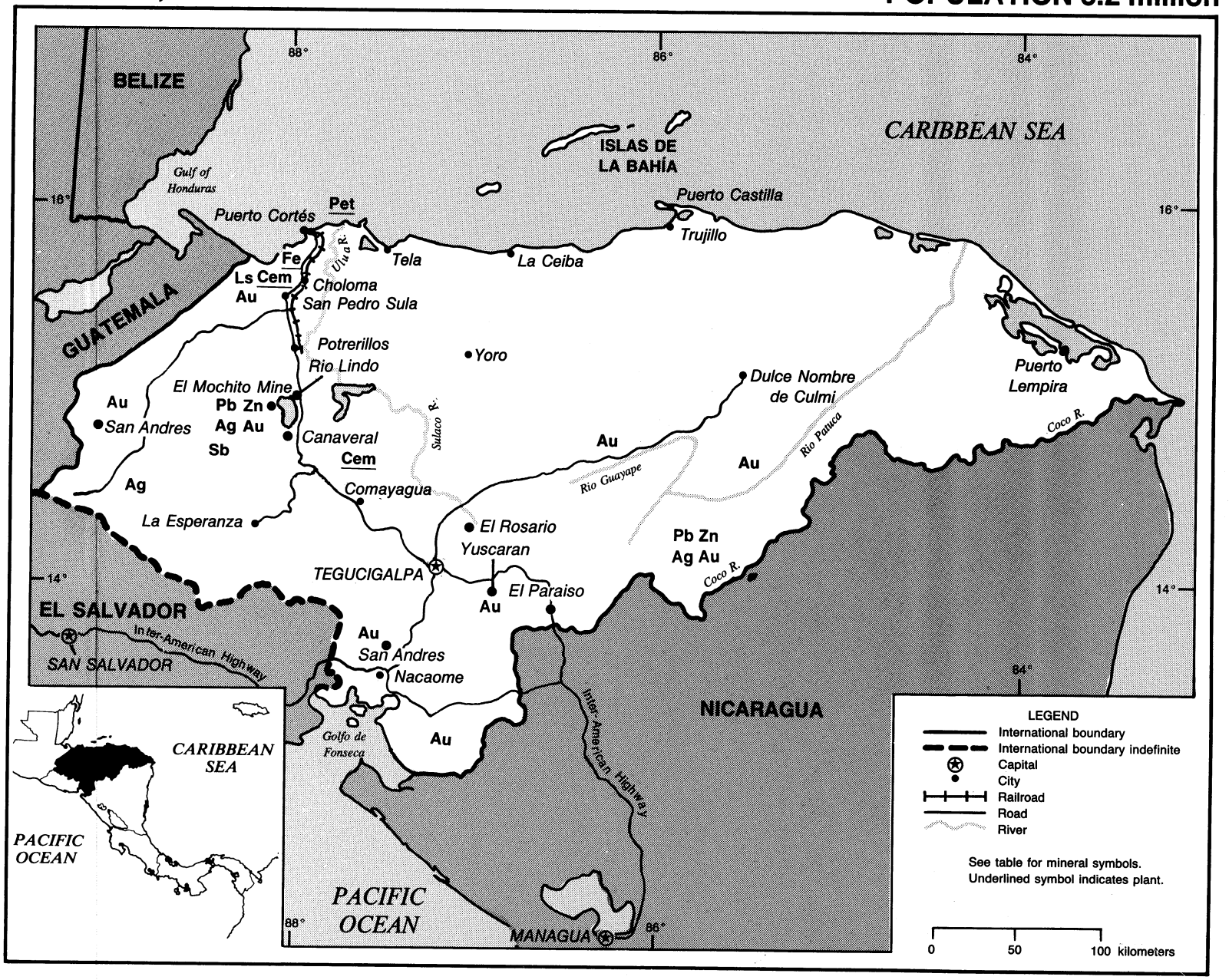
[e]Estimated. [r]Revised.

[1]Includes data available through May 8, 1994.

[2]In addition to the commodities listed, a variety of crude construction materials (common clays, sand, and semiprecious stones) were also produced. Available information was inadequate to make an estimate of production.

HONDURAS

AREA 112,100 km² **POPULATION 5.2 million**



THE MINERAL INDUSTRY OF

HONDURAS[1]

By George A. Rabchevsky

The Republic of Honduras is in Central America on the Isthmus between Mexico and Panama. Its northern shore is bounded by the Caribbean Sea, and the Golfo de Fonseca in the south empties into the Pacific Ocean. The country is mountainous, except for a coastal plain in the north. The dominant geologic feature in Honduras is the Honduras Massif, a complex of metamorphic and igneous rocks occupying the northern part of the country. The massif covers about one-half the country and is geologically the oldest and tectonically the most stable terrain in Central America.

Honduras ranks among the least developed countries in the Western Hemisphere and was the 19th largest economy in Latin America. Agriculture was the country's most important sector of the economy, accounting for more than 25% of the gross domestic product (GDP) and employing more than 60% of the labor force. In 1993, the economy grew by 4%, inflation decreased to 13.4%, and the unemployment rate was about 15%.

The El Mochito Mine was the only large operating metal mine in Honduras. Lead and zinc concentrates from the mine contributed less than 2% to the GDP, and less than 0.3% of the labor force was involved in mining. The mineral resources of Honduras consisted of coal, copper, gold, gypsum, lead, salt, silver, zinc, and some marble.

GOVERNMENT POLICIES AND PROGRAMS

The mining laws in Honduras date to 1968, 1982, and 1987. The hydrocarbon law, Decree 194-84, covers the petroleum industry. The petroleum and minerals operations law, Decree 123-90, was passed in October 1990. The general mining code was passed on February 1991. A new mining code will be proposed in 1994. The state is the owner and exercises direct authority over all mines, but grants rights for reconnaissance, exploration, and exploitation purposes to individuals or corporations within the terms of the general mining law.

All companies in Honduras must be registered with the appropriate Government Ministry, such as the Ministry of Natural Resources for mining companies, and are required to have a labor force that is 90% Honduran. All individuals, including domestic and foreign companies, are subject to taxation, assessed on a progressive scale. Exclusive exploration concessions to foreigners are granted for 4 years and are renewable for 2 years. Mining concessions are granted for 40 years.

ENVIRONMENTAL ISSUES

Honduras operated only one large metal mine, which contributed to the pollution and destruction of the terrain in the surrounding area. The El Mochito Mine is above Lake Yojoa. The mine, operated by Cía. Minera Santa Bárbara, is in a mountainous terrain a few kilometers west of the lake, a recreational outlet that attracted bass fishermen from as far away as the United States. Much of the mine drainage and tailings runoff ends up in the lake. The mine produced gold, lead, silver, and zinc. Reportedly, the Government is attempting to solve this environmental problem by the solicitation of advice from experts. Reportedly, environmental groups of the United States are promoting an environmental movement in Honduras.

The construction of an oil refinery at Puerto Castilla by the United States is now in doubt. The refinery was to produce petroleum products for export only, but faces protests from environmentalists pointing out that the Castilla Bay is one of the most beautiful in the world. The Bay also attracts many tourists, bringing revenues to the local merchants.

The Honduras Ministry of Environment was established in 1993, with about 35 employees and few resources. The Ministry plans to look at the deforestation, soil erosion, air pollution from wood burning, and car emissions. Environmental policies and training of personnel will eventually be introduced by foreign companies and agencies.

PRODUCTION

Honduras produced primarily lead and zinc concentrate in the El Mochito Mine. Cadmium, copper, gold, and silver also were produced, but contributed little to the Honduran economy. Industrial minerals produced in Honduras included cement, gypsum, limestone, marble, and salt. There were no notable increases in mineral output. *(See table 1.)*

TRADE

Honduras was a beneficiary of both the Caribbean Basin Initiative and the Generalized System of Preferences and is a member of the Central American Common Market. In terms of value, Honduras exports about 40% of its metals to Europe and some to Japan, Mexico, the United States, and Venezuela. In 1993, the United States accounted for more than 50% of Honduras' total

exports and supplied 54.2% of its imports.

Exports of gold are subject to a tax of 5%. Imports and exports of gold in any form, other than jewelry, require licenses issued by the Central Bank. Such licenses are not normally granted except for imports and exports by or on behalf of the monetary authorities, industrial users, and producers of gold.

Honduras imported all of its oil requirements, more than 3 Mbbl of crude oil, primarily from the United States. Mexico and Venezuela also supplied crude oil under the San José Accord. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

Mineral, petroleum, and natural gas deposits are regarded as national patrimony, owned by the Honduran Government, and made available to the private sector through concessions.

The private sector directed the mining industry and petroleum refining activity. The Bureau of Mines and Petroleum (Dirección General de Minas e Hidrocarburos) issued mining and petroleum concessions and registered exploration and production companies. The El Mochito Mine was owned by a Canadian company, Breakwater Resources, Ltd. There were several small mines, some operated by United States and Canadian companies. *(See table 4.)*

COMMODITY REVIEW

Metals

Honduras has a long history of gold mining by the Spaniards, when gold was discovered before the conquest of Mexico in 1521. More than 2,000 claims had been registered by 1825, and by 1888 there were 300 mines, of which at least 25 were operated by United States, British, and European companies. These included the San Juancito silver and gold mine of Rosario, which worked uninterruptedly for 71 years until 1954, producing about 7 Mmt averaging 600 g/mt of silver and 3.09 g/mt of gold. Until recently, the country received little attention from mineral exploration companies. Only about 10% of the territory has been geologically mapped at the scale of 1:50,000, despite the fact that former gold mines exist in 16 of the 18 provinces that the country comprises. The publication of a metallogenic map in 1989 and an inventory of known mineral occurrences provided a stimulus to interest by the international mining sector.

Gold and Silver.—Most of Honduras' gold and silver production came from the El Mochito Mine, in the west of the country, which also produced lead and zinc. This mine was opened in 1948 and now is the largest in Central America, with a capacity of about 2,500 mt/d.

The San Andrés Mine is the second gold producer in Honduras. The San Andrés gold project, managed by Fischer-Watt Gold Ltd. (FWG), is about 150 km southwest of San Pedro Sula. Greenstone Resources Ltd. made a proposal in 1993 to acquire an option on the project. Compañía Minerales de Copán S.A. de CV controls the San Andres project and continued its 450-mt/d heap-leaching operation, producing 145 kg of gold in 1993. Gold reserves of the deposit were estimated at 5.6 Mmt at a grade of 3.2 g/mt of gold, containing 18 tons of gold.

Melinga Resources Ltd. (MR), Vancouver, Canada, discovered gold in three areas of its Vueltas del Río and Nelson zones on the Maculizo concession in northwest Honduras. In the El Zapotal concession, MR also held the rights to the Maculizo property. Milagro Minerals Inc., Vancouver, Canada, is to develop its 100%-owned gold heap-leach project on the Maculizo-Vueltas del Rio property.

Aurora Exploracion (Honduras) S.A. de R.L. obtained 15 exploration permits to search for gold in Chameleon-Coyolar area, southeast of Tegucigalapa, where the presence of lead-zinc-gold metal mineralization was detected.

Lead and Zinc.—Accidentally discovered by a drunken campesino, the El Mochito Mine is the largest lead-zinc mine in Central America. Since 1948, more than 11 Mmt of ore has been extracted, containing 750,000 tons of zinc, 500,000 tons of lead, 300,000 tons of copper, and more than 3 Mkg of silver. The deposit has 4.3 Mmt in reserves, grading 1.89% lead, 7.92% zinc, 0.27% copper, and 68.4 gm silver. The mineralization is hosted in Cretaceous carbonates and is usually characterized by skarn minerals. The mine was operated by Cia. Mineria Santa Barbara S.A. (MSB), a wholly owned subsidiary of Breakwater Resources. Mine production declined by 20% in 1993 as a consequence of initial development requirements for the ore body, low equipment availability, and a major rupture in a San Juan sandfill bulkhead. Zinc and lead grades also declined, reflecting mining of low-grade pillars in the Upper San Juan ore body and the lower lead content of the national ore body. Also, in 1993, the company was mining the lowest grade section of the national ore body. The national ore body came into production during the second quarter of 1993. MSB continued its exploration program for gold, lead, silver, and zinc. A new mining concession, known as La Chacra, 10 km from El Mochito Mine, was granted to the company in 1993.

Industrial Minerals

In Honduras, the Cementos de Honduras S.A. (CH) was the largest cement company, followed by the Industria Cementera Hondureña S.A. de C.V., with capacities of 600,000 mt/a and 450,000 mt/a, respectively. Both companies were privately owned. Honduras produced salt in the Choluteca district, in the southwest area of the country.

Mineral Fuels

About 500,000 barrels of oil are pumped out annually by the Texaco Inc. near the Mosquitia coast. Honduras has a number of unexploited oil basins, including Matique, Olancho, Tela, and

Ulua. Mexico and Venezuela supplied crude petroleum to Honduras under the San José Accord. Oil exploration had almost ceased in Honduras because of high costs and risks.

INFRASTRUCTURE

Only 1,700 km of the 8,950 km of roads was paved in Honduras. Access to rural areas remained difficult. There was 785 km of railroad tracks along the Caribbean coast used to transport bananas from the plantations to the port.

Puerto Cortés serves as a shipping port for exports of metals. There are coastal ports on both the Caribbean Sea and Pacific Ocean. Other Caribbean ports included La Ceiba, Puerto Castilla, Tella, and Trujillo. San Lorenzo Port served the Pacific coast activity.

The Government-owned National Electric Power Co. of Honduras or Empresa National de Energía Eléctrica (ENEE), had an installed capacity of 575 MW. In 1993, the country was importing electrical power from Nicaragua. The Government considered importing electricity also from Costa Rica because of the low water level in its main hydroelectric powerplant, Francisco Morazan, on the north coast of Honduras. The plant's capacity was 300 MW, but in mid-1993 was down to 240 MW.

Electricidad de Cortes S.A. de C.V. is planning to build and operate a 54-MW electric powerplant on the Caribbean coast. ENEE will purchase about 90% of the plant's output, and Honduras Electric Co. S.A. de C.V. will purchase the balance. The plant expects to become operative in 1995. Environmental issues associated with this project included air emissions, potential oil spills, disposal of fuel residues during operations, and possible contamination of the sites from past activities.

OUTLOOK

The new administration in Honduras intends to promote and support the mining sector and enact a new mining code. Given that the minerals industry in the country is small, it is not expected that it will develop as quickly as desired. There are now several international mining companies exploring for metals in Honduras. The Government is promoting the creation of mining cooperatives to raise the production of gold. A number of prospects are now being evaluated for copper and gold metals.

Environmental studies are being planned for the Lake Yojoa, receiving chemical effluent from the lead and zinc El Mochito Mine. Eventually, environmental laws and regulations will be passed safeguarding the nature and inhabitants from local pollution.

[1]Text prepared June 1994.

[2]Where necessary, values have been converted from Honduran lempiras (L) to U.S. dollars at the rate of L6.97=US$1.00, the average rate for 1993.

OTHER SOURCES OF INFORMATION

Agencies

Dirección General de Minas e Hidrocarburos
Ministerio de Recursos Naturales
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Dirección General de Inversiones y Promoción de Exportaciones
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501 Fifth Avenue, Suite 1611
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Publications

Banco Central de Honduras, Departamento de Estudios Económicos Honduras en Cifras, annual.

Latin American Mining Institute, Washington, DC: Mexico and Central America Investment and Mining Guide, annual.

Ministerio de Recursos Naturales, Dirección General de Minas e Hidrocarburos and Bureau de Recherches Geologiques et Mineres. Special Reports.

U.S. Department of Commerce, International Trade Administration: Foreign Economic Trends and Their Implications for the United States, annual.

TABLE 1
HONDURAS: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993[e]	Annual capacity[e] (Jan. 1, 1994)
Antimony, mine output, Sb content		[r]10	—	—	—	—	—
Cadmium, Cd content of lead and zinc concentrates		350	372	212	[r]333	300	600
Cement		648,763	652,111	693,040	[e]650,000	645,000	1,050,000
Copper, Cu content of lead and zinc concentrates		2,419	1,388	[r]1,000	[r]1,600	1,000	3,000
Gold	kilograms	160	156	180	[2]163	185	400
Gypsum[e]		25,000	25,000	27,000	26,000	25,500	30,000

See footnotes at end of table.

TABLE 1—Continued
HONDURAS: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1, 1994)
Iron and steel:e							
Steel, crude		8,000	8,000	7,500	7,400	7,300	14,000
Semimanufactures		17,210	15,000	15,000	15,000	15,000	20,000
Lead, mine output, Pb content		9,610	5,785	8,719	r10,797	9,500	12,000
Petroleum refinery products	thousand 42-gallon barrels	3,299	3,106	e3,000	3,903	1,900	5,040
Salte		30,000	30,000	30,000	30,000	30,000	40,000
Silver	kilograms	49,559	r31,105	39,359	r42,847	45,000	70,000
Stone:							
Limestonee		450,000	460,000	500,000	450,000	400,000	600,000
Marble	square meters	74,250	84,400	95,937	e100,000	95,000	200,000
Zinc, mine output, Zn content		37,184	29,628	38,280	r29,008	27,000	45,000

eEstimated. rRevised.

[1]Includes data available through June 14, 1994.

[2]Reported figure.

[3]Includes LPG, aviation and motor gasoline, diesel, kerosene, and distillate fuel oil.

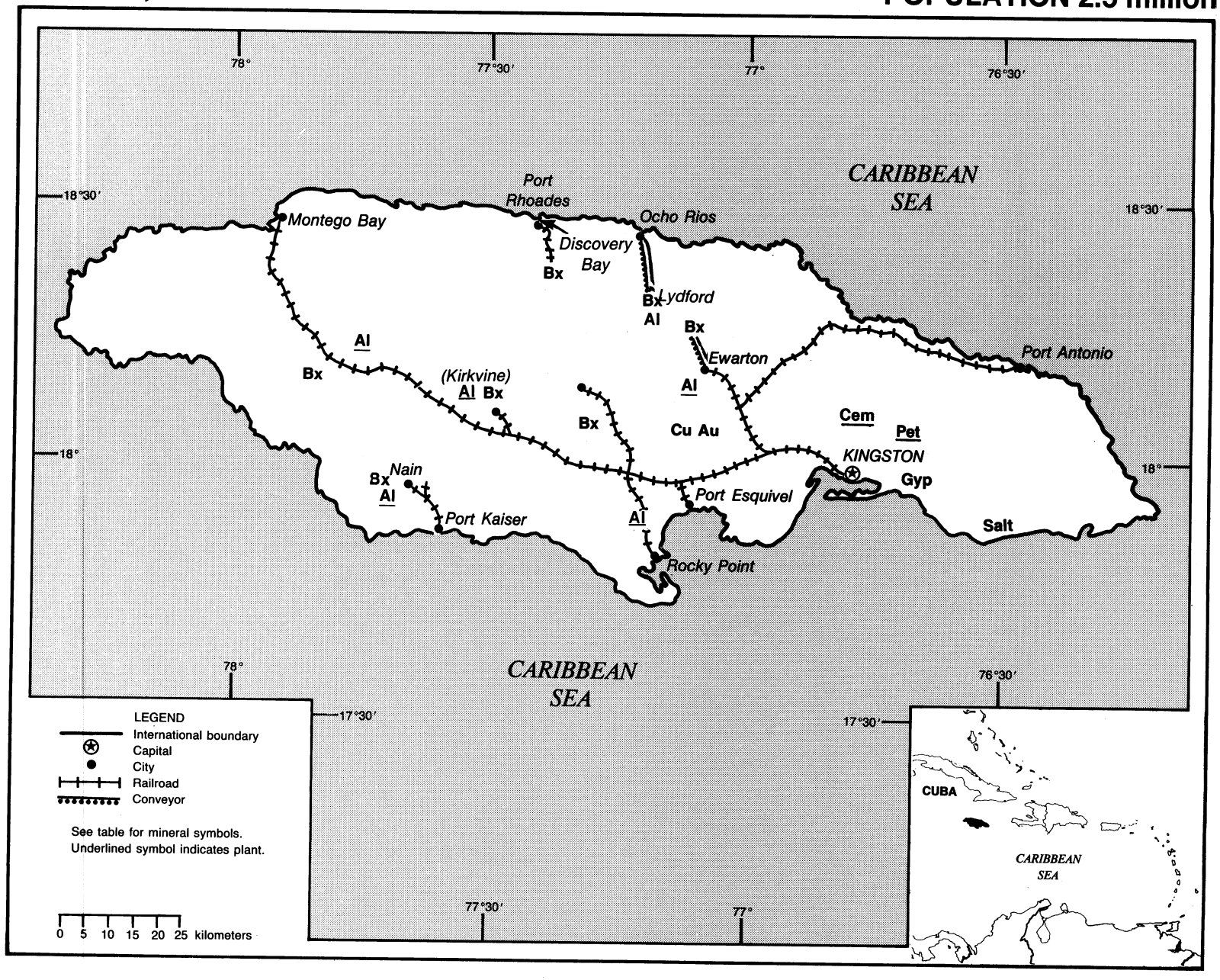
TABLE 2
HONDURAS: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Cementos de Honduras, S.A. (private, 100%)	Río Bijao plant, San Pedro Sula, Cortés Department	600
Do.		Industria Cementera Hondureña, S.A. de C.V. (private, 100%)	Piedras Azules plant, Comayagua Department	450
Gold	kilograms	Compañía Minera Santa Bárbara (Breakwater Resources, Ltd., 100%)	El Mochito Mine, Santa Bárbara Department	300
Do.	do.	Cía. Minerales de Copán, S.A. (Madeleine Mines, 25.5%; Milner Consolidated Silver Mines, 25.5%)	San Andrés Mine, Copán Department	100
Lead		Cía. Minera Santa Bárbara (Breakwater Resources, Ltd., 100%)	El Mochito Mine, Santa Bárbara Department	12
Petroleum products	thousand 42-gallon barrels	Refinería Texaco de Honduras, S.A. (Texaco, Inc. 100%)	Puerto Cortés, Cortés Department	5,040
Silver	kilograms	Cía. Minera Santa Bárbara (Breakwater Resources, Ltd., 100%)	El Mochito Mine, Santa Bárbara Department	50
Do.	do.	Cía. Minera El Paso Mining (private, 100%)	La Pochota Mine, Valle Department	20
Steel		Aceros de Honduras, S.A.	Choloma, Cortés Department	14
Zinc		Cía. Minera Santa Bárbara (Breakwater Resources, Ltd., 100%)	El Mochito Mine, Santa Bárbara Department	45

JAMAICA

AREA 11,000 km² **POPULATION 2.5 million**



THE MINERAL INDUSTRY OF

JAMAICA[1]

By George A. Rabchevsky

Jamaica is the third largest Caribbean island. It lies about 145 km south of Cuba. About 70% of the island is covered by Tertiary limestones. The limestones host deposits of bauxite and produced karst topography. The older Cretaceous igneous rocks contain copper and gold occurrences.

Real gross domestic product (GDP) in 1993 increased by about 1%, inflation was at 30%, and unemployment at 20%. Bauxite and alumina were Jamaica's second strong hard currency earners, following tourism. In 1993, bauxite mining represented almost 9% of the GDP. One-half of Jamaica's land mass is used for bauxite mining and alumina production; the other one-half is under agriculture. Jamaica is the third largest producer of bauxite ore, after Australia and Guinea, and fourth in the production of alumina. The bauxite and alumina commodities contributed about 75% to the total export value. There are also substantial deposits of gypsum, limestone, marble, silica, and natural whiting. Limestone was used domestically in the production of lime, road construction, and for other purposes.

GOVERNMENT POLICIES AND PROGRAMS

A series of laws regulating mining in Jamaica was issued in 1947. In 1950, law No. 12, the Bauxite and Alumina Industries (Encouragement) Law, was enacted. The mining companies in Jamaica always were required to restore the mined land to its former level of productivity.

Raw materials generally are subject to an import duty of 10% and a general consumption tax (GCT), unless there is special exemption in force. Under the deferment scheme established under the General Consumption Tax Act, the GCT assessed on imported raw materials, consumables, intermediate goods, and spare parts will not be paid by the manufacturer.

The National Development Bank of Jamaica (NDB), established in 1981, provides financing of projects in the manufacturing, tourism, agro-industrial, and mining sectors. The Jamaica Pre-Investment Programme (JPIP), operated under the auspices of the Planning Institute of Jamaica, provides financing for prefeasibility studies for industrial, manufacturing, tourism, agricultural, and energy projects. JPIP was established in 1977 by the Inter-American Development Bank and the Government of Jamaica. Projects must contribute to the Jamaican economy through foreign exchange earnings, savings, or employment generation. The Trafalgar Development Bank (TDB), a privately owned Jamaican development bank, provides medium- and long-term financing and limited equity investment for manufacturing, agricultural, tourism, mining and quarrying, and construction projects. TDB was established in 1985.

ENVIRONMENTAL ISSUES

In Jamaica, all projects involving the mining and construction of infrastructures, such as the capacity expansion of alumina refineries, require preparation of environmental impact reports. Mining companies usually make private agreements with residential districts close to their mining areas. The production of alumina, bauxite, and tourism is very important to the Jamaican economy, and they are all affected by the conservation of the regional ecology and protection of the environment on the island. Jamaica relies totally on imported oil, and every gas station, oil pipeline, and refinery must be checked for pollution problems so that tourists would be welcomed on the island with an unpolluted environment.

PRODUCTION

Jamaica remained an important world producer of bauxite and alumina. Jamaica also produced cement, gypsum, lime, marble, salt, sand and gravel, silica sand, and stone. Except for some cement and salt, all industrial minerals were used domestically. Mineral production continued at the 1992 level because of economic and political changes and because of unusual floods caused by rains during April and May. *(See table 1.)*

TRADE

Jamaica was a beneficiary of the Caribbean Basin Initiative, a program designed to improve economic relations between the United States and the nations of the Caribbean basin. Bauxite and alumina in Jamaica accounted for about 75% of total exports. The United States was Jamaica's major market for bauxite and alumina. Jamaica also conducted trade with Canada, Trinidad and Tobago, and the United Kingdom. Jamaica imported all of its crude oil for petroleum refinery products, primarily from Mexico and Venezuela and some from Ecuador.

In 1993, total exports amounted to about $1.1 billion[2] and imports amounted to $2.0 billion. U.S. exports to Jamaica amounted to $1,020 million in 1993, representing 51% of Jamaica's total imports.

STRUCTURE OF THE MINERAL INDUSTRY

The Jamaican Government retained part ownership of the mining companies on the island. In the 1970's, the

Jamaican Government purchased 51% of the local operations of Kaiser Aluminum Corp. and Reynolds Corp. and 6% and 7% of Aluminum Co. of America and Alcan Aluminum Ltd., respectively. In return, these companies were granted 40-year mining leases. Reynolds has since withdrawn from Jamaica.

The laws and regulations controlling mining and prospecting were administered by the Commissioner of Mines. Files of the exploration assessments were maintained by the Ministry of Production, Mining and Commerce.

The Jamaica Promotions Corp. (JAMPRO) is Jamaica's economic development agency. Its role is to encourage investment and production, to assist in the modernization of industries, and to promote the export of Jamaican-made products. The primary aim of JAMPRO is the creation of more jobs and foreign exchange inflows. *(See table 2.)*

COMMODITY REVIEW

Metals

Alumina and Bauxite.—The bauxite deposits and alumina plants are in the north and south-central areas of the island. There were six mining areas with three alumina plants. Gross earnings from the bauxite-alumina industry dropped by 9% to $529 million in 1993, despite a modest increase in alumina output. Net earnings have dropped annually since 1990, when the industry earned $705 million. In 1993, 3.9 Mmt of bauxite and 2.9 Mmt of alumina were exported. About 36% of the bauxite ore was shipped unprocessed, primarily to the United States. The balance was processed locally at three refineries and exported as alumina to the North American and European smelters.

The largest bauxite company in Jamaica was Kaiser Jamaica Bauxite Co., Ltd. at Discovery Bay, St. Ann Parish. Kaiser has been operating at this location since 1967. Alumina Partners of Jamaica (Alpart) was the island's largest alumina refinery. The Alpart plant was undergoing an expansion, from 1.2 Mmt/a to 1.5 Mmt/a in 1995. The second largest alumina company Alcan Jamaica Co. (Jamalcan) was the only Canadian-owned alumina producer on the island. The Jamalcan capacity of 1.1 Mmt/a was being expanded to 1.5 Mmt/a. The third largest refinery, Jamalco, had a capacity of 750,000 mt/a and was being expanded to 1 Mmt/a.

The construction of a 1-Mmt/a alumina refinery was planned at Trelawny in the northwest of the island. Once completed, the plant would employ 750 workers. The total cost of the project was estimated at $1.5 billion.

Copper and Gold.—Of the 55 nonbauxite mining licenses issued, the Government authorized 30 for gold, 15 for marble, and 10 for limestone.

The Vancouver-based Golden Ring Resources Ltd. continued its exploration program for copper and gold in Jamaica. The Camel Hill, Connors, and Geo Hill copper and gold prospects in the Bellas Gate area were the initial targets. Other Canadian companies included Citadel Gold Mines, Galico Resources, and Tantalus Resources. Reportedly, Trev Corp. in Vancouver discovered high-grade copper mineralization at its Golden Spring property, 10 km north of Kingston. Trev Corp. also signed a letter of intent with BHP Minerals International Inc., allowing BHP to earn up to a 100% interest in one of Trev's Jamaican properties, designated as SEPL 400. The property is one-third of Trev's holdings in the country, consisting of the Camel Hill and Connors porphyry-copper deposits. The exploration programs were funded by the Jamaican Ministry of Mining, Energy, and Tourism and the Canadian International Development Agency.

Industrial Minerals

Cement.—Jamaica was self-sufficient in cement. Caribbean Cement Co. Ltd. (CCC), privately owned, was the only operating cement company in Jamaica. About 6% of its production was exported to neighboring islands in 1993.

Other Industrial Minerals.—Jamaica produced gypsum, lime, marble, salt, construction and industrial sand and gravel, and crushed stone. Jamaica Gypsum and Quarries Ltd. was acquired by the CCC in 1990, thus increasing its production from 82,210 tons to an estimated 145,000 tons in 1993.

Jamaica mined marble in the Edge Hill Quarry, Hellshire, St. Catherine Parish, by the Hellshire Marble Ltd. headquartered in Kingston. Marble Farms Ltd. is a private company in Kingston, recently incorporated. The company owns vast reserves of Jamaican marble at Red Ground, also in the parish of St. Catherine.

Jamaica contains large quantities of high-purity limestone. The Tertiary White Limestone Group covered about 65% of the island, with thicknesses of 1,500 m. Other limestone formations also exist in the country. A number of U.S. companies were investigating deposits of high-grade limestone, mainly in St. Ann Parish. Other areas being investigated lie in the eastern (St. Thomas Parish) and western (Westmoreland Parish) parts of the island.

The expansion of the alumina industry in Jamaica created added demands for lime, which is an integral part of the alumina process. The Jamaica Bauxite Institute initiated a feasibility study of building a caustic soda plant in Jamaica. Consultants Gale Peters & Associates completed the first stage of the study to build a 100,000-mt/a caustic soda plant. The plant will use locally available limestone and imported soda ash for the production of caustic soda. The plant project also will include a precipitated calcium carbonate plant (capacity 50,000 mt/a), a ground calcium carbonate plant (50,000 mt/a), and a sodium bicarbonate facility (50,000 mt/a). The status of that plant is now uncertain because of a significant drop in world prices of caustic soda. The country's alumina plants usually imported about 275,000 tons of caustic soda, mostly from Canada and the United States.

Mineral Fuels

Jamaica's domestic sources of energy are limited, and the country relied on imports, almost exclusively oil, to meet its energy needs. Jamaica imported crude oil and petroleum products from Mexico and Venezuela. Petroleum Corp. of Jamaica, a wholly owned Government company, is the only petroleum company in Jamaica. Petroleum products

consumption is linked closely to the bauxite-alumina sector, consuming about 45% of all petroleum products. The oil refinery in Kingston distilled all imported oil.

Peat was being investigated as a potential source of energy in Jamaica. Deposits are estimated to be large enough to generate 50 to 60 MW of electricity for the next 30 years.

The Jamaica Public Service Co. (JPS) installed a 544-MW powerplant, using oil-fired units. Reportedly, a 35-MW gas-fired turbine became operational at the Hunts Bay plant in December. The project was the first under the energy-sector privatization program being cofinanced by the World Bank and Inter-American Development Bank. Another 60-MW diesel unit is expected to become operational in 1995. The hydropower potential of Jamaica was estimated to be about 114 MW, 24 MW of which has already been developed, representing 4% of the installed electrical generating capacity of 544 MW.

Reserves

Reserves of bauxite in Jamaica were estimated at 2.3 billion tons. Gypsum reserves were estimated to be 5 Mmt. Reserves of high-purity limestone were estimated at 150 billion tons.

INFRASTRUCTURE

The country's mining sector transported ore by road, railroad, and conveyor. Railroads, 294 km in length, carried most of Jamaica's bauxite and alumina. Jamaican bauxite mines are close to shipping ports, and the ports are relatively close to the refiners and smelters in the United States. The Inter-American Development Bank granted two loans to Jamaica totaling $36 million for the improvement of infrastructure in Montego Bay and its surroundings. The area was selected for its tourism and export-oriented production, including bauxite.

Jamaica has two major ports, one at Kingston and the other at Montego Bay. Bauxite was exported from Port Rhoades and Rocky Point, while alumina was shipped from Port Kaiser and Port Esquivel.

Oil tanker terminals are in Kingston, Montego Bay, Ocho Rios, and Port Kaiser. Petroleum products were distributed through a 10- km pipeline.

OUTLOOK

Economic growth prospects are likely to be constrained by foreign exchange problems, high inflation, the uncertain international market for bauxite-alumina, and the impact of the Government's restricted fiscal and monetary policies. Industry experts project that both bauxite and alumina production will remain at about the same level in 1994, as will the rest of the mineral commodities. The Government is expected to emphasize restraint of fuel consumption and diversification of the sources of energy, such as peat, coal, hydropower, wind, solar, and biomass over the next 5 to 10 years, thus reducing the country's dependence on imported fuel and vulnerability to fuel price fluctuations.

Since 1989, the Government has pursued a bold program of reforms, including a privatization program, tax reforms, liberalization of trade, and exchange rate regimes. The Government is committed in particular to the privatization and deregulation of the energy sector, including its JPS. The transmission and distribution of electricity will be separated from generation and, therefore, will be privatized separately. This will provide an additional 60 MW by 1995 by the new company, Jamaica Power Partners.

[1]Text prepared Mar. 1994.

[2]Where necessary, values have been converted from Jamaican dollars (J$) to U.S. dollars at the rate of J$22.2=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Commissioner of Mines
Ministry of Production, Mining and Commerce
P.O. Box 189
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National Development Bank of Jamaica Ltd.
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Trafalgar Development Bank Ltd.
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Publications

International Bauxite Association: IBA Review, Quarterly.
The Jamaican Bauxite Institute: Annual report.
The Jamaican Bauxite Institute: JBI Journal, annual.
Planning Institute of Jamaica: Economic and Social Survey Jamaica, annual report.
U.S. Central Intelligence Agency, Washington, DC: World Factbook, annual.

TABLE 1
JAMAICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1, 1994)
Aluminum:							
Bauxite, dry equivalent, gross weight	thousand tons	9,601	10,921	r11,552	r11,302	211,307	12,500
Alumina	do.	2,221	2,869	3,015	r2,917	22,989	3,045
Cement, hydraulic	do.	436	442	395	481	480	830
Gypsum		78,010	82,210	135,844	144,977	144,000	175,000
Iron and steel: Steel, crude		36,732	23,820	e25,000	e25,000	24,500	38,000
Lead, refined (secondary)e		1,000	1,000	1,000	1,000	800	1,000
Lime e		90,000	90,000	95,000	2179,059	200,000	250,000
Petroleum refinery products	thousand 42-gallon barrels	5,928	8,203	6,890	e7,000	7,000	9,000
Salt		15,621	12,124	e14,000	e14,000	13,500	17,000
Silica sand		15,200	16,643	15,622	15,622	15,500	17,000
Stone:							
Limestone	thousand tons	6,800	6,046	5,480	4,298	4,000	8,000
Marble, cut and/or polished		5,000	4,000	12,000	4,620	4,500	15,000
Marl and fill	thousand tons	7,560	7,830	2,950	e3,000	3,000	8,000
Sand and gravel	do.	2,250	2,375	1,214	1,347	1,300	3,500

eEstimated. rRevised.
[1]Table includes data available through Mar. 15, 1994.
[2]Reported figure.

TABLE 2
JAMAICA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Destinations, 1992	
				United States	Other (principal)
METALS					
Aluminum:					
Ore and concentrate	thousand tons	4,261	4,128	4,128	
Oxides and hydroxides	do.	3,036	2,951	504	Ghana 3,757; Norway 704; Canada 664.
Metal including alloys:					
Scrap		846	899	774	Japan 99; United Kingdom 17.
Semimanufactures		222	186	69	Trinidad and Tobago 105; Martinique 11.
Copper:					
Matte and speiss including cement copper		15	—		
Metal including alloys:					
Scrap		707	753	531	United Kingdom 215; Canada 7.
Semimanufactures		150	(2)	—	All to Guyana.
Gold: Waste and sweepings	kilograms	—	90	—	All to Canada.
Iron and steel: Metal:					
Scrap		116	10,525	10,413	Hong Kong 72; United Kingdom 34.
Semimanufactures:					
Flat-rolled products: Of iron or nonalloy steel:					
Not clad, plated, coated		200	—		
Clad, plated, coated		90	90	—	All to Guyana.
Bars, rods, angles, shapes, sections		1	5	—	NA.

See footnotes at end of table.

TABLE 2—Continued

JAMAICA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Destinations, 1992	
				United States	Other (principal)
METALS—Continued					
Iron and steel: Metal—Continued:					
Semimanufactures—Continued:					
Tubes, pipes, fittings		1	1	1	
Lead: Metal including alloys, scrap		249	289	36	Panama 181; Netherlands Antilles 36.
Tin: Metal including alloys:					
Scrap		260	122	122	
Semimanufactures		40	98	—	All to Barbados.
Zinc:					
Blue powder		—	39	39	
Metal including alloys:					
Scrap		25	9	9	
Semimanufactures		—	798	84	Trinidad and Tobago 454; Guyana 260.
Other: Ashes and residues		68	—		
INDUSTRIAL MINERALS					
Cement		20,277	35,325	23,152	Guyana 4,700; St. Lucia 2,186.
Diamond: Natural: Dust and powder	value	$21,336	—		
Fertilizers materials: Unspecified and mixed	kilograms	—	220	—	All to Cayman Islands.
Gypsum and plaster		74,437	115,437	86,372	Trinidad and Tobago 16,938; Colombia 12,124.
Salt and brine		2,752	5,620	—	Trinidad and Tobago 2,352; Guyana 1,443; St. Lucia 717.
Sodium compounds, n.e.s.: Sulfate, manufactured		—	91	91	
Stone, sand and gravel:					
Gravel and crushed rock		83	58,722	56,454	Cuba 2,268.
Limestone other than dimension		36,299	50,779	47,355	Venezuela 2,999; Trinidad and Tobago 18.
Sulfuric acid		437	416	—	Trinidad and Tobago 346; Barbados 44; Belize 26.
Talc		8	—		
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Liquefied petroleum gas	42-gallon barrels	—	12	12	
Gasoline	do.	321	11,649	11,523	Cayman Islands 126.
Mineral jelly and wax	do.	13	2	1	St. Vincent and the Grenadines 1.
Distillate fuel oil	thousand 42-gallon barrels	104	20,008	19,167	Panama 835.
Lubricants	do.	51	57	(2)	Guyana 14; Suriname 14; Trinidad and Tobago 9.
Residual fuel oil	do.	74	5,675	5,569	Antigua and Barbuda 28: Peru 11.
Bitumen and other residues	42-gallon barrels	215	(2)	—	All to Belize, Grenada, and St. Lucia.

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

TABLE 3

JAMAICA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Sources, 1992	
				United States	Other (principal)
METALS					
Aluminum:					
Ore and concentrate		16,629	—		
Oxides and hydroxides		39,945	62	61	United Kingdom 1.
Metal including alloys:					
Scrap	kilograms	—	41	41	
Unwrought		—			
Semimanufactures		2,100	2,328	1,104	Panama 586; United Kingdom 126.
Antimony: Metal including alloys, all forms	kilograms	998	—		
Chromium:					
Ore and concentrate	do.	—	45	45	
Oxides and hydroxides		5	1	—	All from Japan.
Cobalt: Oxides and hydroxides	kilograms	—	5	5	
Copper:					
Matte and speiss including cement copper	do.	—	33	33	
Sulfate	do.	940	28,289	36	Canada 65; Germany 50; unspecified 28,123.
Metal including alloys:					
Scrap	do.	—	100	100	
Unwrought	do.	172	2,944	119	United Kingdom 1,795; Trinidad and Tobago 1,030.
Semimanufactures		828	1,082	485	United Kingdom 226; Taiwan 103.
Gold:					
Waste and sweepings	kilograms	67	—		
Metal including alloys, unwrought and partly wrought	do.	r17	15	13	Canada 2.
Iron and steel: Metal:					
Scrap		2	3	2	Canada 1.
Pig iron, cast iron, related materials		4	7	6	Do.
Ferroalloys:					
Ferromanganese	kilograms	—	45	45	
Ferrosilicon		2	2	2	
Silicon metal[2]	kilograms	1,045	200	200	
Unspecified	value, thousands	—	$26	$26	
Steel, primary forms		31,996	17,926	34	Venezuela 17,892.
Semimanufactures:					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		12,300	10,845	1,432	United Kingdom 3,247; Trinidad and Tobago 1,409.
Clad, plated, coated		821	1,353	321	Guyana 274; Taiwan 169.
Of alloy steel		2,402	3,133	468	United Kingdom 2,166; Brazil 149.
Bars, rods, angles, shapes, sections		23,049	20,567	3,553	Trinidad and Tobago 9,046; Venezuela 4,656.
Rails and accessories		166	149	118	United Kingdom 26; France 5.
Wire		1,967	3,597	45	Trinidad and Tobago 2,921; Venezuela 320; United
Tubes, pipes, fittings		4,186	4,035	2,771	United Kingdom 307; Venezuela 286.
Lead:					
Oxides		95	61	23	Spain 20; Panama 10.
Metal including alloys, semimanufactures		135	68	32	Panama 30; United Kingdom 6.
Magnesium: Metal including alloys, semimanufactures	kilograms	875	32	32	

See footnotes at end of table.

TABLE 3—Continued

JAMAICA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Sources, 1992	
				United States	Other (principal)
METALS—Continued					
Manganese:					
Ore and concentrate		—	18	—	All from United Kingdom.
Oxides	kilograms	6	19,793	386	Mexico 18,000; Canada 907; Germany 500.
Molybdenum: Metal including alloys, semimanufactures	do.	—	52	52	
Nickel:					
Ore and concentrate	do.	—	228	68	Germany 160.
Metal including alloys, semimanufactures		15	11	5	Germany 5; United Kingdom 1.
Platinum-group metals: Metals including alloys, unwrought and partly wrought	kilograms	29	5	5	
Rare-earth metals including alloys, all forms	do.	55	32	32	
Selenium, elemental	do.	182	200	200	
Silver: Metal including alloys, unwrought and partly wrought	do.	21	285	257	Guadeloupe 25; Canada 3.
Tin: Metal including alloys:					
Unwrought	do.	136	—		
Semimanufactures		5,401	5,054	1	United Kingdom 3,446; Netherlands 832; French Guiana 314.
Titanium:					
Ore and concentrate		—	20	(e)	Mainly from France.
Oxides		668	1,210	984	United Kingdom 225; Germany 1.
Tungsten: Metal including alloys, semimanufactures	kilograms	191	122	122	
Zinc:					
Ore and concentrate		—	2	—	All from Germany.
Oxides		226	210	131	United Kingdom 40; Germany 21.
Blue powder	kilograms	1	1,854	1,854	
Metal including alloys:					
Scrap		79	49	—	All from Canada.
Unwrought	kilograms	6	—		
Semimanufactures		75	227	23	New Zealand 97; Peru 71; Belgium-Luxembourg 29.
Other:					
Ores and concentrates	kilograms	—	3	3	
Oxides and hydroxides		37	—		
Ashes and residues		—	216	1	Netherlands 215.
Precious metals, waste and scrap	kilograms	20	—		
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		34	10	10	
Artificial:					
Corundum	kilograms	9	19,282	19,282	
Silicon carbide		6	26	11	Argentina 12; Germany 2.
Grinding and polishing wheels and stones		19	16	5	Switzerland 4; Netherlands 2.
Asbestos, crude		21	20	(e)	Mainly from Canada.
Barite and witherite	kilograms	2	495	495	
Boron materials:					
Crude natural borates	do.	8	—		
Oxides and acids		11	5	1	Germany 3; China 1.

See footnotes at end of table.

TABLE 3—Continued

JAMAICA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Sources, 1992	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Bromine[4]	kilograms	240	25,274	25,184	United Kingdom 90.
Cement		1,838	53,384	52,082	Colombia 420; Belgium-Luxembourg 404.
Chalk	kilograms	33	38	36	United Kingdom 2.
Clays, crude:					
Bentonite		3	182	2	Guatemala 179; United Kingdom 1.
Kaolin		53	36	32	Japan 3; United Kingdom 1.
Unspecified		264	369	365	United Kingdom 4.
Diamond: Natural:					
Gem, not set or strung	value	$179,467	—		
Industrial stones	kilograms	12	10	—	All from United Kingdom.
Diatomite and other infusorial earth		22	25	25	
Feldspar		12	26	26	
Fertilizer materials:					
Crude, n.e.s.	kilograms	7,677	27	27	
Manufactured:					
Ammonia		178	71	54	Trinidad and Tobago 17.
Nitrogenous		22,110	40,038	9,063	Canada 30,941; Belgium-Luxembourg 17.
Phosphatic		333	290	10	Dominica 280.
Potassic		404	2,738	1	Canada 2,405; Israel 300; Belgium-Luxembourg 32.
Unspecified and mixed		26,149	45,953	11,682	Canada 34,266; United Kingdom 3.
Graphite, natural		6	2	1	United Kingdom 1.
Gypsum and plaster		286	172	92	Germany 78; United Kingdom 2.
Iodine	kilograms	141	491	398	United Kingdom 73; Germany 20.
Lime		—	1,962	1,962	
Magnesium compounds:					
Magnesite, crude	kilograms	6	—		
Oxides and hydroxides	do.	1,047	—		
Sulfate		44	32	8	Germany 19; United Kingdom 5.
Mica:					
Crude including splittings and waste		157	204	11	Norway 128; United Kingdom 65.
Worked including agglomerated splittings	kilograms	10,309	599	597	United Kingdom 2.
Nitrates, crude	do.	272	1	1	
Phosphates, crude		441	173	2	NA.
Phosphorus, elemental		7	(5)	(5)	
Pigments, mineral: Iron oxides and hydroxides, processed		145	177	2	Germany 129; United Kingdom 37; Spain 3.
Potassium salts, crude		19	—		
Precious and semiprecious stones other than diamond:					
Natural	value	—	$2,636	$2,636	
Synthetic	do.	$8,274	—		
Pyrite, unroasted		10	5	5	
Salt and brine		26,075	20,740	20,620	Canada 117; United Kingdom 3.
Sodium compounds, n.e.s.:					
Soda ash, manufactured		4,123	6,184	5,991	Germany 193.
Sulfate, manufactured		4,160	1,749	57	Mexico 1,510; Spain 84.

See footnotes at end of table.

TABLE 3—Continued

JAMAICA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Sources, 1992	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		558	77	14	Italy 63.
Worked		293	54	44	Italy 10.
Gravel and crushed rock		19	104	41	Italy 63.
Quartz and quartzite		6	6	(3)	Mainly from Colombia.
Sand other than metal-bearing		840	656	655	United Kingdom 1.
Sulfur:					
Elemental:					
Crude including native and byproduct		4	—		
Colloidal, precipitated, sublimed		6,033	6,031	6,030	Germany 1.
Dioxide	kilograms	—	9	9	
Sulfuric acid		21	75	75	
Talc, steatite, soapstone, pyrophyllite		671	634	592	Norway 19; United Kingdom 18.
Vermiculite including chlorite and perlite	kilograms	136	2,609	2,555	Canada 54.
Other:					
Crude		1	19	9	Barbados 10.
Slag and dross, not metal-bearing		—	126	9	Netherlands 117.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		1,319	14	10	United Kingdom 3; Canada 1.
Carbon including carbon black		1,065	902	280	Venezuela 622.
Coal:					
Bituminous	kilograms	—	56	56	
Briquets of anthracite and bituminous coal	do.	8	10	10	
Coke and semicoke		43,810	105	97	United Kingdom 8.
Peat including briquets and litter	kilograms	299	1,619	—	All from United Kingdom.
Petroleum:					
Crude	thousand 42-gallon barrels	6,912	8,774	80	Mexico 6,108; Venezuela 2,585.
Refinery products:					
Liquefied petroleum gas	do.	707	653	443	Panama 145; Trinidad and Tobago 39.
Gasoline	do.	935	186	131	Brazil 55.
Mineral jelly and wax	do.	11	9	5	Germany 1; Japan 1.
Kerosene and jet fuel	do.	5,476	1,224	131	Netherlands Antilles 878; Mexico 109.
Distillate fuel oil	do.	1,197	1,003	392	Netherlands Antilles 446; Venezuela 105.
Lubricants	do.	72	6	4	Netherlands Antilles 2.
Residual fuel oil	do.	11,143	5,232	4,660	Netherlands Antilles 571.
Bitumen and other residues 42-gallon barrels		485	407	298	France 109.
Bituminous mixtures	do.	2,186	465	194	Venezuela 257; United Kingdom 14.
Petroleum coke	do.	—	19	19	

[r]Revised. NA Not available.
[1]Table prepared by H. D. Willis.
[2]May include high-purity silicon.
[3]Less than 1/2 unit.
[4]Includes fluorine.
[5]Unreported quantity valued at $115.

TABLE 4

JAMAICA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

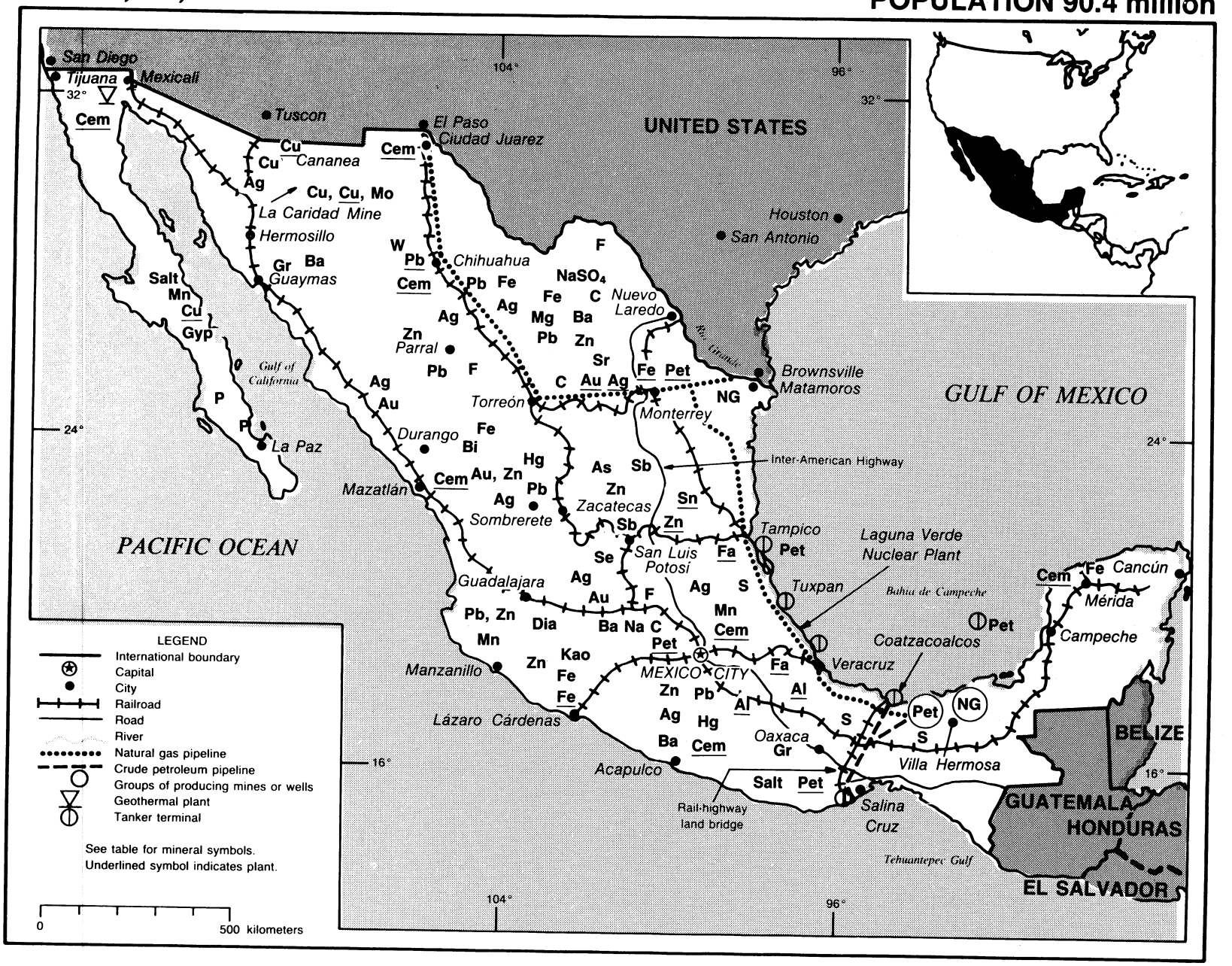
(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina	Alumina Partners of Jamaica (Alpart) (Kaiser Aluminum Corp., 65%; Hydro Aluminum Jamaica a.s., 35%)	Nain, St. Elizabeth Parish	1,200
Do.	Alcan Jamaica Co. (JAMALCAN) (Alcan Aluminum Ltd. Canada, 93%; Government, 7%)	Kirkvine, Manchester Parish, and Ewarton, St. Catherine Parish	1,096
Do.	Jamalco (Aluminum Co. of America/Government, 50%; Clarendon Alumina Production Ltd., 50%)	Halse Hall plant at Clarendon, Clarendon Parish	750
Bauxite.	Kaiser Jamaica Bauxite Co., Ltd. (Government, 51%; Kaiser Aluminum Corp., 49%)	Kirkvine, Manchester Parish; Water Valley, Discovery Bay, St. Ann Parish	4,500
Do.	Jamaica Bauxite Mining Ltd. Lydford Mines (Government, 100%)	Lydford, St. Ann Parish	2,500
Cement	Caribbean Cement Co. Ltd. (private, 100%)	Rockfort, St. Andrews Parish	830
Petroleum products thousand 42-gallon barrels	Petroleum Corp. of Jamaica (Petrojam) (Government, 100%)	Refinery at Kingston, St. Andrews Parish	9,000

MEXICO

AREA 1,972,550 km²

POPULATION 90.4 million



THE MINERAL INDUSTRY OF

MEXICO

By Michael Mir Heydari and Javier Moya

Mexico, one of the world's leading mineral producers, ranked first in the production of silver, celestite (a strontium mineral), and sodium sulfate in 1993. It was among the top five producers of antimony, white arsenic, barite, bismuth, cadmium, fluorspar, and graphite. The production of cement, copper, diatomite, feldspar, gypsum, lead, lime, nitrogen in ammonia, sulfur, and zinc put Mexico in the top 10 world producers. In the Western Hemisphere, only Brazil and Mexico produced manganese in significant quantities.

For Mexico, 1993 was one of the most intense years in the country's recent history regarding political, economic, and social events. The North American Free Trade Agreement (NAFTA) was ratified by the legislative bodies of Canada, Mexico, and the United States. Banco de Mexico was granted autonomy. A new Pact of Stability, Competitiveness, and Employment was signed, introducing important incentives to the industrial activity. These included electricity tariff adjustments, a decrease in the income tax rate on interest paid abroad, and an increase in the depreciation rate for investment in pollution control equipment. Mexico's gross domestic product (GDP) was estimated at $364.5 billion in current prices, up from $329.1 in 1992.[1] Real GDP growth was 0.9% in 1993, compared with 2.6% in 1992. The world economic slowdown, particularly in the United States, Western Europe, and Japan, significantly impacted GDP growth. Government economic policies, beginning with the Economic Solidarity Pact in late 1987, followed by the Pact for Stability and Economic Growth, continued to be geared toward reducing inflation and maintaining economic growth. An extension of the Pact for Stability and Economic Growth was announced on November 20, 1992, and expired on December 31, 1993. In 1993, inflation, as indicated by the consumer price index, decreased to 8%, compared with 11.9% in 1992 and 18.8% in 1993. Inflation levels continued to be low when compared to those of previous years. In 1987 and 1988, inflation had been 150% and 57%, respectively. The Government's goal of reducing the inflation rate to the lowest rate of the past 20 years was accomplished.

The success of Mexico's external debt renegotiation has increased interest by domestic and foreign investment and credit communities. In December 1992, Mexico's total external debt was $114 billion, approximately 75.8% of wich was held by the public sector. Total external debt rose to $120.2 billion as of June 1993. Total debt as a proportion of GDP fell slightly from 34.6% in 1992 to 34.3% for 1993.

Several mines closed and some reopened during 1992 and 1993. The Frisco Group closed the Lampazos silver mine in July 1992. The Real de Angeles silver mine closed in early 1993 but reopened in late 1993. It continued to supply the flotation plant from the ore stockpile. The Frisco Group closed Minera San Francisco del Oro near Hidalgo del Parral in the State of Chihuahua in February 1993; the mine was reopened in late 1993. The Bolaños Mine in Jalisco closed in May 1992, was purchased by the Grupo Industrial Minera México (IMMSA). Minera Santa Maria de la Paz continued to mine only copper minerals while seeking investors and/or partners. The Santa Maria de la Paz used to produce gold, silver, lead, and zinc.

Several new projects were being studied or developed in 1993. These included Minera Bismark, a zinc-silver mine in Chihuahua in which Peñoles increased its participation to 90% by acquiring the 40% share of Cyprus Minerals Co. for $61 million; La Cienega, a gold and silver mine in Durango, a $70 million Peñoles project in the construction phase; Tizapa, a $38 million silver, lead, and zinc mine in the State of Mexico, scheduled for May 1994 startup; Rey de Plata, a lead and zinc project in Guerrero; Concheno, a $12 million underground gold, silver, and zinc project in Chihuahua; Santa Fe, a gold and silver prospect in Chiapas; San Felipe, a $20 million gold project by Frisco in Baja California Norte; San Martin, a $3 million expansion gold project by Sanluis in the State of Queretaro, which started operation during the last quarter of 1993, increasing gold production by 30%; Promontorio gold expansion project in Durango scheduled to come on-stream at the end of 1994, with an additional 30% gold production; La Choya, a $2 million heap-leaching operation in Sonora; La Colorada in Sonora, a $2 million gold project; Moris in Chihuahua, a $17 million gold project; El Oro in the State of Mexico, an old gold and silver mine reopened by Sanluis after investing $45 million; Metates, a $5 million Sanluis project in Durango; Mariquita, a $30 million Frisco copper project in Sonora; and Cerro del Mercado, an old iron mine in Durango, which was reopened by Grupo Acerero del Norte after investing $15 million. The total investment in all these projects is on the order of $325 million. In addition, more than 20 new prospects, mainly gold and copper, are being explored intensively by Mexican and foreign mining enterprises. The cement industry plans to increase its annual

capacity to 39 Mmt by 1994 and is investing $1.17 billion during the 1992-94 period in several projects and plants.

In 1993, Mexico was in sixth place as a producer of crude oil in the world and ranked eighth in terms of oil reserves. Average production of crude oil amounted to about 2.7 Mbbl/d in 1993. 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 less than 90% of that produced by Mexico. During 1993, Mexico exported 1,338 Mbbl/d of crude oil to 23 countries. Petróleos Mexicanos (PEMEX) exported 891,000 bbl/d of crude oil to the United States, or about 67% of its total crude oil exports. Spain was the second largest market, receiving less than 20% of PEMEX's crude oil exports. Next largest was Japan, which used to import about 150,000 bbl/d of crude oil, but only took about 5% of PEMEX's production.

The petroleum industry continued to dominate the Mexican economy, although dependence on the petroleum sector has been reduced significantly in recent years, from almost 80% of the 1982 value of total exports to about 30% in 1993. Approximately 90% of the value of petroleum exports (including petrochemicals) was from crude oil, about the same as that in 1991 and 1992.

GOVERNMENT POLICIES AND PROGRAMS

The Government's privatization efforts continued during 1992 with success in the area of the commercial banking and telecommunications industries. The most important privatizations completed were the sale of Mexico's 18 commercial banks (for which the Government received $12.4 billion) and an international equity placement by Teléfonos de México (Telmex) that raised $1.4 billion.

In September 1992, the Government of Mexico offered Minera Carbonífera Río Escondido, S.A. (MICARE), the northern Mexican coal producer, for privatization; it was purchased in October 1992 for $30 million plus the assumption of $100 million of debt. The company was purchased by a joint venture comprising Grupo Acerero del Norte (51%) and Mission Energy of the United States (49%). Minera Autlán, the manganese producer, was sold in July 1993 for $23 million to Grupo Ferrominero, a new mining group made up of Servisios Financieros S.A. de C.V., Grupo Minero Basis, S.A. de C.V., and Regiomet. Other mining properties offered for sale by the Government included Roca Fosfórica and the sulfur operations Azufrera Panamericana, S.A. (APSA) and Compañía Exploradora del Istmo (CEDI). CEDI is currently 66% owned by APSA and 34% by Texasgulf.

ENVIROMENTAL ISSUES

The protection of the environment is currently a priority for the Government of Mexico. Although several environmental protection laws and regulations had been issued since 1946, it was not until passing the General Law of Ecological Balance and Environment Protection (LGEEPA) in 1992 that important steps were taken in this regard. The Ministry of Social Development (SEDESOL) and the Ministry of Agriculture and Water Resources (SARH) are mainly responsible for the protection and preservation of environment in Mexico. Other ministries and agencies with more limited jurisdictions include: Secretaria de Salubridad y Asistencia (Health and Human Services), Secretaria de Comunicaciones y Transportes (Communications and Transportation), and Secretaria de Turismo (Tourism). A number of permits and authorizations with regard to environmental protection are required for mining and exploration-related activities. In accordance with LGEEPA, SEDESOL's authorization is required for all major exploration activities. Permits required for mining and plant operation include the following: water discharge permit, operating permit, land use permit, explosives permit, water well usage permit, and hazardous materials handling permit. In addition, there are regulations concerning noise, gas and dust emission, dumps and tailings, oil and fuel storage, and electrical transformers.

Water discharge regulations are covered under the National Water Law (LAN) of December 1, 1992, and the Federal Law Concerning Water Rights (LFDMA) of January 1992. According to Article 224 of LFDMA, water pumped from mine workings is not subject to discharge fees if it is not used in the "exploitation and/or metallurgical treatment of ore" or for other industrial or domestic use. Discharge fees are required for water containing more than 2,500 mg/l of total dissolved solids, unless the discharged water meets the minimum quality standards set by the Consejo Nacional de Agua (CONAGUA). Water discharged on runoffs or water basins is also exempted from payment of discharge fee if it meets CONAGUA water quality standards. All other water discharges require payment, according to schedules defined by LFDMA.

According to LGEEPA, infractions to the regulations will be sanctioned with one or more of the following penalties: a fine on the order of $115 to $75,000; temporary or permanent, partial or total, closure of plant; and 36 hours imprisonment of company officials.

PRODUCTION

The total value of all minerals produced, including petroleum, nonfuel minerals, and cement, in 1993 is estimated at $37.9 billion. The value of Mexican nonfuel mineral output plus coal (mining and metallurgical sector) decreased more than 2% from the 1992 value to $2.5 billion. Individually, copper was the most important metal in terms of value ($610 million), followed by zinc ($372 million) and silver ($336 million). Gray portland cement was the most valuable nonfuel mineral product in Mexico with a value of $3.41 billion in 1993. In the industrial mineral sector (excluding cement), salt was the most important in terms of value, at $90 million, followed by sulfur ($76.6 million) and gypsum ($75.2 million).

In general, the production of antimony, bismuth, celestite, coal, gold, graphite, gypsum, iron ore, molybdenum, and silver increased in 1993 compared to that in 1992, while production of barite, cadmium, coke, copper, feldspar, fluorspar, manganese, sulfur, and tin declined. Production of selenium and tungsten was suspended in 1993.

Output from the large mining sector represented by IMMSA, Corporación Industrial Sanluís, Empresas Frisco, Industrias Peñoles, and the new group, Aytrey-Ancira, dominated mining production. Autrey-Ancira, which owns Real del Monte y Pachuca, Bastan del Cobre, and Barita de Sonora, purchased Altos Hornos from the Mexican Government in 1991. In 1992, Autrey-Ancira, through Grupo Acerero del Norte, purchased 51% of coal producer MICARE. Grupo Ica, the large construction company, has a joint venture in concrete aggregates. The cement industry is dominated by Cemex, Apasco, and Cruz Azul. *(See table 1.)*

TRADE

In 1993, total Mexican exports amounted to an estimated $51.9 billion, up from $46.2 billion in 1992. Total imports were $65.4 billion, up from $62.1 billion in 1992. Exports exclusive of those from maquiladoras are estimated at about $30 billion. Nonfuel minerals plus coal and coke contributed about 2.4% of export revenues, valued at $1.24 billion. Relative to total trade, the United States was Mexico's leading trading partner. Other important partners were France, Japan, and Spain. A total of $39.6 billion, representing 76% of Mexico's total exports, was to the United States, while $41.4 billion, or 63% of its total imports, came from the United States. The mineral trade between the United States and Mexico was just as important to Mexico. Approximately two-thirds of Mexico's mineral exports went to the United States, while more than 60% of its mineral imports was from the United States.

The total value of hydrocarbons exports, including refinery products, was about $7.3 billion (14% of total exports). Mexico's hydrocarbon imports totaled about $1.3 billion. Therefore, net export earnings were about $6 billion, a 12% decrease from those of 1992.

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 1993, the President of the United States announced that he favored approval of NAFTA, with the proviso that supplemental agreements be concluded to address concerns regarding the environment, labor, and the ability to deal with unforeseen import surges. Negotiations on NAFTA's parallel agreements began on March 17, 1993, and were completed by yearend. NAFTA entered into force on January 1, 1994. It marked the high point of Mexico's trade liberalization program, begun in 1986 when Mexico joined the General Agreement on Tariffs and Trade (GATT). Bilateral United States-Mexican trade grew 16.5% in the first 4 months of 1994 to $30.8 billion. The impact of NAFTA on the financial sector will be more acutely felt in the second half of 1994 when the Mexican Government plans to issue authorization for the subsidiaries of United States and Canadian financial institutions. Mexico has expanded trade with its Latin American neighbors through other free trade agreements, the most recent of which is an agreement formally concluded with Colombia and Venezuela in June 1994. Seeking to expand its economic and trade ties beyond the Americas, Mexico joined the Asia Pacific Economic Cooperation (APEC) forum in November 1993 and the Organization of Economic Cooperation and Development (OECD) in April 1994.

Direct foreign investment totaled $4.9 billion in 1993, an 11.5% increase from that of 1992. During the first 3 months of 1994 direct foreign investment was $1.76 billion. At the end of March 1994, foreign investment in the Mexican stock market was $50.22 billion. Foreign investment in Mexico is expected to increase rapidly over the next several years due to a new foreign investment law, approved by the Mexican Congress in December 1993, that liberalized Mexico's investment regime in line with NAFTA provisions.

STRUCTURE OF THE MINERAL INDUSTRY

Under the 1917 Mexican Constitution, minerals are considered to be part of the patrimony of the nation. The Government awards concessions for the exploration and exploitation of nonfuel minerals. In most cases, foreign participation in the nonfuel mineral sector was limited to 49% ownership. The 1961 Mining Law imposed the requirement for a majority Mexican participation, in equity and management, of mining companies. The 1961 law granted a 25-year grace period for Mexicanization of the industry, but most companies in the mining industry were Mexicanized within 10 years. The 1975 Mining Law gave the Government even more control over mining activities. The law limited foreign participation to 34% in gaining concessions on national reserves and for the exploitation of certain minerals, such as iron ore and coal. Exploitation of oil and gas, phosphate rock, potassium, sulfur, and uranium was reserved for the Government. In 1990, a new regulation was issued by the Secretaría de Energía, Minas e Industria Paraestatal (SEMIP), which among other things, allowed more flexibility in foreign ownership through exploration and production trusts under the 1975 mining law.

Regulations of the new Mining Law, which became effective in September 1992, as well as the Manual de Servicios al Publico en Materia Minera, were published on March 25, 1993, in the official gazette. The new Mining Law allows the private sector to play a much larger role in the mining industry as the Government of Mexico continues to privatize State-owned companies, decontrols its mining reserves, and encourages domestic investment and foreign participation in the mining

industry. The law allows direct investment, with up to 100% ownership of the capital stock, in exploration works and activities. It also allows, through a 30- year trust mechanism, up to 100% of the capital stock renewable indefinitely, and foreign participation in mining works and activities. The new Mining Law clearly spells out the ores or substances covered by the law and provides greater legal security for holders of exploration and exploitation concessions. The law allows private-sector participation in the exploitation of mineral deposits previously considered as priority and strategic within the domain of Government ownership such as coal, iron, phosphorus, potassium, and sulfur. The law extends the term of exploitation concessions from 25 to 50 years, renewable for a similar period, while exploration concessions will be for a nonrenewable 6-year period. It allows exploration and mining, through competitive bidding, for minerals on the continental shelf and underwater shelves of islands, as well as the seabed and the subsoil of the exclusive economic zone. The only limiting factor of these concessions is that they are nontransferable.

The substances not covered by the 1992 Mining Law are as follows:

- Petroleum and solid, liquid, or gaseous hydrocarbons;
- Radioactive minerals;
- Substances contained in suspension or dissolution by subterranean waters, as long as they do not originate from a mineral deposit different from the components of the land;
- Rocks or the products of their decomposition that can only be utilized for the fabrication of materials for construction or are destined for such purposes;
- Products derived from the decomposition of rocks, whose exploitation is performed principally by open pit work; and
- Salt that comes from salt pits formed by the evaporation of brines in river basins.

The Mining Law eliminates the need for concessions for ore preparation plants, and the system of substances incorporated in the national mining reserves is eliminated. The individuals engaged in processing minerals subject to this law will be obligated to inform SEMIP when their operations begin, submit the relevant reports, and comply with the general regulations and specific technical standards in the area of environmental control.

The law brings greater flexibility to the management of mining affairs; eliminates excessive, repetitive obligations and red tape; stimulates small- and medium-scale mining production; and promotes private-sector investment in exploration and mining activities. The beneficial aspects of the 1992 Mining Law, combined with the reduction of corporate income tax to 35% in 1989 and the elimination of the mineral production tax in 1991, have led to an increase in large mining projects being launched with the participation of domestic and international private capital. During 1990 and 1991, it is estimated that almost $1 billion was invested in the Mexican mining sector, twice the rate of investment in 1989. To date, about 12.7 Mha of national mining reserves has been decontrolled. In addition, to encourage the exploitation of mineral deposits, the number of mining titles issued has doubled from 2,000 annually to more than 4,200, and the land area covered by concessions has increased from 2.8 Mha to 7.1 Mha.

In 1993, the nonfuel minerals sector in Mexico was formed by a mix of 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 minerals sector continued to be substantial under the policy guidance and coordination of SEMIP, although equity participation in the industry has declined dramatically since 1990 because of privatization policies. 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), have operated in the production, exploration, and development of the mining sector. CFM was founded in 1934 with the objective of promoting mining activity through financial support, technical advice, and assistance to the medium and small mining sector. It also was responsible for constructing and operating regional mineral beneficiation plants and mineral research facilities. CRM, formed in 1975, was given the responsibility for mineral exploration and statistics. Under the 1992 Mining Law, CRM also was given the ability to provide technical assistance such as reserve verification to promote the small and medium mining sector. FMNM's functions had been to promote the development, mining, and processing of the industrial minerals (nonmetal) sector. In 1990, management of CFM and FFM was merged with certain operations such as research laboratories assigned to CRM.

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 its regulations.

Other organizations helped shape the Mexican mining industry. One of them, Cámara Minera de México (CAMIMEX), promoted the interest of the mining industry as 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 Sanluís S.A. de C.V. (Sanluís), 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). The Autrey-Ancira Group, which owns or controls Real del Monte y Pachuca, Bastan del Cobre, Barita de Sonora, Altos Hornos, and MICARE, has joined the other four companies as a significant producer. The other significant change in the industry since 1990 has been the influx of more than 100 North American exploration companies in Mexico, most of which have set up offices in Hermosillo, Sonora.

Direct employment in the mining sector decreased for a second year in a row, to 165,000 workers, owing to the closing of several mines. However, the work force is expected to start growing again in 1994 due to development of new projects.

The production of crude oil, natural gas, and basic petrochemicals was reserved for the Government operating through PEMEX, the Government-owned monopoly. PEMEX's activities are regulated by the Regulatory Law to Article 27 of the Mexican Constitution (the "Regulatory Law") and the new Ley Orgánica de Petróleos Mexicanos y Organismos Subsidiarios (the "Organic Law"), which became effective July 17, 1992. Under the Organic Law and related regulations, PEMEX is entrusted with the central planning and the strategic management of the Mexican petroleum industry. The Organic Law reorganized the operating functions of PEMEX into four new subsidiary agencies:

- Exploración y Producción—charged with the exploration and exploitation of oil and natural gas.
- Refinación—controls the industrial refining processes, the manufacture of petroleum products, and basic petroleum derivatives and the distribution systems.
- Gas y Petroquímica Básica—in charge of processing natural gas and natural gas liquids, and the production of basic petrochemicals.
- Petroquímica—controls production of secondary and tertiary petrochemicals.

Each PEMEX subsidiary is in charge of its own budget and planning and is responsible for the transport, storage, and sales of its products. The subsidiaries also manage their own personnel, operations, investments, and property, and are held accountable for their actions and performance. Private investment is not allowed in the first three agencies, but encouraged in secondary and tertiary petrochemical operations.

At yearend 1993, PEMEX had approximately 110,000 employees (including temporary employees), most of whom are represented by the Petroleum Workers Union. This figure is down from 215,000 in 1987 and reflects the various measures undertaken by PEMEX to reduce its costs and improve its efficiency.

In February 1993, PEMEX approved the formation of an affiliate, PEMEX Medical Services, S.A. de C.V., to guarantee medical services for its employees. PEMEX Medical Services owns 21 hospitals, 9 clinics, 161 medical offices, 562 beds, and has 12,370 employees. It also is expected to provide services to the private sector for a fee. In early 1994, there were reports that PEMEX would split into as many as 11 operating companies. *(See table 2.)*

COMMODITY REVIEW

Metals

Copper.—Mine production increased 13% from production in 1992. Mexicana de Cobre was the leading producer with 53% of total output, from its La Caridad Mine, followed by Mexicana de Cananea S.A. de C.V. with 29%. In 1992, Mexicana de Cobre and Cananea had produced 52% and 23% of the total copper produced in Mexico, respectively. In 1993, the bulk of the copper was produced in the State of Sonora where the three largest mines, La Caridad, Cananea, and María, are located. Other important copper-producing States were, in descending order of output, Zacatecas, Chihuahua, San Luis Potosí, Michoacán, and Durango.

Smelter output increased 23% to 281.6 Mmt in 1993. Mexicana de Cobre's complex in Nacozari increased copper in anode production to 181,246 tons in 1993 compared with 164,962 tons in 1992. Mexicana de Cobre accounted for 64% of Mexican smelter production in 1993.

Mexico's production of 171,100 tons of refined copper in 1993 was 10.5% below that of 1992. The Cobre de México refinery accounted for more than 60% of refined copper production, followed by the Cobre de Pasteje refinery and Mexican de Cananea. Much of the anode and blister copper produced by Cananea and La Caridad is transported to Mexico City where it is refined in the Cobre de México electrolytic refinery. In response to the environmental problems of Mexico City, the refinery has transferred some of its production to its new facility in Celaya, Guanajuato.

The newest copper producer in Mexico is Minera María, a joint venture between Empresas Frisco (51%) and Cominco Resources (49%). The underground María Mine started up late in 1990 and achieved full production in 1991. The mine produced a total of 210,000 tons of ore with an average grade of 9% copper during 1992. The 1,000-mt/d concentrator came on-stream in November 1991 and processed 201,000 tons of ore in 1992, producing approximately 54,500 tons of concentrates. Total copper production of the María Mine amounted to slightly more than 16,600 tons in 1993.

Copper reserves of the two most important mines in Mexico were reported at levels of 1,500 Mmt of ore with an average grade of 0.393% copper for La Caridad Mine and for Cananea, 1,670 Mmt with an average grade of 0.618% copper for concentrate to be smelted, plus 850 Mmt of semioxidized or low-grade ore averaging 0.25% copper for solvent extraction and electrowinning (SX-EW).

Gold.—The most important development for Mexican gold in 1991-93

was the increased interest by Mexican and foreign mining companies in exploring for gold in Sonora, Durango, Baja California, Chihuahua, and Sinaloa. Many foreign companies have established investment trusts that allow 100% foreign ownership for their exploration efforts in Mexico.

Mine production of gold decreased slightly from 9,891 kg in 1992 to 9,792 kg in 1993. All gold mines produced silver as their primary product. Gold production from Sonora and Guanajuato decreased about 710 kg and 360 kg, respectively, compared to 1992 production, slightly offsetting the gain of 1,018 kg of gold production from Durango. Other important sources of gold production were the San Luis Mines in the San Dimas District near Tayoltita, Durango, and a number of small mines in Sinaloa. Production of gold in the Sam Dimas District in Durango State (Tayoltita, San Antonio, Promontorio, Castellana, and Rosario Mines) increased substantially to 2,862 kg. In 1993, Durango was the leading gold-producing State, contributing about 29% of the national gold production, followed by Guanajuato (26%), Sonora (18%), Sinaloa (6%), Chihuahua (5%), and Zacatecas (4%). Gold production in the Cucurpe municipality of Sonora, which includes the 49% Phelps Dodge-owned mine, Santa Gertrudis, decreased by 31% from 1992 to 1993, to 1,195 kg. The Cucurpe gold production had increased a staggering 113% in 1992, largely as a result of a full year's production from Santa Gertrudis.

The gold picture will continue to change through 1993 and 1994 as Minera Hecla's La Choya operation in northwestern Sonora began production at the end of 1993. The La Colorada property held by Eldorado Corp. Ltd. began recovering gold in early 1994. Eldorado, through its Mexican subsidiary Exploraciones Eldorado, S.A. de C.V. has earned an effective 70% interest in the La Colorada property from a subsidiary of Campbell Resources Inc. La Colorada has a reported geological resource of approximately 8,050 kg of gold. Other promising projects include the Empresa Minera Can Mex (Placer Dome) property at Mulatos and Cambior's Metates project in Durango State. Corporación Industrial Sanluis started operations in the San Martín project in Querétero State in the last quarter of 1993. This will increase the company's production by about 390 kg/a. The Promontorio Project of Sanluis, located in the San Dimas District of Durango, will consist of the development of rich veins in the southeast part of the district, increasing production from the Tayoltita area beginning in 1994.

Iron and Steel.—Production of pig iron increased slightly to 3.423 Mmt, and directly reduced (sponge) iron increased 18% to 2.736 Mmt. Mexico was the second largest producer of steel in Latin America after Brazil. Together, Brazil and Mexico produced about 85% of Latin American output. Mexico's share of the Latin American output was about 23%. Mexican production of crude steel increased more than 8% in 1993 and represented about 1.3% of the world total. Brazilian crude steel production increased 5.4% to 25.2 Mmt in 1993.

The largest steel producer in 1993 was Altos Hornos de México S.A. (AHMSA), with 2.59 Mmt, followed by Hylsa de México S.A. (HYLSA) in Monterrey, with an output of 2.03 Mmt, IMEXA, previously known as SICARTSA II, with 1.35 Mmt, and Siderúrgica Lázaro Cárdenas-Las Truchas S.A. (SICARTSA), with 1.17 Mmt. Tubos de Acero de México S.A. (TAMSA), with facilities in Veracruz and headquartered in Mexico City, was the fifth largest producer of crude steel with an output of 391,000 tons. TAMSA's most important domestic client was PEMEX.

In terms of process, 59.2% of crude steel was produced by electric furnace and 40.8% was produced by Basic Oxygen Furnace (BOF). The open-hearth process was no longer used in 1992.

Mexico exported about 1.96 Mmt of semifinished and finished steel products with a value of $864 million, while it imported 1.81 Mmt of semifinished and finished products with a value of $1.66 billion. Exports of semifinished and finished products in 1992 were 1.73 Mmt (revised) valued at $1.04 billion, while imports of semifinished and finished products in 1992 were (revised) 3.04 Mmt valued at $2.24 billion.

Lead and Zinc.—Mexico is the sixth largest producer in the world of lead and zinc. Both metals continued to be important to the Mexican mining industry. Mine production of zinc ranked second in terms of value after copper, but ahead of silver. Mine production of lead ranked fifth in terms of value, ahead of gold. In 1993, Mexico produced 9.5% of the world mine output of lead and 5.2% of world output of zinc. 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 more than 92% of the lead and zinc output in Mexico. In 1993, Peñoles was the leading producer of lead and zinc with 34.2% of the total lead and 28.7% of the zinc output. Grupo Industrial Minera Mexico was the leading Mexican zinc producer. During the year, its subsidiary Industrial Minera Mexico (IMMSA), through México Desarrollo Industrial Minero S.A. de C.V. (MEDIMSA), which is owned 31.2% by Asarco Inc., produced 51.5% of the zinc and 28.4% of the lead. Frisco produced 23.7% of the lead and 14.3% of the zinc. The six leading States in the production of lead in 1993, in order of importance, were Chihuahua, Zacatecas, Hidalgo, Durango, Sinaloa, and San Luis Potosí. The five leading States in the production of zinc were Chihuahua, Zacatecas, San Luis Potosí, Michoacán, and Hidalgo.

The largest individual lead producer in 1993 was Cia. Fresnillo in Naica, Chihuahua, which produced 43,046 tons of contained lead, followed by the Real de Angeles Mine (owned 51% by Empresas Frisco) at Noria de Angeles in Zacatecas, which produced 26,218 tons of contained lead and 32,750 tons of zinc. Frisco's other major producer, the San Francisco del Oro Mine near Hidalgo del Parral in Chihuahua, produced 10,249 tons of contained lead and 20,262 tons of zinc in 1993. Both mines were shut

down in early 1993 and reopened in early 1994. Real de Angeles processing capacity was expanded from 15,000 mt/d to 25,000 mt/d.

The Tizapa project in the State of Mexico, a joint venture between Peñoles and Dowa Mining, is a zinc-silver-lead deposit that is expected to be developed by mid-1994 at an initial production rate of 700 mt/d. Tizapa is a massive sulfide deposit with an estimated 4 Mmt of ore grading approximately 8% zinc, 2% lead, and 250 g/mt silver. Metallurgical results so far have been disappointing owing to graphite and iron minerals in the ore and low recovery rates in processing.

Mexico's largest new mining project, the Bismark Mine, is a zinc mine that commenced production in mid-1992. Bismark is near the U.S. border in Ascension, Chihuahua. Bismark produced 43,046 tons of zinc in 1993, which will make it the country's largest individual zinc producer. The flotation plant achieved its capacity level of 2,500 mt/d during 1993. Bismark has reserves of approximately 8.8 Mmt grading 8.5% zinc and 69 g/mt silver. Minera Bismark, S.A. de C.V. was originally a joint venture between Peñoles (40%), Cyprus Minerals (40%), and Promociones Industriales Banamex (20%). Peñoles has since bought out Cyprus and now controls 80% of the shares.

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 1993, with about 16% of world production. Mine production of silver amounted to 2.136 Mkg in 1993, an increase of 1.8% from that of 1992. In 1993, 87.3% of Mexican silver production came from six States: Zacatecas (39%), Durango (16.4%), Chihuahua (15.8%), Guanajuato (7.3%), Sonora (4.6%), and Hidalgo (4.2%). The leading producers were Peñoles (796,437 kg), Frisco (214,506 kg, 167,482 kg of which was from Real de Angeles S.A. de C.V.), and Grupo IMMSA (438,422 kg). In addition, byproduct silver from Mexicana de Cobre amounted to 75,793 kg of contained silver, and contained silver from Mexicana de Cananea amounted to 12,514 kg. The Fresnillo Mine in Fresnillo, Zacatecas, a joint venture between Peñoles (60%) and AMAX Mining Co. (40%), produced 452,350 kg (about 14.5 million ounces) of contained silver in 1993 but lost first place as the world's largest individual silver producer. The La Coipa gold-silver mine in Chile produced more than 500,000 kg (about 16.1 million ounces) to achieve the distinction as the world's largest silver producer during the year.

Most Mexican refined silver comes from facilities that also refine copper, lead, and zinc. The Peñoles facility at Torreón and the Industrial Minera Mexico plant in Chihuahua refine lead concentrates and produce large quantities of silver in the process. Silver also is produced from zinc concentrates at both of these facilities. The Cobre de Mexico refineries in Mexico City and Celaya, Guanajuato, extract silver from copper anodes. Real del Monte in Pachuca has a precious-metals refinery that processes silver and gold from the mine's concentrates and concentrates of other mines.

In January 1993, Mexico began producing new 10 peso silver coins. The Government also was expected to begin producing 20 peso silver coins. Production of coins containing silver could possibly represent consumption of 10% of national silver production. With the purpose of adding value to their silver production, Met-Mex Peñoles through the subsidiary Argentalli S.A. de C.V. began a joint venture with Calegaro, a major Italian silverware producer, to manufacture and distribute solid silverware and cutlery. Real del Monte y Pachuca produces jewelry from 20% of its refined silver.

Industrial Minerals

Cement.—Mexican cement production increased 0.7% in 1993 compared with that of 1992. In 1993, the Mexican cement industry produced 27.1 Mmt compared with 26.9 Mmt the previous year, making cement an increasingly bright spot during difficult times for much of the Mexican mineral industry. Sales of cement, both domestic and foreign, amounted to $3.41 billion in 1993, up substantially from that of 1992. The average cement price in the country was about $126 per ton in 1993. About 96% of Mexican cement production was for the domestic market and 4% was exported. It is anticipated that Mexico will produce between 28 Mmt and 30 Mmt of cement in 1994. Mexico was a large exporter of cement to the United States even though in 1990 the U.S. Government placed a countervailing duty of about 50% on Mexican cement exports to the United States. In July 1992, a dispute settlement panel formed under the auspices of GATT declared that the compensatory duties levied by the United States on cement exported from Mexico to the United States were illegal according to the terms of the antidumping code of GATT and recommended the rebate of deposits paid to date. Although the GATT panel decision is not enforceable under U.S. law, since November 1992 the United States and Mexican Governments have engaged in negotiations seeking a settlement that would include implementation of the GATT panel recommendations.

Cementos Mexicanos S.A. de C.V. (CEMEX) was the leading producer of cement with about 75% of the national capacity of about 32 Mmt and 68.2% of domestic sales. With 18 plants and 28 distribution terminals in Mexico, CEMEX dominates the Mexican cement industry and is ranked as the fourth largest cement producer in the world. There were 30 cement plants in Mexico in 1992. The most important event for CEMEX in 1992 was the acquisition of the two most important cement companies in Spain—Valenciana de Cementos and La Auxiliar de la Construccion (Sanson). After purchasing the remaining outstanding shares of both companies, CEMEX controlled 98% of Valenciana and 97.1% of Sanson. In 1994, CEMEX announced the acquisition of two cement

plants in the United States, one from Lafarge Coppée and the other from Holderbank Financière Glaris Ltd. CEMEX also continued to increase its domestic cement production capacity during 1993.

Other cement producers included Cementos Cruz Azul S.C.L., Cementos Apascos S.A., and nine independent producers. Apasco, which is partially owned by Holderbank of Switzerland, was Mexico's second largest cement producer, with six plants and an expansion project in Ramos Arizpe, Coahuila. Cementos Cruz Azul, a worker's cooperative with two plants, was Mexico's third largest cement producer. Cementos Chihuahua has a new plant in Zamalayuca in the State of Chihuahua, and Cementos Moctezuma is expanding its Cuernavaca plant in the State of Morelos. In 1993, the shares of cement production by the five leading producers were as follows: CEMEX, 68.1%; Apasco, 17.5%; Cruz Azul, 10%; Cementos Chihuahua, 3.2%; and Cementos Moctezuma, 1.2%. Along with CEMEX, Cruz Azul and Apasco have several expansion plans so that Mexican cement capacity may increase to 39 Mmt by the end of 1994.

Most Mexican cement plants have switched to fuel oil from natural gas, in that the first priority for natural gas is Mexico's petrochemical sector, followed by industries located in cities with environmental problems. Many cement plants would prefer to burn natural gas if it were available.

Fluorspar.—Mexican production of fluorspar dropped about 1.4% to slightly less than 283,000 tons in 1993. Approximately 92,000 tons of 1993 production was metallurgical-grade material and 188,000 tons acid-grade material. Mexico exports about 60% to 75% of its fluorspar production, with the United States as its most important destination. Significant quantities of Mexican fluorspar are converted into hydrofluoric acid, most of which is exported to the United States.

Mexico's most important fluorspar deposits are in the northern portion of the State of Coahuila, in Zaragoza, San Luis Potosí, and the Río Verde area in Guanajuato State. Fluorspar also occurs in many lead-zinc-silver veins and is recovered as a byproduct of mining operations in the Hidalgo del Parral, Santa Bárbara, and San Francisco del Oro region of Chihuahua. Mexico's largest fluorspar producer is Minera Las Cuevas near Zaragoza, San Luis Potosí. Presently installed capacity is 320,000 mt/a of acid-grade concentrates and 200,000 mt/a of metallurgical grades. Las Cuevas fluorspar has a relatively high arsenic content that limits the use of the material in hydrofluoric acid plants and, thus, limits export sales. The firm was in the process of a 4-year expansion program to reach a total capacity of 750,000 mt/a of fluorspar production. Minera Las Cuevas is 51% owned by Mexican nationals and 49% owned by Noranda Inc. of Canada.

After a number of mine closures in 1991, the only two large fluorspar operations remaining in Mexico are Fluorita de Mexico and Minera Las Cuevas, both operating at less than 50% of capacity.

Graphite.—Mexico ranks as the number three producer of graphite in the world, after the Republic of Korea and India. Production in 1993 amounted to 43,589 tons, approximately 98% of which was amorphous graphite. The most important center for graphite production in Mexico is southeast of Hermosillo, Sonora, where amorphous graphite is mined from altered coal seams. Grafitera de Sonora and related companies are the largest producers. This group, which is an affiliate of Cummings Moore Graphite Co. of the United States, accounts for about 75% of the graphite production of Sonora. Other companies that produce amorphous graphite are Grafito Superior and Exploradora Sonorense de Grafito.

Grafito de México produces flake (crystalline) graphite at Telixtlahuaca, Oaxaca. This firm was sold by the Government in 1989 to Minerales no Metálicos Mexicanos, a mining company specializing in barite, bentonite, kaolin, and phosphate rock. The plant has an annual capacity to produce about 2,000 tons of flake graphite from 50,000 tons of ore. Mexico exports about one-half of its graphite production to the United States and supplied about 30% of the U.S. demand for imported graphite during the period 1989-1992.

Gypsum.—Mexico ranks as the number three producer of gypsum in the Western Hemisphere, after the United States and Canada, and is the ninth largest producer in the world. Mexican production of gypsum was about 5.34 Mmt in 1993, up 3.5% from that of 1992. Most gypsum mined was used in the production of wallboard. Other uses ranged from the manufacture of plaster, a cement additive to retard setting time, soil enhancer, glass additive, and as a filler in pharmaceuticals. The largest gypsum producer is Cia. Occidental Mexicana, S.A., a 49%-owned affiliate of Domtar Ltd. of Canada. This operation produces about 2.5 Mmt/a of crude gypsum at facilities on San Marcos Island, about 40 km southeast of Santa Rosalia, Baja California Sur, in the Gulf of California. Most of this production is shipped to wallboard plants in the Western United States and Canada.

Other important producers include Yeso Mexicano, Yeso Panamericano, and Ciksa, which are affiliates of USG Inc. of the United States; Yeso Monterrey, and Yeso El Tigre. Yeso Mexicano can produce 280,000 mt/a of processed gypsum from its mine and plant at La Borreguita, San Luis Potosí. Yeso Monterrey can process 150,000 mt/a at its mine and plant in Mina, Nuevo León. Yeso El Tigre has a capacity of 80,000 mt/a from its facilities at Lagunillas de Rayón, Puebla. Yesera Nazas S.A. has a total production capacity of 60,000 mt/a from its plants in Matamoros, Coahuila, and Gómez Palacio, Durango. In 1990, Minera Caopas started production of gypsum at Santa Rosalia, Baja California Sur. In addition to these producers, Mexican cement companies operate mines to meet their gypsum requirements, which amount to approximately 6% of cement production. Gypsum was produced in 16 of Mexico's 31 States during the year.

Sulfur.—Two companies with large Government equity participation, Azufrera Panamericana S.A. (APSA) and Cía. Exploradora del Istmo S.A. (CEDI), produced 101,660 tons of Frasch sulfur in 1993, a decrease of 86% from 1992 production of 710,000 tons, itself a decrease of 32% from that of 1991. Sulfuric acid plants at Mexican smelters produced 1.96 Mmt of sulfuric acid in 1993, with an estimated sulfur content of 640,000 tons.

APSA was controlled by the Government through majority ownership by Comisión de Fomento Minero (55.33%), Nacional Financiera S.N.C. (40.65%), Banco Nacional de México S.N.C. (4%), Roca Fosfórica Mexicana S.A. (0.01%), and Minera Carbonífera Río Escondido (0.01%). CEDI was also majority owned by the Government entities Comisión de Fomento Minero (51%) and Fertilizantes Mexicanos (13%), by Texas Gulf Inc. (34%), and by two Mexican private concerns (2%). APSA produced only about 204,000 tons of Frasch sulfur in 1992, and the company entered into liquidation in October of that year. The company's three sulfur mines closed in November 1992 following liquidation and were being kept on a care-and-maintenance basis. The company had been declared technically bankrupt as early as August 1992. The Government of Mexico was expected to sell APSA as well as its two-thirds share of CEDI. The Fertimex fertilizer plant at Lazaro Cardenas, which has a production capacity of 1.3 Mmt/a of sulfuric acid, was sold to Fertilizantes Guadalajara in December 1992. More than 60% of the elemental sulfur produced in Mexico was exported in 1993.

Mineral Fuels

Hydrocarbons output continued to dominate Mexico's energy sector. Production of crude oil and natural gas in 1991 (the last year for which energy-source information was available) represented about 90.3% of all energy produced. In 1991, the remaining 9.7% of primary energy produced was from coal (1.5%), firewood and sugarcane (4.4%), geothermal (0.7%), hydroelectric sources (2.6%) and nuclear energy (0.5%).

Coal.—Production (run of mine) of steam and metallurgical coal increased about 14% from that of 1992 to 9.9 Mmt. 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 privatized in 1992. In September 1992, the Government of Mexico offered MICARE, for privatization; it was purchased in October 1992 for $30 million plus the assumption of $100 million of debt. The purchaser was a joint venture comprising Grupo Acerero del Norte (part of the Autrey-Ancira Group) with 51%, and Mission Energy of the United States (49%).

The principal coal mining area of Mexico is the northern part of the State of Coahuila, where MICARE operates. Other coal deposits are in Sonora and Oaxaca. About 4 Mmt/a of steam coal is mined by MICARE in Coahuila. MICARE has two open pit and two underground mines. Approximately 3 Mmt of metallurgical-grade coal is mined by Minerales Monclova S.A. (MIMOSA), and the remaining production is from 10 small producers. MICARE is currently undertaking an expansion program to increase its annual production to 9 Mmt to supply new plants being installed at Río Escondido.

Natural Gas and Petroleum.—Worldwide, Mexico, at yearend 1993, ranked eighth 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 (as a company), in 1993, ranked third in the production of crude and fifth in the production of natural gas. In 1993, average daily crude oil production was approximately 2.7 Mbbl, about the same as that in 1992. Mexican output of natural gas averaged 101 Mm^3/d in 1993. Total production of refinery products increased 2.6% compared to that of 1992. PEMEX increased the production of unleaded Magna Sin gasoline by 60.9% in 1993 in an effort to alleviate air pollution. 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, Cardenas, Reforma, Comalcalco, Ocosingo, and Villahermosa Districts. The Marine Region refers to the Bay of Campeche, Ciudad del Carmen, and Dos Bocas. Oil- and gas-producing fields occur in each of the districts. The most important producing regions in 1993, the Marine and South Regions, produced 73% and 21%, respectively, of the total Mexican crude oil. Those two regions also dominated the production of natural gas. The South Region, mostly the Villahermosa District, produced 45.8% of Mexico's natural gas output in 1993. The Marine Region (Bay of Campeche) accounted for 34.8% of total natural gas output for the year, and the Northern Region, 19.4%. PEMEX drilled 66 wells during 1993, of which 19 were exploratory wells and 47 were development wells. PEMEX's oil drilling success rate for finished wells was 57% for exploration wells and 89% for development wells.

According to PEMEX, yearend 1993 proven hydrocarbon reserves were 64.52 billion bbl of oil equivalent, a decrease of 0.8% compared to 1992. About 57% of the oil, 44% of the condensate, and 17% of the gas reserves occur in the Marine Region.

In recent years, PEMEX has provided about 30% of Mexico's total export earnings and has brought in about one-third of all public-sector income, via domestic and export sales, tax payments, and gas taxes. In 1993, exports of crude averaged 1.34 Mbbl/d, or 2.4% less than 1992, but the export mix improved. PEMEX's petrochemical production for 1992 increased by about 4% to 19.2

Mmt, the highest level in the history of the company. In 1993, revenues from crude oil exports reached $6 billion, compared with $7.42 billion in 1992. In 1992, 66% of PEMEX's oil exports went to the United States; European countries bought 21%; the Far East bought 6%; and the rest of the Americas and Canada bought 7% of the Mexican oil.

Imports of natural gas from the United States surged in 1992 to an average of 7.1 Mm^3/d compared with an average of 4.6 Mm^3/d in 1991. Imported natural gas cost Mexico $179 million in 1992, compared with $106 million in 1991 and $31 million in 1990. In addition to natural gas, Mexico imported gasoline, amounting in 1992 to 75,000 bbl/d, for an increase of 10.5% over that of 1991.

To alleviate air pollution in Mexico, the Government has mandated that all cars built beginning in 1992 must use unleaded gasoline, but PEMEX does not have the refining capacity to meet demand. In February 1993, PEMEX began to address its lack of refining capacity by entering into a joint venture with Shell Oil Co. of the United States. PEMEX purchased 50% of Shell's Deer Park oil refinery near Houston, Texas, which has a refining capacity of 225,000 bbl/d and ensures PEMEX a secure outlet for processing Maya crude oil while it upgrades and expands its refinery base in Mexico. PEMEX will export 100,000 bbl/d of Maya crude to the Deer Park refinery and will reimport 45,000 bbl/d of unleaded gasoline. In the near future, PEMEX may purchase additional refining capacity in Louisiana.

Reserves

Most of the mineral reserve 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. 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 reserveholders of antimony (4%), bismuth (9%), cadmium (6.5%), fluorspar (9%), mercury (4%), selenium (4%), soda ash (0.7%), and sodium sulfate (5%). In reserves of lead and zinc, Mexico ranked seventh and sixth, respectively (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. Mexican reserves of antimony, bismuth, and fluorspar exceeded those of the United States. Mexico ranked in eighth place worldwide in terms of proven reserves of crude oil, after Venezuela. *(See table 3.)*

INFRASTRUCTURE

To eliminate inefficiency, Mexico is undertaking major expansion and upgrading projects in all four areas of transportation: highways, rail lines, ports, and airports. In the past 2 years, the Government of Mexico has spent about $10 billion per year on infrastructure.

Mexico had 26,400 km of railroads in 1992, the last full year for which data was available. It had 240,000 km of roads, of which 42,000 were toll roads, 62,000 were state highways, 98,000 were rural roads, and 33,000 were byroads. As part of the Toll Highway Program that began in 1989, more than 5,000 km of new highways are being constructed in Mexico. In addition, private companies are constructing 33 toll highways, 1,600 km of roadway, and four bridges across the border. The Government is financing expansion of 2,100 km of highways to four lanes and has begun to allow the private sector to participate in infrastructure projects that previously were restricted to the public sector. One of the most important programs has involved granting temporary concessions to the private sector for the construction and operation of highways. The concessionholder is allowed to charge tolls on projects developed until construction costs have been recovered and a reasonable profit made, at which time ownership of the highway reverts to the Government. The Government planned to grant concessions to build and operate another 3,046 km of highways in 1992, including highways linking Mexico City-Guadalajara, Pachuca-Tampico and Tehuacan-Oaxaca.

To streamline transport of freight inside Mexico, the Government in 1990 modified regulations governing the trucking industry. With elimination of route control by private companies, Mexican carriers can now move freight between any points in the country. In addition, after adoption of NAFTA, United States and Canadian trucking lines, after a 3-year waiting period, were able to avoid transloading delays at the border by directly transporting freight across national boundaries to destinations in Chihuahua, Coahuila, Nuevo Leon, and Sonora. Mexican carriers had reciprocal rights to operate in Arizona, California, New Mexico, and Texas.

The country had 21 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 major fleet having a total capacity of 7.5 Mbbl, 11 of which were at least 20 years old and 2 that were commissioned in 1989. Capacity utilization in 1992 was 80%. In addition to the tankers, PEMEX owns a fleet of more than 200 lesser vessels, motorboats, fire fighting boats, and an oil spill collector.

The Government also has opened certain operations in ports and airports to private investment, such as the loading and unloading of cargo, pilot services on tug boats, and the operation of storage facilities. Private-sector companies were planning to invest more than $150 million in port facilities under building-operate-transfer arrangements, as much as the total public investment program of 1988 and 1989 in this area. Traditionally, administration of Mexico's ports had been Government controlled under the Department of Communications and Transportation. In a decentralization move, but with eventual privatization in

mind, administrative responsibility passed to the autonomous entity Puertos Mexicanos in 1989. Privatization was announced in September 1992, and the new Law for Ports was submitted for Congressional approval in mid-1993. The ports of Manzanillo, Salina Cruz, and Veracruz were under consideration for private participation.

With the geographic advantage of bordering both Atlantic and Pacific basins, total traffic in all sectors through Mexican ports increased to 29.8 Mmt in 1992, the last year for which data were available. This represented an increase of almost 9% over the 27.4 Mmt handled in 1991. Of the 1992 figure, about 21.75 Mmt was foreign cargo comprising approximately 6 Mmt of agribulks, including grains, sugar, and fertilizers; 4.23 Mmt of mineral bulks; 4.23 Mmt of general goods; 4.22 Mmt of containerized cargo; and 3 Mmt of liquids. Domestic shipments totaled 8 Mmt dominated by 5.3 Mmt of agribulks and 1.8 Mmt of general goods. Foreign traffic through Pacific ports in 1992 amounted to 8.21 Mmt. The largest port in Mexico is the port of Veracruz, which handled 5.2 Mmt of freight in 1992.

Most ore and metallurgical products in Mexico were transported by truck. Railways declined in importance during the 1980's, as the volume of freight and passenger transport dropped by more than 25%, owing to increasingly poor and unreliable service. Railroads accounted for only 9% of Mexico's total freight traffic in 1991. 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.

The Government allocated approximately $1.6 billion in 1992 to shunt a larger share of intra-Mexico and cross-border trade to rail transportation. As part of this program, private investment is sought for the massive rehabilitation of the outmoded system. The country's 26,400 km of rails are under the exclusive control of Ferrocarriles Nacionales de Mexico (FNM). The rail fleet, consisting of 1,700 locomotives and about 45,000 freight cars, moved approximately 50 Mmt in 1992. Rail shipping in Mexico is plagued by outdated signal systems, backups at stations, and overwhelmed distribution and loading facilities. To address these problems, FNM has submitted several initiatives that allow customer participation in railroad operations. Private investors who pay for the repair of rail equipment can hold exclusive rights for the use of that equipment. Shippers also can negotiate lower rates along specific routes and lease unit trains to exclusively carry their products.

Union Pacific, Southern Pacific, Santa Fe, Burlington Northern, and Tex-Mex Railroad are working with FNM to transport freight inside Mexico. Union Pacific is investing in the Huehuetoca rail distribution center and in its "Port Laredo" facility. Union Pacific Technologies has sold its Transportation Control System, designed to manage yard operations and train scheduling to FNM. Southern Pacific and FNM offer double-stack container service to Mexico City. Southern Pacific also is investing in Ferropuertos, a series of intermodal distribution centers in Monterrey, Celaya, Torreón, and north of Los Mochis. The facilities will handle shipments such as grain, consumer goods, and bulk minerals. FNM is also cooperating with Union Pacific, Southern Pacific, and Tex-Mex on integration of shipping rates and training of Mexico's railroad employees.

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. As of January 1, 1993, PEMEX owned and operated more than 60,453 km of pipelines, consisting of 5,649 km for delivering oil, 12,582 km for delivering natural gas, 11,755 km for delivering refined products, 1,570 km for delivering petrochemicals, 247 km for delivering fuel oil, and 28,651 km for the collection of hydrocarbons at the wellhead. There is a program to refurbish more than 250 dams and irrigate more than 7 Mha. In the next 10 years, Mexico is to increase power generation from 25,000 MW to 54,000 MW.

OUTLOOK

In recent years, the Government of Mexico has implemented fiscal and economic programs aimed at reducing inflation, promoting sustained economic growth, and increasing private-sector investment, particularly in the mineral sector. Among the key programs introduced in 1992 was the new Mining Law, which in agreement with other programs attempted to increase interest of domestic and foreign investors in the mining sector, without changing Article 27 of the Constitution, through exploration and production trusts (fideicomisos). The law now allows private-sector participation in the exploitation of mineral deposits previously within the domain of Government ownership such as coal, iron, phosphorus, potassium, and sulfur. The Mining Law brings greater flexibility of the management of mining affairs, eliminates much red tape, stimulates small- and medium-scale mining production, and promotes private-sector investment as well as foreign participation in exploration and mining activities. The exploration boom in Sonora, Baja California, and Chihuahua has intensified as a result of the beneficial aspects of the new Mining Law.

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 for the first time.

According to Mexican Government officials, Mexico needed to increase its mineral exploration program to sustain or increase output levels. The country has planned to increase mining output by 4.5% to 5% by 1994. Government programs were aimed at facilitating mining activities by simplifying

administrative procedures, removing 13.5 Mha from National Mining Reserves, opening more areas for exploration, and modernizing the tax regime.

Looking toward 1994 and beyond, NAFTA should benefit the overall economy, and the 1992 Mining Law will play a significant role in attracting foreign investment from North American mining companies. Of more importance, Foreign investment also should benefit significantly from the new Foreign Investment Law expected to be issued by early to mid-1994. Mexico is now viewed by many companies as presenting fewer obstacles to mining and as a lower political risk for mining investments than Canada and the United States. As a result, Mexico is expected to attract more foreign investment, and its mining industry should continue to increase in importance.

[1]Where necessary, values have been converted from Mexican pesos (Mex$) to U.S. dollars at the rates of Mex$3,094=US$1.00 and Mex$3,111=US$1.00 for the years 1992 and 1993, respectively.

OTHER SOURCES OF INFORMATION

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Publications

Asociación de Ingenieros de Minas, Metalurgistas y Geólogos de México, A.C., México City: GEOMIMET, bimonthly magazine.

Banco de México, México City: Informe Anual, Annual Report.

Cámara Minera de México (CAMIMEX), México City: Asamblea General Ordinaria, Annual Report.

Cámara Nacional de la Industria del Hierro y del Acero (CANACERO), México City: Annual Report.

Consejo de Recursos Minerales, México City: Anuario Estadístico de la Minería Mexicana, Annual Report.

Explanatory text prepared with Geophysical Institute, México City, 1992, 74 pp.

Latin American Mining Institute, Washington, DC: Mexico and Central America, Investment and Mining Guide, annual.

Mining and mineral-related companies: Annual operations reports.

National Autonomous University of Mexico, Geological Institute
Geological Map of the Mexican Republic, 1:2,000,000 scale, 5th edition.

Petróleos Mexicanos (PEMEX), México City: Indicadores Petroleros (Production and trade), monthly.

PEMEX, Memoria de Labores, Annual Report.

PEMEX, Statistical Yearbook, Annual Report.

U.S. Embassy, Regional Resource Office
México City: Minerals Questionnaire, annual.
Minerals Outlook Report, annual.
Petroleum Report, annual.

TABLE 1

MEXICO: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
METALS							
Aluminum:							
Primary		71,691	67,515	50,827	r42,201	25,774	75,000
Secondary		13,172	r60,338	r54,236	r59,476	69,933	90,000
Antimony:							
Mine output, Sb content		1,906	1,672	1,469	r,e1,200	1,469	2,000
Metal (in mixed bars and refined)[3]		1,192	942	1,284	r1,064	1,494	1,600
Arsenic[4]		5,551	4,809	4,922	4,293	4,447	6,000
Bismuth[5]		883	733	651	807	908	1,000
Cadmium:							
Mine output, Cd content[e]		r2,500	r3,400	r3,100	r3,250	6,323	3,500
Sb content[e]		6,1,035	6,367	236	213	200	200
Metal, refined		976	882	688	602	797	1,000
Copper:							
Mine output, Cu content[7]							
By concentration		r243,586	r280,289	r266,978	r238,235	277,069	285,000
Leaching (electrowon)		10,299	26,945	32,059	27,940	24,082	35,000
Total		r253,885	307,234	299,037	266,175	301,151	320,000
Metal:							
Anode and blister		174,294	175,374	182,565	228,166	e181,000	300,000
Refined:							
Primary[8]		124,058	131,689	139,085	r,e171,140	e151,100	175,000
Secondary[e]		22,970	r21,150	r20,298	r20,000	20,000	25,000
Total		147,028	r152,839	r159,383	r191,140	e171,100	200,000
Gold:							
Mine output, Au content	kilograms.	e10,000	9,682	10,142	9,891	9,792	11,000
Metal, refined	do.	5,919	5,789	5,022	5,739	6,093	6,200
Iron and steel:							
Iron ore, mine output:							
Gross weight[e]	thousand tons	15,000	15,000	13,000	15,000	15,000	16,000
Fe content	do.	e7,000	7,112	6,596	7,236	7,547	8,000
Metal:							
Pig iron	do.	3,230	r3,645	r3,039	3,404	3,423	3,800
Sponge iron	do.	2,164	2,525	2,462	2,394	2,736	3,000
Total	do.	5,394	r6,170	r5,501	5,798	6,159	6,800
Ferroalloys:							
Ferromanganese	do.	r113	r123	r98	r79	70	150
Silicomanganese	do.	r91	r65	r51	r51	55	100
Ferrosilicon	do.	9	7	6	r5	(9)	10
Ferrochromium	do.	3	(9)	(9)	(9)	(9)	(9)
Other	do.	(9)	(9)	(9)	(9)	(9)	(9)
Total	do.	r216	r195	r155	r135	125	260
Crude steel	do.	7,851	r8,734	r7,964	r8,459	9,189	10,000
Rolled products[10]	do.	5,959	6,705	6,249	6,236	6,655	7,000
Forgings and castings	do.	74	68	61	60	e60	80

See footnotes at end of table.

TABLE 1—Continued

MEXICO: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
METALS—Continued							
Lead:							
Mine output, Pb content		e170,000	187,116	167,684	169,610	153,563	200,000
Metal:							
Smelter:							
Primary		162,478	178,947	163,186	162,724	172,580	200,000
Secondary (refined)[e]		75,000	65,000	10,000	10,000	10,000	80,000
Total[e]		237,478	243,947	173,186	172,724	182,580	280,000
Refined:							
Primary[11]		160,035	167,191	151,817	166,582	178,419	200,000
Secondary[e]		75,000	65,000	10,000	10,000	10,000	80,000
Total[e]		235,035	232,191	161,817	176,582	188,419	280,000
Manganese ore:[12]							
Gross weight		394,408	r451,208	r253,799	r406,678	362,500	600,000
Mn content		149,875	r166,197	r92,814	r152,865	135,235	220,000
Mercury, mine output, Hg content		651	735	340	21	12	800
Molybdenum, mine output, Mo content		4,189	e2,000	1,716	1,458	1,705	4,200
Selenium, mine output, Se content	kilograms.	e20,000	12,200	2,800	r400	—	10,000
Silver:							
Mine output, Ag content	do.	e2,400,000	r2,424,402	2,295,131	2,097,500	2,135,719	2,500,000
Metallurgical products:							
In copper bars	do.	241,211	224,897	210,114	r286,056	409,339	420,000
Mixed gold and silver bars	do.	83,801	72,809	r72,592	r102,900	108,624	120,000
Metal, refined, primary	do.	1,904,286	1,895,527	1,778,739	1,773,912	1,769,985	2,000,000
Other	do.	28,251	r77,544	r73,184	r110,644	78,142	120,000
Tin:							
Mine output, Sn content		11	5	12	1	3	12
Metal, smelter, primary		4,752	5,004	2,262	r2,594	1,644	5,000
Tungsten, mine output, W content		170	183	194	e162	—	200
Zinc:							
Mine output, Zn content		e300,000	306,656	317,101	294,408	369,697	380,000
Metal, refined, primary		193,279	199,295	189,082	151,615	209,931	220,000
INDUSTRIAL MINERALS							
Abrasives, natural[e] [13]		e22,022	25,000	25,000	25,000	25,000	25,000
Barite		324,739	305,716	r191,962	r187,730	135,891	450,000
Cement, hydraulic	thousand tons	22,766	23,824	25,100	26,900	27,100	28,000
Clays:							
Bentonite		123,927	144,895	145,347	135,993	94,584	150,000
Common		3,838,156	3,829,807	3,922,208	4,166,043	4,424,338	4,500,000
Fuller's earth		24,603	29,865	41,078	41,111	36,068	45,000
Kaolin		141,519	156,140	167,238	144,121	215,510	220,000
Diatomite		44,920	51,084	45,966	46,443	46,077	52,000
Feldspar		121,978	163,011	151,678	r159,718	123,512	180,000
Fluorspar:							
Acid-grade	thousand tons	r524	r428	r277	r189	188	510
Ceramic-grade	do.	27	11	—	—	—	30
Metallurgical-grade	do.	225	192	90	95	92	250
Submetallurgical-grade[e]	do.	r3	r3	r3	r3	3	10
Total	do.	779	634	370	287	283	800

See footnotes at end of table.

TABLE 1—Continued

MEXICO: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued							
Graphite, natural:							
Amorphous		38,304	22,553	35,315	r30,485	42,629	50,000
Crystalline		1,942	2,365	1,943	985	960	2,000
Gypsum and anhydrite, crude (yeso)		5,390,391	5,433,804	4,774,130	5,157,950	5,339,746	6,000,000
Lime, hydrated and quicklime[e]	thousand tons	6,000	6,000	6,500	6,500	6,500	6,500
Magnesium compounds:							
Magnesia[14]		125,210	121,897	111,987	125,108	e125,000	130,000
Magnesite		4,229	579	e600	—	1,533	1,000
Mica, all grades		4,510	5,863	5,587	5,866	6,437	6,500
Nitrogen: N content of ammonia		2,100,154	2,163,672	2,221,374	2,202,500	e2,200,000	2,300,000
Perlite		37,354	42,439	48,860	42,637	34,568	50,000
Phosphate rock[15]		655,477	623,481	r595,800	451,659	501,254	700,000
Salt, all types	thousand tons	6,703	7,135	7,533	7,395	7,491	8,000
Sodium compounds, n.e.s.:							
Carbonate (soda ash):[e 16]							
Natural		190,000	190,000	190,000	160,000	160,000	200,000
Synthetic		267,000	259,000	259,000	280,000	280,000	300,000
Sulfate, natural (bloedite)[17]		478,000	545,157	517,600	534,445	e500,000	600,000
Stone, sand and gravel:							
Calcite, common		444,000	445,415	457,925	475,607	422,871	500,000
Dolomite		469,564	482,168	470,668	466,490	545,494	700,000
Limestone[18]	thousand tons	26,127	27,405	29,477	31,766	33,985	36,000
Marble		524,160	681,408	749,548	r860,331	987,488	1,000,000
Quartz, quartzite, glass sand (silica)		1,216,443	r1,174,095	r1,198,214	r1,129,140	1,310,134	1,500,000
Sand	thousand cubic meters	42,773	44,700	44,012	r46,308	47,611	50,000
Gravel	do.	36,801	37,737	39,747	r42,587	43,718	45,000
Strontium minerals, celestite		67,658	66,254	62,180	61,097	71,903	80,000
Sulfur, elemental:							
Frasch process	thousand tons	1,531	1,441	1,040	710	102	1,600
Byproduct:							
Of metallurgy[e]	do.	286	290	280	817	730	900
Of petroleum and natural gas	do.	555	682	754	775	804	900
Other	do.	—	—	20	—	e30	50
Total[e]	do.	2,372	2,413	2,094	2,302	1,666	3,450
Talc		13,534	13,477	11,883	19,559	14,376	22,000
Vermiculite		300	132	117	125	134	300
Wollastonite		10,618	11,442	13,877	27,392	35,800	30,000
MINERAL FUELS AND RELATED MATERIALS							
Coal:							
Run-of-mine:							
Metallurgical	thousand tons	5,847	5,794	4,536	3,696	4,811	6,000
Steam	do.	4,136	4,220	4,865	e5,004	e5,404	5,500
Total	do.	9,983	10,014	9,401	8,700	10,215	11,500
Washed metallurgical coal	do.	2,761	2,850	2,206	1,605	e1,710	3,000
Coke:[19]							
Metallurgical	do.	2,260	2,315	2,005	r1,887	1,889	2,400

See footnotes at end of table.

TABLE 1—Continued

MEXICO: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
MINERAL FUELS AND RELATED MATERIALS—Continued							
Coke—Continued:							
Imperial	thousand tons	6	6	3	2	3	10
Breeze	do.	4	16	98	144	49	200
Total	do.	2,270	2,337	2,106	r2,033	1,941	2,610
Gas, natural:							
Gross	million cubic meters	36,919	37,741	37,550	37,141	e37,000	40,000
Marketed	do.	30,414	34,138	33,655	32,661	e33,000	35,000
Natural gas plant liquids	thousand 42-gallon barrels	139,254	155,575	164,739	165,279	e170,000	180,000
Petroleum:							
Crude	do.	917,355	930,023	976,668	976,387	e972,141	1,200,000
Lease (field) condensate	do.	2,355	1,831	1,444	1,644	e2,000	3,000
Total	do.	919,710	931,854	978,112	978,031	974,141	1,203,000
Refinery products:							
Liquefied petroleum gas	do.	79,530	88,639	91,357	89,351	e90,000	100,000
Gasoline:							
Aviation	do.	409	372	75	—	e100	500
Motor, leaded and unleaded	do.	140,988	153,731	152,555	148,681	e150,000	160,000
Jet fuel	do.	15,890	18,598	22,502	23,623	e24,000	25,000
Kerosene	do.	9,075	5,778	3,577	4,300	e4,300	10,000
Distillate fuel oil (diesel)	do.	85,518	94,387	100,759	101,682	e102,000	110,000
Lubricants	do.	2,727	2,678	2,803	2,940	e3,000	3,500
Residual fuel oil	do.	155,832	158,811	152,041	157,256	e160,000	170,000
Asphalt	do.	5,484	5,765	7,825	8,536	e9,000	10,000
Unspecified and refinery fuel and losses	do.	44,400	43,467	48,551	41,931	e43,000	50,000
Total	do.	539,853	572,226	582,045	578,300	e585,400	639,000

eEstimated. rRevised.

[1]Table includes data available through Aug. 1994.

[2]In 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 estimates of output levels.

[3]Sb content of antimonial lead and impure bars plus refined metals.

[4]As content of white and black (impure) arsenic trioxide.

[5]Refined metal plus Bi content of impure smelter products.

[6]Reported figure.

[7]Series as reported by CAMIMEX. Tonnages reflect a 2.5% metal loss in smelter.

[8]Includes cathode copper from the Cia. Mexicana de Cananea, S.A. de C.V. electrowinning plant, in metric tons, as follows: 1989—10,299; 1990—26,945; 1991—32,059; 1992—27,940, and 1993—24,082.

[9]Less than 1/2 unit.

[10]Includes flat, nonflat, and seamless pipe steel products.

[11]Includes lead content of antimonial lead.

[12]Mostly oxide nodules; may include small quantities of direct-shipping carbonates and oxide ores for metallurgical and battery applications.

[13]Based on exports, comprised mostly of pumice stone and emery (a granular, impure variety of corundum).

[14]Reported by Industrias Penoles, S.A. de C.V. as the only major poducer.

[15]Includes only output used to manufacture fertilizers.

[16]Total sodium carbonate reported by Asociacion Nacional de la Industria Quimica.

[17]Series reflects output reported by Industrias Penoles plus an additional 22,000 tons estimated production by Sulfato de Viesca.

[18]Excludes that for cement production.

[19]Includes coke made from imported metallurgical coal.

TABLE 2

MEXICO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities[1]	Annual capacity
Aluminum		Private Mexican (Nacobre, 77.8%; Carso, 20%; others, 2.2%)	Smelter at Veracruz, Ver.	94.
Antimony		Cia. Minera y Refinadora Mexican, S.A. (private Mexican, 51%; Cookson Ltd., 49%)	San Jose Mine, Catorce, S.L.P.	NA.
Barite		Barita de Sonora, S.A. (Mexican private, 100%)	Mazatan, Son.	165.
Do.		Minera Capela, S.A. (Penoles, 100%)	La Minita Mine, Michoacan	150.
Cement		Cementos Mexicanos, S.A. de C.V. (private Mexican, 100%)	Monterrey, N.L.; Torreon, Coah.; Huichapan, Hg.; Valles, S.L.P.; Antotonilco, Hgo.; Zapotiltic, Jal; Tolteca, Hgo.; and Mixcoaac, Mex.	[3]19,800.
Do.		Cementos Anahuac, S.A. (Cementos Mexicanos, 100%)	Mexico D.F. y Tamuin, S.L.P.	4,500.
Do.		Cementos Cruz Azul S.C.L. (private Mexican, 100%)	Cruz Azul, Hgo.; Laganeas, Oax.	3,900.
Do.		Cementos Apasco, S.A. (Holderbank, 49%)	Mex. and Tab.	2,600.
Coal		Minerales Monclova, S.A. (Altos Hornos de Mexico, S.A., 100%)	Mimosa, Palau Mines, Muzquiz Washing Plant at Palau, Coah., and Coking Plant at Monclova, Coah.	2,500.
Do.		Minera Carbonifera Rio Escondido, S.A. (MICARE)[4] (Grupo Acerero del Norte, 51%; Mission Engery, 49%)	MinaI, Mina II, and Tajo I at Nava and Piedras Negras, Coah.	4,000.
Copper		Mexicana de Cobre, S.A. (Medimsa, 83.2%; Grupo Perforadora Mexico, 9.8%; other and Workers Union, 7%)	La Caridad Mine and smelter Nacozari de Garcia, Son.	150.
Do.		Mexicana de Cananea, S.A.[5] [Mexicana de Cobre, 76%; ACEC Union Miniere, S.A. (Belgium), 21%; the Workers Union, 2%]	Mine and smelter at Cananea, Son.	170.
Do.		Minera Maria, S.A. de C.V. (Empresas Frisco, 51%; Cominco Resources International, 49%)	Cananea District, Son.	18.
Ferroalloys and manganese		Cia. Minera Autllan, S.A.[6] (Minas Bacis, S.A. de C.V., 30%)	Mines at Molango and Nonoalco, Hgo.	500.
Do.		do.	Plants in Puebla and Tamos, Ver.	185.
Fluorspar		Cia. Minera Las Cuevas, S.A. (Grupo Industrial Camesa S.A.)[7]	Salitera (Zaragoza), S.L.P.	520.
Do.		Fluorita de Mexico, S.A. de C.V. (Mexican, 51%; AIMCOR, 49%)	Mines at La Encantada range and plant at Muzquiz, Coah.	500.
Gold	kilograms	Cia. Fresnillo, S.A. (Penoles, 60%; AMAX, 40%)	Fresnillo Mine, Zac.	1,866.
Do.	do.	Minas de San Luis, S.A. (Industrials Luismin, 100%)	Tayoltita, Durango	1,400.
Do.	do.	Cia. Mineraa de Santa Gertrudis (Grupo Ariztegui, 51%; Phelps Dodge, 49%)	Santa Gertrudis Mine, Sonora	1,600.
Do.	do.	Exploraciones El Dorado, S.A. de C.V., 70%; Cadmill Resources, 30%	La Colorada Mine, Sonora	800.
Do.	do.	Minera Hecla, 100%	La Choya Mine, Sonora	2,000.
Do.	do.	Walhalla Mining Co. NL (private foreign, 100%)	Amelia Mine, Sonora	1,300.
Graphite		Grafitos Mexicanos S.A. [Cummings Moore Graphite Co. (United States), 25%; private Mexican, 75%]	Lourdes and San Francisco Mines, Son.	60.

See footnotes at end of table.

TABLE 2—Continued

MEXICO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities[1]	Annual capacity
Gypsum	Cia. Occidental Mexciana, S.A. (private Mexican, 51%; Domtar, Ltd. of Canada, 49%)	Santa Rosalia on San Marcos Island, B.C.S.	1,500.
Lead and zinc	Mexico Desarollo Industrial Minero, S.A. [Grupo Mexico, 68.8%; ASARCO Incorporated (United States), 31.2%]	Charcas, S.L.P.; San Martin, Zac.; Santa Eulalia, Chih.; Taxco, Gro.; Rosario, Sin.; lead smelter at Chihuahua, lead refinery at Monterrey, N.L., zinc refinery at S.L.P.	70 (lead), 150 (zinc).
Do.	Industrias Penoles, S.A. (private Mexican, 97%; U.S. private, 3%)	La Encantada, Coah.; Fresnillo, Zac.; Naica, Chih. mines; Bismark, Son. (Penoles, 100%). Rey de Plata, Gro. (Penoles, 60%; Outokump, 40%) Metallurgical complex at Torreon with silver, lead, and zinc smelter and/or refineries operated by Met-MexPenoles (Penoles, 100%)	50 (lead), 60 (zinc).
Molybdenum	Mexicana de Cobre, S.A. (Medimsa, 83.2%; Perforadora Mexico, 9.8%; other and Workers, Union, 7%)	La Caridad Mine, Molybdenum plant, Son.	6.
Petroleum thousands 42-gallon barrels per day	Petroleos Mexicanos (PEMEX) (Government, 100%)	Comalcalco, Poza Rica, and Golfo de Campeche districts	[8]3,500.
Salt	Exportadora de Sal, S.A. (ESSA) (Fomento Minero, 51%; Mitsubishi Corp., 49%)	Solar salt complex at Guerrero Negro, B.C.S.	6,000.
Silver kilograms	Industrias Penoles, S.A.[9] (private Mexican 97%; U.S. private, 3%)	Naica, Chih.; Fresnillo, Zac.; Las Torres, Gto.; Cuale, Jal. La Negra, Qro; La Encantada, Coah.; La Minita, Mich. Refinery at Torreon, Coah.	654,000.
Do. do.	Mexico Desarollo Indusstrial Minero, S.A. [Grupo Mexico, 68.8%; ASARCO Incorporated (United States), 31.2%]	San Martin Mine, Sombrerete, Zac.; Taxco, Gro.; Charcas, S.L.P. Santa Eulalia, Chih. Refinery at Monterrey, N.L.	467,000.
Do. do.	Minera Real de Angeles, S.A. de C.V. Frisco, 51%; Placer Development Ltd. Canada, 49%)	Open pit mine and concentrator at Noria de Angeles, Zac.	373,000.
Sodium carbonate	Sosa Texcoco, S.A. (private Mexican, 100%)	Lake Texcoco, Mex., from subsurface brines	200.
Sodium sulfate	Quimica Magna, S.A. de C.V. (Grupo Penoles, 100%)	Subsurfaces brines at Laguna del Rey, Coah.	350.
Steel	Altos Hornos de Mexico, S.A. (AHMSA), Grupo Acereros de Norte	Steelworks at Monclova, Coah. Iron ore from Pena Colorada Mine in Colima	3,900.
Do.	Hylsa de Mexico, S.A. (Grupo Industrial ALFA, 100%)	Direct-reduction units at Monterrey, N.L., and Puebla; Cerro Nahuatl Iron ore mine in Colima	1,800.
Do.	Siderurgica Lazaro Cardenas-Las Truchas, S.A. (SICARTSA) (Grupo Villacero, 80%; Government, 20%)	Port of Lazaro Cardenas, Michoacan	1,300.
Do.	Siderurgica del Balsas, S.A. (SIBALSA) (SICARTSA II) (Caribbean ISPAT, 100%)	SICARTSA II Plant Facilities as Lazaro Cardenas Plus, 29%; share in the Pena Colorada Mine	2,000 (steel), 1,500 (steel plate).

See footnotes at end of table.

TABLE 2—Continued

MEXICO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities[1]	Annual capacity
Iron ore	(Acerero del Norte, 29%; Caribbean ISPAT, 29%; Hylsa, 42%)	Pena Colorada Mine and pellet plant near Mananillo, Colima	3,000.
Do.	Siderurgica Lazaro Cardenas-Las Truchas, S.A. (SICARTSA) (Grupo Villacero, 80%; Government, 20%)	Ferrotepec, Volcan, and Mango deposits in Las Truchas projet area, and pellet plant, Michoacan	1,900 (iron ore).
Strontium (celestite)	Cia. Minera La Valenciana (private Mexican, 100%)	San Agustin Mine in Coah.	50.
Sulfur	Azufrera Panamericana, S.A. (APSA)[10] (Government-Fomento Minero, 96%; private, 4%)	Coachapa, Patapa, Jaltipan, Ver.	1,230.
Do.	Cia. Exploradora del Istmo, S.A. (Government, 64%; Texasgulf, Inc. (France), 34%; private, 2%)	Texistepec, Ver.	750.
Tin[11]	Metales Potosi, S.A. (private Mexican, 100%)	San Luis de Potosi, S.L.P.	6.4.
Do.	Estano Electro, S.A. (private Mexican, 100%)	Tlalnepantla, Mexico D.F.	1.3.
Do.	Fundidora de Esano, S.A. (private Mexican, 100%)	San Luis Potosi, S.L.P.	1.2.

[1]State abbreviations: Baja California Sur (B.C./S.), Chihuahua (Chih.), Coahuila (Coah.), Colima (Col.), Durango (Dgo.), Guerrero (Gro.), Hidalgo (Hgo.), Jalisco (Jal.), Michoacan (Mich.), Nuevo Leon (N.L.), Oaxaca (Oax.), Queretaro (Qro.), San Luis Potosi (S.L.P.), Sinaloa (Sin.), Sonora (Son.), Veracruz (Ver.), and Zacatecas (Zac.).
[2]Formerly ownd by Fideicomiso de Fomento Minero.
[3]Includes capacity from Cementos Tolteca, S.A., purchased by CEMEX in 1989.
[4]Only significant producer. Government equity in MICARE is represented by Fomento Minero, Comision Federal de Electricidad, Nacional Financiera, and AMSHA. Private equity is by Grupo IMMSA. During 1991, CFM's operations were merged into FFM and CRM.
[5]New owners, purchased Cananea in 1990.
[6]Company scheduled for reorganization.
[7]Camesa, S.A. de C.V. is own by private Mexican (59.4%) and Noranda, Inc. of Canada (40.6%).
[8]PEMEX operates nine refineries with an installed capacity of 1.68 million barrels per day.
[9]Includes capacity from Cia. Fresnillo, S.A. de C.V.
[10]Handles all exports of sulfur, including sulfur recovered by PEMEX.
[11]Smelter output from mostly imported concentrated.

TABLE 3

MEXICO: RESERVES OF SELECTED MINERAL COMMODITIES, FOR 1992

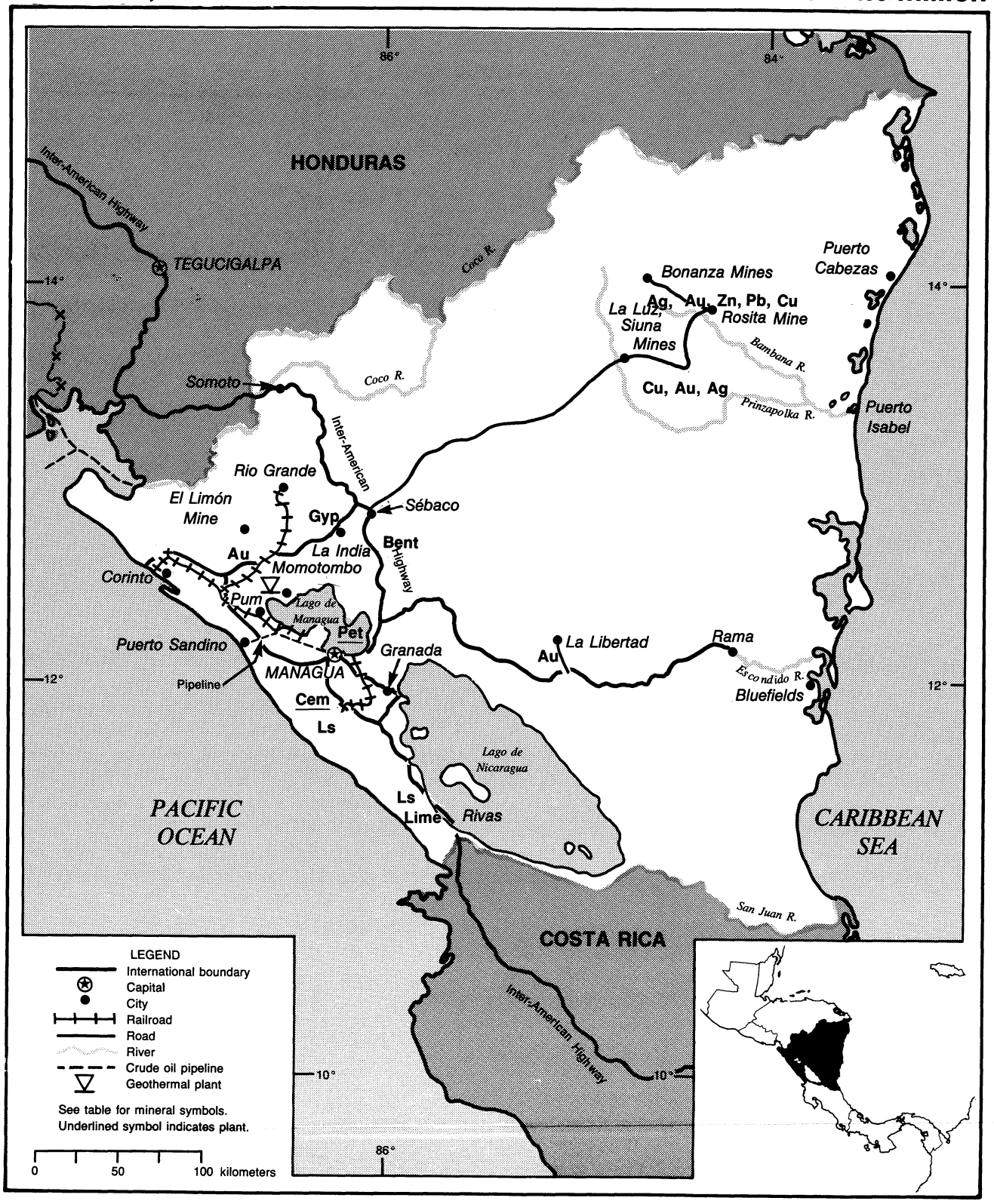
(Thousand metric tons unless otherwise specified)

Commodity[1]		Reserves
Antimony		181
Barite		7,000
Bismuth	metric tons	10,000
Cadium	do.	35,000
Copper		14,000
Fluorspar[2]		19,000
Gas, natural	billion cubic meters	1,957
Graphite, natural		3,100
Lead		3,000
Manganese		3,600
Mercury	metric tons	5,000
Molybdeum	do.	90,000
Petroleum, crude[3]	million 42-gallon barrels	51,225
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

[1]All metals expressed in metal content.
[2]Measured as 100% calcium fluoride.
[3]Yearend 1991. Source: PEMEX Statistical Yearbook 1992.
[4]Sulfur in all forms.

NICARAGUA

AREA 129,500 km² **POPULATION 4.0 million**



THE MINERAL INDUSTRY OF

NICARAGUA[1]

By George A. Rabchevsky

Nicaragua is a Central American country bounded by the Caribbean Sea on the east and by the Pacific Ocean on the west. The terrain is made up of volcanic peaks, with a wide Caribbean coastal plain and a narrow Pacific coastal plain interrupted by volcanoes.

Even though only 10% of the land in Nicaragua is arable, about 45% of the work force was employed by the agriculture industry and accounted for 80% of export earnings. The main agricultural products were bananas, coffee, cotton, grains, sugar cane, and tobacco. Nicaragua had the 11th largest economy of Latin America. The gross domestic product (GDP) growth rate for 1993 was estimated at 1%, inflation at 28.3%, and unemployment at more than 55%. Mining and mineral production in Nicaragua accounted for less than 1% of the country's GDP, based primarily on the extraction of bentonite, gold, gypsum, lime, and silver.

GOVERNMENT POLICIES AND PROGRAMS

Following the 1979 civil war, most mining activities were disrupted and foreign investments were discouraged. In November 1979, the Sandinista Government of Nicaragua issued Decree No. 137, thereby nullifying all mining concessions that had been issued by the previous administration and nationalized all mining companies operating in the country. The decree authorized compensation payment to be made to owners with 5-year, 6.5% bonds. Some companies received the bond compensation, others did not, and several claims remain pending.

A Canadian mining company expressed interest in the La Libertad gold mine. Reportedly, a tentative agreement was arrived at whereby 75% of the mine will be owned by the Canadian and a Nicaraguan partner, with the remaining 25% retained by "IMIMSA", a Nicaraguan mine workers holding corporation. However, after 3 years of negotiations, the La Libertad claimants have yet to reach agreement with the Government. The failure on the part of the Government of Nicaragua to resolve the claim prevented the final signing of the Canadian agreement to privatize the mine. Other negotiations with mining investors have met with similar nationalization claim-related difficulties. One group of U.S. investors has discussed privatization with the Nicaraguan Government of the Bonanza, Siuna, and the inactive Rosita gold mines, which compose the famous "golden triangle" in the north Atlantic region. These talks have stopped, again owing to delays over settling claims by the previous U.S. owners.

Decree No. 377 of July 1988 created the Corporación Nicaragüense de Minas (Nicaraguan Mining Corp. or INMINE). INMINE objectives apply to the organization, administration, direction, and promotion of the state's mining industry. INMINE is responsible for granting, supervising, and canceling permits, licenses, and exploration and exploitation concessions of minerals.

The civil war ended in 1991, and a democratically elected President began to reform the mining sector. The Government of Nicaragua approved new foreign investment laws, including the Foreign Investment Law (Decree No. 127), the Export Promotion Law (Decree No. 37-91), and the Industrial Free Zones Laws (Decree No. 46-91). To attract additional foreign resources, the Government deregulated all exports, except for gold and silver, and imports. Gold and silver exports continued to be controlled by the Government's Central Bank.

In July 1992, the Government and the U.S. Neptune Mining Corp. signed a settlement on Neptune's claim for the Bonanza Mine. In June 1993, the Government and the Rosario Mining Co., a subsidiary of Amax Mines of the United States, signed a final settlement for Rosario's claims for the nationalized Siuna Mine, the Rosita concession, and several other inactive concession areas. The claim of the El Limon Mine remained pending. Reportedly, Norand Mines Corp. has yet to settle with the Government.

By 1993, the Government privatized about 315 state-owned companies, or about 85% of the total that had been incorporated into a state holding corporation, Corporaciones Nacionales del Sector Publico (CORNAP). In 1992, the Government liberalized foreign trade and canceled price controls on most imported goods. Foreign investors were still eligible to bid on companies sold through public bidding. As of December 1993, more than 50% of the agricultural and industrial firms remained state owned.

ENVIRONMENTAL ISSUES

There are no environmental regulations in the country. Nicaragua operated only several small metal mines, producing gold and silver, mostly in the sparsely populated northwest of the country. Pollution from mercury used in the processing of gold is common in Nicaragua. The mining of industrial minerals in Nicaragua, such as bentonite,

gypsum, and sand and gravel, from open pits contributed to deforestation and soil erosion. Environmental remediation remains a low priority, given that Nicaragua is one of the poorest countries in the Western Hemisphere.

PRODUCTION

Production of most commodities in Nicaragua increased slightly in 1993, except the production of bentonite which continued to decline. Production of gold and silver in Nicaragua were directed primarily for export, including bentonite and gypsum. Industrial minerals, such as cement, sand and gravel, and salt, were produced for domestic consumption. *(See table 1.)*

TRADE

Nicaragua was eligible for trade benefits under the Caribbean Basin Initiative (CBI). CBI was made a permanent program in 1990 when the U.S. Congress amended the Caribbean Basin Economy Recovery Expansion Act. Nicaragua signed an agreement on trade liberalization with Costa Rica, El Salvador, Guatemala, Honduras, and Mexico in 1991. A bilateral Framework Agreement on Trade and Investment was signed on June 27, 1991, by Nicaragua and the United States. At the end of 1993, the United States ended the embargo on aid to Nicaragua. The U.S. share of Nicaraguan imports was 24.4% in 1993. *(See tables 2 and 3.)*

About 30% of Nicaragua's exports of chemicals and petroleum products went to Latin America, 25% to the United States, and 20% to the European Union. Gold and silver accounted for about 3% of the nation's total export earnings. Nicaragua was totally dependent on imports for its oil supply. Petroleum was imported primarily from Venezuela under the San Jose accord, and some from Mexico. The accord is renewed each year in August. Nicaragua is obligated to pay market prices for the oil, while 20% of the sale price is returned to the country as a loan. The accord calls for an automatic 5-year loan, to be provided at an annual interest rate of 8%. The loan can be extended to 20 years at an annual interest of 6%. In 1993, Nicaragua exported a total of $260 million[2] in goods and had a total net trade deficit of $405 million.

STRUCTURE OF THE MINERAL INDUSTRY

INMINE controlled most of the country's mineral exploration and production operations. All four gold and silver mines remained state owned. CORNAP's role includes returning firms to former owners, selling them to private investors, and closing unprofitable companies. The Central Bank of Nicaragua (CBN) sets the monetary, exchange rate, and credit policies that regulate the country's economic and financial systems. Gold and silver produced by INMINE must be sold to the CBN. CBN also controls the export of gold and silver from the country. Local prospectors operated small private placer gold mining operations. Cement was produced by the state-owned Compañía Nacional Productora de Cemento. Salt was produced by privately owned operations. *(See table 3.)*

COMMODITY REVIEW

Metals

INMINE estimated gold reserves, the total of proven and probable, to be 19 Mmt. The largest producer of gold, the El Limón Mine, operated by INMINE's Empresa Francisco Meza Rojas, accounted for about 65% of Nicaragua's gold output. The Francisco Meza Rojas company, in Zelaya Province, was operated by INMINE. INMINE also produced gold from the Bonanza, La Libertad, and Siuna Mines. INMINE contributed 1,240 kg of gold, or about 70% of total production in 1993, and 2,355 kg of silver. Table 2 illustrates production results of INMINE in 1993. Greenstone Resources Ltd., Canada, and its local partner Nica Mines Ltd. acquired a 37.5% interest each in the La Libertad open pit gold mine from the Nicaraguan Government. The La Libertad property in central Nicaragua is composed of a 120-km^2 concession surrounding a small existing gold mine. The Bonanza and the Siuna Mines in the country's northeast, the El Limon Mine, and the inactive La India Mine south of El Limon were to be privatized. The La India Mine also includes two gold prospects—the Topacio east of Managua and the La Reina northeast of Managua. The Bonanza Mine is old, has outdated equipment, and is in the north-central mountains with degraded infrastructure.

Industrial Minerals

Empresa Nicaragüense de Minerales No Metálicos controlled the following state's industrial mineral companies: the bentonite operations of Empresa Rotowa S.A.; the gypsum plant and quarries of Yesera Centroamericana S.A.; and the limestone operations of Empresa Piedra Cal S.A. and Empresa Cal El Pueblo.

The Inversiones Mineras A.S. (IMISA) functions as a holding company dedicated to the promotion and expansion of its affiliated companies. IMISA incorporates Arenas S.A. (producing sand and gravel), Canteras S.A. (producing dimension stone), and Calizas S.A. (producing grounded limestone).

There are numerous undeveloped deposits of ash and pumice along the line of volcanoes on the Pacific Coast. Kaolin is reported at several locations, including Cerro Colorado, Dilpito, Mombacho, and Volcán. Nicaragua imported kaolin for its ceramic products.

Mineral Fuels

Nicaragua relied totally on imports for all its mineral fuel needs. Crude oil was imported primarily from Venezuela. The Government was planning legislation to attract foreign participation in oil exploration.

INFRASTRUCTURE

The mining infrastructure in Nicaragua is not well developed. Only about 4,000 km of roads was paved of a total of

26,000 km, including the 369 km of the Pan-American highway. Most minerals are transported by trucks on public roads or on few private roads. Only 373 km was in railroad tracks, mostly used to transport agricultural products and gypsum. A 56-km crude oil pipeline extended from Puerto Sandino on the Pacific coast to the Esso refinery in Managua. Cabezas, El Bluff, and Rama ports serviced the Caribbean traffic also for export of raw materials.

Nicaraguan powerplants were operated by the Government, with a capacity between 401 MW to 450 MW, operating at 65% of its capacity in 1993. More than 55% of electricity (257 MW) was generated by thermal coal plants and 23% (103 MW) by hydrothermal plants. Nicaragua operated one geothermal plant that generated 35 MW, or 8% of the total. The plant is on the slopes of the Momotombo volcano, near Managua. Other private electrical powerplants supplied about 55 MW to the national network. The country spent about $127 million per year on importing 5.2 Mbbl of oil to generate electricity. A small quantity of electricity also was imported from neighboring Costa Rica to supplement its requirements. Nicaragua continued to pursue geothermal energy as an alternative source of energy.

OUTLOOK

The mining sector continues to offer hope for economic recovery for Nicaragua, especially given its large gold reserves. The Government plans to revive Nicaragua's mining industry with financial and technical aid from abroad. The Government hopes that the privatization effort will help reduce the country's deficit once outstanding claims for the previously nationalized mines are resolved. The Government in 1992 prepared plans to overhaul the gold industry to encourage foreign investors and continued to support it in 1993. Most of the equipment in the mines is more than 15 years old and lacks spare parts. The geological potential for new exploration and development is promising, subject to the country's stabilizing its political and foreign investment climate.

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[1]Text prepared June 1994.

[2]Where necessary, values have been converted from Nicaragua cordobas (C$) to U.S. dollars at the rate of C$5.00=US$1.00(June 1993).

OTHER SOURCES OF INFORMATION

Agencies

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Publications

Banco Central de Nicaragua, Gerencia de Estudios Económicos: Indicadores de Actividad Económica, 1993, Managua Nicaragua, annual.

Corporación Nicaragüense de Minas (INMINE): Balance Anual, 1993, Managua, Nicaragua, annual.

Empresa Nicaragüense de Minerales No Metálicos (COMNOMET, S.A.): Balance Anual, 1993, Managua, Nicaragua, annual.

Instituto Nacional de Estadísticas y Censos: Annuario Estadísticoo de Nicaragua, Managua, Nicaragua, annual.

Latin American Mining Institute, Washington, DC: Mexico and Central America Investment and Mining Guide, annual.

Nicaragua Export Directory, 1993-94, Managua, Nicaragua, annual.

U.S. Department of Commerce, International Trade Administration: Foreign Economic Trends and Their Implications for the United States, annual.

TABLE 1
NICARAGUA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1, 1994)
Bentonite		4,164	4,592	5,070	2,816	r2,161	6,000
Cement		r204,600	219,400	239,300	r277,400	275,000	330,000
Gold, mine output, Au content	kilograms	1,410	1,200	1,154	1,322	1,800	3,000
Gypsum an anhydrite, crude		11,570	13,444	16,200	9,115	r11,078	17,800
Lime		r3,500	1,011	2,120	2,003	2,000	4,000
Petroleum refinery products	thousand 42-gallon barrels	e3,500	r4,000	4,543	4,802	5,000	5,400
Salt, marine e		15,000	15,000	15,000	15,000	15,000	16,000
Sand and gravel	thousand tons	e1,125	1,064	1,170	1,288	1,250	2,000
Silver, mine output, Ag content	kilograms	1,113	1,095	1,014	2,240	r2,355	3,000

eEstimated. rRevised.

[1]Includes data available through May 26, 1994. 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.

[2]Reported figure.

TABLE 2
NICARAGUA: 1993 PRODUCTION, CORPORACION

NICARAGUENSE DE MINAS (INMINE)

Mines	Silver (kilograms)	Gold (kilograms)	Employees
El Limon	102	762	463
Bonanza	2,036	281	532
La Libertad	211	173	164
Siuna	6	24	103
Total	2,355	1,240	1,262

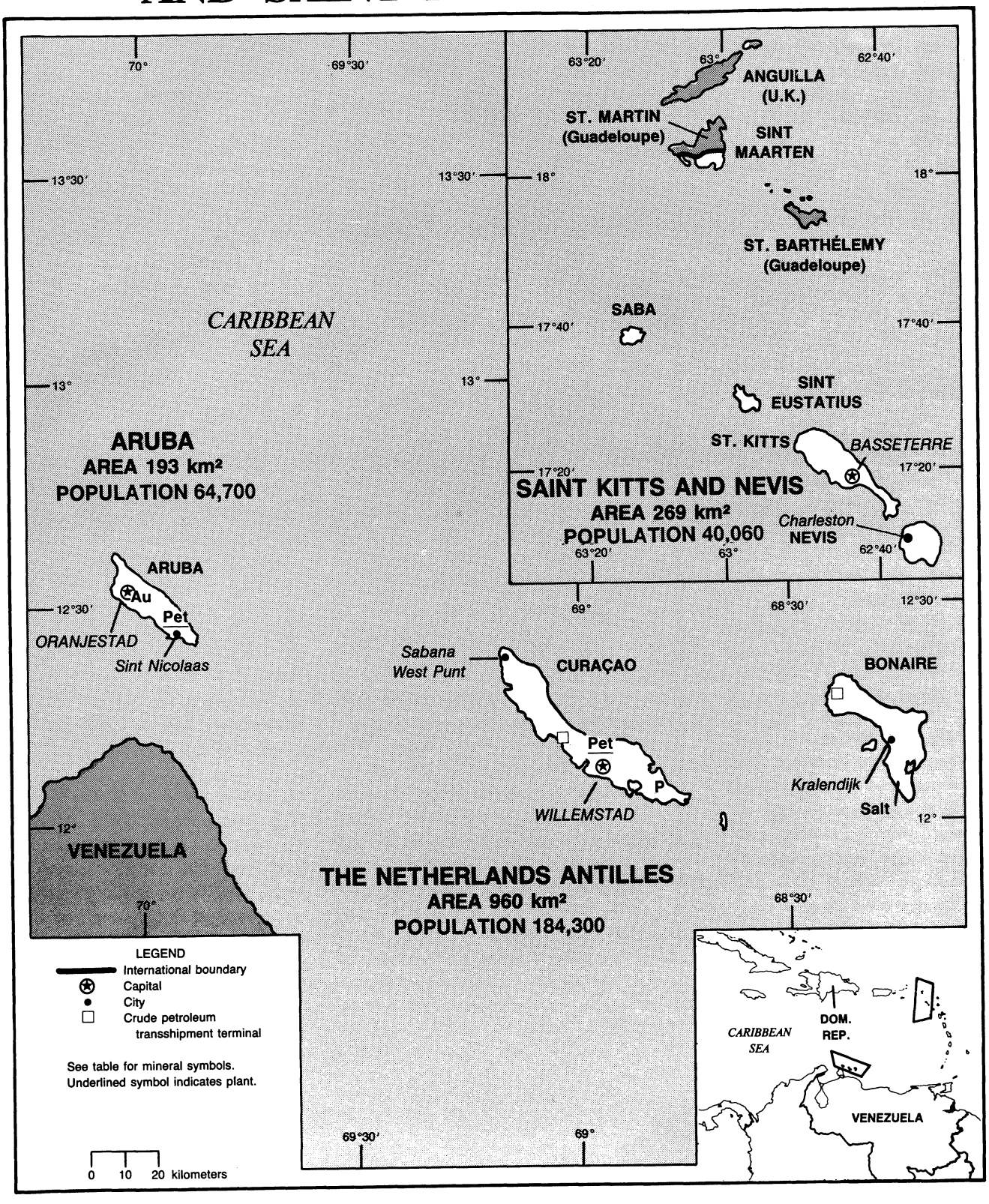
TABLE 3
NICARAGUA: STRUCTURE OF MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

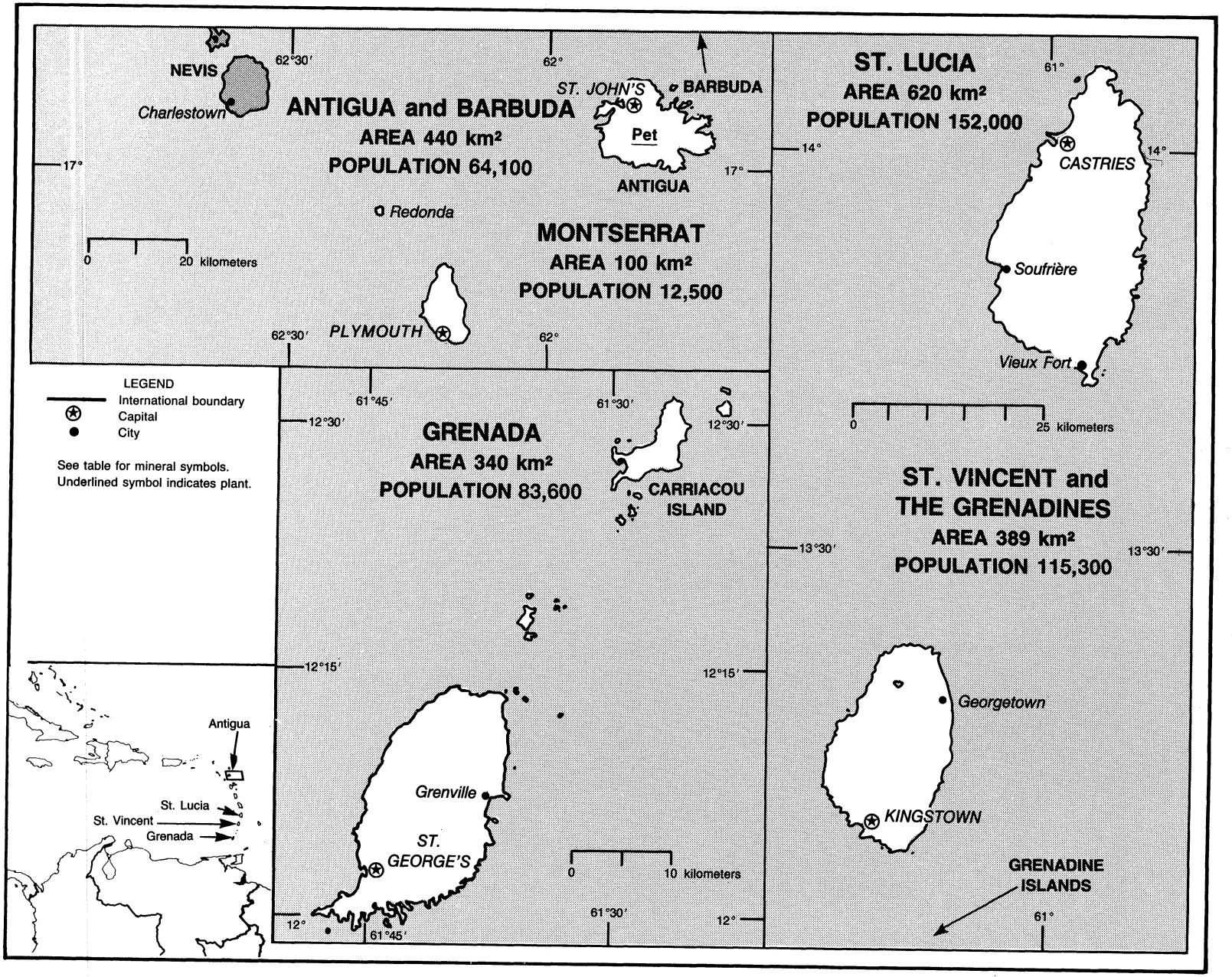
Commodity		Major operating company (ownership)	Location of main facilities	Annual capacity
Bentonite		Empresa Rotowa S.A. Corporación Nicaragüense de Minas (INMINE), Government, 100%	South of Sébaco, Matagalpa Department	4
Cement		Compañiá Nacional Productora de Cemento (Government, 100%)	San Rafaeldel Sur, Managua Department	330
Gold	kilograms	INMINE, 100%	El Limón Mine, León Department; Bonanza mining complex, Zelaya Department; Siuna mining complex[1] Zelaya Department	2,000
Do.		Empresa Mineral La Libertad (Inversiones Mineras, S.A.—Grupo IMISA, 100%)	La Libertad Mine, Chontales Department	1,000
Gypsum		Yesera Centroamericana S.A. (INMINE, 100%)	Santa Rosa del Peñón, León Department	17
Petroleum products	thousand 42-gallon barrels	Esso Standard Oil, S.A. Ltd.	Managua, Managua Department	5,400
Silver	kilograms	INMINE, 100%	Bonanza and Siuna[1] mining complexes, Zelaya Department; El Limon Mine, León Department	3,000

[1]The Siuna Mine is inactive.

ARUBA, THE NETHERLANDS ANTILLES, AND SAINT KITTS AND NEVIS

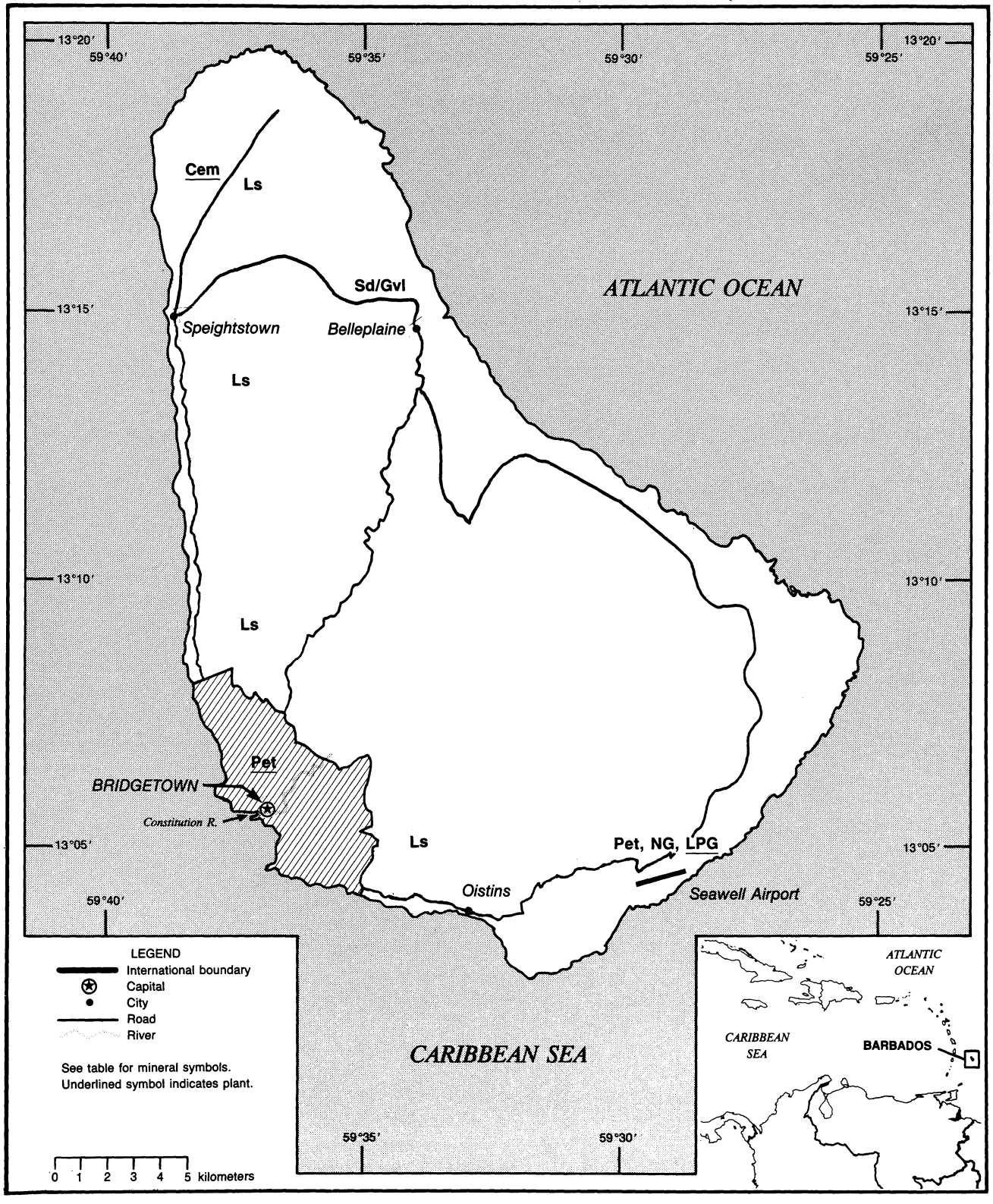


OTHER LESSER ANTILLES

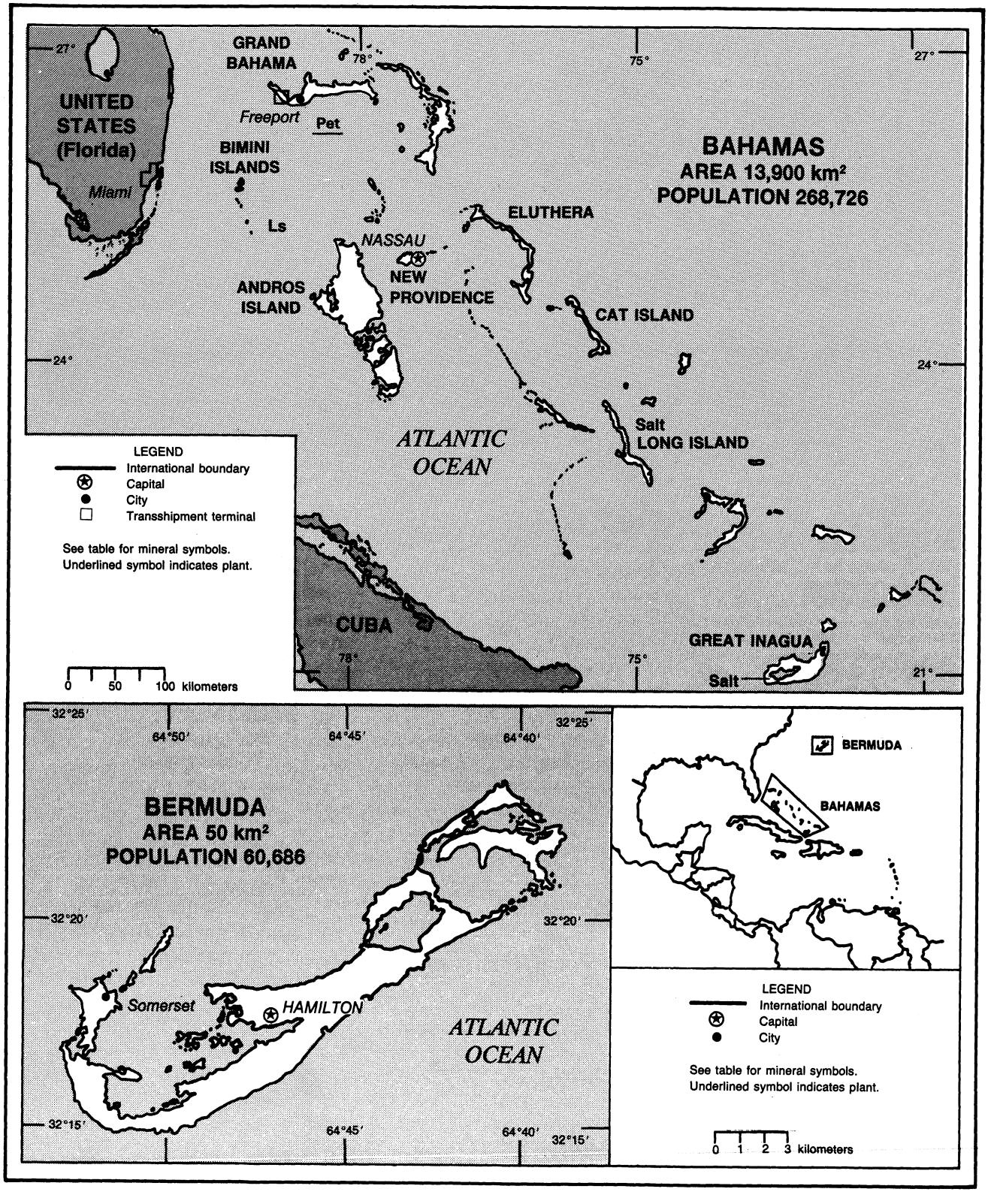


BARBADOS

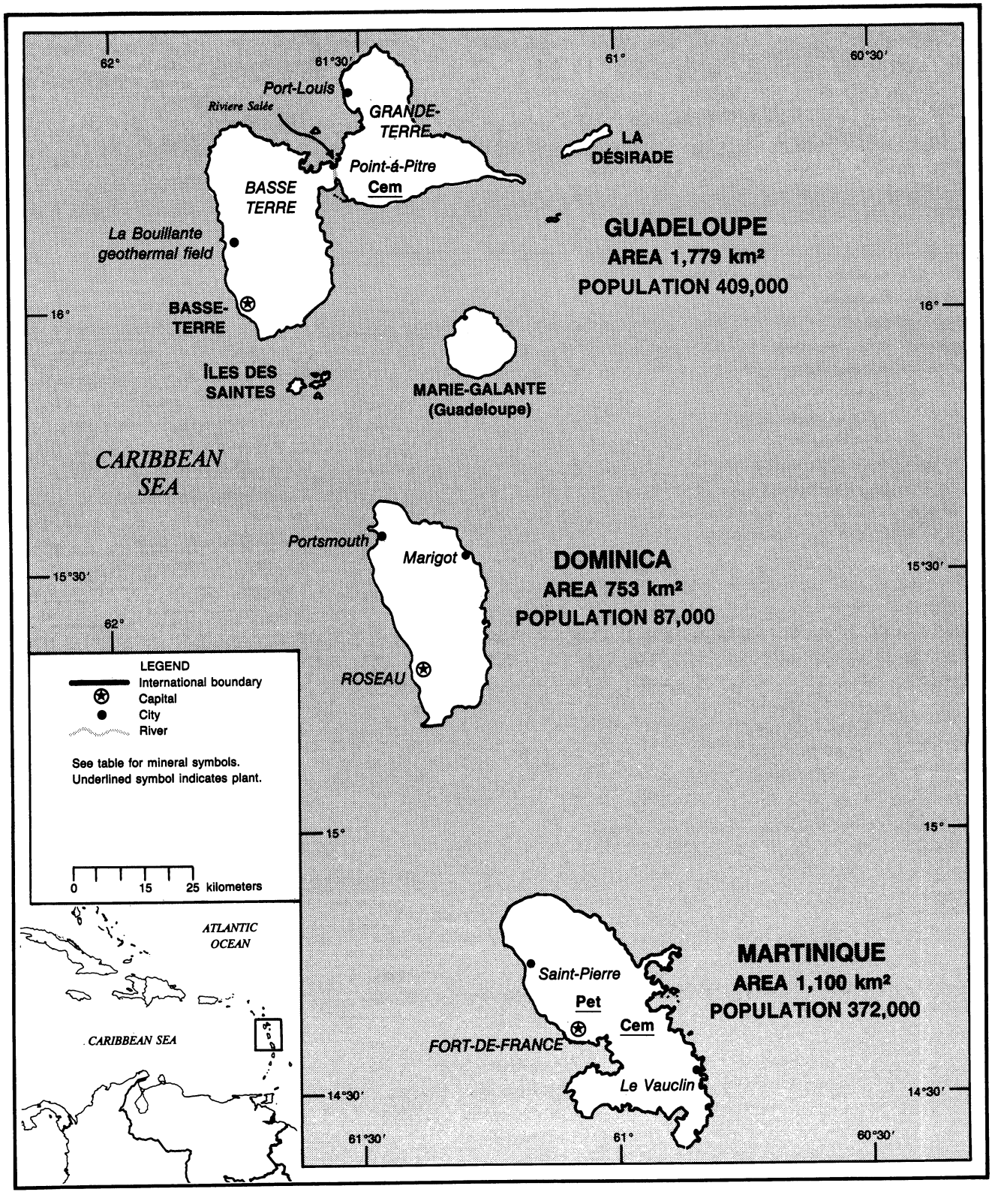
AREA 430 km² **POPULATION 255,000**



THE BAHAMAS AND BERMUDA

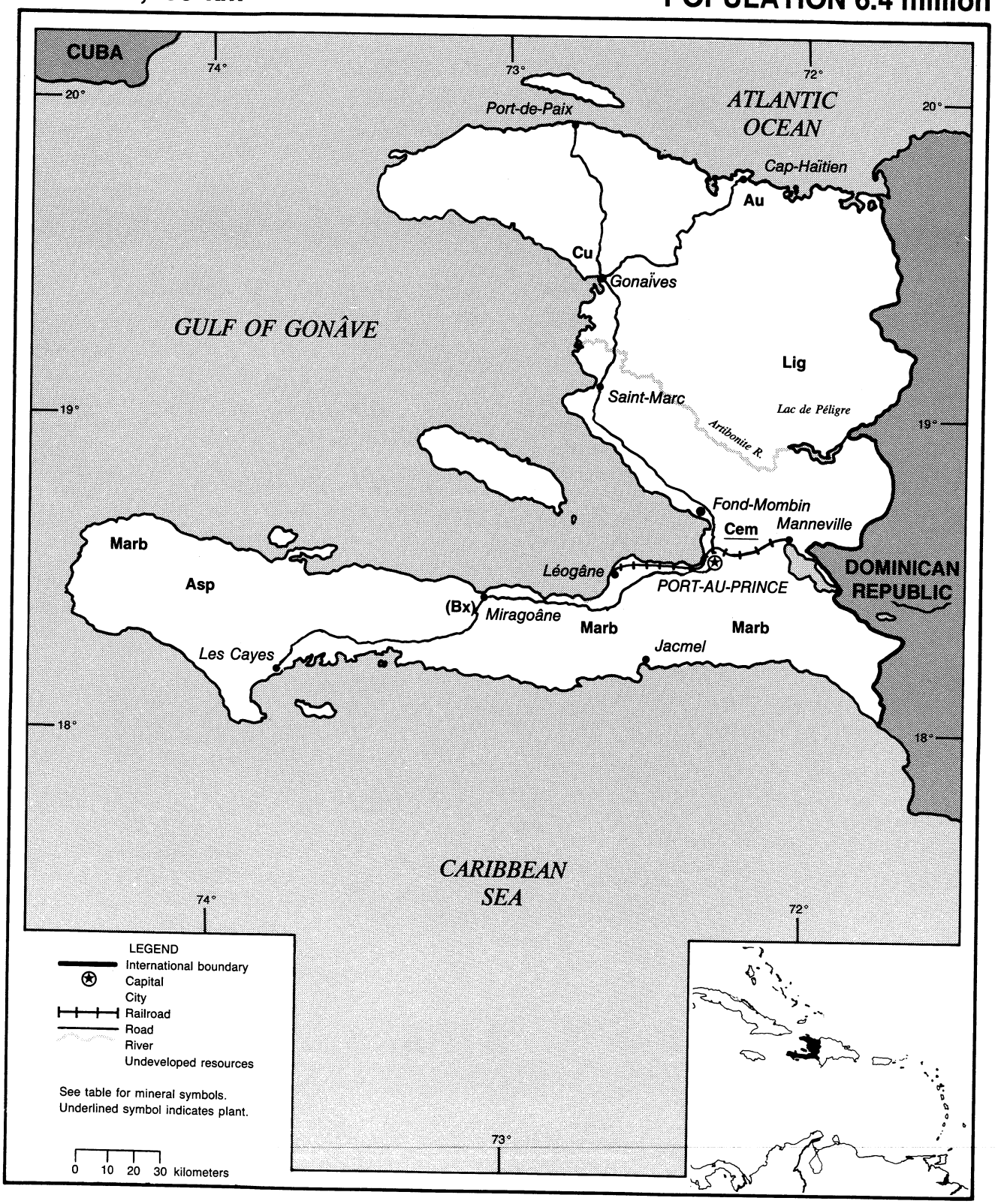


DOMINICA, GUADELOUPE, AND MARTINIQUE



HAITI

AREA 27,750 km² **POPULATION 6.4 million**



THE MINERAL INDUSTRIES OF

OTHER CARIBBEAN AREAS[1]

By George A. Rabchevsky

The Caribbean Basin is a diverse area of island nations and European dependencies, with about 35 political entities and more than 55 million people speaking more than 5 languages. Most of the Caribbean islands are geologically young, having developed in Mesozoic and Cenozoic eras. The Caribbean islands are part of one of the most geologically active areas of the Earth's crust. The Caribbean Plate encompasses most of the area of the Caribbean Sea and is bordered by three other plates. Metallogenically, Caribbean Cenozoic and Mesozoic mineral deposits are classified as massive sulfides, limestone replacements, vein and breccia pipes, synvolcanic manganese, ophiolite chromites, and laterites. Long before the arrival of Columbus in the New World, the indigenous peoples had developed a metallurgy based on gold found in placer deposits or in vein outcrops. Bauxite is the most recent major mineral to be exploited in the 20th century, relative to which the Caribbean has played a significant role. There also has been some limited production of oil and natural gas.

ANTIGUA AND BARBUDA

The Islands of Antigua and Barbuda are east of Puerto Rico. The islands are of volcanic origin and became independent from the United Kingdom in 1981. Tourism was the islands' main industry. The three-island Commonwealth's mineral industry supported the local construction industry. Mineral production was limited to small quantities of sand and gravel and crushed stone. On the Antigua Island, limestone deposits outcrop along the north and east coasts and was quarried for the construction industry. The Barbuda Island produced a small amount of salt. Phosphate previously was mined on the uninhabited island of Redonda. The U.S. Navy and Air Force operated intelligence and strategic facilities on the Antigua Island.

ARUBA

The Island of Aruba is northwest off the coastline of Venezuela. The island is of volcanic origin. Aruba separated from the Netherlands Antilles on January 1, 1986, becoming a sovereign nation within the Kingdom of the Netherlands. Its defense and external relations remained the responsibility of the Netherlands. Tourism was the major economic industry in Aruba.

Aruba has few natural resources; thus, mining and mineral production contributed little to the economy of the island. Reportedly, Aruba was involved in a gold exploration program with the Canadian company Monte Carlo Gold Mines, Ltd., Ontario. The company also planned to build a 200-mt/d heap-leach plant to process the island's tailings. Aruba produced refinery products from imported crude oil. Coastal Aruba Refining Co. N.V., a subsidiary of Coastal Corp. of Houston, Texas, produced asphalt, diesel fuel, feedstock for Coastal's other refineries, kerosene, and residual fuel oil at the 150-Mbbl/a Lago refinery. Petroleum and other mineral products were shipped from the ports of Oranjestad and Sint Nicolaas.

THE BAHAMAS

The Bahamas Islands are in the Atlantic Ocean, north of the Caribbean Basin. The Bahamas comprise 20 major islands and thousands of small islands. The Grand Bahama Island is the closest to the United States. The largest island, Andros, is about 225 km east of Miami. The islands' coral base rests on the volcanic rim foundation, but most of the exposed rock is oolitic limestone. Much of the land area is either rocky or swampy, with some thin fertile soil. Tourism was the largest sector of the economy, followed by offshore banking.

Mineral production on The Bahamas Islands was limited to aragonite, cement, petroleum products, salt, sand and gravel, and stone. Aragonite sand was dredged off the Great Bahamas Bank, south of the Biminis. The only cement plant was in Freeport, with production steadily declining. Limestone and sand were produced by Freeport Aggregate Ltd., in Freeport, for the domestic construction industry. Marine salt was produced in the evaporation pans on the Great Inagua Island, the southernmost island in The Bahamas archipelago. Inagua is one of The Bahama's most remote and least populated islands. Practically everything, including the water supply, was imported from the United States by Norton Co. The Bahamas imported all of its oil for the domestic processing of petroleum products. The Bahama's mineral exports included aragonite blocks, petroleum products, and salt. The United States continued to be The Bahama's most significant trading partner.

BARBADOS

Barbados is a relatively small island off the northeast coast of Venezuela. Tourism, sugar, and light manufacturing were the major contributors to the country's economy.

The mineral sector formed a minor part of the island's economy. The principal mineral commodities produced in Barbados were crude petroleum and natural gas. Industrial minerals produced included cement, clays, limestone, sand

and gravel, and road metal. The Arawak Cement Co. was the sole producer of cement on the island. Cement was exported to regional markets. The Barbados National Oil Co. Ltd. was the only operating crude oil company on the island. The company also produced natural gas and liquid petroleum gas. The Mobil Oil Barbados Ltd. petroleum refinery is on the southwestern coast.

BERMUDA

The Bermuda Islands are north of The Bahamas in the Atlantic Ocean. Bermuda is an archipelago of 7 main islands and about 150 other islands and islets. Those islands are the tops of submerged volcanic mountain ranges, 4,500 meters high, that were extinct before the first ice age. Bermuda is an independent territory of the United Kingdom. Tourism in Bermuda was the main economic activity and declined in 1993 owing to recession in Europe.

The islands have an insignificant mineral industry. All mineral requirements were imported, except for some local stone production, primarily coral limestone. Quarries were privately owned, with low employment. Lacking rivers and streams, fresh water was collected from rainwater and seawater desalinization plants. Petroleum was imported as a domestic fuel. Mineral exports consisted almost entirely of the reexport of fuel oil. The United States continued to be one of Bermuda's most important trading partners. Other significant partners included Canada, Italy, and the United Kingdom.

DOMINICA

The Island of Dominica is about 550 km southeast of Puerto Rico, between Guadeloupe and Martinique Islands. Dominica became an independent state within the British Commonwealth on November 3, 1978. The rugged island is of volcanic origin, containing several hot and warm springs and a boiling lake. Agriculture was the dominant economic activity on the island. Dominica's economy was 60% dependent on banana exports. Tourism is still undeveloped because of the roughness of the terrain and the lack of white sand beaches.

Dominica produced clay, limestone, pumice, volcanic ash, and sand and gravel, primarily for the construction industry. Dominica was the leading producer of fresh water with exports to the other Caribbean islands. The Government supports the use of geothermal energy from its volcanic base and drilled a number of test wells. Dominica was dependent on imports for oil and raw and semimanufactured materials. Dominica exported small quantities of sand and gravel and crushed stone, mostly to Guadeloupe and the Virgin Islands. On April 20, 1993, Dominica became a contracting party to the General Agreement on Tariffs and Trade.

GRENADA

The most southern of the Windward Island chain, or Lesser Antilles, Grenada consists of Grenada and several islands of the southern Grenadines. The extinct volcanic island is off the northeast coast of Venezuela. Grenada has an agricultural economy and is best known for the production of bananas, cocoa, and nutmeg. There were no reported mineral industries in Grenada, although limestone, road metal, and sand and gravel were produced for the local construction industry. Tourism, once developed, could contribute significantly to the island's economy.

GUADELOUPE AND MARTINIQUE

Guadeloupe and Martinique Islands are both Overseas Departments of France. Included are the islands of Basse-Terre, Grande-Terre, Iles des Saintes, La Desirade, Marie-Galante, St. Barthelemy, and the French side of Sint Maarten. Guadeloupe Island is about 500 km and Martinique Island is 625 km southeast of Puerto Rico, both northeast off the coastline of Venezuela. The Basse-Terre portion of Guadeloupe Island is volcanic in origin, and the Grand-Terre area is composed of limestone formations. Martinique Island is a dormant volcano.

Both islands are dependent on France for large subsidies and imports. Agriculture, light manufacturing, and tourism were the main economic activities on the islands. Industrial minerals were the only commodities produced, such as cement, clays, lime, pumice, salt, sand and gravel, and stone. All mineral products, except for some cement and sand and gravel, were used domestically. About 5,000 tons of cement was being exported to French Guiana, while 75% of Guadeloupe's needs were imported mostly from Venezuela. Petroleum products were refined on the Martinique Island from imported crude oil.

HAITI

Haiti is part of the western area of the Island of Hispaniola. Haiti shares the island with the Dominican Republic. Haiti's terrain is mostly rough and mountainous. Economic activity remained depressed owing to the political unrest in Haiti. The trade embargo imposed by the Organization of American States and the United States in 1991 was still in force in the country. Also, because of the international oil embargo, Haitians received only about 2 hours of electricity per day, thus affecting the entire economy. Trees were being cut for the production of charcoal, causing soil erosion and contributing to problems in the agricultural sector. Exxon, Royal Dutch Shell, and Texco oil companies operated gasoline stations in Haiti. Reportedly, gasoline drums were being trucked illegally through the town of Ouanaminthe on the northeast border with the Dominican Republic, controlled by the Haitian military and its civilian allies. Unemployment in Haiti was high, reaching 75%, and about 65% of Haiti's businesses were bankrupt.

The small mineral industry in Haiti was involved in the production of cement, the mining of clays and limestone for cement production, quarrying a small quantity of marble, production of marine salt, dredging for sand and gravel, and other minerals used in the construction industry. In northern Haiti, there were small undeveloped deposits of chromite, copper, gold, iron ore, lead, manganese,

silver, sulfur, tin, and zinc.

MONTSERRAT

The dormant volcanic Montserrat Island is just south of the Antigua and Barbuda Islands. The economy of this small island was centered mostly on tourism. Small quantities of sand and gravel and other quarry products constituted the mineral industries of Montserrat. The island's mineral requirements were imported through the port of Plymouth.

NETHERLANDS ANTILLES

The two islands of the Netherlands Antilles, Bonaire and Curacao, are northwest off the coastline of Venezuela. The rest of the country, the Saba Islands, Sint Eustatius, and Sint Maarten Islands are east of Puerto Rico, about 800 km to the north. The islands are of volcanic origin. Netherlands Antilles is an autonomous dependency of the Kingdom of the Netherlands. Tourism, offshore financing, and sugar production from sugarcane were major contributing sectors to the islands' economy.

Mining and mineral production contributed little to the economy of the Netherlands Antilles. Netherlands Antilles produced limestone, phosphate rock, solar salt, and refined petroleum products on Curacao Island. Salt was exported to the other Caribbean islands, New Zealand, and the United States. Mineral products were shipped through the port of Willemstad on Curacao Island. Refined petroleum products also were exported. Refineria Isla S.A. on the Curacao Island, a Petroleos de Venezuela S.A. (PDVSA) subsidiary, leased the 113-Mbbl/a oil refinery at Willemstad from the Government of Netherlands Antilles. The PDVSA also recovered about 20,000 tons of sulfur at its refinery. The ocean terminal and facilities on Bonaire Island, owned by PDVSA, were used for storage and transshipment. Salt has been produced on Bonaire Island since the 16th century. AKZO Salt Antilles N.V. operated a 2,226-ha, 360,000-mt/a solar salt facility on the southern end of Bonaire.

A stone-crushing plant on Saba Island was operating. Aggregate was quarried on Sint Maarten Island by Bouwwbedrifj Bowen Winden N.V., a subsidiary of Devcon International Corp., Deerfield Beach, Florida. Production was consumed primarily by the local construction industry. A petroleum transshipment terminal was operating on Sint Eustatius Island.

SAINT KITTS AND NEVIS

The Nevis and Saint Kitts volcanic islands are southeast of Puerto Rico Island. The Federation of Saint Kitts and Nevis consist of Nevis and Saint Christopher Islands.

Tourism and sugarcane production were the major economic industries on those islands. Mining and mineral production contributed little to their economy. Although Nevis and Saint Kitts' mineral industry produced some construction materials and salt, most basic mineral requirements were imported. Beach sand mining was proscribed under the 1987 National Conservation and Environmental Protection Act. The deepwater port at Basseterre serves Saint Kitts Island, and Charlestown is the port of entry for goods destined for Nevis Island.

SAINT LUCIA

The volcanic island of Saint Lucia is about 150 km north of Grenada in the Lesser Antilles. Banana production and tourism were the island's main economic activities. Gravel and sand pits and pumice quarries supplied the island's construction sector, which was tied to hotel expansion. Hess Oil St. Lucia Ltd. maintained a petroleum storage and transshipment terminal near Castries, the island's capital. The Government is interested in developing alternative energy sources to supplement petroleum imports. Geothermal energy studies were conducted at the boiling volcanic sulfur springs near Soufriere on the southwest coast. On April 13, 1993, Saint Lucia became a contracting party to the General Agreement on Tariffs and Trade.

SAINT VINCENT AND THE GRENADINES

The small volcanic islands of Saint Vincent and the Grenadines are sandwiched between the islands of Saint Lucia in the north and Grenada in the south. Arrowroot, bananas, and tourism were the island's main industries. A small industrial mineral production supplied sand and gravel and road material needed by the construction industry. Small quantities of salt were privately produced. Reportedly, diplomatic relations were established with Cuba. The islands expected to trade surplus agricultural products, such as flour and rice, for Cuban cement and sugar.

[1]Text prepared Mar. 1994.

OTHER SOURCES OF INFORMATION

Agencies

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Service des Mines et de L'Industrie Point-a-Pitre, Guadeloupe French West Indies
Service des Mines et de L'Industrie Fort-de-France, Martinique French West Indies

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Saint Vincent and the Grenadines
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TABLE 1
ARUBA, NETHERLANDS ANTILLES, AND SAINT KITTS AND NEVIS: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
Aruba:							
Petroleum refinery products[e]	thousand 42-gallon barrels	[3]65,335	70,000	115,000	115,000	115,000	150,000
Sulfur, byproduct of petroleum[e]		60	60	[r]100	[r]100	100	135
Netherlands Antilles:							
Phosphate rock[e]		15	15	15	15	10	20
Salt[e] [4]		350	350	350	350	300	450

[e]Estimated. [r]Revised.
[1]Table includes data available through Mar. 15, 1994.
[2]In addition to commodities listed, crude construction materials (lime, sand, stone, etc.) may also be produced, but data on such production are not available, and information is inadequate to make reliable estimates of output levels.
[3]Reported figure.
[4]Primarily in Netherlands Antilles, with some in Saint Kitts and Nevis.

TABLE 2
THE BAHAMAS: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]	1989	1990	1991	1992	1993[e]	Annual capacity[e] (Jan. 1, 1994)
Salt	858	828	1,096	[r]809	850	1,500
Stone: Aragonite	1,086	807	1,211	[r]871	1,100	2,000

[e]Estimated. [r]Revised.
[1]Table includes data available through Mar. 15, 1994.
[2]In addition to commodities listed, crude construction materials (sand and gravel, stone, etc.) may also be produced, but data on such production are not available, and information is inadequate to make reliable estimates of output levels.

TABLE 3
BARBADOS: PRODUCTION OF MINERAL COMMODITIES[1]

Commodity[2]		1989	1990	1991	1992	1993[e]	Annual capacity[e] (Jan. 1, 1994)
Cement, hydraulic[e]	thousand metric tons	225	200	200	175	175	300
Gas, liquefied petroleum	42-gallon barrels	16,824	[e]18,000	[r]18,931	[r]18,925	18,000	25,000
Gas, natural:							
Gross	million cubic meters	32	33	[e]35	[e]33	33	45
Marketed[e]	do.	15	15	17	15	15	20
Petroleum:							
Crude	thousand 42-gallon barrels	389	454	[e]470	[e]470	460	694
Refinery products	do.	1,915	2,125	[e]2,200	[e]2,120	2,200	2,500

[e]Estimated. [r]Revised.
[1]Table includes data available through Mar. 15, 1994.
[2]In addition to commodities listed, crude construction materials (clays, sand and gravel, stone, etc.) were also produced, but data on such production are not available, and information is inadequate to make reliable estimates of output levels.

TABLE 4

GUADELOUPE AND MARTINIQUE: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1 1994)
Guadeloupe:							
Abrasives, natural: Pumice e		220	220	230	220	210	300
Cement		215	225	e240	e235	230	350
Martinique:							
Cement, hydraulic		244	250	e245	e240	220	300
Lime e	metric tons	5,000	5,000	5,000	5,000	5,000	6,500
Petroleum refinery products e	thousand 42-gallon barrels	4,800	4,800	4,800	4,800	4,800	5,500
Pumice e		140	140	150	140	130	250
Salt e		200	200	200	200	200	300

eEstimated.
[1]Table includes data available through Mar. 15, 1994.
[2]In addition to commodities listed, crude construction materials (sand and gravel, stone, etc.) may also be produced, but information is inadequate to make estimates of output levels.

TABLE 5

HAITI: PRODUCTION OF MINERAL COMMODITIES[1]

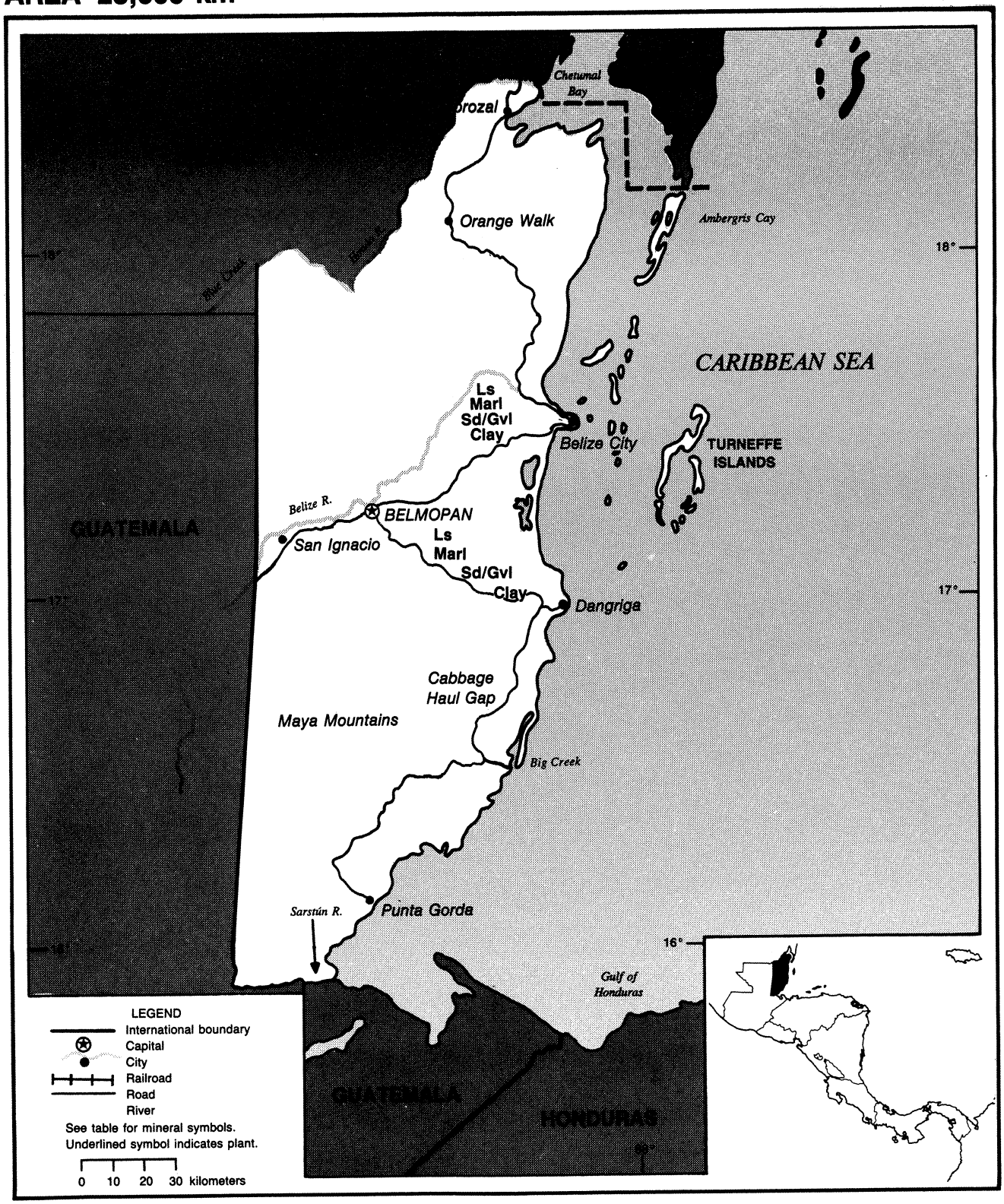
(Metric tons unless otherwise specified)

Commodity[2]		1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1, 1994)
Cement, hydraulic e		215,000	200,000	250,000	200,000	100,000	300,000
Clays, for cement		42,890	48,000	e40,000	e30,000	10,000	55,000
Sand and gravel:							
Gravel	cubic meters	3,809,700	3,967,928	e3,900,000	e3,000,000	1,000,000	4,500,000
Sand	do.	2,166,952	2,256,952	e2,200,000	e2,000,000	500,000	3,000,000
Stone:							
Limestone, for cement		322,949	286,600	e250,000	e220,000	100,000	400,000
Marble e	cubic meters	595	595	600	500	200	800

eEstimated.
[1]Table includes data available through Mar. 15, 1994.
[2]In 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.

BELIZE

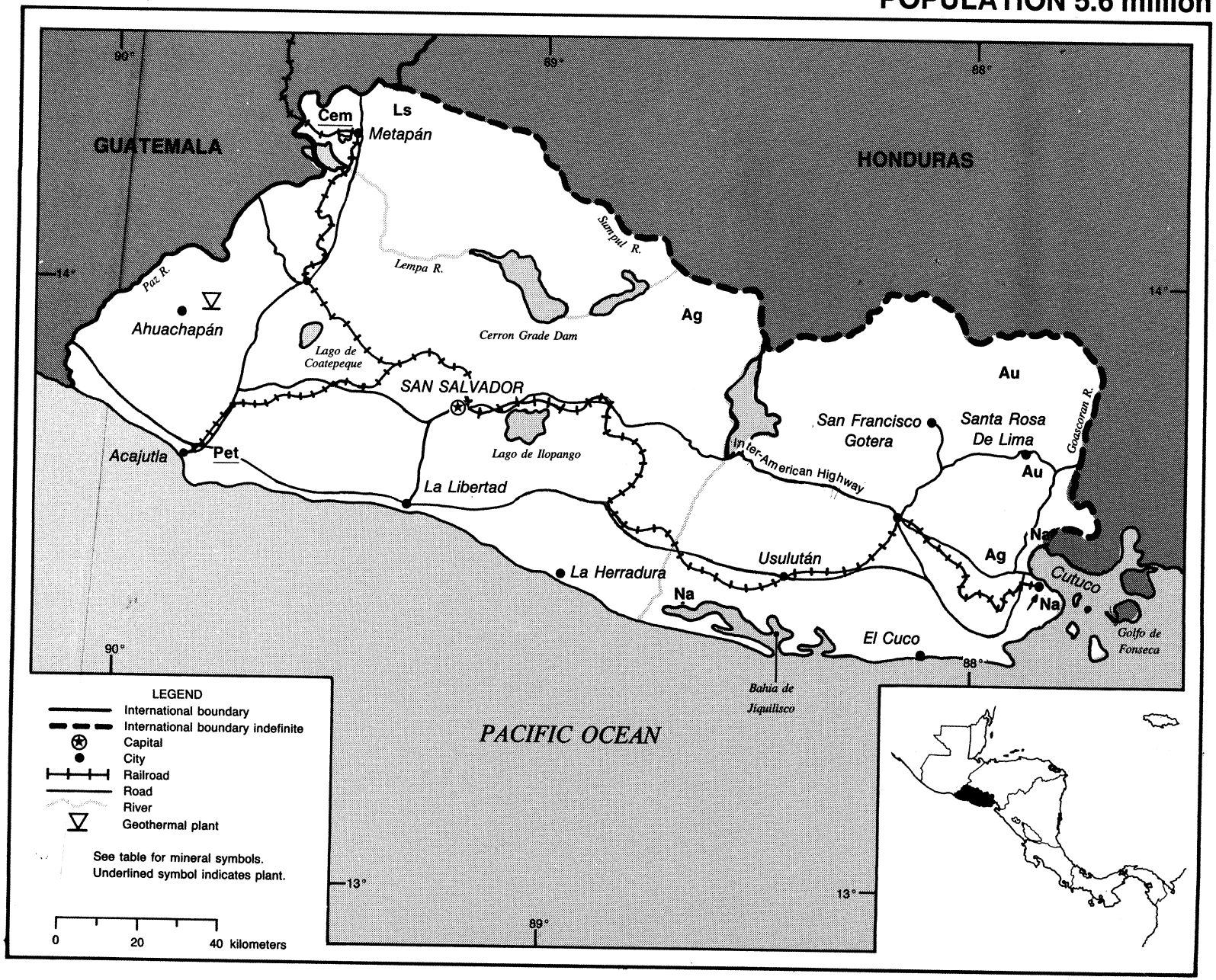
AREA 23,000 km² **POPULATION 203,000**



EL SALVADOR

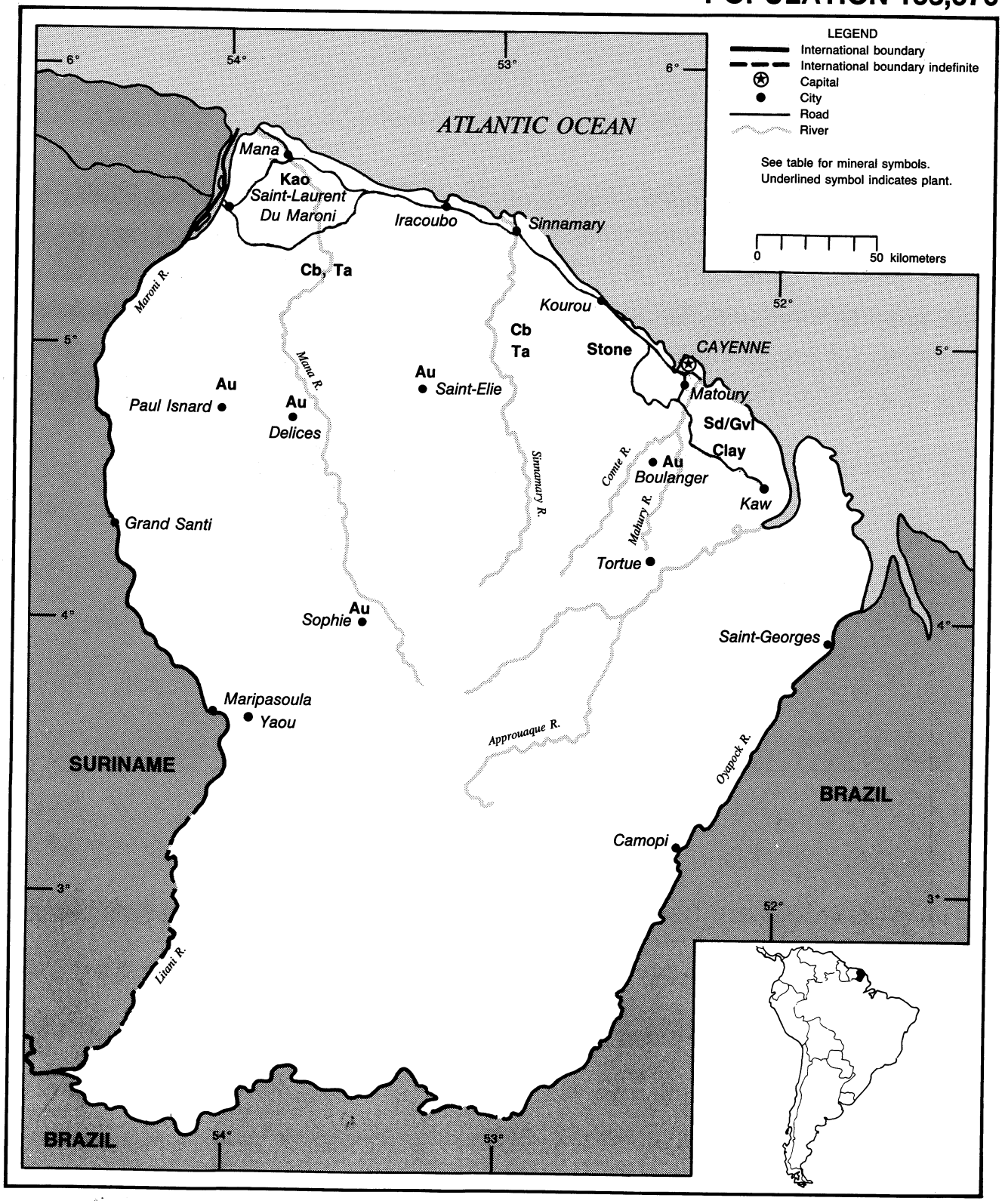
AREA 21,040 km²

POPULATION 5.6 million



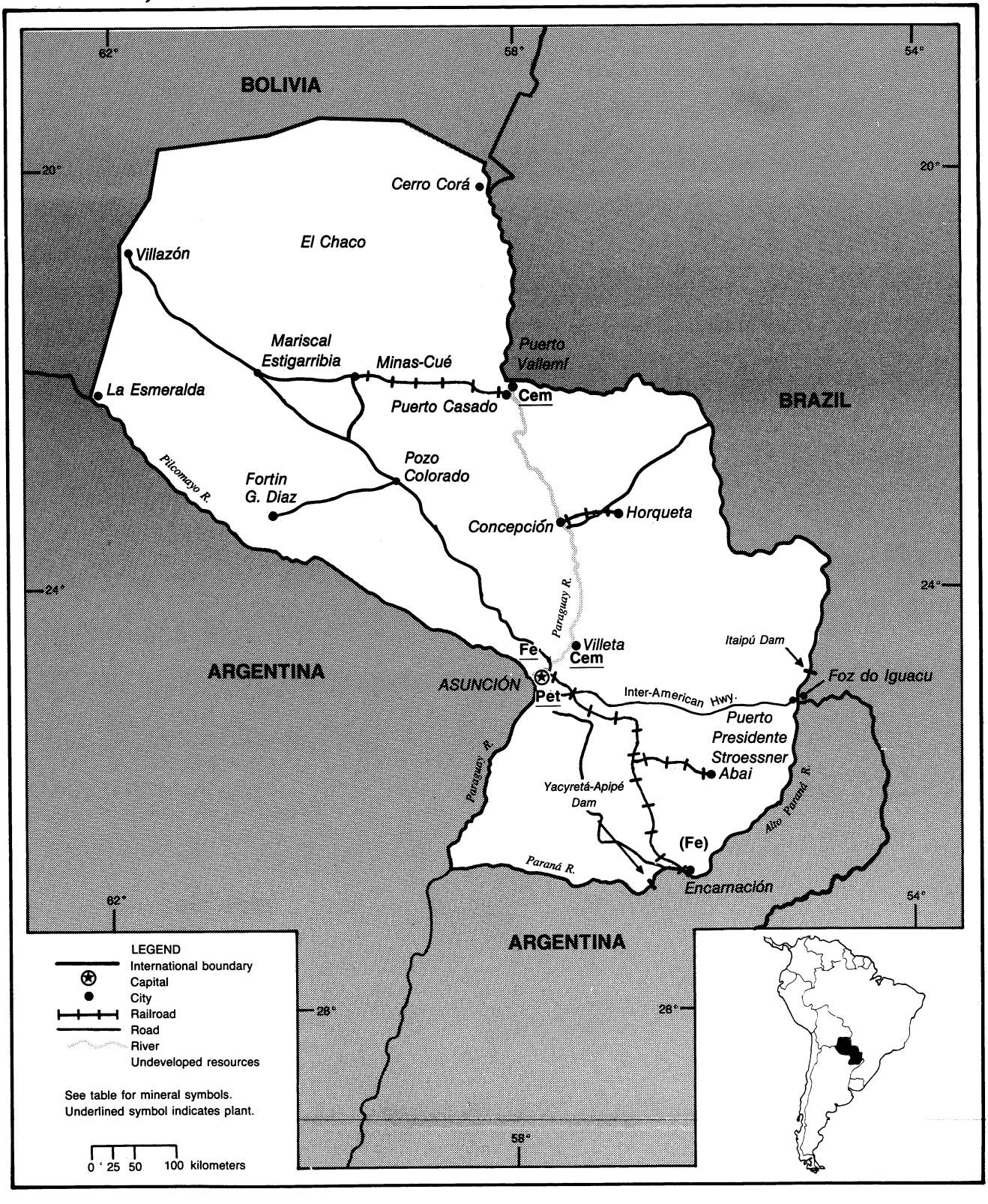
FRENCH GUIANA

AREA 90,909 km² **POPULATION 133,376**



PARAGUAY

AREA 407,000 km² **POPULATION 5 million**



THE MINERAL INDUSTRY OF

OTHER COUNTRIES OF LATIN AMERICA

By Solomon H. Toweh

BELIZE

The mining industry of Belize, traditionally dominated by construction materials, contributed approximately 0.7% of the gross domestic product (GDP) in 1993. The economy of the country is dependent on the agricultural sector, accounting for 30% of GDP and more than 75% of export earnings. The GDP of Belize was estimated to be $550 million[1] in 1993.

The Mines and Minerals Act of 1988 regulated mining activities. The provisions of the act do not include petroleum. Clays, limestone, marl, and sand and gravel for the construction industry accounted for most of Belize's mineral production. *(See table 1.)*

Prior to 1988, much of the nation's industrial minerals output was produced by private companies under contract to the Government's Department of Public Works. The Government's Geology and Petroleum Office has appraised and administered mineral concessions, licenses, and permits since 1988. Exclusive prospecting licenses for base metals, clay, and limestone ventures were held by three foreign companies as of 1991. Most of the nonfuel mineral operations were owned by Belgians, while a number of British and American firms held petroleum concessions. Belize Minerals Ltd. operated a commercial mineral processing plant with a capacity of 20,000-mt/a that ground locally quarried dolomite for use as fertilizer in the country's agriculture sector.

Trucks were used to transport industrial minerals to consumers on a road system that was paved or gravel-surfaced. Belize has made efforts to obtain financing for repairing its infrastructure because many major roads and bridges were deteriorating. The United Kingdom proposed to partially fund the upgrading of roads from Belize's ports to Guatemala.

The World Bank approved a $20 million loan for the "Belize City Infrastructure Project" in 1993, to support the government's efforts to rehabilitate the infrastructure in its largest city, and to promote safety, health, and economic development.

Belize depends on imported oil, mostly supplied by Mexico under the San José Accord, to generate electricity. Belize has a total electric generating capacity of 35 MW which is insufficient to supply electricity in most rural areas. The World Bank is currently preparing a power development project in support of the Government's plan to secure a reliable country-wide electricity supply through year 2005 and to lower electricity costs. It would complement private sector investment in a hydroelectric project supported by the International Financial Corporation.

In keeping with its goal of ensuring a balance between development and the environment, Belize enacted the Environmental Protection Act of 1992. The Department of Environment has been given the mandate to monitor implementation of the Act. To carry out this mandate, the Department has been drafting Effluent Limitations Regulations and Environmental Impact Assessment (EIA) Regulations since early 1993.

Prospects for growth in the mineral industry are tied to industrial mineral development. Continued growth in the tourism industry will lead to increased demand for construction material in the future. The country's large deposits of limestone and granites are ideal sources of aggregate and crushed stones. The existence of gypsum resources has been reported.

EL SALVADOR

The GDP of El Salvador was estimated to be $14.2 billion[2] in 1993. Agriculture accounted for 24% of GDP and 45% of export earnings. Cement production was the leading activity in the mineral sector with limestone as the major source of its raw material. Otherwise, mineral production in 1993 included limestone, gypsum, and salt. After cement, the leading mineral-related production included petroleum refining, phosphatic materials, aluminum, and steel production. *(See table 1.)* The Mining Code of 1922, as amended by the complementary Mining Law, Decree 930 of 1953, governed the Salvadoran mineral industry.

Gold trade and mining activity have been reported in the San Sebastian area, a community near Santa Rosa De Lima bordering Honduras. A small group of miners in the area worked by amalgamation, in which gold is extracted from the ores by treatment with mercury. Most of the product is sold to local jewelers. A group of U.S. investors was interested in reactivating an old mine in the area.

The Salvadoran cement industry had an estimated capacity of 924,000 tons in 1993. The private sector controlled the

industry. Cemento de El Salvador SA operated a 684,000-mt/a plant near Metapán. The government sold its 240,000-mt/a Cemento Maya SA plant to the same group that owned the larger plant. It has been reported that ownership of both cement plants by the same group could lead to monopoly in the industry with its potential for output restriction and/or higher prices. Another mineral-related private sector operation included the 5.8-Mbbl/a Refinería Petrólera Acajutla SA, which is owned by Exxon Corp. (60%) and Royal Dutch/Shell (40%). The prices of petroleum products and locally produced Portland grey cement are reportedly set by the government.

El Salvador's transportation network consisted of 602 km of track and 10,000 km of road, a portion of which connected the two major ports, Acajutla on the Pacific Ocean and the La Unión and Cutuco complex, off the Golfo de Fonseca.

Installed electricity generating capacity in El Salvador was 669 MW, primarily from hydroelectricity.

About 80% of exposed rock in the country is volcanic, with the prospect for exploiting perlite and pumice deposits being very good. As the country's infrastructure is rebuilt, demand for industrial minerals is expected to increase.

FRENCH GUIANA

With the exception of small-scale alluvial gold activity, mineral recovery operations had a relatively negligible economic impact in French Guiana, an overseas Department of France. The mining laws and regulations of France prevailed in the Department.

The Department was situated in the northeast quadrant of the Guiana Shield underlain by weathered Proterozoic granitoid rocks, gneisses, greenstones, and metasediments. Gold had been mined at a number of placer sites in the interior since 1853. Columbite, sand, and tantalite also were produced from alluvial deposits. Sand was dredged from the major rivers, primarily the Mahury and the Maroni. Stone was quarried at Cayenne and to the southeast of Kourou. *(See table 1.)* In general, existing mineral companies tended to be small and locally owned. The French state company, Bureau de Recherches Géologiques et Minières (BRGM), began to divest a number of exploration concessions during the year. Golden Star Resources Ltd. agreed to acquire the Yaou-Dorlin gold prospect from a BRGM-BHP Minerals joint venture. KWG Resources Inc.'s subsidiary Guyane Resources Inc. optioned 15 gold concessions from BRGM.

France dominated French Guiana trade, accounting for more than 50% of total imports and exports. Most of the produced gold was exported to France, however some gold was mined and smuggled out of the country by Brazilian garimpeiros along the southeastern frontier. Sand and stone were consumed by the local construction industry. The Department depended on imports for its other mineral requirements, especially cement and fuels, which were shipped through the port at Cayenne.

Interest in gold mining should continue to grow. As an increasing number of companies and investors from Canada and the United States focus on gold opportunities on the Guiana Shield in Guyana and Venezuela, company interest should spill over into French Guiana. However, the demand for stone and sand and gravel should diminish, with the completion of large-scale public works projects.

PARAGUAY

The mineral sector of Paraguay accounted for about 0.5% of GDP in 1993 compared with 25% for the agricultural sector. The Paraguayan GDP grew by 3.5% from the previous year to an estimated $6.7 billion[3] in 1993 as a result of higher agricultural output and rising international commodity prices. Export revenues were $728 million in 1993, representing a 4% increase from that of the previous year.

Mineral production in Paraguay included clays, glass sand, gypsum, kaolin, limestone, pigments, small amounts of iron oxide, stone, and talc. Mineral-related activities included manufacture of cement and lime, production of pig iron and steel, and refining petroleum from imported raw materials. *(See table 1.)*

Known mineral deposits included high-grade limestone deposits along the Paraguay River. These deposits provided high-grade raw materials for the cement industry, calcium carbide manufacture, precipitated calcium carbonate, lime, and other mineral-related products. 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. Other minerals known to occur included azurite, barite, gypsum, lignite, malachite, mica, peat, pyrite, pyrolusite, and soapstone. Geophysical surveys have identified oil and natural gas potential in the El Palma Largo and Gran Boquerón Chaco regions in northwest Paraguay.

The Government-owned cement plants and petroleum refinery were the primary activities associated with the mineral sector. Cement was produced by Industria Nacional del Cemento (INC) which operated two plants, the Puerto Vallemí cement plant in Concepción Department with a 400,000-mt/a capacity, and the Itapucumi clinker plant in Villeta Department with a 600,000-mt/a capacity. The Paraguayan national steel corporation, Aceros del Paraguay S.A. (ACEPAR), operated a plant at Villa Hayes, 20 km north of Asunción. The raw materials, iron ore and coal, were imported from Brazil. The Government-owned company, Petróleos Paraguayos S.A. (PETROPAR), produced refined petroleum products for domestic consumption at its Santa Elisa refinery in Asunción.

Installed electric generating capacity was 5,257 MW in 1993, mainly from hydroelectric plants at the Itaipú Dam complex, a joint Brazilian-Paraguayan hydroelectric powerplant on the Paraná River; and the Yacyretá-Apipé Dam, a joint Argentinean-Paraguayan hydroelectric project 320 km downstream from Itaipú.

The transportation system in Paraguay comprised 28,300 km of highways, 970 km of railroads, and 3,100 km of inland waterways. Paraguay, Argentina, Brazil, Bolivia, and Uruguay moved closer to the integration of river transportation with the inauguration of two locks in the Tiete River in Brazil. It is reported that, after completion of this waterway, the cost per ton of transportation of Paraguayan products will drop to about $10 from the current $29.

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

[2]Where necessary, values were converted from Salvadoran colones (C) to U.S. dollars at the fixed rate of C8.670=$1.00.

[3]Where necessary, values were converted from Paraguayan guaraníes (G) to U.S. dollars at the average market rate of G1,744.3=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Geology and Petroleum Office
Ministry of Natural Resources
84-36 Unity Blvd.
Belmopan, Belize

Dirección de Recursos Mineros
Ministerio de Economía
4a Avenida Norte No. 233
San Salvador, El Salvador

Direction Regional de l'Industrie, de la Recherche et l'Environnement
B.P. 7001
97307 Cayenne, French Guiana

Administración Nacional de Combustibles, Alcohol y Portland
Asunción, Paraguay
Palma 1084 y Hernanderías
Asunción, Paraguay

Dirección General de Recursos Minerales (DGRM)
Oliva y Alberdi
Asunción, Paraguay

Industria Nacional del Cemento (INC)
Humaitá 357, Edificio Humaitá 5to Piso
Asunción, Paraguay

Ministerio de Industria y Comercio
Ave. España 477 (Esq. Estados Unidos)
Asunción, Paraguay

Publications

Administración Nacional de Combustibles, Alcohol y Portland, Asunción, Paraguay: Memoria y Balance (annual report).

Banco Central del Paraguay, Asunción, Paraguay: Boletín Estadístico (annual report).

Central Intelligence Agency, Washington, DC: The World Factbook, annual.

Garcia, E. Mineral Resources of Belize, C. A. Transcript of Presentation at the Belizean Studies Conference, Belize City, Oct. 26, 1990.

Gédim (Paris, France): Réalités Industrielles, Annales de Mines, monthly.

Inter-American Development Bank, Washington, DC: Economic and Social Progress in Latin America (annual report).

Instituto Latinoamericano del Fierro y el Acero (ILAFA), Santiago: Anuario Estadístico de la Siderúrgica y Minería del Hierro de América Latina, annual.

International Institute for Environment and Development (IIED); World Resources Institute (WRI); The World Conservation Union (IUCN); and the United States Agency for International Development (USAID), Washington, DC: Country Environmental Studies. A product of the International Environmental and Natural Resource Assessment Information Service (INTERAISE) Project. Nov. 1992.

LAMI, The South American Investment and Mining Guide. Paraguay's Update-002, Dec. 1991.

Lorenz, W. Industriemerale, Steine und Erden in der Republik El Salvador, Mittlamerika. Geologisches Jahrbuch, Reihe D. Hanover, 1986, 90 pp.

Siderurgia Latinoamericana, monthly.

U.S. Department of Commerce, International Trade Administration:
Foreign Economic Trends and Their Implications for the United States, annual.

TABLE 1

OTHER COUNTRIES OF LATIN AMERICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993[e]	Annual capacity[e] (Jan. 1, 1994)
BELIZE							
Clays		97,611	r2,082,987	e2,000,000	e2,000,000	2,000,000	2,100,000
Dolomite[e]		—	r 2 28,1562	r28,000	r28,000	28,000	30,000
Gold[e]	kilograms	—	21	5	5	2	5
Lime[e]		—	2936	1,000	1,000	1,000	1,000
Limestone		165,594	r237,262	e300,000	e300,000	250,000	300,000
Marl	thousand tons	1,044	r991	e1,000	e1,000	1,000	1,050
Sand and gravel		278,034	r157,609	e200,000	e300,000	200,000	300,000
EL SALVADOR[3]							
Aluminum: Metal including alloys, semimanufactures		1,795	2,040	1,612	r2,301	2,000	2,400
Cement		632,651	640,943	679,723	r419,378	2861,424	924,000
Fertilizer materials:							
Phosphatic		11,702	7,998	r e8,000	r10,515	10,000	12,000
Other mixed chemical		45,484	53,430	48,697	r47,926	48,000	54,000
Gypsum[e]		4,500	4,500	r4,500	r4,500	5,000	5,000
Iron and steel: Metal:							
Steel, crude[e]		211,700	12,000	11,000	11,000	12,000	12,000
Semimanufactures		37,804	37,847	41,273	r45,016	256,021	56,100
Limestone	thousand tons	1,600	1,700	1,900	r2,200	22,600	2,600
Petroleum refinery products	thousand 42-gallon barrels	5,000	4,856	5,662	r6,033	6,000	6,100
Salt, marine		5,000	8,000	15,000	r e20,000	230,000	30,000
FRENCH GUIANA							
Clays[e]		4,500	5,000	6,000	5,000	5,000	5,000
Columbite and tantalite	kilograms	1,304	1,076	e1,100	e1,100	1,100	1,100
Gold, mine output, Au content	do.	544	870	1,417	r2,140	2,500	2,500
Sand	thousand tons	1,925	1,456	e1,500	e1,000	1,000	1,500
Stone, crushed	do.	1,189	1,319	e1,500	e1,400	1,400	1,500
PARAGUAY[3]							
Cement, hydraulic[e]	thousand tons	2326	326	326	326	326	400
Clays:[e]							
Kaolin		274,000	74,000	74,000	74,000	74,000	75,000
Other	thousand tons	21,860	1,900	1,900	1,900	1,900	2,000
Gypsum[e]		24,500	4,500	4,500	4,500	4,500	5,000
Iron and steel:							
Pig iron		63,000	61,000	60,000	e60,000	60,000	65,000
Steel, crude		55,000	48,000	61,000	86,000	86,000	100,000
Lime[e]		2103,000	100,000	100,000	100,000	100,000	100,000
Petroleum refinery products:[e]							
Liquefied petroleum gas	thousand 42-gallon barrels	100	100	100	100	100	100
Gasoline	do.	560	560	560	560	560	600
Jet fuel	do.	160	160	160	160	160	200
Kerosene	do.	40	40	40	40	40	50
Distillate fuel oil	do.	740	740	740	740	740	800
Lubricants:							
Oil	do.	20	20	20	20	20	20
Grease	do.	5	5	5	5	5	5
Residual fuel oil	do.	350	350	350	350	350	350
Refinery fuel and losses	do.	25	25	25	25	25	25
Total	do.	2,000	2,000	2,000	2,000	2,000	2,150

See footnotes at end of table.

TABLE 1—Continued

OTHER COUNTRIES OF LATIN AMERICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1, 1994)
PARAGUAY[3]—Continued							
Pigments, mineral: Natural, ocher e		[2]320	330	330	330	330	350
Sand, including glass sand e	thousand tons	[2]1,939	2,000	2,000	2,000	2,000	2,000
Stone: e							
Dimension	do.	[2]65	70	70	70	70	70
Crushed and broken:							
Limestone (for cement and lime)	do.	[2]566	600	600	600	600	600
Other	do.	[2]1,960	2,000	2,000	2,000	2,000	2,000
Marble		[2]730	750	750	750	750	750
Talc, soapstone, pyrophyllite e		200	200	200	200	200	200

e Estimated. r Revised.

[1] Includes data available through Dec. 1994.

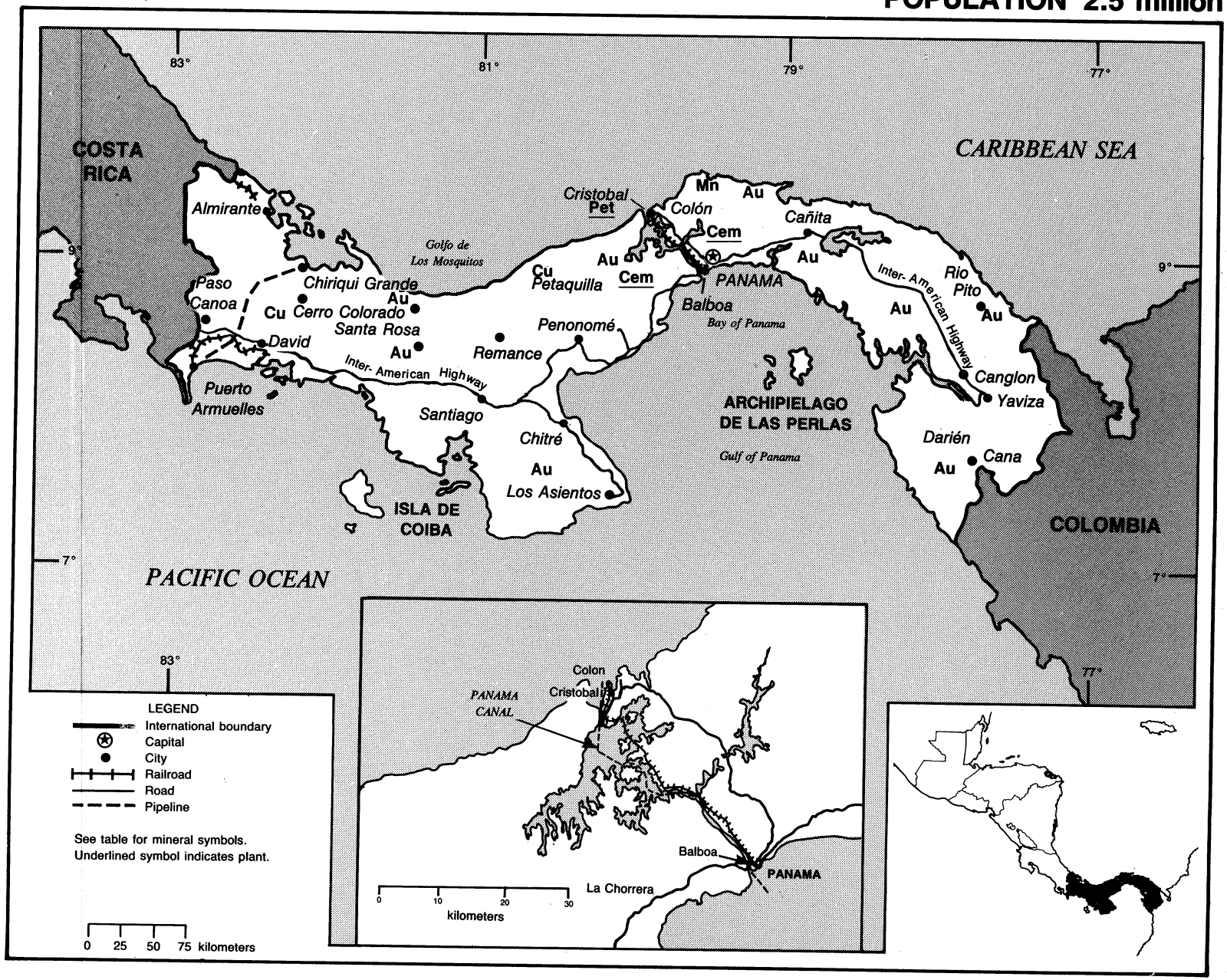
[2] Reported figure.

[3] In addition to commodities listed, construction materials (clays, gravel, miscellaneous rock, sand, and weathered tuffs) were presumably produced. Available information is inadequate to make reliable estimates of output levels of these commodities.

PANAMA

AREA 75,990 km²

POPULATION 2.5 million



THE MINERAL INDUSTRY OF

PANAMA[1]

By George A. Rabchevsky

The Republic of Panama is on the narrowest and lowest portion of the isthmus connecting North and South America. The country is bordered by Costa Rica to the west and Colombia to the east. The north coast is bordered by the Caribbean Sea and the south by the Pacific Ocean. Almost 70% of the country consists of volcanic rocks. Volcanic activity has made the soil very fertile, making agriculture important to the country's economy, accounting for about 15% of the gross domestic product (GDP). Panama's geographic location and configuration is often considered to be its principal natural resource. The Panama Canal, completed in 1914, dominates Panama's economy, generating approximately 25% of its GDP. Under the 1978 U.S.-Panama Treaty, the control of the canal will be turned over to Panama on December 31, 1999.

In 1993, the GDP increased by 5.9%, following a growth of 8% in 1992. The inflation in 1993 was reported as 1.6% and the unemployment rate at 13%. About 5% of the country's economy was credited to mineral transportation and industrial mineral production.

Mining still accounted for less than 1/2% of Panama's GDP. Panama mined gold and silver. Industrial minerals were produced for domestic use including cement, clays, limestone, salt, and sand and gravel. However, a number of new mineral deposits have been discovered, the largest of which was the Cerro Colorado copper deposit in the Chiriqui Province near the Costa Rican border. Gold deposits are now being exploited—the Remance Project was already in production and others like Cerro Quema, Santa Rosa, and Petaquilla are to start in 1995-97.

GOVERNMENT POLICIES AND PROGRAMS

The controlling legislation for mining was The Code of Mineral Resources, Decree law No. 23 of August 22, 1963, as amended by Decree No. 125, July 21, 1964; Decree No. 126, August 21, 1964; Decree No. 142, August 31, 1964; Decree No. 26, August 21, 1969; Decree No. 404, December 29, 1970; law No. 55, July 10, 1973; law No. 70, August 22, 1973; law No. 89, October 4, 1973; law No. 109, October 8, 1973; law No. 9, January 8, 1974; law No. 33, November 8, 1984; law No. 20, December 30, 1985; and law No. 3, January 28, 1988. Law No. 109 regulates the exploration and extraction of industrial minerals.

The Ministry of Trade and Industry is the central administrative body responsible for developing and implementing Government policy on industry, trade, and the exploitation of mineral resources. The Mining law No. 3 was modified on February 8, 1988, to bring the code in line with the international free market and stimulate foreign and local investors within the mining field: (1) Foreign companies are allowed a 4-year concession to work deposits they discovered, with a 2-year extension; (2) Extraction concessions are granted for specific mineral classes for a period of 20 to 25 years, extendable; (3) The state is obligated to grant an extraction concession if exploration is successful; (4) The Government reduced the rate of tax on mines to 2% of gross production for base metals and 4% for placer precious-metals production; (5) The Government also waived import duties on capital equipment; and (6) All minerals produced in Panama may be exported freely and exempt from duties. There are no restrictions on foreign ownership or repatriation of capital, but there is a 10% withholding tax on dividends or interest payable to foreign shareholders.

To stimulate economic recovery, the Government drew up the National Strategy for Economic Development and Modernization, approved by Cabinet Council Resolution No. 17-A of March 14, 1991. The Resolution presented four major principles: (1) Further development of the market economy, (2) private sector responsibility for production, (3) integration of the Panamanian economy in the world economy, and (4) modernization of Government structure. The Panamanian Government also proposed to privatize state-owned companies, including its interest in a cement company, in its national telephone company, in certain port facilities, and in portions of the national electricity company.

ENVIRONMENTAL ISSUES

Panama is better known for its canal than for its mines, but a pollution risk is oil leaking from the ships to the canal. Silting of the canal from bank erosion and sediment built up from tributaries is a common problem and is easily taken care of by regular maintenance service. Gold panning presents some disturbances in the river channels, and the surface mining of the manganese ore uncovers and leaves scars on the topography. The mining of both is not considered large, so environmental problems are not as serious as when the country will uncover larger deposits. Limestone quarries are few and small and are scattered throughout the country, posing no environmental

problems to the local population and tourists.

PRODUCTION

Panama produced only two metals, gold and silver. At the time of writing this report the production numbers were not available, thus all output was estimated. The production of industrial minerals such as cement, limestone, and sand and gravel increased in 1993, reportedly, because of a boom in the construction industry. Petroleum products output rose slightly because of an increase in the tourist industry. *(See table 1.)*

TRADE

Panama's trade policy is regulated by the various laws governing the sector and executive programs of the Government institutions that execute that policy and form part of the Institutional Structure for Foreign Trade. Panama is basically an importing country. Panama imported almost all mineral requirements for its industrial base. Mineral-related exports consisted primarily of scrap metal and petroleum products. Panama imported about 70% of crude oil from Ecuador and about 22% from Venezuela under the San Jose Accord. Saudi Arabia supplied the balance of Panama's crude oil requirements.

Panama signed bilateral agreements with countries in Central America whereby certain items may be imported from or exported to these countries without any customs duties being imposed. Panama was eligible for trade benefits under the U.S. Generalized System of Preferences and the Caribbean Basin Initiative. The United States was Panama's largest trading partner, and Panama was the third largest site of U.S. investment in Latin America after Mexico and Brazil. The major supplier of Panama's imports was the United States, followed by Asian manufacturers such as Japan, the Republic of Korea, and Taiwan and by Costa Rica and Germany. Panama exported raw materials and natural products primarily to the United States, and also to Costa Rica, France, Germany, Italy, Nicaragua, and the United Kingdom. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

The Mineral Resources Department (MRD), a Division of the Ministry of Commerce and Industry (MCI), was established by Decree No. 404 in December 1970. It is responsible for carrying out the technical and administrative functions stipulated in the Code of Mineral Resources. Applications for mining permits are made directly to MRD. Exploration and mining concessions are granted by MCI. There are also a series of governmental, professional, and private organizations involved in the mining sector. MCI and MRD began stimulating the private investments in mineral exploration projects.

Private companies operated most of the mineral industry in Panama. The Government jointly owned the Empresa Estatal de Cemento "Bayano" and held a 40% interest in Petroterminal de Panama, S.A., the crude oil transshipment and pipeline activity. The Government and Rio Tinto Zinc Ltd. (RTZ), which held the remaining 49%, continued to maintain the project in caretaker status. The Government was again considering divesting itself of its interest in the cement company and its 51% interest in the Cerro Colorado copper project. *(See table 4.)*

COMMODITY REVIEW

Metals

Copper.—The Petaquilla property was first geologically mapped in 1968 and 1969 by a United Nations Development Program team, leading to the discovery of a number of copper porphyry mineralized zones. To date, two large copper deposits have been discovered, the Petaquilla and Botija. The Petaquilla deposit is currently the largest of these, with reserves of 444 Mmt of ore grading 0.74% copper, 5 g/mt silver, and 0.08 g/mt gold. Japan and Panama could not reach a development agreement for the Petaquilla deposit, and in May 1992 Adrian Resources Ltd. began exploration. In 1991, Minnova (Panama) Inc. optioned an 80% interest in the Petaquilla copper concession from Geo-Recursos International S.A. In 1992, Adrian Resources Ltd. optioned a 40% interest in Minnova. On July 13, 1993, Adrian acquired 100% of shares of Geo-Recursos. Adrian holds a 20% direct interest in the Petaquilla property and holds an option to acquire a further 32% interest from Metall Mining Corp. Core drilling continued in 1993 on the Botija and Petaquilla sites. Those sites are adjacent to the national park (Parque Nacional del Cope), so the project is particularly sensitive to the potential environmental damages. The final feasibility study may be completed by early 1995. Adrian also secured adjoining properties and is planning to explore other areas of the concession.

The Cerro Colorado copper deposit is considered one of the largest untapped deposits in the world, with proven reserves of 1.4 billion tons of ore grading 0.78% copper, 5.1 g/mt silver, and 0.08 g/mt gold. The Government is attempting to attract foreign investors to evaluate the deposit further. RTZ received an exploration permit in 1975 but later returned its 49% stake to the Government. Indian groups in Panama protested against starting mining. Initially RTZ proposed to mine out the entire deposit, but now the Government is proposing to extract 60 Mmt to conserve the resource and protect the environment. The Government planned to offer 60% of the project to foreign investors.

Gold.—Panama is part of the gold-producing circum-Pacific "ring of gold" and its geology offers optimal conditions for the formation of gold-rich deposits. Panama has 13 gold deposits. Gold mining in Panama also includes small-scale placer operations in the Darien Province, in the southeastern area of the country. Panama has a long history of gold production. Between 1559 and 1589,

the Spanish extracted more than 9 tons of gold from the Cocuyo District on the Atlantic coast. From 1680 to 1729, the Spanish recovered gold at the El Espirito Santo de Cana Mine in Darien Province.

The Panamanian company Transworld Exploration S.A. and the Peruvian company Minera Remance operated an underground gold mine, northeast of Santiago. Remance Mine is northwest of Santiago in the Veraguas Province. The mine was first exploited by Indians in the 19th century, followed by the Veraguas Mining Co. and then by the Panama Corp. in 1931. Minera Remance S.A. is now operating the underground mine. Reserves were estimated at 200,000 tons with a grade of 6.5 g/mt gold and 19 g/mt silver.

Greenstone Resources Ltd., Toronto, Canada, was working on the feasibility study for the Santa Rosa gold mine. The deposit is about 1 kilometer south of the town of Canazas, Veraguas Province. Gold mineralization at the Santa Rosa has been known since the late 1920's. A United Nations study in 1960 followed by governmental drilling confirmed economic occurrences. Freeport McMoRan Inc. drilled again in 1986-88 and sold its interest to a joint venture comprising Greenstone and Boliden International Ltd. in 1990. Greenstone acquired Boliden's interest in the property in January 1993, thus becoming the sole owner of the mine. The Santa Rosa concession encompasses a collapsed Miocene caldera having gold deposits on the northern rim. Hot fluids percolated through the faults, fissures, and porous tuffaceous rocks altering and mineralizing the rock with gold. The adjacent Alto de la Mina gold deposit occurs in an andesite stockwork. Proven and probable minable reserves were estimated at 9 Mmt grading 1.5 g/mt gold for the Santa Rosa deposit. Reportedly, this reserve contains 13,375 kg of gold. The ore will be mined by open pit methods and then heap leached. Startup will be phased in with initial production coming from the smaller Alto de la Mina pit in 1994. Production from the Santa Rosa pit would follow in 1995. Full capacity production of 1,850 g/a gold is expected to be reached in 1996. Mining will be conducted by a contract mining company. Greenstone also worked on two other wholly owned production concessions, in the area surrounding the Santa Rosa project, called Boca d'Hugui and Aquacatal. The company has four exploration concessions in other areas of Panama and continued looking for new opportunities.

Manganese.—Manganese deposits are known in five areas in Panama. They are Bahia de Mandinga, Bahia de Montijo, Calzada Larga, Nombre de Dios, and Rio Boqueron. The Nombre de Dios area on the north coast has been the most productive. A feasibility study was conducted in 1992 by the Caribbean Mining Company Inc. to reopen the open pit Cerro Viejo Mine northeast of Colon. The mine, scheduled to begin operations in January 1994, contains an estimated 600,000 tons of manganese ore reserves. The company received a 25-year manganese mining concession from the Government on August 5, 1992.

The second manganese deposit, "La Soledad," is also in the Colon Province, and exploration rights were granted also to the Caribbean Mining Company. The deposit is composed mostly of pyrolusite and psilomelane with a grade of more than 85% MnO_2 and reserves estimated at 1 Mmt of ore.

Industrial Minerals

Panama produced cement, clays, lime, limestone, marine salt, and sand and gravel in small operations. Cement was produced by the Empresa Estatal de Cemento "Bayano" at Calzada Larga near the canal and by the private company Cemento Panama, S.A. at Quebrancha, also near the Canal. Cement production in 1993 was at 50% capacity, in spite of the reportedly growing tourist trade. Volcanic rocks cover more than 70% of the island's surface, making potential igneous rock quarries and gangue minerals available to future explorations, including basalt, granite, pumice, and tuffas.

Mineral Fuels

In Panama, all crude oil was imported for the refining of its petroleum products. The country owed $131 million to Venezuela and $116 million to Mexico for crude oil imports, under the San Jose agreement. Reportedly, both countries stopped shipping oil to Panama in 1993. About 14.5 million barrels was imported from Ecuador and Saudi Arabia. Lacking funds, the Government offered to pay off Venezuela with milk, sugar, meat, and seafood.

Texaco Exploration Panama Inc. began its exploration for crude oil off the northwest coast in Bocas del Toro Province.

The enactment of Decree No. 29 on July 14, 1992, Decree No. 38 in September 1992, and Decree No. 26 on May 6, 1993, liberalized the status of the petroleum market and created the Petroleum Free Zones (PFZ). Within the PFZ, national or foreign corporations may perform multiple operations under a special tax regime. The activities permitted in the PFZ include all types of operations concerned with warehousing, pumping, transfer, distribution, trading, and refining of crude petroleum and petroleum products.

Geothermal energy sources have been located throughout Panama, with more than 20 thermal hot spring sites. Technical and economic assessments have been carried out at the following locations: Baru-Colorado Volcanic Complex at Chiriqui Province and Chitra-Calobre and El Valle at Cocle Province.

INFRASTRUCTURE

Roads in Panama were generally in good condition, especially in and around urban areas. The Pan-American Highway runs most of the length of the country along the Pacific coast. Paved highways accounted for 2,745 km of about 8,500 km of roads. There was only 238 km of railroad track in the country.

Proximity to both the Pacific Ocean and the Caribbean Sea make the 82 km Panama Canal very useful and profitable. About 60% of the ships using the canal are going from one U.S. port to another. Transportation of mineral products, shipped through the canal or sent through

the oil pipeline, has also been a significant facet of the minerals industry in Panama. Crude oil was transshipped through a 130-km pipeline extending from Puerto Armuelles on the Pacific coast to Chiriqui Grande on the Atlantic coast. The port of Bahia Las Minas in Colon, the site of the oil refinery of Rafineria Panama, S.A., handles and receives oil tankers and other vessels. Balboa, Cristobal, and certain other ports service regular oceangoing freighters and passenger ships.

Electricity in Panama was generated by the state-owned Instituto de Recursos Hidraulicos y Electrificacion. The electrical capacity was rated at 848 MW, 65% of which came from the hydroelectrical stations. Private companies donated about 265 MW to the country's total capacity. A geothermal energy region in southwestern Panama had an estimated potential of 400 MW.

OUTLOOK

Foreign investment in the precious-metals areas is expected to increase because of the incentives provided by law No. 3. New copper, gold, and manganese projects are expected to start in 2 to 3 years. Production of all the commodities is also expected to grow in 1994 because of the growing construction and tourist industries. The approval and funding of the 150-MW coal-fired generating plant would expedite the development of the country's coal reserves. Texaco Panama Inc. is exploring for oil off the northwest coast in Bocas del Toro Province, on the Pacific side. The reliance on all imported oil will decrease once the oil is found, and other companies will start exploration programs. Environmental studies are being considered to evaluate the extraction of gold and manganese ore.

[1]Text prepared May 19, 1994.

[2]Where necessary, values have been converted from Panamanian balboas (B) to U.S. dollars at the rate of B1.00=US$1.00 in 1993.

OTHER SOURCES OF INFORMATION

Agency

Direccion General de Recurssos Minerales
Ministerio de Comercio e Industrias
Panama 5, Panama.

Publications

Dirección de Estadística y Censo, Panama: Panama en Cifras, annual.

Dirección General de Recursos Minerals, Ministerio de Comercio e Industrias, Panama: The Mining Sector of Panama, 1993.

Dirección General de Recursos Minerales, Ministerio de Comercio e Industrias, Panama: Panama, A Directory of Mineral Resources, Results from the National Mineral Inventory Project 1988-1990, 1991, 11 pp.

Latin American Mining Institute, Washington, DC: Mexico and Central America Investment and Mining Guide, annual.

Mining Engineering, The Society For Mining, Metallurgy, and Exploration, Littleton, CO: Don, C. White. Geology and Mineralization of The Santa Rosa Gold Deposits, Panama, Apr. 1994, pp. 346-349.

TABLE 1
PANAMA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993e	Annual capacitye (Jan. 1994)
Cement		168,500	300,000	e300,000	e250,000	300,000	610,000
Clays:							
For cement		43,047	122,332	368,582	415,058	420,000	500,000
For products		e36,000	e90,000	75,343	72,849	72,850	90,000
Gold[2]	kilograms	—	85	194	250	255	350
Lime[e]		[3]2,000	3,000	1,320	1,500	1,500	3,000
Petroleum refinery products	thousand 42-gallon barrels	6,552	8,466	e8,000	e9,000	9,500	14,000
Salt, marine[e]		17,990	22,200	18,000	20,000	20,000	24,000
Silver	kilograms	—	41	91	162	165	200
Stone, sand and gravel:							
Limestone:							
For cement		181,304	315,955	289,855	665,720	670,000	800,000
For other uses		16,509	77,098	47,968	e50,000	55,000	80,000
Sand and gravel	thousand tons	e1,000	470	1,941	2,448	2,500	3,500
Sand, silica		e12,000	14,829	17,613	22,600	22,500	24,000

eEstimated. rRevised.

[1]Includes data available through May 16, 1994.

[2]An unquantifiable amount of gold was recovered from placer deposits in Darien Province during 1989.

[3]Reported figure.

TABLE 2

PANAMA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

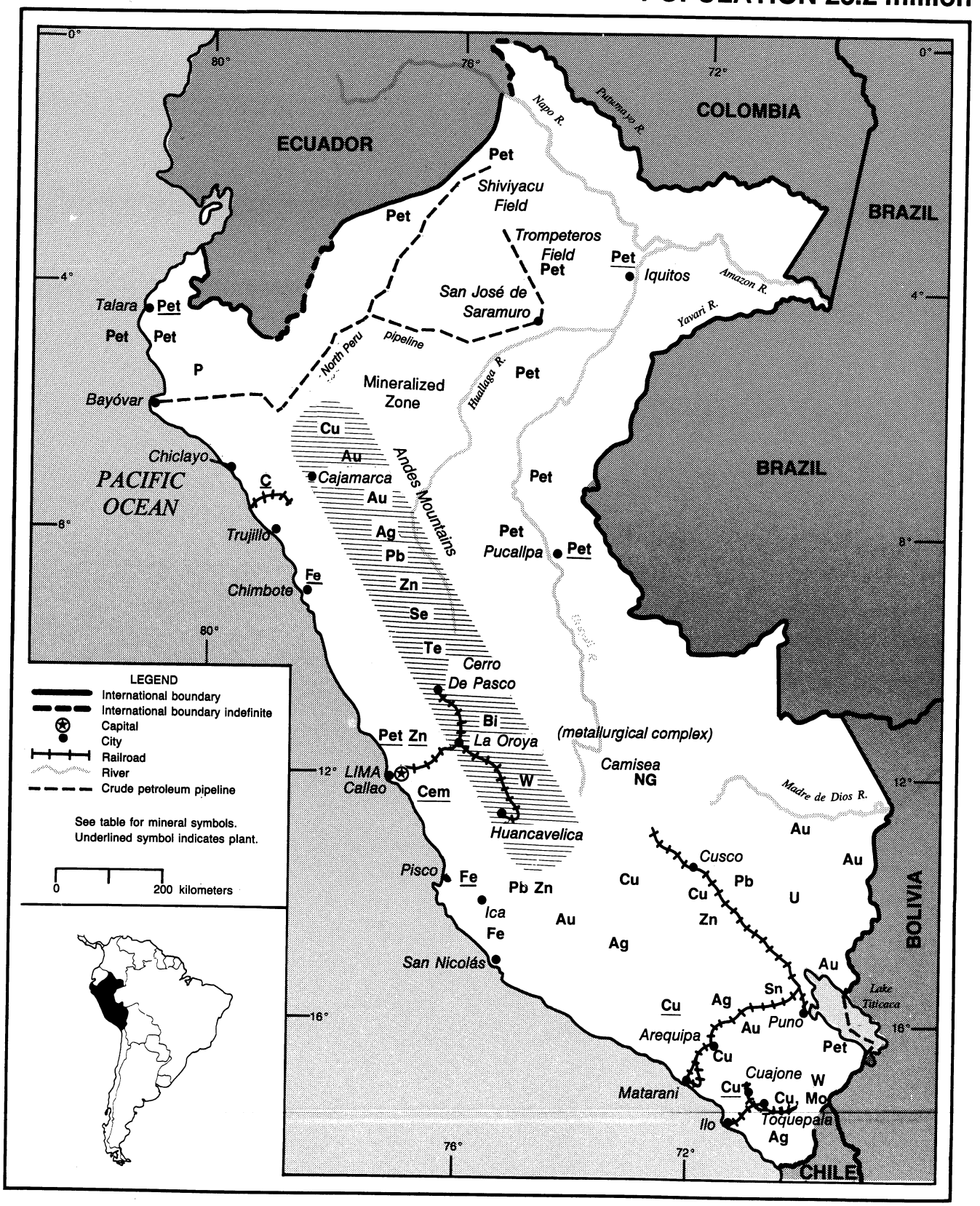
(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Empresa Estatal de Cemento "Bayano" (Government, 50%; Private, 50%)	Calzada Larga, Panamá Province	300
Do.		Cemento Panamá, S.A. (Private, 100%)	Quebrancha, Panamá Province	310
Gold	kilograms	Minas Santa Rosa, S.A. [Greenstone Resources Ltd. (Canada), 100%]	Santa Rosa Mine, Veraguas Province	1,800
Do.	do.	Transworld Exploration, S.A. and Minera Remance (Peru)	Remance Mine, Veraguas Province	293
Do.	do.	Sociedad de Inversiones IXTAPA, S.A. (Private, 100%)	Espíritu Santo de Cana Mine, Darien Province	NA
Petroleum products	million 42-gallon barrels	Refinería Panamá, S.A. (Texaco Panama Inc. [U.S.], 100%)	Las Minas, Colón Province	14
Silver	kilograms	Transworld Exploration, S.A. and Minera Remance (Peru)	Remance Mine, Veraguas Province	200

NA Not available.

PERU

AREA 1,285,200 km² **POPULATION 23.2 million**



THE MINERAL INDUSTRY OF

PERU

By Alfredo C. Gurmendi

Peru is the third largest country in South America, bordering Brazil in the east and the South Pacific Ocean between Ecuador and Chile in the west. Peru has three natural regions: western coastal plain "costa," high and rugged Andes in the center "sierra," and eastern lowland in the Amazon Basin "selva." More than one-half of the country is covered by forests. Most of Peru's minerals are mined in the Andes and its foothills.

The Peruvian economy is based on manufacturing, clothing, fishing, food processing, and on energy, mining, and mineral processing industries. Peru is a major world supplier of arsenic, bismuth, copper, gold, lead, molybdenum, silver, and tellurium. The country was the third largest producer of silver, following Mexico and the United States and produced more than 19 metallic and 30 industrial minerals. In Latin America, Peru is the leading producer of zinc.

In 1993, Peru with a population of almost 24 million, had a gross domestic product (GDP) of $70 billion[1]. The mining and quarrying sectors accounted for 4.7% of GDP. Nonferrous metals refining, iron and steel, and industrial minerals accounted for 6.1% of GDP, while hydrocarbon extraction and petroleum refining accounted for 4.6% of GDP. Thus, minerals and related industries were 15.4% of Peru's 1993 GDP. Mining export revenues, including petroleum, represented about 48% of Peru's total export earnings.

The Peruvian GDP declined 2.7% in 1992 and experienced a 6% growth during 1993. The inflation rate was reduced from about 55% in 1992 to 39.5% in 1993. The country's total foreign debt amounted to almost $22 billion and its reported net international reserves were about $3 billion by the end of 1993.

Peru, in just 3 years, had gone from near bankruptcy to the most attractive open-market economy in Latin America. The country slashed subsidies and tariffs, freed foreign exchange and interest rates, liberalized international investment rules, and embarked on a sweeping privatization process.

According to CARTA MINERA of Andean Air Mail & Peruvian Times, Lima, the Peruvian privatization program began on July 19, 1991, when Centromín Peru S.A. (CENTROMIN) sold its 9.2% share to its partner Cía. de Minas Buenaventura S.A. In November 1992, Shougang Corp. of China acquired Hierroperú for $120 million, bidding almost six times the initial base price. Other important sales included Compañía Minera Condestable S.A, Solgas, Minpeco, and the Quellaveco copper deposit sold for $12 million to Cía. Minera Mantos Blancos S.A., a Chilean subsidiary of Anglo American Corp. Peru has placed 220 state-owned companies on the privatization list and 20 of them were sold by the end of 1993.

Privatization of state-owned mining companies continued during 1993, the Cerro Verde Mine was sold to Cyprus Minerals Company of the United States for $37 million plus an investment commitment of $485 million over the next 5 years. CENTROMIN, Empresa Minera Especial Tintaya S.A. (TINTAYA), and Petróleos del Peru S.A. (PETROPERU, which changed to PERUPETRO) sales were left for 1994-1995.

Southern Peru Copper Corporation (SPCC) continued with its $300-million investment to improve its operations and to conduct its environmental projects. SPCC announced its interest in buying the state-owned Ilo refinery, which will be privatized in early 1994, to complement its Cuajone-Toquepala mine operations.

GOVERNMENT POLICIES AND PROGRAMS

The Peruvian Constitution of December 1993 promotes and protects domestic and international investments. The dramatic changes in Government policies and the rebounding of Peru's economy resulted in a boom in foreign investment. Lima's Stock Exchange (LSE), fueled by international investors, responded with annual yields of over 100% during 1992 and 1993. Today, Peru presents fewer risks than any other country in Latin America, as a result, it is attracting more international corporations, and institutional investors are looking for business opportunities in the country.

After strict fiscal measures during the last 2 years, reduced taxes and tariffs, a favorable 1993 Constitution for investment, an open market economy, and a privatization program, the Government succeded in bringing the country's economy back to a competitive position. All of these reforms generated great confidence, attracting investment and creating business opportunities in Peru.

The privatization process was managed by the Comisión de Promoción de la Inversión Privada (COPRI), and responsibility for specific privatization was vested in special committees, Comités de Privatización (CEPRI). The members of the CEPRI were picked from the ranks of leading professionals and officials, mainly from the private sector.

Legislative Decree 662 of August 29, 1991, was enacted as the Foreign

Investment Promotion Law. Supreme Decree No. 014 of June 2, 1992, was enacted as the only text of the General Mining Law. Decree 109 of June 12, 1981, and Decree 708 of December 14, 1991 (liberalizing the General Mining Law), were contained in this general text. Legal procedures to obtain mining rights were made easier by the enactment of complementary legislation Supreme Decree No. 018 of July 9, 1992. The Government had no longer exclusive control over exploration, mining, smelting, and refining of metals and fuel minerals. Individuals and private companies are allowed to hold mining permits in Peru.

The state-owned PERUPETRO managed these activities for the Government. PERUPETRO is headquartered in Lima and has offices in Iquitos and Talara, which supervise operations in the jungle and the northwest region, respectively. All mineral resources, including geothermal resources, belong to the Government of Peru. The Government grants concessions for use by the State, private companies, and individuals. The administration and management of all mining activities rests in the executive branch. From the early 1970's until 1991, all gold produced in Peru had to be sold to the Government's Mining Development Bank (Banco Minero), abolished in 1992. In 1993, the Central Bank had the legal authority to buy gold.

The Electrical Concession Law of November 1992 provided the framework for the participation of the private sector in the electrical public service.

ENVIRONMENTAL ISSUES

The Environmental Law 25763 of October 11, 1992, and its environmental regulations mandated by Supreme Decree 016-93-EM and modified by Supreme Decree 059-93-EM established the Peruvian environmental and regulatory norms for the mining sector.

Environmental impact studies for each phase of mining and petroleum operations were required by the Environmental and Natural Resources Law, Decree Law 611 of September 1990. Hydrocarbons, guano deposits, and mineral-rich waters are exempted from that law. Hydrocarbon activities were the responsibility of the Ministry of Energy and Mines.

PRODUCTION

According to the ANUARIO 1993-94 of CARTA MINERA published by Andean Air Mail & PERUVIAN TIMES S.A. (ANUARIO), in 1993, the most important mining event was that the Yanacocha Mine became the largest gold producer of the country.

During 1993, ANUARIO's statistics are showing substantial increases for the Peruvian metals, minerals, and petroleum production compared with the previous year *(See table 1.)*

TRADE

While the Latin American region is experiencing a dramatic economic upsurge as it nears the turn of the century, Peru, as a member of the Andean Common Market (ANCOM - Bolivia, Colombia, Ecuador, Peru, and Venezuela), sells about 8% of its exports to the other ANCOM members and almost 5% to the other countries in Latin America. ANCOM was established, as a free trade block, by the Cartagena agreement. During the past few years, trade with other Andean countries was less than 10% of total Peruvian trade. In an attempt to increase interregional trade, ANCOM sought to unify external tariffs. Also recently, Peru became eligible to apply for benefits under the United States Andean Trade Preference Act.

During 1993, mining producers exported an estimated $1.5 billion, or 48% of the total of Peruvian exports of $3.5 billion. Imports remained at a level of $4 billion. Base and precious metals and iron ore were the country's largest exports valued at $1 billion, $400 million, and $81 million, respectively.

Peru, for the eighth consecutive year, imported crude oil and petroleum products valued at $334 million, which created a trade deficit of $135 million for the energy sector.

STRUCTURE OF THE MINERAL INDUSTRY

Peruvian mining law defined large-scale companies as those producing more than 5,000 mt/d of ore. Medium-scale companies were those with a daily output of 350 to 5,000 tons. Small companies produced less than 350 tons of ore daily. The largest state-owned mining companies are CENTROMIN, Empresa Minera del Perú, S.A. (MINEROPERU), and TINTAYA. SPCC, also a large mining company, is privately owned. Large companies produced about 95% of the nation's copper, 100% of iron ore, 40% of lead, 30% of silver, and 40% of zinc. The medium-sized companies accounted for 5% of copper, 55% of lead, 60% of silver, and 55% of zinc outputs. The largest gold producer in the country is Minera Yanacocha S.A. (YANACOCHA), the newly established mining company, is owned by Newmont Mining Company of the United States, CEDIM, a local subsidiary of the BRGM of France, and Compañía de Minas Buenaventura of Peru. YANACOCHA invested $40 million last year, becoming the first significant international investment in Peru's mining sector in nearly 20 years. Private companies, mostly controlled by local interests, dominated the medium and small mining operations.

During 1992-1993, the following state-owned companies were privatized:

1) Empresa Comercializadora de Productos Mineros (Minpeco, S.A.), whose responsibility was to market ores, metals, and minerals produced by other state-owned mining companies, was sold to Companhia Mercantil e Industrial Ingá of Brazil.
2) Hierro Peru S.A. was acquired by Shougang Corporation of Beijing, China.
3) Quellaveco copper deposit of MINEROPERU was sold to Cía. Minera Mantos Blancos, a Chilean subsidiary of Minorco-Anglo American Corp. of South Africa.
4) Cerro Verde Mine of

MINEROPERU was acquired by Cyprus Amax Minerals Corp. of Colorado, United States in 1993.

Petroleum activities were administered by the state-owned PERUPETRO. The new hydrocarbon law eliminated the company's exclusive rights in the industry, such as control over secondary recovery operations, refining, and the importation and subsequent resale of crude petroleum and byproducts. The law enhanced oil and gas exploration and production contract terms, which resulted in an increased number of domestic and foreign firms expressing interest in participating in exploration contracts with PERUPETRO *(See table 2.)*

COMMODITY REVIEW

Metals

Copper.—According to ANUARIO 1993-94 (page 27), copper production increased to 374,891 tons, or about 1.4% over the previous year with a value of $696 million. SPCC remained as the largest copper producer of the country with an output of 241,891 tons of copper from its open pit operations at Toquepala and Quajone mines, which was slightly lower than that of 1992 (244,972 tons). Toquepala produced 106,322 tons of blister copper containing 49 tons of silver and 1,950 tons of molybdenite. Cuajone's production was 135,569 tons of blister copper with 51 tons of silver and 2,800 tons of molybdenite.

The state-owned TINTAYA, Peru's second largest copper producer scheduled for privatization in 1994, produced 48,473 tons of copper, while refined copper production from MINEROPERU's Ilo refinery amounted 180,000 tons of copper cathodes. CENTROMIN, the state-owned mining company to be privatized in 1995, reported a total copper production of 35,198 tons from its seven mines and 43,600 tons of refined copper from its La Oroya complex.

Cerro Verde, a mine previously owned by MINEROPERU and privatized in 1993, reported a production of 31,359 tons of copper. Other copper producers were: Cia Minera Pativilca, private mining company, produced 6,075 tons of copper; Cia Minera Condestable S.A., privatized in 1992, produced 4,383 tons of copper; and an additional production of 2,424 tons of copper came from small mines located throughout the country.

Gold.—According to ANUARIO (page 43), Peru produced 12% more gold than the previous year, which amounted to 23.1 tons of gold and exported 21.5 tons of gold valued at $238 million.

YANACOCHA, the joint venture established in late 1992 and owned by Newmont Mining Co. of the United States (40%); Buenaventura Mines, S.A. of Peru (36%); and France's Compagnie Francaise des Mines (24%); became the largest gold producer in the country with 2.6 tons of gold for 1993. In August 1993, YANACOCHA started mining its Carachugo open pit, and it is planning to expand its gold mine operations developing the Maqui-Maqui gold heap-leaching recovery process near Cajamarca with facilities capable of handling an annual production up to about 7.1 tons of gold. Newmont has identified and partially measured a geologic resource of more than 186 tons of gold in nine deposits within the Yanacocha gold district.

The southeastern Andes have well-known gold placers on the Inambari River and its tributaries. Placer gold production was concentrated in the Inca and Mariategui Regions, although gold was recovered from placers in rivers and streams throughout the jungle.

Gold was also recovered as a byproduct from the concentrates of the nation's polymetallic mines. Cia de Minas Orcopampa S.A, Buenaventura's subsidiary, reported a production of 264 kg of gold as byproduct of its base metal concentrates.

Iron and Steel.—Hierro Peru S.A.(HIERROPERU), formerly owned by the Government, was sold in 1992 to Shougang Corporation of the People's Republic of China. HIERROPERU produced 5.0 Mmt of iron ore. This represents an increase of 80% of output compared to the previous year's production. The Marcona Mine produced direct reduction iron pellets, pelletized fines, blast furnace pellets, and sinter feed. In 1993, the company exported 4.8 Mmt of iron ore, through the Port of San Nicolás, 15 km from the Marcona Mine, to Argentina, China, Japan, Republic of Korea, the United States, Yugoslavia, and locally to Empresa Siderúrgica del Perú.

Lead and Zinc.—In 1993, Peru produced 217,088 tons of lead and 664,045 tons of zinc. Both lead and zinc production increased by 10.9% and 9.8%, respectively over that of the 1992 outputs.

Zinc metal was refined at the MINEROPERU's Cajamarquilla plant (92,500 tons) and at CENTROMIN's La Oroya plant (265,400 tons), CENTROMIN also reported a production of 88,600 tons of lead and continued as the leading lead-zinc producer from its seven mines and smelting and refining complex of La Oroya.

Cía Minera San Ignacio de Morococha, S.A remained as the largest private zinc producer of Peru with 66,436 tons. Cía Minera Santa Luisa, subsidiary of Mitsui Mining Company of Japan, produced about 40,549 tons of zinc and 15,217 tons of lead from its Huanzalá Mine.

Cía. Minera Milpo, S.A., the largest private lead producer in Peru, reported 22,932 tons of lead and 37,373 tons of zinc outputs in 1993. Milpo operated a lead-zinc-silver deposit in the Central Mining District, Andrés Avelino Cáceres Region, northeast of Lima. This company was 73.8% owned by local shareholders and 26.2% by foreign investors.

Cía. Minera Atacocha, S.A., also operated in the Central Andes Cáceres Region. The mine was located in Yauricocha, 15 km to the northeast of Cerro de Pasco. Atacocha produced about 30,855 tons of zinc, 15,515 tons of lead, and 58 tons of silver in 1993.

Silver.—Silver production increased 1% to 1,631 tons in 1993, becoming the third world's largest producer, behind

Mexico and the United States. The medium-sized companies accounted for 55% of total output. Large mining companies contributed 30% of total output, and small companies the remaining 15%.

Peru operated at least 30 silver mines in 1993. The most important silver mines included Andaychagua, Arcata, Carolina, Cuajone, Casapalca, Caylloma, Cerro de Pasco, Cobriza, Julcani, El Brocal, Millotingo, Morococha, Orcopampa, Santa Luisa, Toquepala, Uchucchacua, and Yauricocha.

CENTROMIN led silver producers in the nation's total silver output, with 418,501 kg of silver. Buenaventura and its subsidiary, Orcopampa, dominated the medium-sized silver mining sector with 18% of the country's total silver production. Buenaventura was Peru's second largest silver producer and Orcopampa was rated as the nation's ninth silver producer, Orcopampa was running out of its reserves and was traditionally ranked as the third silver producer. In 1993, Buenaventura produced 133,514 kg of silver. Its Uchucchacua Mine accounted for 75% of its production, and the rest came from its Julcani Mine. The company also produced 3,017 tons of lead and 789 tons of zinc. Gold was mined from the Julcani Mine and lead and zinc from the Uchucchacua deposits.

Tin.—Minsur, S.A. was Peru's only tin producer in 1993. Production from its San Rafael Mine in Mariátegui Region was 13,687 tons of tin, a 34% increase over that of 1992. This positions Peru as the second largest tin producer after Brazil in Latin America. Peru's proven and probable tin reserves amounted to 7.8 million tons, grading 5.5% metal content; this grade was reported to be the highest in the world. Bolivia and Brazil, world-class producers of tin, had a metal content of only 1% and 2%, respectively. Tin concentrates were exported to Brazil and Thailand.

Tungsten.—Two private companies in Peru were mining tungsten at the Pasto Bueno Mine in Ancash and at Regina in Puno Region. The Palca XI Mine in Puno, operated by Sociedad Minera Regina was the main producer of tungsten. In 1993, production decreased to 398 tons or almost 50% from that of 1992, mainly because of lower world market prices.

Industrial Minerals

Cement.—There were five cement companies in Peru, including Cementos Lima, S.A., Cementos Norte Pacasmayo, S.A., Cemento Andino, S.A., Cementos Yura, and Cementos del Sur. The Government was planning to sell its 48.87% share in Cementos Lima, S.A., the country's main cement producer. The company produced about 870,000 tons of cement in 1993, about 40% of Peru's total cement output. The Atocongo has a designed capacity of 1 Mmt/yr, with its limestone quarries nearby. Most of the cement was exported primarily to Chile via the firm's own pier at Port Conchan, about 8 km from the plant. The pier started operation in 1990 and in May 1992 it was enlarged, including a new silo. The company also operated the small Rioja cement plant in San Martín Region using Chinese equipment.

Cementos Norte Pacasmayo, S.A. was the second largest cement company in Peru, accounting for 21% of total production. It has an installed capacity of 1 Mmt/yr, with a plant utilization of 47%. The plant is 670 km north of the Panamerican Highway in Pacasmayo, La Libertad Region.

Fertilizers.—Phosphate and potash deposits are in the Sechura Desert, Grau Region, north of Peru. They have been studied intermittently since the late 1950's but have never been developed to the extent that they should. The phosphate deposits of Bayóvar in northern Peru have proven reserves of 570 Mmt. Bayóvar deposits in the Sechura Desert were covered by sand and recent landslides. Only a small amount of phosphate was being produced. The 90,000-mt/yr phosphate plant was operated by Empresa Minera Regional Grau Bayóvar, S.A. Phosphate shipments continued to New Zealand under a 100,000-ton contract signed with Norphos International Ltd. of Auckland. Other shipments through the Port of Paita went to Chile and Costa Rica.

Other.—In addition to the oil refineries, PERUPETRO also operated five industrial plants. However, PERUPETRO closed the nonprofitable fertilizer plant, carbon black plant, and solvent complex as part of its reorganization plan. The natural-gas plant and the oil-lubricants plant remained open.

Mineral Fuels

Liquid fuels provided more than 60% of Peru's total energy requirements. Petroleum accounted for 23% of energy consumption, and electricity met 10% of energy demand. Natural gas supplied 7% of the country's energy mix. Gas was projected to provide a significantly increased share with the development of the fields in the Camisea area.

Peru's largest coal deposits are at Alto Chicama, 140 km north of Trujillo in La Libertad Region. Other coal deposits occur in the Cuenca del Santa in the Marañón Region and coal basins of Goyllarisquizga and Hatun Huasi in Cáceres Region of central Peru.

Natural gas was primarily piped from the Talara Basin in the Grau Region to the Talara refinery on the coast. Two gasfields in the Ucayali Basin were candidates for development. Peru's proven natural gas reserves at the end of 1993 were estimated at 196 billion m^3. The Aguaytia gasfield, approximately 41 km west-northwest of Pucallpa, had proven reserves of 12.5 billion m^3 of gas and 13.2 Mbbl of condensate. The country's largest potential gasfield is Camisea in Cuzco. The San Martín and the Cachiriari prospects at Camisea had estimated potential reserves of about 305.8 billion m^3 of gas and 725 Mbbl of condensate (natural gas liquids). The fields are very distant from potentially accessible markets, however,

infrastructure must be developed.

In 1993, petroleum production in Peru increased by 9% to 126,280 bbl/d compared with last year's output. However, for the eighth continuous year, the country imported crude oil and petroleum products to satisfy its internal demand.

Peru's total crude oil production of 46 Mbbl in 1993 came from PERUPETRO, 34%; Occidental Petroleum Corp., 45%; Petromar, 15%; and the consortium Oxi-Bridas, 4%. About 65% of the country's crude oil production came from the jungle blocks; the remaining was produced at the coastal and offshore fields in the northwest region of Peru.

There were 18 identified oil basins in the country, covering 84 Mha. Offshore and coastal basins were, from north to south: Tumbes-Progreso, Talara, Lancones, Sechura, Trujillo, Salaverry, Lima, Pisco, Moquegua, and Mollendo. Interior basins were, from north to south: Marañón, Santiago, Bagua, Huallaga, Ucayali, Ene, Madre de Dios, and Titicaca. Most production was from fields in the Marañón and Talara basins. Seven of the basins reportedly have yet to be drilled. Peru's petroleum reserves have been declining and were estimated at about 400 Mbbl in 1993, compared with the 1981 peak of 835 Mbbl.

In Peru, 12 of the 20 private oil companies were American, including Petrotech International Corp. of Delaware, which won the bidding to operate for 20 years the offshore reserves of Petromar. Mobil Exploration & Producing Peru Inc. had contracted to explore blocks 28, 29, 30, and 53 in the Upper Huallaga Valley and continued seismic and geological studies in the northern portion of its acreage, just south of PERUPETRO's block 8.

The largest oil refinery in Peru is La Pampilla, with a capacity of about 102,000 bbl/d. The second largest oil refinery in Peru, Talara, had a capacity of about 60,000 bbl/d. Smaller refineries were in Conchan, Iquitos, and Pucallpa.

INFRASTRUCTURE

The country had 1,801 km of railroads and 69,942 km of roads, of which 7,459 km were paved and 13,538 were unpaved. There were 8,600 km of navigable on land waterways, tributaries to the Amazon River system, and 208 km of waterways into the Lake Titicaca.

Peru had an installed electrical generating capacity of 5,042 MW, 60% of which came from the hydroelectric plants. Power and telecommunication lines, railroads, and roads in the Andes were subject to damage by landslides.

Important mineral industry ports included Callao, Ilo, Matarani, Paita, San Nicolás, and Talara on the Pacific Ocean and Iquitos on the Amazon River. There was also a petroleum depot at Bayóvar, with the 800-km North Peru crude oil pipeline. Natural gas and liquid gas were transported through a 64-km pipeline. PERUPETRO employs pipelines, coastal tankers, trucks, railway cars, and barges to supply crude oil and products to its 6 refineries, 20 sales plants, and 6 airport stations located throughout the country.

OUTLOOK

Peru's economy rebounded as strong national and international investments helped push growth to 6%. Foreign investment, after 20 years of absence, came back to the country attracted by its privatization program and its sound political, fiscal, and economic policies provided by the Government since 1990.

Fiscal austerity, hyperinflation control, privatization program, reduced taxes and tariffs, new financial conditions and arrangements for its mounting external debt, a new 1993 Constitution that promotes and protects investment, and the country's economy becoming increasingly market oriented paved the road to its economic recovery. Also, these reforms will bring long-term benefits to the energy, mining, and mineral processing industries.

After a burst of inflation as the austerity program eliminated government price subsidies, monthly price increases eased to the single digit level. By working with the IMF, the World Bank, and the Inter-American Development Bank, Peru succeeded in ending its arrears by March 1993.

With additional privatizations scheduled for 1994-1995, prospects for the mining and oil and gas industries will continue improving. Mineral industry output is expected to increase in 1994 in spite of lower prices for Peru's main mineral exports, base and precious metals, the medium- and long-term outlook for the mining sector is positive. The petroleum sector has also improved in 1993. Perupetro, the former Petroperu, will privatize some of Petroperu's operations in 1995; however, the Government will retain a 40% interest in the refineries.

Peru's privatization program will continue acting as a catalyst to reactivate the entire mineral sector. During 1991-1993 the Government had privatized 20 state-owned firms. There are 180 state-owned companies, including electrical, mining, and petroleum units, to be privitized during 1994-1995.

Investment studies for new energy production projects are being drafted with the support of the Inter-American Development Bank and the World Bank. There are also plans to privatize or form joint ventures in the existing power companies.

[1]Where necessary, values have been converted from Peruvian nuevos soles (S/.) to U.S. dollars using the average exchange rate for 1993 of S/.2.10=US$1.00.

OTHER SOURCES OF INFORMATION

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Publications

Andean Air Mail & Peruvian Times, S.A., Lima: Carta Minera y Panorama Petrolero, weekly.
International Trade Administration, U.S. Department of Commerce, Washington, DC: Foreign Economic Trends and Their Implications for the United States, Peru, annual.
Latin American Mining Institute, Washington, DC: The South American Investment and Mining Guide, annual.
Ministerio de Energía y Minas, Lima: Anuario de la Minería del Perú, annual.
U.S. Central Intelligence Agency, Washington, DC: The World Factbook, annual.
U.S. Embassy, Lima, U.S. Department of State: Industrial Outlook Report on Minerals, annual.

TABLE 1
PERU: PRODUCTION OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1, 1994)
METALS							
Antimony:							
Mine output, Sb content		r304	r307	r278	339	339	350
Metal		304	313	227	311	311	320
Arsenic, white[2]		563	e500	661	607	607	700
Bismuth:							
Mine output, Bi content		687	e555	e610	e550	e550	700
Metal		646	521	576	418	418	650
Cadmium:							
Mine output, Cd content		472	378	r526	399	399	500
Metal		352	265	135	339	339	350
Chromium, mine output, Cr content e		430	400	410	400	400	400
Copper:							
Mine output, Cu content		368,168	317,706	381,991	369,365	369,365	400,000
Sulfate (Cu content)		4,663	e3,500	5,083	3,823	3,823	6,000
Metal:							
Smelter:							
Refined		241,424	195,539	268,784	253,899	253,899	300,000
Electrowon		204,608	165,483	228,228	232,137	232,137	250,000
Total refined		19,652	16,307	17,908	19,004	19,004	20,000
Gold:		224,260	181,790	246,136	251,141	251,141	270,000
Mine output, Au content[4]	kilograms	9,898	r e9,100	r9,934	10,014	10,014	10,000
Metal	kilograms	2,923	1,270	r1,348	1,228	1,228	3,000
Indium	do.	3,026	2,801	3,142	3,050	3,050	3,100
Iron and steel:							
Iron ore and concentrate:							
Gross weight	thousand tons	4,507	3,307	3,593	2,848	2,848	6,000
Fe content	do	2,923	2,147	r2,331	1,820	1,820	3,000
Metal:							
Pig iron	do.	199	93	207	147	147	200
Sponge iron		45,746	28,968	24,064	e20,000	e20,000	50,000
Ferroalloys		r1,426	r1,706	r e390	e360	e360	2,000
Steel ingots and castings	thousand tons	401	284	418	338	338	500
Semimanufactures	do.	222	243	r251	242	242	250

See footnotes at end of table.

TABLE 1—Continued

PERU: PRODUCTION OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993[e]	Annual capacity[e] (Jan. 1, 1994)
METALS—Continued							
Lead:							
Mine output, Pb content		192,213	r187,827	199,811	194,225	194,225	200,000
Metal		73,402	69,305	74,510	82,488	82,488	90,000
Manganese, mine output, Mn content[e]		150	150	160	160	160	200
Molybdenum, mine output, Mo content		3,177	2,510	r3,031	3,339	3,339	3,500
Selenium, metal, refined	kilograms	e9,000	8,913	12,422	14,396	14,396	15,000
Silver:							
Mine output, Ag content		1,840	1,762	1,769	1,573	1,573	2,000
Metal, refined		658	623	631	691	691	700
Tellurium, metal	kilograms	e8,000	7,842	13,355	18,631	18,631	20,000
Tin, mine output, Sn content		5,082	5,134	6,559	10,195	10,195	10,000
Tungsten, mine output, W content		970	1,536	r1,232	802	802	2,000
Zinc:							
Mine output, Zn content		597,413	583,934	627,824	602,614	602,614	650,000
Metal		126,698	120,631	154,294	124,434	124,434	160,000
INDUSTRIAL MINERALS							
Barite		e150,000	re130,000	150,200	16,579	16,579	150,000
Boron materials, crude (borates)		re24,900	r19,917	r26,390	26,613	26,613	30,000
Cement, hydraulic	thousand tons	2,105	2,185	e2,200	2,089	2,089	2,500
Chalk[e]		470,000	200,000	391,500	100,000	100,000	500,000
Clays:							
Bentonite		e40,000	e45,000	55,300	14,500	14,500	60,000
Fire clay		e5,000	e5,000	7,320	9,500	9,500	10,000
Kaolin[e]		200	8,000	37,100	5,500	5,500	8,000
Common clay		e100,000	e100,000	395,890	67,915	67,915	400,000
Diatomite[e]		20,000	20,000	325,500	25,000	25,000	25,000
Feldspar		e10,000	e10,000	e3,000	10,021	10,021	10,000
Gypsum, crude[e]		160,000	150,000	160,000	35,300	35,300	160,000
Lime[e]		13,000	13,000	14,000	14,000	14,000	15,000
Mica[e]		100	100	100	100	100	100
Nitrogen, N content of ammonia[e]		91,000	90,000	95,000	90,000	90,000	100,000
Phosphates, crude		r14,804	r47,333	r18,239	e18,200	e18,200	50,000
Salt, all types		e200,000	e200,000	e200,000	238,244	238,244	250,000
Stone, sand and gravel:							
Stone:							
Dolomite[e]		9,000	9,000	343,800	40,000	40,000	50,000
Flagstone[e]		300,000	300,000	300,000	300,000	300,000	300,000
Granite[e]		2,000	2,000	2,000	2,000	2,000	2,000
Limestone	thousand tons	e3,000	e3,000	3,199	1,479	1,479	3,000
Marble[e]		20,000	20,000	30,000	310,256	310,256	30,000
Onyx[e]		500	500	500	3204	3204	500
Quartz and quartzite (crushed)[e]		40,000	40,000	340,505	40,000	40,000	40,000
Shell, marl[e]		4,000	4,000	4,000	4,000	4,000	4,000
Slate[e]		18,000	18,000	18,000	18,000	18,000	20,000
Travertine[e]		5,000	5,000	5,000	33,990	33,990	5,000

See footnotes at end of table.

TABLE 1—Continued

PERU: PRODUCTION OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993e	Annual capacitye (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued							
Stone, sand and gravel—Continued:							
Sand and gravel:							
Construction	thousand tons	e5,000	e5,000	3,100	960	960	5,000
Silica sand	do.	e75	e100	150	152	152	200
Sulfur:							
Elemental:e							
Native		100	100	100	100	100	100
Byproduct of metallurgy		66,000	66,000	66,000	66,000	66,000	70,000
Sulfuric acid, gross weight		e180,000	e150,000	206,828	41,973	41,973	210,000
Talc and related materials:e							
Talc		1,500	1,500	2,100	2,000	2,000	2,500
Pyrophyllite		7,500	7,500	8,000	8,000	8,000	8,500
Total		9,000	9,000	10,100	10,000	10,000	11,000
MINERAL FUELS AND RELATED MATERIALS							
Carbon black		5,028	e5,000	re3,000	—	—	5,000
Coal:							
Anthracite, run-of-mine		e100,000	e125,000	125,300	79,805	79,805	150,000
Bituminous, run-of-mine		e50,000	e50,000	25,500	14,485	14,485	50,000
Total		e150,000	e175,000	150,800	94,290	94,290	200,000
Coke, all typese		10,000	10,000	10,000	10,000	10,000	10,000
Gas, natural:							
Gross	million cubic meters	1,125	e1,100	1,012	e1,200	e1,200	1,200
Marketed	do.	283	e280	566	e570	e570	600
Natural gas liquids:							
Natural gasoline and others[5]	thousand 42-gallon barrels	e240	226	299	e295	e295	300
Propane	do.	e20	93	—	—	—	100
Butane	do.	e5	6	4	e4	e4	10
Total	do.	e265	325	303	e299	e299	410
Petroleum:							
Crude	thousand 42-gallon barrels	47,597	47,050	re41,896	42,298	42,298	50,000
Refinery products:							
Liquefied petroleum gas	do.	1,685	1,471	1,476	1,535	1,535	2,000
Gasoline, motor	do.	10,916	10,476	9,123	9,087	9,087	10,000
Jet fuel	do.	1,970	2,034	2,526	2,171	2,171	2,500
Kerosene	do.	6,484	5,699	5,468	5,534	5,534	10,000
Distillate fuel oil	do.	8,547	8,578	9,586	11,578	11,578	15,000
Lubricants	do.	48	38	54	38	38	100
Residual fuel oil	do.	24,751	24,762	10,366	24,389	24,389	25,000
Asphalt	do.	871	134	264	270	270	1,000
Other[6]	do.	298	888	16,704	e848	e848	20,000
Total	do.	55,570	54,080	55,567	55,450	55,450	85,600

eEstimated. pPreliminary. rRevised.

[1]Table includes data available through Mar. 15, 1994.

[2]Output reported by Empresa Minera del Centro del Perú, S.A.

[3]Reported figure.

[4]Much of Peru's placer gold production was not reported.

[5]Includes hexane.

[6]Includes refinery fuel and losses.

TABLE 2

PERU: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity ownership	Location of main facilities	Annual capacity
Antimony	metric tons	Centromín Perú S.A. (CENTROMIN) (Government, 100%)	Smelter at La Oroya, Andrés A. Cáceres Region	530
Arsenic		CENTROMIN	Refinery at La Oroya	4
Barite		Barmine, S.A. (private, 100%)	Mine in Huánuco	324
Do.		Perúbar, S.A. (Marc Rich & Co. Minera A.G., 100%)	Santa Cruz de Cocachacra, Lima Region	100
Bentonite		Minerales Andinos, S.A. (NL Industries, 90%)	Vichayal Mine, Grau Region	9
Bismuth	metric tons	CENTROMIN	Refinery at La Oroya	816
Cadmium	do.	do.	do.	215
Copper		Southern Perú Copper Corp. (SPCC) (Asarco Inc. 52.3%; Phelps Dodge Overseas Capital Corp., 16.3%; The Marmon Group Inc., 20.7%; Newmont Mining Corp., 10.7%)	Cuajone Mine, José Carlos Mariategui Region; Toquepala Mine, José Carlos Mariategui Region Smelter at Ilo, José Carlos Mariategui Region	300 300
Do.		Empresa Minera Especial Tintaya, S.A. (Tintaya) (Government, 100%)	Tintaya Mine, Inka Region	60
Do.		CENTROMIN	Cobriza Mine, Libertadores-Wari Region; Casapalca and Yauricocha Mines, Lima Region; Morococha Mine, Andrés A. Cáceres Region Smelter at La Oroya Refinery at La Oroya	60 70 58
Do.		Minera Cerro Verde S.A. (Cyprus Amax Minerals Corp, 100%)	Cerro Verde Mine, Arequipa Region	33
Do.		Empresa Minera del Perú, S.A. (MINEROPERU) (Government, 100%)	Refinery at Ilo	175
Dolomite		Minera Baribent, S.A. (private, 100%)	Esperanza Mine, Chavin Region	25
Gold	kilograms	Cía. de Minas Orcopampa, S.A. (Orcopampa) (Cía. Buenaventura, S.A., 99.9%)	Orcopampa Mine, Arequipa Region	2,500
Do.	do.	Cía. Minera Poderosa, S.A. (private, 100%)	Poderosa Mine, San Martín La Libertad Region Refinery at Pataz, San Martín La Libertad Region	1,600 4,800
Do.	do.	CENTROMIN	Refinery at La Oroya	1,720
Do.	do.	Cía. Aurífera Río Inambari, S.A. (Cía. Minera del Sur, S.A., 84%; Aurífera Claudia, 16%)	Río Caichive, Inka Region	200
Do.		Cía. Minera de Caylloma, S.A.	Caylloma District, Arequipa Region	190
Iron ore		Shougang Hierro Perú, S.A. (Shougang Corp., 98.4%)	Marcona Mine, Los Libertadores-Wari Region	13,000
Lead		CENTROMIN	Cerro de Pasco, Casapalca, San Cristóbal, Morococha, Yauricocha, and Andaychagua Mines Smelter at La Oroya Refinery at La Oroya	85 93 87
Do.		Cía. Minera Milpo, S.A. (Milpo) (private, 100%)	El Porvenir Mine, Andrés A. Cáceres Region	24
Do.		Cía. Minera Atacocha, S.A. (private, 100%)	Atacocha Mine, Los Libertadores-Wari Region	16
Do.	do.	Minera Yanacocha, S.A. (Newmont Mining Co., 40%; Compañía Buenaventura, S.A., 34%; Bureau de Recherches Géologiques et Minieres of France, 26%)	Yanacocha, Cajamarca	8

Seefootnotes at end of table.

TABLE 2—Continued

PERU: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

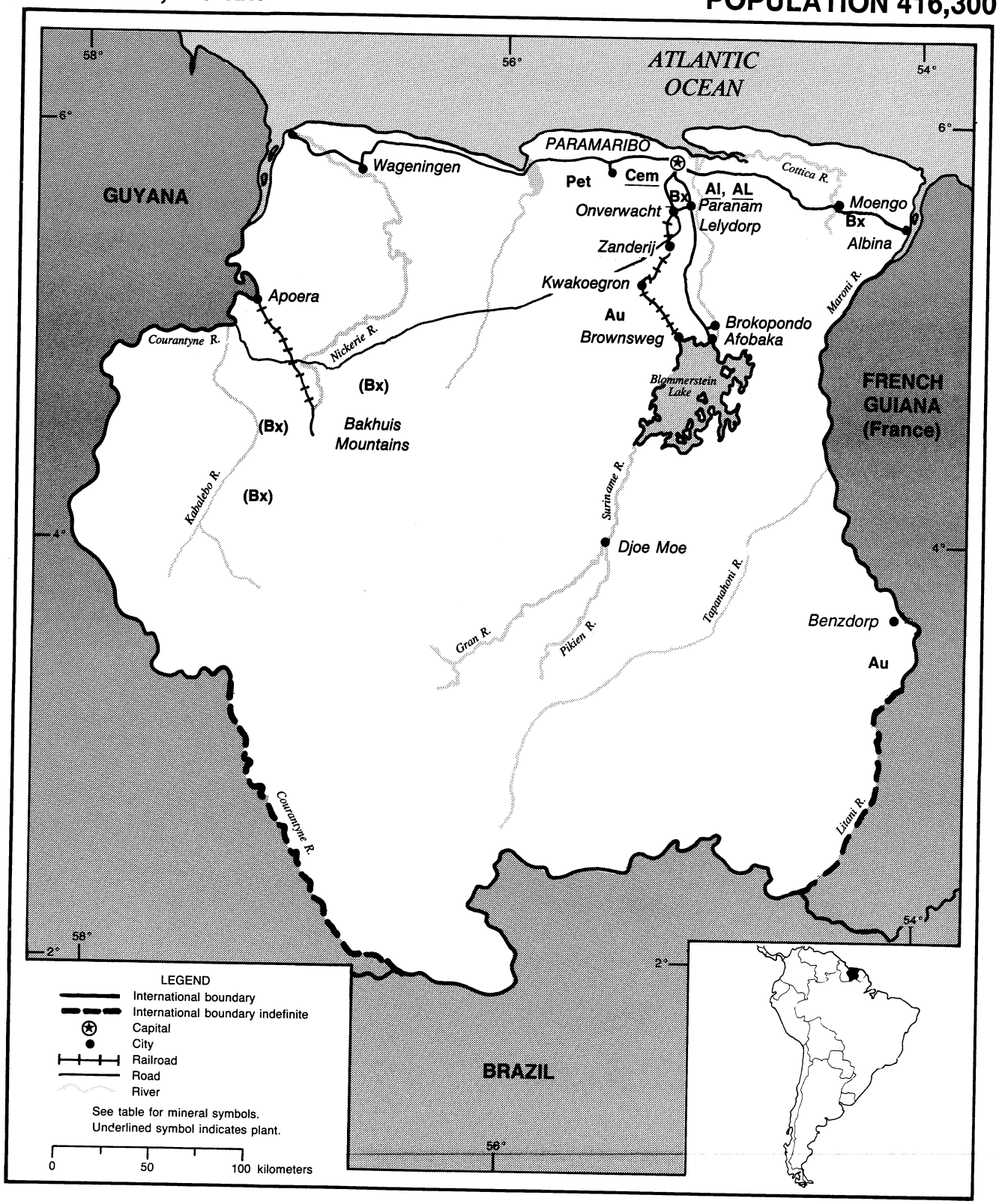
Commodity		Major operating companies and major equity ownership	Location of main facilities	Annual capacity
Lead—Continued:		Cía. Minera Santa Luisa, S.A. (Mitsui Mining and Smelting Co. Ltd., 70%; Mitsui & Co. Ltd., 29.99%; and Tomiya Nitta, 0.01%)	Huanzala Mine, Andrés A. Cáceres Region	16
Do.		Fundición de Concentrados, S.A. (private, 100%)	Smelter at Oyón, Lima Region[1]	24
Molybdenum		SPCC	Cuajone and Toquepala Mines	NA
Petroleum, crude	thousand 42-gallon barrels	Occidental Petroleum Corp del Perú (Occidental Petroleum Co., 100%)	Northeastern jungle, Amazonas Region	33,000
Do.	do.	Petróleos del Perú S.A. (PERUPETRO) (Government, 100%)	Onshore Talara Area, Grau Region; Ucayali Area, Ucayali Region; Marañón area, Amazonas Region	25,000
Do.	do.	Petróleos del Mar, S.A. (PERUPETRO, 100%)	Offshore Grau Region	10,500
Petroleum products	do.	PERUPETRO	Refineries at Talara, Lima, Iquitos, Marsella, and Pucallpa	67,000
Silica sand		Minera Baribent, S.A. (private, 100%)	María G. and Martín I. Quarries, Andrés A. Cáceres Region	27
Silver	metric tons	CENTROMIN	Casapalca, Cerro de Pasco, Cobriza, Morococha, San Cristóbal, Yauricocha, and Andaychagua Mines Refinery at La Oroya	466 809
Do.	do.	Cía. de Minas Buenaventura, S.A. (private, 100%)	Julcani Mine, Los Libertadores-Wari Region; Uchucchacua Mine, Lima Region	187
Do.	do.	Orcopampa	Orcopampa Mine, Arequipa Region	161
Do.		Minas de Arcata, S.A.	Coyavani District, Arequipa Region	130
Do.	do.	Sociedad Minera Carolina, S.A. (private, 100%)	Mine in Hualgayoc, Cajamarca, San Martín La Libertad Region	110
Steel		Empresa Siderúrgica del Perú (Government, 100%)	Chimbote, Chavin Region	550
Do.		Empresa Lamidora del Pacífico, S.A. (private, 100%)	Pisco, Los Libertadores-Wari Region	180
Tellurium	metric tons	CENTROMIN	Refinery at La Oroya	21
Tungsten	do.	Minera Regina, S.A. (private, 100%)	Palca XI Mine, Puno Region	1,400
Do.	do.	Fermín Málaga Santolalla e Hijos (private, 100%)	Pasto Bueno Mine, Chavin Region	1,000
Zinc		CENTROMIN	Casapalca, Cerro de Pasco, Moroccocha, San Cristóbal, Yauricocha, and Andaychagua Mines Refinery at La Oroya	235 70
Do.		Sociedad Minera San Ignacio de Morococha (private, 100%)	San Vicente Mine, Andrés A. Cáceres Region	70
Do.		Milpo	El Porvenir Mine, Andrés A. Cáceres Region	24
Do.		Perúbar, S.A.	Santa Cruz de Cocachacra Mine, Lima Region	65
Do.		MINEROPERU	Refinery at Cajamarquilla	102

NA Not available.

[1]Operations suspended during 1989.

SURINAME

AREA 163,270 km² **POPULATION 416,300**



THE MINERAL INDUSTRY OF

SURINAME[1]

By Alfredo C. Gurmendi

Bauxite and alumina continued to be the most important export commodities to the Surinamese economy in 1993. They accounted for about 90% of exports and more than 85% of the country's hard currency earnings. However, weak aluminum, alumina, and bauxite prices during the year adversely impacted the availability of foreign exchange. Suriname's dependency on the bauxite industry's ability to raise foreign exchange was expected to improve because of the January 1993 Bauxite Agreement, between the Government and producers, which stipulated a change in the exchange rate applied to the bauxite sector from 8 guilders or florins (Sf) per $1.00 to 55 Sf per $1.00 effective on January 1, 1994. In the mineral sector, Suriname was interested in attracting foreign investment via joint ventures, particularly in the diamond, gold, kaolin, sand, and stone industries. Suriname's gross domestic product (GDP) was $2.1 billion[2] in 1991, the last year for which data were available. This was a 23% increase from the $1.7 billion GDP posted for 1990 (per capita GDP of $3,400). During 1993, the Government continued work on an economic reform program, and a renegotiated exchange rate for the bauxite sector was anticipated during 1994.

GOVERNMENT POLICIES AND PROGRAMS

Suriname was interested in attracting joint ventures with foreign investors; thus, environmentally sound modern mining technology could be obtained and a very competitive mineral industry be established. Lack of finance and environmental measures hindered exports and increased deforestation in the vicinity of bauxite mining areas and gold placer operations.

The Mining Law of 1986 was reported to be in the process of being revised. This law provides a 2-year Right of Reconnaissance, a 3-year Right of Exploration, and a 25-year Right of Exploitation. The state guaranteed no overlapping titles.

In 1993, the Council of Ministers approved draft legislation establishing a Constitutional Court to review the constitutionality of laws and regulations; however, the draft will have to be approved by the Legislature before entering into effect so it can legally review Government measures.

PRODUCTION

Mineral commodity production data are shown in table 1. Bauxite and alumina continued to dominate the industry's annual output. Gold, petroleum, and sand production were expected to increase in the near term. *(See table 1.)*

TRADE

The Netherlands and the United States supplied approximately 60% of the value of Suriname's imports; more than 70% of the country's exports went to the United States and Western Europe. Suriname's bauxite companies exported much of the produced alumina to Canada, France, the Netherlands, Norway, and the United States. During the period 1989-93, Suriname accounted for 7% of U.S. alumina imports and ranked second behind Australia with 80%.

STRUCTURE OF THE MINERAL INDUSTRY

Suriname's mineral industry was based on bauxite and alumina. Privately owned multinational companies mined bauxite and processed alumina and aluminum. Gold concessions were negotiated with N.V. Grassalco (Grassalco), the state-owned company. Gold was produced by numerous small placer operators and sold to the Government. Golden Star Resources Ltd. of Edmonton, Alberta, Canada, continued with gold exploration during the year. Staatsolie Maatschappij Suriname NV (Staatsolie), the Suriname state oil company, was involved in the development and production of petroleum. *(See table 2.)*

COMMODITY REVIEW

Metals

Bauxite.—In 1993, NV Billiton Maatschappij Suriname (Billiton) provided 55% of bauxite to the Paranam alumina refinery from its Accaribo Mine (57% alumina content), near Paranam. The remaining feed came from the Suriname Aluminum Company's (SURALCO) Coermotibo Mine (44% alumina content), 10 km northeast of Moengo Mine, which was replaced by Coermotibo Mine. Billiton proposed development of a new mine at Lelydorp to replace production from the Accaribo Mine, which was projected to be mined out by 1995-96.

In 1993, the Paranam plant (SURALCO, 55%, and Billiton, 45%), a medium-sized bauxite refinery and aluminum smelter 25 km south of Paramaribo, produced 1.6 Mmt of alumina and 32,400 tons of aluminum.

Recently, the Paranam plant has been smelting less aluminum. One of the two pot lines, energy-intensive aluminum smelting units, was shut down and being dismantled.

Gold.—According to recent reports, there were more than 700 known gold occurrences in Suriname. However, many of these occurrences need to be explored and drilled to assess their reserves and economic viability.

In June 1993, Canarc Resource of Canada (CANARC) signed an option to acquire an 80% interest in the Sara Creek concession of 22,500 ha in east-central Suriname and 150 km north of Paramaribo. Production during a 3-month test was 13 kg of gold from surface alluvial material. CANARC was conducting feasibility studies for a large surface gold mining operation.

In September 1993, Gold Vessel Resources (GVR), a subsidiary of St. Genevive Resources of Canada, signed a deal with Surinamese interests to participate in three gold properties. Two of them comprised 20,000 ha in the Sipalvini district, where small-scale gold mining was conducted. Also, GVR and partner Margo Mining Co. applied for permits to explore 65,000-ha properties held by Golden Star Resources near Gros Rosabell, and GVR applied for five permits to explore an area of 259 km² near the western border with Guyana.

Last year, Golden Star obtained a 2-year Right of Reconnaissance for the 200,000-ha Headley's Reef area in the Brokopondo District, approximately 80 km south of Paramaribo, and reached an agreement with Grassalco concerning the 17,000-ha Gross Rosebell property within the Headley's Reef area. The early 1993 exploration program at Gross Rosebell consisted of fieldwork at the Royal Hill, Mayo, and Roma zones, including 18 km of assay trenches and approximately 11,000 samples. Golden Star's contract with Grassalco reduced the currency risk exposure with the provision that taxes were to be denominated in U.S. dollars. Stability clauses also ensured that terms would not change during the life of the contract. Golden Star also was negotiating with Nana Resources NV of Paramaribo for an option on Nana's South Benzdorp property.

A number of Brazilian miners were employed by Surinamese small-scale miners, which may have lead to the conflicting reports on the presence of garimpeiros illegally producing gold as far north as Brokopondo.

Mineral Fuels

Staatsolie continued with the construction of a 55-km pipeline from the Catharina Sophia Field at Tambaredjo to the Suriname river export terminal at Tout Lui Faut, 5 km south of Paramaribo. The Tout Lui Faut canal was proposed as the site of the Staatsolie refinery.

Pecten International Co. of Houston, Texas, negotiated with the Government for an offshore exploration license.

Reserves

Suriname's bauxite reserves were estimated at 575 Mmt. Government estimates of gold and petroleum reserves were not available.

INFRASTRUCTURE

A general lack of maintenance on coastal roads, canals, and port facilities resulted in degraded infrastructure and higher local transportation costs. These costs represented a crucial aspect of the marketing of Suriname's bulk commodities of alumina, bauxite, and rice. There was limited access to the interior.

Suriname's bauxite industry and energy sector were closely entwined. The country had an installed electrical generating capacity of 458 MW. SURALCO owned and operated the 189-MW hydroelectric plant at Afobaka and another 47-MW oil-fired turbine plant. SURALCO has sold electricity to the Government since 1964. Petroleum-fired electrical generating plants owned by the Government energy company, Energie Bedrijven Suriname (EBS), accounted for the remainder of the country's installed generating capacity. EBS also was responsible for electricity distribution within the country.

OUTLOOK

The bauxite-alumina-aluminum industry will continue to be the single most important sector in the Surinamese economy, and the Government will be interested in the development of nontraditional exports to increase foreign currency earnings.

With the formal end of the 6-year-old civil war, interest in the mineral potential of the nation's interior was expected to increase. Located on the eastern portion of the Guyana Shield greenstone belt, Suriname was ready to receive the spillover from the recent gold activity in Brazil, Guyana, and Venezuela.

In the late 1980's, SURALCO and Billiton were forced to import bauxite for processing at the Paranam plant because SURALCO's Moengo Mine was occupied by armed insurgents. Surinamese bauxite production, in the near term, will be sufficient to run competitive operation of the Paranam refinery. The new Lelydop Mine will provide Billiton's 45% and Coermotibo Mine will provide SURALCO's 55% of Paranam's bauxite requirements, respectively.

Should Suriname's proposal of August 1993 for a bilateral Trade and Investment Framework Agreement (TIFA) with the United States be signed, TIFA could identify opportunities for expanding trade and investment and remove impediments to trade and investment flows. TIFA could pave the road for possible trade with NAFTA, and Suriname could become part of a probable economic block called "The Americas" in the foreseeable future.

[1]Text prepared Apr. 1994.

[2]Where necessary, values have been converted from Surinamese guilders or florins (Sf) to U.S. dollars at the rate of Sf1.78=US$1.00 (Mar. 1993).

OTHER SOURCES OF INFORMATION

Agencies

Geologisch Mijnbouwkundige Dienst
Kleine Waterstraat 2-6
Paramaribo, Suriname
Staatsolie Maatschappij Suriname NV
Industrieterrein 21, Flora
P.O. Box 4069
Paramaribo, Suriname

Publications

Central Intelligence Agency, Washington, DC: The World Factbook annual.
International Bauxite Association, Kingston, Jamaica: IBA Qarterly Review.
U.S. Department of Commerce, International Trade Administration: Foreign Economic Trends and Their Implications for the United States, annual
U.S. Department of the Interior, U.S. Bureau of Mines: Mineral Commodity Summaries, annual.
U.S. News & World Report: New World of Nations, annual.

TABLE 1
SURINAME: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992	1993e	Annual capacitye (Jan. 1, 1994)
Aluminum:						
Bauxite, gross weight	3,530	3,283	3,198	3,250	3,300	4,000
Alumina	1,567	1,532	1,510	1,576	1,600	2,000
Metal, primary	28	32	29	32	30	50
Cement, hydraulice	50	50	50	50	50	50
Clays, commone	16	16	16	16	20	20
Gold, mine output, Au contente kilograms	[2]31	r30	r30	300	300	300
Petroleum, crudee thousand 42-gallon barrels	1,442	[2]1,436	1,500	1,500	1,500	1,500
Sand and gravel:e						
Gravel	35	35	35	35	35	50
Sand, common	160	160	160	160	160	200
Stone, crushed and brokene	50	50	50	50	50	50

eEstimated. rRevised.
[1]Includes data available through Mar. 15, 1994.
[2]Estimated capacity on the basis of recent production history.
[3]Reported figure.

TABLE 2
STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

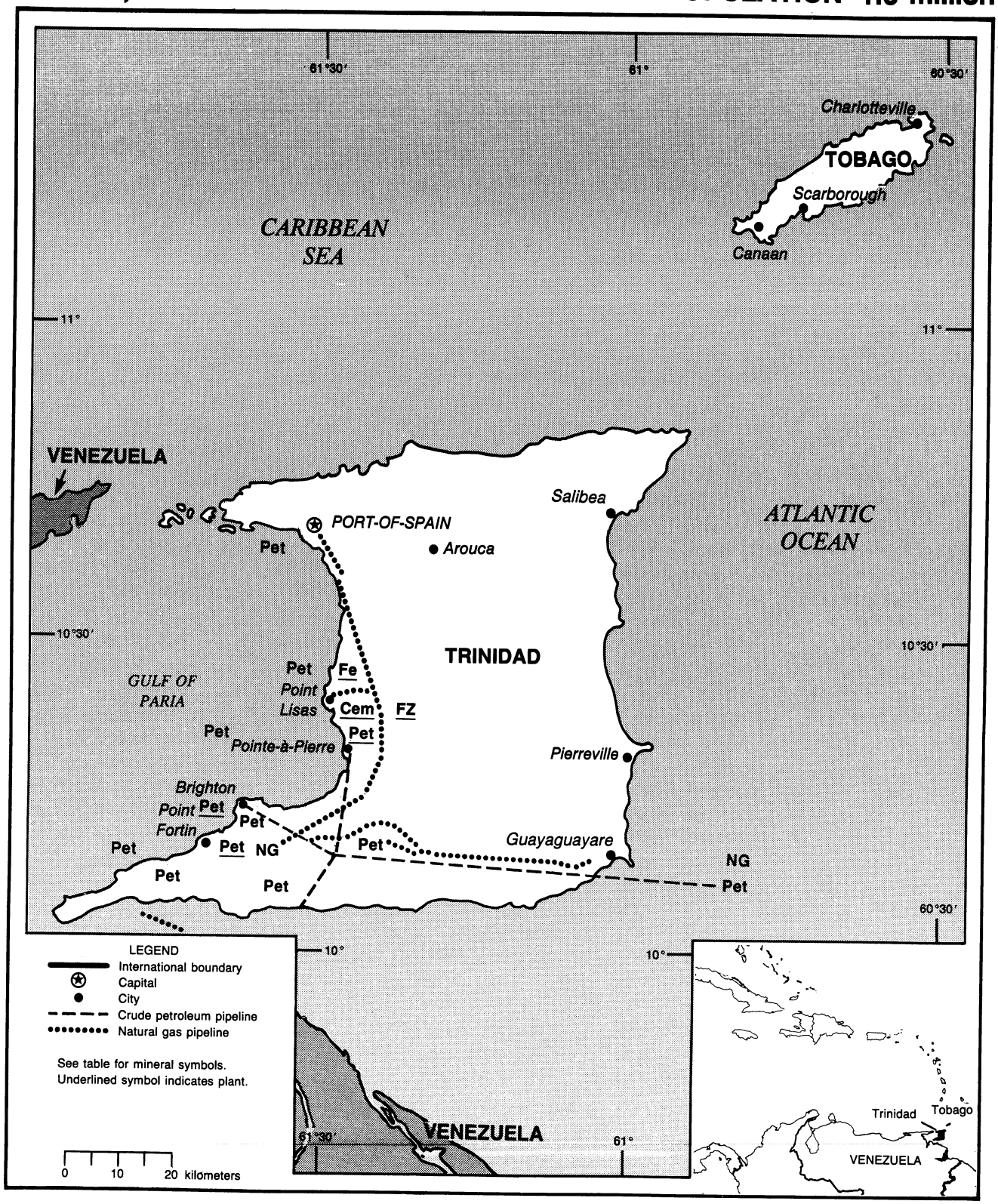
(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina	Suriname Aluminum Co. (SURALCO) [ALCOA, USA, 55%; [and NV Billiton Maatschappij (Billiton), 45%]	Refinery at Paranam, District of Para	1,600
Aluminum	SURALCO, 100%	Smelter at Paranam, District of Para	34
Bauxite	do.	Mines at Coermotibo and Accaribo, District of Marowijne	1,800 1,500
Do.	Billiton 76%; SURALCO, 24%	Accaribo Mine, District of Para	1,000
Cement	Vensur NV (private, 100%)	Paramaribo, District of Para	60
Gold	No major operating companies	South and east Suriname	NA
Petroleum	Staatsolie Maatschappij Suriname NV (Government, 100%)	Tambaredjo, District of Saramacca	1,825

NA Not available.

TRINIDAD AND TOBAGO

AREA 5,130 km² **POPULATION 1.3 million**



THE MINERAL INDUSTRY OF

TRINIDAD AND TOBAGO[1]

By David B. Doan

Although traditionally having had a relatively high gross domestic product (GDP) for a small Caribbean nation, more so on a per capita basis, and a notably high standard of living, Trinidad and Tobago had been in a moderate but steady economic decline through most of the years 1980-90. Much of the difficulty arose from the virtual collapse of world oil prices during that decade, impairing the country's revenues and introducing an element of uncertainty into petroleum exploration as well as the Government's economic planning.

The decline began to turn around in 1991 as a combination of oil price recovery and consumer confidence took hold sufficiently to spark improvement in other sectors of the ecomomy. Inflation dropped from about 11% in 1990 to 4% in 1991, increasing the real value of individual income and adding purchasing power to the wage- and salary-earning public into early 1992.[2] The recovery was short, unfortunately. A burgeoning of external debt to about $2.4 billion[3] brought debt-service requirements close to the $600 million range in 1993. Further instability in crude prices in the latter part of 1993, however, added a dimension of confusion and uncertainty to economic conditions that had already frustrated labor, added to unemployment, rekindled inflation, and led to devaluation of the Trinidad and Tobago dollar earlier in the year. The Government indicated that austerity would be the watchword in 1994.[4] World oil prices continued sinking to the $14 range.

Overall, mining and petroleum, including refining, accounted for about 30% of the GDP, and petroleum exports alone were about 70% of export revenues in 1992.[5] Besides petroleum, including both crude and natural gas, Trinidad's mineral resources included asphalt, limestone, and sand and gravel. Iron, steel, and refined (secondary) lead were produced, as were chemical products from natural gas such as ammonia, methanol, urea, and sulfur. Building stone and hydraulic cement were produced for local use.

GOVERNMENT POLICIES AND PROGRAMS

In April of the year, the Government floated the Trinidad and Tobago dollar, which settled gradually downward to lose about 36% of its former value after having been pegged firmly to the U.S. dollar. Sensing that the path to financial improvement for Trinidad and Tobago lay in boosting exports, primarily petroleum and petroleum products, the Government began to push exploration for new production. After having held a major share of the equity of most state petroleum corporations, the Government plainly sought direct private investment to help fund ventures in exploration and production. Two state-owned oil companies, Trinidad and Tobago Petroleum Co. Ltd. (Trintopec) and Trinidad & Tobago Oil Co. (Trintoc), were merged early in 1993 for purposes of cost-cutting and increased efficiency. The Petroleum Company of Trinidad and Tobago (Petrotrin), also a Government-owned oil company, offered all of its unassigned holdings of onshore and offshore oil- and gas-producing grounds for farm-out, joint venture, or outright sale.[6]

ENVIRONMENTAL ISSUES

As Trinidad and Tobago shifted steadily to increased industrial activity in the form of refining and petrochemicals, it seemed that air pollution, and possibly ground-water contamination, would become issues, but Government attention seemed to be focused elsewhere. The perception that environmental legislation might impede badly needed investment and development engendered uncertainty, ironically, that of itself might delay investment. Most current environmental activity seemed to have been driven by conditions attached to Inter-American Development Bank and World Bank loans.

PRODUCTION

The mineral industry of Trinidad and Tobago produced petroleum crude and natural gas, industrial minerals, petrochemicals, and some metals such as iron and steel from offshore sources of iron ore, as well as refined (secondary) lead. Asphalt and hydraulic cement are produced, as is ammonia from natural gas. Crude oil production has been divided almost evenly between the state-owned oil companies and AMOCO Trinidad Oil Co., wholly owned by the U.S. company AMOCO Inc. Petroleum production in 1993, after the downtrend of recent years, was slightly higher. The country ranked seventh as a crude oil producer, after Ecuador, in Latin America. *(See table 1.)*

TRADE

Major trading partners of Trinidad and Tobago were the United States, Puerto Rico, and the Virgin Islands. Imports generally totaled about $450 million. Exports to the United States in 1992 totaled $862 million, including about 50% of total output of crude oil, as well as anhydrous ammonia, diesel fuel, methanol, and urea. Other exports included nitrogenous fertilizer, sulfur (a

petroleum byproduct), and asphalt, primarily to Germany, French Guiana, the United Kingdom, and the United States. About 80% of the refined petroleum products was exported, including 20% to the United States. All in all, Trinidad and Tobago was the fourth most important supplier of crude oil and refined products to the U.S. market after Mexico, Venezuela, and Colombia.

The country relied heavily on imported metals, mostly from Europe (Belgium-Luxembourg, Finland, the Netherlands, and the United Kingdom) and South America (Brazil and Venezuela). Industrial minerals also were imported. *(See tables 2 and 3.)*

Beginning in 1992 the Andean Pact countries (Bolivia, Colombia, Ecuador, Peru, and Venezuela), which formed the Andean Development Corp., extended credit to Trinidad and Tobago through this multipurpose bank with the object of stimulating mutual trade.

STRUCTURE OF THE MINERAL INDUSTRY

Although the Government and private sector together controlled much of the mineral industry by joint ventures, several mineral producers were owned totally by the Government. Most of the petroleum production was Government-owned, with minority interests held by private companies or investors. During the year, however, a shift began toward greater participation by private-sector and foreign capital. By and large, foreign investment in the nation's mineral industry included U.S. firms in the petroleum and anhydrous ammonia sectors and an Indian group in the steel industry. *(See table 4.)*

COMMODITY REVIEW

After more than 10 years of effort, it appeared that the Trinidad and Tobago iron and steel industry was finally realizing its relatively moderate production objectives. Caribbean Ispat Ltd. (CIL), which leased and operated the Government-owned facility at the Point Lisas Industrial Estate, appeared profitable and able to direct the work it undertook when it assumed management of the iron and steel mill in 1989. Ispat Ltd., an Indian firm based in Jakarta, Indonesia, approached the Government after previous negotiations with a German firm fell through. Operating at about 35% of capacity, the mill was rumored to have been losing about $250,000 every day until Ispat stepped in.[7] CIL products included direct-reduced iron, steel ingots, and wire rod. The mill operated on inexpensive local natural gas. Upon expiration of Ispat's 5-year lease in 1994, the Government was considering sale of the operation and retention of a small proportion of equity.

The U.S. minimill steelmaker Nucor Steel Corp., of North Carolina, invested $75 million for the construction of a 320,000-mt/a iron carbide plant at Point Lisas. The product would be shipped to the United States to feed Nucor's steel mills. Fine granular hematite from Brazil would feed the plant, construction of which began in 1993. Production was to start in late 1994.[8]

Lake Asphalt of Trinidad and Tobago Ltd. (LATT) sought technical consultants to study the feasibility of converting a laboratory-scale asphalt pelletization process to large-scale commercial production. LATT aimed for an ultimate capacity of 60,000 mt/a of pelletized material for the world market. The company envisioned new packing techniques wherein plastic containers would melt into the final heated asphalt mix, thus precluding the necessity of special shipping cases as at present. LATT mined reserves in southwest Trinidad from the largest natural asphalt lake in the world.

Trinidad Cement Ltd., on the western coast near Point Lisas, was the only producer in the country. The main firing used natural gas with gypsum supplied from Venezuela. The company supplied cement for domestic consumption and exported more than 250,000 mt/a. Sand and gravel were produced for use as concrete aggregate. Crushed stone was used for the manufacture of cement clinker.

Natural gas accounted for most domestic energy consumption, supplying more than 85% of the nation's requirements. The Government encouraged the use of compressed natural gas in vehicles. Substantial reserves were being developed for local use, both for fuel and petrochemical feedstock, and also for liquefied natural gas, primarily for export. Trinidad and Tobago ranked fourth in Latin America in gas production, after Venezuela, Mexico, and Argentina. The largest foreign holders of gas reserves were Amoco Corp., British Gas Ltd., Deminex Ltd., and Occidental Petroleum Corp.

To meet its supply contract with National Gas Co., Amoco Trinidad Oil Co. (ATO) stepped up its ambitious development program, begun in 1991, to develop the Flamboyant and Immortelle fields off southeastern Trinidad. ATO intended drilling as many as 15 wells in these fields, about 60 km offshore. Gas from the Flamboyant field flowed southwest, past the Immortelle field, to Cassia Gasfield through a 20-km submarine pipeline laid in 1992. A pipeline between Cassia and the future site of Immortelle was being installed during 1993.

Compared with that of 1992, production of crude oil decreased roughly 10% in 1993, largely reflecting natural decline curves for existing wells in conjunction with little or nothing in the way of discoveries. At the beginning of the year, 3,262 wells were producing out of a total of 14,060 originally drilled starting in 1903. About 80% of Trinidad and Tobago's oil production came from offshore fields, so exploration tended to focus on expanding the number of these fields, but all exploration has been stagnant in view of price weakness in world markets. In that Trinidad and Tobago derives the major portion of its national income from petroleum, the decision was made in 1993 to stimulate the hunt for new oil in the hope that augmented production might compensate for lower prices. Accordingly, the Government awarded oil exploration rights to Unocal Trinidad Ltd. for block

89/3, about 70 km off the east coast of Trinidad. Operations would commence with the first well to be drilled in 1994 in water that averages about 90 m. Unocal holds a 100% interest in the block. Previously, ATO had been the only major foreign producer of crude in Trinidad and Tobago, delivering about 50% of total domestic production.

Next, Petrotrin, one of the Government-owned companies, offered all of its unassigned land and offshore producing grounds for farm-out, joint venture, or outright sale. Trinidad and Tobago Oil Co. Ltd. (TTOC) asked for foreign drilling and other oilfield service contractors to submit qualifications for enhanced (secondary) recovery onshore of heavy oil in southwest Trinidad. Shortly after, other tenders were solicited for developmental drilling in established fields in south Trinidad.[9]

Domestic refinery utilization remained low at about 35% of design capacity because of aging facilities and infrastructure in need of rehabilitation. TTOC operated two oil refineries, one at Point-a-Pierre having a throughput of about 31 Mbbl/a and the other at Point Fortin, producing only fuel oil, with a throughput of about 11 Mbbl/a. Expansion plans for the Point-a-Pierre plant involved upgrading the capacity by 160,000 bbl/d.

Petrochemical activity centered on partial privatization of methanol production facilities with the construction of a new plant at Port Fortin, 31% of which would be owned by a German consortium in return for an investment of $235 million. The Government also contemplated stepping back to a position of 44% net ownership of methanol production by selling an additional 25% of the company.[10]

Reserves

Estimated proven crude oil reserves officially[11] were 550 Mbbl in late 1992 and probably did not change significantly in 1993. Industry sources, however, estimated that actual reserves might be more than 1.5 billion bbl and potential oil reserves as much as 2.9 billion bbl, mostly offshore. Officially, proven natural gas reserves in late 1992 were estimated at 487 billion m^3, ranking fourth in Latin America after Venezuela, Mexico, and Argentina, but if "proven probable" reserves are added, the total jumps to 1.3 trillion m^3. Reserve data on industrial minerals were not available.

INFRASTRUCTURE

The nation of Trinidad and Tobago comprises two islands in the Caribbean, the larger (Trinidad) lying just off Venezuela and noted for petroleum resources. The smaller island (Tobago), about 50 km to the northeast, is the southernmost of the outer Antilles volcanic arc and is accessible by sea and air from Trinidad. The nation has 8,000 km of roads, with 4,000 km paved, 1,000 km improved, and 3,000 km unimproved. There are five usable airports, two having permanent surface runways, two having runways 2,440 to 3,659 m long, and one having runways 1,220 to 2,439 m long. Main seaports include Pointe-a-Pierre, Point Lisas, and Port-of-Spain, all in Trinidad. Smaller harbors in Tobago are at Scarborough and Charlotteville. More than 1,000 km of pipelines carry crude from fields offshore the southeast coast to Brighton on the southwest coast and from the south coast north to Pointe-a-Pierre. At least 1,900 km of natural gas pipeline paralled the petroleum pipelines onshore, and a second gas pipeline extended from the gasfields in southwest Trinidad along the west coast to Port-of-Spain.

OUTLOOK

Trinidad and Tobago's economic outlook is intimately related to the world market prices for crude oil and natural gas. Debt- service requirements in 1993 were about 24% of the external debt of $2.4 billion. Although tourism and agricultural productivity may conceivably help the situation with more concentrated effort, it is not unlikely that further emphasis on petroleum refinery products and petrochemicals also can add significantly to exports sufficiently to curtail much of the outstanding debt. Energy-intensive operations such as steelmaking and lead refining might be expanded to capitalize on value added based on plentiful and locally inexpensive petroleum.

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[1]Text prepared Apr. 1994.

[2]Inter-American Development Bank. Economic and Social Progress in Latin America; 1992 Report, Johns Hopkins University Press, Oct. 1992, p. 172.

[3]Where necessary, values have been converted from Trinidad and Tobago's dollar (TT$) to U.S. dollars at the rate of TT$5.77=US$1.00. The previous conversion rate, pegged officially at TT$4.25=US$1.00, was abandoned in early Apr. 1993.

[4]James, Canute. Stuck Fast in a Nightmare of Debt. Financial Times (London), Jan. 24, 1994.

[5]Ridgeway, J. M. Trinidad and Tobago. Min. Ann. Rev. (London), v. 83, folio 506, 1993.

[6]U.S. Embassy, Port of Spain, Trinidad and Tobago. Various Department of State Telegrams, Feb. to Apr. 1993.

[7]———. Department of State Telegram 00571, Feb. 17, 1993.

[8]Metal Bulletin Monthly. No. 7747, Jan. 11, 1993, p 19.

[9]U.S. Embassy, Port of Spain, Trinidad and Tobago. Various Department of State Telegrams, Apr. to June 1993.

[10]———. Department of State Telegram 01839, June 11, 1993.

[11]———. Department of State Telegram 03639, Oct. 15, 1992, p. 5. All petroleum reserve projections are from this source.

OTHER SOURCES OF INFORMATION

Agency

Ministry of Energy
Port-of-Spain, Trinidad
Telephone: 809-623-6708

Publication

Ministry of Energy, The Petroleum Industry. Port-of-Spain, Trinidad, monthly.

TABLE 1
TRINIDAD AND TOBAGO: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993e	Annual capacity e (Jan. 1, 1994)
Asphalt, natural		27,231	e19,155	e20,000	24,565	24,600	25,000
Cement, hydraulic		e380,000	437,954	485,396	482,000	485,000	540,000
Gas, natural:							
Gross	million cubic meters	7,146	6,720	8,733	e7,000	8,200	8,300
Marketed e [2]	do.	r3,833	3,750	3,750	3,750	4,000	8,200
Iron and steel:							
Iron, sponge		612,000	697,000	710,000	680,198	675,000	720,000
Steel, crude		294,000	372,000	444,000	553,000	515,000	600,000
Semimanufactures (rolled) e		250,000	290,000	290,000	r449,529	446,000	455,000
Lead, refined (secondary) e		1,800	1,800	1,800	1,800	1,700	2,000
Natural gas liquids e	thousand 42-gallon barrels	40	40	40	40	40	50
Nitrogen: N content of ammonia	thousand tons	e1,550	1,520	1,524	1,142	1,100	1,750
Petroleum:							
Crude	thousand 42-gallon barrels	56,189	55,200	52,600	e51,000	43,600	40,000
Refinery products	do.	28,225	28,130	30,200	e30,000	30,000	98,550
Stone: Limestone	thousand tons	e600	e600	1,028	1,420	1,580	1,600
Sulfur, byproduct of petroleum e [4]		5,000	5,000	5,000	5,000	5,000	5,000

eEstimated.
rRevised.
[1]Table includes data available through Mar. 1994.
[2]Excludes natural gas used in field operations.
[3]Reported figure.
[4]Sulfur 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 OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Destinations, 1992	
				United States	Other (principal)
METALS					
Aluminum: Metal including alloys:					
Scrap		1,113	669	437	United Kingdom 232.
Unwrought		—	54	54	
Semimanufactures		23	15	—	Jamaica 10; Canada 4; St. Vincent and the Grenadines 1.
Copper: Metal including alloys:					
Scrap		517	62	8	United Kingdom 53.
Unwrought		147	39	—	All to United Kingdom.
Semimanufactures		567	491	481	Jamaica 5; Barbados 1.
Iron and steel: Metal:					
Scrap	value, thousands	$470	$320	$3	Germany $317.
Pig iron, cast iron, related materials		159,997	128,182	—	Mexico 72,500; Venezuela 18,700; China 18,500.
Steel, primary forms		5,265	4,840	—	All to Colombia.
Semimanufactures:					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		24	24	—	Grenada 17; St. Lucia 5; St. Vincent and the Grenadines 1.
Clad, plated, coated		82	589	—	Martinique 424; Belize 92; Netherlands Antilles 26.
Of alloy steel		—	73	—	Netherlands Antilles 70; St. Vincent and the Grenadines 2.

See footnotes at end of table.

TABLE 2—Continued

TRINIDAD AND TOBAGO: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Destinations, 1992	
				United States	Other (principal)
METALS—Continued					
Iron and steel: Metal—Continued:					
Semimanufactures—Continued:					
Bars, rods, angles, shapes, sections		424,594	487,458	85,731	Mexico 65,744; Japan 64,238.
Rails and accessories		2	20	—	All to bunkers.
Wire		182	919	—	Jamaica 496; Netherlands Antilles 230; Guyana 81.
Tubes, pipes, fittings		154	601	527	Guyana 25; St. Lucia 16.
Lead: Oxides		27	—		
Magnesium: Metal including alloys, semimanufactures		1	—		
Nickel: Metal including alloys:					
Scrap		—	17	—	All to United Kingdom.
Unwrought		—	8	—	Do.
Silver: Waste and sweepings[2]	kilograms	271	189	—	All to Canada.
Zinc: Metal including alloys:					
Scrap	value, thousands	$2	$1	—	All to St. Vincent and the Grenadines.
Semimanufactures		1	1	—	All to bunkers.
Other: Ores and concentrates		1,010	—		
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		21	20	—	All to Netherlands Antilles.
Grinding and polishing wheels and stones	value, thousands	$2	$2	$1	Bunkers $1.
Cement	thousand tons	293	277	8	Guyana 49; St. Lucia 35; Grenada 33.
Clays, crude		28	2	—	All to St. Vincent and the Grenadines.
Fertilizer materials: Manufactured:					
Ammonia	thousand tons	1,580	1,725	1,248	Belgium-Luxembourg 148; France 117.
Nitrogenous		441,670	442,424	109,026	Dominican Republic 49,518; Guatemala 38,935.
Phosphatic		—	40	—	All to Guyana.
Unspecified and mixed		4	260	—	Guyana 212; Jamaica 45; St. Vincent and the Grenadines 2.
Gypsum and plaster		—	1	—	All to bunkers.
Lime		1	1	—	NA.
Mica: Crude including splittings and waste		2	—		
Phosphates, crude		—	22	—	All to Guyana.
Pigments, mineral: Iron oxides and hydroxides, processed	value, thousands	$1	$1	—	All to Barbados.
Salt and brine		900	962	—	Guyana 718; Dominica 144; Barbados 40.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked	value, thousands	$1	$3	—	Grenada $2; St. Vincent and the Grenadines $1.
Worked		8	3	—	Guyana 2; St. Vincent and the Grenadines 1.
Gravel and crushed rock		9,061	6,491	—	St. Vincent and the Grenadines 3,518; Suriname 1,564; St. Lucia 981.
Limestone other than dimension		111	344	—	All to Guyana.
Sand other than metal-bearing		19,064	11,290	—	Aruba 4,000; St. Lucia 3,952; St. Vincent and the Grenadines 2,700.
Sulfur: Sulfuric acid		5	—		
Talc, steatite, soapstone, pyrophyllite		(e)	3	—	Guyana 2; Grenada 1.

See footnotes at end of table.

TABLE 2—Continued

TRINIDAD AND TOBAGO: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Destinations, 1992	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Other: Slag and dross, not metalbearing		—	53,622	—	All to Germany.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		448	118	—	Montserrat 72; Guyana 45.
Petroleum:					
Crude	thousand 42-gallon barrels	27,139	20,984	20,980	French Guiana 3; St. Vincent and the Grenadines 1.
Refinery products:					
Liquefied petroleum gas	do.	1,047	2,803	560	Dominican Republic 631; Chile 405.
Gasoline	do.	3,915	4,087	925	Colombia 763; Netherlands Antilles 565.
Mineral jelly and wax	do.	(4)	(4)	—	Mainly to Jamaica and Barbados.
Kerosene and jet fuel	do.	3,918	2,891	1,395	Barbados 405; French Guiana 228.
Distillate fuel oil	do.	6,002	7,802	2,358	French Guiana 871; Netherlands Antilles 667.
Lubricants[5]	do.	193	399	166	Cuba 70; Netherlands Antilles 57.
Residual fuel oil	do.	22,338	23,949	8,747	Netherlands Antilles 6,746; Cote d'Ivoire 2,003.
Bitumen and other residues	do.	40	2	—	St. Lucia 1; St. Vincent and the Grenadines 1.
Bituminous mixtures	do.	4	16	—	French Guiana 4; Guyana 4; St. Vincent and the Grenadines 1.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]May include other precious metals.
[3]Unreported quantity valued at $1,000.
[4]Less than 1/2 unit.
[5]May include nonlubricating oils.

TABLE 3

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1991	1992	Sources, 1992	
			United States	Other (principal)
METALS				
Alkaline-earth metals	1	5	4	Germany 1.
Aluminum:				
Ore and concentrate	—	50	50	
Oxides and hydroxides	328	179	46	United Kingdom 129; Venezuela 3.
Metal including alloys:				
Scrap	1	221	20	Venezuela 201.
Unwrought	459	20	—	Canada 17; United Kingdom 3.
Semimanufactures	44,539	4,666	2,774	Canada 809; Venezuela 529.
Antimony: Metal including alloys, all forms	130	10	10	
Cadmium: Metal including alloys, all forms value, thousands	$6	—		
Chromium:				
Ore and concentrate	—	18	—	All from United Kingdom.
Oxides and hydroxides	8	12	11	United Kingdom 1.
Cobalt: Oxides and hydroxides	(4)	2	1	Do.
Copper: Metal including alloys:				
Scrap	718	238	238	
Unwrought	391	361	361	
Semimanufactures	752	706	574	Brazil 41; Japan 19.

See footnotes at the end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Sources, 1992	
				United States	Other (principal)
METALS—Continued					
Iron and steel:					
Iron ore and concentrate		586,768	253,343	—	Brazil 129,942; Mexico 122,847; Peru 527.
Metal:					
Scrap		5,980	4,444	8	Suriname 2,280; Guyana 1,578; Guadeloupe 578.
Pig iron, cast iron, related materials		16	18	8	Netherlands 6; United Kingdom 4.
Ferroalloys:					
Ferrochromium		—	10	10	
Ferromanganese		155	19	19	
Ferronickel	value, thousands	—	$2	$2	
Ferrosilicon		903	1,150	—	All from Venezuela.
Ferrosilicochromium	value, thousands	$3	—		
Ferrosilicomanganese		4,909	4,505	—	Brazil 4,104; Venezuela 401.
Silicon metal		—	[3]5	(4)	Mainly from United Kingdom.
Unspecified		11	11	10	Mexico 1.
Steel, primary forms		810	52	52	
Semimanufactures:					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		11,363	8,838	188	United Kingdom 2,970; Venezuela 1,634; Czechoslovakia 997.
Clad, plated, coated		15,732	10,662	925	United Kingdom 4,555; Sweden 1,404; Argentina 1,238.
Of alloy steel		4,209	1,531	167	Japan 574; Brazil 383; United Kingdom 343.
Bars, rods, angles, shapes, sections		3,584	7,177	502	United Kingdom 6,161; Belgium-Luxembourg 350.
Rails and accessories		44	(3)	(3)	
Wire		1,654	2,010	27	Brazil 866; United Kingdom 368; Belgium-Luxembourg 274.
Tubes, pipes, fittings		27,951	24,402	6,306	Japan 5,571; France 4,232.
Lead:					
Ore and concentrate	value, thousands	—	$1	$1	
Oxides		9	20	(4)	Venezuela 14; Spain 5; Canada 1.
Metal including alloys:					
Scrap		1,844	99	—	Barbados 69; Jamaica 30.
Unwrought		10	7	—	All from Venezuela.
Semimanufactures		928	457	29	United Kingdom 387; Venezuela 40.
Magnesium: Metal including alloys:					
Unwrought	value, thousands	$1	$1	$1	
Semimanufactures		2	1	1	
Manganese: Oxides		—	3	2	United Kingdom 1.
Molybdenum: Metal including alloys, semimanufactures	value, thousands	$32	$6	$6	
Nickel:					
Matte and speiss		—	22	22	
Metal including alloys, semimanufactures		33	1	1	
Platinum-group metals:					
Waste and sweepings	kilograms	5	—		
Metals including alloys, unwrought and partly wrought	value, thousands	$1	$5	$5	

See footnotes at end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Sources, 1992	
				United States	Other (principal)
METALS—Continued					
Silver:					
Waste and sweepings	kilograms	1	2	2	
Metal including alloys, unwrought and partly wrought	value, thousands	$67	$61	$4	Canada $56; United Kingdom $1.
Tin: Metal including alloys:					
Scrap		—	2	2	
Unwrought		1	4	1	China 2; Bolivia 1.
Semimanufactures		419	1,113	4	Netherlands 1,059; Japan 47.
Titanium:					
Ore and concentrate		2	—		
Oxides		894	916	346	United Kingdom 468; Italy 54.
Metal including alloys, semimanufactures	value, thousands	$5	$44	$44	
Tungsten: Metal including alloys:					
Unwrought	do.	$109	—		
Semimanufactures		5	1	1	
Vanadium: Metal including alloys, all forms		1	—		
Zinc:					
Oxides		206	95	22	Venezuela 40; France 26.
Metal including alloys:					
Scrap		77	39	—	All from Canada.
Unwrought		5	20	18	United Kingdom 2.
Semimanufactures[6]		30	483	22	Jamaica 454; Norway 7.
Zirconium: Metal including alloys, Unwrought		—	1	1	
Semimanufactures		37	19	19	
Other:					
Oxides and hydroxides		117	423	51	Venezuela 354; France 7.
Base metals including alloys, all forms		—	1	1	
Metalloids[7]		7	1	1	
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		53	19	(e)	Guatemala 10; Dominica 9.
Artificial: Corundum		—	12	6	United Kingdom 6.
Grinding and polishing wheels and stones		91	88	8	Venezuela 25; Austria 16; United Kingdom 11.
Asbestos, crude		18	18	—	All from Canada.
Barite and witherite	value, thousands	$4,279	$681	$2	Morocco $672; Germany $6.
Boron materials:					
Crude natural borates		3	2	2	
Oxides and acids		8	7	1	France 5; United Kingdom 1.
Bromine[8]		2	7	6	United Kingdom 1.
Cement		3,020	1,384	27	Germany 702; Belgium-Luxembourg 369; Denmark 166.
Chalk		83	46	—	United Kingdom 43; Netherlands 3.
Clays:					
Bentonite	value, thousands	$625	$644	$643	United Kingdom $1.
Kaolin		634	553	277	United Kingdom 276.
Unspecified		104	88	65	United Kingdom 20; Netherlands 2.

See footnotes at end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Sources, 1992	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Diamond, natural:					
Gem, not set or strung	value, thousands	$205	$139	$60	India $63; Belgium-Luxembourg $16.
Industrial stones	do.	$3	$170	$9	India $131; Belgium-Luxembourg $30.
Diatomite and other infusorial earth		31	54	29	Venezuela 18; United Kingdom 6.
Feldspar		217	122	—	All from United Kingdom.
Fertilizer materials:					
Crude, n.e.s.		45	124	1	Canada 123.
Manufactured:					
Ammonia		38	41	9	Belgium-Luxembourg 22; Germany 10.
Nitrogenous		991	783	92	Dominican Republic 443; Belgium-Luxembourg 200.
Phosphatic		665	1,766	515	Colombia 804; Dominican Republic 316.
Potassic		1,243	164	69	Germany 68; Belgium-Luxembourg 20.
Unspecified and mixed		2,717	2,570	180	Belgium-Luxembourg 1,200; Germany 854; Dominican Republic 317.
Fluorspar		288	—		
Graphite, natural		2	1	1	
Gypsum and plaster		24,688	17,155	28	Venezuela 9,945; Jamaica 7,110; United Kingdom 58.
Lime		2,965	4,246	333	United Kingdom 1,993; Venezuela 1,920.
Magnesium compounds:					
Magnesite, crude		1,975	300	—	Mainly from Venezuela.
Oxides and hydroxides		3,732	1,469	—	Do.
Mica:					
Crude including splittings and waste		106	122	2	Norway 95; United Kingdom 25.
Worked including agglomerated splittings	value, thousands	$15	$4	$2	United Kingdom $2.
Nitrates, crude	do.	—	$1	$1	
Phosphates, crude		—	1	1	
Pigments, mineral: Iron oxides and hydroxides, processed		67	88	27	Germany 31; Spain 13.
Potassium salts, crude		816	2,998	2,998	
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	$12	$40	$38	Thailand $2.
Synthetic	do.	$14	$4	$4	
Salt and brine		13,892	14,395	26	Netherlands Antilles 11,460; Jamaica 2,104; Cuba 750.
Sodium compounds, n.e.s.:					
Soda ash, manufactured		86	3,020	—	France 3,000; United Kingdom 20.
Sulfate, manufactured		1,579	2,057	64	Belgium-Luxembourg 1,981; United Kingdom 10.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		128	36	(e)	Mainly from Venezuela.
Worked		43	89	59	Italy 23; Venezuela 4.
Dolomite, chiefly refractory-grade		625	272	272	
Gravel and crushed rock		5,514	2,195	1,753	Italy 341; Venezuela 52.
Limestone other than dimension		54,249	73,019	—	Venezuela 56,733; Netherlands 5,959; Barbados 5,302.
Quartz and quartzite		24	9	—	Netherlands 5; Turkey 4.
Sand other than metal-bearing		1,387	1,635	1,455	Netherlands 126; United Kingdom 48.
Sulfur:					
Elemental:					
Crude including native and byproduct		8	—		

See footnotes at end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Sources, 1992	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Sulfur—Continued:					
Elemental—Continued:					
Colloidal, precipitated, sublimed		30	30	27	United Kingdom 2.
Sulfuric acid		5,522	3,505	2,024	Jamaica 770; Italy 592.
Talc, steatite, soapstone, pyrophyllite		629	524	335	Norway 181; United Kingdom 8.
Vermiculite, perlite, chlorite		—	2	1	United Kingdom 1.
Other:					
Crude		2,344	2,683	2,683	
Slag and dross, not metal-bearing		102	232	232	
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		20	18	18	
Carbon black		684	848	25	Venezuela 798; United Kingdom 23.
Coal:					
Anthracite		1,091	1,746	1,646	Venezuela 100.
Bituminous		10	42	41	United Kingdom 1.
Briquets of anthracite and bituminous coal	value, thousands	$2	$1	—	All from Netherlands.
Coke and semicoke		250	2,408	2,305	Canada 98; United Kingdom 5.
Peat including briquets and litter		74	53	—	Canada 52; United Kingdom 1.
Petroleum:					
Crude	thousand 42-gallon barrels	10,970	7,205	—	Venezuela 6,555; Suriname 342; Netherlands Antilles 308.
Refinery products:					
Liquefied petroleum gas	42-gallon barrels	143,318	[9]2,111	2,111	
Gasoline	do.	11,058	([10])	—	All from United Kingdom.
Mineral jelly and wax	do.	5,304	5,682	1,968	China 1,377; Germany 984.
Kerosene and jet fuel	do.	287	1,054	1,054	
Distillate fuel oil	do.	405,279	149	134	United Kingdom 15.
Lubricants	do.	102,592	112,693	5,467	Venezuela 79,674; Netherlands Antilles 14,497; Jamaica 11,438.
Residual fuel oil	do.	359,787	133	126	Venezuela 7.
Bitumen and other residues	do.	12	61	42	Netherlands 18.
Bituminous mixtures	do.	351	127	36	United Kingdom 73; Germany 18.
Petroleum coke	do.	456	—		

[1]Table prepared by H. D. Willis.
[2]Unreported quantity valued at $8,000.
[3]May include high-purity silicon.
[4]Less than 1/2 unit.
[5]Unreported quantity valued at $5,000.
[6]Includes zinc dust, flakes, and powders.
[7]Reported under SITC item number as "selenium, tellurium, phosphorus, arsenic, etc."
[8]Includes fluorine and iodine.
[9]Excludes unreported quantity of liquefied butane and propane valued at $19,000.
[10]Unreported quantity valued at $2,000.

TABLE 4

TRINIDAD AND TOBAGO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

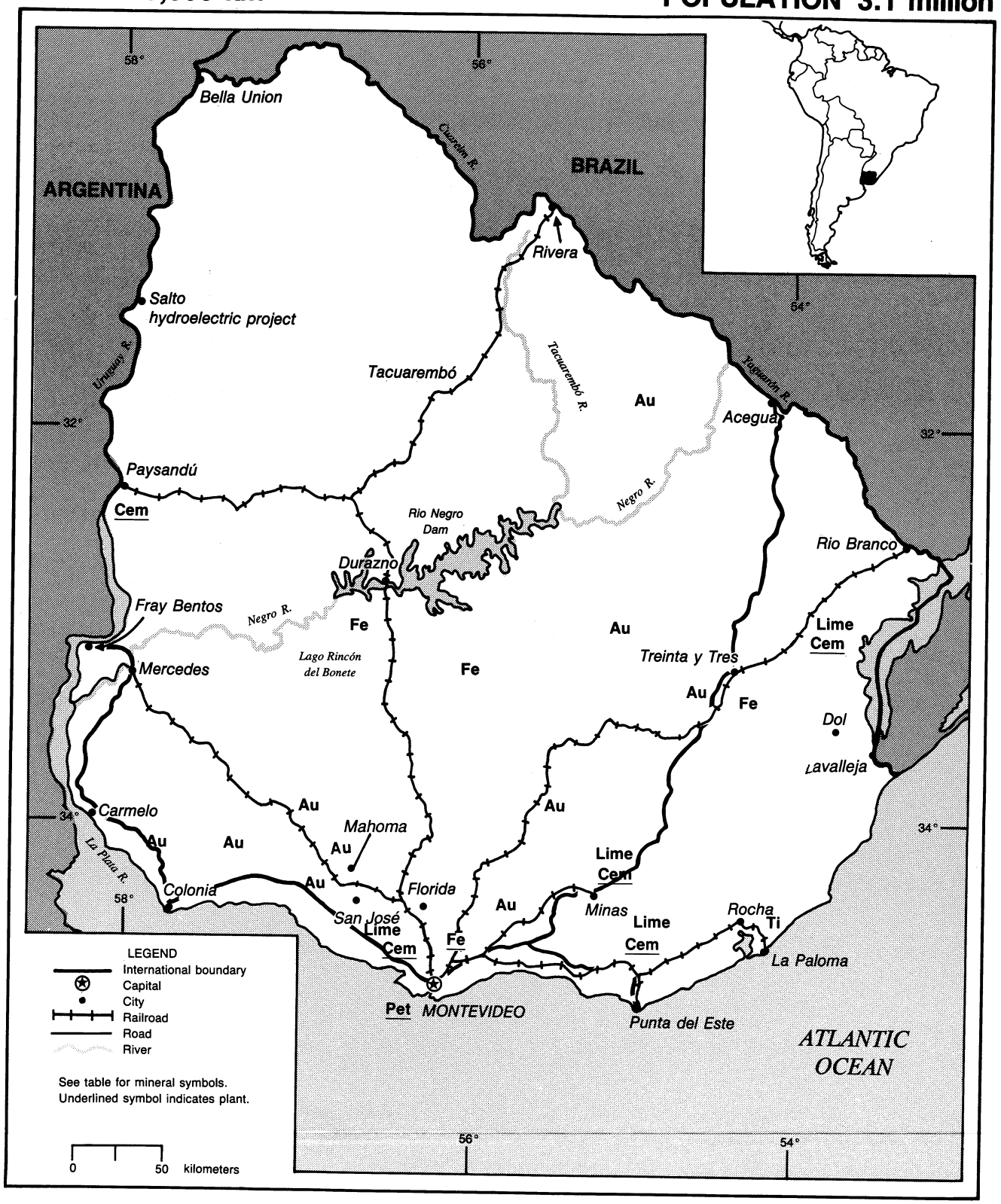
(Thousand metric tons unless otherwise specified)

Major commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Anhydrous ammonia[1]	Trinidad Nitrogen Co. Ltd. (Norsk Hydro AS, 49%; Government, 51%)		
	Tringen I	Point Lisas, Caroni Co.	370.
	Tringen II	do.	450.
Do.	Fertilizers of Trinidad and Tobago Ltd. (Amoco International Oil Co. Ltd., 49%; Government, 51%)	do.	710.
Do.	Federation Chemicals (Norsk Hydro AS, 100%)	do.	230.
Asphalt	Lake Asphalt of Trinidad and Tobago (1978) Ltd. (Government, 100%)	Brighton, St. Patrick Co.	60.
Cement	Trinidad Cement Ltd. (Government, 100%)	Claxton Bay, Caroni Co.	540 cement, 600 clinker.
Iron and steel	Iron and Steel Co. of Trinidad and Tobago Government, 100%)	Point Lisas, Caroni Co.	900 sponge iron, 700 steel, 600 wire rod.
Petroleum:			
Crude barrels per day	Amoco Trinidad Oil Co. Ltd. (Amoco International Oil Co. Ltd., 100%)	Poui, Samaan, Teak, and Cassia Fields, offshore, east of Guayaguayare	95,000.
Do. do.	Trinidad and Tobago Oil Co. Ltd. (Government, 100%)	Point Fortin, Ortoire, Penal Forest Fields, offshore, east of Guayaguayare	20,000.
Do. do.	Trinidad Northern Areas Ltd. (Texaco Trinidad Inc., Trinidad and Tobago Oil Co. Ltd., and Trinidad and Tobago Petroleum Co. Ltd., 33 1/3% each)	Soldado Fields, offshore in Gulf of Paria	40,000.
Do. do.	Trinidad and Tobago Petroleum Co. Ltd. (Government, 100%)	Soldado Field, onshore; Galeota Field offshore (exported)	24,000.
Products do.	Trinidad and Tobago Oil Co. Ltd. (Government, 100%)	Point Fortin, St. Patrick Co.	80,000.
Do. do.	do.	Pointe-a-Pierre, Victoria Co.	220,000.

[1]Capacity based on 340-day operation year.
[2]Barrels per day.

URUGUAY

AREA 176,000 km² **POPULATION 3.1 million**



THE MINERAL INDUSTRY OF

URUGUAY[1]

By Alfredo C. Gurmendi

Uruguay has a very stable market economy, largely agrarian, but with liberal foreign investment policy, political stability, progressive Government, and outstanding regional and international relations. The production of minerals is evolving from small-scale to more capital-intensive mining operations. The mining industry attracted domestic and foreign investors, particularly from Argentina, Brazil, Canada, Italy, Japan, and the United States, to produce granite, gold, and semiprecious stones. The gross domestic product (GDP) grew by 7% to $10.2 billion,[2] while the rate of inflation was 59% by yearend, representing a small increase over that of 1992, when it was 57%. The foreign debt decreased to $3.9 billion, unemployment reached 8.3%, and the country's international reserves were $979 million.

The Government was seeking to increase exports by relaxing regulations on participation of foreign investors in the mineral industry and by requiring no tariffs for imports of equipment, machinery, tools, and accessories used in prospecting, exploring, mining, and processing of mineral commodities.

GOVERNMENT POLICIES AND PROGRAMS

Uruguay's economic development strategy is based on the active involvement of the private sector within a competitive market economy. Monetary and exchange rate policy changes were aimed at curbing inflation. The Government appeared to have a tighter grip on public spending. The Treaty of Asunción, Paraguay, created the Southern Cone Common Market (MERCOSUR), which would establish a common market by the end of 1994 and bring economic and commercial benefits to Uruguay from a reduction of all tariff barriers on traded goods. The MERCOSUR agreement also provides that capital, services, and labor would circulate freely among Argentina, Brazil, Paraguay, and Uruguay by January 1995.

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 Argentinian and Brazilian investors, who were lured by the free-floating exchange rate, absence of capital controls, and traditional banking secrecy. 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. Uruguay benefits from the Generalized System of Preferences. Tariff exemptions exist for imports of capital goods, accelerated depreciation, and export financing. Restrictions on foreign investment in Uruguay were nonexistent. In December 1987, Uruguay passed a law creating "free trade zones" particularly meant to improve trade. Uruguay's debt-equity swap program offers incentives for foreign investment; included are no time restrictions on profits and capital repatriations. A growing number of companies took advantage of Uruguay's liberal foreign investment policies, resulting in increased mineral exploration activities.

The 1972 Mining Code is very workable. Exploration and mining agreements are as follows: prospecting permit is for up to 1,000 km^2 and a 2-year term; exploration permit is for up to 10 km^2 and a 2-year term; and a mining concession is for a maximum of 5 km^2 and up to a 30-year term.

Decree No. 516/990 of November 1990 authorized the Administración Nacional de Combustibles, Alcohol y Portland (ANCAP) to call for tenders from companies interested in offshore drilling.

PRODUCTION

Uruguay's mining and quarrying were for gold and construction minerals such as clays, dimension stone, dolomite, granite, gypsum, limestone, marble, quartz, and sand and gravel. The Mahoma gold project, 60 km northwest of San José, came on-stream at an initial production rate of 1,250 kg/a. Expansion plans would double gold production in late 1994. Dolomite was mined for use in the glass and construction industries, for steel, and in refractories. Limestone was produced principally for portland cement production. Various clays were mined for producing brick, pipe, tile, and whiteware. Talc was mined for use in the paper industry and in ceramics, cosmetics, insecticides, and pharmaceutics. Feldspar was mined for the ceramics industries and glass. *(See table 1.)*

TRADE

Uruguay reduced diesel and fuel oil export taxes and abolished import tariffs for raw materials and capital goods applicable in the mining sector. During 1993, Uruguay's total exports and imports were $1.7 billion and $2.1 billion, respectively. The country exported clays, gravel, limestone, precious stones, sands, and chemical products valued at $125 million. Imports of crude oil, lubricants, and petroleum products were estimated at $300 million.

ANCAP imported crude oil and refined petroleum from Argentina, Brazil, Colombia, Iran, Mexico, and Nigeria.

The mining sector imported from the United States ammonium phosphate for fertilizer, valued at $20 million, and mineral products, sulfur, lubricants, and petroleum byproducts and chemicals, valued at $65 million. Uruguay's exports to the United States were valued at $255 million. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

The National Institute of Mining and Geology 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 Ltd. (BIG), and Steel S.A., a subsidiary of Brazil's Mineração e Participacoe, invested $40 million in precious-metal and other metal exploration. American Resource Corp. (ARC) of Greenbrae, California, developed an initial 1,250-kg/a gold mine at Mahoma, 130 km from Montevideo. Two years ago, two gold refineries with production of 4 kg/d and 5 kg/d of gold each started operations. One was at Mahoma Sur in San José Department owned by Australia's BIG Resources Management Pty. Ltd., and the other was at the Corrales Mines in Rivera Department operated by Brazil's Steel S.A. During 1993, 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. Also, Gerdau of Brazil acquired the additional 43% of the Industria Nacional Laminadora S.A., including a 60,000-mt/a steel mill at Pando and a 100,000-mt/a rebar and wire mill in Montevideo. Gerdau controls the whole Uruguayan steel industry. *(See table 4.)*

COMMODITY REVIEW

Metals

Uruguay has provided ARC with exclusive rights to explore and develop Mahoma gold leases in San José Department. Gold ore produced from a series of high-grade open pits was processed in a conventional mill using gravity separation and carbon-in-leach recovery at a rate of 1,000 mt/d. The final product of doré will be exported for refining. The U.S. company, Gold Standard Inc., 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 gold 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. It was announced during 1992 that a Uruguayan-Bolivian joint-venture iron production facility was to be built, possibly with Japanese technology, at the mouth of the Paraná River. Bolivia would supply iron ore from the Mutún deposit and natural gas to power the plant. Electricity would be supplied from Uruguayan hydroelectric plants. The projected output was about 2 Mmt/a of high-quality iron worth $300 million.

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 mined marble in Lavelleja, Maldonado, and Soriano Departments, which was 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 Lavelleja, 250 km east of Montevideo. About 19,000 mt/a of dolomite was mined in Lavelleja and Maldonado Departments for use in construction, glass, the steel industry, and refractories. ANCAP produced limestone in Cerro Largo, Lavelleja, 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 1993. Natural gas reserves remained unquantified, and coal continued to be of poor quality. In an effort to reduce its heavy dependence on crude oil imports, Uruguay maintained a well-developed hydroelectric power system and has the potential for alternative energy sources from small uranium deposits. ANCAP also has been seeking joint-venture partners interested in new exploration for oil in the River Plate area.

Reserves

Uruguay's mineral reserves are modest compared with some other mineral producing countries in Latin America. ARC developed a gold mine at Mahoma in Canelones Department, which contains 169,000 tons of proven and probable reserves grading 11.8 g/mt of gold. Satellite deposits, Cerro San Carlos and Madre, of Mahoma, contain 113,000 tons grading 8.4 g/mt of gold and 66,000 tons grading 6.7 g/mt of gold, respectively. Uruguay has two iron ore deposits; each has proven reserves of 45 Mmt of 40% iron in Florida and Treinta y Tres Departments. In addition, the Zapucay deposit in the northern Department of Durazno includes 400 Mmt of iron ore containing 40% iron.

INFRASTRUCTURE

Uruguay has an extensive and well-maintained infrastructure. Mineral production, including mineral fuels, is transported primarily by the road and rail systems. In 1993, 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. There is 3,000 km of railroad in the country, all standard gauge (1.4 m) 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 within the Montevideo Province.

In 1993, total installed electric power capacity was about 1,720 MW, of which 32% was generated by thermal plants and 68% by hydroelectric plants. Uruguay's energy import problem was eased 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.

OUTLOOK

Uruguay's mineral sector is expected to remain of minor importance to the economy. However, the country has a potential for producing a variety of minerals, particularly gold, which is projected to be highly profitable. Investors have excellent opportunities to enter this sector through expansions at existing projects and prospects, although Uruguay's main mining activities still remained in the production of construction materials, industrial minerals, and semiprecious stones. The country has no known gasfields or oilfields and only poor-quality coal. Most of the country's energy requirements will be supplied by hydroelectric plants, unless exploration reveals significant exploitable mineral fuel deposits. There is a real interest in foreign investment, and major commitments recently have been made in mining; some taxes were waived within the gold industry during the construction or investment phases. Expropriation is remote, and no changes in current Government policies can be foreseen.

[1]Text prepared May 1994.

[2]Where necessary, values have been converted from Uruguayan Pesos ($) to U.S. dollars at the average market rate of $3.70=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Administración Nacional de Combustibles, Alcohol y Portland
Montevideo, Uruguay
Ministerio de Industria y Energía
Montevideo, Uruguay
Instituto Geológico del Uruguay
Montevideo, Uruguay

Publications

Banco Central del Uruguay, Montevideo, Uruguay: Boletín Estadístico (annual report).
Instituto Latinoamericano del Fierro y el Acero, Santiago: Anuario Estadístico de la Siderúrgica y Minería del Hierro de América Latina, annual.
Inter-American Development Bank, Washington, DC: Economic and Social Progress in Latin America, annual.
Latin American Mining Institute, Washington, DC: The South American Investment and Mining Guide, annual.
Siderurgia Latinoamericana, monthly.

TABLE 1
URUGUAY: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
Aluminum, secondary[e]		42	42	42	42	42	50
Barite[e]		15	15	15	15	15	15
Cement, hydraulic[e]		[2]560,000	500,000	500,000	500,000	500,000	600,000
Clays, unspecified[e]		150,000	150,000	150,000	150,000	150,000	150,000
Coke, gashouse[e]		8,000	8,000	8,000	8,000	8,000	8,000
Corundum[e]		45	45	45	45	45	50
Feldspar[e]		[2]2,680	3,000	3,000	3,000	3,000	3,000
Gemstones, semiprecious:[e]							
Agate		90	100	100	100	100	100
Amethyst		20	80	80	80	80	100
Gold[e]	kilograms	—	—	—	[2]300	300	300
Gypsum[e]		145,000	145,000	145,000	145,000	145,000	145,000
Iron and steel:							
Iron ore[e]		5,000	5,000	5,000	5,000	5,000	5,000
Metal:							
Ferroalloys: Electric-furnace ferrosilicon crust		250	250	250	250	250	250
Steel, crude		[2]37,150	[2]38,000	[r 2]41,000	[r 2]55,000	40,000	55,000
Semimanufactures[e]		18,000	18,000	18,000	18,000	18,000	18,000
Lime[e]		12,000	12,000	12,000	12,000	12,000	12,000
Petroleum refinery products:[e]							
Liquefied petroleum gas	thousand 42-gallon barrels	600	[2]698	700	700	700	700
Gasoline	do.	1,550	[2]1,849	1,850	1,850	1,850	2,000
Jet fuel	do.	300	[2]201	200	200	200	300
Kerosene	do.	500	[2]409	410	410	410	500
Distillate fuel oil	do.	3,300	[2]2,963	2,970	2,970	2,970	3,500
Lubricants	do.	60	[2]60	60	60	60	100
Residual fuel oil	do.	2,500	[2]2,573	2,580	2,580	2,580	3,000
Unspecified	do.	800	[2]501	500	500	500	1,000
Refinery fuel and losses	do.	20	[2]29	30	30	30	50
Total	do.	9,630	[2]9,283	9,300	9,300	9,300	11,150
Sand and gravel:[e]							
Sand, common	thousand metric tons	1,500	1,500	1,500	1,500	1,500	1,500
Gravel	do.	500	500	500	500	500	500
Stone:[e]							
Dimension		10,000	10,000	10,000	10,000	10,000	10,000
Crushed and broken:							
Alum schist		8,000	8,000	8,000	8,000	8,000	10,000
Dolomite		19,000	19,000	19,000	19,000	19,000	20,000
Limestone		750,000	750,000	750,000	750,000	750,000	750,000
Marble		4,000	4,000	4,000	4,000	4,000	5,000
Marl		7,000	7,000	7,000	7,000	7,000	10,000
Quartz		300	300	300	300	300	500
Other, including ballast	thousand metric tons	2,000	2,000	2,000	2,000	2,000	2,000
Sulfur, elemental, byproduct[e]		2,000	2,000	2,000	2,000	2,000	2,000
Talc, soapstone, pyrophyllite[e]		1,500	1,500	1,500	1,500	1,500	1,500

See footnotes at end of table.

TABLE 1—Continued

URUGUAY: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
Tuff: Tufa	3,500	3,500	3,500	3,500	3,500	3,500

[e]Estimated. [r]Revised.
[1]Production estimated unless otherwise specified.
[2]Reported figure.

TABLE 2

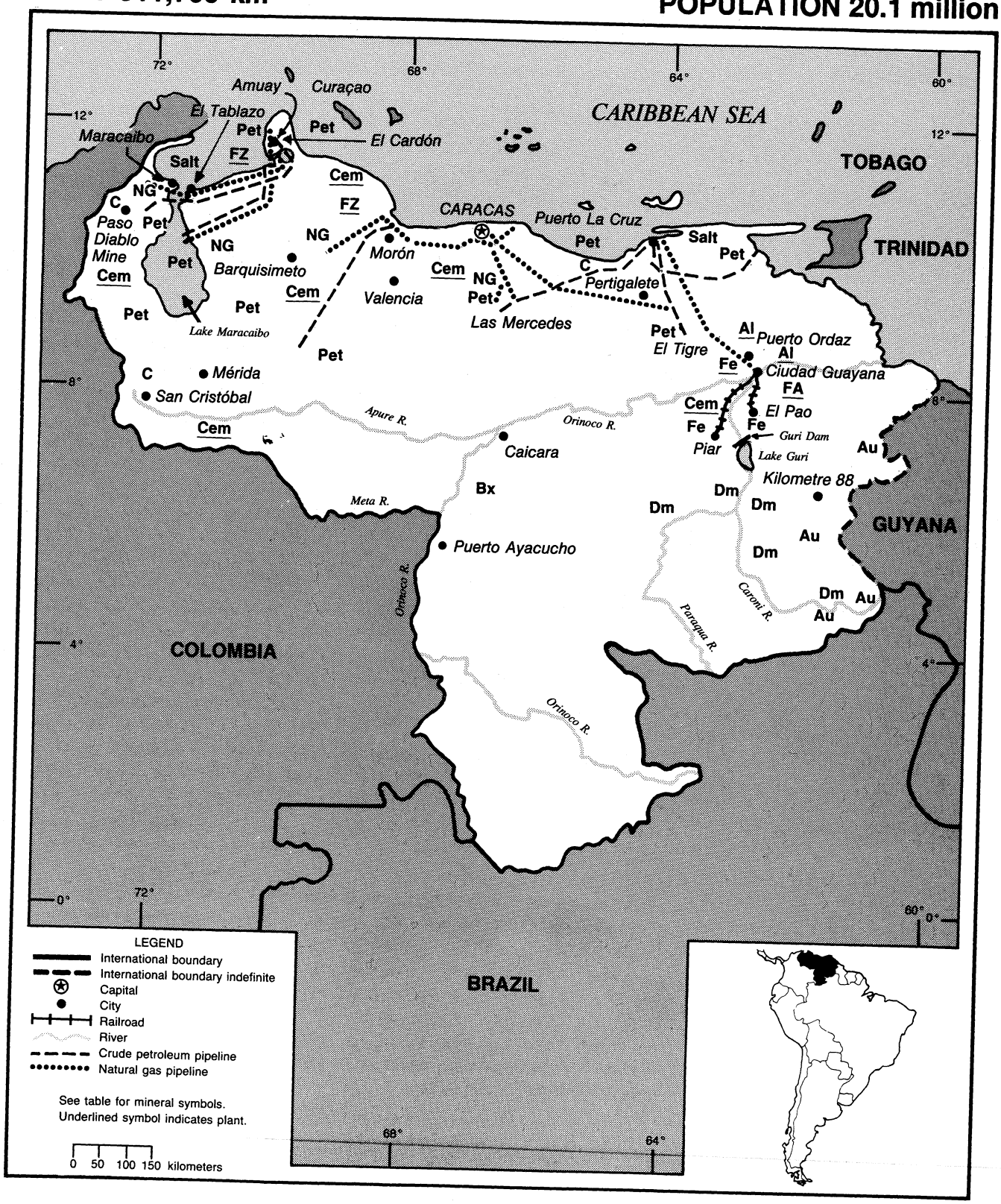
URUGUAY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Administración Nacional de Combustibles, Alcohol y Portland, ANCAP (Government, 100%)	Paysandu Mines and plants, Montevideo	1,000
Dolomite		do.	Lavalleja, 250 kilometers east of Montevideo	30
Gold	kilograms	American Resource, Corp. (private, 100%)	Mahoma, 130 kilometers from Montevideo	1,250
Do.	do.	BIG Resources Management, Pty. Limited (private, 100%)	Mahoma Sur, San José Department	1,800
Do.	do.	Stell, S.A. (private, 100%)	Corrales Mines, Rivera Department	1,440
Petroleum products	thousand 42-gallon barrels	ANCAP (Government, 100%)	La Teja Refinery, Montevideo	13,400
Steel		Industria Nacional Laminadora, S.A. (private, 100%)	Pando and Barros Arana plants near Montevideo	60
Talc	tons	Minas de Talco Narancio, S.A. (private, 100%)	Talc Mines in Colonia and Lavalleja Departments	1,500

VENEZUELA

AREA 911,700 km² **POPULATION 20.1 million**



THE MINERAL INDUSTRY OF

VENEZUELA

By David B. Doan

What might have been a continuation of the relatively good years, economically, of 1990, 1991, and 1992 for Venezuela turned out otherwise. World prices softened further for petroleum, cutting the value of the country's exports of crude and refined products that normally make up of 80% of its foreign-exchange earnings. Changes in production of mineral commodities, with two or three exceptions, ranged from unspectacular to disappointing compared with previous years.

The country saw increasing political turmoil in 1993 until President Carlos Andres Perez, who survived two previous coup attempts the previous year, was forced out of office in May by the Supreme Court of Venezuela. Investment activity dwindled to virtually nothing through the first eight months, and the gross domestic product (GDP) fell, ending the year down 1% compared with the previous year, or an estimated $41.75 billion[1] considering the weakening bolivar. Inflation picked up, consumer price levels having risen 25% by the end of August and about 46% by the end of the year. The rate of growth of imports dropped sharply, from about 20% in 1992 to 3% for most of 1993. For the first time the bolivar "went through" the U.S. dollar, ending the year at bs106 = $US1.00 and still climbing.

A caretaker Government did its best to stabilize the economy through the latter part of the year until December, when national elections brought in a new Government headed by Rafael Caldera, who was widely regarded as an economic populist. Real wages have declined 50% over the past 10 years in a country that believed its petroleum resources would carry the economy virtually forever. Petroleos de Venezuela SA (PDVSA), the Government-owned petroleum company, turned out a moderate performance that was 1% or 2% less than that of 1991 in terms of revenues, but PDVSA did receive a reduction in taxes, one of which, at 20%, will be phased out in 1996.

On the brighter side, exports of several major mineral commodities other than petroleum increased about 37% compared with those of the previous year. Several countries including China expressed interest in PDVSA's Orimulsion liquid fuel for thermal power generation, and privatization continued to attract investment in mineral exploration.

GOVERNMENT POLICIES AND PROGRAMS

In the midst of declining tax revenues resulting from lower prices for petroleum, the congress addressed its almost yearly task of "reforming" the tax laws to generate enough income to stave off a potential fiscal disaster. The major political parties were apprehensive about increasing taxes in an election year, but in Venezuela all non-oil taxes brought in only about 3% of GDP. Such a "balancing" of tax measures was seen as improving revenue and simultaneously relieving pressure on PDVSA operations. Laboring under a draconian tax rate of approximately 82%, this national linchpin of the Venezuelan economy was alleged by the political opposition to be bleeding capital to the point of exhaustion. It was claimed that if PDVSA's balances were translated in terms of other (stronger) currencies, its financial situation looked worse even than admitted, especially considering the depreciation system used for company assets as well as the continuous devaluation of the Venezuelan currency. Consequently, it was asserted, the real tax rate in U.S. dollars was at least 90% and PDVSA was not even self-sufficient in terms of capital for furthering operations.[2]

At midyear a petition was filed with the Venezuela Supreme Court by a local group questioning the legality of a decree that formed the basis of Placer Dome Inc.'s ownership of rights to the Las Christinas property at Kilometre 88 in southeastern Boliuvar State. This action was not so much intended to frustrate Placer Dome as to clarify the ownership of rights to other properties thrown into question by the action of Corporacion Venezolana de Guayana (CVG), the state-owned holding company for basic industries, in granting mineral rights. The petitioners claimed that only the Ministry of Energy and Mines could grant mineral rights, even though CVG has granted more than 400 work contracts to private interests in Venezuela. Although the foreign media reported[3] this situation as if it were aimed at Placer Dome, the fact remained that it had all the earmarks of an internal squabble prompted by private Venezuelan citizens determined to protect other unrelated mining interests.

Late in the year, the Venezuelan Minister of Energy and Mines signed a Memorandum of Understanding with his Russian counterpart to start a program of cooperation and training in mining, cartography, environmental studies, and related subjects. Technical information will be exchanged through conferences, missions, and other means.

ENVIRONMENTAL ISSUES

Venezuela, under the General

Agreement on Tariffs and Trade, challenged a clean-air regulation imposed by the U.S. Government on gasoline it imports from Venezuela. The regulation was intended to reduce smog-producing substances in the gasoline, but Venezuela argued that the rule would discriminate against all foreign suppliers because the refining product formula differs from the one applied to domestic companies.[4] Indications were that Venezuela would drop the challenge upon agreement by the U.S. Environmental Protection Agency to modify the rule, although this prospect did not please U.S. environmentalists or domestic gasoline producers.

As Venezuela struggled toward an orderly political system and a viable economy, environmental problems were seemingly of secondary concern in the media. The fact remained, however, that garimpeiros (illegal miners) had caused cumulative environmental damage in southeast Venezuela where they used mercury for gold amalgamation. Upon heating to drive off mercury and retrieve gold, gaseous mercury is released to the atmosphere and then precipitates to fall with the rain. Not only were soils and streams poisoned but aboriginal settlements were put at risk.

Most, if not all, of the garimpeiros are thought to be Brazilians who have little idea of the location of the unmarked border in the dense tropical wilderness.

PRODUCTION

The mineral sector's principal products were aluminum, cement, diamonds, ferroalloys, gold, iron ore, iron and steel, petroleum crude and natural gas, and petroleum products. (See *table 1.*) Gold output, about 15% greater than that of 1992, led the list of metals in terms of increased production during the year. Output of direct-reduced iron was unchanged, ferroalloys were down moderately, crude steel was down 21%, and hot-rolled steel was up slightly in each case compared with that of 1992. Bauxite production increased a phenomenal 177% compared with that of 1992, while output of alumina was up 15%, aluminum increased 1%, and iron ore dropped 7% in each instance compared with the previous year.

Among the industrial minerals, production of diamond dropped sharply. Gem-quality diamond output decreased 52%, and industrial diamond yield declined by 12%, compared with that of the previous year. Production rose for cement, 4%; common clay, 18%; feldspar, 30%; gypsum, 28%; limestone, 4%; industrial nitrogen, 32%; sand and gravel, 2%; and silica sand, 7%. Output declined for dolomite, 9%; and kaolin, 41%. Production ceased for amphibolite and phosphate rock.

Production of coal increased by a solid 37% compared with that of 1992, signalling impressive growth in organization and mining. Reflecting price disincentives, output of natural gas declined 3%, and petroleum crude fell 6%, compared with 1992. Output of refinery products was estimated to have been down slightly, probably proportionate to natural gas and crude, compared with that of the previous year.

Because the mining sector has customarily played a minor role in the Venezuelan economy, particularly by comparison with the petroleum industry, the Government has been encouraging increased mining activity. It seemed reasonably clear that metals and mineral fuels responded to world market prices, while many of the industrial minerals reflected the domestic requirements of a country that has been growing in spite of political and economic problems. Although showing negative growth in the early 1980's, mining as a whole grew to achieve earnings approximating 2% of GDP in 1992.

TRADE

Venezuela continued its difficult transition from a closed economic system to an open, export-oriented economy. Its principal export was petroleum crude, and its biggest customer was the United States. The latest full-year statistics show that, in 1992, slightly more than 65% of Venezuela's total exports of crude and refined products went to the United States, compared with 61% the year before, and possibly reflected decreasing U.S. petroleum production. In turn, the imported crude and products amount to about 90% of all U.S. imports from Venezuela. Average value of the exported "basket" of crude and refined product was $14.91 in 1992, dropping somewhat to $13.41 for the first 11 months of 1993, and was expected to recover to about $13.50 in 1994. Total 1992 international sales of crude and products by PDVSA averaged 2.721 Mbbl/d and represented revenues of $20.131 billion, down slightly from $20.807 billion in 1991.

Besides the United States, 1992 exports went to Central America and the Caribbean, 17% versus 14% in 1991; Europe, 11.7% versus an unusual 21% in 1991; South America, 3.4%; and Japan and other buyers, 2.6%. Brazil, alone, bought 20,000 to 30,000 bbl/d.

In December 1992, Veneuela's then-President Carlos Andres Perez announced that the San Jose Agreement, which allowed Central American and Caribbean states to import cheap oil from Mexico and Venezuela, could not be extended. Theretofore, the 11 importing countries had split 84,500 bbl/d from the two exporters and paid only 80% of the cost in hard currency, with the balance of 20% financed on easy terms by Venezuela and Mexico. With the departure of the Perez Government, however, the San Jose Agreement was again ratified in 1993, as it has been in August of each year.

In order of volumes, the major metal mineral commodities recently exported by Venezuela to the world were fabricated steel, pig iron, unwrought aluminum, rolled steel, steel bars, primary steel, coated steels, aluminum oxides, aluminum semimanufactures, and manganese oxides. Industrial mineral exports were nitrogenous fertilizer materials, ammonia, gypsum, gravel and crushed rock, sand, elemental sulfur, and carbon black. About $1 million worth of precious and semiprecious stone dusts and powders also were marketed abroad.

During 1993, Venezuela and Russia signed an agreement for Venezuela to fulfill Russia's commitment to provide

crude to Cuba. As a quid pro quo, Russia would supply crude to European refineries owned by Venezuela, with an incidental saving to Russia of former shipping costs on about 2 million tons of crude.

In addition to several trade pacts signed the previous year, 1993 saw new ones put in place. Venezuela and Colombia signed an agreement with the Central American Common Market to begin forming a free trade zone in which advantage is given to some of the latter countries to compensate for the greater industrial development of Venezuela and Colombia.

An agreement was signed with Chile to begin phasing out tariffs over a 6-year period, starting with autos and auto parts, but with early consideration for agricultural products.

Finally, Mexico, Venezuela, and Colombia concluded negotiations on a free-trade pact to take effect in the first half of 1994. Tariffs would be phased out rather than abolished immediately.

Near the end of the year, complaints were lodged with the U.S. International Trade Commission that silicomanganese was being dumped in the United States by Venezuela, Brazil, Ukraine, and the People's Republic of China.

STRUCTURE OF THE MINERAL INDUSTRY

Traditionally, the major mineral producers have been essentially State-owned, but beginning in 1989 the Government worked to privatize Venezuela's mineral industry, comprising more than 450 separate companies. The industry anticipated increasing private investment in aluminum, coal, and petrochemicals and later, presumably, in steel and petroleum, the latter having been opened to private investment for the first time during the year.

Major investment of new capital throughout the mineral sector was courted, but the main interest in 1992 seemed to be in gold.

In 1990, the mineral labor force totaled 47,000 in petroleum, 29,000 in iron and steel, and 26,000 in mining and quarrying. This was approximately 6% of the 1.7 million in the industrial sector of a labor force totaling 7.4 million overall. (See *table 2.*)

COMMODITY REVIEW

Metals

Alumina, Aluminum, and Bauxite.— With production of bauxite in 1993 almost doubling compared with that of the previous year, along with a real increase in production of alummina and a slight increase in output of aluminum, the entire industry gave the appearance of good health following what was thought to be the worst of the Russian dumping of aluminum on world markets. However, after the capitalizing of expansions in alumina and bauxite production during the period of Russian dumping, all was not well with the industry, particularly after a reported loss of $168 million in 1993 and the expectation of a bigger loss in 1994.[5] Venalum, the biggest aluminum smelter, owned 80% by the Government and 20% by Japanese groups, as well as Interalumina and Bauxiven were put on the market for privatization by Corporacion Venezolana de Guayana (CVG), which merged the administrative operations of the three companies. The hope was that the profit picture could be turned around, sooner rather than later, in light of the fact that Venalum already has one of the world's lowest production costs for primary aluminum. Moreover, aluminum has been Venezuela's second-largest source of export revenue, after petroleum. Interalumina itself had been moving forward on setting up a third alumina production line, intended to be ready in the first half of 1996 and utilizing Alusuisse technology. Production was targeted to increase from 2 Mmt/a to 3 Mmt/a at that time.

Meanwhile, Aluminos del Caroni (Alcasa), owned 92% by the Government and 8% by Reynolds International, operating a primary aluminum smelter and two rolling mills, posed perhaps a bigger financial problem. Based in Puerto Ordaz, Alcasa has only two of its four reduction lines operating and a fifth under construction. Alcasa was not to be included in the Bauxiven-Interalumina-Venalum package, but instead was offered separately for privatization.

With good supplies of bauxite, plentiful labor, and low energy costs, Venezuela boded well to become a serious competitor in world aluminum markets at such time as the combined effects of Russian dumping and domestic economic problems could be overcome.

Gold.—Gold output in Venezuela continued climbing, showing a 15% increase in 1993 compared with production in 1992, and exceeding the previous all-time high of 7,700 kg produced in 1990. Data represented only reported production and did not include output by unlicensed miners, called garimpeiros, known to be widespread in their small operations in the less accessible parts of eastern and southeastern Venezuela along the border with Brazil. Although environmental measures have been enforced in many areas, particularly with respect to mercury pollution, it seemed that policing actually reduced the activities of unlicensed miners.

As in previous year, virtually all news of gold exploration and discovery during 1993 centered on the so-called Kilometre 88 district of southeastern Bolivar State in the Precambrian shield, where the geology is very similar to that of the greenstone belts of the Canadian Shield. So named because of its location along Highway 10 south of the zero marker near El Dorado on the Cuyuni River, the area was worked illegally for years by unlicensed miners, including garimpeiros from Brazil, all of whom were thought to have removed more than 62 tons of gold from surface operations using primitive mining techniques. In 1990-92, the Government largely closed down illegal mining, relocated the garimpeiros and, in conjunction with the liberalization of its mining laws, made the region accessible to large-scale exploration fueled by foreign investment. Issues relating to title needed clarification, but reportedly could be resolved by expert Venezuelan

legal advice.

Many Canadian junior and senior companies were greatly involved in what could only be called a major gold rush at Kilometre 88, and exploration service organizations have been active, particularly geophysical and drilling companies. Increased attention was attracted by Placer Dome's (owned 70%, Government 30%) apparent major discovery at Las Christinas, and concessions have been established virtually throughout an area of roughly 30 km by 45 km. After the end of the year, Placer Dome announced that their Conductora and Cuatro Muertos zone contains a resource comprising about 124 Mmt grading 12.3 g/t of gold at a 0.7 g/t cutoff, amounting to 4.8 million ounces (1,543 kg), which would be worth more than $1.8 billion at a projected price of $380 per troy ounce.

Iron Ore.—Production of iron ore dropped about 7%, retreating to the 16 Mmt range from the 18 Mmt range in 1991, and marked the lowest output in 5 years, largely reflecting lower domestic sales during a period of economic instability.

C.V.G. Ferrominera Orinoco C.A. (Ferrominera), Venezuela's only producer of iron ore, operated the San Isidro, Cerro Bolivar, El Pao, and Los Barrancos mines. Ferrominera announced that it planned to increase its installed mining capacity from the current 20 Mmt/a to 40 Mmt/a by the year 2000, after having operated essentially at or slightly above installed capacity in previous years, particularly in 1991. It was estimated that the ultimate cost of doubling capacity with ancillary infrastructural upgrades would reach $1.3 billion by 2000. The program would include construction of new facilities for expansion of pellet production. Overall, plans were aimed to adapt new iron and steel technologies to reduce production costs, cope with environmental requirements, increase competitiveness, and generate a reasonable return on investment.

As of 1991, Ferrominera had proven iron ore reserves of 1.96 billion tons, grading 60%, and estimated reserves of 11.7 billion tons of lower-grade ore, averaging about 44% iron. Most of these reserves are in Bolivar State of southern Venezuela in the 50,000-km^2 Imataca region. At presently projected rates of production, Venezuela's proven iron ore reserves should last for more than 100 years.

Iron and Steel.—Venezuela enjoyed significant success in 1993 with its direct-reduced iron (DRI) production and actually operated above (900,000 tons produced versus 830,000 tons rated) capacity for output of hot briquetted iron (HBI), a highly suitable feed for iron and steelmaking furnaces, at its Minarales Ordaz CA (Minorca) plant at Porto Ordaz.[6]

C.V.G. Siderurgica del Orinoco C.A. (Sidor) was to be at least partly privatized, with the private sector taking over services to, and management of, the 3 Mmt/a raw steel producer. Services to be privatized included oxygen, gas, and infrastructure supply. It was disclosed that 51% of Sidor's seamless pipe mill had been purchased for $116 million by Finalven, a domestic company, and Iritecna, a subsidiary of the giant Italian company Instituzione Per La Ricostruzione Industriale (IRI), which also owns the airline, Alitalia. Furthermore, no World Bank money was to be involved.[7] The joint venture will be called Tubos Del Orinoco, or Tuborca. The only seamless pipe mill in Venezuela, its construction had been initiated by Sidor in 1986 with help from another IRI subsidiary, but lack of funds had caused suspension of the project in 1989. When completed, the mill would have a capacity of 250,000 mt/a. Sidor was to retain 40% ownership, with 9% going to the Tuborca workers. Demand for seamless steel pipe has been growing steadily from the State-owned PDVSA for oil and gas operations.

Along with several other countries, Venezuela was accused in 1992 of dumping ferrosilicon in the United States. The general manager of Fesilven, the producer in Venezuela, stated that he thought the allegations of subsidization and dumping were politically motivated, noting that the initial assertion of 184% subsidies had been reduced to exactly 1%. He pointed out that Fesilven's production costs were relatively cheap, owing to an abundance of local hydroelectric power, and that all the raw materials required for FeSi production were available not far from the plant. However, on May 4, 1993, the U.S. International Trade Commission determined that Venezuelan Ferrosilicon was being sold in the United States at less than fair value.[8]

Nickel.—The Loma de Hierro laterite deposit in Miranda State, that includes an estimated 25 Mmt of material grading 1.8% nickel (1.5% cutoff) and 0.05% cobalt, has attracted outside interest on the part of Anglo-American Corp. of South America (AMSA). Owners were Jordex Resources Inc., a Canadian company based in Vancouver, in a 50/50 joint venture with the Venezuelan company Caracas Corporation, called Corporacion Federal de Minas (COFEMINAS), which has been carrying out exploration drilling prior to an analysis of mining feasibility. During the year, AMSA acquired the right to purchase up to 70% of Jordex's half of COFEMINAS. The deposit was valued at $43.5 million as is.

Industrial Minerals

Ammonia.—Anzoategui State could be the site of a new ammonia plant according to rumors, early in 1994, that saw a use for purged gas from two methanol plants under construction nearby. Pequiven is a partner in both methanol plants, one with Mitsubishi and the other with the Italian compani ENI.

Cement.—Output of hydraulic cement, at 6.842 Mmt, was up about 4% compared with that of the previous year, sustaining a steady climb in output for more than 5 years. Demand for cement had followed suit, showing an increase of more than 5% through the first quarter of 1993, but flattening to barely more than

1% in the second quarter, a time of political upheaval, President Perez' ouster, and burgeoning economic uncertainty.

In 1991, the U.S. Department of Commerce (DOC) began conducting an antidumping investigation of Venezuelan cement and clinker exports to the United States. Approximately one-half of Venezuela's exports, or 2.5 million tons, was to the United States in 1990. The Venezuelan producers argued that the dumping charges were "blatant protectionism." A DOC decision on the charges had been expected early in 1992, and in March of that year the U.S. International Trade Commission announced that its countervailing duty investigation was suspended after the Government of Venezuela agreed to offset or eliminate all benefits DOC had found to constitute bounties or grants on exports of cement and clinker to the United States. Exports of cement to all purchasers were up 5% during the first half of 1993, compared with the same period of 1992, and offshore demand remained firm.

Refractory Materials.—The principal manufacturer of refractories in Venezuela, Ceramica Carabobo CA, had a capacity of 120,000 mt/a and production in 1992 of 90,000 tons of high and medium alumina bricks, low alumina bricks for insulation, basic refractories, chemically bonded materials, mortars, castables, plastics, rammables, and gunning mixes. Castables included low iron, normal, dense, or extra-dense, and in each case were silica-alumina, high alumina, or basic. The gunning mixes were based on chromites and chrome magnesites. The company also produced light aggregates, alumina cement, and bauxite. Raw materials mainly were imported magnesites from the United States, Austria, Netherlands, and Brazil; chromite from the Philippines, Africa, and Cuba; aluminas from the United States and Europe; and aluminous cements from France and the United States.

Mineral Fuels

Coal.—Output of bituminous coal soared upward about 57% as development of Venezuela's coal resources intensified and the Government pushed its plan to diversify the country's mineral production away from almost total reliance on petroleum. The Venezuelan coal-mining company, Carbozulia, a subsidiary of PDVSA, exported more than 3 Mmt of coal in 1993, worth about $31 million. Smaller volumes also were exported by other sources. Mined in the north-central part of the country south and east of Caracas, as well as in the northwest part of the country east, west, and south of Lake Maracaibo, Venezuelan coals tend to have low sulfur, in some cases high volatile matter and/or relatively high ash, but generally a high thermal value that together put much of the coal reserves in the high-rank bituminous category. Production is commonly by open-pit operations, affording cost controls leading to very competitive market pricing.

In the Guasare district of Zulia State, a sedimentary basin in the foothills of the Andes and virtually on the border with Colombia, Carbozulia presently aims for an output of 18 Mmt/a by 1997 and 20 Mmt/a by 2000. Guasare coals are metallurgical, having 51% fixed carbon and a high thermal value, 7.5% ash, and 0.6% sulfur, suitable for direct injection into blast furnaces as a substitute for coke. The resource includes 11 groups of seams, the thickness of individual seams ranging from 1 to 13 meters.[9] Carbozulia was further thought to be negotiating with Japanese sources to build a 1 Mmt/a coking plant south or west of Lake Maracaibo. Recent Guasare development and production have been centered on the Paso Diablo coal mine, operated jointly by Carbozulia and Agipcoal of Italy.

The Ministry of Mines had approved a long-term permit for the British Young Group PLC to expand the coal reserves of Carbonar, about 300 km east of Caracas and near the coast. Mining operations were to be expanded to allow the company to ship 1 Mmt of coal to British electric generating plants.

Natural Gas.—Production of natural gas amounted to 42.459 billion m^3, with about 11,826 billion^3 of this having been utilized in the field for reinjection; 15,622 billion m^3 utilized in other operations and processes; and the remaining 15.011 billion m^3 marketed. Natural gas liquid output was 38.756 Mbbl, of which 29.694 was liquid petroleum gas and 7.903 Mbbl was natural gasoline. Slightly more than 1 million barrels was unaccounted for.

Almost all natural gas produced in Venezuela has been associated gas. Until recently, virtually all gas produced was reinjected, sold for power generation, used for feedstock and power in refineries, or consumed as petrochemical feedstock, introducing an element of confusion as to applicability of the term "marketed".

Starting in 1991, plans were made to develop gas fields in the Gulf of Paria off Venezuela's east coast, with eight production platforms drilling at least 55 wells. About 50 km of pipeline would carry the gas ashore for processing and export.

Petroleum Crude.—Production of crude in 1993 amounted to slightly more than 894 Mbbl, a decrease of about 1.4% compared with output in the previous year. Gross revenues to PDVSA were $21.275 billion, of which $10.7 billion represented exports and about $978 million came from domestic sales. Approximately $5.8 billion went to the government in direct taxes. PDVSA net earnings were $1.1 billion, up from $338 million in 1992. The remainder, or $2.7 billion, presumably, went to operating costs. The increase in earnings from the previous year resulted from a reduction in tax levies, including a modification of the export reference value tax surcharge.

For 1993, capital investment by PDVSA and ancillary entities amounted to $3.4 billion in oil and gas operations; $103 million in petrochemicals; $56 million in bitumen and Orimulsion (see below); and $2 million in coal and fertilizers. Perhaps the big news for the year was that PDVSA once again

achieved financial self-sufficiency, regaining the capability of financing its own operations, taxes, and investments, and ending the year with a positive cash balance of nearly $400 million. Beyond this, PDVSA discovered an additional 2.03 billion bbl of crude during 1993, achieving a net increase of 1.12 billion bbl after allowing for total production during the year. With total reserves of more than 64 billion bbl, Venezuela had enough crude for 70 years' production at present rates.[10]

The Orinoco heavy oil belt consists of an estimated 1.2 trillion bbl of bitumen that by itself exceeds the world's total reserves of crude, although this bitumen or tar is not crude. The tar is too thick to refine or burn, but can be extracted from the ground for $3/bbl versus at least $9/bbl to mine tar sands or oil shales in various other countries such as Canada and Russia. One solution reached by PDVSA after 15 years of research has been to convert the tar into an emulsion of 70% oil and 30% water ("Orimulsion"), which flows and can be transported easily. It ignites readily and can be burned in powerplants. PDVSA has amassed contracts to supply power generators in the United States, Europe, and Japan with 10 Mmt of Orimulsion, and other agreements are being negotiated.

Reserves

Venezuela has significant reserves of bauxite, coal, gold, iron ore, natural gas, and petroleum. The reserves of the country's major mineral commodities, as projected by officials of the Venezuelan Government or their representatives, are shown in Table 3. Recent exploration has been sufficiently successful to suggest that the data for gold will be revised upward in the near future *(see table 3)*.

INFRASTRUCTURE

Venezuela's rail system had 542 km of single-track 1.435-m gauge rail, 363 km of which was Government-owned and the remainder privately owned. The country's road system consisted of 22,780 km of paved highway and 24,720 km of gravel-surfaced roadway. An additional 14,450 km was loose-surface road and 15,835 km was unimproved loose-surface road. The country had 360 airports, 331 of them in usable condition; 133 of them had paved runways. No runway exceeded 3,659 m in length; 15 had runways 2,440 to 3,659 m long; and 87 had runways 1,220 to 2,439 m long. Venezuela's navigable waterways for oceangoing vessels totaled 7,100 km, including the Rio Orinoco and Lago de Maracaibo. The country's hydrocarbon pipeline system consisted of 6,370 km for crude petroleum, 480 km for refined products, and 4,010 km for natural gas.[11] Thirty of the fifty-eight ships in the Venezuelan merchant marine were available for mineral products transportation.

Coal produced in the Guasare coal basin was hauled by highway trucks about 85 km to the Santa Cruz port facilities on Lake Maracaibo and then barged by canal to oceangoing vessels. Plans were being considered for construction of a railroad and new port facilities to expedite coal exports.

Late in 1992, it was announced that an important addition to the nation's infrastructure, in the form of a 344-km railway costing about $600 million, would be built from Caracas eastward almost to the Guyana border. The project consortium was to be led by Fiat of Italy and Marubeni of Japan.

OUTLOOK

The tax reform enacted in 1992 was expected to stimulate foreign investment in the hydrocarbon and other mineral industries, but it seemed that more than tax reform might be needed. Venezuela's legal requirements were blocking the very capital investment the country hoped to attract, particularly from other countries. The laws governing prospecting, claiming, and mining were detailed, and potentially complex. The succession of Government decrees and resolutions from 1944 through 1990 constituting the present mining law have great potential for manipulation and mischief because of their very complexity. Establishment of a single, uncomplicated, comprehensive mining law could stimulate activity in all sectors of the mineral industry of Venezuela.

Venezuela is endowed with natural resources that could make the country relatively wealthy provided political stability, technology, and infrastructure are encouraged to develop and build a strong economic base. The country may be expected to continue its efforts toward diversification of its mineral sector to reduce its heavy dependency on petroleum.

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[1]Where necessary, values have been converted from Venezuelan bolivars (Bs) to U.S. dollars at the rate of Bs93 = US$1.00, the median exchange rate for 1992.

[2]U.S. Department of State Telegram 11244, Oct. 22 1992, Caracas, Venezuela.

[3]Mining Journal. V. 321, No. 8232, July 9, 1993, London.

[4]New York Times. Mar. 18, 1994.

[5]Kepp, Michael. American Metal Market, Sept. 9, 1994.

[6]American Metal Market. Dec. 29, 1993, p. 2.

[7]Metal Bulletin. Apr. 15, 1993, p. 24.

[8]U.S. Department of State Telegram 135647, May 4, 1993, Washington, DC.

[9]Weaver, Jean N. Coal in Latin America: 1992 Uruguay, Argentina, Chile, Peru, Ecuador, Colombia, Venezuela, Brazil, and Bolivia, U.S. Department of the Interior, U.S. Geological Survey, Open-File Report 93-239, Denver, Colorado, 1993, p. 47 et seq.

[10]U.S. Embassy Caracas. Department of State Telegram 02388 of Mar. 23, 1944.

[11]Central Intelligence Agency. The World Factbook, 1993, p. 412.

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

U.S. Embassy, Caracas: Industrial Outlook Report, Iron and Steel (SPR-539), annual.
Industrial Outlook Report, Minerals (SPR-429), annual.
Minerals Questionnaire (SPR-4291), annual.
Venezuelan Petroleum Industry Development and Outlook Report, annual.
Latin American Mining Institute, Washington, DC: The South American Investment and

Mining Guide (annual); includes section on Venezuela.
Ministerio de Energía y Minas, Caracas:
Carta Semanal, weekly.
Memoria y Cuenta, annual.
Petróleo y Otros Datos Estadísticos, annual.
Presidencia de la República, Oficina Central de Estadística e Informática, Caracas:
Anuario Estadístico de Venezuela, annual.
U.S. Department of Commerce:
Foreign Economic Trends, annual.

TABLE 1
VENEZUELA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993	Annual capacity (Jan. 1, 1994)
METALS							
Aluminum:							
Alumina	thousand tons	e1,350	1,293	1,295	1,308	1,500	2,000
Bauxite		701,770	771,422	1,992,348	1,052,052	2,914,446	3,000,000
Metal, primary, unalloyed		539,647	590,379	600,544	561,354	567,562	650,000
Gold, mine output, Au content	kilograms	3,867	7,700	4,215	7,553	8,709	10,000
Iron and steel:							
Iron ore and concentrate	thousand tons	r18,053	r20,119	r21,196	r18,070	16,851	25,000
Metal:							
Pig iron	do.	r455	314	—	—	—	—
Direct-reduced iron	do.	r2,447	r2,718	r3,476	r3,920	3,927	5,000
Total	do.	r2,902	r3,032	r3,476	r3,920	3,927	5,000
Ferroalloys:							
Ferromanganese	do.	—	—	1	9	e10	12
Ferrosiliconmanganese	do.	32	r31	r31	r32	47	50
Ferrosilicon[2]	do.	55	r53	r54	r55	48	60
Total	do.	87	84	r86	96	105	122
Steel, crude	do.	r3,196	r2,998	r3,304	r4,263	3,356	3,500
Semimanufactures, hot-rolled	do.	r2,388	2,335	r2,208	r2,449	2,560	3,000
Lead, secondary, refined		r14,000	14,000	15,000	e15,000	e15,000	18,000
INDUSTRIAL MINERALS							
Amphibolite	thousand tons	144	188	212	200	—	—
Cement, hydraulic	do.	4,510	5,230	6,337	6,585	6,842	6,650
Clays:							
Kaolin	do.	15	12	39	37	22	42
Other	do.	1,903	3,057	2,747	1,629	1,924	3,000
Diamond:							
Gem	carats	69,724	e85,000	102,034	302,000	145,464	320,000
Industrial	do.	184,846	e248,000	111,523	176,000	155,246	200,000
Total	do.	254,570	e333,000	213,557	478,000	300,710	520,000
Feldspar	thousand tons	97	91	138	169	220	250
Gypsum	do.	332	201	244	175	224	250
Nitrogen, N content of ammonia	do.	532	557	450	404	535	560
Phosphate rock	do.	237	165	162	10	—	—
Pyrophyllite[e]	do.	32	32	32	32	32	35
Salt, evaporated		365,000	439,400	430,000	317,700	e370,000	450,000
Serpentinite, crushed[e]	thousand tons	550	550	550	550	550	550
Stone, sand and gravel:							
Stone:							
Dolomite	do.	383	300	e300	275	250	400
Granite	do.	440	262	370	47	195	200

See footnotes at end of table.

TABLE 1—Continued

VENEZUELA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	1991	1992	1993	Annual capacity[e] (Jan. 1, 1994)
INDUSTRIAL MINERALS—Continued							
Stone, sand and gravel—Continued:							
Stone—Continued:							
Limestone	thousand tons	15,371	12,563	11,440	14,266	14,903	15,000
Marble	do.	—	—	—	r134	—	150
Sand and gravel	do.	5,789	5,332	4,608	4,944	5,033	5,200
Silica sand	do.	378	443	343	703	753	790
Sulfur, byproduct of petroleum and natural gas		e125,000	r125,000	r155,000	r155,000	135,000	165,000
MINERAL FUELS AND RELATED MATERIALS							
Carbon black[e]	thousand tons	60	60	60	60	60	60
Coal, bituminous	do.	2,113	2,190	r2,500	2,880	3,940	4,000
Gas, natural:							
Gross	million cubic meters	38,097	40,516	42,326	43,435	42,459	45,000
Marketed	do.	e14,160	15,600	r e15,000	r e15,000	15,011	42,000
Natural gas liquids:[4]							
Natural gasoline	thousand 42-gallon barrels	7,380	e7,500	e8,190	18,600	7,903	20,000
Liquid petroleum gas	do.	29,963	e30,044	e33,290	74,485	38,756	78,000
Total	do.	37,343	e37,544	e41,480	93,085	46,659	98,000
Petroleum:							
Crude	do.	696,407	770,133	871,762	907,025	894,250	920,000
Refinery products:							
Liquefied petroleum gas	do.	3,650	2,920	e3,000	e3,500	2,920	6,000
Gasoline:							
Aviation[e]	do.	300	178	e350	300	64	1,000
Motor	do.	93,440	e122,111	115,227	e105,000	68,935	180,000
Naphtha[e]	do.	17,000	22,000	6,000	12,000	e58,035	80,000
Jet fuel	do.	21,535	e24,000	28,058	e29,000	28,543	40,000
Kerosene	do.	2,190	2,325	803	e1,000	999	5,000
Distillate fuel oil	do.	84,680	99,934	106,952	e100,000	104,025	115,000
Lubricants	do.	2,920	e2,975	2,946	e2,950	3,324	4,000
Residual fuel oil	do.	100,000	e89,217	106,952	e105,000	102,200	140,000
Asphalt and bitumen	do.	e9,000	12,120	9,037	e10,000	8,231	20,000
Refinery fuel gas[e]	do.	8,200	9,000	9,100	9,000	27,948	XX
Unspecified[e]	do.	10,030	1,365	1,213	1,500	1,240	XX
Total	do.	352,945	388,145	389,638	e379,250	406,464	(5)

[e]Estimated. [r]Revised. XX Not applicable.

[1]Table includes data available through Sept. 1994.

[2]Figures represent combined 45% silicon content and 75% silicon content production.

[3]Reported figure.

[4]From nonassociated natural gas only.

[5]Estimated capacity for each individual fraction of refinery products has been maximized at the expense of kindred fractions for a given volume of input raw crude; consequently a total is meaningless.

TABLE 2

VENEZUELA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1993

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina	(Interalumina) (Government, 88.7%; Aluminio Suizo S.A., 11.3%)	Ciudad Guayana, Bolivar State	1,300
Aluminum	Aluminio del Caroni S.A. (Alcasa) Government, 82%; Reynolds International, Inc., 8%)	do.	300
Do.	Industria Venezolana de Aluminio C.A. (Vanalum) (Government, 80%; 6 Japanese companies, 20%)	do.	366
Bauxite	C.V.G. Bauxita Venezolana C.A. (Bauxiven)	Los Pijiguaos Bolivar State	1,000
Cement	C. A. Venezolana de Cementos	Barquisimeto, Lara State; Maracaibo, Zulia State; Pertigalete, Anzoatequi State	2,750
Coal	Carbones del Guasare S.A.1	Paso Diablo, Zulia State Guasare coal basis	1,500
Gold	Revemin II (C.V.G., 49% Monarch, 49%; public, 2%)	El Callao, Bolivar State	.9
Do.	Las Christinas (Placer Dome 70%; C.V.G. 30%)	Kilometre 88, Bolivar State	new
Iron ore	Corporacion Venezolana de Guyana (C.V.G.) Ferrominera del Orinoco C.A. (Government, 100%)	Cerro Bolivar, El Pao, Los Barrancos, and San Isidro Mines, Bolivar State	20,000
Nickel	Jordex Resources 50% Corporacion Federal de Minas 50%	Loma de Hierro, Miranda State	new
Petroleum thousand 42-gallon barrels per day	Petroleos de Venezuela S.A. (PDVSA) (Government, 100%)	Fields in Anzoatequi, Apara, Falcon Guarico, Monagas, and Zulia States	1,822
Petroleum products do.	do.	Major refineries at Amuay Bay and Cardon, both in Falcon State	1,588
Steel	C.V.G. Siderurgica del Orinoco C.A. (Sidor) (Government, 100%)	Ciudad Guayana, Bolivar State	4,300

[1]Established by Carbonca del Zulia S.A. (Carbozulia) or the operating company for the Guasare coal project.

TABLE 3

VENEZUELA: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1992

(Thousand metric tons unless otherwise specified)

Bauxite		400,000
Coal		10,200,000
Gold	metric tons	8,000
Iron ore		2,052,000
Natural gas	million barrels of oil equivalent	23,800
Nickel		55,000
Petroleum crude	thousand barrels	64,450,000

MAP SYMBOLS

Commodity	Symbol
Alunite	Alu
Alumina	Al
Aluminum	AL
Andalusite	And
Antimony	Sb
Arsenic	As
Asbestos	Asb
Asphalt	Asp
Barite	Ba
Bauxite	Bx
Bentonite	Bent
Beryllium/beryl	Be
Bismuth	Bi
Bitumen (natural)	Bit
Boron	B
Bromine	Br
Cadmium	Cd
Calcium/calcite	Ca
Carbon black	CBl
Cement	Cem
Cesium	Cs
Chromite	Cr
Clays	Clay
Coal	C
Cobalt	Co
Columbium (niobium)	Cb
Copper	Cu
Corundum	Cn
Cryolite	Cry
Diamond	Dm
Diatomite	Dia
Dolomite	Dol
Emerald	Em
Emery	E
Feldspar	Feld
Ferroalloys	FA
Ferrochrome	FeCr
Ferromanganese	FeMn
Ferronickel	FeNi
Ferrosilicon	FeSi
Fertilizer	Fz
Fluorspar	F
Gallium	Ga
Garnet	Gt
Gemstones	Gm
Germanium	Ge
Gold	Au
Graphite	Gr
Gypsum	Gyp
Ilmenite	Il
Indium	In
Iron and steel	Fe
Iron ore	Fe
Jade	J
Kaolin	Kao
Kyanite	Ky
Lapis lazuli	Laz
Lead	Pb
Lignite	Lig
Lime	Lime
Limestone	Ls
Liquefied natural gas	LNG
Liquefied petroleum gas	LPG
Lithium	Li
Magnesite	Mag
Magnesium	Mg
Manganese	Mn
Marble and alabaster	Marb
Marl	Ma
Mercury	Hg
Mica	M
Molybdenum	Mo
Natural gas	NG
Natural gas liquids	NGL
Nepheline syenite	Neph
Nickel	Ni
Nitrates	Nit
Nitrogen (ammonia plants)	N
Ochre	Oc
Oil sands	OSs
Oil shale	OSh
Olivine	Ol
Opal	Opal
Peat	Peat
Perlite	Per
Petroleum, crude	Pet
Petroleum refinery products	Pet
Phosphate	P
Pig iron	Pig
Pigments, iron	Pigm
Platinum group metals	PGM
Potash	K
Pozzolana	Pz
Pumice	Pum
Pyrite	Py
Pyrophyllite	Pyrp
Quartz or quartzite	Qtz
Rare earths	RE
Rhenium	Re
Rutile	Ru
Salt	Salt
Sand and gravel	Sd/Gvl
Sandstone	Ss
Selenium	Se
Sepiolite, meerschaum	Sep
Serpentine	Serp
Shale	Sh
Silicon	Si
Sillimanite	Slm
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 (rutile or ilmenite)	Ti
Titanium dioxide (processed)	TiO_2
Tungsten	W
Umber	Um
Uranium	U
Vanadium	V
Vermiculite	Vm
Wollastonite	Wo
Wonderstone	Ws
Yttrium	Y
Zinc	Zn
Zirconium	Zr

MAP LEGEND

Symbol = Mine, including beneficiation plants, wells

Circled Symbol = Group of producing mines or wells

Underlined Symbol = Processing plant or oil refinery, including smelters and metal refineries

(Symbol) = Undeveloped resource

UNITS OF MEASURE AND ABBREVIATIONS

Unit of Measure	Symbol
American Petroleum Institute gravity	• API
barrels	bbl
calories	cal
centi (prefix)	c
centimeters	cm
cubic or cubed	^{3}(superscript)
cubic meters	m^3
day	d
giga (prefix)	G
gigawatt	GW
gigawatt hours	GW•h
gram	g
grams per metric ton	g/mt
gravity	
hectare	ha
kilo (prefix)	k
kilocalories	kcal
kilograms	kg
kiloliter	kL
kilometer	km
kilovolts	kV
kilowatts	kW
kilowatt hours	kW•h
liter	L
mega (prefix)	M
megawatts	MW
megawatt hours	MW•h
meter	m
million	M
million metric tons	Mmt
square or squared	^{2} (superscript)
square meters	m^2
square kilometers	km^2
standard coal equivalent	SCE
thousand	k
thousand metric tons	kmt
tons, deadweight	dwt
tons, metric	mt
volt	V
watt	W
watt hour	W•h
year	a

Name or Term	Abbreviation
American Petroleum Institute	API
European Community[1]	EC
European Free Trade Association	EFTA
Free Trade Agreement	FTA
General Agreement on Tariffs and Trade	GATT
gross domestic product	GDP
gross national product	GNP
Inter-American Development Bank	IDB
Latin American Iron and Steel Institute	ILAFA
liquefied natural gas (methane)	LNG
liquefied petroleum gas (propane-butane)	LPG
North American Free Trade Agreement	NAFTA
Organization for Economic Cooperation and Development	OECD
Organization of Petroleum Exporting Countries	OPEC
United Nations	UN
United Nations Development Program	UNDP

[1]Became part of the European Union (EU) on Nov. 1, 1993.

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