Minerals yearbook: Mineral industries of Latin America and Canada 1992. Year 1992, Volume 3 1992

Bureau of Mines
Washington, D. C.: Bureau of Mines : United States Government Printing Office, 1992

MINERAL INDUSTRIES OF

LATIN AMERICA AND CANADA

U.S.
DEPARTMENT
OF THE
INTERIOR

BUREAU
OF
MINES

1992

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

WASHINGTON : 1994

For sale by the U.S. Government Printing Office
Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328
ISBN 0-16-043162-X

Preface

This edition of the Minerals Yearbook discusses the performance of the worldwide minerals and materials industry during 1992 and provides background information to assist in interpreting that performance. Content of the individual Yearbook volumes follows:

Volume I, Metals and Minerals, contains chapters on virtually all metallic and industrial mineral commodities important to the U.S. economy. Chapters on advanced materials, nonrenewable organic materials, and nonferrous metals recycling also were added to the Minerals Yearbook series beginning with the 1989, 1990, and 1991 volumes, respectively. A new chapter on materials recycling has been initiated in this 1992 volume. 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, 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, Minerals Yearbook—International Review contains the latest available mineral data on more than 175 foreign countries and discusses the importance of minerals to the economies of these nations. Since the 1989 International Review, this volume has been presented as six reports: Mineral Industries of the Middle East, 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, and Minerals in the World Economy. The reports incorporate location maps, industry structure tables, and an outlook section previously incorporated in our Mineral Perspectives Series quinquennial regional books, which are being discontinued.

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 will be welcomed.

Acknowledgments

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

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

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

George J. Coakley
Chief, Division of International Minerals

Contents

Tables

Vitae

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.

Alfredo C. Gurmendi is a mining engineer and mineral economist with more than 30 years of experience. He pursued graduate studies in mining engineering and mineral economics at Colorado School of Mines and holds an M.B.A. from the University of New Mexico. His mining and energy industry professional experience included Cerro de Pasco Corp., the Anaconda Co., Exxon Minerals Co., Tennessee Valley Authority, and the U.S. Department of Energy. In June 1987, he joined the U.S. Bureau of Mines as a country specialist. He is a member of the American Institute of Mining, Metallurgical and Petroleum Engineers.

Orlando Martino is Chief, Branch of Latin America and Canada, and has covered the mineral industry of Latin America with the U.S. Bureau of Mines since 1976. He studied applied physics and engineering sciences at Harvard University and international economics at the Johns Hopkins School of Advanced International Studies. He initiated his engineering career with Westinghouse International Co. in New York, and he evaluated mineral development projects with the U.S. Agency for International Development and the Inter-American Development Bank. He has visited mineral operations throughout Latin America, with 40 years of experience in the region, and has a working knowledge of French, Portuguese, and Spanish.

Philip M. Mobbs holds a B.S. in Geology from Old Dominion University, an M.S. in Geology from Louisiana State University, and an M.B.A. from the University of Houston. His professional career began with the U.S. Geological Survey in 1977, followed by industrial experience in offshore petroleum operations as an engineer for Shell Oil Co. and as a geologist for Amerada Hess Corp. He joined the U.S. Bureau of Mines in 1990 as a specialist for a number of Latin American countries.

Gary R. Peterson has a B.S. in Business Administration and an M.S. in Mineral Economics from the Colorado School of Mines. He worked at the U.S. Bureau of Mines from 1980 to 1987 in the Minerals Availability Field Office (MAFO) and then was a Senior Mineral Economist at Pincock, Allen & Holt, Inc. until mid-1989. During that period, he conducted visits to Mexico to study lead and zinc deposits. He rejoined the U.S. Bureau of Mines in 1989 and is currently a Mineral Economist with MAFO in Denver, CO, involved in preparing a report on world gold deposits.

Dr. George A. Rabchevsky has a B.S. degree in Geology from American University, a Ph.D. in Geology from George Washington University, and other graduate work at Cornell University. His experience includes 5 years as senior geologist at Allied Research Associates Inc., 4 years as head of Image Analysis and Applications at Photo Sciences Inc., and 5 years as vice president of geotechnical and remote sensing consultation at Rainbow Systems Inc. Dr. Rabchevsky has lectured in geology and remote sensing at the George Washington University and American University. With the U.S. Bureau of Mines since 1978, he worked as a country specialist with the Branch of Europe and Central Eurasia before joining the Branch of Latin America and Canada in 1992.

Pablo Velasco has an Engineer of Mines degree from the Colorado School of Mines and holds a B.S. degree in Physics and Mathematics from the San Simón University of Cochabamba, Bolivia. His 33 years of professional experience include all phases of mining engineering and management of projects. He spent 18 years as a mining engineer in the private sector prior to joining the U.S. Bureau of Mines in 1978, where he worked with the Minerals Availability Field Office in Denver, CO, before transferring to the Branch of Latin America and Canada in 1980. His professional career in Latin America and the United States included COMIBOL, St. Joe Minerals Corp. (El Aguilar), Climax Molybdenum Co., American Metal Climax Inc., Kerr-McGee Nuclear Corp., N.L. Industries Inc., and Mobil Research and Development Corp.

For comments or further information, please contact

Chief, Branch of Latin America and Canada
Division of International Minerals
U.S. Bureau of Mines
810 7th St., NW, MS 5205
Washington, DC 20241
Telephone: (202) 501-9675
Fax: (202) 219-2489

LATIN AMERICA

AREA 19.5 million km² **POPULATION 492 million**

MAJOR MINERALS IN LATIN AMERICA

THE MINERAL INDUSTRIES OF

LATIN AMERICA AND CANADA

By Orlando Martino and Staff, Branch of Latin America and Canada

INTRODUCTION[1]

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

Latin America and Canada have a rich and diversified endowment of mineral fuels, metals, and industrial minerals. Tables 1 and 2 provide a summary view of Latin America and Canada's output of its major mineral commodities in world mineral supply in 1991 (revised) and 1992. Table 3 shows the relative importance of a selected group of minerals produced in Latin America in the world mineral economy.

Position in the World Mineral Economy

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

Production data for the United States has been included in summary tables 1 and 2 in order to show the importance of the whole Western Hemisphere in world mineral supply. Among the metals, the Western Hemisphere in 1992 produced more than one-half of the world's copper and silver, and more than 40% of the world's aluminum and zinc. Among the industrial minerals, the Western Hemisphere accounted for 44% of world sulfur and 35% equally of world phosphate rock and salt. Of the mineral fuels, this hemisphere supplied 39% of world output of petroleum products, 26% of crude oil, and 21% of coal.

Production Trends

Nonfuel Minerals.—Considering all the countries in Latin America, the most outstanding production from the region in terms of share of world output includes silver, tin, copper, bauxite, iron ore, zinc, crude oil, lead, aluminum, petroleum products, and gold, in order of world percentage as shown in table 3. Over the past decade, as a result of new discoveries and expanded production facilities, Latin America has improved its relative world position as a supplier of aluminum, tin, copper, gold, and iron ore, as shown in table 3. It is a tribute to the resource base of the region that, after 450 years of mining operations, Latin America is still a key producer of silver and gold.

Energy Minerals.—Latin America's crude oil output has grown steadily as new discoveries have been developed. Crude oil output has increased from 1.92 billion barrels in 1979 to 2.64 billion barrels in 1992. New crude oil developments in Brazil, Colombia, and Mexico were special factors in this upward trend. In 1992, a total of 14 countries in Latin America produced crude oil led by Mexico, Venezuela, Brazil, Argentina, and Colombia, in order of importance. Practically, all of the countries in the region installed oil refineries to meet domestic demands. Coal output in the region increased from 15.2 million tons in 1979 to 42.3 million tons in 1992, mostly because of new mine developments in Colombia, Mexico, and Venezuela. In addition to oil, gas, and coal, the region is significant as a source of geothermal power. Mexico ranks third after the United States and the Philippines in installed geothermal generating capacity, followed at much lower levels by El Salvador, Nicaragua, and Costa Rica, in order of capacity.

Regional Mineral Trade

Relative to growing domestic requirements, Latin America and Canada produce an important surplus of mineral commodities for international trade. In terms of value, the most important mineral exports for the global economy include: crude oil, natural gas, silver,

copper, gold, bauxite, zinc, and aluminum, in order of value. Latin America is not a significant coal producer, but has a significant role as an exporter of steam coal by Colombia. Coal exports from Colombia increased from less than 1 million tons in 1983 to 15.2 million tons in 1992 and were expected to increase to 35 million tons by the year 2000. Venezuela has also become a new coal exporter. As a region, Latin America continued as a net exporter of energy. Table 4 shows the importance of mineral commodities in the export sectors for a select group of countries in Latin America and Canada.

For most of the countries in the region, the United States is the major market for their mineral exports. As border countries, Canada and Mexico export the major part of their surplus mineral output to the United States. In turn, the United States depends upon Canada and Mexico as the primary suppliers of a large variety of mineral commodities. As shown in table 5 for the period 1988-91, Canada was the leading foreign supplier to the U.S. economy of potash, nickel, cadmium, selenium, gypsum, zinc, sulfur, nitrogen, salt, iron ore, lead, cement, and copper, in order of U.S. net percentage import dependency. On the other hand, Mexico was the leading supplier to the United States of graphite, strontium, fluorspar, and silver. Brazil was the leading source for the United States of columbium, tin, and silicon.

In 1992, the United States imported crude oil from eight countries in Latin America as detailed in table 6. The bulk of crude oil imports came from Venezuela, Mexico, Colombia, Trinidad and Tobago, and Ecuador, in order of importance. If exports of petroleum products from Latin America and Canada are taken into account, Venezuela becomes the most important supplier of oil to the U.S. market. U.S. oil imports from Latin America in 1992 represented about 31% of total U.S. oil imports. Combined oil imports from both Latin America and Canada accounted for about 43% of total U.S. oil imports or an estimated 16% of total U.S. consumption, again with the inclusion of certain petroleum products. In the Western Hemisphere, Venezuela continued in 1992 to surpass Canada as the leading oil supplier to the United States. In sum, the United States relies heavily on the Western Hemisphere as a source of energy minerals. This dependency is more pronounced if U.S. imports of natural gas are included. In 1991, natural gas imports from Canada accounted for 9% of U.S. consumption or 97% of total U.S. gas imports. In turn, the United States exports increasing amounts of natural gas to Mexico. The good road, rail, and pipeline infrastructure between the United States and Canada and Mexico facilitates the importation of oil and natural gas.

On a country basis, the U.S. trade balance in 1992 worsened with most major trading partners except Mexico and Taiwan. A U.S. International Trade Commission report shows that the single most significant bilateral development in 1992 was the $7.3 billion rise in U.S. exports to Mexico.

Trade Liberalization Developments

A salient development during 1992 was the completion in August of negotiations relating to the North American Free Trade Agreement (NAFTA) followed by its signing by the Heads of State of Canada, Mexico, and the United States on December 17, 1992. The three side agreements covering environmental and labor issues and import surges were signed in September 1993. The package containing NAFTA together with implementing legislation was then approved by the U.S. Congress in November 1993. When NAFTA becomes effective on the planned date of January 1, 1994, it will create the largest and richest trading block in the world of 370 million consumers with an annual output of almost $7 trillion. Once effective, NAFTA will replace the free trade agreement between Canada and the United States after 5 years of operation.

The scheduled reduction of tariffs under NAFTA is expected to increase the already strong and diverse trade in mineral raw materials and processed materials related to minerals between Mexico and the United States and between Canada and the United States. Because most mineral commodities from Mexico already enter the U.S. market duty free, NAFTA will mostly increase U.S. mineral exports to Mexico where the average duty is 10% and certain items have a tariff of 20%. Steel is an exception. Because of the expiration of the Voluntary Restraint Agreement (VRA), Mexican steel exports to the United States are expected to increase by competing freely with European and Asian sources. The United States depends significantly on Canada and the Latin American countries for mineral imports. In 1992, U.S. mineral imports (including mineral fuels) from Canada and all of Latin America amounted to $45 billion and represented 41% of total U.S. mineral imports valued at $110 billion. Canada is the most important trading partner of the United States followed by Japan and Mexico.

Efforts toward increasing regional economic integration through the use of trade agreements, began as early as 1960, when the Central American Common Market (CACM) and Latin American Free Trade Area (LAFTA) agreements were signed. Progress in trade liberalization has escalated throughout Latin America such that by 1995 nearly every country in the region can expect to be a member of a free trade area or common market.

Members of CACM have adopted a common external tariff and are currently discussing a proposed free trade agreement with Mexico, Colombia, and Venezuela, as well as expanded trade ties with the Caribbean Community. CACM has five members: Costa Rica, Elcolon Salvador, Guatemala, Honduras, and Nicaragua.

The Caribbean Community (CARICOM), formed with 13 members in 1973, is progressing toward the adoption of a common external tariff, the elimination of nontariff barriers and the creation of a monetary union.

Members of the Andean Pact have eliminated most nontariff barriers among

themselves and have agreed to adopt a common external tariff by yearend 1993, all as part of the goal to create an Andean Common Market by 1994. The Andean Pact was signed in 1969 and is composed of Bolivia, Colombia, Ecuador, Peru, and Venezuela. (Chile withdrew in 1976.) The U.S. Andean Trade Preference Act was formed in late November 1991.

The countries of the Southern Cone Common Market (MERCOSUR), formed by Argentina, Brazil, Paraguay, and Uruguay, have reduced tariffs among themselves by 75% and have agreed to adopt a common external tariff by 1995. The region as a whole has begun to see the benefits of free trade. For example, among MERCOSUR countries, trade in 1992 increased by 58% and in the Andean Group by 18%.

Chile was the first Latin American country to sign a bilateral free trade agreement (FTA) with Mexico. This FTA, which entered into force January 1, 1992, is scheduled to phase out most tariffs and eliminate nontariff barriers by January 1, 1996. The FTA also has an accession clause permitting other countries the Latin American Integration Association (LAIA) to join.

Colombia, Mexico, and Venezuela were negotiating an FTA designed to create a $373 billion economic market encompassing about 145 million people. The agreement was expected to be signed in early 1994.

Increased trade has contributed to the region's economic recovery. Latin America was the only region in the world in 1992 to have a trade deficit with the United States.

Economic Growth Trends

According to the 1993 report of the Inter-American Development Bank "Economic and Social Progress in Latin America," the region's GDP grew nearly 3% in 1992 for the second year in a row. This growth was contrary to sluggishness in the rest of the world economy. Both imports and exports increased in the region from the prior year. Considering the high level of interdependency between the U.S. economy and Latin America, a factor in the impressive growth of the region was the U.S. GDP growth of 2.8% in 1992.

The Andean countries as a group led the region's growth in 1992 with a 5.5% increase in GDP. Growth was greatest in Chile where a vigorous export sector pushed GDP growth up to 10.4%. In Venezuela, a booming private sector gave a 7.3% growth. Only Peru had a decline in output of 2.7% because of continuing social and political problems.

In Central America, every country had growth exceeding 4% except Nicaragua with less than 1% expansion. Belize grew an impressive 8.1% from a citrus boom.

The four southern cone countries had mixed performances. Argentina had the highest growth rate at 8% followed by Uruguay at 7.4%. In Brazil, which accounts for more than one-third of regional output, GDP decreased nearly 1% because high interest rates and high inflation suppressed demand.

Increased Investor Interest

As a result of political stability, the return to democratic government, and liberalization policies, there has been a surge of interest in investing in Latin America. Foreign investment in Latin America has also been stimulated by more open economies and less intervention by governments, but more particularly by liberalized investment and mining laws offering incentives and equal treatment to the foreign investor. In some countries like Mexico, incentives include reduction in corporate taxes. Chile, Bolivia, and Mexico have been particular beneficiaries of increased foreign investment. Foreign investors have targeted precious metals in their exploration and development projects. Large investments by U.S. and Canadian mining companies in Chile have enabled that country to obtain record highs in its gold and copper production and become the largest world producer and exporter of copper. Increased gold output in Bolivia, Uruguay, and Venezuela is also the result of foreign investment. As a result of changes in the petroleum laws of Argentina, Bolivia, Chile, and Peru, there was increased interest and exploration by foreign oil companies.

The overall change in investment climate and the issuance of new liberalized mining laws and regulations have led to an increase in mineral exploration in Latin America, especially in Mexico. It has been estimated that since 1990 there has been an influx of more than 100 U.S. and Canadian exploration companies in Mexico, most of which have set up offices in Hermosillo, Sonora.

It has been estimated that Latin America attracted a $40 billion inflow of private capital in 1991 that included a significant reversal of capital flight. Total U.S. direct foreign investment in Latin America has increased from a low of $24 billion in 1983 to $77.3 billion in 1991, of which $4.3 billion was directed toward the petroleum sector. U.S. investment in the primary and fabricated metals sector was $1.9 billion. The net capital inflow for 1992 is estimated at just over $50 billion, a record level. Mexico has been the clear leader in attracting capital inflows. Lesser, but still significant beneficiaries include Argentina, Brazil, Chile, Colombia, Peru, and Venezuela. Capital inflows in 1992 were particularly significant as a share of GDP in Peru (10.1%), Chile (4.8%), and Brazil (3.1%).

Privatization

In a global view, the Latin American region was the most active in terms of privatization developments. A large number of countries in the region were in the process of reducing the role of their governments in the economy through privatization of state-owned or state-controlled business operations. The sales had two objectives: increase income into the national treasury and reduce the burden on government operating budgets because many of the companies were generating losses. Privatization also gave the benefits of bringing in new management skills and technologies. In many cases, privatized companies were restructured with sharp reduction of

personnel to make the companies attractive to domestic and foreign private investors.

Privatization programs were especially active in Argentina, Bolivia, Chile, Brazil, Mexico, and Peru. Numerous mining operations and processing plants such as steel mills have been included. Privatization also involved the release of mineralized areas or ore deposits controlled by the government, thus giving a stimulus to exploration and development.

In Mexico, in a sharp reversal of past practice, the Government initiated in 1988 a clear policy of encouraging private enterprise in all sectors of the economy and of divestment of state-owned enterprises. In 1982, the Government owned 1,155 parastate enterprises and planned to hold equity in only about 150 entities when all privatization efforts are concluded. By yearend 1992, there were about 220 companies left in the public sector. Particularly notable were the actions by Mexico to auction the Government interest in a number of large-scale mining operations such as La Caridad copper operations in 1988, followed by Cananea copper operations in 1990. In November 1991, Mexico privatized its large iron and steel companies. Especially notable was the action taken by Argentina to sell control of its state oil company, Yacimientos Petrolíferos Fiscales (YPF), to local and foreign investors.

Historically, state energy companies have been considered the crown jewel of any Latin American government and their sale to the private sector represents a significant policy shift. YPF shares were made available in 1993 on the New York Stock Exchange in the form of American Depository Receipts. After the stock sale, equity participation revealed an interesting distribution between national and foreign investors and between Government and private shareholders as follows: foreign investors—28%, Argentine public—31%, YPF employees—10%, Argentine National Government—20%, five Provinces—11%. The equity mix and the use of local and foreign stock exchanges to liquefy Government assets will set a strong precedent for other Latin American countries where the Government has a monopoly in oil and gas operations.

Peru was among the more recent countries to embark on a privatization program of about 250 state-owned companies including numerous well-known mining operations. Hierro Peru's iron ore operations were sold to China's Shougang Corp. in 1992 followed by Cerro Verde copper operations in 1993. The sale of the large mining and metallurgical complex of CENTROMIN was scheduled for early 1994.

Rio Conference on the Environment

The 1992 Earth Summit was held in Rio de Janeiro, sponsored by the United Nations Conference on Environment and Development (UNCED). The Summit generated national and regional environmental reports, research papers, reports from participants, and nongovernmental organizations. The most important result was Agenda 21, the action plan for the environment for the 21st century.

Acknowledgments

The authors give their appreciation to Harold Willis for his preparation of the trade tables, to Roger Shockey for the country and regional maps, and to Emilia Colón for the layout of the manuscripts to enable publication of this regional report.

---

[1]Orlando Martino, Chief, Branch of Latin America and Canada, Division of International Minerals. The introduction was based on data available as of December 1993.

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, OK: International Petroleum Encyclopedia.
Robertson, A. (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, VA: Foreign Broadcast Information Service Regional Publications, weekly.
University of Miami, North-South Center for Latin American Studies: North-South, the Magazine of the Americas, bimonthly.
Weaver, J. 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, 1991 (REVISED)

(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)	2	259	24	—	69	2,972	—	39
Bolivia	—	—	(1)	4	102	21	—	376	—	17	130
Brazil	1,140	10,414	38	89	150,500	7	21	154	22,616	29	130
Chile	—	—	1,814	29	8,692	1	—	678	805	—	31
Colombia	—	2	4	35	450	(1)	21	8	664	—	(1)
Costa Rica	—	—	—	(1)	—	—	—	(1)	—	—	—
Cuba	—	—	e3	—	—	—	e34	—	270	—	—
Dominican Republic	—	7	—	3	—	—	29	22	39	—	—
Ecuador	—	—	(1)	12	—	—	—	—	20	—	(1)
El Salvador	2	—	—	—	—	—	—	—	11	—	—
Guatemala	—	—	—	(1)	5	(1)	—	—	—	—	23
Guyana	—	2,204	—	4	—	—	—	—	—	—	—
Honduras	—	—	e1	(1)	—	9	—	39	8	—	38
Jamaica	—	14,139	—	—	—	—	—	—	36	—	—
Mexico	51	—	299	10	e13,000	168	—	2,295	7,883	(1)	317
Nicaragua	—	—	—	1	—	—	—	1	—	—	—
Panama	—	—	—	(1)	—	—	—	(1)	—	—	—
Paraguay	—	—	—	—	—	—	—	—	61	—	—
Peru	—	—	382	10	3,593	200	—	1,769	418	7	628
Suriname	29	3,198	—	(1)	—	—	—	—	—	—	—
Trinidad and Tobago	—	—	—	—	—	—	—	—	444	—	—
Uruguay	42	—	—	—	—	—	—	—	44	—	—
Venezuela	601	1,992	—	4	21,241	—	—	—	3,119	—	—
Others[2]	—	—	—	e1	—	—	—	—	—	—	—
Total Latin America	2,030	31,956	2,541	203	197,842	430	82	5,411	39,433	53	1,336
Share of world percent	10	30	27	9	20	13	11	34	5	26	18
Canada	1,822	—	811	177	36,383	277	192	1,339	12,987	4	1,157
United States	4,121	W	1,630	297	54,000	477	6	1,855	79,738	W	547
Total Western Hemisphere[3]	7,973	31,956	4,982	677	288,225	1,184	280	8,605	132,158	57	3,040
Share of world percent	40	29	54	31	30	36	29	54	17	28	42
Total world	19,528	108,000	9,187	2,149	956,224	3,276	949	15,692	736,007	203	7,170

See footnotes at end of table.

TABLE 1—Continued

PRODUCTION OF SELECTED MINERALS IN LATIN AMERICA AND CANADA, 1991 (REVISED)

(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	61	3,500	78	—	679	—	294	e22,000	178,379	175,428
Barbados	—	e200	—	—	—	—	—	e35	e470	e2,200
Bolivia	1	592	4	—	(1)	3	—	5,432	8,094	9,770
Brazil	51	27,490	967	3,280	8,213	e316	4,578	6,597	235,680	526,695
Chile	3	2,251	336	13	1,676	419	2,741	4,067	6,499	46,127
Colombia	9	6,202	639	32	701	47	20,031	5,202	155,329	88,863
Costa Rica	—	700	—	—	50	—	—	—	—	e2,500
Cuba	—	e2,000	e130	—	e200	e4	—	—	e5,150	e53,000
Dominican Republic	—	1,231	118	—	e11	—	e(1)	—	—	10,301
Ecuador	—	2,300	25	—	—	e14	—	239	109,387	44,922
El Salvador	—	680	5	—	15	—	—	—	—	5,662
Guatemala	—	1,442	52	—	e100	—	—	e12	1,352	4,287
Honduras	—	650	e27	—	e30	—	—	—	—	e3,000
Jamaica	—	395	136	—	e14	—	—	—	—	6,890
Mexico	204	25,100	4,774	4596	7,533	e2,094	9,401	37,550	978,112	582,045
Nicaragua	—	239	16	—	e15	—	—	—	—	4,543
Panama	—	e300	—	—	e18	—	—	—	—	8,000
Paraguay	—	326	5	—	—	—	—	—	—	2,000
Peru	150	e2,200	e160	18	e200	e66	151	1,012	41,896	55,567
Suriname	—	e50	—	—	—	—	—	—	e1,500	—
Trinidad and Tobago	—	485	—	—	—	e5	—	e9,000	52,600	30,200
Uruguay	15	500	145	—	—	2,000	—	—	—	9,300
Venezuela	—	6,337	244	162	430	e83	2,500	42,326	871,762	389,638
Others[5]	(1)	490	—	e15	e550	60	—	—	—	119,800
Total Latin America	494	85,660	7,861	4,116	20,435	5,111	39,696	133,472	2,646,210	2,174,438
Share of world percent	8	7	8	2	10	9	1	6	12	9
Canada	50	9,396	6,830	—	11,993	6,979	71,130	144,987	e563,985	617,532
United States	448	66,753	14,021	48,096	35,943	10,820	903,571	645,979	2,705,745	5,568,440
Total Western Hemisphere[3]	992	161,809	28,712	52,212	68,371	22,910	1,014,397	924,438	5,915,940	8,360,410
Share of world percent	16	13	29	34	35	41	22	46	26	35
Total world	5,685	1,189,855	97,792	149,665	192,280	55,041	4,492,000	2,000,000	21,980,665	23,623,895

eEstimated. W Withheld to avoid disclosing company proprietary data.

[1]Less than ½ unit.

[2]Includes French Guiana.

[3]Excludes Greenland.

[4]Includes only output used to manufacture fertilizers.

[5]Includes Guadeloupe, Haiti, Martinique, and the Netherlands Antilles.

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

TABLE 2

PRODUCTION OF SELECTED MINERALS IN LATIN AMERICA AND CANADA, 1992

(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	4	18	—	46	2,900	—	41
Bolivia	—	—	(1)	5	55	20	—	282	—	17	144
Brazil	e1,200	e10,500	38	e89	e151,000	e8	e21	e155	e24,000	e29	e140
Chile	—	—	1,933	34	8,270	1	—	1,029	994	—	30
Colombia	—	2	4	32	674	(1)	23	8	725	—	(1)
Costa Rica	—	—	—	(1)	—	—	—	(1)	—	—	—
Cuba	—	—	e3	—	—	—	e40	—	e250	—	—
Dominican Republic	—	—	—	2	—	—	28	13	e35	—	—
Ecuador	—	—	—	12	—	—	—	—	20	—	(1)
El Salvador	2	—	(1)	—	—	—	—	—	11	—	—
Guatemala	—	—	—	(1)	1	(1)	—	—	18	—	—
Guyana	—	e2,300	—	e5	—	—	—	—	—	—	—
Honduras	—	—	e2	(1)	—	9	—	39	7	—	e32
Jamaica	—	12,233	—	—	—	—	—	—	36	—	—
Mexico	25	—	266	10	e15,000	170	—	2,098	8,435	(1)	294
Nicaragua	—	—	—	1	—	—	—	2	—	—	—
Panama	—	—	—	(1)	—	—	—	(1)	—	—	—
Paraguay	—	—	—	—	—	—	—	—	86	—	—
Peru	—	—	369	10	2,848	194	—	1,573	338	10	603
Suriname	32	3,250	—	(1)	—	—	—	—	—	—	—
Trinidad and Tobago	—	—	—	—	—	—	—	—	553	—	—
Uruguay	—	(1)	—	—	—	—	—	—	53	—	—
Venezuela	561	1,052	—	8	18,050	—	—	—	3,200	—	—
Others[2]	—	—	—	e2	—	—	—	—	—	—	—00
Total Latin America	1,985	29,337	2,615	212	195,901	420	112	5,245	41,661	56	1,284
Share of world percent	10	28	28	9	21	12	12	34	5	31	17
Canada	1,950	—	764	158	34,136	342	192	1,207	13,924	—	1,312
United States	4,042	W	1,760	329	54,000	408	7	1,804	84,322	W	552
Total Western Hemisphere[3]	7,977	29,337	5,139	699	284,037	1,170	311	8,254	139,907	56	3,148
Share of world percent	41	28	55	31	30	36	33	53	19	31	44
Total world	19,219	103,625	9,290	2,248	929,754	3,242	922	15,345	721,315	179	7,137

See footnotes at end of table.

TABLE 2—Continued

PRODUCTION OF SELECTED MINERALS IN LATIN AMERICA AND CANADA, 1992

(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	44	4,905	567	—	938	—	212	21,900	179,000	e175,250
Barbados	—	—	e175	—	—	—	—	e33	e470	e2,120
Bolivia	(1)	600	6	—	(1)	(1)	—	5,522	7,752	9,719
Brazil	50	e28,000	e970	e3,300	e8,200	e316	e4,700	e6,600	e236,000	e526,940
Chile	2	2,645	424	17	1,672	424	1,901	4,039	5,423	47,412
Colombia	9	6,807	e650	32	547	48	23,776	e5,200	e160,600	e89,470
Costa Rica	—	700	—	—	50	—	—	—	—	e3,000
Cuba	—	e2,000	e125	—	e185	e5	—	—	e5,300	e55,000
Dominican Republic	—	e1,300	83	—	e12	—	e(1)	—	—	e10,370
Ecuador	—	2,250	24	—	—	e14	—	195	117,172	44,164
El Salvador	—	680	5	—	15	—	—	—	—	5,000
Guatemala	2	1,400	68	—	e100	—	—	e12	2,051	5,696
Honduras	—	e1,600	e26	—	—	—	—	—	—	e3,000
Jamaica	—	e390	e100	—	e16	—	—	—	—	e7,000
Mexico	444	e26,900	5,158	452	7,395	2,302	e8,700	37,141	978,031	578,300
Nicaragua	—	e277	9	—	e15	—	—	—	—	4,802
Panama	—	e500	—	—	e20	—	—	—	—	e9,000
Paraguay	—	326	5	—	—	—	—	—	—	2,000
Peru	17	2,089	e35	e18	238	e66	e150	e1,200	42,298	55,450
Suriname	—	e50	—	—	—	—	—	—	e1,500	—
Trinidad and Tobago	—	482	—	—	—	e5	—	e7,000	e51,000	e30,000
Uruguay	15	500	145	—	—	2,000	—	—	—	9,300
Venezuela	—	6,585	175	10	318	e85	2,880	43,435	907,025	e379,250
Others[5]	(1)	440	—	e15	e550	e60	—	—	—	e119,800
Total Latin America	583	91,426	8,750	3,844	20,271	5,325	42,319	132,277	2,693,001	2,172,043
Share of world percent	9	7	8	2	10	10	1	6	12	9
Canada	32	8,484	7,054	—	11,154	7,124	65,362	158,067	e585,076	604,362
United States	316	71,426	14,759	46,965	34,830	10,663	907,000	657,024	2,617,415	5,635,507
Total Western Hemisphere[3]	931	171,336	30,563	50,809	66,255	23,112	1,014,681	947,368	5,895,492	8,411,912
Share of world percent	16	13	31	35	35	44	21	47	26	35
Total world	5,436	1,253,826	97,791	143,753	184,853	52,409	4,828,000	2,000,000	21,993,075	e23,725,000

eEstimated. W Withheld to avoid disclosing company proprietary data.

[1]Less than ½ unit.

[2]Includes French Guiana.

[3]Excludes Greenland.

[4]Includes only output used to manufacture fertilizers.

[5]Includes Guadeloupe, Haiti, Martinique, and the Netherlands Antilles.

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

TABLE 3
THE ROLE OF LATIN AMERICA IN WORLD MINERAL PRODUCTION

(Percent of total world output)[1]

Commodity	1980	1985	1990	1991	1992
Silver	34	35	35	34	34
Tin	15	25	28	26	31
Copper	21	26	26	27	28
Bauxite	28	20	24	30	28
Iron ore	16	17	21	20	21
Zinc	16	17	17	18	17
Crude oil	9	12	11	12	12
Lead	12	15	13	13	12
Aluminum	5	8	10	10	10
Petroleum products	9	7	9	9	9
Gold	5	10	9	9	9
Cement	8	7	7	7	7
Steel	4	5	5	5	5
Coal	—	.5	1	1	1

[1]By volume.

TABLE 4
LATIN AMERICA AND CANADA: ROLE OF MINERALS IN THE EXPORT SECTOR (1990)

Country	Value of total mineral exports ($US million)	Nonfuel mineral share of total exports (percent)	Mineral fuel share of total exports (percent)	Total mineral share in percent
Canada	37,846	16.0	10.7	26.7
Venezuela	15,290	5.6	81.3	86.9
Mexico	11,580	5.7	37.0	42.7
Brazil	6,740	21.4	—	21.4
Chile	4,700	55.1	—	55.1
Colombia	3,171	9.8	35.1	44.9
Trinidad and Tobago	1,700	9.0	80.0	89.0
Peru	1,513	46.0	5.0	51.0
Ecuador	1,460	—	52.0	52.0
Cuba	1,375	15.0	10.0	25.0
Argentina	844	.7	6.3	7.0
Jamaica	707	62.0	—	62.0
Bolivia	635	43.9	24.5	68.4
Suriname	350	75.0	5.0	80.0
Dominican Republic	296	32.0	—	32.0
Honduras	50	5.0	—	5.0

TABLE 5

U.S. IMPORT DEPENDENCY ON WESTERN HEMISPHERE MINERAL SOURCES

(In percent of total imports—1988-91)

Mineral commodity	Overall dependency percent	First rank		Second rank		Third rank		Fourth rank	
Arsenic	100	Chile	(22)	Other	(19)	Mexico	(16)	Other	
Bauxite	100	Other	(36)	Jamaica	(26)	Brazil	(12)	Other	
Columbium	100	Brazil	(68)	Canada	(24)	Other		Other	
Graphite	100	Mexico	(32)	Other	(28)	Brazil	(7)	Other	
Manganese ore	100	Other	(42)	Brazil	(21)	Other	(19)	Mexico	(8)
Strontium	100	Mexico	(97)	Other		Other		Other	
Fluorspar	87	Mexico	(41)	Other	(23)	Other	(23)	Canada	(4)
Tungsten	85	Other	(53)	Bolivia	(8)	Peru	(6)	Other	
Cobalt	76	Other	(27)	Other	(23)	Canada	(20)	Other	
Tin	73	Brazil	(26)	Bolivia	(19)	Other		Other	
Potash	67	Canada	(91)	Other		Other		Other	
Nickel	64	Canada	(57)	Other	(14)	Other	(7)	Dom. Rep.	(6)
Antimony ore	58	Other	(40)	Mexico	(22)	Bolivia	(14)	Guatemala	(9)
Iodine	52	Other	(62)	Chile	(37)	Other		Other	
Cadmium	49	Canada	(36)	Mexico	(21)	Other		Other	
Selenium	47	Canada	(34)	Other		Other		Other	
Barite	44	Other	(71)	Other	(17)	Mexico	(4)	Other	
Silicon	36	Brazil	(28)	Canada	(13)	Venezuela	(13)	Other	
Gypsum	35	Canada	(69)	Mexico	(23)	Other		Other	
Zinc: Ore and metal	34	Canada	(60)	Mexico	(11)	Peru	(5)	Other	
Pumice	32	Other	(75)	Mexico	(7)	Ecuador	(7)	Other	
Magnesium compounds	23	Other	(32)	Canada	(22)	Other	(16)	Mexico	(9)
Sulfur	18	Canada	(52)	Mexico	(46)	Other		Other	
Nitrogen (ammonia)	15	Canada	(36)	Trinidad and Tobago	(25)	Other	(25)	Mexico	(10)
Salt	13	Canada	(41)	Mexico	(24)	Bahamas	(12)	Chile	(6)
Iron and steel	12	Other	(31)	Other	(20)	Canada	(17)	Brazil	(8)
Iron ore	12	Canada	(48)	Brazil	(24)	Venezuela	(20)	Other	
Lead	8	Canada	(67)	Mexico	(21)	Other	(4)	Peru	(3)
Cement	7	Canada	(23)	Mexico	(22)	Other		Other	
Copper	3	Canada	(46)	Chile	(22)	Mexico	(12)	Other	
Sodium sulfate	1	Canada	(95)	Mexico	(4)	Other		Other	
Silver	1	Mexico	(41)	Canada	(32)	Peru	(6)	Other	

[1]The United States is a net importer of silver; however, changes in unreported investor stocks preclude calculation of a meaningful net import reliance.

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

TABLE 6

U.S. DEPENDENCY ON IMPORTS OF PETROLEUM FROM LATIN AMERICA, 1992

(Thousand 42-gallon barrels)

Country	Crude oil	Percent share	Petroleum products[1]	Percent share	Total petroleum	Percent share
Venezuela	300,671	44.0	124,462	59.1	425,133	47.5
Mexico	287,141	42.1	15,630	7.4	302,771	33.9
Colombia	37,103	5.4	[2]8,297	3.9	45,631	5.1
Trinidad and Tobago	25,514	3.7	9,323	4.4	34,837	3.9
Netherlands Antilles	—	—	24,160	11.5	24,160	2.7
Ecuador	20,933	3.1	[2]1,054	.5	21,987	2.5
Bahamas	—	—	[2]13,259	6.3	13,259	1.5
Brazil	—	—	7,340	3.5	7,340	.8
Peru	205	([3])	[2]3,845	1.8	4,050	.5
Argentina	9,144	1.3	3,383	1.6	12,527	1.4
Guatemala	1,979	.3	—	—	1,979	.2
Total	682,690	100.0	210,753	100.0	893,674	100.0
Total U.S. imports	2,215,938	100.0	655,099	100.0	2,871,037	100.0
From Latin America	682,690	30.8	210,753	32.2	893,443	31.1
From Canada	287.868	13.0	96,229	14.7	384,097	13.4
From Western Hemisphere	970,558	43.8	306,982	46.9	1,277,540	42.8

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

Source: U.S. Department of Energy, Energy Information Administration, Petroleum Supply Annual 1992, Feb. 1993.

TABLE 7

HISTORIC LEVELS OF MINERAL OUTPUT OCCURRING IN 1992

(Thousand metric tons unless otherwise specified)

Country	Commodity	Output			
		1985	1990	1991	1992
Argentina	Petroleum, crude thousand barrels	167,781	175,836	178,379	179,000
Bolivia	Natural gas million cubic meters	4,647	5,276	5,432	5,522
Do.	Zinc	37	104	130	144
Brazil	Aluminum	550	931	1,140	1,150
Do.	Cement	20,612	25,848	27,490	28,100
Do.	Steel (crude)	20,456	20,567	22,617	23,934
Canada	Aluminum	1,282	1,567	1,821	1,950
Do.	Coal	60,436	58,924	62,149	64,550
Do.	Diatomite	3.8	4.1	8.0	10.0
Do.	Natural gas million cubic meters	92,094	138,358	144,987	158,069
Do.	Natural gas liquids thousand barrels	125,085	151,306	157,973	165,600
Do.	Nepheline syenite	467	533	493	566
Do.	Peat	643	716	856	880
Do.	Petroleum, crude thousand barrels	538,200	566,978	563,985	585,076
Chile	Copper	1,356	1,588	1,814	1,933
Do.	Gold thousand kilograms	17.2	27.5	28.9	33.8
Do.	Silver do.	517	655	678	1,029
Colombia	Cement	5,394	6,253	6,202	6,807
Do.	Nickel, mined tons	12,800	22,439	20,590	23,063
Do.	Petroleum, crude oil thousand barrels	64,410	160,431	155,329	160,600
Do.	Petroleum, products do.	69,600	83,715	88,863	89,470
Do.	Platinum-group metals kilograms	362	1,316	1,603	1,956
Do.	Steam coal	9,710	19,834	19,231	22,876
Ecuador	Petroleum, crude thousand barrels	102,415	104,442	109,387	117,113
Mexico	Cement, hydraulic	20,680	23,824	25,100	26,900
Do.	Copper, blister (primary) tons	67,192	175,374	182,565	228,166
Do.	Copper, refined do.	123,565	162,689	192,085	271,140
Do.	Graphite, natural amorphous do.	33,468	22,553	35,315	47,053
Do.	Wollastonite do.	13,512	11,442	13,877	27,392
Peru	Gold kilograms	6,621	9,100	9,934	10,014
Do.	Tin tons	3,807	5,134	6,559	10,195

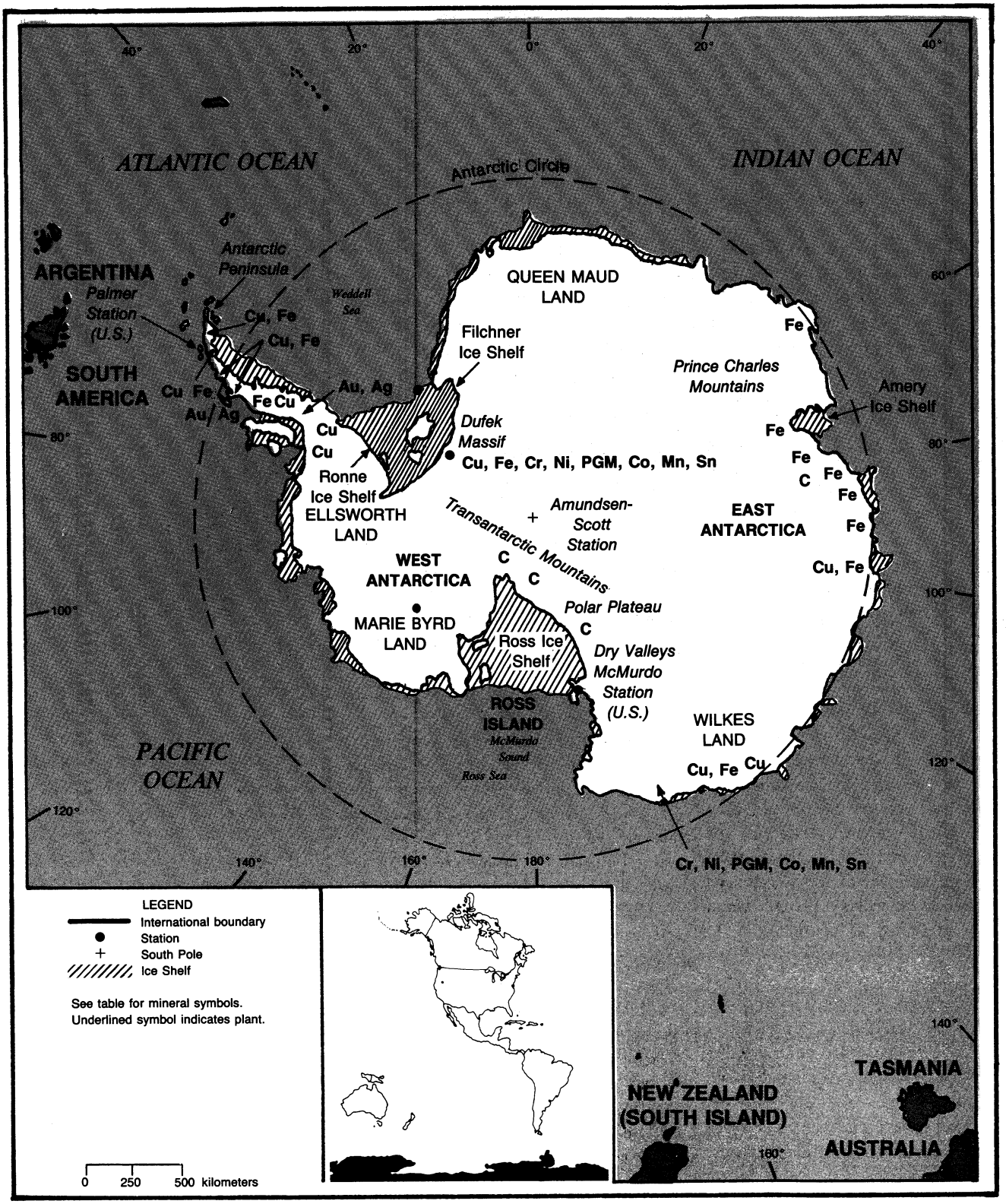
TABLE 8

LATIN AMERICA AND THE CARIBBEAN: INTERNATIONAL ORGANIZATIONS

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

ANTARCTICA

AREA 14.3 million km² **POPULATION varies**



THE MINERAL POTENTIAL OF

ANTARCTICA

By David B. Doan

A large continent of about 14 Mkm^2 in area, Antarctica lies almost entirely within the appropriately named Antarctic Circle. It is virtually surrounded by deep ocean basins and supports an ice sheet varying from 1,500 to about 3,900 m thick. Through a period of years, geophysical studies have revealed a fairly complete physiographic picture beneath the ice cover. West Antarctica is connected to the main part of the continent by a mountain chain rising well above sea level, though largely masked by ice and snow. The mountains of Marie Byrd Land are a large island mass whose surrounding ice extends well below sea level. The bedrock of most of East Antarctica apparently rises above sea level, with the high ranges of the Transantarctic Mountains and Queen Maud Land extending far above sea level.

The Antarctic continent, with its accompanying continental ice sheet and widely distributed mountain glaciers, is more or less unique at the planetary surface, being at once the coldest area on earth, the least inhabited continent, the southern pole, and the locus of the greatest impoundment of fresh water on Earth. Moreover, it has a distinct fauna and flora, relating evidently both to temperature and the uniqueness of the landmass as a major continent. Exploration began piecemeal and by accident in the early 1800's, primarily by whale and seal hunters, and increased gradually toward the so-called Heroic Era, from 1894 to the late 1920's. During this 35-year period explorers from a number of countries established bases, planted their flags at the pole, and in some cases made claims of land on behalf of their countries. Starting in the 1940's, geopolitical interest and contention rose sharply. By the early 1960's, scientifically sophisticated bases were established, and overland expeditions mounted, by many countries. Intentions were diverse, but most countries maintained a public posture of scientific objectivity. Accomodation among countries, however, became desirable.

INTERNATIONAL POLICIES AND PROGRAMS

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

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

Argentina and Chile are signatories of the 1961 Antarctica Treaty and are among the seven countries making claims on Antarctic territories. In October 1985, Uruguay achieved Consultative Party status within the treaty. Cuba and Peru are acceding (nonvoting) members. Argentina and Chile maintain research stations on Antarctica. Of all the claimant nations, Argentina has had the longest presence in Antarctica, dating back to 1904. Argentina and Chile have signed the agreement called the Convention on the Regulation of Antarctic Mineral Resources Activities (CRAMRA) negotiated by the Antarctica Treaty nations during the period 1982-88.

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

The Madrid Antarctica Treaty Conference in Spain, in June 1991, saw near unanimity on the part of the consultative and nonclaimant nations as to a 50-year protected future for Antarctica. The United States acceded to a compromise stating, in effect, that any of the parties wishing to mine after 50 years may do so only if it is agreed to by three-quarters of the 26 consultative nations.

These matters having been settled, attention of most of the consultative and acceding nations turned to environmental problems and issues during 1992. Procedures for environmental monitoring were discussed at a meeting in Buenos Aires, and the activities most likely to have environmental consequences were considered to be:

(1) Station and airstrip construction and operations
(2) Wastewater and sewage disposal
(3) Incineration of waste
(4) Power and heat generation
(5) Human activities affecting native fauna and flora
(6) Scientific research activities

(7) Accidents causing fuel spills or other types of environmental contamination

Recommendations were taken up on the establishment of environmental monitoring techniques and programs to be considered in detail in future meetings.

MINERAL POTENTIAL

What is known of the geology of Antarctica, together with additional evidence from a great many mineral prospects in the small proportion of rocks actually exposed, suggests that a significant potential for mineral deposits occurs in various parts of the continent. Geologic work pointing to this conclusion has been published by geologists from Argentina, Australia, Canada, China, Germany, New Zealand, Norway, the Republic of South Africa, the United Kingdom, the United States, and the former U.S.S.R. Known metalliferous fold belts in Africa, Australia, and South America appear to have continuations in Antarctica, based on general concepts of plate tectonics. Although much evidence is circumstantial, a reasonable scientific basis exists for projecting high-probability areas of ore-grade mineralization in Antarctica.

Some copper-bearing plutons on the Antarctic peninsula have distinct similarities to the Andean porphyry copper bodies. The Dufek Massif, a major intrusion near the African end of the Transantarctic Mountains, bears a distinct resemblance to, and is potentially larger than, the Bushveld Complex in the Republic of South Africa. Although the geology of the two complexes is comparable, they are quite different in geologic age.

Based on geologic structure and geophysical evidence, there is a clear possibility that petroleum reserves are likely to be present, particularly offshore in the thick sedimentary basins of the Amery Ice Shelf, Filchner Ice Shelf, Ronne Ice Shelf, Ross Sea and Ice Shelf, and the Weddell Sea. Shows of petroleum and natural gas were encountered during Deep Sea Drilling Project Leg 28 in 1973, while drilling on the continental shelf in the Ross Sea area. The discovery of hydrocarbons along the Atlantic coasts of Africa and South America, the east coast of India, and the south coast of Australia underscores the possibility of similar accumulations along the coasts of Antarctica that were once in proximity to these petroliferous margins of other continents.

INFRASTRUCTURE

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

OUTLOOK

The CRAMRA Treaty was adopted in Wellington, New Zealand, on June 2, 1988. It sought, among other things, to regulate a controlled, rational approach to future mineral exploration activities in the Antarctic. Three years later, however, the Madrid conference ultimately agreed to a 50-year moratorium on mineral exploration and mining of any kind, thus defining the outlook for the foreseeable future. Antarctica's remoteness, its harsh climate, the ice coverage of 98% of its surface, the lack of suitable mining-related technology, the abundance of minerals elsewhere, and the opposition of environmentalists and conservationists would provide additional reasons for hesitation in attempting exploration with the intent of mineral extraction.

OTHER SOURCES OF INFORMATION

Agencies

National Science Foundation
1800 G Street, NW
Washington, DC 20550
Telephone: 202-357-5000

United States Geological Survey
12201 Sunrise Valley Drive
Reston, VA 22092
Telephone: 703-648-6600

Publications

American Geophysical Union, Washington, DC: Mineral Resources Potential of Antarctica, 1990, 310 pp.

Kimbell, C., T. Lyday, and H. Newman. Mineral Industries of Australia, Canada, and Oceania. Bureau of Mines Mineral Perspective, 1985, 69 pp.

U.S. Department of State, Washington, DC: Incoming Telegrams.

Hodgson, Bryan. Antarctica: A Land of Isolation No More, National Geographic Magazine, Apr. 1990, pp. 2-51.

Oxford Science Publications (Clarendon Press), Oxford, England: Minerals and Mining in Antarctica, 1985, 123 pp.

U.S. Geological Survey, Reston, VA: The Antarctic and its Geology, 1978, 15 pp.

ARGENTINA

AREA 2.8 million km² **POPULATION 32.9 million**

THE MINERAL INDUSTRY 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 1992 GDP of about $153 billion.[1] In 1992, 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 7,750 MW of electric power to Argentina in 1992, or 14% of the total of 53,600 MW. The real GDP grew by about 6.5%, thus making 1992 the second year in a row of economic recovery. The Argentine economy has been stable since early 1991.

The enactment of the Economic Emergency Act (EEA), Law No. 23697, and the new State of Reform Act (SRA), Law No. 23696 of August 1989, declared Argentina to be in a state of emergency and attempted to deregulate and liberalize the economy by setting guidelines for the privatization process and the development of the capital market. As a result, Argentina's international capital market has experienced a soaring trading volume since August 1991. Even Argentine Bonds have climbed in price, encouraging foreign investment. The economic reform effort hit its stride with the Congress' enactment in March 1991 of the Convertibility Law. This fixed the exchange rate with respect to the U.S. dollar and provided for the full backing of the monetary base with foreign reserves. The fixing of the exchange rate, forceful political leadership, and the successful effort to eliminate the fiscal deficit have all helped lower inflationary expectations. Monthly inflation has fallen from levels as high as 197% in July 1989 to a monthly average of 1.4% over the 12 months ending October 1992. Over the 18 months before yearend 1992, Argentina had enjoyed a period of economic stability, which in turn generated a dramatic spurt of growth from the low level of production in 1989-90. The spurt of growth was quite dramatic, reaching an annualized level of more than 10% in the first quarter of 1992. Argentina's economic recovery has become a model for Latin America economic reform.

The Government, through the Ministry of Economy, continued with its policies of extensive public-sector reform, rapid privatization of state enterprises, and reliance on market forces. Economic stability resulted from the Government balancing its budget and maintaining confidence in the domestic currency. With its "Deregulation Decree" enacted on October 31, 1991, Argentina started unraveling innumerable regulations that favored select interest groups, distorted relative prices, and allowed corruption.

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 1992, excluding hydrocarbons, declined to an estimated $50 million, 36% lower than those in 1991. Metallic mineral exports represented 60.5% and industrial minerals 39.5% of the total nonfuel mineral sector's exports figure. The privatization of several state-owned companies, which had begun in 1989, was continued in 1992. Privatization plans for the state-owned entities included the petroleum company Yacimientos Petrolíferos Fiscales (YPF), with the first stage of its privatization scheduled for the first quarter of 1993. The Government plans to retain 20% of the company for itself while 28% of the shares will be offered to foreign investors. Gas del Estado, already has been sold to private investors. (It was split into two transportation companies and eight distribution companies). Hierro Patagónico de Sierra Grande S.A. Minera (HIPASAM), was shut down in 1991, and Sociedad Mixta Siderúrgica Argentina (SOMISA) was sold to Aceros Paraná, S.A. in June 1992. Yacimientos Carboníferos Fiscales (YCF) temporarily shut down for technical problems. Dirección General de Fabricaciones Militares (DGFM) and the Altos Hornos Zapla smelter were sold to Aceros Zapla S.A.

GOVERNMENT POLICIES AND PROGRAMS

The Ministry of Economy and Public Works and Services announced, on November 26, 1991, the creation of the Secretary of Hydrocarbons and Mines. This new position would combine functions formerly separated. The Secretary of Mines is an administrative unit within the Ministry of Economy and Public Works and Services. The objective of the Secretary of Mines is to draft, implement, and control national mining policies. An essential part of its functions is to foster mining investments and promote and participate in cooperation and integration agreements, both domestic and international. Part of its activities is to participate in geological mapping and basic mining prospection and to promote geological-mining,

economic, financial, statistic, and market survey activities to plan and coordinate a rational use of the country's mineral resources. Other objectives of the Secretary of Mines refers to labor safety and health in mining and the protection of the environment. The Secretary of Mining controls the Subsecretary of Mining, the National Directory of Mining, and the National Directory of Geological Services. The new legal framework of Argentina's mining policy aims to make the mining activity predictable by means of a clear and transparent rule based on a new Mining Investment Law, Mining Reorganization Law, and the Federal Mining Agreement (El Acuerdo Federal Minero) signed by the national mining officials and the Provinces.

The mining legislation of Argentina is based on the old Mining Code, passed as law No. 1919 by the National Congress on November 25, 1886. The Mining Code could be considered as a progressive mining law, which currently adapts itself to the trends of the world mining environment. It is based on a liberal philosophy, which recognizes that private activity is the fundamental driving force. When a physical or legal person is the owner of a mine, to keep the property the owner must pay an annual mining fee and show that investment was made on the property during the past year. The only way to lose the property is by ceasing to pay the mining fee. There are no records of state confiscations. The law adhered to the same private investment philosophy that opened industrial development to participation from small, medium, and large mining enterprises. 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. Considering Argentina's economic situation, it is recognized that a good source of risk capital required to activate mineral and metals production is from foreign companies.

Argentina is a member of the Latin American Integration Association (ALADI) and the Southern Region Common Market Treaty (MERCOSUR). Senior mining officials from Argentina and Chile signed an agreement to integrate the mining industries of the two countries. The two page document "The Program for Chilean-Argentine Mining Integration" was signed by the Chilean Undersecretary of Mining and the Argentine Secretary of Hydrocarbons and Mining. The first part of the agreement calls for "a continuous exchange of geological information" between the respective Government mining agencies. The second part of the agreement calls for changes to the mining legislation of both countries to facilitate non-discriminatory-treatment toward investors. A third part of the agreement seeks to expedite transit between the two countries of "persons, goods and services dedicated to mineral exploration and exploitation." As an outcome of Argentine and Chilean border dispute in the 1970's, both prohibit investments within 50 km of the border separating the two countries.

Several Provincial governments were very active in promoting joint-venture explorations in 1992. The governments of Catamarca, Mendoza, Neuquén, and San Juan Provinces reorganized into more flexible organizations that were at liberty to form joint ventures. Broken Hill Pty. Co. Ltd. (BHP), Anglo-American Corp., Río Tinto Zinc Corp. Ltd. (RTZ), International Musto Exploration Ltd. (Musto), American Resources Corp., and other foreign companies were carrying out exploration programs throughout the country. (There is more detail on the Musto operation under copper in the commodity section.)

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, and zinc; industrial minerals such as asfaltite, barite, bentonite, clays, celestite, feldspar, fluorite, granite, gypsum, kaolin, marble, sodium carbonate, and vermiculite; and mineral fuels such as coal, coke, crude oil, and natural gas.

Production of precious metals was limited; gold output in 1992 reached 1,300 kg, which was a decrease of 25% over that of the previous year. Smelter and refinery production of most metals, including ferroalloys, generally remained at about the same level as that of 1991. Argentina's major nonferrous metals industries—aluminum, zinc, and copper—like the steel industry, were hard hit by import-export red tape. Argentina's only primary aluminum producer, Aluminios Argentinos, S.A.I.C. (ALUAR), would not financially benefit from the deregulation measures. 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 decreased slightly in 1992 to about 2.9 Mmt while domestic consumption increased to 2.1 Mmt from 1.9 Mmt in 1991. The biggest producers of steel in Argentina were SOMISA and Industria Argentina de Aceros S.A. (ACINDAR). Production of crude oil and refinery products maintained the same level in 1992 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 1991. The export value of crude oil and refinery products increased 38.3% to $848 million in 1992. 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 1992, 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%; Germany, 3.3%; Singapore, 2.2%; Italy, 2.2%; Mexico, 1.9%; Indonesia, 1.9%; China, 1.5%; India, 1.4%; and Bolivia, 1.1%.

According to Government import figures, the value of imports of minerals and basic manufactured products derived from mineral substances amounted to about $989 million. Imports of natural gas from Bolivia increased 1.4% to 2.7 Mm^3 having an estimated value of $230 million. Imports of metallurgical coal from the United States and other countries decreased 3.6% to an estimated 0.6 Mmt. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

As aforementioned, the Secretary 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 Secretary 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 preserves the single bank of mining and geological data. 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. Specific tasks are executed through the different subordinate boards, as follows: (1) Mining Investment Board: Promoting investment in mining, controlling and following up projects, and evaluating legal regulations, as well as proposing alternatives to enhance the sector analyzing the information on mining activities to edit and publish "Mining Statistics of Argentina," performing market surveys of mineral substances, and drawing up the "Mining Producers' Register." (2) Mining Evaluation Board: Evaluates mining projects and draws up economic mining profiles of field and mining projects. Advises national, provincial, and international organizations on the supply, demand, and marketing of products in the mining sector. (3). Mining Development Board: Proposes engineering, benefit, and mineral treatment projects, and promotes the incorporation of new technologies. Evaluates and determines the cost of mining operations on different scales. Proposes health safety rules and measures for the preservation of the environment in mining activity.

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 and contribute toward the protection of life and the assets of its inhabitants vis-a-vis the risks generated by geodynamic processes. 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. Atucha II, still under construction, also will utilize the same source of uranium (U_3O_8) fuel for its power reactor when completed.

Between 1989 and 1992, Argentina privatized the majority of the public enterprises controlled by the national Government. The process is expected to be completed in 1993 with the partial privatization of the postal service, large hydroelectric and nuclear powerplants, ports and airports, the remaining railroad lines, and toll concessions on the auto access routes to Buenos Aires. 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 begin 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, 1990-92, 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: (1) local companies, $4.61 billion or 27.9%; (2) foreign companies $6.82 billion or 41.2%; and (3) the national Government, $5.10 billion or 30.9%. Total assets were valued $16.53 billion.

The mineral industry in the private sector was composed of several mining and manufacturing companies, such as ALUAR, Cementos Loma Negra CIASA, 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 3.0 million, or 28%, was organized in labor unions. Approximately 8.6% of the labor force was unemployed in 1991. Of the total labor force employed in industry, 7,000 were in the cement industry, 36,000 in the metallurgical plants, 24,000 in the mining sector, and 21,000 in the oil and gas industry. *(See table 2.)*

COMMODITY REVIEW

Metals

Aluminum.—Primary aluminum in Argentina was produced by Aluminios Argentinos ALUAR. ALUAR's refinery in Puerto Madryn, Chubut Province, has an installed production capacity of 170,000 mt/a of primary aluminum. No decision has been reached on the construction of a second aluminum smelter in the south of Argentina by a consortium of Japanese and European companies. ALUAR has been discussing a possible joint venture with Pittsburgh-based Aluminum Co. of America (Alcoa) about trade between Argentina and Brazil. The joint venture was being discussed in connection with the Mercosur free trade agreement between Argentina, Brazil, Paraguay, and Uruguay aimed at eliminating customs duties among the four countries in 1995-96. According to ALUAR officials, even if the Mercosur agreement does not go into effect by that date, the joint venture may still go forward by or before then. The joint-venture talks between ALUAR and Alcoa, which holds an interest in the 345,000-mt/a Alumar aluminum smelter through its Brazilian subsidiary Alcoa do Brazil, are based in part on the idea that some Brazilian industries may find Argentinean aluminum cheaper to purchase than some Brazilian metal and vice versa. Most Brazilian output occurs in the north of the country and, as such, there are long distances and high transportation costs involved in moving primary metal from smelters like Alumar at Sao Luis, Maranhao State, to downstream processing facilities, most of which are in southern Brazil. Thus reduced tariffs between Argentina and Brazil through the implementation of the Mercosur agreement, coupled with shorter transportation routes and cheaper transportation costs, could make aluminum trade between the two countries more economically feasible.

Copper.—The Bajo de la Alumera deposit, discovered in 1949, was the focus of exploration by Yacimientos Mineros de Agua de Dionisio (YMAD.) YMAD is a quasi Government-owned mining company and the 100% owner of the mining concession for the Bajo de la Alumbrera deposit. The deposit's potential for development as a large-scale copper-gold operation has been demonstrated by four prefeasibility studies. Despite favorable recommendations, the limited financial resources of Argentina and rather onerous preconditions imposed by the Government (including the required installation of a copper smelter, refinery, iron pelletization plant, and a molybdenum circuit), and the resulting rather large capital cost at a time when Argentina's nationalistic policies discouraged foreign investment, ensured that the project did not proceed.

With the elimination of all pre-conditions, the election of the democratic Government in 1989, and the resulting sweeping reforms, the economic viability of Bajo La Alumbrera was enhanced greatly. During late 1990, International Musto Exploration Ltd. of Canada, through contacts in Argentina, became aware of the property, its potential, and the Government's call for tender from the international mining community to develop the ore body. Musto successfully bid and was awarded the right by 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 Minería Técnica Consultores Asociados of Tucson, Arizona, in 1992 are 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, considering a standard open pit method, 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. The study is to address all aspects of the project, including its costs and its economic viability to assist in project financing. The study will include mining, processing, metallurgy, infrastructure, tailings disposal, and environmental studies, as well as an economic analysis. Preliminary production rates have been examined in all previous prefeasibility studies and are currently being reviewed by Wright Engineers in the final feasibility study. Data to date suggest a 50,000- to 60,000-mt/d operation with a life of mine stripping ratio of 1:1 at the mentioned grades. Recovery rates of 90% for copper and 70% for gold would produce an excellent quality, clean copper concentrate containing 9,331 kg of gold and 95,254 tons of copper annually at a cash cost (net of gold credits but including smelting and refining charges and all transportation charges) of $0.41/lb. Capital costs could be $500 million, with first production as early as 1996.

Gold and Silver.—The rising trend in gold output was reversed in 1992. Gold and silver were produced mainly from the

Farallón Negro Mine in Catamarca Province and the Angela Mine in Chubut Province. The Farallón Negro, the Alto de la Blenda Mines, and other properties in the mining district are owned by YMAD. The district, in addition to these two mines, included the large Bajo La Alumbrera copper-gold-silver-molybdenum deposit. YMAD also continued mining gold on a pilot basis using the heap-leaching process from ores produced at the Bajo La Alumbrera deposit, which recently was awarded to Musto for development. Musto has issued for sale 2,594,111 common shares at a price of $2.25 to raise about $5.8 million. The net proceeds of the offering will be used to repay bank debt and fund completion of a feasibility study on the company's Bajo La Alumbrera copper-gold porphyry deposit in northwestern Argentina.

The Alto de la Blenda deposit has similar characteristics to Farallón Negro, and 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 additional years owing to the successful results found mainly in the lower level of the Alto de la Blenda deposit.

There were several gold projects at the discussion stage in Argentina. Several major international minerals firms were reportedly looking at gold properties in Argentina, including Homestake (United States), BHP (Australia), and RTZ (United Kingdom). The government of the Province of Santa Cruz recently opened for bids the Cerro Vanguardia gold deposit where vein-type gold was identified. Bidders included Anglo-American of the Republic of South Africa, which owns the Mantos Blancos gold mine in Chile, and others. The bids are still being considered.

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 studies will emphasize the reevaluation of existing geological data and the gathering and interpretation of additional data. 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, Stager 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 mile 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 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 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 12 months, 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 now have to be reassessed following a period of inactivity since 1988. The third prospect, Cerro Atajo, contains both 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.

The Inter-American Investment Corp. (IIC), a subsidiary of the Inter-American Development Bank, provides medium- and long-term loans or guaranties to, and/or makes equity and quasi-equity investments in, private enterprises in the member countries in Latin America and the Caribbean that have difficulty raising financing from other sources on reasonable terms. An example of projects for which the IIC has approved direct financing in Argentina is the IIC Board approval of a $2 million loan for the financial restructuring of Cerro Castillo, S.A., a mining company in Argentina's Patagonia Region. Subsequently, based on IIC's reappraisal after completion of the phase 1 restructuring project, the corporation would provide an additional $6 million for the phase 2 modernization and expansion program. The Cerro Castillo is a medium-sized mining company producing concentrates containing gold and zinc, with a lower production of copper, lead, and silver. The Cerro Castillo project is sponsored by Industrias Petroquímicas Argentinas S.A., which is active in the Argentine petrochemical sector. The total cost of the project

through phase 2 is estimated at $59.7 million. The project is expected to generate significant foreign exchange revenues; Cerro Castillo currently sells all of its production to a European smelter. Projected foreign exchange earnings are estimated at $155 million over a 10-year period. Another new IIC loan of $3 million was 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 Argentina's Provinces of Mendoza and Neuquén, which will be discussed in more detail under potassium (Industrial Minerals section).

Iron and Steel.—Production of iron ore in Argentina decreased by an estimated 74% to 259,000 tons in 1991 and 4,000 tons in 1992 compared with that of 1990. The iron ore output comes from two sources, Altos Hornos Zapla in Jujuy Province and Hierro Patagónico de Sierra Grande (HIPASAM) in Río Negro Province. In 1991, HIPASAM was shut down, and Argentina imported 2.3 Mmt of iron ore from Brazil (44%), Chile, and Peru.

Crude steel production in Argentina continued its decreasing trend to 2.9 Mmt from about 3.0 Mmt the previous year, while domestic consumption decreased to 2.0 Mmt from 2.2 Mmt in 1989. The total amount imported reached 570,000 tons. In 1991, the steel industry had to import about 2.3 Mmt of iron ore and concentrate for a total value of $100 million, mainly from Brazil. In early February, the administrator of Argentine's integrated steelmaker SOMISA, appointed a new board of directors to prepare the company for its privatization, which was expected to take place in June. The new board members have brought back on-stream the company's No. 1 blast furnace, taken out of production by the previous administration. Also, the new board shortly was to decide whether 40% or up to 100% of the steelmaker's share is to be available to a single buyer during the forthcoming privatization. SOMISA produced 1.4 Mmt of raw steel in 1992, well below its capacity of 2.5 Mmt/a, due to problems, including a dispute with trade unions over preprivatization issues. Argentina finally sold 79.9% of the state-owned SOMISA to a consortium of Aceros Paraná, S.A., a group of Brazilian, Chilean, and local investors, for $152.1 million. The new owners will pay the $140 million base price in cash and the remaining $12.1 million in Argentine debt paper. According to officials from the Government, the companies, Usiminas and Vale do Río Doce of Brazil, Compañía de Aceros del Pacífico of Chile and Techint of Argentina, agreed to assume $250 million in debt SOMISA owed to local and overseas banks and $12.6 million in overdue employee wages. It was not clear what the state will do with the remaining shares of SOMISA.

Aceros Zapla S.A., formerly known as Establecimientos Altos Hornos Zapla, was sold for $3.3 million in cash and $29.7 million in debt to a consortium of French stainless and alloy steel producer Aubert and Duval, Argentine engineering and construction group Pensa, and Citicorp. This consortium was the only bidder. Aceros Zapla announced a $50 million investment plan to bring blast furnaces back online, improve melting shop, and adapt the plant for increasing special steel output. The work force was to be cut from 2,700 to 882.

The possible sale of the Argentine minimill by Aceros Bragado S.A., was being studied following the company's filing for bankruptcy in June, according to industry sources in Buenos Aires. The company was reported to have debts of $100 million and to have encountered financial difficulties following changes of ownership. Aceros Bragado's owners for many years, has sold 80% of its shareholding, retaining 20%. Aceros Bragado, 200 km from Buenos Aires, is continuing to produce bars and wire rod at a low capacity level due to difficulties in obtaining funds for its raw material purchases. It was being operated by a manager appointed by an Argentine court. Plant capacity is 210,000 mt/a of raw steel and 120,000 mt/a of rolled products. Aceros Bragado's sister company, the La Cantabrica rolling mill, was reported to be shut down.

Uranium.—Preliminary figures released by the Secretaría de Hidrocarburos y Minería indicate that the production of yellow cake (U_3O_8) in 1992 increased 5.7% to 140 Mmt compared with that of the previous year. The National Commission for Atomic Energy (CNEA) sources announced on December 29, 1991, that Argentina will commission a plant at yearend 1992 to produce the heavy water that is used in its nuclear plants. Argentina would then stop importing heavy water from other countries, particularly from Canada, its main supplier. Ninety-eight percent of the work on this plant, the first of its kind in Latin America, has been completed; it is in Arroyito, Neuquén Province, 1,000 km south of Buenos Aires. The production of heavy water would be sufficient to supply the Atucha I plant, the Embalse plant, and Atucha II plant, currently under construction, which will be finished in 1995. It was expected that production would be sufficient to supply a fourth nuclear plant that Argentina plans to build at the end of the century and that heavy water also would be exported to other countries in the medium term.

The Government announced on October 27 that there were plans to privatize the country's nuclear plants in 1993; private capital was needed to complete the construction of the Atucha II nuclear plant. Such a decision would have to be approved by Congress.

CNEA would become the head of a group of private energy companies for nuclear development and fuel fabrication with major participation of private capital. Four companies will be created: (1) nuclear plant management; (2) radioisotopes fabrication; (3) heavy water production, uranium extraction, and conversion into fuel; and (4) technology services and nuclear development. All these companies were a part of CNEA's structure. The change will be implemented by a decree signed by the president. The project has aroused interest from Germany, Great Britain, and the United States.

Argentina is one of the developing countries that is very advanced in nuclear technology. Argentina fully dominates the nuclear energy cycle. It has signed guarantees with Brazil, the other Latin American country that is also advanced in the development of this sector. Argentina has promised not to transfer "sensitive technology" to third countries. Argentina and Brazil have announced that they will ratify their adherence to the nuclear nonproliferation Tlatelolco Treaty once they receive guarantees that they will have the protection of industrial secrecy.

Industrial Minerals

Boron.—Argentina ranked third in the world as a boron producer after Turkey, Russia, and United States. Production of boron minerals reversed the downward trend. In terms of foreign exchange generated, this community sector ranked first among all the industrial minerals produced in the country. Of the total minerals and derivatives exported in 1992, borates accounted for 21.3%; boron minerals, 1.5%; boric acid, 7.8%; and sodium borate, 12.0%. The largest boron mineral producer in the country was Cía. Boroquímica SAMICAF, owned by RTZ Corp. and Industrias Químicas Boradero S.A., both in the Province of Salta.

Cement.—The Argentine production of cement continued its downward trend, which began in 1987 and reached 3.5 Mmt/a in 1991 and an estimated 4.9 Mmt/a in 1992. For the year, the cement industry operated at 30% of its installed capacity. According to the Portland Cement Manufacturer's Association, the average consumption of cement per inhabitant declined from 198 tons in 1987 to about 100 tons in 1992. 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, maintained 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 C.I.A.S.A., with six plants, had a total installed capacity share of 43.3% (5.2 Mmt) from six cement plants and one grinding operation.

The Argentine cement industry appears to have great potential. Domestic consumption is at a true historical low, and there are great opportunities for increased cement consumption throughout the economy. A number of plants are highly efficient, especially those in the more important markets, and there is great capacity on-line for future increased civil construction and exports. Any hopes of recovery for the Argentine cement industry hinge on Government policies to stabilize investment opportunities and provide the framework in which construction investment is once again attractive.

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 was planning to spend $5.0 million in exploration and up to $60.0 million in investments, if the project were developed. FMC also has been involved in discussions in Bolivia and Chile where similar salt flats exist; however, only one of these projects was considered likely to emerge. On March 5, the Governor of Salta advised the U.S. Ambassador that the Province of Salta had a longstanding boundary claim against the Province of Catamarca that would include the lithium deposits recently won as a concession by FMC. The Governor of Salta fully supported FMC's development of these lithium deposits, but wanted to advise the U.S. Representative that the boundary dispute would become public and controversial. The situation was that those territories stood divided without any legally established boundaries. The Province of Salta possessed a large portion of the Hombre Muerto Salt Flats, where it maintained police detachments, provincial road commission outposts, a provincial civil registry office, a school, and a health station. Furthermore, the only access by road to the area was through the Province of Salta.

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. Potassium, commonly referred to as potash, is considered to be 1 of 36 metals and minerals fundamental to industrial development and is 1 of the 3 primary agriculture nutrients along with nitrogen and phosphorus. Exploratory drilling and tests suggested that the Río Colorado deposit could be one of the best potash deposits in the world, with sufficient reserves for significant future expansions. The IIC Board of Directors IDB approved a new loan of $3 million for 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 Argentina's provinces of Mendoza and Neuquén. The IIC had approved a loan of $6 million for phase 1 of the project on October 29, 1990. The IIC'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 built 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 IIC 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 65.0 Mmt of standard coal equivalent. Of the total energy produced, solid fuels accounted for only 0.7%, liquid fuel, oils, 54.2%; natural gas, 41.2%; and hydropower, 3.9%.

Energy consumption data were not available for the years subsequent to 1991, when the total consumption was 61.9 Mmt of standard coal equivalent. Solid fuels provided 2.6%, liquid fuels, 45.2%; natural gas, 48.0%; and hydropower, 4.2%.

Of the total installed electrical generating capacity of 16,600 MW in 1989, 54.1% was thermal, 39.7% was hydroelectric, and 6.1% was nuclear. In that year, the latest for which complete data were available, a total of 50,910 kW•h was produced, 59.3% by thermal plants, 29.8% by hydroelectric plants, and 10.9% by nuclear plants. In 1989, total electric power output declined 4.1%, but its distribution by source was not available, and 1990's power output was not reported. Argentina's total hydropower potential, according to OLADE, is estimated at 44,500 MW.

Coal.—Production of bituminous coal decreased about 28% to 212,000 tons compared with that of 1991 in continuation of a notable decreasing trend. YCF, the state-owned coal company, produced coal from the Río Turbio Mine in Santa Cruz Province. Production declined owing to lack of sufficient financial resources and a small contribution from the National Energy Fund, setting back production and investment in the industry. In addition to this situation, the Río Turbio coal mines developed some operating problems that reduced production. One of the biggest problems was the high level of methane gas encountered in the coal mines as a result of a poor ventilation system. Other problems concerned the slow process in clearing the contaminated areas and delays in the provision of needed operating supplies and transportation equipment. The new economic stabilization program did not help because it reduced the existing tariff rates by a factor of four. Devaluation continued through the second half of the year. In 1991, YCF officials decided to decrease production in accord with SOMISA's instructions.

Natural Gas.—Natural gas production in 1991 by YPF was maintained at the same level of recent past years. During 1992, it became evident that Argentina's proved reserves of natural gas were about 579.05 billion 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 state oil company, YPF. About 81% 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 were paid directly by Gas del Estado, the state-owned gas distribution company. Argentine Government officials had stated that Argentina would not renew the contract to purchase natural gas from Bolivia when it expired on April 30, 1992. Instead, the Government expected to be well advanced in the deregulation and privatization of the natural gas sector and planned to leave commercial arrangements like Bolivian gas purchases to private operators. However, by yearend, it appeared that Argentina would agree to a new contract because restructuring of the gas sector in Argentina, including the privatization of Gas del Estado, was not completed. The new agreement extended the current natural gas contract until December 31, 1993, although Argentina would be paying a price per cubic foot of about one-third of what it had been paying. To help compensate Bolivia for the lost revenues, Argentina agreed to what is called "gift" payments, totaling $110 million over the 20-month contract term. The Government of Bolivia must use these funds to buy Argentine products or to complete infrastructure projects in Bolivia near the Argentine border. The Government's position was that there would be no need to extend the agreement with Bolivia when it expires in 1993. By that time, privatization of the Argentine natural gas sector was expected to be completed.

One of the major events of 1992 was the privatization of Gas del Estado into eight local private gas distribution companies to serve the whole country.

Petroleum.—Crude oil production was maintained at about the same level as that in 1991. *(See table 1.)*

More than 1 year has passed since the Government had launched its revolutionary hydrocarbons deregulation plan. The result of the plan was 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 last fall 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. Argentina is a vast underexplored country with an area of 2.8 Mkm^2. With taxes reduced, royalty pegged at a maximum 12%, and equity participation from the state eliminated, the Secretary of Hydrocarbons and Mines was expecting to award most of the 145 exploration concession blocks by yearend 1992. In preparation for Plan Argentina, the Government contracted private consultant firms of Buenos Aires to fully review the exploration potential of the open blocks covering 15 onshore and offshore sedimentary basins. More than 145 open onshore and offshore blocks in 15 basins are available in Plan Argentina.

The Governments of Argentina and Great Britain decided for the first time since the reestablishment of diplomatic relations to form a joint commission to determine whether or not oil deposits exist in the Malvinas Islands zone. According to official statements, a commission from both countries will carry out a study of mineral reserves around the Malvinas Islands, with an eye to possible joint oil exploitation and drilling ventures in the region.

The legal framework in the petroleum sector is provided by Hydrocarbons Law 17,319, which devises a licensing scheme not very different in nature from that of other jurisdictions. The licensee has ownership over hydrocarbons produced, and the Government share is obtained by means of royalties (12%) and taxes. Exploration permits are granted through a competitive bidding system, where investment commitments are required, and if not carried out, give rise to an obligation of payment. The periods for exploration fluctuate between a minimum of 9 years up to a maximum of 14 years (on shore) and 17 years (offshore). These permits are automatically converted into exploitation concessions, if a commercial discovery is declared by the licensee, for a period of 25 to 35 years to which the unused portion of the exploratory period may be added. The 145 blocks included in the Plan Argentina, 41 of which are offshore, were to be offered every 2 months, and companies will have the opportunity to propose area delimitations. Newly enacted Decree No. 2778/90 established that the state was no longer a state-owned company ruled by public law, but a corporation ruled by private law (Companies Law 19,550). This meant that there was no difference between the state and any other private company in its operating structure. The state became authorized to sell all or part of its shares on the stock exchange by any mechanism available to private companies without any further limitation. In the same way, the state became free to contract loans with national or foreign banks.

The Argentine Government has enacted Decree No. 1930/91, ordering an International Call for Bids to select companies that will enter into contracts in association with the state in the exploration and exploitation of the AUSTRAL Basin. For the purpose of the call for bids, the AUSTRAL Basin was divided into the three following blocks: Santa Cruz I, Santa Cruz II, and Tierra del Fuego. The decree has established (1) the stages of the International Call for Bids, and (2) the general guidelines to be followed by the Bidders Conditions.

INFRASTRUCTURE

The Argentine road network consisted of about 208,350 km, of which 47,550 was paved, 39,500 was gravel, 101,000 was improved earth, and 20,300 was unimproved earth. Roads were one of the principal transport methods used to move mine production to processing plants in Buenos Aires and other shipping centers. Argentina had 11,000 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 covered approximately 34,172 km. It transported about 19 Mmt of freight and 300 million passengers per year. Of the total rail network, 164 km was electrified. The network was owned and operated by the state enterprise Ferrocarriles Argentinos.

OUTLOOK

Argentina's energy resources are abundant and diverse. They include crude oil, natural gas, 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. New investments in the mining sector are expected to be stimulated by the Mining Investment Law expected to the issued in early 1993, announced on October 1. The new law is the result of the Government's first call for bids on the Secretary of Hydrocarbons and Mines, the "central areas" that contain the richest petroleum reserves. The Government achieved much less than it hoped for in its auction of three areas in one of Argentina's richest Basins Areas of petroleum reserves. The Government had hoped that bidders would offer as much as $600 million for rights to 70% of the production in three areas (all onshore) in the Austral Basin in southern Argentina. However, only one bid, of $55 million, exceeded the base price set by MR, and

that was for the Santa Cruz I area, which had by far the lowest base price. For the two other areas, the bids, which varied widely, were not close to the MR minimum. The Government canceled the offer for those areas together with other similar-size areas in the northeast Basin, until the first quarter of 1992.

During 1992, the investment climate in Argentina continued to improve with the implementation of a comprehensive economic plan directed at privatizing state-owned companies, lowering import tariffs, removing import bans on most products, a new foreign investment law granting national treatment to foreign investors, and allowing the private sector the opportunity to enter previously closed areas. The launching of the Argentine Plan is expected to generate investments in exploration. Exploitation activities will improve and require additional investment following adjudication of the central and secondary oilfields. As a result of these changes, an increased number of U.S. companies have indicated interest in investing in Argentina.

---

[1]Where necessary, values have been converted from Argentine pesos to U.S. dollars at the rate of 1,00 peso = US$1.00, the average exchange rate in 1992. The austral was replaced by the peso at the rate of 10,000 to 1.00.

OTHER SOURCES OF INFORMATION

Agencies

Ministerio de Economía y Obras y Servicios Públicos
Hipólito Yrigoyen 250, (1310)
Buenos Aires, Argentina
Fax: (541) 331-7426

Secretaría de Minería
Ministerio de Economía y Obras y Servicios Públicos
Julio A. Roca 651-2do (1322)
Buenos Aires, Argentina
Fax: (541) 331-4230

Consejo Federal de Inversiones
San Martín 871-1004
Buenos Aires, Argentina

Dirección de Recursos Geológicos y Mineros
Torre Gubernamental II
53 Esq. 12, Piso 15to
1900-La Plata, Argentina

Dirección Provincial de Minería
8340-Zapala-Neuquén, Argentina
Telephone: (0942) 21475, Fax: (0942) 21282

Dirección General de Minas y Geología
Julio Argentina Roca 582
9103-Rawson-Chubut Argentina
Telephone: (0965) 81-462, Fax: (0965) 82-603

Dirección de Minería e Hidrogeología
Garrone 156
8500-Vienma-Río Negro, Argentina

Dirección General de Minería
Mariano Moreno 123 y Fagnano
9400-Río Gallegos-Santa Cruz, Argentina
Telephone: 0966-20189

Dirección de Minas
Centro Cívico, 3er Piso
6300-Santa Rosa-La Pampa, Argentina
Telephone: (0954) 33010 Int. 335, Fax: 0954-31595

Dirección General de Industria y Minería
Pellegrini 3100
3000-Santa Fe, Argentina
Telephone: 042-40181

Dirección de Minería y Recursos Hídricos
Corrientes 480
3100-Paraná, Argentina
Telephone: (043) 214847

Secretaría de Minería
Belgrano 347-1er
5000-Córdova, Argentina
Telephone: (051) 30710 y 221349
Fax: (051) 245115

Dirección General de Minería y Geología
25 de Mayo 60
4200-Santiago del Estero, Argentina
Telephone: (085) 21-5022, Fax: (085) 22-4238

Secretaría de Minería
Esquiu 503-1er
4700-San Fernando del Valle de Catamarca, Argentina
Telephone: (0833) 25951 y 30962,
Fax: (0833) 24308

Secretaría de Industria, Comercio y Minería
Pelagio Luna 812-1er
5300-La Rioja, Argentina
Telephone: (0822) 28519/28197,
Fax: (0822) 28570

Dirección de Minas
24 de Septiembre 848
4000-San Miguel de Tucumán, Argentina

Dirección Provincial de Minería
La Madrid 438-1er Piso
4600-San Salvador de Jujuy, Argentina
Telephone: (0882) 26332/25204

Departamento de Minería
Paula de Sarmiento 134-Oeste
Edificio 9 de Julio-4to Piso
5400-San Juan, Argentina
Telephone: (064) 221984/226677

Dirección General de Minería
Boulogne Sur Mer 3051
5500-Mendoza, Argentina
Telephone: Fax: (061) 256-442

Dirección Provincial de Minería
Pedernera 1065
5100-San Luis, Argentina
Telephone: (0652) 25048,
Fax: (0652) 26991

Dirección General de Minas y Geología
San Lorenzo 480
3300-Posadas-Misiones, Argentina
Telephone: (0752) 37436

Dirección de Recursos Naturales
San Martín 1401
9410-Ushuaía-Tierra del Fuego, Argentina
Telephone Fax: 0901-22576

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.

TABLE 1

ARGENTINA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[e]
METALS						
Aluminum						
Primary		154,203	[e]162,000	165,608	[e]165,000	165,000
Secondary[e]		[3]7,100	5,300	6,000	6,000	6,000
Beryllium: Beryl concentrate:						
Gross weight		39	89	[r]34	[r e]34	34
BeO content		4	10	[r]3	[r e]3	3
Cadmium: Smelter		54	60	55	[e]49	37
Columbium: Columbite concentrate:						
Gross weight[e]	kilograms	88	[3]116	100	90	95
Cb_2O_5 content	do.	51	87	[e]75	[e]67	70
Copper:						
Mine output, Cu content		492	653	[r]357	[r]409	300
Refined		12,500	11,000	15,000	15,000	15,000
Gold: Mine output, Au content	kilograms	962	1,150	[r]1,199	[r]1,510	1,300
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand tons	1,037	1,017	992	[r]259	4
Fe content	do.	550	539	[r]681	[r]171	2
Metal:						
Pig iron	do.	1,596	2,062	1,883	1,366	[3]971
Sponge iron (direct reduction)	do.	1,067	1,166	1,034	954	[3]1,013
Total	do.	2,663	3,228	2,917	2,320	[3]1,984
Ferroalloys, electric furnace:						
Ferromanganese		19,737	[r]24,441	[r]24,344	[r]26,337	25,000
Ferrosilicomanganese		11,610	[r]21,160	[r]21,805	[r]14,564	18,000
Ferrosilicon		30,539	[r]35,667	[r]23,641	[r]14,437	19,000
Silicon metal[e]		10,000	10,000	10,000	10,000	10,000
Other		[r]5,952	[r]5,805	[r]6,310	[r]5,400	5,400
Total		[r]77,838	[r]97,073	[r]86,100	[r]70,738	77,400
Steel, crude	thousand tons	3,652	3,909	[r]3,636	[r]2,972	2,900
Semimanufactures[4]	do.	3,624	3,844	[r]3,451	[r]2,797	2,500
Lead:						
Mine output, Pb content		28,549	26,650	23,365	23,697	18,000
Metal:						
Smelter, primary		14,810	11,500	5,500	[e]11,000	[3]14,597
Refined:						
Primary		14,810	[r]13,650	[r e]10,000	[r e]10,000	[3]14,597
Secondary		[r]13,739	[e]13,000	[r]13,365	[r]13,697	15,000
Total		[r]28,549	[r]26,650	[r]23,365	[r]23,697	29,597
Manganese ore and concentrate:						
Gross weight		9,339	5,532	[e]3,500	[r]4,943	[3]3,842
Mn content		1,817	1,080	727	[r]965	750
Silver:						
Mine output, Ag content	kilograms	79,415	[r]83,126	[r]75,798	[r]69,920	46,000
Metal, smelter[e]	do.	108,000	106,000	112,000	109,000	107,000
Tin:						
Mine output, Sn content		446	405	[r]123	—	—

See footnotes at end of table.

TABLE 1—Continued

ARGENTINA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[e]
METALS—Continued						
Tin—Continued:						
Metal, smelter		323	311	e180	r240	140
Tungsten, mine output, W content		13	20	6	r8	8
Uranium, mine output, U_3O_8 content	kilograms	r21,000	r73,000	r13,000	r25,000	140,000
Zinc:						
Mine output, Zn content		36,849	43,155	38,664	39,253	41,000
Metal: Smelter:						
Primary		32,748	31,567	31,517	35,766	34,494
Secondary[e]		2,700	2,700	2,700	2,800	2,800
Total		35,448	34,267	34,217	38,566	37,294
INDUSTRIAL MINERALS						
Asbestos		2,328	225	r275	r270	1,093
Barite		48,972	57,558	r36,597	r61,094	44,170
Boron materials, crude		269,574	261,308	r123,492	r113,123	142,580
Cement, hydraulic	thousand tons	6,048	4,470	3,629	e3,500	4,905
Clays:						
Ball clay (plastic clay), n.e.s.	do.	844	307	r82	r80	100
Bentonite		173,930	r89,189	r123,254	r135,569	81,534
Foundry earth[e]		100,000	100,000	100,000	100,000	90,000
Fuller's earth (decolorizing clay)[e]		2,000	2,000	2,000	2,000	1,500
Kaolin		93,871	45,598	r72,421	r145,098	90,545
Laterite (aluminous)		65,651	67,200	r7,060	r23,881	31,902
Refractory		49,287	32,111	r32,761	r30,903	31,000
Other[5]	thousand tons	2,819	2,889	r2,170	r2,350	2,610
Diatomite		7,122	6,301	r6,789	r10,981	5,227
Feldspar		39,469	23,688	r15,091	r23,065	17,948
Fluorspar		18,052	23,317	r23,727	r28,925	23,157
Graphite		24	100	e100	e100	90
Gypsum, crude		520,153	402,399	r615,540	r78,188	566,943
Lithium: Spodumene, amblygonite, gross weight		r117	r84	r67	r305	126
Mica:						
Sheet		330	327	r243	r313	290
Waste and scrap		630	e500	r684	r533	450
Nitrogen: N content of ammonia		78,100	74,000	70,000	e75,000	72,000
Phosphates: Thomas slag[e 6]		55	50	55	50	50
Pigments, mineral, natural: Ocher		815	578	e600	e600	600
Pumice and related volcanic materials (perlite, pozzolan, and toba, etc.)		r157,600	r89,223	r118,101	r69,216	61,000
Salt:						
Rock	thousand tons	1	1	e1	e1	1
Solar	do.	1,246	1,185	r595	r678	937
Total	do.	1,247	1,186	r596	r679	938
Sand and gravel:						
Sand:						
Construction	do.	9,657	8,740	r10,171	r11,038	12,800
Silica sand (glass sand)	do.	294	344	r325	r374	307
Gravel	do.	4,657	3,700	r5,885	r6,432	7,500

See footnotes at end of table.

TABLE 1—Continued

ARGENTINA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[e]
INDUSTRIAL MINERALS—Continued						
Soda ash		150	350	e300	e300	290
Stone:						
Basalt	thousand tons	2,627	1,900	r737	r548	635
Calcareous:						
Calcite, nonoptical		41,130	r5,300	r6,789	r7,520	7,100
Calcium carbonate (chalk)		51,300	58,500	r17,600	r8,325	8,585
Dolomite		488,204	e250,000	r278,302	r416,438	300,000
Limestone	thousand tons	11,896	9,190	r7,588	r9,243	10,800
Marble:						
Aragonite, broken		5,504	1,882	r1,118	r1,140	1,100
Onyx, in blocks and broken		8,256	4,809	r1,631	r2,553	1,500
Travertine, in blocks and broken		21,107	3,467	r5,710	r18,693	13,000
Unspecified, in blocks and broken		72,959	35,122	r24,918	r23,140	15,000
Flagstone		42,809	77,913	r72,784	r92,882	90,000
Granite:						
In blocks		50,398	39,347	r46,279	r59,697	45,000
Crushed	thousand tons	5,425	4,168	r3,525	r4,316	5,000
Quartz, crushed		153,816	140,538	r76,149	r81,613	96,420
Quartzite, crushed	thousand tons	1,287	691	r476	r538	400
Rhodochrosite		19	40	r67	r20	30
Gamestone (agate, amatist, apolo, turmalin, etc.)	kilograms	r2,000	r5,000	r14,970	r43,385	30,000
Sandstone[e]		3120	300	300	250	240
Serpentine, crushed		29,750	11,333	r13,748	r19,921	20,000
Shell, marl		383,363	285,630	r328,970	r240,462	250,000
Tuff, (tosca)	thousand tons	r1,966	2,006	r2,061	r2,050	2,000
Strontium minerals: Celestite		2,241	1,193	r3,112	e1,200	1,200
Sulfates, natural:						
Aluminum (alum)		71,985	66,844	r6,930	r23,369	320,849
Magnesium (epsomite)[e]		312,140	7,000	7,000	6,500	6,500
Sodium (mirabilite)		15,341	10,281	r12,677	r13,520	39,788
Talc and related materials:						
Pyrophyllite		671	1,310	r2,687	r4,925	5,012
Steatite[e]		250	250	250	250	240
Talc		26,108	26,658	r26,206	r24,766	22,774
Total		27,029	28,218	r29,143	r29,941	328,026
Vermiculite		19,300	590	r3,334	r3,951	34,451
Water, mineral-containing		172,152	142,229	140,000	r e140,000	140,000
Zeolite[e]		r—	r—	r—	r—	—
MINERAL FUELS AND RELATED MATERIALS						
Asphalt and bitumen, natural (asphaltite)		2,158	824	r2,480	r5,852	3994
Coal, bituminous	thousand tons	505	441	270	r294	3212
Coke, all types, including breeze[e]	do.	3820	800	800	830	820
Gas, natural:						
Gross	million cubic meters	22,695	21,992	e21,800	e22,000	21,900
Marketed[7]	do.	17,831	18,993	18,094	17,913	18,000
Natural gas liquids:						
Butane	thousand 42-gallon barrels	3,887	4,384	e4,196	e4,200	4,200

See footnotes at end of table.

TABLE 1—Continued

ARGENTINA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992e
MINERAL FUELS AND RELATED MATERIALS—Continued						
Natural gas liquids:						
Propane[e]	thousand 42-gallon barrels	[3]5,283	5,300	5,000	5,000	5,000
Total[e]	do.	[3]9,170	9,684	9,196	9,200	9,200
Peat, agricultural (turba)		2,621	2,481	r3,800	r3,726	[3]2,308
Petroleum:						
Crude	thousand 42-gallon barrels	164,418	167,949	175,836	178,379	179,000
Refinery products:						
Gasoline	do.	28,041	40,311	34,615	35,909	36,000
Kerosene	do.	3,503	3,364	3,634	3,770	3,800
Jet fuel	do.	5,176	5,566	6,123	6,352	6,300
Distillate fuel oil	do.	53,997	56,108	58,776	60,974	60,900
Lubricants	do.	1,781	1,669	1,354	1,405	1,400
Residual fuel oil	do.	27,790	30,232	25,636	26,595	26,500
Other	do.	16,499	13,762	13,185	13,678	13,600
Refinery fuel and losses	do.	21,400	13,745	25,781	26,745	26,750
Total	do.	158,187	164,757	169,104	175,428	175,250

[e]Estimated. [r]Revised.

[1]Table includes data available through June 1993.

[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 1992

(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		Cía. Boroquímica S.A.M.I.C.A.F., (owned by Río Tinto Zinc Corp. Ltd.)	El Porvenir Mine, Jujuy Province; Tincalayu and Campo Quijano, Salta Province	300.
Cement		Loma Negra C.I.A.S.A., #1; Juan Minetti, S.A., #2; Corporación Cementera Argentina, S.A., #3 (100% private)	Buenos Aires, Córdoba, Corrientes, Salta San Juan, Mendoza, and Jujuy Provinces	6,000.
Coal		Yacimientos Carboníferos Fiscales (Government, 100%) (Shut down partially in 1991)	Río Turbio, Santa Cruz Province	300.
Gold, silver	kilograms	Yacimientos Mineros de Agua de Dionisio (YMAD) (Government, 100%), Angela Mine (private, 100%)	Farallón Negro, Hualfin and Belén Departments Gastre Department, Chubut Province	1,300 Au, 50,000 Ag.
Iron ore		Hierro Patagónico de Sierra Grande, S.A. Minera (HIPASAM) (Government, 100%) (Shut down partially in 1991)	Sierra Grande, Río Negro Province	5,000.

See footnotes at end of table.

TABLE 2—Continued

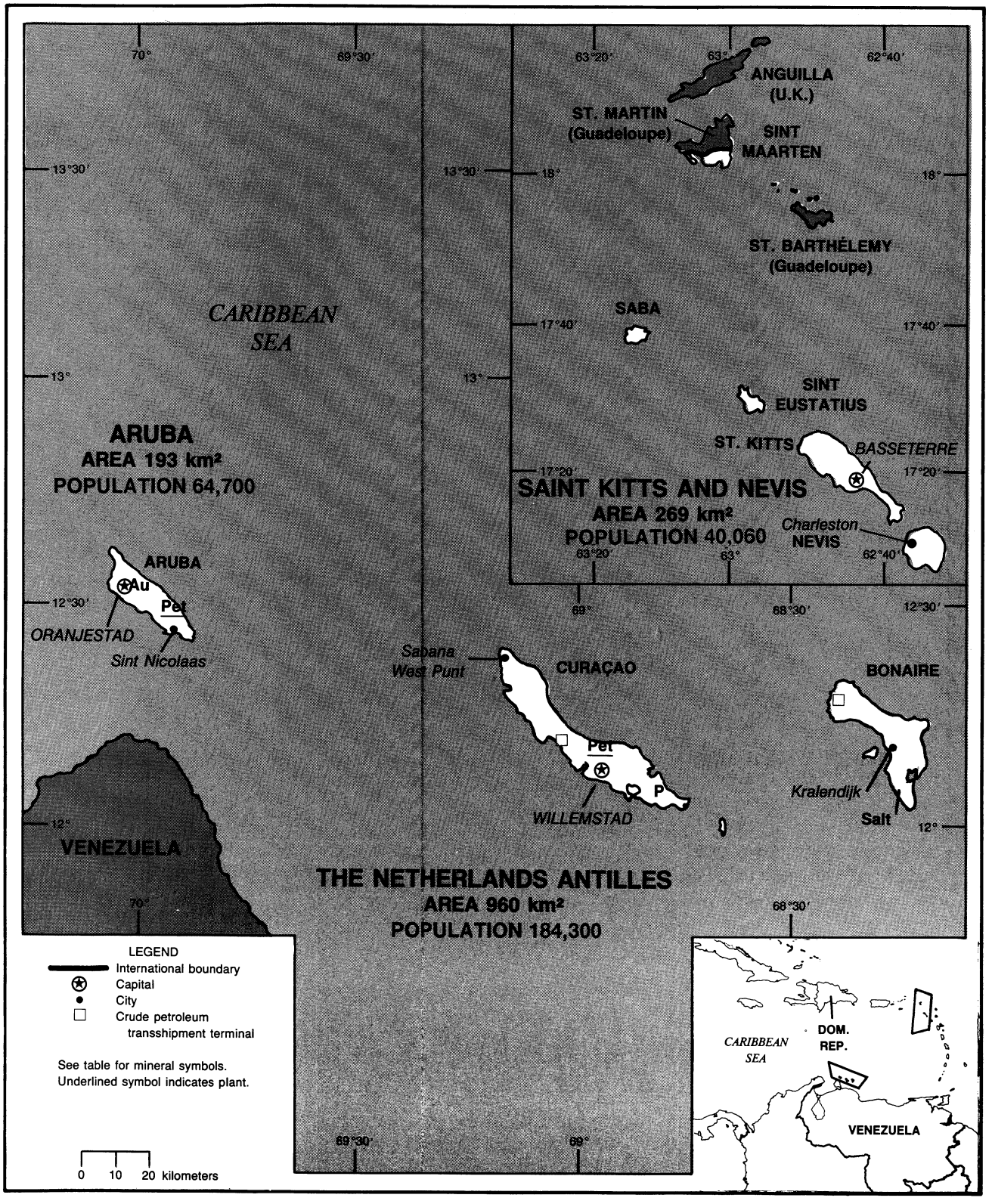
ARGENTINA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Lead, silver, zinc kilograms	Cía. Minera Aguilar, S.A. [A Bolivian Consortium Cía. Minera del Sur, (COMSUR), 100%]	Estación 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 Petrolíferos Fiscales (YPF) (It was privatized 100% in 1992)	Neuquén Santa Cruz, Tierra del Fuego, Salta, and Río Negro Provinces	22,000.
Petroleum million barrels	Yacimientos Petrolíferos Fiscales (YPF)[1]	Chubut, Santa Cruz, Neuquén, Río Negro, Mendoza, Salta, Tierra del Fuego, Jujuy, La Pampa, and Formosa Provinces	179.
Steel	Sociedad Mixta Siderúrgica Argentina (SOMISA) (Privatized in 1992; owned by Aceros Paraná, S.A., 79.9%; Government, 20.1%)	7 kilometers from San Nicolás de los Arroyos, Buenos Aires Province	2,850.
Do.	ACINDAR-Industria Argentina de ACEROS, S.A. (Private, 100%)	Plant Nos. 1. and 3 Buenos Aires Province; Plant No. 2. near Río Paraná, Santa Fé Province	1,500.
Uranium (ore)	Empresa Nuclear Mendoza, subsidiary of Comisión Nacional de Energía Atómica (Government, 100%)	Sierra Pintada, San Rafael, Mendoza Province	150.
Zinc, refinery	Cía. Sulfacid S.A.C.I. y F (50% C.M.A.S.A.; private, 50%)	Near Rosario on the Paraná River, Santa Fé Province	35.

[1]By Decree No. 2778/90, no longer a state-owned company, but a corporation ruled by Law 19,550.

ARUBA, THE NETHERLANDS ANTILLES, AND SAINT KITTS AND NEVIS



THE MINERAL INDUSTRIES OF

ARUBA, NETHERLANDS ANTILLES, AND SAINT KITTS AND NEVIS

By Philip M. Mobbs

Mineral-related activity played a limited role in the economies of Aruba, Netherlands Antilles, and Saint Kitts and Nevis. The economy of Aruba was led by tourism. In 1992, the export of salt and oil refinery products was the leading mineral-related activity of Netherlands Antilles, an autonomous dependency of the Kingdom of the Netherlands. Tourism and offshore financing were the other major sectors of the Netherlands Antillean economy. The Federation of Saint Kitts and Nevis consisted of the volcanic islands of Nevis and Saint Christopher. Sugarcane culture and processing historically dominated the islands' economy.

PRODUCTION AND TRADE

The mineral industry of Aruba consisted primarily of a petroleum refinery and a gold exploration program. The mineral industry of Netherlands Antilles included a solar salt operation and a petroleum transshipment terminal on Bonaire; limestone and phosphate rock quarrying and petroleum refining on Curaçao; a stone-crushing operation on Saba; a petroleum transshipment terminal on Sint Eustatius; and aggregate production on Sint Maarten. Although Saint Kitts and Nevis' mineral industry produced some construction materials and salt, most of the nation's basic mineral requirements were imported. Beach sand mining was proscribed under the 1987 National Conservation and Environmental Protection Act.

Salt was exported from Netherlands Antilles to the Caribbean, New Zealand, and the United States. *(See table 1.)*

COMMODITY REVIEW

Metals

Monte Carlo Gold Mines Ltd., Richmond Hill, Ontario, Canada, and Auromar Development began drilling the Kadushi prospect on Aruba during 1992. The companies planned to build a 200-mt/d heap-leach plant to process the island's turn-of-the-century tailings.

Industrial Minerals

Salt had been produced on Bonaire 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.

Bouwwbedrifj Boven Winden N.V., a subsidiary of Devcon International Corp., Deerfield Beach, Florida, quarried aggregate on Sint Maarten. Production was consumed by the local construction industry.

Refineria Isla (Curacao) S.A., a Petróleos de Venezuela S.A. (PDVSA) subsidiary, produced approximately 20,000 tons of sulfur at the Isla oil refinery.

Mineral Fuels

Coastal Aruba Refining Co. N.V., a subsidiary of Coastal Corp. of Houston, Texas, produced asphalt, diesel fuel, feedstocks for Coastal's other refineries, kerosene, and residual fuel oil at the 150-Mbbl/a Lago refinery on Aruba. PDVSA leased the 113-Mbbl/a Isla oil refinery at Willemstad, Curacao, from the Government of Netherlands Antilles. Refineria Isla (Curacao) S.A. operated the refinery. The ocean terminal and facilities on Bonaire, purchased by PDVSA in 1989, were used for storage and transshipment.

INFRASTRUCTURE

Mineral products were moved through the ports of Oranjestad and Sint Nicolaas on Aruba and Willemstad on Curacao. Salt was transported from the AKZO Salt Antilles' stockpiles directly aboard ship via conveyor belt. The deepwater port of Basseterre served Saint Christopher, and Charlestown was the port of entry for goods destined for Nevis. Netherlands Antilles and Aruba had a combined total of 950 km of roads. Saint Kitts and Nevis had 300 km of roadway.

Aruba's electrical generating capacity was 310 MW. Netherlands Antilles had an electrical generating capacity of 125 MW. Saint Kitts and Nevis had an electrical generating capacity of 15.8 MW with a proposed 1993 expansion of 4 MW being funded by the Caribbean Development Bank.

OTHER SOURCES OF INFORMATION

Agencies

Central Bureau Voor de Statistiek
Windstraat 21
Oranjestad, Aruba
Central Bureau Voor de Statistiek
Willemstad, Curacao
Ministry of Public Works
Basseterre, Saint Kitts and Nevis
(809) 465-2521

Publications

U.S. Central Intelligence Agency: The World Factbook, 1992.
U.S. Department of Commerce, International Trade Administration:
Foreign Economic Trends and Their Implications for the United States, Aruba, irregular.
Foreign Economic Trends and Their Implications for the United States, Netherlands Antilles, irregular.

TABLE 1

ARUBA, NETHERLANDS ANTILLES, AND SAINT KITTS AND NEVIS: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

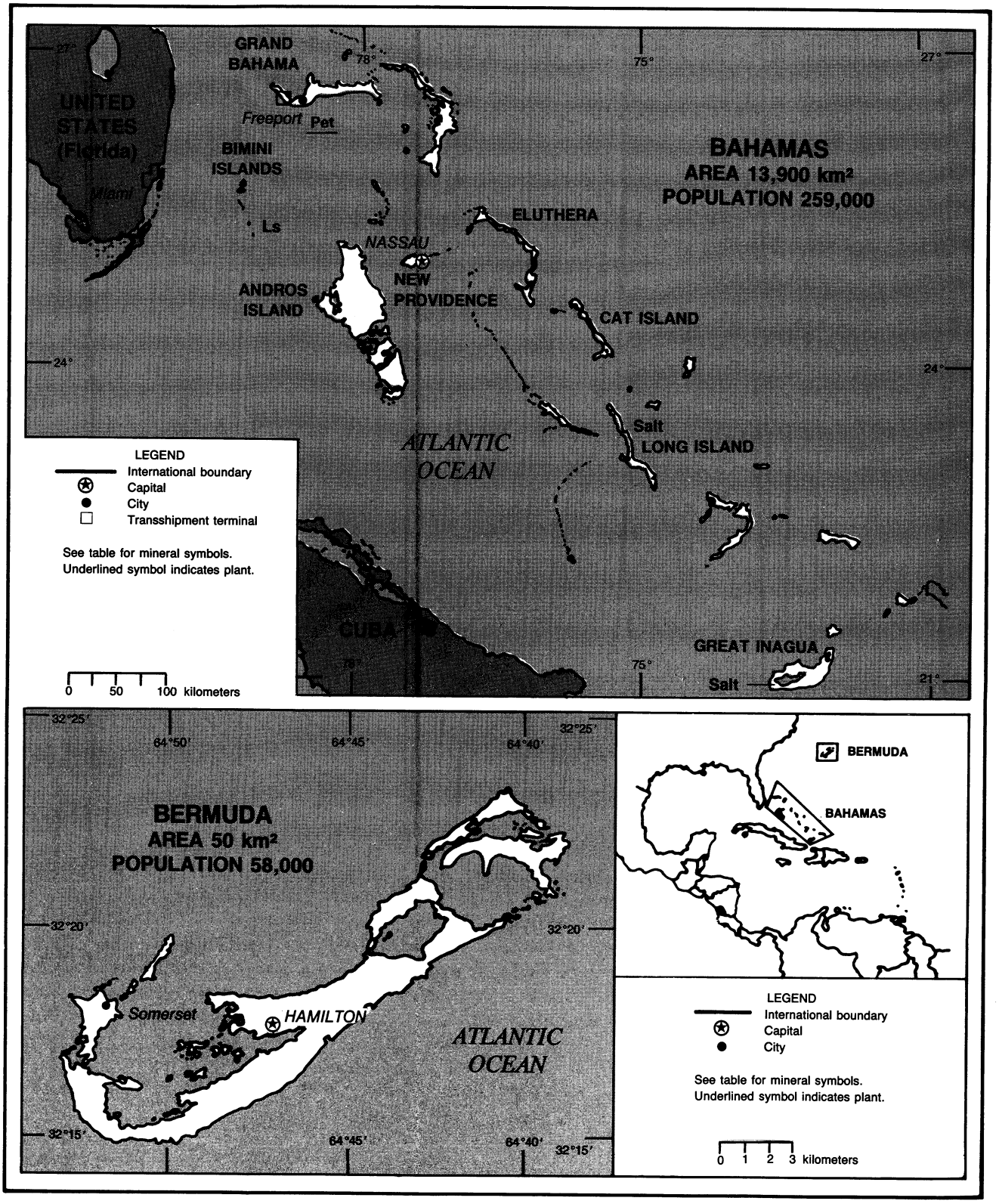
Commodity[2]		1988	1989	1990	1991	1992
Petroleum refinery products	thousand 42-gallon barrels	69,350	65,335	e70,000	e115,000	e115,000
Phosphate rock e		16	r10	r5	r5	5
Salt e		350	350	350	350	350
Sulfur, byproduct of petroleum e		60	60	60	60	60

eEstimated. rRevised.

[1]Table includes data available through Apr. 1, 1993.

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

THE BAHAMAS AND BERMUDA



THE MINERAL INDUSTRIES OF

THE BAHAMAS AND BERMUDA

By George A. Rabchevsky

THE BAHAMAS

The Bahamas islands are situated 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 terrain of the islands is flat, with coral formations and reefs, with some low rounded hills. Tourism was the largest sector of the economy, followed by offshore banking. Tourism provided more than 65% of GDP, employing more than 50% of the work force. Inflation was estimated at 10%, with 25% unemployment.

The mineral production on The Bahamas islands was limited to aragonite, cement, petroleum products, salt, sand and gravel, and other construction materials. Most of these commodities were consumed domestically. Less than 2% of the total work force was employed in the mineral industry.

Production

Aragonite, cement, salt, stone, and sand and gravel were the major industrial minerals produced in The Bahamas. Aragonite, stone, and sand and gravel are a form of calcium carbonate, derived from the eroded coral reefs and sea shells. *(See table 1.)*

Trade

Domestic mineral requirements were met through imports, except for small volumes of industrial minerals produced for local use. Mineral-related imports included cement, crude and manufactured fertilizers, iron and steel, metal ores, crude oil, and petroleum products. Mineral exports included mostly aragonite blocks, petroleum products, and salt. The United States continued to be The Bahamas' most significant trading partner. Foreign investment in the mineral sector was actively encouraged, especially if export-oriented and labor-intensive.

Structure of the Mineral Industry

Except for small aragonite sand and stone producers, mineral industries in The Bahamas were owned or operated by foreign companies. Private industry dominated the limited industrial minerals industry. The utility companies in The Bahamas were Government-owned. Government approval must be obtained for foreign investors to own and operate a business in The Bahamas.

Commodity Review

Industrial Minerals.—Aragonite sand was dredged off the Great Bahamas Bank, south of the Biminis. Limestone and sand were produced by Freeport Aggregate Ltd., in Freeport, for the local construction industry. The only cement plant was in Freeport, with production steadily declining. Marine salt was produced in the evaporation plant, on the Great Inagua Island.

Mineral Fuels.—The Bahamas imported all of its crude oil for the domestic processing of petroleum products. The islands also imported various categories of petroleum products to serve local needs in the transportation and electricity sectors and for reexport to third countries. Petróleos de Venezuela S.A. operated the Bahamas Oil Refining Co. oil transshipment facilities in Freeport. The largest oil-bunkering installation in the Western Hemisphere is also in Freeport. *(See table 2.)*

Infrastructure

There was 2,400 km of roads in The Bahamas, 1,350 km of which was paved, the rest with gravel. There were two major commercial ports—Freeport on Grand Bahama Island and Nassau on New Providence Island. Petroleum products are received by ocean tanker and pumped into storage tanks at the Clifton Pier terminal on the western end of New Providence. The products were then delivered to retail stations by road tank wagons. A flatbed delivery truck was used to transport the packaged products.

The island's capacity for electrical generation amounted to 386 MW, all from oil-fired plants. The Bahamas Electricity Corp. continued pursuing alternative energy projects, funded by the Inter-American Development Bank. Those projects included the feasibility studies for the dendrothermal (wood-burning) power generating plants on the islands of Abaco and Andros and the development of the solar water heating plant on Ragged Island. The Clifton Power plant and the Blue Hill plant, both in western New Providence Island near Nassau, were being modernized and upgraded.

BERMUDA

The Bermuda islands are in the Atlantic Ocean north of The Bahamas and about 1,800 km east of South Carolina of the United States. Bermuda is an independent territory of the United Kingdom whose main industry was

tourism.

The islands have an insignificant mineral industry. Mineral requirements were imported, except for some local stone production, primarily coral limestone. Quarries were privately owned, with low employment. Stone was transported in trucks over 250 km of public roads. Electric power capacity was about 154 MW, all from oil-fired plants. 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. No new mineral development projects are expected in the foreseeable future.

The United States continued to be one of Bermuda's most important trading partners. Other significant partners included Canada, Italy, and the United Kingdom.

OTHER SOURCES OF INFORMATION

Agencies

Ministry of Agriculture, Trade and Industry
Nassau, The Bahamas
Ministry of Works and Lands
Nassau, The Bahamas

Publications

Central Intelligence Agency: The World Factbook, annual.

TABLE 1
THE BAHAMAS: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]	1988	1989	1990	1991	1992[e]
Salt	616	858	r828	1,096	1,000
Stone: Aragonite	897	1,086	r807	1,211	1,000

[e]Estimated.
[1]Table includes data available through Apr. 1993.
[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 2
THE BAHAMAS: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

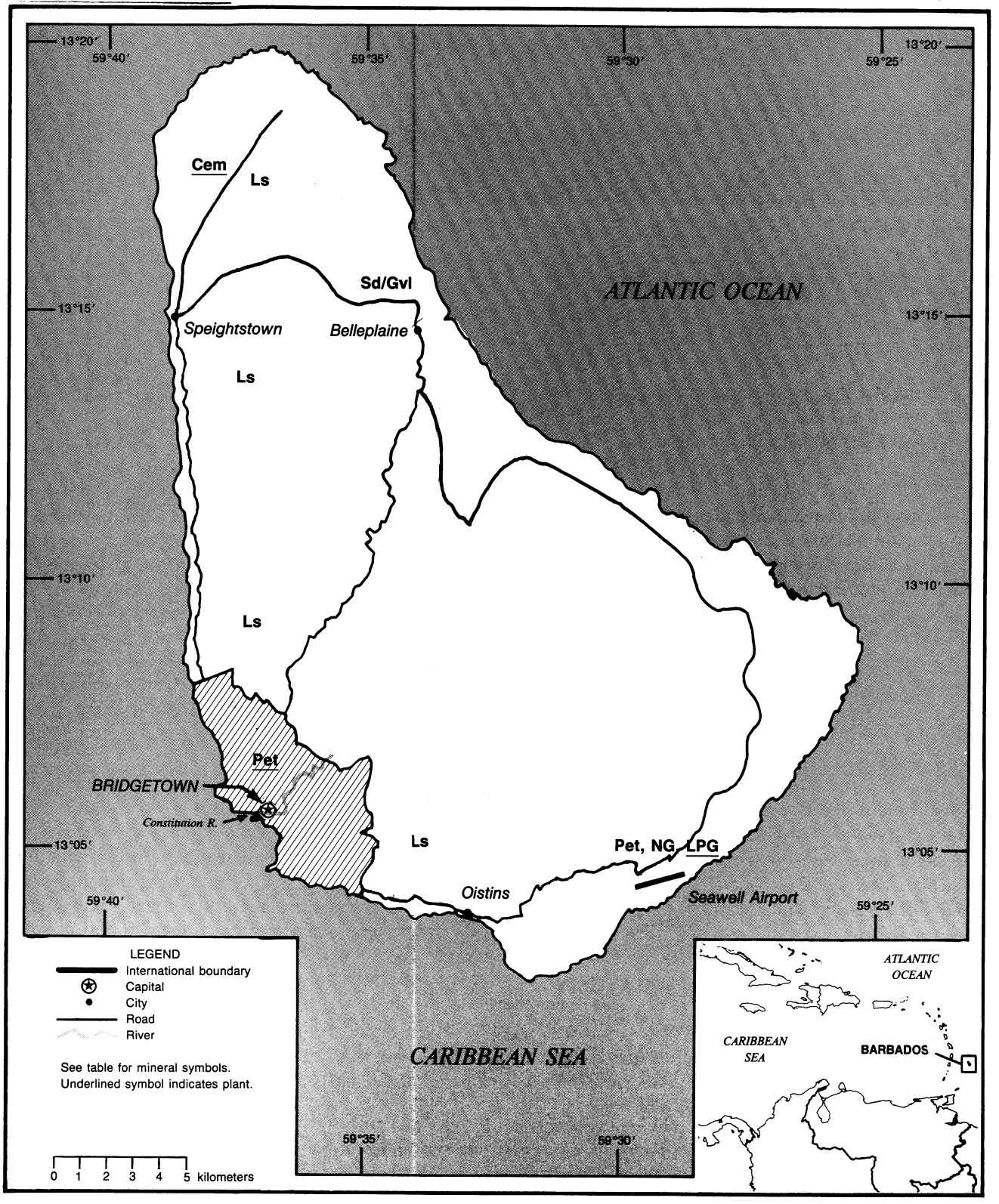
(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Bahamas Cement Co. (Int. Devel. Corp., S.A. and Tag Group, S.A.)	Freeport, Grand Bahama Island	690
Aragonite		Marcona Ocean Ind., Inc. (Marcona Corp., 100%)	Ocean Cay	2,500
Petroleum products	thousand 42-gallon barrels	Bahamas Oil Refining Co. (Petróleos de Venezuela S.A., 100%)	Freeport, Grand Bahama Island[1]	128,000
Salt		Morton Salt (Bahamas) Ltd. (Morton Salt Co., 100%)	Great Inagua Island	1,500

[1]Refinery closed in 1985. Transshipment and storage facilities operational.

BARBADOS

AREA 430 km² **POPULATION 258,000**



THE MINERAL INDUSTRY OF

BARBADOS

By George A. Rabchevsky

Barbados is a relatively small island, located off the coast of Venezuela, with a total area of about 430 km^2. The size of the island is slightly less than 2.5 times the size of Washington, DC. Tourism, sugar, and light manufacturing and assembly were the major contributors to the country's economy. The unemployment rate in Barbados was estimated at 20% in 1992. A per capita income of about $7,000[1] gives Barbados one of the highest standards of living of all the small island states of the eastern Caribbean.

The minerals sector formed a minor part of the country's economy. The principal mineral commodities produced in Barbados were crude petroleum and natural gas. The industrial minerals produced included cement, clays, limestone, sand and gravel, and crushed stone.

GOVERNMENT POLICIES AND PROGRAMS

Barbados encouraged foreign investment by granting investors tax advantages and other concessions, mostly for nonmineral industries. The Quarry Act covered limited aspects of nonfuel mineral sector operations.

PRODUCTION

Mineral production in 1992 was about the same as that during the previous year. Barbados' production was primarily of crude petroleum and natural gas. Industrial minerals contributed little to the mining industry. Cement, clays, limestone, sand and gravel, and crushed stone were produced for the domestic construction industry. The official statistics were not published for those commodities. *(See table 1.)*

TRADE

The island was a member of the Caribbean Community and Common Market (Caricom). Barbados received preferential trade benefits under the Caribbean Basin Initiative of the United States. Other major trading partners included Canada, Caricom countries, Germany, Japan, the United Kingdom, and Venezuela. Venezuela continued shipping crude oil to Barbados under the San José Accord. *(See tables 2 and 3.)*

The Andean Development Corp. (ADC), a multipurpose bank owned by the Andean Pact member countries (Bolivia, Colombia, Ecuador, Venezuela; Peru has temporarily withdrawn from the agreement), Chile, and Mexico, signed an agreement with Barbados under which the ADC will give Barbados a $5 million line of credit to help stimulate trade between members of the Caribbean Basin and the Andean Pact.

STRUCTURE OF THE MINERAL INDUSTRY

The mineral-related companies were owned and operated by the Barbados Government or as joint ventures with other countries. Small quarries were privately owned. Employment in the mineral industry was estimated at 2,500 people, or about 2% of the country's total labor force. Cement, petroleum, and gas producers continued to be the major employers in the country's mineral industry. *(See table 4.)*

COMMODITY REVIEW

Industrial Minerals

Industrial minerals produced in Barbados consisted of cement, clays, limestone, sand and gravel, and crushed stone. The Arawak Cement Co. was the sole producer of cement on the island. The plant was brought on-line in 1984. The dry kiln line was supplied by Voest Alpine Co. of Austria, fired by fuel oil. The Arawak plant was advertised by the Government for sale.

Clays, clinker, and limestone were locally mined. Gypsum was imported primarily from Venezuela for use in cement production. Cement was exported to regional markets, including Dominica, Grenada, Montserrat, St. Lucia, St. Kitts, St. Vincent, and others. Imports of cement into Barbados were negligible. When clinker was necessary, it was imported from Trinidad and Tobago or Venezuela.

Mineral Fuels

The Barbados National Oil Co. Ltd. (BNOC) was the only operating crude oil company on the island, located north of Bridgetown. BNOC also produced natural gas and liquid petroleum gas. The National Petroleum Corp. (NPC) supplied natural gas to commercial, domestic, and industrial consumers. At the end of 1992, the Government of Barbados was offering BNOC and NPC for sale under its privatization program.

Petroleum deposits in Barbados are located in the Woodbourne Field, St. Philip and Christ Church Parishes, in the southeastern part of the island. The field had a rated capacity of 1,900 bbl/d,

producing about 450 kbbl/a of crude oil. The petroleum refinery is located on the southwestern coast, north of Bridgetown, with a production of about 2.1 Mbbl/a. Refinery products were produced by a private company, Mobil Oil Barbados Ltd.

In Barbados, oil accounted for more than 70% of the nation's total energy requirement. Domestic crude oil production supplied 31% of Barbado's total demand. About 20% of total energy demand was contributed by bagasse burning. Solar energy and natural gas satisfied the remaining energy needs.

Reserves

The island was composed almost totally of limestone, with more than 1 billion tons in reserves. Crude oil reserves were estimated at 3 Mbbl, and natural gas reserves at 205 Mm^3.

INFRASTRUCTURE

As a small country, the island enjoyed an extensive paved road network of 1,570 km. Bridgetown was the only major port on the island. Petroleum was imported at terminals on the southeast and the southwest coasts. Barbados Light and Power Co. Ltd. had an installed electric generating capacity of 152 MW.

OUTLOOK

Little changes are expected in the near future, primarily with regard to industrial minerals. Oil and natural gas production are increasing slowly, and more drilling is expected to locate new hydrocarbon basins. The generation of electricity for the 255,000 inhabitants is expected to remain stable for the near future.

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

OTHER SOURCES OF INFORMATION

Agency

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

Publications

Ministry of Finance and Economic Affairs, Barbados Economic Report, annual.

TABLE 1

BARBADOS: PRODUCTION OF MINERAL COMMODITIES[1]

Commodity[2]		1988	1989	1990	1991	1992e
Cement, hydraulic	thousand metric tons	184	r225	r200	200	175
Gas, liquefied petroleum	42-gallon barrels	16,632	16,824	e18,000	e18,500	18,000
Gas, natural:						
Gross	million cubic meters	35	32	33	e35	33
Marketed	do.	17	15	15	17	15
Petroleum:						
Crude	thousand 42-gallon barrels	427	389	454	e470	470
Refinery products	do.	1,723	1,915	2,125	e2,200	2,120

eEstimated. rRevised.

[1]Table includes data available through Apr. 1993.

[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 2

BARBADOS: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	Destinations, 1990	
				United States	Other (principal)
METALS					
Aluminum: Metal including alloys:					
Scrap		10	30	14	West Germany 16.
Semimanufactures		10,478	7,086	6,418	St. Vincent and the Grenadines 668.
Copper: Metal including alloys:					
Scrap		31	319	313	West Germany 6.
Semimanufactures		(2)	17	15	Grenada 2.
Iron and steel: Metal:					
Scrap		90	90	—	All to United Kingdom.
Semimanufactures:					
Bars, rods, angles, shapes, sections		16,888	981	27	Dominica 624; Antigua and Barbuda 118; St. Kitts and Nevis 89.
Universals, plates, sheets		249	189	—	St. Vincent and the Grenadines 93; St. Lucia 68; Dominica 13.
Hoop and strip	value, thousands	$2	$2	—	Mainly to St. Lucia.
Rails and accessories	do.	—	$1	—	All to Dominica.
Wire		6	30	—	St. Vincent and the Grenadines 28; St. Lucia 2.
Tubes, pipes, fittings		37	13	—	St. Lucia 9; Dominica 3.
Lead: Metal including alloys, scrap		112	—		
Zinc:					
Oxides		—	4	—	All to Trinidad and Tobago.
Metal including alloys, semimanufactures		—	1	—	All to Grenada.
Other: Ashes and residues		10	—		
INDUSTRIAL MINERALS					
Cement		116,700	98,383	—	St. Vincent and the Grenadines 14,124; St. Kitts and Nevis 13,752; Netherlands Antilles 13,434.
Clays, crude		4	—		

See footnotes at end of table.

TABLE 2—Continued

BARBADOS: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	Destinations, 1990	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Fertilizer materials: Manufactured:					
Ammonia	value, thousands	$5	$2	—	St. Lucia $1; St. Vincent and the Grenadines $1.
Nitrogenous		106	—		
Phosphatic		2	—		
Potassic	value, thousands	$1	—		
Unspecified and mixed	do.	$3	$1	NA	NA.
Gypsum and plaster		1,915	508	—	St. Vincent and the Grenadines 492; Grenada 12; St. Kitts and Nevis 4.
Mica: Crude including splittings and waste		—	2	—	All to Trinidad and Tobago.
Pigments, mineral: Iron oxides and hydroxides, processed	value, thousands	$1	—		
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		8	—		
Worked		(3)	38,391	—	St. Lucia 37,959; Antigua and Barbuda 430.
Gravel and crushed rock		541	218	—	U.S. Virgin Islands 65; Grenada 49; Jamaica 48.
Limestone other than dimension		255	193	—	St. Vincent and the Grenadines 110; Trinidad and Tobago 60; Grenada 22.
Sulfur:					
Elemental: Colloidal, precipitated, sublimed	value, thousands	$1	$1	—	All to Antigua and Barbuda.
Sulfuric acid		2	12	—	St. Lucia 10; Grenada 2.
MINERAL FUELS AND RELATED MATERIALS					
Carbon: Carbon black	value, thousands	$1	$1	NA	NA.
Peat including briquets and litter		6	—		
Petroleum refinery products:					
Gasoline	42-gallon barrels	6,690	6,630	NA	NA.
Mineral jelly and wax	do.	228	23,618	—	All to Dominica.
Kerosene and jet fuel	do.	971,083	876,068	NA	NA.
Distillate fuel oil	do.	109,953	217,698	NA	NA.
Lubricants	do.	117,656	3,822	175	St. Vincent and the Grenadines 1,428; Guyana 700.
Residual fuel oil	do.	399,081	1,063,455	NA	NA.
Bituminous mixtures	do.	57,285	545	—	Grenada 394; St. Kitts and Nevis 151.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]Unreported quantity valued at $15,000.
[3]Unreported quantity valued at $6,000.

TABLE 3

BARBADOS: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	Sources, 1990	
				United States	Other (principal)
METALS					
Aluminum:					
Oxides and hydroxides		23	40	37	Canada 1; France 1.
Metal including alloys:					
Scrap		—	8	8	
Semimanufactures		1,493,251	92,687	92,599	United Kingdom 53; Trinidad and Tobago 11.
Columbium and tantalum: Tantalum metal including alloys, all forms	value, thousands	$362	$351	$351	
Copper: Metal including alloys:					
Scrap		—	2	2	
Unwrought	value, thousands	$1	$1	—	All from United Kingdom.
Semimanufactures		20,788	2,012	1,996	United Kingdom 9; Sweden 4.
Gold: Metal including alloys, unwrought and partly wrought	kilograms	—	2	2	
Iron and steel:					
Iron ore and concentrate excluding roasted pyrite		2,412	1,214	—	All from Venezuela.
Metal:					
Pig iron, cast iron, related materials		5	27	27	
Steel, primary forms		18	39	2	United Kingdom 10; uspecified 27.
Semimanufactures:					
Bars, rods, angles, shapes, sections		408,692	63,202	22,522	United Kingdom 24,690; Venezuela 8,358.
Universals, plates, sheets		271,028	5,369	651	United Kingdom 2,739; Belgium-Luxembourg 1,443.
Hoop and strip		39	1,100	1,095	China 2; United Kingdom 1.
Rails and accessories		5	12	12	
Wire		1,508	2,966	1,950	United Kingdom 610; Venezuela 147.
Tubes, pipes, fittings-thousand tons		64	1,584	12	Venezuela 1,554; United Kingdom 17.
Castings and forgings, rough		4	9	(2)	Mainly from Venezuela.
Lead:					
Oxides		100	70	3	Trinidad and Tobago 34; West Germany 20; Venezuela 10.
Metal including alloys, semimanufactures		3,184	527	421	Venezuela 83; United Kingdom 23.
Manganese: Ore and concentrate, metallurgical-grade	value, thousands	$1	$1	$1	
Nickel: Metal including alloys, semimanufactures		1	1	(2)	Mainly from Ireland.
Silver: Metal including alloys, unwrought and partly wrought	value, thousands	$6	$20	$20	
Tin: Metal including alloys, semi-manufactures		2,454	2,298	53	Netherlands 2,198; United Kingdom 47.
Titanium: Oxides		598	428	290	United Kingdom 99; Finland 21.
Tungsten: Metal including alloys, semi-manufactures	value, thousands	$1	—		
Zinc:					
Ore and concentrate	do.	—	$3	$3	
Oxides		35	29	2	Venezuela 10; France 8.
Metal including alloys, semimanufactures		35	25	3	United Kingdom 22.

See footnotes at end of table.

TABLE 3—Continued

BARBADOS: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	Sources, 1990	
				United States	Other (principal)
METALS—Continued					
Other:					
Ores and concentrates		4	91	91	
Oxides and hydroxides		196	224	9	United Kingdom 202; West Germany 11.
Ashes and residues		51	—		
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		(3)	14	(2)	Mainly from Greece.
Grinding and polishing wheels and stones		9	6	2	United Kingdom 2; Canada 1.
Asbestos, crude	value, thousands	$1	$6	$6	
Barite and witherite		4,044	1,051	1,026	France 25.
Boron materials: Crude natural borates		—	50	—	All from United Kingdom.
Cement		1,743	52,235	24,097	Denmark 27,810; Belgium-Luxembourg 300.
Chalk		10	1	—	All from United Kingdom.
Clays, crude		947	2,324	1,897	United Kingdom 427.
Diamond: Natural: Industrial stones	value, thousands	—	$1	$1	
Diatomite and other infusorial earth		29	50	49	Canada 1.
Fertilizer materials:					
Crude, n.e.s.	value, thousands	$1	—		
Manufactured:					
Ammonia		19	19	13	United Kingdom 6.
Nitrogenous		3,743	6,090	2,457	Belgium-Luxembourg 1,691; Spain 1,170.
Phosphatic		467	514	137	Martinique 194; Dominican Republic 160.
Potassic		1,755	149	22	Martinique 62; Dominican Republic 45; United Kingdom 20.
Unspecified and mixed		3,718	2,907	1	Dominican Republic 1,465; Mexico 1,306; Dominica 80.
Graphite, natural		10	—		
Gypsum and plaster		32,241	4,148	48	Venezuela 4,016; United Kingdom 84.
Lime		3,014	74	—	France 25; Jamaica 25; United Kingdom 24.
Magnesium compounds: Magnesite, crude		3	—		
Mica:					
Crude including splittings and waste		109	114	30	Norway 81; United Kingdom 3.
Worked including agglomerated splittings		5	1	1	
Phosphates, crude		201	—		
Pigments, mineral: Iron oxides and hydroxides, processed		18	20	12	United Kingdom 5; Spain 3.
Potassium salts, crude		—	159	—	Martinique 94; Belgium-Luxembourg 65.
Salt and brine		43,135	39,830	3,988	Jamaica 34,399; Canada 1,114.

See footnotes at end of table.

TABLE 3—Continued

BARBADOS: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990	Sources, 1990	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		78	872	109	United Kingdom 600; Italy 159.
Worked		1,095	2,942	1,728	St. Lucia 1,200; St. Vincent and the Grenadines 7.
Gravel and crushed rock		135	121	108	Trinidad and Tobago 13.
Limestone other than dimension		21	[1]6,668	16,668	
Sand other than metal-bearing		21,024	2,575	2,539	Trinidad and Tobago 34; West Germany 2.
Sulfur:					
Elemental: Colloidal, precipitated, sublimed		3	—		
Sulfuric acid		128	65	4	Jamaica 30; Netherlands 22; Belgium-Luxembourg 5.
Talc, steatite, soapstone, pyrophyllite		71	172	101	United Kingdom 50; Norway 19.
Other:					
Crude		1	48	48	
Slag and dross, not metal-bearing		—	9,910	—	All from Trinidad and Tobago.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		3	148	2	United Kingdom 146.
Carbon: Carbon black		25	41	13	United Kingdom 26; Netherlands 2.
Coal:					
Lignite excluding briquets		10	—		
All grades including briquets		136,119	14,535	14,349	United Kingdom 3; unspecified 183.
Coke and semicoke		5	—		
Peat including briquets and litter		1,786	130	5	Ireland 105; Canada 13; West Germany 7.
Petroleum refinery products:					
Liquefied petroleum gas	thousand 42-gallon barrels	86	111	14	Trinidad and Tobago 57; Venezuela 39.
Gasoline	do.	53	8	—	All from Trinidad and Tobago.
Mineral jelly and wax	do.	166	40	9	Netherlands 30; United Kingdom 1.
Kerosene and jet fuel	do.	877	850	—	Trinidad and Tobago 547; Netherlands Antilles 258; Venezuela 44.
Distillate fuel oil	do.	159	309	—	Netherlands Antilles 258; Trinidad and Tobago 51.
Lubricants	do.	2,473	1,390	353	Jamaica 861; Trinidad and Tobago 47.
Residual fuel oil	do.	1,738	2,298	—	Venezuela 1,000; Netherlands Antilles 890; Trinidad and Tobago 243.
Bitumen and other residues	do.	([4])	([2])	([2])	
Bituminous mixtures	do.	7	4	1	United Kingdom 2; Trinidad and Tobago 1.

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

TABLE 4

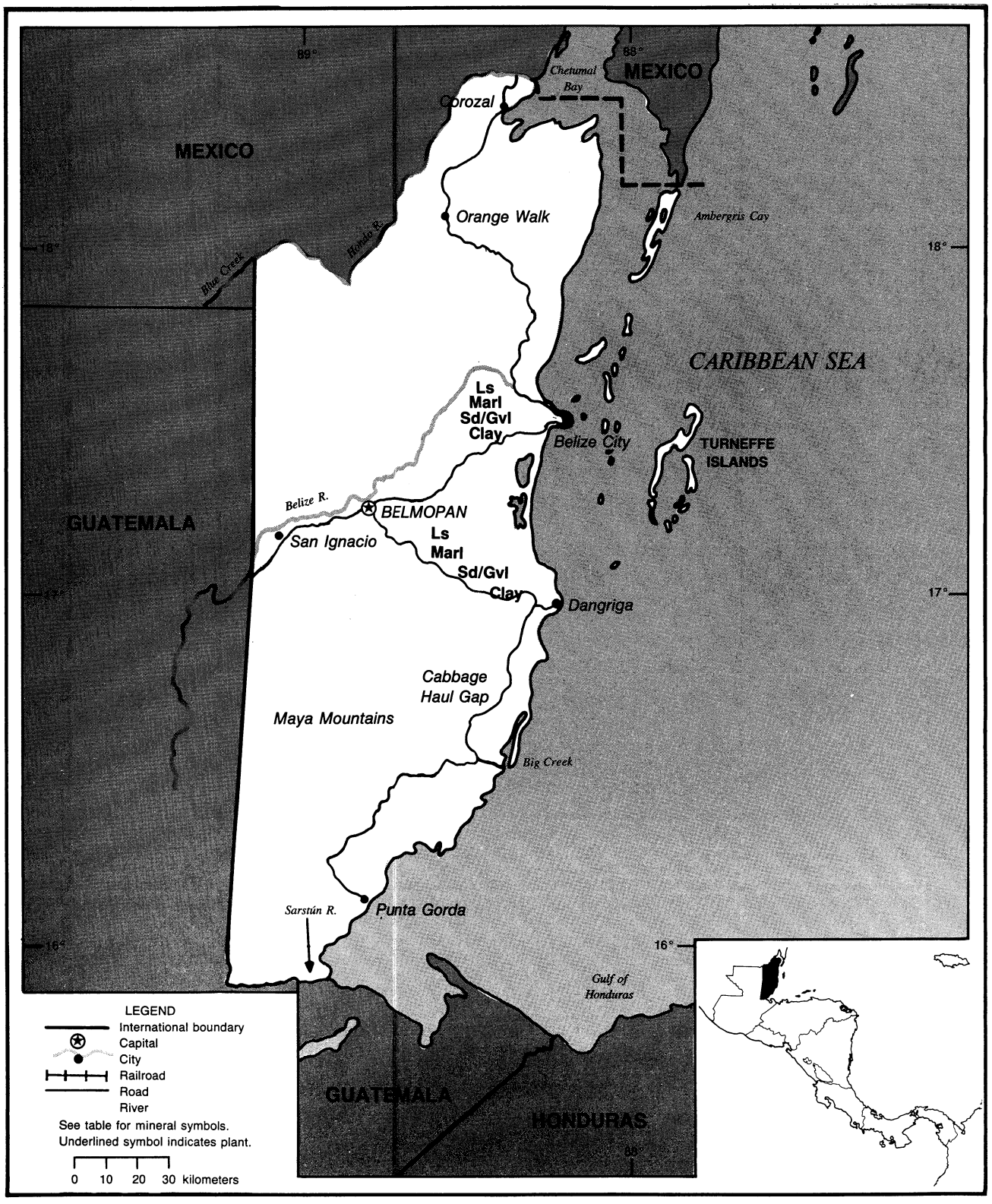
BARBADOS: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand 42-gallon barrels unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement thousand metric tons	Arawak Cement Co. (Governments of Barbados, 51%, and Trinidad and Tobago, 49%)	Checker Hall, St. Lucy Parish	300
Gas, liquefied petroleum	Barbados National Oil Co. Ltd. (BNOC) (Government, 100%)	Woodbourne Field, St. Philip Parish	25
Petroleum:			
Crude	BNOC	Woodbourne Field, St. Philip and Christ Church Parishes	694
Refinery products	Mobil Oil Barbados Ltd. (Mobil Oil Corp., 100%)	Bridgetown, St. Michael Parish	1,100

BELIZE

AREA 23,000 km² **POPULATION 229,000**



THE MINERAL INDUSTRY OF

BELIZE

By Philip M. Mobbs

The earnings of Belize's mining industry, traditionally construction materials oriented, grew by approximately 10% in 1992. Agriculture dominated the country's economy, accounting for 20% of GDP and more than 75% of export earnings. The nation's GDP increased by about 9% in 1992 to an estimated $430 million[1] at current prices.

The mineral industry was subject to the Mines and Minerals Act, 1988. Petroleum was specifically excluded from the provisions of the act. Mineral production consisted primarily of clays, limestone, marl, and sand and gravel for the construction industry. *(See table 1.)* Belize depended on imports for its other minerals and mineral fuel requirements.

Before 1988, much of the nation's industrial minerals output was produced by private companies under contract to the Government's Department of Public Works. Since 1988, the Government's Geology and Petroleum Office has appraised and administered mineral concessions, licenses, and permits. Many of the companies involved in nonfuel mineral operations were Belizean-owned. Three foreign companies held exclusive prospecting licenses for base metals, clay, and limestone ventures at the beginning of 1991. A number of British and American firms held petroleum concessions.

Belize Minerals initiated a commercial mineral processing plant during the year. The company's 20,000-mt/a plant ground locally quarried dolomite for fertilizer for the nation's agriculture sector.

Industrial minerals were trucked to consumers over a 2,575-km road system, most of which was paved or gravel-surfaced. The United Kingdom proposed to partially fund the upgrading of roads from Belize's ports to Guatemala. The deepwater ports in Belize City, Daigriga, and Big Creek handled the nation's shipping.

To generate electricity, Belize depended on imported oil, much of which was supplied by Mexico under the San José Accord. Despite the Belize Electricity Board's 10 diesel generating plants with a total generating capacity of 25 MW, electricity was unavailable in most rural areas. Bagasse and diesel fuel were used to generate an additional 9 MW by private industries and individuals. The 25-MW Macal River hydroelectric plant, under construction near Benque Viejo in western Belize, was expected to replace many of the diesel plants, thus reducing the nation's dependence on imported mineral fuels.

Industrial mineral development offers the greatest opportunity for expanding the mineral industry of Belize. Increased construction material demand could be expected given the nation's growing tourism industry. The country has extensive limestone deposits that would be suitable as aggregate. Granite outcrops have been identified as prospective sources of crushed stone and possibly dimension stone, and gypsum deposits have been recorded, though not evaluated.

TABLE 1
BELIZE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1988	1989	1990	1991e	1992e
Clays	—	97,611	2,082,864	2,000,000	2,000,000
Dolomite	—	—	86,045	100,000	100,000
Gold kilograms	—	—	r1	5	5
Limestone	e350,000	165,594	237,248	300,000	300,000
Marl	e900,000	1,043,891	1,000	1,000	1,000
Sand and gravel	e500,000	278,034	157,600	200,000	300,000

eEstimated.
[1]Includes data available through Apr. 7, 1993.

[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.

OTHER SOURCES OF INFORMATION

Agencies

Geology and Petroleum Office
Ministry of Natural Resources
84-36 Unity Blvd.
Belmopan, Belize

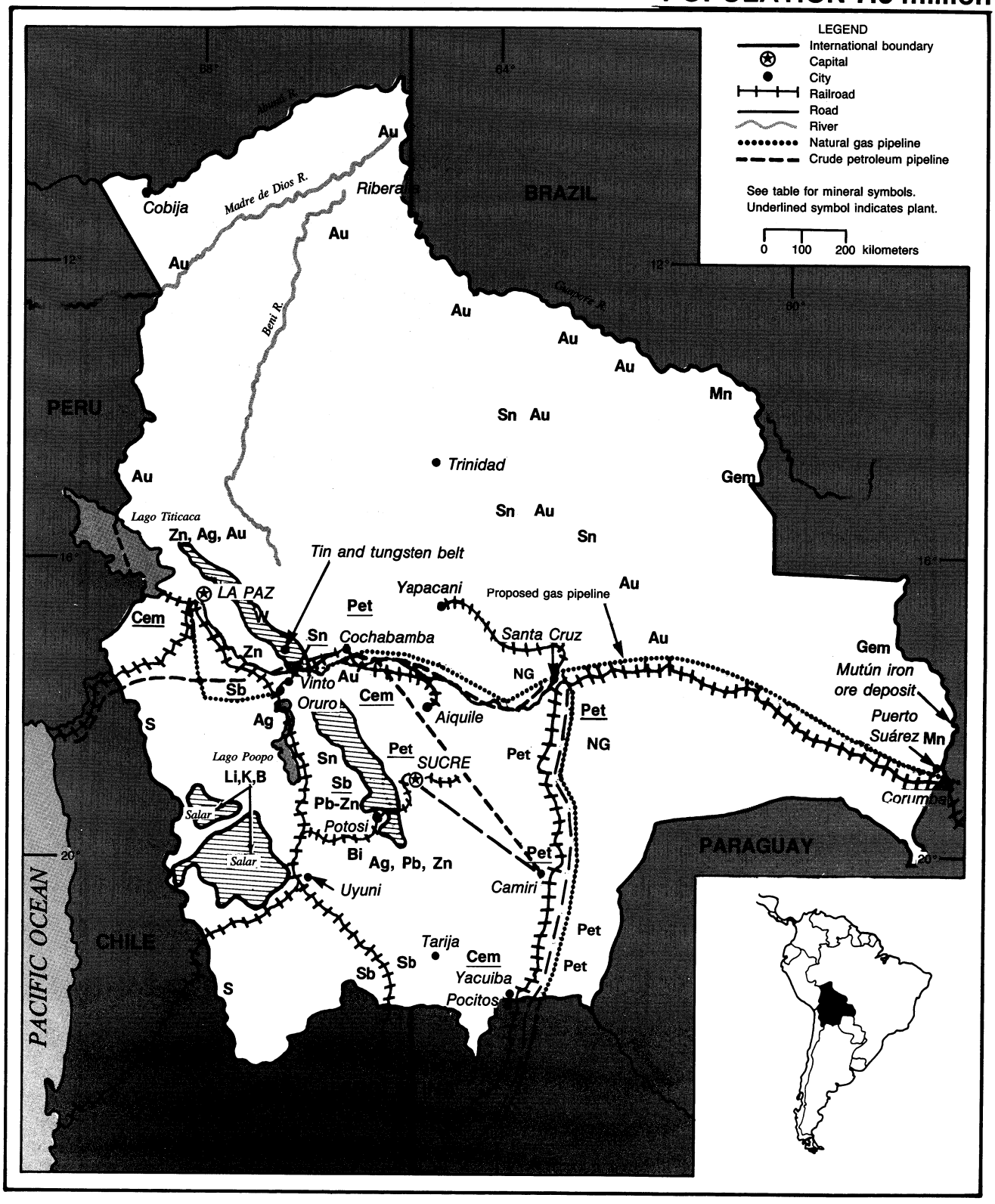
Publications

Garcia, E. Mineral Resources of Belize, C. A. Transcript of Presentation at the Belizean Studies Conference, Belize City, Oct. 26, 1990.

International Trade Administration, U.S. Department of Commerce: Foreign Economic Trends and Their Implications for the United States. Washington, DC, 1992, annual.

BOLIVIA

AREA 1.1 million km² **POPULATION 7.3 million**



THE MINERAL INDUSTRY OF

BOLIVIA

By Pablo Velasco

In 1992, Bolivia's mining industry continued to underpin the economic life of the country; relative political stability, new technology, and external capital are generating additional mineral reserves. The contribution of the mineral sector to the national economy in 1992 remained substantial at 6.2% of GDP. The more telling measure was the contribution of minerals to Bolivia's exports; in 1992 69.6%, or about $503 million of the country's legitimate earnings from trade, came from the mineral sector. Although the total value was slightly below that of the previous year (1991, $586 million), the substantial contraction in the value of the other export staples underlined the importance of the industry. The decrease of income from natural gas sales meant that zinc concentrates became Bolivia's single most valuable export commodity in 1992. Zinc overtook tin as the country's most important commercial metallic mineral 3 years ago. The reversal of Government policy in 1985, away from state ownership and toward the private sector, has been strongly reflected in the mining industry. The economic stability of Bolivia has become evident, and the mining industry now is much more responsive to market forces and less dependent on a single commodity than in the past. Although it had access to more credit than at any time during the past 12 years, investment capital continued to be scarce. The state mining corporation, Corporación Minera de Bolivia (COMIBOL), formerly the largest mineral producer in the country, has now focused its efforts on attracting private firms to operate its mines under joint-venture or operating contracts and had reopened some of its mines to improve their mineral output in 1992. The private mining sector, composed of medium- and small-scale mining entities and cooperatives, maintained its position as the largest producers of antimony, gold, lead, tin, tungsten, and zinc in the country. However, some of its tungsten, tin, and antimony mines—closed in previous years—stayed shut as market prices remained low. The private mining sector continued increasing its national economic importance relative to the reduced output of COMIBOL.

The decline in importance of the state mining sector reflects a number of long-term trends. History has determined that the corporation's mines were built around tin, so the low price of the metal since 1985 has rendered most of them uneconomic; a question mark hangs over the future of Huanuni, COMIBOL's remaining significant tin producer (1991 production: 3,429 tons of tin-in-concentrate). COMIBOL lost a further $15 million in 1992, according to officials. The Government has been attempting to divest itself of COMIBOL's liabilities by encouraging joint ventures whereby, in effect, the operations of individual mines would be taken over by private capital, leaving the corporation as a mere holding company responsible for overseeing exploration and attracting developers and for the less agreeable job of closing mines that proved unprofitable. COMIBOL would earn a share of any surpluses generated. The effective privatization program for COMIBOL suffered a number of setbacks in the past year. The miners and their union, the Federación Sindical de Trabajadores Mineros de Bolivia, have staged a number of protests and strikes to emphasize their opposition to joint ventures. The corporation claims to have lost $11.6 million in potential production during the first half of 1992 through work stoppages, and interruptions to production continued in the second half of 1992.

According to the Central Bank of Bolivia estimates, Bolivia's GDP growth rate in 1992 was 3.4%, down from 4.6% in 1991. The economic decline was due to adverse weather conditions that affected agricultural production and to a decrease in the price of Bolivia's principal exports (minerals and natural gas). The GDP in real terms grew to about $6.35 billion,[1] up from $6.1 billion in 1991. For the first time in more than a decade, real per capita income made significant gains. Inflation and the public debt continued under control. Inflation fell to 10.5% from 14.5% the year before, one of the lowest rates in South America.

Preliminary data showed a negative trade balance of $561 million as imports increased by 18% to $1,169 million. Exports decreased by about 21% to $608 million, owing to lower world prices for minerals and a decrease in the contract price for natural gas sales to Argentina that alone accounted for $123 million, a decrease of about 46% from that of 1991. The nonfuel mineral sector contributed about $379 million of the total exports. Bolivia urgently needed a new market for its natural gas. It signed a 20-year contract to sell natural gas to Brazil, but pipeline financing still was not determined. The Government would not seriously consider gas sales to Chile until the Brazilian deal was finalized.

GOVERNMENT POLICIES AND PROGRAMS

Despite the political uncertainty of the June 1993 presidential elections, Bolivia's market economic policies should continue more or less the same. The Bolivian Government free-market policies were now 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 had been incorporated into laws, approved by Congress and changeable only by Congress. The 1990 investment law guaranteed national treatment for foreign investors, allowed free convertibility of currency, foreign remittances, and free imports and exports of goods and services, except those affecting public health or safety. It ended price controls and allowed for arbitration (except as prohibited by the hydrocarbons law).

The 1990 mining and hydrocarbons laws allowed joint ventures with the state-owned corporations and contained a new income tax system designed so foreign investors could obtain tax credits in their home country. The mining law also allowed foreign firms to extract minerals within 50 km of the border, a mineral-rich area that was previously off limits to foreign firms, provided they have Bolivian partners with title to the mining concession. A privatization law, passed in April 1992, allowed the Government to sell off all state-owned mining companies. To date, the Government had privatized only small noncontentious companies previously owned by the regional development corporations. Most presidential candidates supported at least partial privatization of the big state-owned enterprises, including the electricity, telecommunications, and petroleum companies, although they preferred to describe the process as "recapitalization" or "reconversion."

The most attractive incentives that Bolivia offered under the new Mining Code were as follows: a 5% tax on imported machinery and equipment, a 10% tax on imported raw materials and components, a 10% tax on dividends, a 30% tax (maximum) on profits, a 100% tax exception on reinvestment of profits in the mining sector, a 100% tax exception for transformation of precious metal mining permission in the border zones, and positive host country attitude, with foreign investment welcomed by Government and the private sector. Also provided were equal treatment for foreign and local investors under the law, excellent support services and international cooperation funded by the United States Agency for International Development (USAID), and assistance programs sponsored by the United States, Germany, Japan, Inter-American Development Bank, World Bank, International Monetary Fund (IMF), and the European Community Bank.

In March 1992, GATT granted a waiver to the United States to implement its Andean Trade Preference Act (ATPA). The ATPA's beneficiaries to date were Bolivia and Colombia; the United States was considering the extension of ATPA's benefits to Ecuador and Peru.

On April 27, 1992, the environmental law, law No. 1333, was approved by the Bolivian Congress and enacted by the President of the Republic of Bolivia. Under Title I, General Provisions, Chapter I, Purpose of the Law states, under Article 1,"The purpose of the law is to protect and conserve the environment and natural resources by regulating human activities in relation to nature and by promoting sustainable development with a view to improving the quality of life of the population at large." Article 2 states, "For the purpose of this law, "sustainable development" shall be understood to be the process whereby the needs of the present generation are met without endangering the ability to meet the needs of future generations. The concept of "sustainable development" implies a worldwide undertaking of a permanent nature." Article 3 states, "The environment and natural resources are common property and their protection and utilization are governed by law and are matters of public order." Article 4 states that the law concerns the common, economic, and cultural good of the country. Title II, Environmental Management, Chapter I, Environmental Policy, Article 5, states that the purpose of a national environmental policy is to help improve the quality of life for the population based on the following action: "1. Identifying Government action that will guarantee the protection, conservation, improvement, and restoration of urban and rural environmental quality. 2. Promoting sustainable development with equity and social justice, taking the country's cultural diversity into account. 3. Promoting the preservation of biological diversity, guaranteeing the maintenance and perpetuity of the country's various ecosystems. 5. Incorporating an environmental dimension into national development. 6. Using environmental education to benefit the population at large. 7. Promoting and fostering scientific and technological research in areas relating to the environment and natural resources. 8. Establishing land-use management. 9. Creating and strengthening the vehicles, instruments, and procedures needed for developing environmental plans and strategies for the country, giving priority to formulating and maintaining natural resource accounts so as to be able to measure any changes that occur in Bolivia's natural resource capital. 10. Bringing national policies into line with developments in international policy concerning the environment, while protecting national sovereignty and interests". Chapter II refers to the Institutional Framework, while chapter III refers to environmental planning, and chapter IV to the national environmental information systems. Title III, Environmental Concerns, chapter I, addresses environmental quality; chapter II, activities and factors likely to cause environmental degradation; chapter III, environmental problems stemming from national disasters; chapter IV, environmental impact assessment; and chapter V, environmental issues in an international context.

PRODUCTION

Official figures for 1992 indicated that the value of Bolivia's nonfuel mineral production increased by about 6% to $379 million compared with that of 1991. The tin industry showed a modest increase of 7% in value as primary tin output decreased by 1.9% to 16,516 tons in 1992.

COMIBOL's overall mineral output declined in 1992 for the fourth

consecutive year. Mine output of the private mining sector surpassed past levels in 1992.

During the past 3 years, the Bolivian mining industry has tried to diversify its mineral production away from tin by increasing production of lead, ulexite, and zinc. Production of zinc reached a record figure of almost 144,000 tons and in dollar value increased 23% to about $176 million compared with that of 1991.

Lead output maintained almost the same level of production as that of the previous year, or about 20,000 tons of lead concentrate. Silver production decreased 16% below that of the previous year. There was an increase of 34% of officially recorded gold production, from 3,501 kg in 1991 to about 4,700 kg in 1992. The increase in gold production, according to official information from the Ministry of Mining and Metallurgy, was due largely to the increase in the price of gold and a decrease in gold contraband. The closure of the state mining bank strongly affected the internal gold market in the country. According to official figures, gold exported by the mining cooperatives was limited to 165 fine kg; it is assumed that about 5,000 to 6,000 fine kg of unregistered production was sold internally or was 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. The future of COMIBOL remained in doubt, having lost about $5.3 million in 1992 compared with $2.6 million lost the previous year. The mining sector work force, including the mining cooperatives, has remained fairly constant for the past 5 years at about 4% of Bolivia's total work force. *(See table 1.)*

TRADE

Nonfuel minerals and mineral fuels (oil and gas) continued to be Bolivia's leading exports; in combination they contributed about 70% of Government revenues. All minerals accounted for more than one-half of total exports. Exports of nonfuel minerals in 1992 increased 6.3% in value to $379 million, compared with that of 1991. Mine output, which started to grow in 1989, was strongly affected in the past 3 years by low international mineral prices. In spite of this, primary mine output in 1992 increased by $41 million. In 1992, Bolivia's mining exports to the United States dropped by 13.1% to $102 million. Mineral exports to European countries increased by 17% to $270 million. Zinc and tin continued to lead nonfuel mineral exports by value, along with strong performance by silver. Tin export earnings, historically Bolivia's most important mineral export, increased about 8.2% in value to $108 million in 1992. Zinc exports, the rising star among Bolivia's mineral exports, likewise jumped from 127,519 tons to 142,021 tons and in dollar value went up almost 23% to $172 million. Gold exports in dollar terms decreased by 44% in 1992. All other minerals decreased their export value, with the exception of ulexite and other nonmetallic minerals. The medium-size mining group was, for the third straight year, the largest exporter within the mining sector. This group's exports went up 39% and represented 37% of Bolivia's total mineral exports. The small miners and mining cooperatives accounted for 24% of the country's total mineral exports. The nonfuel minerals sector surpassed the hydrocarbon sector as the leading foreign exchange earner for the fifth consecutive year.

Empresa Metalúrgica de Vinto, formerly Empresa Nacional de Fundiciones (ENAF), the past foreign exchange leader in the mining sector, had an excellent year in 1992. During 1992, exports of metallic tin by Vinto decreased in volume, although their dollar value increased slightly to $77.8 million from $76.2 million in 1991. Tin export value, including metallic tin, was up 8.2% to $108 million.

In 1992, 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 42% of the national treasury's consolidated revenues. In 1992, hydrocarbons decreased from 27% to 17% by value of Bolivia's total exports. The value of exports to Argentina decreased to $123 million, compared with $228 million in 1991, owing to lower prices agreed to in May 1992 between the Governments of Bolivia and Argentina. Petroleum and refined products exports in 1992 were zero. *(See table 2.)*

STRUCTURE OF THE MINERAL INDUSTRY

The Ministry of Mining and Metallurgy and the Ministry 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 1992, COMIBOL continued to hold 5 subsidiary mining companies operating 17 mines, 1 service company, and 2 smelting subsidiary companies. The subsidiaries were: Empresa Minera Quechisla, which operated the Chorolque tin mine, the San Vicente zinc-silver mine, the Tatasi lead-zinc-silver mine, the Tasna bismuth-gold mine (joint venture with COMINESA, a subsidiary company of Specialty Metals of Denver, Colorado), and the Animas-Inocente mine under exploration; Empresa Minera de Potosí, which operated the Colavi tin mine and the La Palca tin fuming (volatilization) plant in addition to the tin/silver mine of Unificada del Cerro Rico de Potosí; Empresa Minera de Oruro, which managed five of COMIBOL's mines, a small smelter, and one service company and controlled the Huanuni Mine, the richest underground tin deposit in Bolivia, and the Bolívar,

San José, María Luisa, Santa Fé, and Poopó; Empresa Minera de La Paz, which controlled the mines of Viloco, Colquirí, and Caracoles; and Empresa Minera del Oriente, which controlled the El Mutún iron and manganese ore deposit. The U.S./Australian company MINPROC has a leasing contract signed with COMIBOL to retreat mill tailings that were produced from the Colquiri mine from 1948 until 1981. Some of the mines aforementioned were originally tin mines but shifted to producing associated metals.

GEOBOL's basic functions were to prospect for and explore the mineral resources of Bolivia. In 1991 the U.S. Geological Survey and GEOBOL concluded a 2-year program of the mineral assessment of the altiplano. The total cost of the program was $1.85 million, of which $1.35 million was financed by the U.S. Trade Development Agency (TDA) and $0.5 million was provided by USAID. TDA also financed the preparation and publication of the "Compendium of the Economic Geology of Bolivia" for the Ministry of Mining and Metallurgy.

Despite the scaling down of its operations, COMIBOL was still the major single producer of minerals in the country and could become more important and productive because it was reorganizing. COMIBOL operated about 10 mining units with the responsibility of running the Vinto tin and antimony smelter and of maintaining of the Karachipampa smelter. Furthermore, COMIBOL held promising mineral properties that had been explored in varying degrees.

In the private sector, there were 20 affiliated mining companies in 1992 under the National Association of Medium-Size Miners. Compañía Minera Salinas, S.A. (COMISAL) and the Grupo Minero Chojnacota were the new members. This group was Bolivia's and the world's largest producer of antimony and tungsten among free-market countries. It also produced gold, lead, silver, tin, ulexite, and zinc and became the most productive entity in the mineral sector.

The Small Miners Association, grouped under the Cámara Nacional de Minería, included 650 small mines operating in the country in 1992, a decrease of 150 compared with 1991. Mining cooperatives are organized under the Federación Nacional de Cooperativas Mineras and included most of the gold mining cooperatives of Tipuani, Guanay, Mapirí, and Conzata. According to the National Institute of Cooperatives, there were more than 320 mining cooperatives in the country, grouped under the wing of Federación Regional de Cooperativas, of which about 40% were mining gold in 1992, mainly in the Province of Larecaja, La Paz Department (Tipuani area). In addition to gold, cooperatives also produced antimony, copper, iron ore, manganese, salt, sulfur, tin, and tungsten.

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. *(See table 3.)*

COMMODITY REVIEW

Metals

Antimony.—Bolivia's antimony output continued to decline in 1992, falling about 17% below that of 1991 to 6,022 tons, the lowest production since 1980. Bolivia's antimony production was entirely in the hands of the private sector. A large number of producers (about 70%) were small miners. 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. A newcomer to the medium miners association, COMISAL increased production of antimony ore from 662 tons 1991 to 1,042 tons 1992 from its Mining Group Putuma in Potosí. Antimony production was entirely by the private sector, with the medium-size mining sector contributing about 86% of total production, followed by the small-size mining sector and cooperatives with 12%, and the remaining 2% by COMIBOL. In 1992, Bolivia exported 7,056 tons of antimony, a 4.2% decrease in volume and a 3.7% decline in value compared with that of 1991. Of the total amount of antimony exported, 20% was in concentrates and 76% was as antimony trioxide, with the remaining 4% as antimony alloys.

Of the total antimony exported, 45% went to Europe, 53% went to the United States, and the remaining 2% went to Asia and Africa. Bolivian primary antimony producers, through their local committee, strongly opposed the potential antimony sales program from the U.S. strategic stockpile. They suggested that the mere possibility of such sales had a negative impact on international market prices. They were also opposed to the selling at below market prices of Chinese antimony. Although the Vinto antimony smelter of COMIBOL was closed for the previous 4 years, in August 1990 it was fired up to start antimony metallic production and antimony trioxide, using a new smelting method provided by Laurel Industries of Ohio, United States.

The private Palala antimony smelter of Hermanos Bernal in Tupiza, Department of Potosí, produced 527 tons of antimony trioxide in 1992, 15% less than in 1991.

Gold.—Official gold production in Bolivia increased in volume and value 34% and 27%, respectively, to 4,688 kg. Legal gold exported totaled 1,963 kg, a decrease of 42% compared with the previous year. From this total 165 kg was exported as gold bars and 1,798 kg as precipitated gold. Private exporting of gold was legalized in August 1985 by Supreme Decree 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 at 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 richest and most productive alluvial gold deposits are located 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 exploited from the Madera and Madre de Dios Rivers. U.S. Embassy officials in Bolivia estimated that "unofficial" gold production in the Araras region in 1992 may have been more than 10,000 kg. The principal source of gold production in Bolivia continued to be the 128 gold mining cooperatives operating in the gold fields of Guanay, Huayti, Mapirí, Teoponte, Conzata, and Tipuani (120 km north of La Paz), which accounted for approximately 64% of total production. The medium-size mining sector contributed 36% of total output. Most of the gold cooperatives are small-size operations, poorly organized, and seriously undercapitalized. However, these gold cooperatives were anxious and willing to establish joint ventures with nationals or foreign investors.

In the medium-size mining sector, Empresa Minera Inti-Raymi S.A. has become the largest private gold producer in Bolivia. Inti-Raymi was mining gold at its Kori Khollo open pit mine, next to the old La Joya Mine near Oruro, at the rate of 1,675 kg/a of gold and 10,849 kg/a of silver. The Kori Khollo volcanic plug was mined out of the shallow oxide cap that had approximately 5 Mmt of ore, which was processed in the old leaching facility. Inti-Raymi has begun constructing a 14,500-mt/d carbon-in-pulp facility at an anticipated cost of $163 million. Construction of the facility started in January 1992, and the mechanical completion of the expansion of the Kori Khollo was finished by MINPROC in December 1992, 2 months ahead of schedule.

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, United Mining Corp., Cyprus Minerals Co., and Tipuani Development Co., S.A., who purchased the gold dredge of Compañía Minera del Sur S.A. (COMSUR). Pan American Mining, Nevada Manhattan, Domestic Petroleum Investments Inc., and General Mining Co. In addition, there were several small gold operations involving small U.S. investors in the Guanay, Yuyo, Mapirí, and Teoponte areas that had operating contracts with local gold mining cooperatives.

Iron Ore.—Production and exports of iron ore decreased almost 66% and 39%, respectively, in 1992 below the 1991 level. 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 and signing of a contract in October 1989 to supply 177,000 tons of iron ore (62% iron). ACEPAR was to receive 12,000 tons per month of iron ore with an agreed price of $12.50 per ton f.o.b. Puerto Ladario in the Paraguayan River. In 1992, EMEDO exported almost 35,000 tons of iron ore to Paraguay, compared with 25,000 tons in 1991. The iron ore exported was worth about $437,000. As was the case in 1990 and 1991, ACEPAR did not buy enough iron ore in 1992 to fulfill its contractual obligations.

EMEDO was not programmed to produce any iron ore in 1993 because it has more than 145,000 tons of iron ore stocked at its Mutum iron mine.

Lead, Silver, and Zinc.—Production of lead ore and concentrate decreased 4%, silver was down 16%, and zinc was up 11% compared with that of 1991. Output of metallic lead, including alloys, recovered by 124% from the depressed level of the previous year. Output of metallic silver increased 15% above that of 1991. The medium-size mining sector was the dominant lead and zinc producer, with 62% of total lead and 58% of total zinc. In this sector, the major producers were Cía. Quioma, S.A. and COMSUR. All the production of COMSUR came from the Porco zinc-lead-silver mine. Other lead and zinc producers were El Caballo Blanco, S.A. and Tiahuanacu Ltda., which had a 50-50 joint-venture with the U.S.-Canadian company JORDEX. In 1992, about 51.3% of COMIBOL's zinc production came from the Colquiri Mine in La Paz. The rest came from the Poopó-Machacamarca and Santa Fe Mines in Oruro, the San Vicente Mine in Quechisla, and the Unificada Mine in Potosí. COMIBOL registered 106,566 tons of ore as produced from the Bolívar Mine, the largest zinc mine in Bolivia. Bolivia does not have a zinc smelter, and all past and limited metallic production came from Vinto's tin refinery. Vinto together with four primary zinc producers—COMSUR, Tiawanacu, Tuntoco, and Asunción—and COMIBOL were considering the construction of a 100,000-mt/a zinc smelter.

COMIBOL mines continued to be the largest silver producers in the country with 35% of total output. The medium-size mines produced 34% and the small mines 31% of total silver. COMSUR, Bolivia's largest private-sector mining firm, continued to be the largest private silver producer in Bolivia. It mined the Porco zinc-lead-silver deposit and operated a new 1,100-mt/d flotation mill. It also acquired the Cascabel lead-silver mine (400 mt/d) from Alameda Ltda., where production continued in 1991. The Quioma Ltda. mining company, a subsidiary company of COMSUR, mined the zinc-lead-silver deposit of Asientos in Cochabamba. COMSUR partially owns the mining company Caballo Blanco, which mines the zinc-lead-silver mine of Huari Huari. COMSUR, through its subsidiary company Compañía Minera

Conception (COMCO), also opened a 700-mt/d heap-leaching plant in mid-1988, which later expanded to 1,000 mt/d. The plant treated old tailings of the Cerro Rico de Potosí Mine area (averaging 180 g/mt of silver content) purchased by COMCO from the mining cooperatives.

Tiawanacu Ltda., a 50-50 joint venture with the U.S.-Canadian company JORDEX, was another of the large private zinc-silver producers in Bolivia. Tiawanacu operated its own Monserrat Mine and COMIBOL's San Francisco Mine, under a 10-year lease, and two mills. One of its mills is in Poopó and was recently enlarged to treat 500 mt/d; the other is in Potosí (250 mt/d). Most of the ore treated in Tiawanacu's mills was purchased from the small miners sector and cooperatives. In addition, the Poopó mill purchased about 300 mt/d of zinc ore from COMIBOL's Bolívar Mine. Tiawanacu expressed interest in leasing COMIBOL's Poopó zinc-tin-silver mine. Resurrección Minera S.A. (REMINSA) was owned by the Canadian company Golden Star and operated the Carguaicollo Mine with a 250-mt/d mill to treat tin-zinc-silver complex ores. Golden Star sold its properties and left the country in early 1991. This decision was taken because exploration in Carguaicollo showed limited reserves.

Other smaller medium zinc producers were Maragua Ltda., San José de Berque, and Bernal Hermanos, all operating zinc mines located in Potosí Department. COMIBOL's zinc production was 24% of the country's total zinc production; the medium miners sector contributed 57% and the remaining 19% was by the small miners sector. Zinc concentrate exports increased almost 29% in 1992 to an alltime record of 127,519 tons (metallic content). No exports of metallic zinc were made in 1992.

Tin.—Bolivia's relative position as a world tin producer remained in fourth place after Brazil, Malaysia, 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. Tin output amounted to 28.4% of the country's total 1992 minerals export value, compared with zinc exports that increased to 45.5% of the total export mineral value. Bolivia's primary tin output decreased in volume by 1.8% to 16,516 tons (this figure does not include 31.8 tons produced as metallic tin by the medium-size mining company Hormet S.A.). The largest production increase in the private sector was by the small-size mines and cooperatives, which for the sixth consecutive year replaced COMIBOL as the leading tin-producing sector, and in 1992 accounted for about 66% of Bolivia's tin production. The COMIBOL mines produced about 34% 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. This effort was not seconded by the Executive Branch, which showed lack of political will to do so. The strong opposition from the miners' unions to COMIBOL's joint-venturing program, coupled with the assertions by some legislators that the already-signed contracts were illegal, were the reasons for the Executive Branch's indecision. The World Bank's loan for COMIBOL's rehabilitation plan, which was intended to reopen some mines that could be exploited without economic losses, was set aside, causing disorder in the Ministry of Mining and Metallurgy and COMIBOL's policies. The World Bank was then determined to work only on a privatization program for COMIBOL. The future of COMIBOL remained in doubt, the company having lost about $5.3 million in 1992 compared with $ 2.6 million lost the previous year. COMIBOL's tin production in 1992 decreased to 5,662 tons from 7,375 tons 1991, and the company probably would have a hard time maintaining the current level of production in the next 3 to 4 years. Despite continuing to be Bolivia's largest single silver producer, production in 1992 was down 32.5%, output of zinc was also down about 12%, and lead dropped by 38% compared with that of the previous year. COMIBOL did not produce any bismuth-in-concentrate from its Tasna Mine. Iron ore production from COMIBOL's Mutún Mine had a drastic drop to 34,945 tons from 101,642 tons mined in 1991 because the company was forced to close its Mutún Mine operation in May 1992. COMIBOL signed a joint venture with COMINESA, a subsidiary company of Specialty Metals of Denver, Colorado, for the Tasna Mine. Only a few leasing contracts were fulfilled. COMIBOL's Huanuni Mine became the largest and the richest tin mine in the country since its reopening in September 1988. Huanuni's tin ore production in 1992 decreased almost 29% to 2,400 tons of tin content, although Huanuni was programmed to produce 4,410 tons 1992. The Colquirí tin mine, with its new 1,000-mt/d mill for ores carrying 1.2% tin and 6.6% zinc, is COMIBOL's second largest tin producer.

COMIBOL signed five leasing contracts with domestic and foreign companies that have made investment commitments of about $150 million. The main foreign companies involved in the exploitation of tin mines were the Canadian-Australian-U.S. company MINPROC and the Brazilian company Paranapanema, with which a joint-venture agreement to recycle tin tailings from Catavi was not implemented. The MINPROC project is for the exploitation of the old zinc-tin-silver tailings of the Colquirí Mine. The contract was scheduled to be signed in December 1992 for a 10-year period for an estimated investment of $70 to $90 million. Production at Catavi-Siglo XX, previously the largest underground tin mine in the world, stopped when the mine closed in 1986. Catavi's large mine and mill dumps were being mined by cooperatives formed by former COMIBOL miners who produced 242 mt/d of tin.

The state-owned Vinto tin smelter (formerly operated by ENAF) increased its exports to 14,276 tons of metallic tin (99.95% average tin content) in 1992 and sold to Bolivian customers 118 tons (worth about $813,000) of metallic tin. About 83% of Bolivia's metallic tin

exports went to the United States and the rest to seven Latin American countries, Germany, and Holland. Crude alloys were not exported since 1991. Vinto exported for the first time 51.1 tons of metallic lead. Tin alloys with metals, such as antimony, bismuth, copper, and lead, were sold by companies that included Bera of Bolivia, Bolimex, Fundiciones Hormet, Comintex Trading, and Sara Importaciones S.R.L. The Vinto smelter projected production of about 14,000 tons of metallic tin in 1992, but owing to a larger local primary tin output plus the availability of Peruvian tin, Vinto was able to produce 14,670 tons. The smelting was done in the high-grade smelter's furnaces, and the refining occurred in the low-grade smelter units.

Auction sales from the U.S. Government tin strategic stockpile continued to be a source of great concern to the Bolivian tin producers and Government authorities. Available surplus material for future disposal has added to concern about possible market disruption. During 1992, Vinto smelted 5,820 tons of antimony-in-concentrates to produce 4,306 tons of antimony trioxide. The plan for 1993 is to smelt 4,500 tons of ore to produce 3,200 tons of antimony trioxide. Vinto's labor force in December 1992 was 699 workers, down from 940 in 1991 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 1,073 tons in 1992 from 1,343 tons in 1991. The mines that were closed in previous years owing to severe ore depletion and high operating costs did not resume operations. Increased production came from the small miners and cooperatives that have small deposits with high ore grades and low labor costs. COMIBOL ceased production in 1986 due to severe ore depletion and high mining 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 Corporation 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 Corporation 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 1992, total cement sold in the country was about 510,000 tons, the same as in 1991. During 1992, production of cement increased by about 1.5% from that of 1991. Production of clinker in 1992 was about 550,000 mt/a, but U.S. Embassy officials estimated the output of limestone from quarries near the cement plants at more than 900,000 mt/a. The Yacuses limestone deposit, with 60 Mmt of reserves in eastern Bolivia in Santa Cruz Department, is jointly owned by the Regional Development Corporación of Santa Cruz and private entrepreneurs (Roda Group). The owners planned to install a 345,000-mt/a cement and clinker plant. The new company would be named Compañía de Cemento Camba, S.A.M. The project is still in the planning stage. Another project, in Sevaruyo, 125 km south of the city of Oruro, is where a 150,000-mt/a cement plant was to be built. Due to current financial problems, this project has been postponed indefinitely.

Lithium.—On May 22, 1992, Bolivia's procurement consultant, Crown Agents, presented to the Ministry of Mining and Metallurgy its recommendations on the bids received to exploit the brine deposits of the Salar de Uyuni. Three companies presented tenders for the exploitation of boron, lithium, magnesium, and other salts. The U.S. company Lithium Corporation of America (LITHCO), of North Carolina, a subsidiary company of FMC Corporation (FMC-LITHCO), offered a bid judged the best, and the Ministry of Mines invited the company to start negotiations with Complejo Industrial de Recursos Evaporíticos del Salar de Uyuni for the signing of a joint-venture contract. Crown Agents also recommended that the winning tender be renegotiated to gain more economic benefits for the Bolivian Government. After almost a year of negotiations, the contract was signed by the Minister of Mines and Metallurgy and FMC-LITHCO's President at the Salar de Uyuni. In July 1992, the Bolivian National Congress approved the contract, but made some modifications to it. 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 controversial internal discussions between the Executive Branch and congressional members, followed by negative press publications on the project, FMC-LITHCO sent a letter to the Ministry of Mining and Metallurgy ending its 5-year negotiations 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 apparently a saga that has troubled Bolivian officials for the past 4 years. FMC-LITHCO negotiated a total of three contracts with Bolivia, the first with the previous Government and the last two with the current administration in 1992. FMC-LITHCO was dismayed that Congress subsequently added clauses to the last contract. The main issue was the Government's offer to tax FMC-LITHCO at a lower rate than it taxes anybody else. Congress said that FMC-LITHCO would have to pay at the full rate and refused to allow FMC-LITHCO exclusivity. FMC-LITHCO had been prepared to invest $92 million in the country initially and to increase this to $200 million over 20 years. According to the contract, FMC-LITHCO would have produced 400,000 tons of lithium over the 40 years of the contract and paid the state $1.6 billion in royalties.

Mineral Fuels

Bolivia's hydrocarbon sector's participation in the worldwide energy picture remained negligible, a position not expected to change soon. However, Bolivia continued to be self-sufficient in crude oil, natural gas, and refined petroleum products. In 1991, crude oil production decreased by 4.2% to 7.8 Mbbl compared with that of 1991.

In 1992, Bolivia's oil and gas industry dropped to third place in the Bolivian export sector, after nonfuel minerals and nontraditional goods. In 1992, hydrocarbons decreased from 27% to 17% by value of Bolivia's total exports. The sector accounted for 6.2% of the GDP and it employed about 5,600 persons out of a total work force estimated at 2 million. The industry continued to be controlled by the Ministerio de Energía e Hidrocarburos through its agency Yacimientos Petrolíferos Fiscales Bolivianos (YPFB).

YPFB conducted exploration, production, refining, transportation, and marketing in 1992. YPFB has signed 37 operational contracts since 1973, when the former hydrocarbon law was implemented. Of this total, three were exploration contracts to explore new areas in the altiplano central and in the northern sub-Andean zone. In March 1992, Phillips Petroleum Co. Bolivia, a subsidiary of Phillips Petroleum Co. of Bartlesville, Oklahoma, signed a 30-year operational contract with YPFB to explore the Curahuara de Carangas Block in the altiplano central. In May 1992, the wholly owned Bolivian company Sociedad Petrolera del Oriente S.A. signed a combined exploration and enhanced secondary-recovery contract to explore 78,500 ha of the Palmar de Oratorio Block just southwest of the city of Santa Cruz plus enhanced recovery of the Palmar field. Also on May 1992, the wholly owned Bolivian company Compañía Petrolera de Exploración y Explotación S.A. signed a 30-year operational contract with YPFB to explore 305,125 ha of the Lagunillas Block in the sub-Andean zone in the Departments of Chuquisaca and Santa Cruz. During 1992, YPFB continued to negotiate exploration contracts with Pluspetrol, S.A. of Argentina to explore the Los Lirios-Surutu Block in the Department of Santa Cruz and with the British-Irish company Pan Andean to explore the Chapare Block, just northwest of the Maxus Tract, in the Departments of Cochabamba, Santa Cruz, and Beni. Petrobrás of Brazil continued with its application for exploration in the Madre de Dios Basin. Petroleum reserves were estimated by YPFB as of yearend, at 108.39 Mbbl of liquids (88.36 Mbbl for YPFB and 20.03 Mbbl as proven reserves of contractors). Bolivia's crude reserves at current production and consumption could last for another 13 to 14 years. Bolivia's crude oil reserves were estimated at about 438.9 Mbbl.

Natural Gas.—Production of natural gas increased 1.7% from that of 1991 to 5,522 Mm^3. YPFB's Río Grande Gasfield continued to be Bolivia's largest natural gas producer, although its production was slowly dropping due to depletion. Vuelta Grande's output, YPFB's second largest natural gas producer, increased 9.5%. Production from the new fields of Sirari and San Roque increased 19.3% and 8%, respectively. YPFB's total natural gas production increased 7% as the contractors' production, on the other hand, dropped 7.9%. Occidental Boliviana's Porvenir Gasfield and Tesoro Bolivia's La Vertiente Gasfield decreased 16.8% (continuing the downtrend started 5 years ago) and increased 19.2%, respectively. Of the total production of natural gas, 68% was produced from YPFB gasfields and 32% by private contractors.

Bolivia's domestic consumption of natural gas continued to be minimal at 575 Mm^3, 23.3% of the total produced over that of 1991. The major consumer of natural gas in 1992 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 1992, Bolivia's LPG consumption increased 28.3% from 1.72 Mbbl in 1982 to 2.20 Mbbl in 1992. About 60,500 barrels of LPG was exported to Chile valued at $942,000.

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 5 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 $1.00 per MBtu from May 1, 1992, through the end of 1993, or about one-third the price that Argentina paid during 1991. During 1992, Bolivia exported to Argentina 2,126 Mm^3, a decrease of 2.4% compared with 1991. Revenues from gas exports, at $122.8 million, were 46.1% lower than in the previous year. Of the total natural gas produced in Bolivia, 36.3% was exported to Argentina; 11.8% was consumed domestically; 35.1% was reinjected into the gasfields; 10.6% was vented, flared, or lost; 4.6% 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 2.4 Mbbl in 1991 to 2.5 Mbbl in 1992. In 1991 and 1992, 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.

On March 25, 1992, Petróleo Brasileiro S.A. (Petrobrás) and YPFB agreed to construct 563 km of 71-cm diameter gas pipeline from 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 to export 8 Mm^3/d of natural gas. They also agreed to increase the export volume to 16 Mm^3/d after the seventh year. Based on the March agreement, Petrobrás and YPFB in August 1992 signed a preliminary contract for the sale/purchase of natural gas with a starting price of $0.90 per 1,000 Btu at the entrance of the pipeline.

Trans-Andean Partners, Inc., a consortium of U.S. firms, presented to the Bolivian Government a proposal for the construction and operation of 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 4.2% to 21,180 bbl in 1992 from 22,174 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 23,657 m, 45.4% less than that in the previous year. YPFB made three new oil discoveries, the Tundy X-2, Puerto Palos X-1, and Katari X-1. A fourth productive exploratory well was the Yapacani X-14, discovered in a new oil-bearing formation in the Yapacani oilfield. Domestic consumption of refined petroleum products increased about 0.5% above that of 1991, to 25,322 bbl/d. The domestic prices for refinery products were revised only once (January 2, 1992). 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 January 1993. Internal sales of finished products, including LPG and natural gas, totaled the equivalent of $489.2 million compared with $466.4 million in 1991.

Reserves

In keeping with the 1989 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 1992, were 108.39 Mbbl. YPFB's proven reserves total 88.36 Mbbl or about 82% of the total crude oil proven reserves.

The contractors' crude oil proven reserves amounted to 20.03 Mbbl or 18% 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 35% are crude oil and 65% 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 yearend 1992, were 165.6 billion m^3, of which 111.2 billion m^3 is proven (remanent) reserves. YPFB's proven natural gas reserves are 88 billion m^3, or 79% of the total proven reserves, and the contractor's total stood at 24 billion m^3. Original natural gas reserves were 176.1 billion m^3. Natural gas reserves were adequately quantified and certified by YPFB officials.

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 occur, blocking them temporarily. In the eastern plains, the flooding of rivers is a serious problem, preventing deliveries of supplies and food to the consumers. Nevertheless, Bolivia has a reasonably well-developed infrastructure. The transportation network is composed of a total of 38,836 km of highways, 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 Argentina and Brazilian consumers. Bolivia has 14,000 km of commercially navigable waterways that connect the eastern region of the country with the Amazon basin.

About 13.6 Mbbl of crude oil and condensates, 5.6 Mbbl of refined oil products, and 121.0 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 Ministry of Energy and Hydrocarbons formulated national policies for the electrical power sector and regulated power systems operations. The generation, transmission, and distribution of electrical power in Bolivia was carried out by both state and private companies. ENDE, the state-owned electricity company, was in charge of planning the expansion of the electrical power sector. It was also responsible for contracting and operating new generation and transmission facilities everywhere, except in the cities of La Paz and Oruro. As for the electricity supply for the country, an estimated 1,763 MkW • h was produced in 1990, an increase of 2% over that of 1989. The average consumption was 260 kW • h per capita. Bolivia had an installed electrical generating capacity of 605 MW, of which 301 MW or about one-half, was generated by hydroelectric plants and the remaining by thermoelectric plants. ENDE has an installed generating capacity of 318.1 MW (53% of Bolivia's total). The privately owned Bolivian Electric Power Co. (COBEE-BPC), originally Canadian, has 140.3 MW of installed capacity (24% of the country's total). COBEE-BPC supplies electricity to the cities of La Paz and Oruro.

On March 9, 1984, the Bolivian Government signed a joint project agreement with the Italian Government and the United Nations Development Program to prepare a feasibility study of the geothermal potential in the western Cordillera region of the country. YPFB and ENDE were assigned as the national counterpart agencies. The geological fieldwork and preliminary drilling was done by the Bolivian GEOBOL, with technical assistance from the Italian Government. Four wells have been drilled by YPFB and ENDE at the geothermal field of Laguna Colorada, about 220 km southwest of the town of Uyuni, Department of Potosí, and about 11 km east of the Bolivian-Chilean border. ENDE's plan to install a pilot geothermal plant with Italian funding has not made any progress, owing to a lack of total financing.

OUTLOOK

The Bolivian Andean mineral belts and the eastern Precambrian shield hold substantial mineral wealth. These mineral resources 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. The exploitation of Bolivia's mineral base is strongly dependent on international mineral market prices and investments.

Prospects for Bolivia's mineral industry continued to improve in 1992. Foreign investment in exploration for mineral deposits has accelerated in the past 5 years, after foreign investors became confident that the economic reforms introduced by the Government beginning in 1985 would endure. It was expected that in the near future new private investment in primary gold deposits would tend to increase exports of precipitated gold, gold-in-concentrates, or unrefined gold. 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 persist. The mining sector has received numerous proposals and inquiries from potential foreign investors from South Africa, Canada, the United Kingdom, Australia, 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 may offer the private sector good opportunities for joint-venture or lease contracts. 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 was also expanding. Nevertheless, Bolivia continued to be one of the poorest countries in Latin America, and it remained vulnerable to price fluctuations for its limited exports, mainly nonfuel minerals and natural gas.

Bolivia's 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, together accounting for 69% of the total exports. Minerals accounted for 52% and hydrocarbons for 17% of total 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. Bolivia and Argentina signed on March 20, 1992, an additional agreement that fixes a lower export price for natural gas sales at $1.00 per MBtu from May 1, 1992, through the end of 1993. This represents about one-third the price that Argentina paid during 1991. Bolivia's earnings from natural gas

exports to Argentina are projected to drop from $228 million in 1991 to about $75 million in 1993. Future generation of electrical power from geothermal fields at Laguna Colorada could be sold to existing mining interests in the Uyuni salt flat area or might attract new mining exploitation interest to the area of South Lipez, where sulfur and low-grade epithermal gold-silver deposits exist near Laguna Colorada.

Natural gas 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 efforts centered on privatization programs to attract private capital to operate its mines under contract or joint-venture agreements. The World Bank is providing assistance for a privatization program for COMIBOL. Future resource development is likely to focus on continued expansion of the hydrocarbon sector, as well as the development in a rational manner of Bolivia's gold industry and the iron ore-steel prospects at the Mutún deposit near Brazil. Planned medium-term mining projects include continuation of COMIBOL's rehabilitation program, the lithium and potassium projects, and the expansion of sulfur production and gold from alluvial deposits. The Bolivia-Brazil energy integration agreement includes the selling of electricity generated by a natural gas-fired thermo-electric 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.

[1]Where necessary, values have been converted from bolivianos ($b) to U.S. dollars at the rate of $b3.9=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Ministerio de Minería y Metalurgia
Ave. 16 de Julio 1769, Casilla 8686
La Paz, Bolivia
Telephone: (02) 379310

Ministerio de Energía e Hidrocarburos
Ave. Mariscal Santa Cruz 1322
La Paz, Bolivia
Telephone: (02) 374050

Corporación Minera de Bolivia (COMIBOL)
Ave. Mariscal Santa Cruz 1092
Casilla 349
La Paz, Bolivia
Telephone: (02) 354044

Empresa Metalúrgica Vinto (EMV)
Casilla 612
Oruro, Bolivia
Telephone: 52857

Instituto Nacional de Inversiones (INI)
Calle Colombia 263
Casilla 4393
La Paz, Bolivia
Telephone: (02) 375730

Yacimientos Petrolíferos Fiscales Bolivianos (YPFB)
Calle Bueno, Casilla 401
La Paz, Bolivia
Telephone: (02) 356540

Asociación Nacional de Mineros Medianos
Edif. Petroleros
Ave. 16 de Julio 1616, of 4
Casilla 6094
La Paz, Bolivia
Telephone: (02) 352223

Cámara Nacional de Minería
Bernardo Trigo 429
Casilla 2022
La Paz, Bolivia
Telephone: (02) 350623

Corporación de las Fuerzas Armadas Para El Desarrollo Nacional (COFADENA)
Ave. 6 de Agosto 2649
Casilla 1015
La Paz, Bolivia
Telephone: (02) 37305

Servicio Geológico de Bolivia (GEOBOL)
Calle Federico Zuazo 1673
La Paz, Bolivia
Telephone: 377310

Instituto de Investigaciones Minero-Metalúrgicos (IIMM)
Casilla 600
Oruro, Bolivia

U.S.Embassy-La Paz; Economic Section, (Fernando Urquidi)
APO AA 34032
Telephone: 591-2-350251
Fax: 591-2-359875

Publications

Ministerio de Minería y Metalurgia, La Paz City: Boletín Estadístico Minero Metalúrgico, monthly.

Asociación Nacional de Mineros Medianos, La Paz City: Minería Mediana-Memoria 1990, 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-1992; Bolivian Petroleum Industry-Development and Outlook-1992. April 1993.

U.S. Embassy,-La Paz, Bolivia: Annual Petroleum and Natural Gas Questionnaire, Bolivia, for calendar year 1992 (SPR-4255).

Annual Minerals questionnaire for Bolivia, Calendar year 1992 (SPR-4291).

Banco Central de Bolivia. Boletín Estadístico, No. 270, June 1992.

TABLE 1

BOLIVIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[p]
METALS[3]						
Antimony:						
Mine output, Sb content		9,943	9,189	8,454	7,287	6,022
Metal including Sb content of trioxide		1,015	1,236	1,046	3,548	5,670
Arsenic, mine output, arsenic trioxide, arsenic sulfide		191	338	300	463	633
Bismuth:						
Mine output, Bi content		13	41	68	—	—
Metal, smelter		—	—	137	—	30
Cadmium, mine output, Cd content[4]		39	79	102	115	71
Copper, mine output, Cu content		153	298	157	30	101
Gold, mine output, Au content[5]	kilograms	4,889	3,595	5,198	r3,501	4,688
Iron ore:[6]						
Gross weight		33,840	14,254	125,264	101,642	55,486
Fe content		21,319	8,980	78,916	72,148	34,956
Lead:						
Mine output, Pb content		12,544	15,728	19,913	20,810	20,010
Metal, smelter		24	12	117	213	261
Manganese, mine output, Mn content		—	100	3,778	215	100
Silver, mine output, Ag content[7]	kilograms	231,766	267,084	310,543	375,702	282,350
Tantalum, tantalite	do.	—	—	583	3,735	2,722
Tin:						
Mine output, Sn content		10,504	15,849	17,249	16,830	16,516
Metal, smelter		5,373	9,448	12,567	14,663	14,393
Alloys		—	—	832	261	75
Tungsten, mine output, W content		900	1,118	1,014	1,065	851
Zinc: Mine output, Zn content		56,957	74,789	103,849	129,778	143,936
INDUSTRIAL MINERALS						
Barite		—	—	300	1,277	368
Bentonite		—	—	—	825	454
Calcite (limestone)		e600	e500	300	r480	e500
Cement, hydraulic		452,285	505,426	560,446	591,630	600,288
Gemstone, amethyst:						
Polished	kilograms	—	—	50	254	3
Rough	do.	—	—	—	r32,147	47,234
Gypsum, crude[e]		100	100	100	r4,000	e6,000
Marble		187	70	81	37	67
Onyx	kilograms	—	—	—	10,800	104
Pumice[e]		—	200	100	100	100
Quartz	kilograms	—	—	—	—	100
Salt		e100	60	155	r255	e260
Sandstone		—	—	—	—	119
Slate		—	84	104	14,820	e5,000
Sodalite	kilograms	—	—	—	4,170	e3,000
Sulfur, native		6,733	8,167	2,101	2,782	15
Ulexite		586	9,609	3,076	r14,226	23,244

See footnotes at end of table.

TABLE 1—Continued

BOLIVIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[p]
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	4,811	5,291	5,276	5,432	5,522
Marketed	do.	2,520	2,565	2,203	2,178	2,126
Natural gas liquids:						
Natural gasoline	thousand 42-gallon barrels	544	627	732	814	775
Other (consumption)	do.	e2,600	2,628	2,040	1,847	1,816
Petroleum:						
Crude including condensate	do.	7,019	7,274	7,635	8,094	7,752
Refinery products:						
Liquefied petroleum gas	do.	878	1,106	e1,200	570	511
Gasoline	do.	3,266	3,504	e3,400	3,297	3,224
Jet fuel	do.	578	631	e600	683	669
Kerosene	do.	325	317	e300	269	262
Distillate fuel oil	do.	2,067	2,252	e2,560	2,828	2,848
Lubricants	do.	107	75	e100	90	70
Residual fuel oil	do.	208	106	e90	816	202
Unspecified	do.	311	164	e200	1,217	1,933
Refinery fuel and losses	do.	33	—	e50	—	—
Total	do.	7,773	8,155	e8,500	9,770	9,719

eEstimated. pPreliminary. rRevised.

[1]Table includes data available through July 1993.

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

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

[7]Includes production of 38,692 kg of metallic silver in 1991 and 47,526 kg in 1992.

TABLE 2

BOLIVIA: EXPORTS OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1991	1992	Principal destinations, 1992
METALS			
Antimony:			
Ore and concentrate, Sb content	3,820	1,385	NA.
Trioxides	3,075	5,383	NA.
Metal including alloys:			
Regulus	13	—	
All forms	461	288	NA.
Total	3,549	5,671	United States 2,272; United Kingdom 2,554; Chile 827.
Arsenic: Trioxides and other compounds	463	633	NA.
Bismuth: Metal including alloys, all forms	—	17	United States 17.
Cadmium: Cd content of zinc ore	26	5	NA.
Columbium and tantalum: Tantalum ore and concentrate kilograms	3,735	2,722	NA.

See footnotes at end of table.

TABLE 2—Continued

BOLIVIA: EXPORTS OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	1992	Principal destinations, 1992
METALS—Continued				
Copper: Ore and concentrate, Cu content		25	101	NA.
Gold:				
Ore and concentrate, Au content	kilograms	1,458	1,799	NA.
Metal including alloys, unwrought and partly wrought	do.	1,899	165	NA.
Iron and steel: Iron ore and concentrate, Fe content		24,853	34,600	NA.
Lead:				
Ore and concentrate, Pb content		19,393	20,585	NA.
Metal including alloys		116	58	All to Germany.
Manganese: Ore and concentrate		1,215	100	NA.
Silver:				
Ore and concentrate, Ag content	kilograms	299,431	327,194	NA.
Metal including alloys, unwrought and partly wrought	do.	41,353	42,242	France 26,982; United Kingdom 12,024; Germany 1,970; United States 1,266.
Tin:				
Ore and concentrate, Sn content		3,522	3,359	NA.
Metal including alloys, all forms		14,512	14,363	United States 11,842; Venezuela 657; Netherlands 650.
Tungsten: Ore and concentrate, WO_3 content		1,495	1,076	NA.
Zinc: Ore and concentrate, Zn content		127,519	142,021	NA.
INDUSTRIAL MINERALS				
Barite		1,277	368	NA.
Boron materials:				
Crude natural borates		12,225	21,364	NA.
Oxides and acids		—	965	NA.
Clays, crude: Bentonite		825	454	NA.
Precious and semiprecious stones other than diamond: Natural	kilograms	[2]43,254	[3]151,334	NA.
Stone, sand and gravel: Dimension stone: Crude and partly worked		152	186	NA.
Sulfur, all forms		2,795	15	NA.
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural	million cubic meters	2,178	2,126	All to Argentina.
Petroleum refinery products: Liquefied petroleum gas	thousand 42-gallon barrels	125	61	All to Chile.

NA Not available.

[1]Table prepared by H. D. Willis. Table includes partial provisional export data. Import data for 1991 and 1992 were not available at time of publication.

[2]Amethyst and onyx.

[3]Amethyst, onyx, and red quartz.

TABLE 3

BOLIVIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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	5.2.
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	2,472.
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. (U.S.) and Empresa Naviera Pérez-Compac-Sacfic (Argentina) contractors (private, 100%)	El Porvernir and La Vertiente Gasfields, Santa Cruz Department	66,100.
Gold	kilograms	Cooperatives (some with U.S. equity) (private, 100%)	Tipuani, Guanay, Mapirí, 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 U.S.)	Asientos, lead-silver-zinc mine at Mizque, Cochabamba Department	6.5.
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	4,500.
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	1,200.
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, Poopó, Santa Fe, San Vicente, Tatasi, Animas-Inocente, and Unificada Mines at Oruro, 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	97,000.
Tin		COMIBOL: Cía. Minera de Oruro, Cía. Minera Quechisla, Cía. Minera de Potosí and Cía. Minera La Paz (Government, 100%)	Huanuni, Colquirí, Caracoles, Viloco, and Chorolque Mines, at Oruro, Potosí, and La Paz Departments	5.7.
Do.		COMSUR, Barrosquira, International Mining Co., Yana Mallcu and Avicaya companies (private, 100%)	Martha, Cerro Grande, Milluni, and Berenguela tin mines	.8.
Do.		Small miners and cooperatives (private, 100%)	Catavi-Siglo XX, Caracoles, Bolívar Viloco, Colquirí, and Colquechaca Mines	10.0.

TABLE 3—Continued

BOLIVIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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	14.3.
Do.	Fundestano de Oruro S.A. (private, 100%)	City of Oruro, Oruro Department	.05.
Do.	Cía. Metalúrgica Industrial y Comercial-Hormet S.A. (private, 100%)	City of La Paz, La Paz Department	.25.
Tungsten	COMIBOL-Cía. Minera La Paz (Government, 100%)	Kami, Tasna, and Bolsa Negra Mines, La Paz Department	Closed since 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, Colquirí, San Vicente, Tatasi, Animas-Inocente, and Unificada Mines at Oruro, Potosí, and La Paz Departments	27.8.
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	83.5.

TABLE 4

BOLIVIA: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1992

(Metric tons unless otherwise specified)

Commodity		Reserves
Antimony, metal content		350,000
Lead, metal content		63425,965
Lithium carbonate	thousand metric tons	5,500
Natural gas	billion cubic meters	166
Petroleum	million 42-gallon barrels	20.03
Silver, metal content		1,378
Tin, metal content		274,774
Tungsten, metal content		53,000
Zinc, metal content		935,497

BRAZIL

AREA 8.5 million km² **POPULATION 158 million**

THE MINERAL INDUSTRY OF

BRAZIL

By Alfredo C. Gurmendi

Brazil is a world-class producer of important minerals to the global economy, such as bauxite, columbium, gemstones, gold, iron ore, kaolin, manganese, tantalum, and tin. Within the Latin American region, Brazil is a leader in producing 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 in 1992.

The Brazilian economy during 1992 experienced difficulties because of political uncertainties and postponement of investment decisions, which provoked a rocky period for the Brazilian stock market in the last quarter of 1992. For instance, in November alone, the shares of TELEBRÁS, the State-owned telephone company, lost 27% of its value, decreasing to $40 billion from $67 billion in April 1991. Because Brazil's privatization program was being conducted via stock auctions on the Rio de Janeiro and São Paulo exchanges, remarkable bargains were available, motivating the flow of foreign investments that were stimulated by the removal of onerous restrictions on foreign institutional investors in May 1991. Since then, there has been a steady and growing flow of fresh capital from developed world insurance and pension funds to the Brazilian economy. In 1992, new foreign investments totaling about $1 billion were originated from the United States, 29.8%; Germany, 14.6%; Japan, 9.2%; Switzerland, 8.4%; the United Kingdom, 6.8%; and others, 31.2%. The next step to attract added investments into Brazil would be to remove restrictions on individual investors.

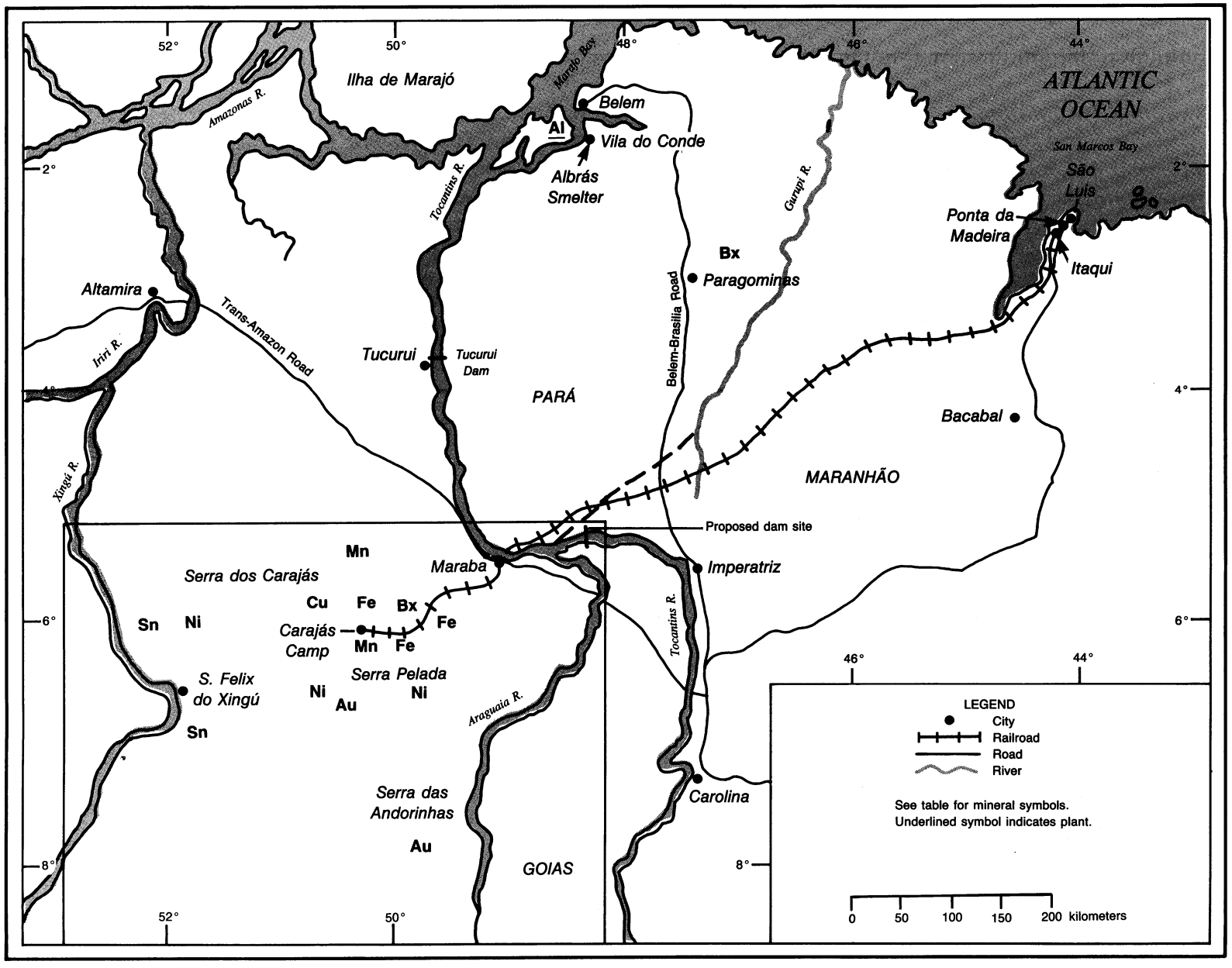
The gross domestic product decreased by about 1% and amounted to $417 billion.[1] Industrial output decreased by almost 4%, and the minerals sector showed an estimated decrease of almost 2% below that of 1991 owing to reductions in gold and iron ore production and soft market prices. The major contributors to the mineral output were bauxite, diatomite, kaolin, nickel, and tungsten. The government continued to utilize tight monetary policy and high interest rates with the objective of reducing inflation and preventing price explosion. These measures were insufficient to effectively reduce Brazil's hyperinflation of 1,200% in 1992. Brazil, like its neighbors, was changing to an open and modern system, but at a slower pace than Argentina, Chile, and Peru.

GOVERNMENT POLICIES AND PROGRAMS

Inflation control policy continued to be based on monetary instruments in 1992. Investment in mining and exploration decreased considerably from the early and mid-1980's. For instance, direct investment in mining and processing declined from almost $1 billion in 1987 to about $300 million in 1991. Similarly, investment risk in exploration decreased from about $150 million in 1987 to about $40 million in 1992, and 80% of this amount was originated by State-owned firms, primarily by Companhia Vale do Rio Doce, S.A. (CVRD). However, some of these decreases may be attributed to the general global recessionary economic climate. The reduction of foreign investment in Brazil was largely triggered by the 1988 Constitution, which limits foreign equity in any new mining project to a maximum participation of 40%. Congress was studying a measure that would eliminate the 40% rule. Total foreign investment in Brazil also declined from $1.8 billion in 1981 to $180 million in 1989. The Executive Branch sent to the Brazilian Congress an amendment to the 1988 Constitution for removing restrictions on foreign participation. The constitutional review should begin on October 6, 1993.

Brazil's privatization program represents the country's effort to modernize its economic infrastructure. Since the end of 1991, the Brazilian Government has sold 24 firms, mostly in the chemical, fertilizer, and steel sectors. Many union leaders and workers believed that the State's role was to provide jobs by operating chemical, mining, and steel monopolies. However, unions understand that inefficient State companies, which are losing revenues estimated at $5 billion in 1992 alone, must be modernized by replacing outdated equipment with modern technology to become competitive in the global economy. Companies in the sectors of communications, energy, and mining, that were off limits in the earlier phase of privatization now are targeted for sale. Unlike the large and older manufacturing corporations, State-owned service companies such as telephone and electricity suppliers, have attracted foreign interest because the Government was gradually raising rates and abolishing subsidies. Although Brazil's privatization program started later than similar programs in Argentina and Mexico, the program sold $5.25 billion in State assets, with another $13 billion expected from the remaining 35 firms of the first phase. Sales of Government minority holdings would provide an additional revenue of $2.5 billion. When auctioning of the large State-owned mining, telephone, and

BRAZIL — MINERAL PROVINCE OF CARAJÁS



petroleum corporations takes place, $20 billion more could be added, bringing a total revenue of about $40 billion. For this revenue to be realized, however, some barriers still must be removed, and because the country's Constitution of 1988 reserves many mining, petroleum, energy, and communication activities as Government monopolies, the Brazilian Congress must change such provisions during the constitutional review to attract more foreign investment. The privatization program also has been changed to encourage foreign participation. For example, the rule that prohibited sale of stock bought with foreign capital for 2 years was removed in early 1992. As the barriers to foreign investments continue to fall, foreign interest should increase dramatically because Brazil is a country rich in resources with the potential of a large domestic market of 160 million people.

A Trade Pact of the Southern Cone Common Market (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 labor, goods, and services among the four countries. Already, MERCOSUR has had its impact on trade between Argentina and Brazil. In 1992, Brazil's exports to Argentina increased 108% to $3.1 billion or 8.5% of Brazil's total exports. This resulted in a surplus of $1 billion in the trade balance with Argentina.

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) will become an autonomous Federal agency by the end of 1993. DNPM will continue with the specific responsibility over mining and 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.

PRODUCTION

Brazilian minerals production decreased approximately 2% over that of 1991, caused mostly by reductions in gold and iron ore output and very soft market prices. The total value of minerals produced in 1992 was about $7.3 billion, or almost 2% of GDP. The mineral commodities that were major contributors to the total mineral production in 1992 were bauxite, chromite, diatomite, ferroalloys, gold, gypsum, iron ore, kaolin, lime, manganese, nickel, petroleum, steel, tungsten, and zinc. *(See table 1.)*

TRADE

The negative trade balance in the minerals sector for 1992 was heavily influenced by the value of petroleum imports. Total mineral imports were valued at $4.5 billion, while total exports were $3.2 billion or about 6% above the 1991 mineral exports; this was mostly because of the increase in exports of iron ore, gold, and dimension stones. In addition to petroleum, other major mineral imports, in alphabetical order, were coal, copper, lead, natural gas, potash, sulfur, and zinc. In 1992, the total value of exports was approximately $36.2 billion versus the total value of $20.5 billion for imports. The trade surplus amounted to $15.7 billion.

In 1989, Brazil and the United States reached an accord on a new Voluntary Restraint Agreement (VRA) that boosted steel shipments to the United States by up to 55% during 1991 and 1992. The VRA allowed for steel exports of up to 1,556,000 tons in 1991, with an increase of 260,000 tons in 1992.

The Brazilian Ministry of Industry and Commerce opened an antidumping inquiry into low-carbon ferrochrome imports from Kazakhstan, Russia, and Ukraine, responding to a request filed in late 1992 by the Brazilian ferroalloys producers' association, Associação Brasileira Dos Produtores De Ferroligas (ABRAFE), on behalf of Companhia de Ferroligas da Bahia (FERBASA), Brazil's sole producer. In 1992, the three countries shipped to Brazil 3,000 tons of ferrochrome at a cost of $1,630 per tons. FEBRASA produced 7,400 tons at a cost of $2,280 per ton. The Brazilian consumption of ferrochrome with a maximum 0.1% carbon content was 12,000 mt/a.

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 1992. 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 1992, 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 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 steelmaker 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, to be 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 1992, there were 162 cement and limestone mining companies operating 247 limestone mines in Brazil. In the same year, there were 34 separate iron ore mining companies operating 80 mines.

The five major integrated steelworks produced approximately 66% of the crude steel in 1992. 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 in 1992.

Brazil's total labor force was approximately 57 million in 1992. Of the total, services comprised 42%; agriculture, 31%; and industry, 27%. The minerals sector comprised approximately 4% (700,000) of the industry total of 15.4 million. This did not include the 500,000 to 1 million garimpeiros active in Brazil. *(See table 2.)*

COMMODITY REVIEW

Metals

Alumina, Aluminum, and Bauxite.— In 1992, primary aluminum production amounted to 1.2 Mmt of metal, which was an increase of 5% over that of the previous year, and bauxite production increased 6% to 10.8 Mmt for the same period. Alumina production remained at the 1991 level. Apparent consumption of primary aluminum for 1992 was 360,000 tons.

Industrias Votorantim, Brazil's largest private-sector company, completed the expansion of its Cía. Brasileira de Aluminio (CBA) primary aluminum plant in Mairinque, São Paulo State, from 170,000 mt/a to 215,000 mt/a in 1992.

CVRD announced plans to construct a 1.1-Mmt/a alumina refinery near Paragominas, Pará State, to process the bauxite from the 850-Mmt deposit there. It will be known as the Jabuti Project at a cost of $875 million and scheduled to enter into production in 1995. CVRD announced that debt rescheduling talks with the International Monetary Fund and private creditor banks were crucial to the completion of its Jabuti alumina refinery. In 1992, 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%), with 335,200 tons and CBA with 217,400 tons, which increased by 16.4% and 6.4%, respectively. Valesul Alumínio, S.A. (VALESUL), a joint venture of ALUVALE (49.72%), Billiton Metais (41.49%), and Companhia Força e Luz Cataguazes (8.79%), produced 92,600 tons.

Mineração Rio do Norte, S.A. (MRN), the world's third largest bauxite producer and exporter, decreased its production during 1992 by about 14.4% to 7.3 Mmt compared with 8.5 Mmt in 1991. MNR was planning to invest $60 million to open a new mine in Trombetas, Pará State, 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, announced plans to increase its plant capacity from 160,000 to 345,000 mt/a by 1995 at a cost of approximately $650 million.

Reynolds Internacional do Brasil will triple its output of aluminum cans to 750,000 mt/a and begin to export them to Latin American markets. This was announced at yearend 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 State. Construction began in 1991 on phase 1, to have a capacity of 2.5 Mmt/a, which, depending on the market, could reach 4.5 Mmt/a. When in operation, it will supply the feed to the Alcoa Aluminio, S.A. refinery at São Luís, Maranhão State. The Brazilian exports of primary aluminum increased to 816,000 tons, or 3.7% over those of 1991. These exports represented 68% of total Brazilian production.

Columbium and Tantalum.—In 1992, Cía. Brasileira de Metalurgia e Mineração (CBMM) accounted for approximately 80% of Brazil's production capacity and supplied approximately 65% of the world demand for ferrocolumbium.

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

Early in the year the Mining Resources and Research Co. of Amazonas announced the discovery of what may be the largest columbium-containing deposit in the world. It was found in the São Gabriel da Coxoeira

district of Amazonas State and contains approximately 2.9 billion tons of columbium ore.

Tantalum production in Brazil was 84 tons compared with 90 tons in 1991. Brazil was third in tantalum concentrate production in 1992, following Australia and Malaysia.

Copper.—Brazilian copper concentrate production amounted to 39,845 tons in 1992. Total primary metal production amounted to 157,950 tons that was produced by Caraíba Metais, the only electrolytic producer in Brazil. Secondary metal production increased to 52,000 tons or 4.8% over that of 1991. CVRD and its partner, 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 State, proving 1.3 billion tons of reserves with a grade of 0.86% of copper with associated gold, molybdenum, and silver. Production is planned at the rate of 240,000 mt/a of copper concentrates at 38% Cu or 130,000 mt/a of copper metal. The expected production of gold and silver is about 8 mt/a and 15 mt/a, respectively. CVRD announced plans to build a $345 million, 225,000-mt/a copper refinery near its Salobo Mine. The plant is expected to go on-line sometime in 1998. Copper-consuming companies in Brazil imported approximately 88,000 tons of copper in 1992. Exports were 96,000 mt/a or 6.6% over those of 1991.

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.—Official gold production in 1992 was approximately 86 tons. The industrial sector, which excluded "garimpos" (gold fields) production of 39 tons, increased by 5 tons over that of 1991, or 39 tons. For the first time, the private sector, working primary gold sources, surpassed garimpos production, which centered on alluvial deposits.

MMV produced 12,231 kg of gold in 1992. The second largest producer of gold in Brazil was CVRD with 11,280 kg. Fazenda Brasileiro produced 4,295 kg; the Itabira Mine, 685 kg; the María Preta Mine in Bahía, 616 kg; the Riacho dos Machados Mine, 829 kg; and the Igarapé Bahía in Pará, 4,856 kg. 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 1991 to 2,463 kg in 1992, was that of Caraíba Metais, the largest copper producer in Brazil, which produced gold as a byproduct.

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. At yearend, the Minas Gerais Environment Policy Commission closed a garimpo alluvial gold mining operation on the Paracatu River. Health checks on the 2,000 garimpeiros that worked there revealed an excessive exposure to mercury. Many had absorbed mercury into their bloodstream 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 1992, ferroalloy production decreased to 935,154 tons or 0.7% from that of the previous year. For the year, exports increased from those of last year and reached 473,900 tons, while imports decreased from 25,000 tons to 16,700 tons. In 1992, 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 1992 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 1992 production of iron ore, reportedly 150 Mmt, remained at the same level as that of the previous year. 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) with 20 Mmt of ore, Ferteco Mineração, S.A. with 10 Mmt, S.A. Mineração da Trindade (SAMITRI) with 10 Mmt, and Samarco Mineração, S.A. (SAMARCO) with 8 Mmt.

Total iron ore exports for 1992 were 106 Mmt, which represented a reduction of 6% compared with 1991. The total export revenues of $2.3 billion also decreased by 13% compared with the previous year of $2.6 billion. This reduction was the first during the past 5 years. The major importers of Brazilian iron ore were Japan (25.5%) and the Federal Republic of Germany (19.3%). In 1992, 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, 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 23.2 Mmt of pig iron, which was 2% higher than that of the previous year, and exported 2.5 Mmt valued at $287 million, approximately one-third of the pig iron traded in the world. However, by early 1992, the industry in Brazil was in serious trouble. The major source of the problem was the new environmental laws stipulating that by 1991 a minimum of 50% of the charcoal used had to come from reforested areas rather than the virgin forests. A maximum of 20% of the charcoal used was allowed to be purchased from third parties. It also was stipulated that the percentage of charcoal used by the producers from their own reforestation programs must grow by 10% per year until it reaches 100% by 1995.

Steel.—Brazil's 1992 steel production totaled 23.9 Mmt, which increased almost 5.6% in comparison to the previous year, placing the country eighth in world ranking. Steel exports amounted to 12 Mmt valued at $3.5 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 175,200 tons valued at $203 million. Thus, Brazil enjoyed a very positive balance in its steel trade. Because the United States was the leading export market for Brazilian steel, the U.S. Department of Commerce investigations on dumping and the U.S. International Trade Commission (ITC) decisions were closely monitored by the Instituto Brasileiro de Siderurgia (IBS). The final ITC decision, which was in Brazil's favor in three of four categories, leaves the U.S. market open to all Brazilian products except steel plate. 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. Thus, Brazil would be allowed to continue to sell its steel products 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 line 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 scheduled to be 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 110,400 in 1992 reflected, in part, the effects of privatization. The State-owned companies that were privatized reduced employment levels in anticipation of the process.

In 1992, Brazil exported almost 50% of its steel production as of a result of its recessionary and weak economy; however, this share could change in the foreseeable future as the Brazilian economy improves.

Cía. Siderúrgica Belgo-Mineíro, in a joint venture with Trefil Arbed of Luxembourg, constructed a 20,000-mt/a steel cord works in Pine Bluff, Arkansas (United States). The plant came on-stream in 1992, with 50% of its wire rod requirement coming from Belgo-Mineíro's wire mill in Brazil.

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

Manganese.—Brazilian production in 1992 was about 2 Mmt. 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 State, was the larger 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 domestic market.

The other producers' (SAMITRI, SMML, and URUCUM) output was 593,000 tons with shipments of 458,000 tons and 210,000 tons to foreign and domestic markets, respectively.

Tin.—Brazil no longer continued to be the leading tin producer in 1992. Tin production decreased from 41,000 tons in 1990 and 31,500 tons in 1991 to 30,000 tons in 1992. The reduction in Brazilian output was because of the closing of some high-cost operations and the downturn in tin prices. Brazilian tin exports in 1992 declined to 20,000 tons compared with those of the previous year. Domestic consumption was about 6,300 mt/a, a small increase from that of 1991.

Paranapanema, S.A. Mineração, Industría e Construção, Brazil's largest tin-mining company, reported that its tin output was 14,853 tons from its high-grade Pitinga Mine, with byproducts of columbium, tantalum, zirconium, hafnium, thorium, and chryolite, in order of importance. In 1992,

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 1992, CVRD invested in the production of titanium sponge and an advanced titanium compound used in the space, shipbuilding, and chemical industries on an industrial scale. CVRD reached an agreement with the space technology institute of the air force, whereby the institute will receive 1% of all royalties when the compound is produced industrially in exchange for the transfer of equipment to CVRD.

The Brazilian subsidiary of E. I. du Pont de Nemours and Co. Inc. of the United States began construction of a titanium dioxide sizing and packaging facility at Uberaba, Minas Gerais State. The plant is to begin operation 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 1992, the total value of gemstone (including diamond) exports remained at the same level of the previous year. 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 1992, Brazil 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.—Because potash production continued to decline, Brazil imported 1.9 Mmt of potash in 1992.

Production of phosphate rock amounted to 3.4 Mmt, an increase of 4% over the 1991 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 3.7 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 1992, 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.

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

Coal.—The Brazilian coal industry, not a large component of the minerals industry, has been in decline in recent years. 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 1992 was estimated to be about 4.7 Mmt/a, of which 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 tons. 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 1992.

Natural Gas and Petroleum.—The gas pipeline linking the Enchova platform in the offshore Campos Basin to Macaé, Río de Janeiro State, which was completed in midsummer 1989, has added 5 Mm^3/d of gas flow to the Río de Janeiro and São Paulo markets.

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

Petroleum production was about the same level of 1991, while natural gas production increased about 5%. In 1992, Brazil's imports of petroleum were 209 Mbbl at a cost of $3.5 billion.

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 1992 amounted to about 163,000 tons 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 1992, Brazil was among the world leaders in reserves of the following mineral commodities, by rank: columbium (1); barite (2); bauxite (3); vermiculite (3), tin (3); iron ore (4), manganese (5), and talc and pyrophyllite (5). *(See table 3.)*

INFRASTRUCTURE

In 1992, Brazil had a total of 32,002 km of railroads composed of 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. The country contained a total of 1,448,000 km of roads, composed of 48,000 km paved and 1,400,000 km of gravel and dirt. There was 50,000 km of navigable inland waterways. The major shipping ports were Belém, Manaus, Porto Alegre, Recife, Río de Janeiro, Río Grande, Salvador, and Santos. Among the 271 ships were 56 tanker, 15 chemical tanker, 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 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 were $10.00 plus per ton of steel.

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

In 1992, CVRD invested almost $119 million to improve its rail transportation system. 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 new system's projected cost is $2.5 billion. This addition will connect to the existing system, which runs from Vitória, Espírito Santo State; Belo Horizonte, Minas Gerais State; Santos, São Paulo State; and Chapadao do Sul, Mato Grosso do Sul State. The new railroad system will run from Chapadao do Sul, Mato Grosso do Sul State, to Cuiabá, Mato Grosso State, and Santarem, Pará State, branching from Cuiabá, Mato Grosso State, to Porto Velho, Rondônia State.

OUTLOOK

Brazil's efforts to keep inflation under control will provide a framework for 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 in the midst of sustainable development.

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 affected 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 1993 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 become 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 increasing 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 potential fully. There is also a need to change some procedures that disturb market performance and hamper the country's integration into the international markets of goods, services, and capital. In the near term several measures are expected to be implemented, such as the removal of nontariff barriers, the gradual reduction of import taxes, the liberalization of the exchange system, and the freedom of capital flows. Currently, the fastest growing area of the world is Asia; but Latin America, particularly Brazil with its size, resources, and tremendous mineral potential, is going to be the next area for growth within the global economy.

---

[1]Where necessary, values have been converted from Brazilian cruzeiros (Cz$) 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
30000-Belo Horizonte-MG-Brasil

Departamento Nacional de Produção Mineral (DNPM)
Ministério da Minas e Energia
SAN-Quadra 01-Bloco "B"
70040-Brasilia-DF-Brasil

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, Oklahoma: 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]		1988	1989	1990	1991	1992[e]
METALS						
Aluminum:						
Bauxite, dry basis, gross weight		7,727,600	r8,665,300	9,678,203	r10,413,900	10,500,000
Alumina		1,487,850	1,632,000	r1,654,800	r1,739,400	1,750,000
Metal:						
Primary		873,500	889,500	930,600	r1,139,600	1,200,000
Secondary		60,500	66,000	60,000	r e62,000	62,000
Beryllium: Beryl concentrate, gross weight		913	800	e850	e850	850
Cadmium: Metal, primary		283	283	e200	e200	200
Chromium:						
Crude ore		779,000	829,000	e810,000	e890,000	900,000
Concentrate		147,122	182,877	r102,968	r e143,000	145,000
Marketable product[3]		229,912	e225,000	256,453	306,900	307,000
Cobalt:[e]						
Mine output, Co content by hydroxide		150	200	200	200	200
Metal, electrolytic		—	30	60	60	60
Columbium-tantalum ores and concentrates, gross weight:						
Columbite and tantalite		444	481	342	e320	320
Djalmaite concentrate[e]		10	10	10	10	10
Pyrochlore concentrate, Cb_2O_5 content		37,274	29,023	27,142	28,449	28,500
Copper:						
Mine output, Cu content		44,845	r47,439	36,441	r37,947	38,000
Metal:						
Primary		147,880	153,378	r152,117	r141,443	157,950
Secondary		38,051	54,426	r47,628	r37,035	52,244
Gold:						
Mine output	kilograms	r22,159	r22,849	r30,098	r34,053	39,044
Garimpos (independent miners)	do.	r34,288	r29,678	r71,815	55,525	46,818
Total	do.	r56,447	r52,527	r101,913	r89,578	85,862
Iron and steel:						
Ore and concentrate (marketable product):[3]						
Gross weight	thousand tons	146,008	157,900	152,300	r150,500	151,000
Fe content[e]	do.	98,600	102,300	99,900	100,000	100,000
Metal:						
Pig iron[4]	do.	23,454	24,363	21,141	e22,000	22,000
Ferroalloys, electric furnace:						
Chromium metal		155	135	37	37	r37
Ferrocalcium silicon		31,519	33,020	27,520	21,708	22,000
Ferrochromium		130,024	113,267	83,753	82,225	82,000
Ferrochromium silicon		9,177	8,938	4,973	4,524	4,500
Ferrocolumbium		19,106	16,378	16,643	18,959	19,000
Ferromanganese		180,588	180,668	170,504	169,103	169,000
Ferromolybdenum		427	332	69	47	r47
Ferronickel		33,930	34,997	34,257	34,069	34,000
Ferrophosphorus		1,469	1,928	1,278	864	800
Ferrosilicon		267,538	286,994	229,408	191,423	190,000
Ferrosilicon magnesium		17,000	15,864	10,340	10,168	10,000

See footnotes at end of table.

TABLE 1—Continued

BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[e]
METALS						
Iron and steel—Continued:						
Metal—Continued:						
Ferroalloys, electric furnace—Continued:						
Ferrosilicon zirconium		793	1,392	503	102	[5]102
Ferrotitanium		549	430	125	126	[5]126
Ferrotungsten		133	22	6	1	[5]1
Ferrovanadium		261	302	44	41	[5]41
Inoculant		7,678	12,098	11,461	24,431	24,500
Silicomanganese		193,490	208,262	216,779	272,046	273,000
Silicon metal		79,287	116,779	131,614	106,002	106,000
Total		973,124	1,031,806	939,314	935,876	935,154
Steel, crude, excluding castings	thousand tons	24,656	25,055	20,567	22,616	24,000
Semimanufactures, flat and nonflat	do.	32,306	32,537	29,450	[e]25,000	25,000
Lead:						
Mine output, Pb content		14,314	[r]13,970	9,291	[r]7,273	7,500
Metal:						
Primary		29,501	32,522	30,118	[r]22,023	25,000
Secondary		68,681	53,295	[r]45,330	[r]42,000	42,000
Magnesium metal:[e]						
Primary		[5]5,865	6,200	6,500	6,500	6,500
Secondary		1,500	1,500	1,600	1,600	1,600
Manganese ore and concentrate, marketable, gross weight		1,670,000	1,904,000	2,300,000	[r]2,000,000	2,000,000
Nickel:						
Mine output, Ni content		18,667	18,826	18,788	[r]20,456	20,500
Ferronickel, Ni content		9,216	9,445	8,847	[r]8,620	9,000
Rare-earth metals: Monazite concentrate, gross weight		2,633	2,503	1,656	[r]1,308	1,400
Silver[6]	kilograms	124,100	114,117	171,052	[r]154,000	155,000
Tin:						
Mine output, Sn content		44,102	50,232	39,149	[e]29,253	27,500
Metal:						
Primary		41,857	44,240	37,580	[r]25,776	27,000
Secondary[e]		250	250	250	250	250
Titanium concentrates, gross weight:						
Ilmenite		142,167	[r]144,212	114,117	[r]69,064	70,000
Rutile		1,514	[r]2,613	1,814	[r]1,094	1,100
Tungsten, mine output, W content		738	679	316	[r]223	250
Zinc:						
Mine output, Zn content		155,531	178,439	158,025	[r]130,000	140,000
Metal, smelter:						
Primary		139,667	155,846	[r]149,483	[r]157,462	160,000
Secondary		4,307	6,409	[r]4,603	[r]5,538	6,000
Zirconium: Zircon concentrate, gross weight		28,029	32,970	16,907	[r]18,590	20,000
INDUSTRIAL MINERALS						
Asbestos:						
Crude ore[e]		[5]3,554,916	3,500,000	3,940,000	3,950,000	3,950,000
Fiber		227,653	206,195	[r]205,081	[r]237,000	237,000

See footnotes at end of table.

TABLE 1—Continued

BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[e]
INDUSTRIAL MINERALS—Continued						
Barite:						
Crude		68,855	63,665	64,923	r50,978	50,000
Beneficiated		78,842	51,407	55,576	r46,784	47,000
Marketable product[3]		85,287	57,741	68,188	e65,000	65,000
Calcite		51,138	r45,130	r13,368	r45,710	45,000
Cement, hydraulic	thousand tons	25,330	25,926	25,848	r27,490	28,000
Clays:						
Bentonite (beneficiated)		147,149	r188,260	r179,646	r130,000	130,000
Kaolin:						
Crude		2,092,635	r2,187,919	r1,624,529	r1,838,000	1,850,000
Beneficiated		759,892	714,647	r658,927	r746,000	750,000
Marketable product[3]		1,121,892	r1,022,415	r930,753	r1,089,000	1,100,000
Diamond:						
Gem	thousand carats	350	350	600	e600	600
Industrial	do.	180	150	900	e900	900
Total[e]	do.	530	500	1,500	e1,500	1,500
Diatomite:						
Crude[e]		5,33,500	35,000	35,000	35,000	35,000
Beneficiated		15,145	15,618	13,311	r12,446	13,000
Marketable product[3]		15,165	15,759	13,313	e13,100	13,100
Feldspar:						
Crude		140,951	140,651	104,647	120,000	120,000
Feldspar, marketable product[3]		146,951	142,893	r111,206	r121,957	5,122,000
Leucite, marketable product[3]		5,562	5,000	5,000	5,000	5,000
Sodalite, crude, marketable product[3]		5,517	500	500	500	500
Total:[e]		5,153,030	148,393	r116,706	r127,457	127,500
Fluorspar:						
Crude[e]		5,401,384	400,000	400,000	400,000	400,000
Concentrates, marketable product:						
Acid-grade		54,920	56,973	47,724	r52,415	52,000
Metallurgical-grade		35,078	r38,550	22,659	r28,898	29,000
Total		89,998	r95,523	70,383	r81,313	81,000
Graphite:						
Crude[e]		5,730,851	650,000	650,000	650,000	650,000
Marketable product:						
Direct-shipping crude ore		12,570	13,005	8,400	r7,298	7,000
Concentrate		34,520	31,650	r28,890	r26,965	27,000
Total		47,090	44,655	r37,290	r34,263	34,000
Gypsum and anhydrite, crude		788,673	r860,620	r823,688	r966,651	970,000
Kyanite:[e]						
Crude		5,689	700	750	750	750
Marketable product[3]		5,630	600	600	600	600
Lime, hydrated and quicklime[e]	thousand tons	5,5,500	5,5,730	5,700	5,700	5,700
Lithium: Concentrates		1,441	r1,471	r475	r1,560	1,600

See footnotes at end of table.

TABLE 1—Continued

BRAZIL: PRODUCTION OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[e]
INDUSTRIAL MINERALS—Continued						
Magnesite:						
Crude		810,837	1,385,565	1,432,741	r879,477	880,000
Beneficiated		404,126	259,508	257,159	r242,256	250,000
Mica, all grades		2,520	e3,700	e5,000	r5,080	5,000
Nitrogen: N content of ammonia		935,400	935,400	937,500	e940,000	940,000
Phosphate rock including apatite:						
Crude:e						
Mine product	thousand tons	526,458	27,000	27,000	27,000	27,000
Of which, sold directly	do.	538	535	35	35	35
Concentrate:						
Gross weight	do.	4,672	3,655	2,968	r3,280	3,300
P_2O_5 content	do.	r754	r727	r625	r650	650
Pigments, mineral: Other, crude[e]		55,223	5,500	5,500	5,500	5,500
Potash: Marketable product (K_2O)		54,121	96,945	65,735	r100,667	100,000
Precious and semiprecious stones except diamond, crude and worked:						
Agate		2,600	3,000	3,000	3,000	3,000
Amethyst		1,500	1,000	1,000	1,000	1,000
Aquamarine		5197	20	20	20	20
Citrine		160	100	100	100	100
Emerald		100	90	90	90	90
Opal		513	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		572	50	50	50	50
Tourmaline		5170	80	80	80	80
Other		500	e500	e500	500	500
Quartz crystal, all grades		3,020	3,174	e3,100	e3,100	3,100
Salt:						
Marine	thousand tons	3,020	2,355	4,170	r3,703	3,700
Rock	do.	1,336	1,298	1,033	r4,510	4,500
Silica (silex)	do.	4,077	4,100	3,721	r3,113	3,200
Sodium compounds:[e]						
Caustic soda		975,000	975,000	975,000	975,000	975,000
Soda ash, manufactured (barilla)		5184,416	200,000	200,000	200,000	200,000
Stone, sand and gravel:[e]						
Dimension stone:						
Marble, rough-cut	cubic meters	5132,490	150,000	200,000	200,000	200,000
Slate		545,384	50,000	50,000	50,000	50,000
Crushed and broken stone:						
Basalt	cubic meters	5993,855	1,000,000	1,000,000	1,000,000	1,000,000
Calcareous shells		5440,589	450,000	450,000	450,000	450,000
Dolomite	thousand tons	53,395	3,500	3,500	3,500	3,500
Gneiss	cubic meters	51,042,467	51,039,829	1,000,000	1,000,000	1,000,000
Granite	thousand cubic meters	558,646	60,000	60,000	60,000	60,000
Limestone	thousand tons	560,111	60,000	60,000	60,000	60,000
Quartz[9]		5247,465	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]		1988	1989	1990	1991	1992[e]
INDUSTRIAL MINERALS—Continued						
Stone, sand and gravel—Continued:						
Crushed and broken stone—Continued:						
Quartzite:						
Crude		[5]393,346	400,000	400,000	400,000	400,000
Processed		[5]197,886	200,000	200,000	200,000	200,000
Sand: Industrial		[5]2,613,027	2,700,000	2,700,000	2,700,000	2,700,000
Sulfur:						
Frasch		6,039	5,721	[e]6,000	[e]6,000	6,000
Pyrites		102,856	71,740	[e]90,000	[e]90,000	90,000
Byproduct:						
Metallurgy		152,013	163,724	[e]160,000	[e]160,000	160,000
Petroleum		61,396	60,121	[e]60,000	[e]60,000	60,000
Total		322,304	301,306	[e]316,000	[e]316,000	316,000
Talc and related materials:						
Talc:						
Crude		359,162	393,012	296,338	292,270	290,000
Marketable product[3]		[r]3,453	[r]895	[r]1,597	[r]1,957	2,000
Pyrophyllite: Crude		211,000	231,000	174,000	186,000	186,000
Vermiculite:						
Concentrate		18,808	20,523	23,340	25,000	25,000
Marketable product[3]		[r]2,465	[r]6,917	[r]10,080	[r]1,965	2,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous, marketable[3]	thousand tons	7,428	7,186	[r]5,218	[r]4,416	4,500
Coke, metallurgical, all types	do.	1,185	1,006	[r]535	[r]162	200
Gas, natural: Gross	million cubic meters	[r]6,051	[r]6,105	[r]6,278	[r]6,597	6,600
Natural gas liquids	thousand 42-gallon barrels	[e]9,400	[e]9,500	13,073	12,935	13,000
Petroleum:						
Crude	do.	[r]202,770	[r]217,272	[r]238,211	[r]235,680	236,000
Refinery products:[10]						
Gasoline	do.	[r]150,268	[r]149,078	[r]145,649	[r] [e]145,649	145,700
Jet fuel	do.	[r]21,156	[r]22,746	[r]20,445	[r] [e]20,445	20,500
Kerosene	do.	[r]3,259	[r]2,417	[r]1,536	[r] [e]1,536	1,540
Distillate fuel oil	do.	[r]175,043	[r]174,061	[r]170,658	[r] [e]170,658	170,700
Lubricants	do.	[r]4,869	[r]4,830	[r]4,871	[r] [e]4,871	4,900
Residual fuel oil	do.	[r]89,631	[r]93,054	[r]90,857	[r] [e]90,857	90,900
Other	do.	[r]63,140	[r]63,946	[r]68,949	[r] [e]68,949	69,000
Refinery fuel and losses	do.	18,250	22,008	[r]23,730	[r] [e]23,730	23,700
Total	do.	[r]525,616	[r]532,140	[r]526,695	[r] [e]526,695	526,940

[e]Estimated. [r]Revised.

[1]Table includes data available through Oct. 31, 1993.

[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: 1988—195; 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: 1988—34,319; 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 1992

(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).
Do.	Vale do Sul Aluminio, S.A. (Government, 27%; private, 25%; Shell do Brasil, S.A., 44%; Reynolds Metals Co., 4%)	Santa Cruz, Rio de Janeiro State (smelter)	86 (metal).
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 1992

(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)	1,080 (ore). 300.
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.	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	Aco Minas Gerais, S.A. (AÇOMINAS) (Government, 99.8%; others, 0.2%)	Rodovia, Minas Gerais State	2,000.
Do.	Companhia Acos 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.
Do.	Companhia Siderúrgica de Tubarão (CST) (Government, 74%; Kawasaki Steel Corp.,13% Societa Finanziaria Siderúrgia-Finsider, 13%)	Serra, Espírito Santo State	3,000.
Do.	Companhia Siderúrgia Nacional (CSN) (Government, 99.7%; others, 0.3%)	Volta Redonda, Rio de Janeiro State	4,600.
Steel	Companhia Siderúrgica Paulista (COSIPA) (Government, 99.6%; others, 0.4%)	Cubatão, São Paulo State	3,900.
Do.	Usinas Siderúrgicas de Minas Gerais, S.A.(USIMINAS) (Government, 95%; Nippon Usiminas, 5%)	Ipatinga, Minas Gerais State	4,400.
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).

TABLE 2—Continued

BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
METALS—Continued				
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.
Do.		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	thousand carats	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.
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).

TABLE 2—Continued

BRAZIL: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
INDUSTRIAL MINERALS—Continued			
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 (FOSFERTIL) (Government, 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.	Petroleo Brasileiro, S.A. (PETROBRAS)(Government, 81.4%); private, 11.8%; public, 6.8%)	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 1992

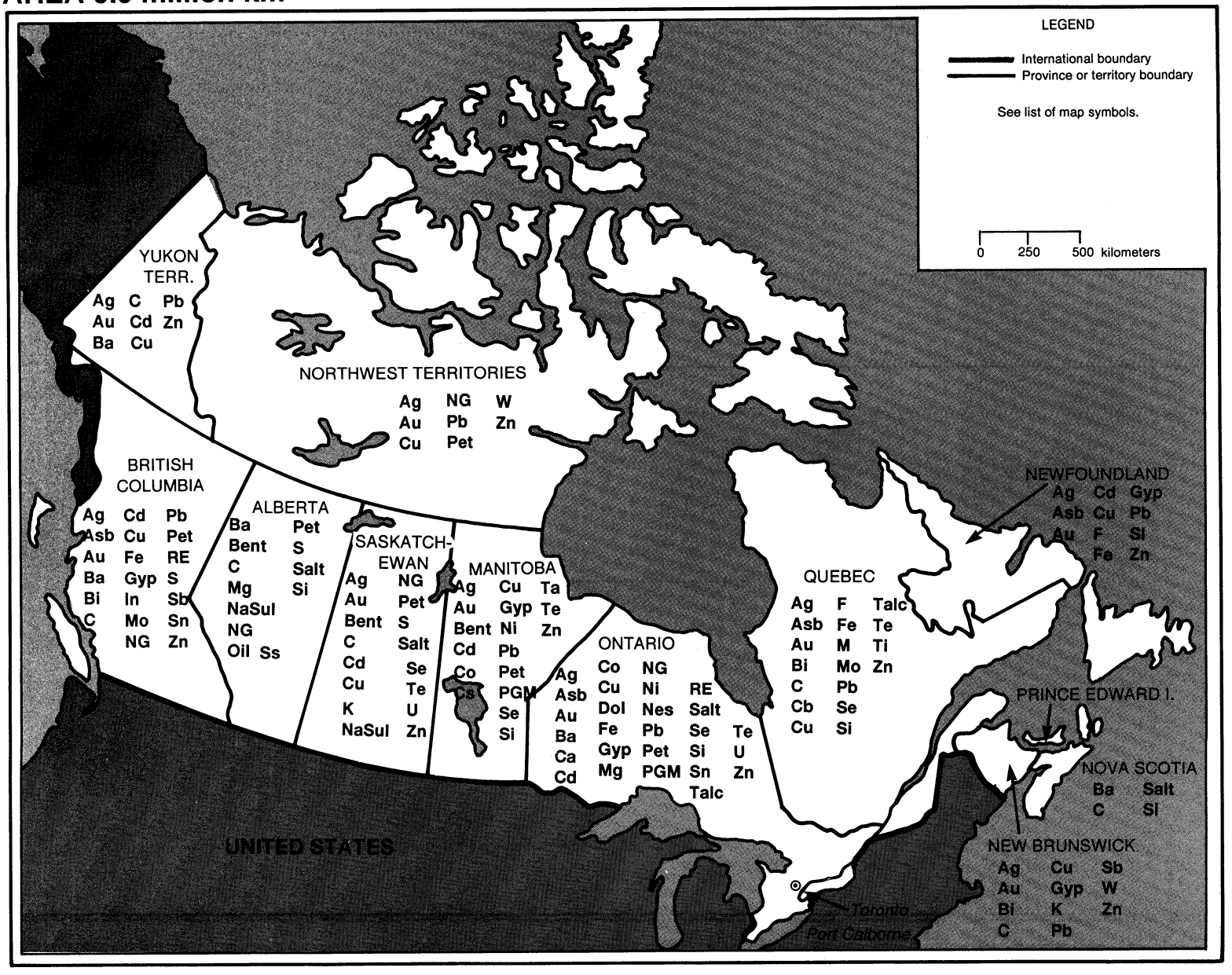
(Thousand metric tons unless otherwise specified)

Commodity		Reserves
Asbestos, fiber		3,416
Bauxite, ore		2,660,000
Chromite, Cr_2O_3 content		4,780
Coal, all types		23,670,000
Columbium, pyrochlore, and columbite ore		3,604
Copper, metal content		12,000
Fluorspar, ore		36,000
Gold, metal	metric tons	1,000
Graphite, ore		38,000
Gypsum		674,151
Iron ore, 60% to 65% Fe content		19,200,000
Kaolin		1,100,000
Lead, metal content		359
Magnesite		176,000
Manganese, metal content		89,360
Natural gas[1]	million cubic meters	123,776
Nickel, metal content		6,134
Petroleum[1]	thousand 42-gallon barrels	9,429,210
Phosphate rock		300,000
Tin, metal content		752
Titanium, TiO_2 content		2,733
Uranium, U_3O_8	metric tons	163,000
Zinc, metal content		4,400
Zirconium, ore		1,692

[1]Petroleo Brasileiro, S.A. (PETROBRAS), 1991 Annual Report, p. 13.

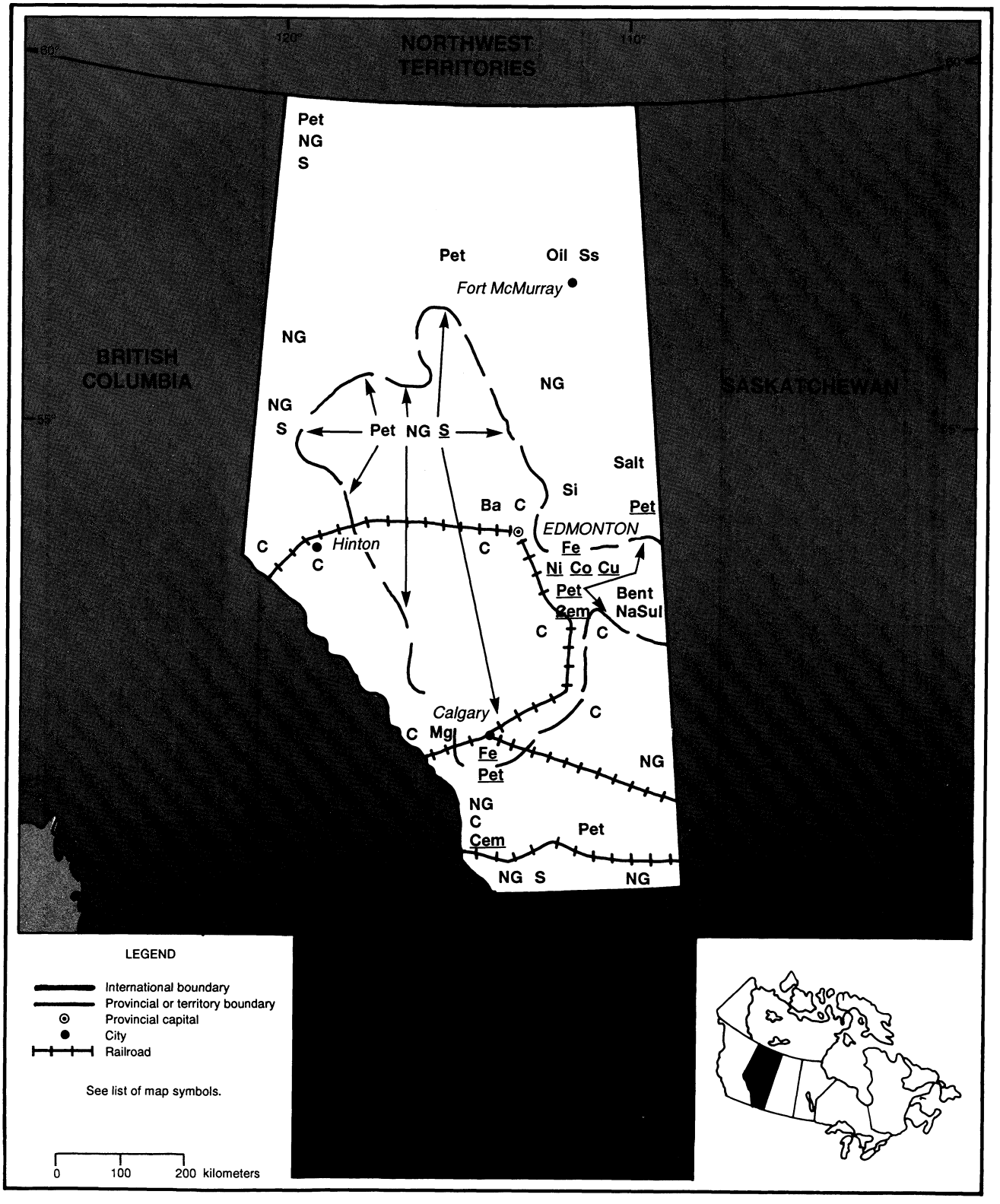
MAJOR MINERALS IN CANADA

AREA 9.9 million km² **POPULATION 28.7 million**



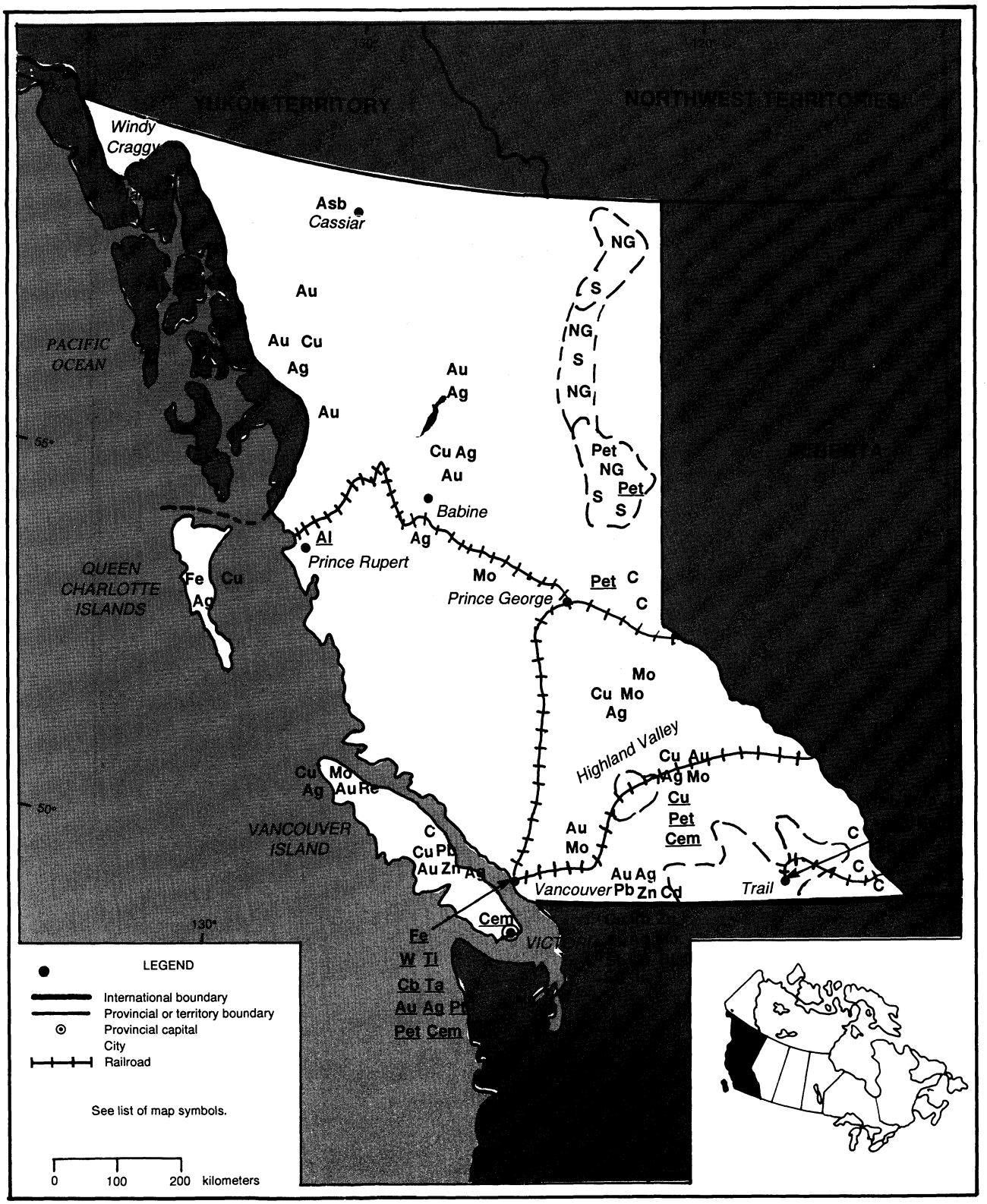
ALBERTA

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



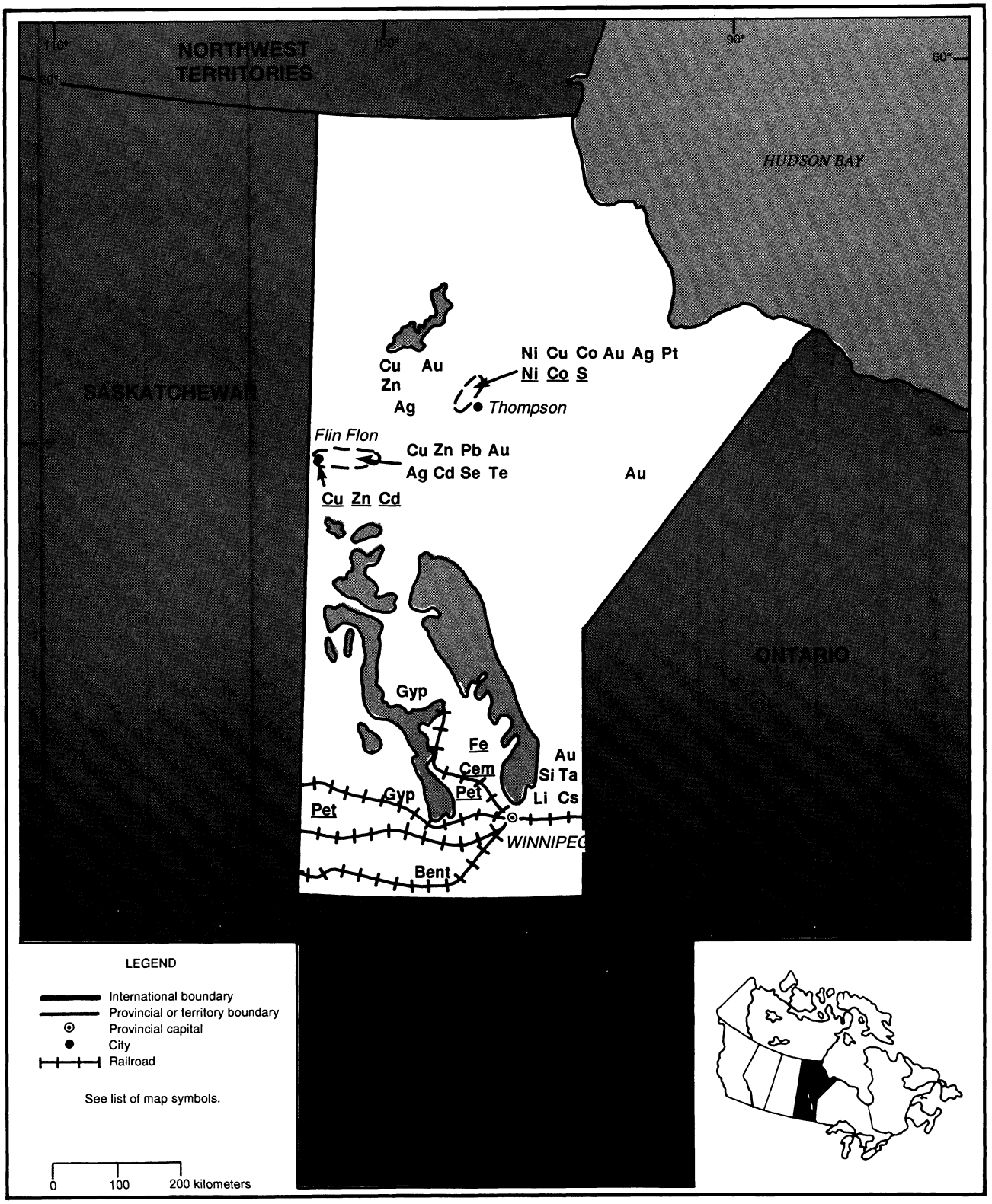
BRITISH COLUMBIA

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



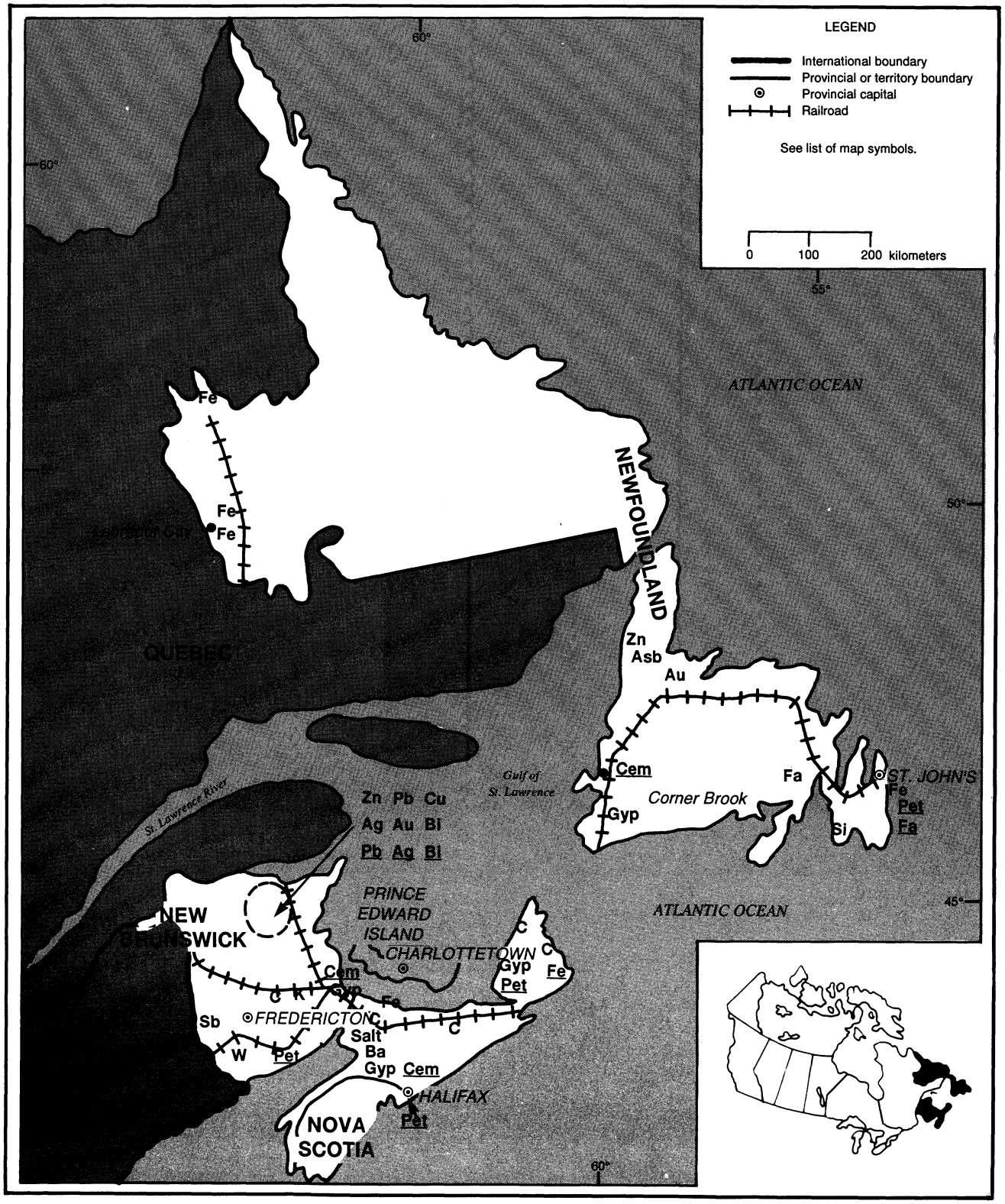
MANITOBA

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



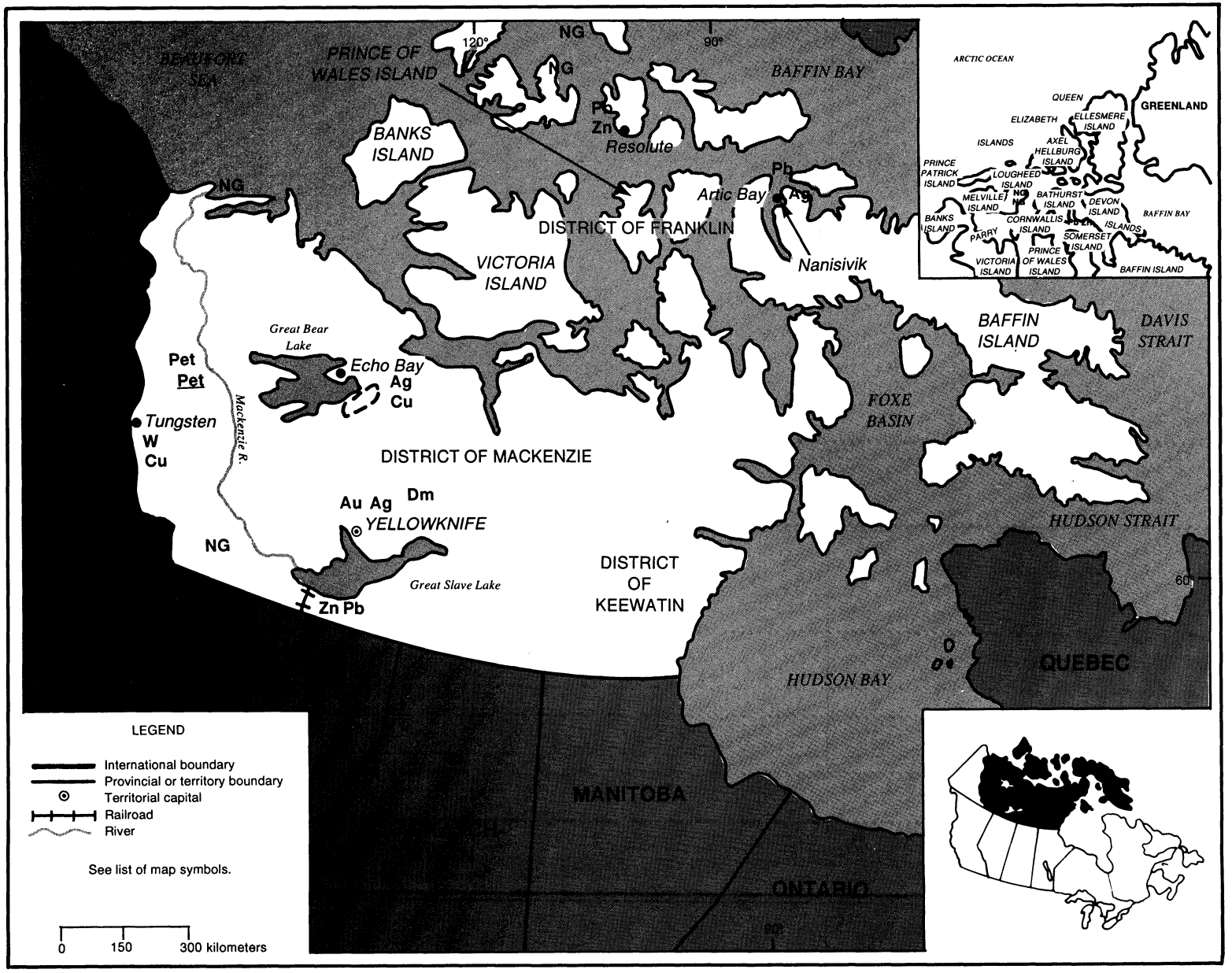
NEWFOUNDLAND, NEW BRUNSWICK, NOVA SCOTIA, AND PRINCE EDWARD ISLAND

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



NORTHWEST TERRITORIES

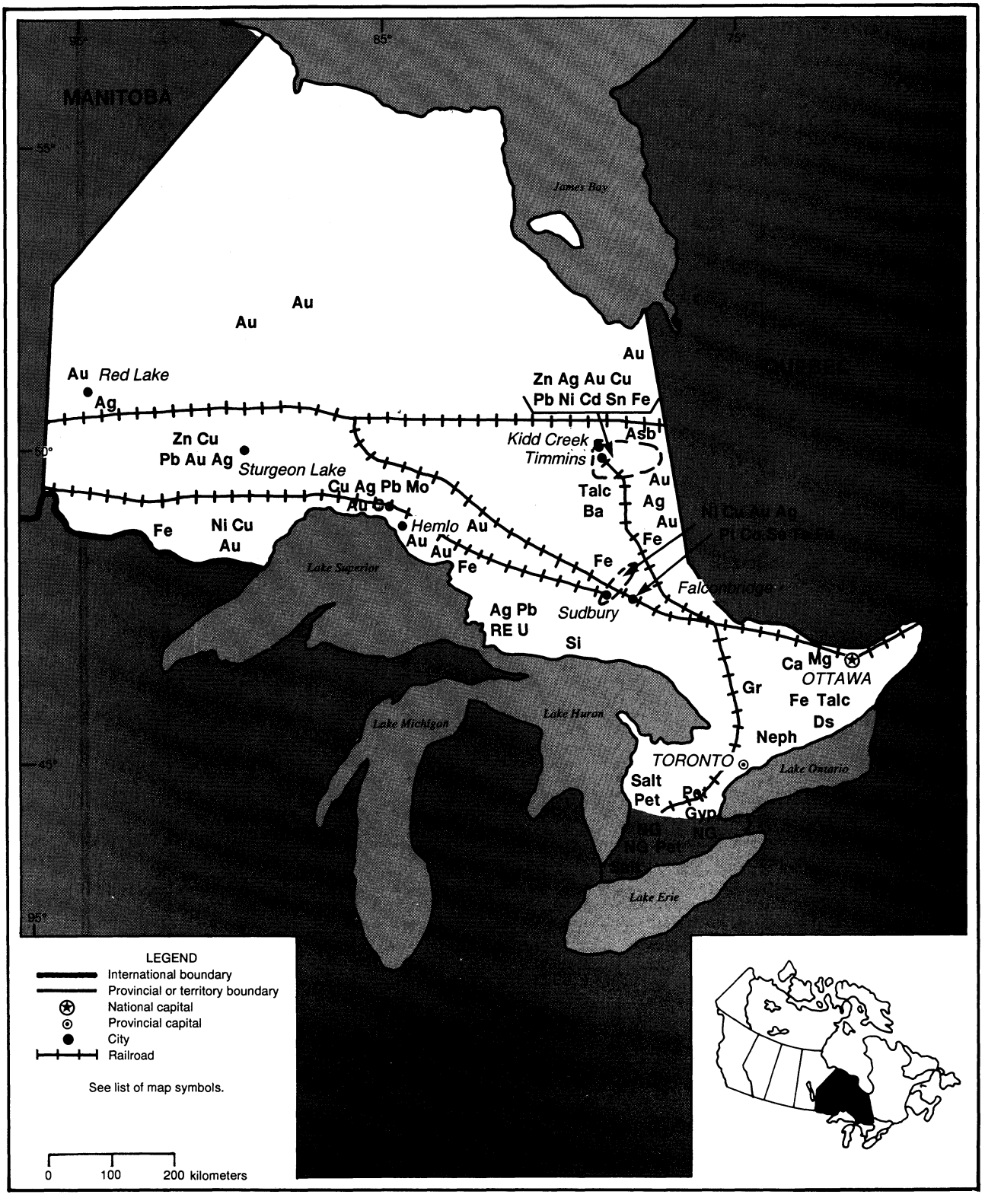
AREA 3.4 million km² **POPULATION 63,000**



ONTARIO

(MINERAL DEPOSITS)

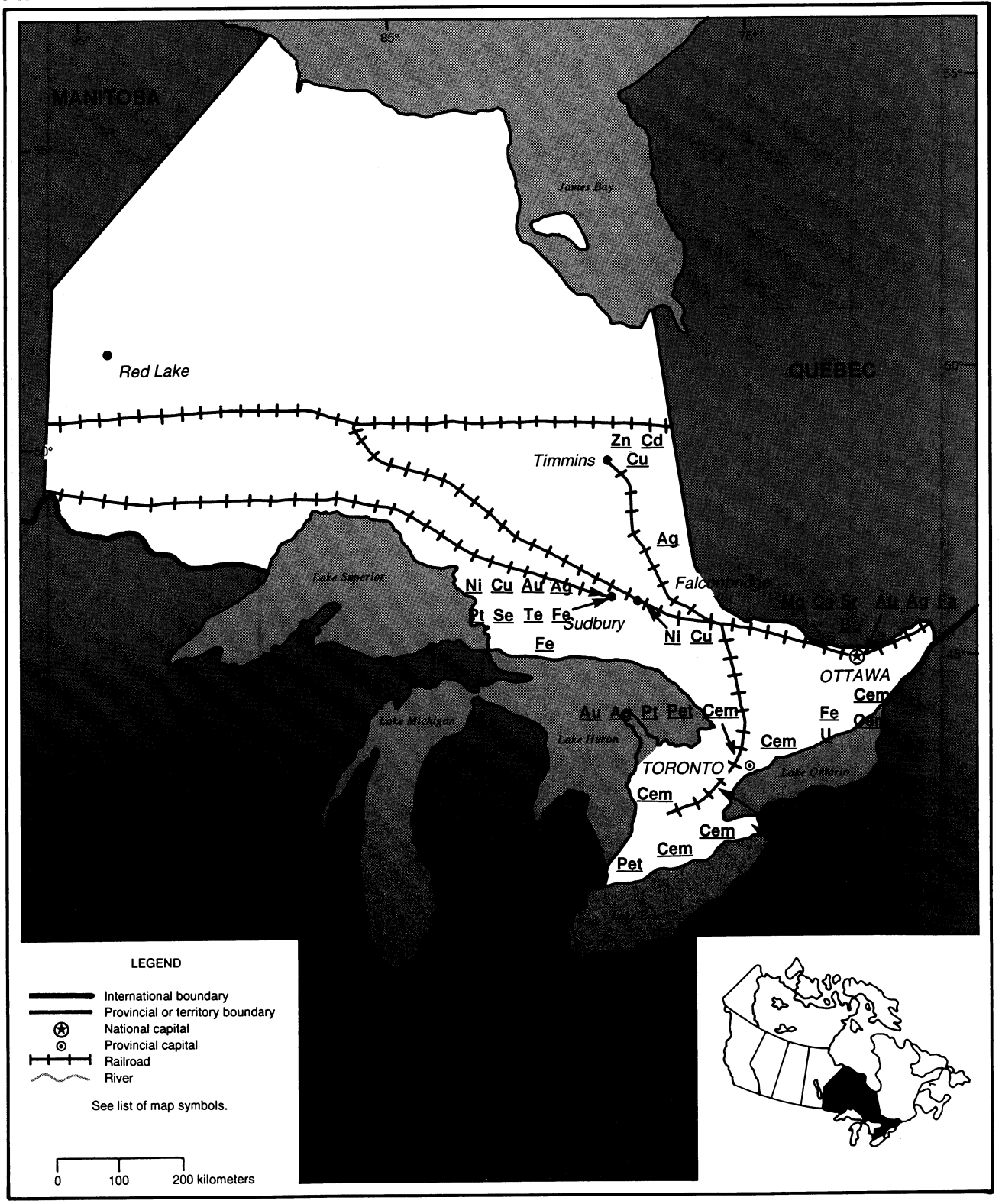
AREA 1.1 million km² **POPULATION 10.7 million**



ONTARIO

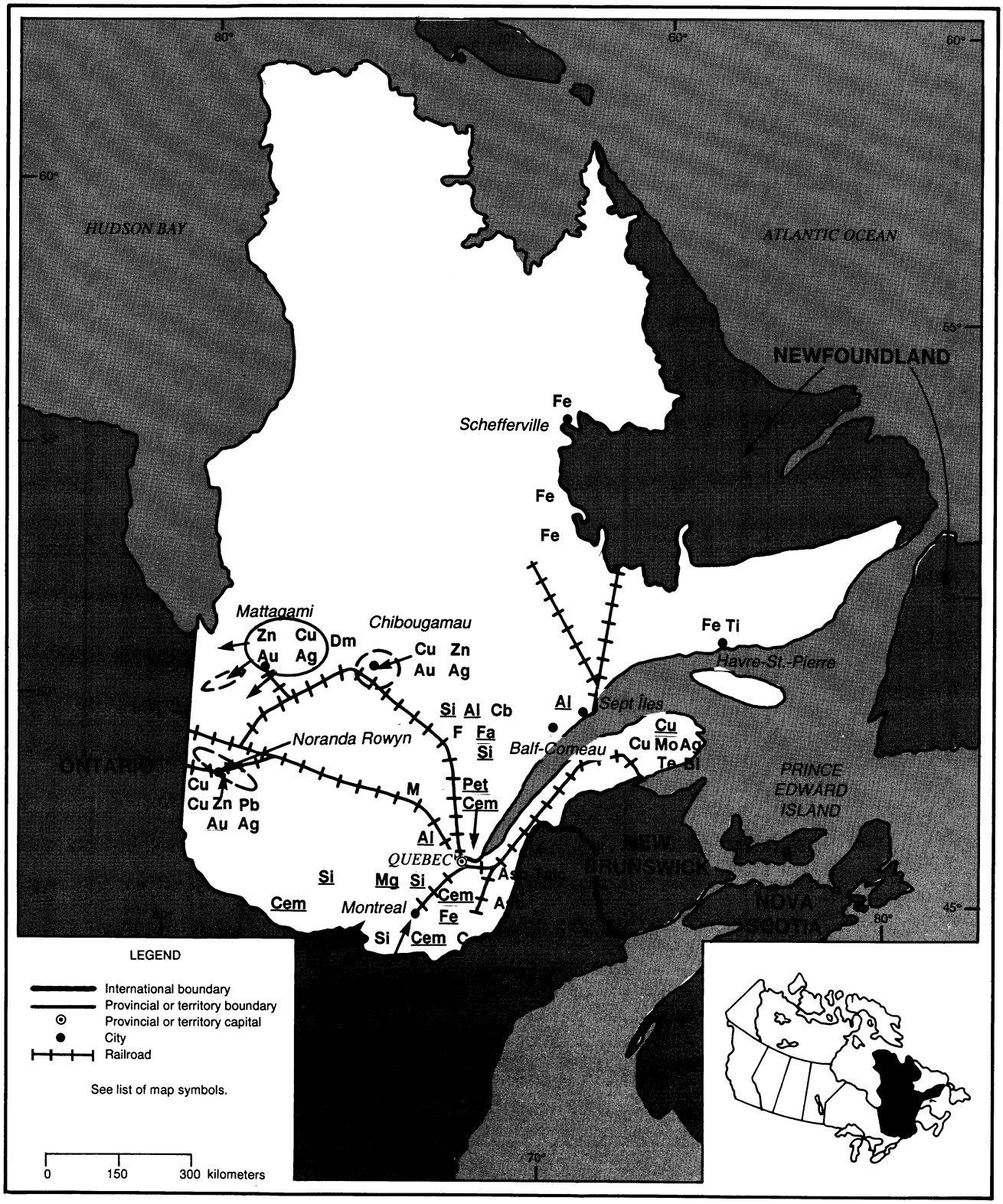
(SMELTERS AND REFINERIES)

AREA 1.1 million km² **POPULATION 10.7 million**



QUEBEC

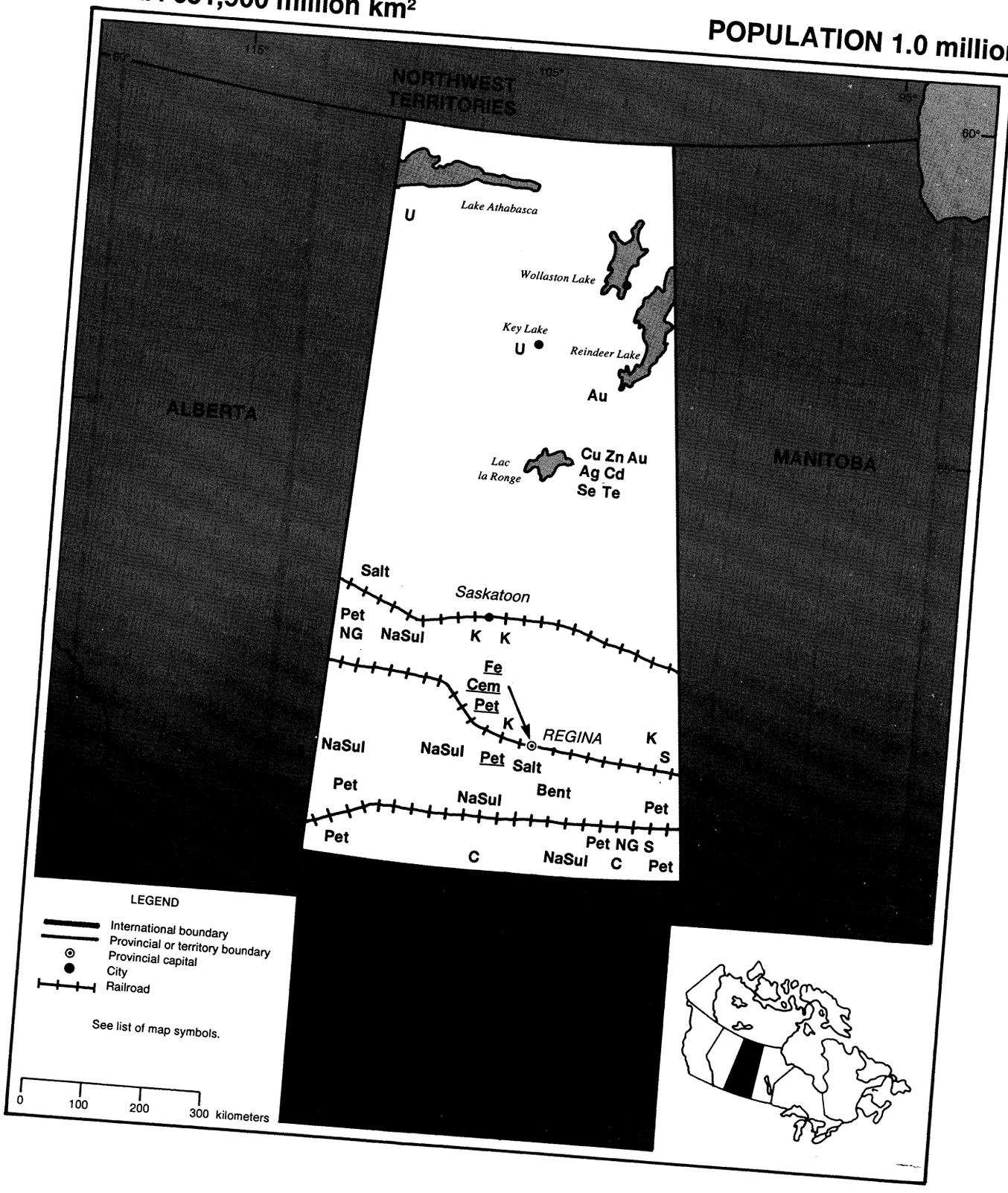
AREA 1.5 million km² **POPULATION 7.2 million**



SASKATCHEWAN

AREA 651,900 million km²

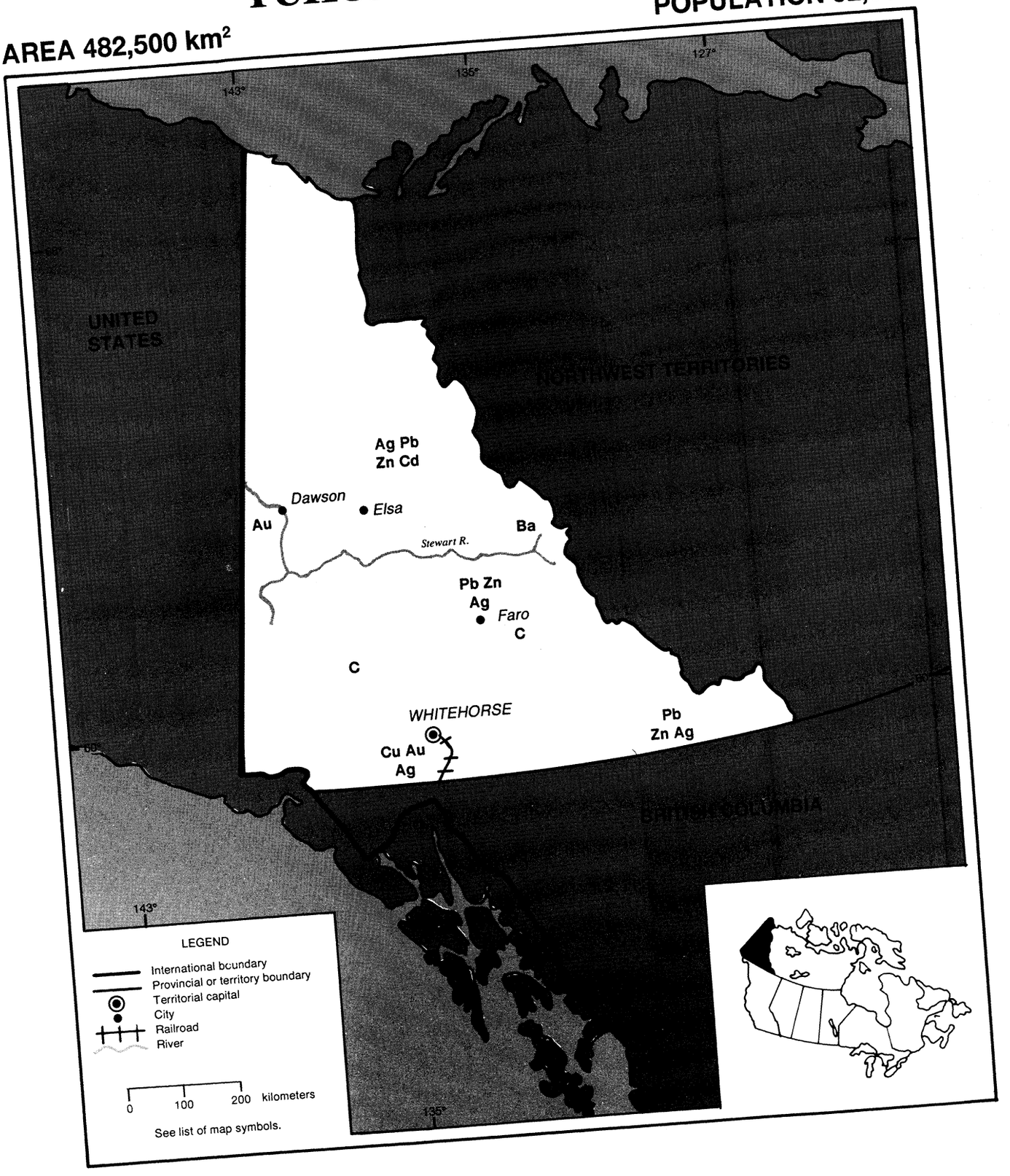
POPULATION 1.0 million



YUKON TERRITORY

AREA 482,500 km²

POPULATION 32,000



THE MINERAL INDUSTRY OF

CANADA[1]

By David B. Doan

Canada's gross domestic product (GDP) for 1992 was approximately $571 billion,[2] of which minerals and metals contributed about 4.4%. This GDP represented an increase of only about 0.9% over that of 1991. The economic recession showed signs of recovery during 1992, as did parallel economic difficulties in the United States, but in both cases progress was slower than had been hoped for. Unemployment exceeded 11% in Canada as layoffs continued and uncertainty remained. However, the inflation rate, at 1.5%, was the lowest of the seven major industrialized economies of the world and was expected to remain low.

While attention of the mining industry seemed to shift from gold to diamond exploration, established reserves of base metals were being depleted faster than they were being replaced by new discoveries.

Inventory accumulation in various parts of the world for certain mineral commodities resulted from a slackening of demand, particularly in the highly developed countries. A progressive weakening in market prices was attributed to, in part, the selling of abundant stocks of various metals into world markets by states of the former U.S.S.R. As commodity prices sagged, many Canadian mines either suspended production or closed permanently in cases where marginal operations could not sustain continued low price levels.

Preliminary data for 1992 on the value of mineral production, including fuels, showed a small increase of approximately 0.6% to about $29.3 billion compared with that of the previous year. Gains in value were led by petroleum crude, zinc, and natural gas, in that order. Gold, coal, and elemental sulfur led the declines.

Environmental concerns continued to influence mineral exploration and development activity in Canada, and some companies began to look elsewhere for projects, particularly in Latin America. A prominent example was the world-class Windy-Craggy copper-cobalt deposit in northern British Columbia. In response to environmental concerns and pressures from both Canada and the United States, the Government of British Columbia ruled against the permitting of mine development in the area. This action set a precedent that has led to considerable uncertainty as to the future of mining in British Columbia, if not all of Canada.

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 impermissable in terms acceptable to both the mineral industries and the concerns of environmental conservation and preservation.

GOVERNMENT POLICIES AND PROGRAMS

Within the realm of legislation, the Canadian Environmental Assessment Act was given final approval in midyear by the Senate. This bill was designed to replace the guidelines of the Environmental Assessment and Review Process of 1984 (known widely as EARP). Later in the year, an agreement was ratified at the Canadian Mines Ministers' annual meeting to extend the Mine Environmental Neutral Drainage (MEND) program from 1993 to 1997 as well as to increase its funding from $10.4 million to about $15 million. Started in 1985 with funding from the Mining Association of Canada (MAC), MEND addresses problems of acid-water drainage from mine tailings.

The "piecemeal policy approach" to the solution of outstanding problems in the Canadian minerals and metals sector was challenged by MAC in terms of a proposal to the Mines Ministers' Conference in Whitehorse, Yukon, that a major initiative be undertaken to develop a comprehensive strategic vision for the future of mining in Canada. Accordingly, a planning group was formed, including representatives from governments, industry, labor, environmental groups, and aboriginal peoples to work toward a Whitehorse Mining Initiative (WMI) that would bring together all interests, concerns, and viewpoints. Response was impressive, leading to unprecedented study of the range and complexity of problems and issues facing the Canadian mining sector. Thirteen interim, or background, reports were completed, but the WMI was to be a continuing effort intended to carry the ultimate blessing of all interests concerned. A summary report, "The Canadian Mineral Industry in a Competitive World," noted three points of major significance that could have a negative impact on Canada's suitability for mineral investment over the long term: (1) environmental assessment, permitting, and regulation, causing uncertainty and unpredictability in the regulatory framework, possible unreasonable delays and costs, excessive overlap of regulations and jurisdictions, and the costs of *a priori* reclamation charges and levies; (2) land use problems such as restrictions on access and

uncertainty of legal tenure; (3) mineral taxation, wherein recent changes to the Canadian tax system have eroded Canada's previous most-favorable-standing among its world competitors.

The WMI was intended to be carried forward with additional research and analysis throughout 1993, aiming at further guidance to governments and industry in taking necessary steps to reestablish Canada's fundamental position in the international mineral economy.

The Free Trade Agreement (FTA) with the United States, which the Canadian mining industry actively supported, completed its fourth year of existence in 1992. In effect since January 1989, the FTA included 5-year and 10-year phaseouts of tariffs on mineral commodities. Not only did the FTA create the largest such trade zone in the Western Hemisphere, but both countries looked southward toward Mexico as a candidate for an even-larger North American Free Trade Agreement, or NAFTA, to be negotiated in 1992 and completed in 1993 if all went well.

The Tariff Acceleration Agreement between the United States and Canada in 1989 testified to the FTA's success. The phaseout of tariffs was accelerated on more than 400 products, including minerals (as shown in table 4), worth $6 billion in two-way trade. Some United States-Canada subsidy issues, however, continued unresolved. Chapter 19 of the FTA provided for continuing negotiations on subsidies and antidumping measures, and a bilateral working group was established to negotiate on subsidies. This would depend on the completion of the General Agreement on Tariffs and Trade (GATT) subsidy negotiations in the Uruguay Round, whose future was not yet clear.

PRODUCTION

The value of mineral production in Canada in 1992 overall, including fuels, was $29.3 billion, up about 0.6% or $166 million from the equivalent total of the year before. Value of mineral fuels produced increased by 4.4% to $17.23 billion in 1992, but even this value was at the mercy of relatively soft petroleum prices during the year.

The aggregate value of all nonfuel mineral production in Canada during 1992 was $12.1 billion, down about 4.4% from that of the preceding year. Of this total, the value of metals produced was $8.45 billion, a decrease of 2.5% compared with that of the previous year. In the industrial minerals group, the value of nonmetals produced was $1.82 billion, down 7.7% from that of 1990, and the value of the so-called structurals, or construction materials, dropped by 9.2% to $1.81 billion in 1992. New highs in output were reached only in aluminum among the metals; diatomite and nepheline syenite among the industrial minerals; and coal, natural gas, natural-gas byproducts, peat, and petroleum crude among the mineral fuels. This inventory of "highs" reflects the depressed markets for base metals and lower prices for precious metals. In the industrial minerals, recovery from the economic recession probably still constrained output. Brisk foreign markets for Canadian petroleum, especially in the United States, seemed to stimulate the production of mineral fuels.

In terms of provinces and territories, Alberta led the list in value of output, $14.1 billion, followed by Ontario and British Columbia as a distant second and third, as shown in table 1. The 10 leading minerals produced nationwide, in order of value of output, were petroleum crude, natural gas, natural-gas byproducts, gold, copper, zinc, nickel, coal, iron ore, and potash, as shown in table 5. Capacity utilization rates in Canada's mining industries, including open pit and quarry extraction, averaged about 86.3% for the first three quarters of 1992. Exploration expenditures for nonfuel minerals were estimated at only about $350 million, the lowest since the mid-1970's, measured in constant dollars.

Following are regional summaries, considering the provinces from east to west:

Newfoundland

Newfoundland and Labrador registered a decrease from 1991 of about 4.8% for a total mineral output value of $609 million. Of this, iron ore comprised 93% of the total. Royal Oak Mines Inc. reopened the gold mine at Hope Brook and commenced pouring gold bars in July. Baie Verte Mines Inc.'s open pit asbestos mine closed in 1991, but the assets of Baie Verte Mines Reprocessing Inc. were purchased by Teranov Mining Corp., which continued operation of the wet-process mill for recovery of asbestos from tailings.

New Brunswick

New Brunswick's mineral production climbed about 32% in value to about $733 million in 1992, with the resumption of zinc and lead output by Brunswick Mining and Smelting Corp. Ltd. playing a significant role. The Caribou lead-zinc mine suspended operations in 1990, expecting to reopen in 1991 after a new determination of reserves; however the mine was reported to be manned by a skeleton crew monitoring effluents but ready for prompt startup. The mine was offered for sale by Breakwater Resources Ltd. A 50% share was purchased by the U.S. company Arimetco International Inc., which was studying an ammonia-leach process for the removal of copper and zinc.

Nova Scotia

Mineral production in Nova Scotia decreased in value by 5% to about $362 million in 1992, with $219 million represented by coal. Curragh Resources Inc.'s Westray coal mine at Stellarton, that had been expected to reach an output of 700,000 tons in 1992, suffered a disastrous and fatal underground explosion that required closure during resulting investigations. Among other consequences, a major precedent was set by the lodging of a criminal suit against the mine owners and managers.

Nova Scotia had no metal mines at yearend after closure of the Rio Algom Ltd. East Kemptville tin mine in early January 1992. Westminer Canada Ltd.,

a subsidiary of Western Mining of Australia, suspended activity of its Gays River lead-zinc mine and offered the property for sale. These two mines, along with the Tangier gold mine, were being evaluated by potential investors.

Quebec

The value of Quebec's mineral production in 1992, at $2.18 billion, shrank more than 10% from that of the previous year. Mining jobs in the province fell by about 8.3%. Mine closures, weakness in both base- and precious-metal prices, and slack demand for construction materials combined to cause the decline. Exploration activity, however, continued apace and resulted in several discoveries, mainly of gold mineralization, that boded well for future mining activity. However, all areas of investment, including exploration, development, capital assets, and purchase and repair of equipment, fell compared to those of the previous year. The Financial Assistance Program for Mineral Prospecting in eastern Quebec, involving about 100 prospectors primarily in the Lower St. Lawrence and Gaspe regions, was renewed during the year.

Ontario

At $3.89 billion, Ontario showed a decrease of 6.3% in the value of mineral production in 1992. Metals, industrial minerals, and construction materials were down in total value, representing lowered metal prices and easing of construction demand. The third largest category, industrial minerals, roughly held its own from 1991 levels. Uranium production dropped sharply. Soft metals prices resulted in suspensions or closings at Timmins (Timmins Nickel Inc.), Kirkland Lake (Northfield Minerals Inc.), Thunder Bay (Inco Ltd.), Elliot Lake (Dennison Mines Ltd.), and Wawa (Muscocho Explorations Ltd. and McNellen Resources Inc.). Furthermore, there were production cutbacks at the Sudbury operations of Inco Ltd. and Falconbridge Ltd.

Manitoba

The value of Manitoba's mineral production in 1992 increased slightly, 1.2% from that of 1991 to a total of $828 million. The increase in value of copper and zinc produced was enough to overcome the decrease in value of nickel output. In addition, the value of crude oil and natural gas produced was about $116 million. The number of jobs dropped about 6% to 4,500, a number that was expected to decline further in 1993. Hudson Bay Mining and Smelting Co. Ltd. closed its Snow Lake and Spruce Point copper-zinc mines but continued modernizing its zinc plant as well as its copper smelter. Although exploration expenditures were down, property acquisition was up sharply, amounting to 742 claims in the first 11 months of 1992 versus 580 claims altogether for all of 1991.

Saskatchewan

Exploration throughout the province was vigorous: late in the year more than 5,620 km^2 had been staked for diamond. Saskatchewan saw the value of its mineral output edge upward 1.4% to $1.12 billion in 1992, largely the result of fairly steady demand combined with price increases for potash. Uranium production, at 8,070 tons of U_3O_8, was up 17% over that of the previous year. Coal production increased by 9.4% to 9.4 Mmt for 1992. Beyond these, the value of petroleum crude and natural gas production added another $1.45 billion to the total. Employment decreased slightly to a level of about 5,040 jobs.

Alberta

The value of mineral output in Alberta increased about 4.3% to $14.5 billion, fossil fuels having accounted for just less than 98% of the total. Natural-gas byproducts and sulfur registered declines, the latter having dropped 62% to about $95 million as the result of the steady fall of world prices. Exploration for diamond resulted in the staking of 220,000 km^2, which was 45% of the total area available for mineral exploration and development in the entire province.

British Columbia

At $2.15 billion, the value of mineral production in British Columbia was down 14% from that of the previous year, due mainly to extended strikes in the coal industry. In addition, production of petroleum crude and natural gas was valued at about $740 million. Coal production itself declined 32% to 17 Mmt, valued at about $580 million. Openings of several new mines, including the Windy Craggy copper-gold-silver-cobalt project, were delayed by provincial policy decisions resulting from environmental concerns as well as a lack of sufficient capital in some cases. The Dome Mountain gold mine was able to open, but three others closed permanently, including Noranda Minerals Inc.'s Bell copper mine, Minnova Inc.'s Samatosum silver mine, and Cassiar Mining Corp.'s McDame asbestos mine. At about 9,000, the number of jobs in the mineral industry fell by 15% in 1992.

Northwest Territories

The value of mineral production in the Northwest Territories, including fuels worth about $141 million, was $540 million, or 8% below that of 1991. Exploration expenditures, however, were much higher than those of 1991, focusing on diamond targets in a large region centering on Lac de Gras, where diamond was found in kimberlite. Total staking was on the order of 54,000 km^2.

Yukon

The Yukon Territory realized mineral production worth $387 million in 1992, up 37% from that of 1991, reflecting greater production of lead and zinc. Although gold output from placer mines remained about even, production from lode or bulk-minable deposits was down about 10% because of weaker gold prices and consequent acceleration of depletion of reserves. Curragh Inc.'s lead-zinc mine at Faro was shut down in late 1992

and into 1993. Exploration expenditures were steady but, unlike the neighboring Northwest Territories, the quest in the Yukon Territory was mainly for base metals and gold rather than diamond.

TRADE

Mineral commodity exports for the first 9 months of 1992, valued at $24.1 billion, increased by 4.6% compared with the like period of the previous year. Exports included crude minerals, smelted and refined products, semifabricated and fabricated forms, plus waste and scrap for recycling.

The mining and metallurgical extractive industries registered about 70% of all mineral exports, and the latter amounted to about 17.1% of total Canadian exports for the year. As well as its best overall customer, the United States continued to be Canada's best mineral-exports customer in 1992, absorbing 59% of the total, including coal but excluding crude oil and natural gas. Of the remaining mineral exports, 13.3% went to the European Community (EC), and about 10% to Japan. According to the latest full year of data, 1991, mineral imports were $11.2 billion, down from $11.7 billion in 1990. Of these imports in 1991, 68.7% came from the United States, 11.7% from the EC, and 3.4% from Japan. The mineral industry of Canada thus contributed a net trade surplus of $9.43 billion to the country's merchandise balance of trade, down only slightly from that of 1990. The equivalent datum for 1992 showed a surplus of $6.6 billion for the first 9 months of the year.

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

Total trade between the United States and Canada exceeds that of any other two countries in the world, amounting to slightly less than $200 billion in 1992, with further growth expected. So far, the United States-Canada FTA implementation had been successful and smoother than might have been expected for such a complex accord, particularly with subsidy issues yet to be resolved. This is not to say that the FTA was regarded favorably throughout Canada. Minor disputes have arisen in the metals trade sector that are blamed on the FTA in the popular mind, although they would probably have occurred regardless. As quoted in various Canadian newspapers, the prestigious C.D. Howe Institute in Toronto, probably Canada's leading independent, nonpartisan, nonprofit economic-policy research institution, concluded that the FTA was working well and that merchandise and services exports have thrived in sectors that were liberalized by the FTA, while exports have languished in sectors not affected by the FTA. Contrary to some complaints growing out of the lingering effects of the recession, the Howe Institute said that the FTA has not led to widespread job losses and that Canada has not become simply a provider of natural resources to the U.S. economy. The Howe report further noted that the trade data do not support a link between FTA and penetration of Canadian markets by U.S. producers, and that in many import categories the lion's share of growth in the Canadian market has been grabbed by overseas producers.

The Economic Council of Canada, a research organization of the Federal Government, forecast that by 1998 free trade would bring a net gain of 251,000 jobs to Canada, increasing employment by almost 2% and Canada's 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 were considered foreign whose corporate voting rights were at least 50% non-Canadian, 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, for example, that were not smelters in the strict sense. In general, foreign companies were subject to all of the same taxes as domestic companies, but repatriation of earnings was unimpeded.

As a whole, 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 the drilling and production operations characteristic of the petroleum industry. Table 8 depicts the structure of the mineral industry by sectors of the major mineral commodities.

On the labor scene, total employment in actual mining plus primary metals (iron and steel mills and nonferrous smelting and refining) in 1992 was, at 121,934 jobs overall, down about 12% from the year before. This was the lowest level since 1961 and continued the decline that began after 1989. The work force in metal mines was down 6% overall. The labor force in industrial-mineral

extraction was likewise down generally, about 3% for nonmetals and 7% in structural materials. Jobs in the the coal mining sector, which showed an increase of 3% in 1991, plummeted 17% in 1992.

Average earnings in mining in Canada have been among the highest of all industrial classifications. Average weekly earnings in 1991 for hourly-waged employees were about $735 for metal mines and $590 for nonmetals, with indications of at least a 3.6% increase for 1992. Likewise, indications were that wages would improve by 8% or more in the coal industry. Although these rates were well above those for manufacturing and construction, problems loomed in the future. Changes in technology, skill levels, and work force demographics, combined with a weakening of enrollment in mining-related courses at colleges and universities, have raised questions about the future viability of the mining work force in Canada. Accordingly, attention is being focused by the industry, Provincial governments, and educational institutions to develop strategies for human resource development.

COMMODITY REVIEW

Metals

Aluminum.—Production of primary aluminum increased 7% to 1.950 Mmt in 1992, marking a new high, from 1.822 Mmt in 1991. Significant startups included Aluminerie Alouette Inc., owned by Vereignigte Aluminum-Werke AG of Germany (20%); Austria Metall Aktiengesellschaft of Austria (20%); Hoogovens Groep B.V. of the Netherlands (20%); Sociéte Générale de Financement du Québec (SGF) (20%); Kobe Steel Ltd. (13.33%); and Marubeni Corp. of Japan (6.67%). The June startup of this $22 billion, 215,000-mt/a smelter at Sept-Iles, Quebec, included arrangements for 29,000 mt/a of aluminum ingot for Kobe Steel's rolling mills and 14,000 mt/a for Marubeni. Total annual capacity was rated as 215,000 tons. The first shipment of aluminum, about 4,500 tons, went to Rotterdam on August 20.

Alcan Aluminum Ltd. (Alcan), previously the most profitable company in Canada in 1988-89, further idled its $1 billion Kemano hydroelectric project in British Columbia, which would have upgraded its generating capacity from 896 MW to 1,436 MW. Construction had been halted pending an appeal filed by Alcan to a court ruling providing for an independent environmental review. The company had initiated the project only after previous environmental reviews and changes to meet Federal and Provincial requirements. Plans were to sell excess power to the British Columbia Hydro Power Authority until such time as Alcan decided to add additional smelting capacity.

Alcan also completed construction of its Laterriere smelter in Quebec, costing almost $700 million, with a rated capacity of 200,000 mt/a. Older Soderberg potlines at the Arvida smelter in Jonquiere, Quebec, in 1990 were being replaced by Laterriere production, where pollution control is projected to capture more than 99% of the fluorides and dust particles in effluent gases. Startup of Laterriere and closure of the Soderberg potlines at Arvida is expected to reduce atmospheric emissions of polycyclic aromatic hydrocarbons by 60% and fluorides by 50%.

Cobalt.—Reversing the downtrend of 1991, cobalt production in Canada increased to 2,219 tons in 1992, representing a gain of about 2.2%. The significant news, however, was that the value of 1992 production, $113 million, was almost 77% higher than the value of 1991 output. Price hikes reflected uncertainty of supply from Zaire, the world's principal producer, where civil and political instability threatened production of that country's 40% world share of refined cobalt.

Cobalt production in Canada is entirely the byproduct of nickel-copper mining and processing by Inco Ltd. and Falconbridge Ltd., as well as from processing of purchased and toll-refining materials from both imported (including Cuba) and domestic sources by Sherritt Gordon Ltd. in Fort Saskatchewan, Alberta.

In the light of weakening demand for nickel, Inco decided to shut down its 1992 nickel mining and processing altogether in both the summer (5 weeks) and during the following Christmas vacation (3 weeks), and further announced that a 4-week shutdown would occur in 1993. Nonetheless, Inco produced 1,154 tons of cobalt during the year. Falconbridge produced 723 tons, a decrease of 3% from that of 1991, after shutting down for two 5-week periods in 1992. Sherritt Gordon, which produces cobalt solely from purchased feedstock rather than from base-metal mines in Canada, refined 803 tons of cobalt in 1992, a decrease of 2% from that of 1991. The company used richer feed materials from Cuba containing 5% cobalt. It neared completion of its augmented cobalt refining facilities, with a reported design capacity of 3 million pounds per annum, relying partly on a proprietary process for adapting to the new high-ratio cobalt feed.[3]

Copper.—Output of copper dropped from 811,134 tons in 1991 to 764,189 tons in 1992, a decrease of 6%, while prices remained fairly steady at an average $1.04 per pound for the year, down only about $0.02 from 1991, but down $0.16 from the $1.20 per pound of 1990. Mine closures in 1991-92 and lower output at some other mines combined to affect Canadian production negatively compared to the previous year.

Blister and anode copper production rose 1% to slightly more than 550,000 tons, while refined copper showed a miniscule increase to 539,000 tons. Exploration for new copper deposits continued strong, stimulated by depleting reserves and depleted mine closures.

In northwestern British Columbia, 30 km from the U.S. border, Geddes Resources Ltd. continued with its huge and expensive Windy Craggy project that involved reserves of about 300 Mmt grading 1.9% copper and 0.8% cobalt along with significant gold and silver. Copper demand throughout the world will require about four such new deposits yearly between 1995 and 2000. A world-

class deposit by any standard, Windy Craggy engendered strong environmental objections based on the probability of acid mine drainage, seismic safety of tailings impoundment dams, disturbance of the Chilkat Bald Eagle Preserve and other migratory birds and wildlife, impact on Alsek River salmon spawning grounds, and impact on wilderness river pleasure rafting, among other factors. Potential cross-border impacts prompted resolutions in the 102d U.S. Congress to be put forth requesting that Canada and the Province of British Columbia put the Windy Craggy project on hold for further study of the impacts. British Columbia's Commission on Resources and Environment (CORE) took the entire matter under advisement with the aim of recommending the course and degree of development in the northern part of the province. CORE was expected to announce its conclusions early in 1993. Whatever the outcome, in the minds of many observers Windy Craggy augured to become a bellweather for the future of mining in Canada.

Settlement was reached between Aur Resources Inc. and Louvem Mines Inc. in 1990 as to ownership of the Louvicourt property near Val d'Or, Quebec, containing an estimated 37 Mmt grading 3.6% copper, 1.59% zinc, 21.3 g/mt silver, and 0.09 g/mt of gold. Societe Miniere Louvem's share of ownership was 45%, Aur's 30%, and Teck Corp.'s 25%. Aur announced in late 1991 that development originally projected at somewhere between $125 and $175 million would instead be closer to $290 million, with production starting probably in 1994. After raising the cutoff grade to restrict the tonnage to 25 Mmt, output was targeted at 50,000 mt/a of contained copper and 20,000 mt/a of zinc, plus significant amounts of gold and silver.

Falconbridge Ltd. continued exploration of its Raglan copper-nickel deposit in the Ungava region of Quebec, with reserves thus far projected at 17 Mmt grading 3.13% nickel and 0.88% copper. A full and final feasibility study was anticipated in mid-1993.

Gold.—Production of gold in Canada dropped sharply from 176,552 kg the previous year to 158,049 kg in 1992, a decrease of 10.5% from 1991's alltime high. This did not change Canada's position as fifth in world production behind the Republic of South Africa, the United States, the former U.S.S.R., and Australia, in that order. Based on an average price of $344 per ounce, the value of production was $1.75 billion, down 14% from that of 1991. After 3 new primary gold mines opened and 11 closed during the year, 88% of the gold produced came from 50 primary gold mines.

Gold prices fluctuated narrowly compared with previous years. Enough downward pressure was exerted on prices in world markets that gold mining companies in Canada carefully watched their cash-flows and break-even points. Costs were reexamined continually, along with tonnages, grades, and mining plans. Suspensions and closures were invoked freely as a means of avoiding loss.

Placer Dome Inc. had declined to proceed with development of the Eskay Creek property in British Columbia after a protracted negotiation with Corona Corp. that reduced the complexity of interlocking ownerships to a straight 50-50 agreement. Following an intensive review, Placer Dome concluded that an estimated capital cost of $183.3 million for production of a projected 7,776 kg/a of gold plus ancillary silver did not fit its corporate goals. The deposit has been characterized as 1.15 Mmt of ore grading 59.8 g/mt of gold and 2,405 g/mt of silver. Corona conceded a 22% joint-venture interest to Placer Dome, undertook a $8.7 million feasibility study, and aimed for production by 1995. Corona was taken over by Homestake Mining Co., which decided to truck the ore 550 km to be processed at a mill near the Equity Silver Mine.

Placer Dome decided against developing its Mount Milligan property, a large, low-grade copper and gold deposit in British Columbia. Upon acquisition in 1990, the ore body was estimated at 313 Mmt grading a rather marginal 0.53 g/mt of gold. After 18,900 m of new drilling, however, the deposit was projected to be 329 Mmt grading 0.22% copper and 0.40 g/mt of gold. With cutoffs the adjustment came to 300 Mmt grading 0.23% copper and 0.56 g/mt gold, but judged not to justify the $390 million to $480 million capital investment required for development.

Although Aurizon Mines Ltd. closed the Sleeping Giant mine, 65 km north of Amos, Quebec, in the midst of gold price weakness in 1991, Cambior Inc. began a 3-year, $10.5 million exploration program to earn a 50% interest in the property. New drifting on the 295-m level cut mineralized zones from which wall sampling yielded 2 m grading 24.3 g/mt gold, 3 m of 31.5 g/mt, and another 2 m yielding 21 g/mt gold. Cambior planned to reopen the mine in early 1993.

As the result of shutdowns in Ontario, the three gold mines in the Hemlo area managed to account for more than 50% of the 1992 total production of 74 tons in the Province.

Iron and Steel.—Continuing a trend begun in 1990, production of iron ore dropped slightly in 1992, decreasing to 34.14 Mmt from 36.38 Mmt the previous year, a drop of 0.06% compared with the 1.6% drop from 1990 to 1991. Employment throughout the iron ore mining and processing industry dropped below 5,700, with further layoffs planned in 1993. Imports of iron ore from the United States represented 40% of total consumption of iron ore by Canadian steel plants in 1992. Only 7 blast furnaces operated in 1992 compared with 10 in 1989.

About 34.4 Mmt of concentrates and products was produced during the year, the largest category having been 13.8 Mmt of concentrates not further processed. Shipment of acid pellets was 14.1 Mmt, fluxed pellets 5.5 Mmt, and sinter 0.99 Mmt.

Following the closure of the Iron Ore Co. of Canada (IOC) Schefferville mine in Quebec, the Adams mine at Kirkland Lake, Ontario, and the Sherman mine at Temagami, Ontario, all in the past 2 or 3 years, only four principal iron mines remained operating in Canada. Three of these were in Quebec or Labrador,

including Quebec Cartier Mining Co. (QCM) at Mt. Wright; IOC at Carol Lake, Labrador; and Wabush Mines Ltd. at Wabush, Labrador, and Pointe-Noire, Quebec. The fourth mine was the Algoma Steel Corp. Ltd.'s Algoma Ore Div. in Wawa, Ontario. Some additional concentrates have been produced on a much smaller scale, averaging about 75,000 mt/a, in British Columbia.

Production of pig iron increased 4% to about 8.6 Mmt, somewhat better than that of 1990 and 1992 but significantly less than the 10.1 Mmt of 1989. Crude steel output increased approximately 7% to about 13.9 Mmt in 1991, but again, not very close to the 15.5 Mmt of 1989. Production of ferroalloys was estimated at 100,000 tons for 1991, down sharply from estimates for previous years.

Lead and Zinc.—Production of lead from Canadian mines rose significantly for the second year in a row, from 276,528 tons in 1991 to 342,486 tons in 1992, an increase of 24%. The gain resulted from the resolution of labor disputes and production problems the previous year, followed by 1992 production closer to capacity as well as new mines completing a full year of production. Output of primary and secondary refined lead jumped from 212,000 tons in 1991 to 255,000 tons in 1992, a gain of 20%, in spite of the persistence of weak lead prices averaging $0.245 per pound on the LME, down from LME averages of $0.37 cents per pound in 1990 and $0.253 cents per pound in 1991.

Mine production of zinc rose from 1.157 Mmt in 1991 to 1.312 Mmt tons in 1991, up about 13%, while output of refined primary zinc edged upward from 661,000 tons in 1991 to 672,000 tons in 1991, an increase of less than 2%. LME average zinc prices climbed from $0.51 per pound in 1991 to $0.56 per pound in 1992, giving some stimulus to production. Canada remained the leader in production of zinc concentrates by furnishing 24% of the Western World's supply.

After Cominco Ltd.'s Sullivan mine at Kimberly, British Columbia, reopened with a new labor contract in 1991, the company began construction of a new $6.62 million regrind circuit to improve the quality of lead and zinc concentrates that will come on-stream in 1993. The Sullivan mine has a remaining life of about 9 years based on reserves of more than 18 Mmt tons grading 4.7% lead, 7.6% zinc, and about 28 g/mt silver.

Problems continued through the year at Cominco's new 160,000-mt/a Queneau-Schuman-Lurgi (QSL) smelter at Trail, which remained closed. The company had discontinued modifications of the plant and postponed a 1991 startup pending tests on similar equipment in Germany. Metallgesellschaft AG froze modification of its 100,000-mt/a QSL lead smelter pending further study of gas injectors and refractory stabilizing systems. Cominco did, however, finish modification of its zinc smelter at Trail for accomodation of concentrates from its Red Dog mine in Alaska.

The Stronsay lead-zinc project 240 km northwest of Fort St. John, owned by Curragh Resources Inc., was slated for development construction in 1992 upon approval of environmental permits, which were obtained, but lack of financing stalled the project. With reserves of 52 Mmt grading 2% lead and 8% silver, plus 42 g/mt silver, the operation was projected to produce 28,000 mt/a of lead in concentrate for about 20 years. New financing was being sought.

Magnesium.—Refinery production of magnesium dropped sharply from 35,512 tons in 1990 to 25,700 tons in 1991, a decrease of about 28%. In September 1991, the Magnesium Corporation of America (Magcorp) filed an antidumping and countervailing duties petition against imports of pure and alloyed magnesium from Canada and Norway manufactured by Norsk Hydro. The countervailing duties petition against Norway was later dropped by the U.S. International Trade Commission on the basis of insufficient evidence. By the time of Magcorp's filing in September, deep discounts were being offered in light of lowered demand and large inventories overhanging the market. Trades occurred in Europe at prices reportedly as low as $0.90 per pound. In November, Norsk Hydro left the International Magnesium Association (IMA), taking Norsk Hydro Canada, based in Quebec, along with it. During the same month the company also cut production at its plant in Becancour, Quebec, from a rate of 35,000 mt/a to 20,000 mt/a. In December, the U.S. Department of Commerce issued a preliminary ruling that exports of magnesium from Canada were subsidized below fair market price.

After further investigation by the Department of Commerce, a final determination was made in 1992 and countervailing duties were set at 21.61% on an ad valorem basis. The high rate was based on a finding that electricity contracts between Norsk Hydro and Hydro-Quebec conferred a benefit to the former, as did assistance provided to the company by the Province of Quebec under its industrial development program.

In February, in addition to the countervailing duties, the United States issued an antidumping preliminary determination placing a 32.7% dumping margin against Norsk Hydro Canada Inc. In August, the U.S. International Trade Commission made a final injury determination in the affirmative, thus confirming the 22% countervailing duty and 33% antidumping duty against magnesium imports from Norsk Hydro in Canada.

In October 1992, however, the Department of Commerce issued a changed-circumstances review that concluded that the amended contract for electricity between Hydro-Quebec and Norsk Hydro did not confer a subsidy. Countervailing duties were reduced from 22% to 8%, and requests were filed by Norsk Hydro and the Government of Quebec for a panel review according to dispute settling provisions of the FTA between Canada and the United States, to consider both the dumping and subsidy determinations previously lodged. Resolution was hoped for in 1993.

Nickel.—Mine production of nickel was virtually unchanged from that of the previous year at 192,086 tons. Prices

softened as LME nickel stocks increased to the highest levels ever (67,000 tons) and exports from the former U.S.S.R. continued to increase. Average LME nickel prices dropped from $3.70 per pound in 1991 to $3.18 in 1992, but averages did not tell the whole story. Prices fell to $2.39 per pound on the LME in November 1992, before production cuts announced in the third quarter by Inco and Falconbridge halted the slide. By and large, however, exploration continued.

Falconbridge continued its program at its wholly owned subsidiary, New Quebec Raglan Mines Ltd., in the Ungava region of northern Quebec. With reserves now estimated at 18.5 Mmt grading 3.13% nickel and 0.88% copper plus some platinum-group metal values, the Katinnic deposit had a 1,830-m ramp driven into it, for 55,000 m of diamond drilling and the taking of a 500-ton bulk sample. Other work was directed toward developing local infrastructure for the mine as well as study of the potential mine's impact on the local Innuit and Cree peoples.

Inco officials noted that depleting reserves, environmental cost pressures, and high labor costs were forcing the company to reconsider its long-term future in Canada. Sudbury nickel reserves were seen as lasting 30 years and Manitoba reserves only 20 years. Labor costs were at highs of nearly $60,000 per worker per year, representing 50% of total costs. Inco noted that less than 30% of its markets were in Canada and that the costs of controlling sulfur dioxide emissions have "drastically forced up capital expenditure."

Timmins Nickel Inc. closed its two operations in northeast Ontario, placing Langmuir No. 1 and Redstone mines on care and maintenance pending improvement in nickel prices.

Sherritt Gordon, needing nickel sulfides to satisfy unused capacity at its refinery in Fort Saskatchewan, Alberta, had entered into an agreement with the Republic of Cuba to purchase nickel matte. Cuba had difficulty raising enough cash to obtain fuel for its nickel refineries owing to political and economic troubles in the former U.S.S.R. and also was also unable to carry out the planned expansion of its nickel refining capacity because its former partner, East Germany, was absorbed into Germany. The tradeoff in the Sherritt Gordon arrangement was the cost of transporting nickel sulfides from Cuba to Alberta as well as the inability to sell any of its product in the United States because of the U.S. trade embargo on Cuban materials. Sherritt continued to operate below capacity.

Platinum-Group Metals.—Mine production of platinum-group metals (PGM) dropped slightly from 11,708 kg (revised) in 1991 to 11,058 kg in 1991, a decrease of less than 6%, that represented captive recovery from nickel ore rather than response to market conditions. Most Canadian production is by Inco or Falconbridge from their Sudbury mines, plus a minor amount in Manitoba from Inco's Thompson mine, the HBMS Namew Lake mine, and Outokumpu Mines Ltd. near Flin Flon.

As an approximation, based on corporate reports, Inco's ratio of PGM produced worked out to about 12:7.6:1 for the group members palladium: platinum:rhodium. Although rhodium amounted to only a little more than one-twentieth of the PGM, prices had tripled to $3,620 in 1990 and then reached $3,982 in 1991 before dropping to below $2,000 per troy ounce at the end of that year. Having reached $2,323 per troy ounce in September 1992, the rhodium price again dropped below $2,000 by the end of the year.[4]

New nickel discoveries by Inco in the Sudbury Basin boded well for the PGM outlook; the Victor discovery contains an estimated minimum of 18 Mmt grading 11.6 g/mt PGM plus gold. The McCreedy discovery contains 5 Mmt grading 10.6 g/mt PGM plus gold. In the meantime, production startup was expected in early 1993 of the Madeleine Mines Ltd.'s Lac-des-Iles property in northwest Ontario, which was projected to be capable of producing 5,120 kg/a of PGM.

Silver.—In the midst of adequate inventories and little real demand, mine production of silver in Canada declined from 1,339 tons in 1991 to 1,207 tons in 1992, a difference of about 10%, following a drop of 11% the year before. Silver has been mainly a byproduct of gold and base-metal mining and subject to whatever mining incentive applies to the major product, whether gold, copper, or lead-zinc. Accordingly, silver output suffered as mines closed for reasons involving supply, demand, and prices for other major mineral commodities.

Canada's largest primary silver producer, the Equity Silver mine in British Columbia, was expected to close upon exhaustion of reserves in 1992, but new exploratory drilling in the first half of the year discovered an additional 480,000 tons grading 190 g/mt of silver, 4.5 g/mt of gold, and 0.7% copper. Development began at the rate of 1,000 mt/d, which would extend the mine life into mid-1994.

Postclosure reclamation costs had been negotiated with the Government of British Columbia and the company, Equity Silver Mines Ltd., placed a $28 million bond to cover effluent treatment costs after closure, plus a $4.8 million security payment against waste-dump and plant-site restoration.

Elsewhere in British Columbia, the Samatosum mine near Kamloops, owned jointly by Minnova Inc. (70%) and Rea Gold Corp. (30%), closed in September because of exhaustion of ore. Generation of acid mine-water drainage was countered by mixing carbonate-rich rock with mine waste rock, followed by restoration of the topography, replanting, and fertilization over the waste dumps.

Tin.—The only operating tin mine in North America, Rio Algom Ltd.'s mine at East Kemptville, Nova Scotia, was closed in early January 1992. Low tin prices and a high Canadian dollar combined to make the operation unprofitable. A plan for keeping the mine in operation was presented by company management to the Government of Nova Scotia and to the labor union,

but foundered because such issues as reclamation could not be resolved. About 4,400 tons of tin concentrates produced in 1991 ended by being smelted in Malaysia.

Uranium.—The downward trend in uranium output turned around in 1992 as Canada produced 10,869 tons of U_3O_8 during the year, about 13% more than the 9,624 tons produced in 1991. As the world's leading supplier of uranium, Canada was well placed in terms of resources, reserves, skilled mining labor, and technology to maintain this position in spite of falling prices and a diminishing oversupply that had weakened the market.

The former U.S.S.R., appearing as a new supplier and competitor on the world scene, was accused of selling uranium at less than fair value. In August, the United States announced that it had initialed an agreement with Russia, to be negotiated in full in the forthcoming 12 months, for the U.S. Department of Energy to purchase highly enriched uranium taken from nuclear warheads in the former U.S.S.R.

Other Metals.—Production of antimony decreased from 469 tons in 1991 to 327 tons in 1991, continuing a downtrend of more than 5 years. Dominion Explorers Inc. closed its Durham mine at Lake George, New Brunswick, the previous year, the only primary antimony mine in North America. Oversupply from China caused price deterioration to the point at which profitability disappeared.

Canadian molybdenum production amounted to 11,329 tons in 1991 but fell to 9,540 tons in 1992, a drop of about 16%. Reserves had been enhanced as both tonnage and grade were increased at Canada's only primary molybdenum producer, Placer Dome Inc.'s Endako mine in British Columbia, but soft demand and oversupply created lower prices. Additional supplies of molybdenum have been produced by Highland Valley Copper at Logan Lake, British Columbia.

Industrial Minerals

Asbestos.—Despite moderate price rises of 7% to 8% for asbestos in 1992, production decreased about 8% from 639,000 tons (revised) in 1991 to 585,000 tons in 1992, a result mostly from closure of the Cassiar mine in British Columbia and lowered production at mines in Newfoundland and Quebec. Weak demand continued for short fibers.

Following the decision in October 1991 by the U.S. Fifth Circuit Court of Appeals (New Orleans) that the U.S. Environmental Protection Agency (EPA) had failed to show sufficient justification for phasing out most (97%) current asbestos uses, which EPA had scheduled for 1997, the EPA was denied permission by the U.S. Department of Justice to appeal the ruling to the Supreme Court. This led to some wrangling between EPA and various end users of asbestos, with the EPA claiming that most asbestos products or uses were still subject to its overturned rules. In response, U.S. consumers, particularly U.S. auto manufacturers, asserted that no substitute exists for all uses of asbestos. These users further asserted that they would continue their use of asbestos until a substitute became available that afforded the same level of safety. Significantly, all reference to asbestos was removed from "Agenda 21" documents at a preparatory meeting at the United Nations Conference on the Environment and Development (UNCED) in March, prior to the June conference in Rio de Janeiro, where UNCED advanced Agenda 21 as its plan for issues of environment and development in the next century.

Cement.—Production of cement, at 8.5 Mmt, dropped from 9.4 Mmt in 1991, continuing a trend after the high of 12.6 Mmt in 1989, probably reflecting the general economic recession in spite of an increase in housing starts. The interconnected North American cement market has been based on marine transportation at low cost, attracting buyers to sellers to a degree that about 9% of U.S. cement consumption was from Canada in 1992, down slightly from the Canadian production high of 1989. Particularly affected states were Michigan, Minnesota, New York, Vermont, and Washington. Both cement and clinker were competitive in the U.S. market because of Canadian production efficiency and the relatively strong U.S. dollar. A progressive restructuring of the cement industry in Canada has resulted in increased foreign control, estimated at about 80% of capacity.

Diamond.—Exploration for diamond deposits reached a furious pitch as heavy staking continued for several hundred kilometers in all directions from the Lac de Gras diamond discovery site in Northwest Territories, followed by intense geophysical survey work and some bulk sampling. Kimberlite pipes were identified in several other provinces, including one in Quebec's Le Tac Township by Explorations Minieres du Nord Ltd. that stimulated its own aura of tight staking in several directions. It has been clear that not all pipes contain gem-quality diamond, but such stones have been found in small sizes at a number of sites, and many of the pipes were found to contain micro-diamonds. The point has been made in a recent technical paper[5] that "there are no known cases where a pipe barren of macro-diamonds has a high micro-diamond content; and conversely, [to the researcher's knowledge] there are no cases where a pipe has macro-diamonds and no micro-diamonds." The exploration and staking rush showed no signs of abating.

Graphite.—In the midst of production by Stratmin Inc. in Quebec and Cal Graphite Corp. in Ontario, Societe d'Exploration Miniere Mazarin Inc. still sought financing to bring its Lac Knife graphite deposit, in eastern Quebec, into production, having originally planned to begin mining in 1991. Even without this mine, however, production from the other two jumped sharply from 6,000 to 17,000 tons in 1991 and 1992, respectively. The deposit comprises 8.1 Mmt of ore grading 16.7% Cg (carbon in the graphite

structure), with the relatively uniform graphite grain-size distribution running fairly constant. The open pit mining plan projects production of 23,000 mt/a for a period of 60 years. Capital of about $28.5 million is thought to be required to bring the project to production.

Gypsum and Anhydrite.—At approximately 7.054 Mmt produced in 1992, output of gypsum increased about 3% above that of 1991 after a gentle downtrend for several years that seemed to reflect ongoing weakness in the construction sector.

Production has been mostly by subsidiaries of U.S. companies such as USG Corp. and National Gypsum Co., according to demand for wallboard by both U.S. and Canadian consumers in all building categories. Nova Scotia and Newfoundland produced the bulk of Canadian gypsum, with lesser amounts from Ontario, British Columbia, and Manitoba in about that order of value. Although gypsum occurs widely in Canada (and the world), the relatively high unit weight, low unit cost, and vulnerability to damage of wallboard combine to give gypsum products a relatively high place value, discouraging long-distance transportation. Instead, gypsum industries tend to develop in localities that serve developing construction requirements.

U.S.-based Louisiana-Pacific Corp. finished its $57 million fiber-gypsum board plant at Port Hawksbury, Nova Scotia, but began operation at less than capacity. It used local gypsum, imported perlite, and recycled paper to produce board for both the regional and export markets.

Domtar Inc. operates continuous-mining machines used to extract material from gypsum reserves thought to be sufficient for 75 years at Caledonia, Ontario. Domtar's Surrey, British Columbia, plant was the first in North America to use large quantities of reclaimed and recycled wallboard.

At Hagersville, Ontario, CGC Inc., partly owned (75%) by USG Corp. of Chicago, continued its 6-year expansion program and operates an underground mine and a wallboard facility.

Potash.—Production of potash climbed in 1992 to 7.324 Mmt from 7.087 Mmt the previous year, a difference of about 3.3% that reflected what seemed to be the beginning of a recovery from weakened demand, high inventories, and soft prices. The immediate cause was stronger demand in the United States, which was punctuated by an increase of about 10% in purchases from Canada. But Canada's annual capacity of about 11.8 Mmt/a K_2O was not even close to having been tested. Worldwide overcapacity, and resulting oversupply, of potash seemed likely to continue for several years, depressing the mining incentive of many producers in Canada and the remainder of the world.

In response to complaints in the United States that potash imports from Canada, the United Kingdom, and Italy represented dumping of potash, the International Trade Commission of the U.S. Department of Commerce ruled in February that there was no reasonable indication of either injury or the threat of injury to any industry in the United States.

The Province of Saskatchewan completed the final step in privatization of its Potash Corp. of Saskatchewan (PCS), having sold off all but 1.2% of its remaining ownership of the company, increasing liquidity in equities markets and dispelling any investor concern over Government participation. A group of Canadian underwriters had paid the province about $120 million to acquire special warrants that were exchangeable into 7,301,133 common shares at $16.37 per share. The PCS privatization began in 1989 when it first went public, amidst much political controversy, and has been done in stages since then as the first publicly traded potash supplier in Canada. Excluding some acquired concessions, PCS reported ownership of rights to 575,000 acres (232,794 ha) in Saskatchewan, thought to contain reserves of 4.3 billion tons of 22.8% K_2O. PCS has been a low-cost producer that was expected to be able to double its production on short notice with little additional capital cost.

Sulfur.—Production of elemental sulfur increased by about 2% to 6.35 Mmt in 1992, representing output from sour natural gas, petroleum refineries, and tar sands. From the latter, sulfur production increased by about 5% to a record level of 575,000 tons. In addition to these sources, smelter gases accounted for an additional 774,000 tons, for a total of 7.124 Mmt from all sources. Canada thus continued as the world's second largest producer of elemental sulfur, with an 18% market share, and continued as the largest exporter with a 38% share of global trade. About 52% of U.S. imports of sulfur during 1988-91 were supplied by Canada. New drilling and natural gas production feeding improved processing facilities accounted for much of the increase in sulfur production, partly the result of strengthening demand for gas in the United States.

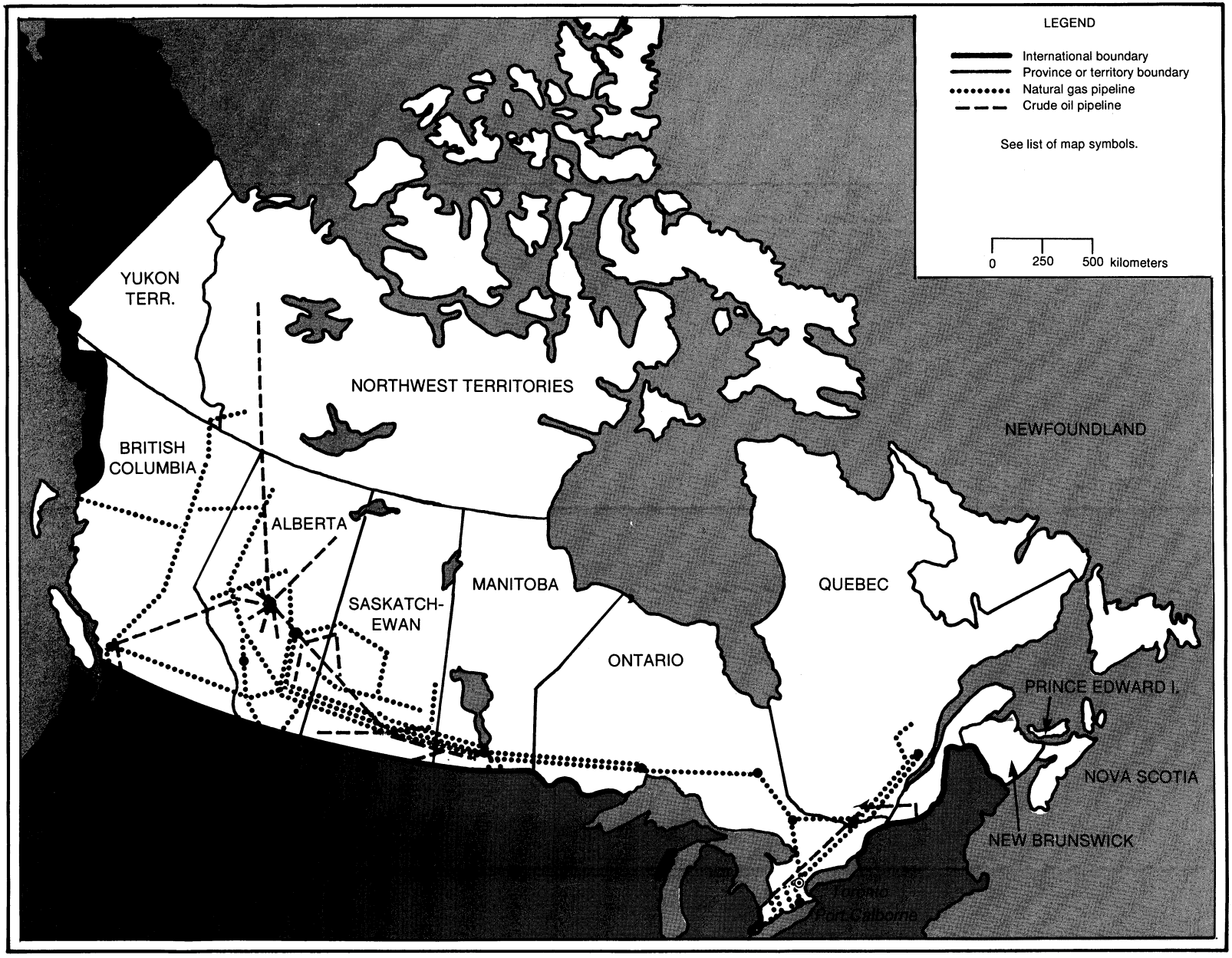
U.S. imports of sulfur from Canada in 1992 were estimated at 1.92 Mmt, an increase of 14% compared with those of the previous year. The United States was thus the destination for 34% of Canadian sulfur exports, and Canada's prime customer for this commodity.

Other Industrial Minerals.—Production of lime, at 2.383 Mmt, was virtually unchanged from the previous year's 2.375 Mmt, and not much change was foreseen in 1993 depending on steel industry demand. In 1991 the lime industry included 14 companies that operated 20 plants, 13 of them in eastern Canada. Employment equaled about 900 jobs, still above the average of 810 since 1961.

Production of salt was 11.154 Mmt in 1992, a decrease of 7% from that of the previous year. Canada ranked about fifth in world salt production and was the leading foreign supplier to the United States. Production capacity overall was 70% rock salt, 23% captive brines, and 7% evaporated salt. The pulp and paper industry furthered its switch of bleaching processes away from chlorine technology.

Output of silica fell to 1.4 Mmt in 1992, a drop of about 7% that was generally blamed on the economic recession. Widely produced in Canada,

CANADA: CRUDE OIL AND NATURAL GAS PIPELINES



silica was meeting competition from plastics in the glass container market, but new opportunites were on the horizon, including cultured quartz for electronic oscillators, chemical-grade silica for silicones, monocrystalline silicon for silicon chips, refined silicon carbide for advanced ceramics, and fused high-purity silica for other chemical and electronic uses. A cultured quartz plant was under construction at Trois-Rivieres, Quebec.

For reasons probably involving weakening of the construction industry during the year, production of all types of stone fell from 87.826 Mmt in 1991 to 81.639 Mmt in 1992, a decrease of about 7%. Categories of stone for construction included granite, sandstone, limestone, slate, and marble. Common uses were aggregate for concrete, crushed stone for paving, dimension stone and other masonry, roofing, finishing or facing stone, (with which Canada is well endowed), and stone for pulverizing and chemical uses.

Mineral Fuels

Coal.—Production of Canadian coal and lignite, totaling 65.4 Mmt, was down 8% from that of the previous year, thus continuing the up-and-down character of production levels since 1988, alternating by a few percent each year. Value of production declined from $1.66 billion in 1991 to $1.38 billion in 1992 as the result of lowered output, offerings at below-market prices, and the onset of decreased pricing for 1993 contracts. The overall decrease in coal output reflected labor troubles as well as production problems at three major coal mines in British Columbia that involved restructuring of the industry.

In Nova Scotia, the new Westray coal mine near Stellarton in Pictou County, owned 90% by Curragh Resources Inc., began operations at an expected capacity exceeding 1 Mmt/a and employing 250 miners. Extending offshore under the ocean, this mine was expected to enable Nova Scotian power units to combine advanced combustion technology with lower-sulfur coal to reduce nitrogen oxides and sulfur dioxide emissions to the atmosphere. In May 1992, an explosion underground cost 26 lives, the cessation of production, and both technical and political repercussions. At yearend, investigations were continuing. Elsewhere in the province, the Lingan coal mine, scheduled for closure in early 1993, was sealed off because of flooding. Beyond this, the Evans Coal Mine Ltd. mine closed because of fire and subsequent flooding.

Although Canada accounted for less than 2% of world coal production, it exported about one-half of its production, making it the fourth largest coal exporter after Australia, the United States, and the Republic of South Africa. These exports consisted mainly of Albertan metallurgical coal shipped to Japan and the Republic of Korea, where it competed with like volumes of U.S. coal. In eastern Canada, however, domestic coal has to be augmented by imports of U.S. coal, mostly thermal coal, so that Canada is in the unusual position of being both a major exporter and importer of coal. The paradox reflects transportation costs between mines and consumers and is one more example of the natural integration of U.S. and Canadian interest in various mineral commodities, another being cement. Domestic consumption of coal was essentially by provincial electric utilities.

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. Production rose in 1992 to a gross output of 158 billion m^3, an increase of 9%, and once again the production of natural gas played a major role in the mineral economy of Canada. Production of marketable gas in Canada increased from 105 billion m^3 in 1991 to 118 billion m^3 in 1992, an increase of more than 13%, compared with an increase of about 6% in 1991. 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 (1 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 being recognized as having the best reserve and deliverability potential of any play 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 climbed to 585 Mbbl in 1992, a gain of 4% compared with output in 1991, 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, which 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 1992 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

Table 9 shows the levels of Canadian reserves of major minerals as of early 1992, in terms of metal contained in ore. These reserves represent "proven" and "probable" categories. Tonnage reported as "possible" was not included. Reserves were defined as well delineated and economically minable ore from producing mines and deposits committed to production.

Canadian reserves of gold decreased 100 tons, from the previous year, to 1,430 tons. This was the third straight year of reversal of the marked growth in gold reserves during the 1980's, reflecting in turn the impetus of high gold prices at the beginning of that decade. On-site exploration and development at existing mines partly replaced the amount of gold removed during the year. Copper reserves decreased about 2% to mark the effect of only minor additions by discovery. Other copper producers lowered the reserves total through routine depletion of the ore mined during the year. Reserves of molybdenum decreased throughout 1991 to about 182,000 tons in January 1991, a drop of 6%. Only one of the several mines producing molybdenum, all in British Columbia, had added significantly to reserves. Lead reserves were down 13% from those of the year before. Largest negative factors were depletion of reserves at the Curragh Resources Inc.'s Faro mine in the Yukon, closure of the Caribou mine, and more conservative methods of reporting reserves at the Brunswick No. 12 mine, all in addition to normal mining depletion. Zinc reserves decreased 10% to 16.5 Mmt in spite of some additions of reserves at the Louvicourt deposit. At 19,000 tons, silver reserves were down 9% at the beginning of 1992. Mining and changes in reporting subtracted more silver from the reserve lists than was replaced or added by development decisions. Reserves of nickel declined about 1% to 5.691 Mmt. In addition to normal depletion, changes in reporting in 1991 had removed an amount equal to about one-half of what was mined during that year. Nonetheless, the ratio of reserves to average yearly production of nickel was significantly higher than for any of the other metals.

INFRASTRUCTURE

With a total land area of about 9,221,000 km^2, which is slightly larger than the United States, Canada has networks of highly developed infrastructure as well as other vast areas of trackless wilderness. The country has 884,272 km of roads, comprising 250,023 km of paved highway, 462,913 km of gravel or other loose surface, and 171,336 km of earth-surface roads, the latter not graded or drained in many places. Bulldozed temporary roads have been established for mining exploration in many out-of-the-way places, but these deteriorate quickly where not maintained.

A total of 93,544 km of railroads included two main systems, the Canadian National and the Canadian Pacific. The country also has about 3,000 km of inland waterways, including the St. Lawrence Seaway, one of the greatest in the world. Principal ports were Halifax, Montreal, Québec, St. John (New Brunswick), St. 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

The continuing pattern of new mineral discoveries confirmed the desirability of further exploration and increased the reserves in a few mineral categories. Canada's mineral industry thus provided assurances that it is very much alive even if not entirely well. By supporting a number of regional economies, it will continue to be a significant part of the national economy. Some observers, however, saw a lack of balance in exploration results in that precious metals seemed to be absorbing effort that might alternatively be spent on base metals. Reserves of the latter have declined generally in recent years, but there were signs that the situation could be turning around. The big exploration rush for diamond in several parts of the country represents a "wild card" that could play out in several ways in the next several years. Results could range from nil to inconclusive, to encouraging, to highly successful on a par with the Republic of South Africa or Australia. Much remains to be done in diamond exploration that will require effort, capital, and time.

The larger picture starts with the Canadian economy slowly coming out of a recession, along with that of the United States, its major trading partner. Uncertainties of demand, price weaknesses, and labor instabilities are characteristics of economic downturns, and there were no clear indications as to when these would improve.

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

Over the longer term there were questions of Quebec's potential secession and the economic consequences to both Quebec and the remainder of Canada.

On the positive side, the FTA between Canada and the United States should become an economic plus factor in both countries. Although preliminary concern has been heard both north and south of the border, the long-term benefits of this agreement should include gradual labor shifts into more productive industries in both countries. Beyond this, the completion of NAFTA, with Mexico as the third partner, was expected to bring significant economic benefits to all three countries.

[1]For more detailed information on the mineral industry, see the Canadian Mineral Yearbooks for 1991 and 1992, prepared by the Mining Sector and the Energy Sector, Department of Natural Resources, Ottawa, Canada, which were used extensively as source material for this report. The U.S. Department of the Interior, Bureau of Mines, has arranged to have these Canadian publications placed in selected depository libraries of the 50 States and Puerto Rico. 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 the Department of Natural Resources.

[2]Where necessary, values have been converted from Canadian dollars (CAN$) to U.S. dollars at the rate of CAN$1.2083=US$1.00. All values in this report are expressed in U.S. dollars.

[3]Sherritt Gordon Ltd. 1992 Annual Report, no pagination.

[4]American Metal Market. Various issues, 1992-93.

[5]Davison, J. G. Diamond Exploration Samples: Laboratory Processing, Lakefield Research Laboratory, Lakefield, Ontario.

OTHER SOURCES OF INFORMATION

Agencies, Federal

Department of Natural Resources
580 Booth St.
Ottawa, Ontario K1A 5H3
Canada
Mineral Policy Sector
Geological Survey of Canada
Surveys, Mapping, and Remote Sensing Sector
Canada Centre for Mineral and Energy Technology, Energy Sector (CANMET)
Statistics Canada
Tunney's Pasture
Ottawa, Ontario
Canada
Department of Indian Affairs and Northern Development
Les Terrasses de la Chaudiére,
Ottawa, Ontario K1A 0H4
Canada
Environment Canada
Les Terrasses de la Chaudiere
27th Floor
10 Wellington St.
Ottawa, Ontario K1A 0H3
Canada

Agencies, Provincial (West to East)

Ministry of Energy, Mines and Petroleum Resources
Parliament Buildings
Victoria, British Columbia V8V 1X4
Canada
Department of Energy
Petroleum Plaza, North Tower
9945 108 St.
Edmonton, Alberta T5K 2G6
Canada
Department of Energy and Mines
Room 306, Legislative Building
Regina, Saskatchewan S4S 0B3
Canada
Administration of Mining Lands
Toronto-Dominion Bank Building
1914 Hamilton St.
Regina, Saskatchewan S4P 4V4
Canada
Department of Energy and Mines
Room 301, Legislative Building
Winnipeg, Manitoba R3C 0V8
Canada
Ministry of Northern Development and Mines
10 Wellesley St. East
Toronto, Ontario M4Y 1G2
Canada
Mines and Minerals Division:

Mineral Development and Lands Branch
Ontario Geological Survey
Southern Ontario Region
Northeastern Region
Northwestern Region
Ministere de L'Energie et Des Ressources, Secteur Mines
1620 boul de l'Entente
Québec, Québec G1S 4N6
Canada
Department of Natural Resources and Energy
Minerals and Energy Division
Hugh John Flemming Forestry Centre
Fredericton, New Brunswick E3B 5H1
Canada
Mines and Minerals Division:
Geological Surveys Branch
Mineral Development Branch
Planning and Administration Branch
Energy Branch
Department of Mines and Energy
1701 Hollis St.
P.O. Box 1087
Halifax, Nova Scotia B3J 2X1
Canada
Department of Energy and Forestry
P.O. Box 2000
Charlottetown, Prince Edward Island C1A 7N8
Canada
Newfoundland Department of Mines and Energy
P.O. Box 8700
St. John's, Newfoundland A1B 4J6
Canada

Associations

The Mining Association of Canada
1105-350 Sparks St.
Ottawa, Ontario K1R 7S8
Canada
Northwest Territories Chamber of Mines
P.O. Box 2818
Yellowknife, Northwest Territories X1A 251
Canada
Yukon Chamber of Mines
P.O. Box 4427
Whitehorse, Yukon Territory 1A 3T5
Canada
British Columbia and Yukon Chamber of Mines
840 West Hastings St.
Vancouver, British Columbia V6C 1C8
Canada
Chamber of Mines of Eastern British Columbia
215 Hall St.
Nelson, British Columbia V1L 5X4
Canada
Mining Association of British Columbia
P.O. Box 12540, 860, 1066 West Hastings St.
Vancouver, British Columbia V6E 3X1
Canada

Alberta Chamber of Resources
1410 Oxford Tower, 10235 101 St.
Edmonton, Alberta T5J 3G1
Canada
Saskatchewan Mining Association Inc.
1740 Avord Tower
Regina, Saskatchewan S4P 0R7
Canada
The Mining Association of Manitoba
700-305 Broadway
Winnipeg, Manitoba R3C 3J7
Canada
Ontario Mining Association
1114-111 Richmond St. West
Toronto, Ontario M5H 2G4
Canada
Québec Asbestos Mining Association
410-1140 Sherbrooke St. West,
Montreal, Québec H3A 2M8
Canada
Québec Mining Association Inc.
942-2635 Boulevard
Hochelaga, Ste. Foy
Québec G1V 4W2
Canada
The New Brunswick Mining Association
Suite 312-236 St. George St.
Moncton, New Brunswick E1C 1W1
Canada
Chamber of Mineral Resources of Nova Scotia
202-5525 Artillery Place
Halifax, Nova Scotia NS B3J 1J2
Canada

Publications

Canadian Geoscience Council, annual report.
Canadian Institute of Mining and Metallurgy, monthly.
Canadian Mineral Analysts, monthly.
Canadian Mining Journal, Canada's Top Mining Companies, monthly.
Department of 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, 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 Minieres 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: VALUE OF PROVINCIAL MINERAL PRODUCTION

(Billion U.S. dollars)

Province or Territory	1991	1992[p]
Alberta	14.1	14.1
Ontario	4.4	4.0
British Columbia	3.3	2.9
Saskatchewan	2.6	2.5
Quebec	2.5	2.2
Manitoba	1.0	.9
New Brunswick	.7	.7
Newfoundland	.5	.6
Northwest Territories	.7	.5
Nova Scotia	.3	.4
Yukon	.4	.4
Prince Edward Island	(1)	(1)
Total[2]	30.4	29.3

[p]Preliminary
[1]Less than 1/2 unit.
[2]Data may not add to total shown because of independent rounding.

Sources: Energy, Mines and Resources Canada. Statistics Canada. Ottawa, 1993.

NOTE.—Conversion to U.S. dollars at different average yearly rates may distort relationships expressed originally in Canadian dollars.

TABLE 2
CANADA: VALUES OF PRINCIPAL MINERAL PRODUCTION

(Million U.S. dollars)[1]

Commodity	1991	1992[p]
Metals:		
Gold	2,056	1,727
Copper	1,834	1,707
Zinc	1,179	1,429
Nickel	1,596	1,390
Iron ore	982	935
Uranium	412	476
Lead	178	191
Silver	162	143
Cobalt	64	113
Platinum group	124	97
Total[2]	8,587	8,209
Industrial minerals:		
Potash	802	797
Cement	713	612
Sand and gravel	551	527
Stone	448	420
Salt	226	210
Asbestos	240	195
Lime	163	151
Sulfur elemental	213	109
Clay products	122	97
Peat	80	90
Gypsum	63	66
Total[2]	3,621	3,274
Mineral fuels:		
Petroleum crude	9,269	9,311
Natural gas	4,527	4,641
Natural gas byproducts	1,853	1,901
Coal	1,662	1,377
Total[2]	17,311	17,230

[p]Preliminary.
[1]Values shown were converted to U.S. dollars using the 1991 and 1992 average conversion rates for each entire year, thus these values may differ slightly from those noted in text.
[2]Data may not add to totals shown because of independent rounding.

Sources: Energy, Mines and Resources Canada. Statistics Canada. Ottawa, 1993.

Note.—Conversion to U.S. dollars at different aver-age yearly rates may distort relationships expressed originally in Canadian dollars.

TABLE 3

CANADA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992[p]
METALS						
Aluminum:						
Alumina, gross weight	thousand tons	993	1,048	1,087	1,131	1,104
Metal:						
Primary		1,534,499	1,554,753	1,567,395	1,821,642	1,950,000
Secondary		113,000	77,000	67,659	67,660	67,680
Antimony[2]		3,171	2,821	658	r469	327
Bismuth[3]		181	157	74	r65	100
Cadmium[4]		1,664	1,711	1,334	r1,787	1,529
Calcium	kilograms	W	W	W	W	W
Cobalt:						
Mine output, Co content[5]		2,398	2,344	2,184	r2,171	2,219
Metal[6]		2,356	2,110	2,063	2,248	2,210
Columbium and tantalum:						
Pyrochlore concentrate:						
Gross weight		5,230	5,443	5,272	5,230	5,300
Cb content		2,354	2,458	2,382	2,354	2,400
Tantalite concentrate:						
Gross weight		91	295	r331	399	180
Ta content		27	73	82	95	45
Copper:						
Mine output, recoverable Cu content[7]		r776,482	723,052	793,735	r811,134	764,189
Metal, primary and secondary:						
Blister and anode		r524,903	r500,153	r522,995	546,495	550,356
Refined		528,723	515,216	515,835	538,339	539,302
Gold	kilograms	135,889	159,527	169,412	r176,552	158,049
Iron and steel:						
Iron ore:[8]						
Gross weight	thousand tons	38,742	40,900	36,443	r36,383	34,136
Fe content	do.	24,540	26,180	22,959	r22,921	21,506
Metal:						
Pig iron	do.	9,500	10,139	7,346	8,268	8,621
Ferroalloys	do.	207	250	e240	e249	100
Steel, crude	do.	14,866	15,458	12,281	12,987	13,924
Lead:						
Mine output, Pb content		366,564	276,065	241,277	r276,528	342,486
Metal, refined:						
Primary		179,461	157,330	87,180	106,420	151,252
Secondary		89,863	85,515	96,465	r105,946	103,936
Lithium: Spodumene[9]		14,000	14,000	12,000	12,000	18,500
Magnesium metal, primary[e]		7,000	7,000	r[10]26,726	r[10]35,512	25,700
Molybdenum		12,494	14,073	11,994	r11,329	9,540
Nickel:						
Mine output, Ni content[11]		r216,600	r202,500	196,225	r192,259	192,086
Metal, plant production[12]		r145,700	r130,300	r126,800	r120,300	127,454
Platinum-group metals	kilograms	12,541	10,389	11,709	r11,708	11,058
Selenium, refined[13]	do.	321,000	270,000	r341,650	r207,286	294,057

See footnotes at end of table.

TABLE 3—Continued

CANADA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992[p]
METALS—Continued						
Silver	kilograms	1,483,816	1,370,737	1,501,451	r1,338,799	1,206,961
Tellurium, refined[13]	do.	10,000	8,000	r9,859	r12,374	21,776
Tin, mine output, Sn content	tons	3,591	2,790	2,828	4,455	—
Titanium: Sorel slag[14]		1,025,000	1,040,000	1,046,000	701,000	753,000
Uranium oxide (U_3O_8)		14,695	13,475	10,342	r9,624	10,869
Zinc:						
Mine output, Zn content		1,370,000	1,216,139	1,203,161	r1,156,582	1,311,884
Metal, refined, primary		703,206	669,677	591,788	660,552	671,702
INDUSTRIAL MINERALS						
Asbestos	thousand tons	710	714	686	r639	585
Arsenic trioxide[15]		2,825	1,825	485	e236	e250
Barite		51,000	39,000	44,000	r50,000	32,000
Cement, hydraulic[16]	thousand tons	12,036	12,591	11,745	9,396	8,484
Clays and clay products[17]	value, thousand CAN$	$196,724	$200,138	$143,072	r$119,838	$117,326
Diatomite[e]		4,200	4,200	4,100	r8,000	10,000
Graphite (exports)		4,900	6,000	10,200	6,200	17,400
Gypsum and anhydrite	thousand tons	9,512	8,180	7,978	r6,830	7,054
Lime	do.	2,518	2,552	2,341	r2,375	2,383
Magnesite, dolomite, brucite		150,000	150,000	150,000	e180,000	e180,000
Mica, scrap and flake		12,000	12,000	e16,000	e17,000	e17,500
Nepheline syenite		540,000	551,000	533,000	493,000	566,000
Nitrogen: N content of ammonia		4,010,161	4,100,000	r3,053,566	r3,016,247	3,104,119
Potash, K_2O equivalent	thousand tons	8,328	7,014	7,345	r7,087	7,324
Pyrite and pyrrhotite, gross weight[e]		5,000	5,000	5,000	5,000	5,000
Salt	thousand tons	10,687	11,158	11,191	r11,993	11,154
Sand and gravel	do.	287,653	274,848	244,316	r215,905	199,657
Silica (quartz)	do.	2,807	2,332	2,081	r1,500	1,400
Sodium compounds, n.e.s.:						
Sodium carbonate (soda ash)[e]		325,000	325,000	315,000	310,000	305,000
Sodium sulfate, natural[18]		331,000	327,000	347,000	r332,000	280,000
Stone[19]	thousand tons	120,126	119,335	111,352	r87,826	81,639
Sulfur: Elemental byproduct:						
Of smelter gases	do.	856	809	790	r749	774
Of sour natural gas	do.	5,981	5,183	5,210	5,460	5,563
Of refineries[e]	do.	200	200	207	230	235
Of tar sands	do.	485	500	503	540	552
Talc, soapstone, pyrophyllite		146,443	144,828	131,000	r123,000	122,000
MINERAL FUELS AND RELATED MATERIALS						
Carbon black		180,697	180,000	178,212	157,115	161,218
Coal:						
Bituminous and subbituminous	thousand tons	57,500	60,085	58,924	62,149	55,335
Lignite	do.	12,000	10,915	9,407	8,981	10,027
Coke, high-temperature	do.	4,663	4,414	3,708	3,622	3,711
Gas, natural:						
Gross	million cubic meters	109,088	114,661	138,358	144,987	158,067
Marketed	do.	88,035	92,530	98,773	105,201	118,925

See footnotes at end of table.

TABLE 3—Continued

CANADA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992[p]
MINERAL FUELS AND RELATED MATERIALS—Continued						
Natural gas liquids: Gross						
Ethane	thousand 42-gallon barrels	38,165	42,352	44,694	47,414	45,953
Propane	do.	39,327	41,302	42,448	42,393	45,304
Butane	do.	19,044	22,194	21,621	23,557	24,878
Pentanes plus	do.	40,620	43,414	41,567	43,392	48,069
Condensate	do.	1,521	1,871	976	1,217	1,396
Total	do.	138,677	151,133	151,306	157,973	165,600
Peat		736,000	812,000	715,776	[r]856,000	880,000
Petroleum:						
Crude[20]	thousand 42-gallon barrels	584,000	583,827	[r]566,978	563,985	585,076
Refinery products:						
Liquefied petroleum gas, propane, and butane	do.	19,710	20,700	17,224	16,538	17,293
Gasoline:						
Aviation	do.	2,477	1,059	813	759	706
Other	do.	218,635	228,298	231,545	229,665	229,316
Petrochemical feedstocks	do.	42,330	29,080	31,345	31,942	30,721
Jet fuel	do.	32,485	26,980	33,288	28,592	24,668
Kerosene	do.	11,680	15,546	2,792	3,493	2,015
Distillate fuel oil, diesel and light	do.	160,600	166,731	174,588	169,184	163,159
Residual fuel oil, heavy	do.	50,735	53,903	56,673	54,081	50,131
Lubricants including grease	do.	7,300	7,372	6,549	6,176	5,363
Asphalt	do.	21,577	17,018	16,894	15,922	15,221
Petroleum coke	do.	(21)	(21)	5,398	5,692	6,307
Unspecified	do.	40,196	40,072	33,730	30,791	30,322
Refinery fuel and losses[22]	do.	37,595	32,726	26,537	24,697	29,140
Total	do.	645,320	639,485	637,376	617,532	604,362

[e]Estimated. [p]Preliminary. [r]Revised. W Withheld to avoid disclosing company propricty data.

[1]Table includes data available through Aug. 1993.

[2]Sb content of antimonial lead alloys, flue dust, and doré slag estimated on the basis of reported gross production.

[3]Refined metal and bullion from domestic ores plus recoverable Bi content of exported concentrates.

[4]Refined metal from domestic ores plus recoverable Cd content of exported ores and concentrates.

[5]Actual output not reported. Data represent the Co content of all products derived from ores of Canadian origin, including nickel oxide sinter shipped to the United Kingdom and nickel-copper-cobalt matte shipped to Norway for further processing.

[6]Actual output not reported. Data represent the output within Canada of metallic cobalt from ores of both Canadian and non-Canadian origin.

[7]Blister copper from domestic ores plus recoverable Cu content of exported matte and concentrates.

[8]Series represent gross weight and metal content of usable iron ore as mine shipments.

[9]Based on all of Canada's spodumene concentrates (Tantalum Mining Corp. of Canada Ltd.'s Tanco property.)

[10]Reported figure.

[11]Refined nickel from domestic ores plus recoverable Ni content of exported matte.

[12]Includes metallic nickel, nickel oxide, Incomet, nickel powder and pellets, utility nickel, nickel carbonate, and nickel residue.

[13]From all sources, including imports and secondary sources. Excludes selenium intermediates exported for refining.

[14]Refined sorel slag contained 80% TiO_2 in 1986-90. TiO_2 content in 1991-92 is not reported.

[15]Refined Arsenic (AS_2O_3) from Nerco's Con Mine in Yellow Knife, Northwest Territories.

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

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

[18]Excludes byproduct production from chemical plants.

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

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

[21]Combined with "unspecified" category.

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

TABLE 4

CANADA: UNITED STATES-CANADA FREE TRADE AGREEMENT SCHEDULE OF SELECTED TARIFFS[1]

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

[1]Based on the United States-Canada Free Trade Agreement and Minerals and Metals: An assessment, Energy, Mines and Resources Canada, Ottawa, 1988.
[2]Previous tariff rates under the General Agreement on Tariffs and Trade (GATT).

TABLE 5

CANADA: PROPORTIONATE CONTRIBUTION OF LEADING MINERALS TO TOTAL VALUE OF MINERAL PRODUCTION, BY PERCENTAGE

Total value for 1992 = US$29.3 billion

Commodity	1988	1989	1990	1991	1992[p]
Petroleum crude	24.8	27.7	32.1	29.7	31.8
Natural gas	14.1	13.7	14.0	15.3	15.8
Natural gas byproducts	4.3	4.1	5.8	6.2	6.5
Gold	6.3	5.9	5.9	6.7	5.9
Copper	6.5	6.1	6.0	6.0	5.8
Zinc	6.1	7.0	5.6	3.9	4.9
Nickel	7.5	7.7	5.0	5.1	4.7
Coal	4.9	4.9	4.5	5.4	4.7
Iron ore	3.6	3.5	3.1	3.5	3.2
Potash (K_2O)	3.2	2.6	2.4	2.6	2.7
Cement	2.6	2.4	2.4	2.3	2.1
Sand and gravel	2.3	2.2	2.0	2.1	1.8
Uranium (U)	2.8	2.3	2.2	1.7	1.6
Stone	1.7	1.7	1.6	1.5	1.4
Salt	.7	.6	.6	.7	.7
Asbestos	.7	.7	.7	.8	.7
Lead	1.0	.7	.7	.6	.7
Lime	.5	.5	.5	.6	.5
Silver	1.0	.7	.6	.5	.5
Cobalt	.1	.1	.1	.2	.4
Sulfur, elemental	1.2	1.1	.9	1.0	.4
Clay products	.5	.5	.3	.3	.3
Platinum-group metals	.5	.4	.5	.4	.3
Peat	.2	.3	.2	.3	.3
Gypsum	.2	.2	.2	.2	.2
Other minerals	2.6	2.4	2.3	2.2	2.0
Total	100.0	100.0	100.0	100.0	100.0

[p]Preliminary.

Sources: Energy, Mines and Resources Canada. Statistics Canada. Ottawa, 1993.

TABLE 6

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1990	1991	Destinations, 1991	
			United States	Other (principal)
METALS[2]				
Alkali and alkaline-earth metals:				
Alkali metals	175	3	(3)	Mainly to Australia.
Alkaline-earth metals	408	348	246	Netherlands 50; United Kingdom 26.
Aluminum:				
Ore and concentrate	687	1,835	1,835	
Oxides and hydroxides	134,334	85,697	81,258	Germany 1,829; Brazil 1,061.
Ash and residue containing aluminum	49,566	25,820	8,077	Norway 17,711; United Kingdom 32.

See footnotes at end of table.

TABLE 6—Continued

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
METALS[2]—Continued					
Aluminum—Continued					
Metal including alloys:					
Scrap		188,363	173,675	150,588	Japan 16,368; Republic of Korea 1,757.
Unwrought		1,282,196	1,473,183	965,289	Japan 168,739; Netherlands 134,993.
Semimanufactures		188,364	213,881	197,983	United Kingdom 4,958; Morocco 3,704.
Antimony:					
Ore and concentrate		463	81	81	
Oxides		—	6	6	
Metal including alloys, all forms		202	2	2	
Arsenic: Metal including alloys, all forms		51	7	7	
Beryllium: Metal including alloys, all forms	kilograms	4,358	392	45	Argentina 347.
Bismuth: Metal including alloys, all forms		131	49	49	
Cadmium: Metal including alloys, all forms		1,283	1,452	750	Japan 294; Netherlands 147.
Chromium:					
Ore and concentrate		1,283	3,620	3,620	
Oxides and hydroxides		157	75	73	Costa Rica 2.
Metal including alloys, all forms		4	2	2	
Cobalt:					
Ore and concentrate		—	78	78	
Oxides and hydroxides		393	462	14	United Kingdom 448.
Metal including alloys, all forms		3,056	4,910	2,509	Norway 1,596; United Kingdom 316.
Columbium and tantalum:					
Ores and concentrates[4]		4,269	4,172	2,205	United Kingdom 950; Japan 782.
Tantalum metal including alloys, all forms		5	2	2	
Copper:					
Ore and concentrate, Cu content		360,193	325,869	273	Japan 256,103; Spain 25,189; Philippines 22,997.
Matte and speiss including cement copper		14,682	22,211	—	Norway 21,200; United Kingdom 1,011.
Oxides and hydroxides		18	1	1	
Sulfate		3,245	2,807	2,806	Netherlands 1.
Ash and residue containing copper		5,847	1,792	1,755	Belgium-Luxembourg 37.
Metal including alloys:					
Scrap		104,469	86,40	73,564	Republic of Korea 4,363; China 2,155.
Unwrought		336,697	378,223	196,069	United Kingdom 53,645; Netherlands 41,706.
Semimanufactures		22,343	25,955	22,430	Israel 1,365; Saudi Arabia 589.
Germanium: Metal including alloys, all forms	kilograms	5,801	1,760	1,760	
Gold:					
Ore and concentrate, Au content	do.	10,817	8,401	NA	NA.
Waste and sweepings	do.	30,021	17,807	4,970	Germany 12,810; Japan 27.
Metal including alloys, unwrought and partly wrought	do.	144,929	162,976	96,481	Hong Kong 29,913; Switzerland 20,485.
Iron and steel:					
Iron ore and concentrate excluding roasted pyrite, gross weight	thousand tons	27,100	29,688	7,266	Germany 4,970; Netherlands 4,016.
Metal:					
Scrap	do.	1,372	1,077	893	Republic of Korea 59; Indonesia 26.
Pig iron, cast iron, related materials		r263,222	126,422	124,091	France 1,599; Italy 640.
Ferroalloys:					
Ferrochromium		573	343	322	Philippines 21.

See footnotes at end of table.

TABLE 6—Continued

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
METALS[2]—Continued					
Iron and steel—Continued:					
Metal—Continued:					
Ferroalloys—Continued:					
Ferromanganese		15,041	13,657	11,124	Norway 2,525; Brazil 6.
Ferromolybdenum		35	8	8	
Ferronickel		172	—		
Ferrosilicomanganese		7,734	17,530	15,611	Norway 1,919.
Ferrosilicon		53,532	34,047	19,335	Japan 5,401; Germany 3,994.
Silicon metal		14,811	13,058	7,532	Japan 2,738; Germany 2,215.
Unspecified		380	592	300	France 175; Iran 100.
Steel, primary forms		327,263	306,994	101,051	Japan 50,792; Republic of Korea 41,506.
Semimanufactures:					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		1,476,210	2,101,581	717,663	Republic of Korea 446,830; Thailand 114,893.
Clad, plated, coated		380,085	409,211	338,530	Mexico 36,971; Hong Kong 6,097.
Of alloy steel		82,926	129,497	85,650	Republic of Korea 29,096; Australia 3,030.
Bars, rods, angles, shapes, sections		906,835	868,088	839,955	Mexico 7,093; France 4,509.
Rails and accessories		245,929	158,957	104,504	Egypt 20,052; India 11,499.
Wire		158,804	145,735	141,698	Thailand 902; New Zealand 804.
Tubes, pipes, fittings[5]		401,873	551,708	449,628	China 72,408; U.S.S.R. 12,341.
Lead:					
Ore and concentrate		211,245	164,508	8,837	Japan 51,397; Italy 46,179; Germany 26,459.
Oxides		307	696	696	
Ash and residue containing lead		1,097	216	197	India 19.
Metal including alloys:					
Scrap		17,950	5,237	2,228	Ireland 878; Indonesia 450.
Unwrought		116,134	114,838	84,198	Japan 7,013; Germany 4,300.
Semimanufactures		857	586	577	Australia 9.
Lithium: Oxides and hydroxides	kilograms	—	50	50	
Magnesium: Metal including alloys:					
Scrap		3,358	3,035	3,035	
Unwrought		19,466	26,643	24,670	Japan 373; Netherlands 304.
Semimanufactures		844	1,102	839	Ireland 160; Australia 51.
Manganese:					
Oxides		29	55	55	
Metal including alloys, all forms		264	346	318	Germany 26; Singapore 1.
Mercury	kilograms	33,165	50,858	50,858	
Molybdenum:					
Ore and concentrate:					
Roasted		6,687	7,100	—	Japan 4,148; Netherlands 816; Republic of Korea 806.
Unroasted		4,375	3,099	36	Chile 2,361; Belgium-Luxembourg 436; Brazil 186.
Oxides and hydroxides		25	107	102	Australia 4; Republic of Korea 1.
Metal including alloys:					
Unwrought including	kilograms	7,226	329	259	Australia 70.

See footnotes at end of table.

TABLE 6—Continued

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
METALS[2]—Continued					
Molybdenum—Continued:					
Metal including alloys—Continued:					
Semimanufactures	kilograms	839	11	11	
Nickel:					
Ore and concentrate, Ni content		—	2	1	United Kingdom 1.
Matte and speiss		68,671	75,107	629	Norway 40,905; United Kingdom 33,572.
Oxides and hydroxides		395	404	401	Brazil 3.
Metal including alloys:					
Scrap		5,594	4,232	3,486	Finland 312; Netherlands 225.
Unwrought		65,860	61,961	61,148	Belgium-Luxembourg 491; Japan 187.
Semimanufactures		10,891	10,456	7,172	Japan 2,203; Netherlands 375.
Platinum-group metals:					
Ore and concentrate[6]	kilograms	10,323	7,921	—	All to United Kingdom.
Waste and sweepings	do.	931	24,502	878	Germany 14,246; Japan 9,378.
Metals including alloys, unwrought and partly wrought:					
Palladium	do.	5,167	5,729	2,038	United Kingdom 3,095; France 560.
Platinum	do.	1,850	612	91	Hong Kong 424; Switzerland 41.
Rhodium	do.	25	13	13	
Iridium, osmium, ruthenium	do.	18	—		
Rare-earth metals including alloys, all forms		—	3	3	
Selenium, elemental		393	377	156	Netherlands 70; United Kingdom 64.
Silicon, high-purity		—	14	—	All to Republic of Korea.
Silver:					
Ore and concentrate, Ag content	kilograms	1,866	—		
Waste and sweepings[7]	do.	196,377	258,190	90,835	Germany 90,082; United Kingdom 48,102.
Metal including alloys, unwrought and partly wrought		1,270	994	813	Singapore 93; Republic of Korea 51.
Tin:					
Ore and concentrate		2,828	3,716	9	Malaysia 3,508; Mexico 199.
Metal including alloys:					
Scrap		529	460	312	Hong Kong 109; United Kingdom 38.
Unwrought		467	553	552	United Kingdom 1.
Semimanufactures		275	261	247	The Bahamas 10; Republic of Korea 3.
Titanium:					
Ore and concentrate		29,197	50,439	50,439	
Oxides		5,686	5,636	5,334	United Kingdom 145; Germany 62.
Metal including alloys, all forms		1,038	681	585	United Kingdom 95.
Tungsten:					
Ore and concentrate	kilograms	5,386	—		
Metal including alloys:					
Unwrought including waste and scrap		63	70	64	Australia 2; Germany 2.
Semimanufactures	kilograms	12,795	996	15	Iran 567; Australia 182.
Uranium and thorium:					
Oxides and other compounds		118	161	52	France 109.
Uranium metal including alloys, all forms		12,498	11,701	10,316	France 969; United Kingdom 137.
Vanadium:					
Oxides and hydroxides		1	74	57	Netherlands 17.
Ash and residue containing vanadium		1,085	680	680	
Metal including alloys, all forms		67	—		

See footnotes at end of table.

TABLE 6—Continued

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
METALS[2]—Continued					
Zinc:					
Ore and concentrate		737,809	610,655	10,377	Germany 120,027; Belgium-Luxembourg 105,141; Spain 99,279.
Oxides		27,319	21,448	21,098	U.S.S.R. 306; India 24.
Blue powder		5,365	5,347	5,204	Venezuela 128; Singapore 12.
Ash and residue containing zinc[8]		8,752	9,723	5,711	Republic of Korea 1,319; India 1,113.
Metal including alloys:					
Scrap		38,295	33,327	28,241	Taiwan 4,231; China 491.
Unwrought		456,322	528,663	390,919	Taiwan 49,277; Japan 22,518.
Semimanufactures		1,099	7,283	6,705	Singapore 424; Germany 102.
Zirconium:					
Ore and concentrate		20	73	55	France 16; United Kingdom 2.
Metal including alloys, all forms		108	45	42	France 2; Germany 1.
Other:					
Base metals:					
Ores and concentrates		6,513	11,103	6,878	Germany 667; Netherlands 355.
Oxides and hydroxides		1,385	1,172	1,172	
Ashes and residues		85,908	54,364	53,926	Belgium-Luxembourg 260; United Kingdom 64.
Base metals including alloys, all forms		211	30	26	Philippines 2; United Kingdom 1.
Precious metals, n.e.s.: Ores and concentrates	kilograms	115,392	37,614	(3)	United Kingdom 18,377; Japan 10,194; Germany 9,022.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		5,914	4,689	4,654	Malaysia 19; Sweden 14.
Artificial:					
Corundum		105,897	124,271	103,778	United Kingdom 16,345; Germany 3,128.
Silicon carbide		59,229	37,857	37,533	Republic of Korea 304; Spain 20.
Dust and powder of precious and semiprecious stones excluding diamond		165	407	407	
Grinding and polishing wheels and stones	value, thousands	$15,171	$15,522	$9,621	Germany $704; United Kingdom $523.
Asbestos, crude		649,485	686,053	34,525	Thailand 98,399; Japan 96,846; Republic of Korea 48,032.
Barite and witherite		9,945	12,080	12,020	Republic of Korea 60.
Boron materials:					
Crude natural borates		2	—		
Elemental including tellurium		24	11	5	United Kingdom 6; Netherlands 1.
Oxides and acids		45	26	26	
Cement	thousand tons	2,904	2,805	2,801	Gabon 2; France 1.
Chalk		—	161	59	Malaysia 99; France 3.
Clays, crude:					
Bentonite		1,170	1,139	1,037	Australia 36; Belgium-Luxembourg 21.
Fire clay		168	230	230	
Fuller's earth		45	26	26	
Kaolin		38	528	263	China 265.
Unspecified		1,263	8,226	8,153	Finland 72; Germany 1.
Cryolite and chiolite		25	28	28	

See footnotes at end of table.

TABLE 6—Continued

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Diamond, natural:					
Gem, not set or strung	carats	66,736	32,851	22,979	Belgium-Luxembourg 4,298; Hong Kong 2,094.
Industrial stones	do.	43,105	82,252	28,477	Italy 27,500; Chile 26,031.
Dust and powder	thousand carats	3,721	2,888	2,873	Czechoslovakia 15.
Unsorted	value, thousands	$986	$1,720	$1,720	
Diatomite and other infusorial earth		24	2	2	
Feldspar, fluorspar, related materials:					
Feldspar		348	127	19	Taiwan 108.
Fluorspar		22,620	1,599	1,599	
Unspecified		382,408	352,224	290,173	Netherlands 20,993; Italy 12,576.
Fertilizer materials:					
Crude, n.e.s.		18,713	125	125	
Manufactured:					
Ammonia	thousand tons	1,124	1,059	1,034	Costa Rica 12; Republic of Korea 12.
Nitrogenous	do.	2,159	2,150	1,835	China 85; Australia 72.
Phosphatic		2,746	31,724	31,724	
Potassic	thousand tons	11,769	10,628	6,108	China 1,366; Malaysia 493.
Unspecified and mixed	do.	180	170	133	Turkey 25; Jamaica 8.
Graphite, natural		10,530	8,535	5,943	Japan 428; France 358.
Gypsum and plaster	thousand tons	5,806	4,974	4,332	Panama 11,113; Thailand 237.
Kyanite and related materials		295	—		
Lime		138,410	134,405	134,372	Bermuda 33.
Magnesium compounds:					
Magnesite, crude		75	156	21	Thailand 100; Colombia 35.
Oxides and hydroxides		61,338	63,978	54,320	Germany 3,454; Italy 2,508.
Sulfate		31	70	—	Saudi Arabia 37; Venezuela 25; Chile 8.
Mica:					
Crude including splittings and waste		12,182	13,362	9,357	Japan 2,722; Netherlands 487.
Worked including agglomerated splittings		3	1	1	
Nitrates, crude		101	—		
Phosphates, crude		5,716	3,322	3,321	Jamaica 1.
Phosphorus, elemental		11,276	8,893	8,645	Colombia 115; Australia 48.
Pigments, mineral:					
Natural, crude		1	—		
Iron oxides and hydroxides, processed		16,923	15,721	15,701	Jamaica 10; Netherlands 8.
Potassium salts, crude		1,285	54	51	Chile 3.
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	$8,851	$8,599	$3,360	France $2,521; China $809.
Synthetic	do.	$240	$67	$58	Japan $9.
Pyrite, unroasted		119,722	3	3	
Quartz crystal, piezoelectric	value, thousands	—	$24	$24	
Salt and brine	thousand tons	1,912	2,783	2,779	St. Pierre and Miquelon 2.
Sodium compounds, n.e.s.:					
Soda ash, natural and manufactured		144,741	136,337	136,252	U.S.S.R. 49; Jamaica 36.
Sulfate, natural and manufactured		167,638	159,386	157,206	New Zealand 1,918; Ireland 110.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		985,950	107,100	35,286	Japan 50,720; Italy 13,232.

See footnotes at end of table.

TABLE 6—Continued

CANADA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Stone, sand and gravel—Continued:					
Dimension stone—Continued:					
Worked	value, thousands	$28,564	$29,451	$27,778	Japan $980; United Kingdom $322.
Dolomite, chiefly refractory-grade		896,725	247,094	247,094	
Gravel and crushed rock	thousand tons	1,351	1,464	1,317	St. Lucia 79; Barbados 26.
Limestone other than dimension	do.	1,368	1,134	1,134	
Quartz and quartzite		637	3,393	3,393	
Sand other than metal-bearing		235,226	334,716	212,650	St. Lucia 67,959; The Bahamas 34,923.
Sulfur:					
Elemental:					
Crude including native and byproduct	thousand tons	6,058	5,304	1,672	Morocco 823; India 355.
Colloidal, precipitated, sublimed		291	431	431	
Dioxide		61,867	73,039	73,039	
Sulfuric acid		1,280,508	1,265,739	1,265,686	Bermuda 24; St. Vincent and the Grenadines 9.
Talc, steatite, soapstone, pyrophyllite		40,119	34,325	34,036	United Kingdom 103; Cuba 88.
Vermiculite[9]		17	25	16	Italy 9.
Other:					
Crude		40,980	34,264	28,509	Netherlands 2,140; France 1,425.
Slag and dross, not metal-bearing		589,323	345,808	324,271	Norway 21,534; Japan 3.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		155,252	39,509	39,509	
Carbon including carbon black		82,339	71,771	57,547	Germany 4,729; Spain 2,314.
Coal:					
Anthracite		668	436	242	Australia 170; Trinidad and Tobago 24.
Bituminous	thousand tons	31,986	32,402	775	Japan 18,497; Republic of Korea 5,675; Brazil 1,283.
Lignite including briquets		63,487	73,057	73,056	Republic of South Africa 1.
Unspecified including briquets		8,127	6,788	6,754	Belgium-Luxembourg 18; France 16.
Coke and semicoke		160,293	49,714	49,714	
Gas, natural: Gaseous	million cubic meters	47,373	47,445	47,445	
Peat including briquets and litter		616,588	650,206	576,677	Japan 66,196; Australia 2,490.
Petroleum:					
Crude	thousand 42-gallon barrels	220,488	270,975	267,407	Republic of Korea 2,241; Taiwan 893.
Refinery products:					
Liquefied petroleum gas	do.	41,133	47,731	47,730	St. Pierre and Miquelon 1.
Gasoline	do.	[10]25,220	([11])		
Naphtha	do.	[10]3,850	([11])		
Mineral jelly and wax	do.	264	264	260	Germany 2; Guyana 1.
Kerosene and jet fuel	do.	[10]11,020	([11])		
Distillate fuel oil	do.	[10]29,154	([11])		
Residual fuel oil	do.	[10]15,251	([11])		
Bitumen and other residues	do.	72	887	885	St. Pierre and Miquelon 2.
Bituminous mixtures	do.	1,237	654	650	Venezuela 2.; St. Pierre and Miquelon 1.
Petroleum coke	do.	684	846	553	Japan 292.
Unspecified	do.	—	86,065	74,487	Netherlands 3,418; Italy 1,044.

[r]Revised. NA Not available.
[1]Table prepared by H. D. Willis.
[2]Data for ores and concentrates equal total weight of all metals contained unless otherwise indicated.
[3]Less than 1/2 unit.
[4]Includes vanadium ore and concentrate.
[5]Unreported quantities for fittings, valued at $32,526,000 in 1990 and $36,521,000 in 1991.
[6]Metal content.
[7]Includes other precious metals.
[8]Includes hard zinc spelter.
[9]Includes chlorite and perlite.
[10]Source: International Energy Agency, Organization for Economic Cooperation and Development.
[11]Separate breakdowns for some refinery products were not available; included in "Unspecified."

TABLE 7

CANADA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS[2]					
Alkali, alkaline-earth metals:					
Alkali metals		4,162	4,829	4,825	Japan 4.
Alkaline-earth metals		121	174	NA	China 112.
Aluminum:					
Ore and concentrate, gross weight	thousand tons	2,310	2,774	33	Brazil 1,480; Guinea 398.
Oxides and hydroxides	do.	1,983	2,456	974	Australia 827; Jamaica 533.
Ash and residue containing aluminum		1,750	1,923	1,923	
Metal including alloys:					
Scrap		52,603	46,339	45,87	United Kingdom 463, unspecified 5.
Unwrought		84,658	73,877	62,541	France 7,760; Switzerland 1,319.
Semimanufactures		328,196	299,461	272,143	France 7,090; Republic of South Africa 3,533.
Antimony:					
Ore and concentrate		44	23	23	
Oxides		1,277	1,165	423	United Kingdom 662.
Metal including alloys, all forms		182	110	35	China 74.
Arsenic:					
Elemental		203	47	NA	NA.
Oxides and acids		996	NA		
Beryllium: Metal including alloys, all forms		31	12	12	
Bismuth: Metal including alloys, all forms		40	35	31	Peru 4.
Cadmium: Metal including alloys, all forms		48	17	17	
Chromium:					
Ore and concentrate		21,309	20,957	7,201	Philippines 7,358; Republic of South Africa 3,339.
Oxides and hydroxides		2,563	2,531	1,995	Germany 366; United Kingdom 152.
Metal including alloys, all forms		214	273	112	Japan 124; United Kingdom 18.
Cobalt:					
Ore and concentrate		20	122	3	Zaire 118; Belgium-Luxembourg 1.
Oxides and hydroxides		72	42	9	Belgium-Luxembourg 28; Finland 5.
Metal including alloys, all forms		812	2,083	264	Zaire 1,262; Belgium-Luxembourg 474.
Columbium and tantalum:					
Tantalum metal including alloys, all forms		25	45	45	
Copper:					
Ore and concentrate, Cu content[3]		40,643	69,824	40,417	Portugal 19,315; Chile 4,940.
Matte and speiss including cement copper		3,032	4	1	United Kingdom 2.
Oxides and hydroxides		532	507	256	Australia 249.
Sulfate		5,078	3,967	655	Netherlands 987; Poland 564.
Ash and residue containing copper		37,248	19,241	7,797	Brazil 8,974; Sweden 1,702.
Metal including alloys:					
Scrap		65,540	47,704	47,416	U.S.S.R. 163; Haiti 65.
Unwrought		12,732	19,929	18,137	Chile 799; Germany 362.
Semimanufactures		68,546	65,827	54,655	Germany 2,541; Brazil 2,156.
Germanium: Metal including alloys, all forms		11	19	5	Belgium-Luxembourg 14.
Gold:					
Ore and concentrate, Au content	kilograms	626	698	NA	NA.

See footnotes at end of table.

TABLE 7—Continued

CANADA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1990	1991	Sources, 1991	
			United States	Other (principal)
METALS[2]—Continued				
Gold—Continued:				
Waste and sweepings	1,892	3,064	3,043	United Kingdom 20; Trinidad and Tobago 1.
Metal including alloys, unwrought and partly wrought kilograms	47,906	30,388	24,148	Guyana 1,872; Nicaragua 1,707.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite, gross weight thousand tons	4,113	4,620	4,559	Brazil 61.
Pyrite, roasted	1,656	366	366	
Metal:				
Scrap	1,002,519	809,349	807,784	Venezuela 988; France 61.
Pig iron, cast iron, related materials	24,302	41,431	18,418	Brazil 12,642; U.S.S.R. 9,620.
Ferroalloys:				
Ferrochromium	43,202	46,225	4,804	Republic of South Africa 26,419; Sweden 10,529.
Ferromanganese	29,358	46,054	11,990	Republic of South Africa 13,550; Norway 5,616.
Ferromolybdenum	581	544	82	Chile 334; United Kingdom 77.
Ferronickel	2,524	1,517	—	All from Dominican Republic.
Ferroniobium	1,108	1,466	663	Brazil 803.
Ferrosilicochromium	1,192	890	706	Zimbabwe 184.
Ferrosilicomanganese	17,153	15,514	1,939	Brazil 8,005; Republic of South Africa 4,000.
Ferrosilicon	20,504	21,927	21,292	Brazil 305; U.S.S.R. 300.
Ferrotitanium and ferrosilicotitanium	533	302	224	United Kingdom 77.
Ferrovanadium	300	187	139	Austria 34.
Silicon metal	2,407	3,012	1,211	Brazil 1,317; France 429.
Unspecified	4,623	4,809	2,527	France 1,095; Brazil 618.
Steel, primary forms	277,327	147,454	60,806	Belgium-Luxembourg 25,037; United Kingdom 19,532.
Semimanufactures:				
Flat-rolled products:				
Of iron or nonalloy steel:				
Not clad, plated, coated	775,587	635,700	405,448	Germany 47,324; United Kingdom 38,104.
Clad, plated, coated	403,955	422,554	295,766	Japan 52,159; Republic of Korea 16,278.
Of alloy steel	147,660	139,004	66,334	Germany 17,692; Japan 14,722.
Bars, rods, angles, shapes, sections	753,556	661,396	427,360	Japan 46,077; Trinidad and Tobago 33,135.
Rails and accessories	76,365	49,555	19,700	Japan 21,755; United Kingdom 2,888.
Wire	61,567	54,759	31,977	United Kingdom 3,453; France 3,268.
Tubes, pipes, fittings[4]	373,091	414,460	242,869	Japan 69,653; Germany 22,879.
Lead:				
Ore and concentrate	43,974	5,133	3,604	Peru 861; Belgium-Luxembourg 668.
Oxides	6,238	5,541	5,374	Republic of South Africa 165; Germany 2.
Ash and residue containing lead	2	95	NA	NA.
Metal including alloys:				
Scrap	34,831	58,044	58,031	Unspecified 13.
Unwrought	11,682	7,921	6,175	Mexico 1,746.
Semimanufactures	951	759	706	Denmark 20; Belgium-Luxembourg 18.

See footnotes at end of table.

TABLE 7—Continued

CANADA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS[2]—Continued					
Lithium: Oxides and hydroxides		82	34	NA	NA.
Magnesium: Metal including alloys:					
Scrap		41	260	260	
Unwrought		11,758	8,143	7,475	Norway 532; France 71.
Semimanufactures		1,126	727	722	France 4; United Kingdom 1.
Manganese:					
Ore and concentrate, metallurgical-grade		62,831	7,325	7,142	Brazil 183.
Oxides		7,568	8,296	7,230	Japan 851; Brazil 112.
Metal including alloys, all forms		4,268	3,712	1,680	Republic of South Africa 1,777; Brazil 160.
Mercury		54	12	11	Ireland 1.
Molybdenum:					
Ore and concentrate		258	334	219	Belgium-Luxembourg 63; Chile 51.
Oxides and hydroxides		176	305	212	Chile 93.
Metal including alloys:					
Unwrought including waste and scrap		42	24	24	
Semimanufactures		35	23	21	Austria 2.
Nickel:					
Ore and concentrate, Ni content		33	8	8	
Matte and speiss		13,086	23,300	4,371	Cuba 10,727; Belgium-Luxembourg 3,017.
Oxides and hydroxides		37	69	NA	NA.
Metal including alloys:					
Scrap		9,314	14,717	12,672	Germany 715; United Kingdom 584.
Unwrought		4,083	10,490	367	U.S.S.R. 6,257; Norway 1,941; United Kingdom 1,418.
Semimanufactures		2,684	2,089	1,268	Germany 350; Spain 227.
Platinum-group metals:					
Waste and sweepings	value, thousands	$11,584	$14,159	$12,961	Costa Rica $508; Cuba $401.
Metals including alloys, unwrought and partly wrought:					
Palladium	kilograms	1,682	1,540	1,034	Germany 197; unspecified 309.
Platinum	do.	4,217	3,476	685	Republic of South Africa 986; U.S.S.R. 848; United Kingdom 846.
Rhodium	do.	361	288	28	U.S.S.R. 123; Republic of South Africa 104; United Kingdom 33.
Iridium, osmium, ruthenium	do.	15	47	45	Unspecified 2.
Rare-earth metals including alloys, all forms		20	11	NA	NA.
Selenium, elemental		9	8	NA	NA.
Silicon, high-purity		469	311	NA	NA.
Silver:					
Ore and concentrate[5]	value, thousands	$9,516	$7,881	$752	Peru $7,113; Guyana $15.
Waste and sweepings[5]	do.	$61,397	$56,979	$48,086	France $3,516; United Kingdom $2,977.
Metal including alloys, unwrought and partly wrought	kilograms	110,734	152,632	55,263	Canada 95,627; unspecified 1,742.
Tin:					
Ore and concentrate	do.	291	283	283	
Metal including alloys:					
Scrap		94	167	164	Malaysia 3.
Unwrought		3,760	3,337	158	China 1,009; Brazil 650; Bolivia 594.

See footnotes at end of table.

TABLE 7—Continued

CANADA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS[2]—Continued					
Tin—Continued:					
Metal including alloys—Continued					
Semimanufactures		332	238	220	Malaysia 17; Belgium-Luxembourg 1.
Titanium:					
Ore and concentrate		27,523	43,304	811	Australia 31,153; Republic of South Africa 10,537.
Oxides		3,954	9,940	2,435	France 2,848; United Kingdom 2,149.
Metal including alloys:					
Unwrought including waste and scrap		908	598	598	
Semimanufactures		1,633	1,016	928	United Kingdom 36; Japan 22.
Tungsten: Metal including alloys:					
Unwrought including waste and scrap		62	49	48	Germany 1.
Semimanufactures		66	95	84	Japan 7; United Kingdom 2.
Uranium and thorium:					
Ore and concentrate	value, thousands	$339	$2,014	$2	Nigeria $1,978; France $34.
Oxides and other compounds	kilograms	248,490	70,381	—	Mainly from France.
Uranium metal including alloys, all forms		1,870	1,321	463	Australia 470; Namibia 267.
Vanadium:					
Oxides and hydroxides		838	851	315	Republic of South Africa 526.
Metal including alloys, all forms		5	1	1	
Zinc:					
Ore and concentrate		182,733	188,878	180,499	Peru 8,378; Belgium-Luxembourg 1.
Oxides		2,438	3,138	2,634	Mexico 451; Netherlands 40.
Blue powder		555	343	282	Australia 61.
Ash and residue containing zinc		567	472	NA	NA.
Metal including alloys:					
Scrap		1,615	655	655	
Unwrought		9,482	4,687	4,662	Belgium-Luxembourg 4; unspecified 21.
Semimanufactures		4,366	3,510	3,431	Germany 54; Japan 6.
Zirconium:					
Ore and concentrate		9,841	7,102	6,093	Republic of South Africa 912; Australia 83.
Metal including alloys:					
Unwrought including waste and scrap		9	5	4	United Kingdom 1.
Semimanufactures		280	267	163	France 104.
Other:					
Ores and concentrates, metal content		1,001	14,457	14,457	
Oxides and hydroxides		983	1,089	NA	NA.
Ashes and residues		17,372	31,412	20,300	United Kingdom 6,097; Italy 3,565.
Base metals including alloys, all forms		9	13	13	
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		25,339	21,530	13,576	Turkey 7,386; Ecuador 180.
Artificial:					
Corundum		5,637	3,623	2,778	Austria 626; Japan 144.
Silicon carbide		6,036	8,400	8,082	Unspecified 318.
Dust and powder of precious and semiprecious stones excluding diamond	thousand carats	r395	809	NA	Ireland 573.

See footnotes at end of table.

TABLE 7—Continued

CANADA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Abrasives, n.e.s.—Continued:					
Grinding and polishing wheels and stones	value, thousands	$42,258	$43,108	$24,823	Italy $6,175; Germany $2,652.
Asbestos, crude		879	867	857	Zimbabwe 10.
Barite and witherite		7,995	12,493	11,303	Netherlands 1,030; Germany 131.
Boron materials:					
Crude natural borates		573	525	525	
Elemental[6]		6	4	NA	NA.
Oxides and acids		5,672	4,979	4,916	United Kingdom 45; U.S.S.R. 18.
Bromine and fluorine		1,512	1,410	1,401	Unspecified 9.
Cement		655,500	620,245	538,075	Colombia 76,408; United Kingdom 1,704.
Chalk		15,889	5,070	4,866	United Kingdom 127; Republic of Korea 41.
Clays, crude:					
Bentonite		229,959	268,612	220,150	Greece 48,430; Republic of South Africa 23.
Chamotte and dinas earths		9,622	12,968	12,968	
Fire clay		10,443	9,041	8,639	Unspecified 402.
Fuller's earth		6,643	6,138	6,138	
Kaolin		506,432	520,562	520,054	United Kingdom 448; France 60.
Unspecified		196,388	170,588	170,397	Unspecified 191.
Cryolite and chiolite		7,926	672	650	Netherlands 22.
Diamond, natural:					
Gem, not set or strung	value, thousands	$119,393	$112,471	$17,720	U.S.S.R. $37,486; Belgium-Luxembourg $29,120.
Industrial stones	do.	$6,213	$3,674	$1,286	Ireland $2,015; Zaire $266.
Unsorted	do.	$51,055	$44,681	$10,788	Belgium-Luxembourg $18,803; Israel $10,587.
Dust and powder	thousand carats	r6,158	7,589	872	U.S.S.R. 6,395; Ireland 306.
Diatomite and other infusorial earth		20,951	22,250	22,195	Germany 53; Spain 2.
Feldspar, fluorspar, related materials:					
Feldspar		2,589	2,865	2,865	
Fluorspar		151,255	112,085	9,264	Mexico 46,504; Morocco 33,799; China 22,518.
Leucite, nepheline and nepheline syenite		93	428	NA	NA.
Fertilizer materials:					
Crude, n.e.s.		4,900	6,112	6,102	United Kingdom 7; Netherlands 3.
Manufactured:					
Ammonia		12,754	17,182	17,165	Germany 16.
Nitrogenous		320,107	306,689	178,281	Netherlands 125,082; Norway 1,989.
Phosphatic		52,017	44,555	44,555	
Potassic		96,171	77,742	75,359	France 1,839; Germany 333.
Unspecified and mixed		483,593	502,747	499,836	Belgium-Luxembourg 1,285; Israel 442.
Graphite, natural		6,278	5,413	5,254	China 66; Sri Lanka 42.
Gypsum and plaster		336,796	284,880	76,957	Mexico 164,592; Spain 42,473.
Iodine		104	108	67	Japan 35.
Kyanite and related materials:					
Andalusite, kyanite and sillimanite		4,950	4,369	4,369	
Mullite		1,295	1,989	1,989	
Lime		43,696	44,917	44,145	Germany 755; Belgium-Luxembourg 17.

See footnotes at end of table.

TABLE 7—Continued

CANADA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Magnesium compounds:					
Magnesite, crude		96,714	71,341	1,214	China 70,092; United Kingdom 35.
Oxides and hydroxides		99,827	87,006	46,522	China 36,893; Austria 1,500.
Mica:					
Crude including splittings and waste		2,340	1,201	1,143	Japan 58.
Worked including agglomerated splittings	value, thousands	$5,977	$4,902	$3,001	France $1,608; India $218.
Nitrates, crude		7,880	11,385	1,442	Chile 9,838; Poland 36.
Phosphates, crude	thousand tons	1,258	1,080	365	Togo 699; Senegal 16.
Phosphorus, elemental		75	249	246	Japan 3.
Pigments, mineral:					
Natural, crude		1,002	675	635	Unspecified 40.
Iron oxides and hydroxides, processed		7,069	6,416	5,530	Germany 643; Spain 166.
Potassium salts, crude		8	49	49	
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	$14,554	$12,278	$4,347	Thailand $3,077; India $1,085.
Synthetic	do.	$1,563	$1,312	$764	U.S.S.R. $124; Thailand $94.
Pyrite, unroasted		2,860	6,710	6,710	
Quartz crystal, piezoelectric	value, thousands	$588	$410	$333	Japan $53; United Kingdom $15.
Salt and brine	thousand tons	2,095	1,203	772	Mexico 312; Chile 74.
Sodium compounds, n.e.s.:					
Soda ash, natural and manufactured		158,719	152,191	152,183	Germany 4; United Kingdom 4.
Sulfate, natural and manufactured		8,375	3,926	3,576	United Kingdom 241; Japan 42.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		77,261	61,485	35,086	Republic of South Africa 17,487; Italy 2,166.
Worked	value, thousands	$83,017	$62,320	$16,189	Italy $29,746; Spain $2,905.
Dolomite, chiefly refractory-grade		4,721	8,257	8,252	United Kingdom 5.
Gravel and crushed rock	thousand tons	1,177	1,208	1,204	France 2; Italy 1.
Limestone other than dimension	do.	3,750	2,514	2,513	Thailand 1.
Quartz and quartzite		7,796	39,215	5,747	Spain 33,060; Brazil 408.
Sand other than metal bearing		1,215,081	885,712	883,747	Sweden 754; Japan 375.
Sulfur:					
Elemental:					
Crude including native and byproduct		13,247	9,026	8,962	France 60; Germany 4.
Colloidal, precipitated, sublimed		1,620	1,268	1,258	France 10.
Dioxide		840	130	130	
Sulfuric acid		71,319	79,207	79,093	Germany 57; United Kingdom 57.
Talc, steatite, soapstone, pyrophyllite		43,974	44,372	43,294	United Kingdom 517; China 434.
Vermiculite[7]		48,568	51,266	38,564	Greece 6,331; Republic of South Africa 5,971.
Other:					
Crude		28,113	9,039	9,011	Unspecified 28.
Slag and dross, not metal-bearing		348,542	171,012	163,194	Germany 7,125; Netherlands 431.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		6,340	7,909	7,887	Trinidad and Tobago 21; Germany 1.
Carbon including carbon black		17,074	24,860	24,443	Germany 374; Belgium-Luxembourg 24.

See footnotes at end of table.

TABLE 7—Continued

CANADA: 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					
Coal:					
Anthracite		440,670	312,863	312,863	
Bituminous	thousand tons	14,347	11,344	11,344	Germany 2.
Lignite including briquets		178	230	230	
Unspecified including briquets		19,237	35,925	34,527	Germany 1,398.
Coke and semicoke		873,543	482,550	482,404	France 119; Germany 27.
Gas, natural: Gaseous	million cubic meters	[8]293	NA		
Peat including briquets and litter		316	15,496	15,496	
Petroleum:					
Crude	thousand 42-gallon barrels	200,310	193,871	1,682	United Kingdom 63,200; Norway 56,337; Saudi Arabia 25,779.
Refinery products:					
Liquefied petroleum gas	do.	6,483	6,370	6,297	United Kingdom 71.
Gasoline	do.	[8]5,814	(9)		
Naphtha	do.	[8]264	(9)		
Mineral jelly and wax	do.	163	181	171	Germany 4; Italy 2.
Kerosene and jet fuel	do.	[8]11,238	(9)		
Distillate fuel oil	do.	[8]4,715	(9)		
Lubricants	do.	61	(9)		
Residual fuel oil	do.	[8]25,361	(9)		
Bitumen and other residues	do.	2,348	2,756	1,325	Venezuela 561; Netherlands Antilles 496.
Bituminous mixtures	do.	1,010	703	261	Venezuela 379; Spain 61.
Petroleum coke	do.	5,429	4,967	4,965	France 2.
Unspecified	value, thousands	—	$1,036,922	$452,259	Venezuela $182,873; U.S.S.R. $42,763.

[r]Revised. NA Not available.
[1]Table prepared by H. D. Willis.
[2]Data for ores and concentrates equal total weight of all metals contained unless otherwise indicated.
[3]Includes copper content of other ores and concentrates.
[4]Quantities for fittings were not provided; valued at $190,919,000 in 1990 and $198,951,000 in 1991.
[5]Includes other precious metals.
[6]Includes tellurium.
[7]Includes chlorite and perlite.
[8]Source: International Energy Agency, Organization for Economic Cooperation and Development.
[9]Separate breakdowns for some refinery products were not available; included in "Unspecified."

TABLE 8

CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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, 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), 55%; Societe Nationall de l'Amiante (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 undergound).
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.	Highvale 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%)	Sudbury 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%; and 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.
Do.	do.	Refinery, Subdury, Ontario	170.
Do.	Noranda Inc.	Bell Copper Mine, Babine Lake, British Columbia	5,550 (mine).

See footnotes at end of table.

TABLE 8—Continued

CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper—Continued:	Noranda Inc.	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, Contwoyto Lake; Northwest Territories	612 (ore).
Do.	Royal Oak Mines Inc.	Giant Mine, Yellowknife, Northwest Territories	407 (ore).
Do.	do.	Giant Mill-tailings, Yellowknife, Northwest Territories	3,265 (ore).
Do.	do.	Pamour, Ontario	945 (ore).
Do.	do.	Schumacher, Ontario	931 (ore).
Do.	Hemlo Gold Mines Inc. (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, Newfoundland	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 8—Continued

CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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, Nova 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 McCreedy East and West, Shebandowan, Clarabelle, Lower Coleman, Crean Hill, Murray, and Totten in Sudbury area, Ontario	106 (metal contained).
Do.	do.	Smelter, Sudbury, Ontario	110 (metal contained).
Do.	do.	Refinery, Sudbury, Ontario	56.8 (metal contained).
Do.	do.	Refinery, Port Colborne, Ontario	30 (metal contained).
Do.	Inco Ltd.	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 thousand 42-gallon barrels	Imperial Oil Ltd. (Exxon Corp., USA, 70%; others, 30%)	Judy Creek, Cold Lake, Alberta, and Mackenzie Delta, Beaufort Sea, Yukon and Northwest Territories	670.
Gas million cubic meters	do.	do.	36.4.

See footnotes at end of table.

TABLE 8—Continued

CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum—Continued:			
Crude million 42-gallon barrels	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	26.1.
Gas billion cubic meters	do.	do.	3.0.
Crude million 42-gallon barrels	Norcen Energy Resources Ltd. (Hollinger Inc., 59%; Hees International, 41%)	Pembina, Bodo, Majorville, Alberta	12.1.
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.	PanCanadian 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.
Crude 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. 58.8%)	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).

See footnotes at end of table.

TABLE 8—Continued

CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
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.	Sarnia, 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	Sarnia, Ontario	50.
Do.	Sulconam Inc. (Petro Canada, 7.6%)	Montreal, Quebec	108.
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. (Chevron 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 and H_2SO_4 production capacities	Canadian Electro Zinc Ltd. (CEZ) (Noranda Inc., 90.17%)	Valleyfield, Quebec	430 (H_2SO_4).
Do.	INCO Ltd.	Copper Cliff, Ontario	950 (H_2SO_4).
Do.	Falconbridge Ltd. (Noranda Inc., 50%; Trelleborg AB, 50%)	Kidd Creek, Ontario	690 (H_2SO_4).
Do.	ESSO Chemical Canada (Imperial Oil, Ltd., 100%)	Redwater, Alberta	910 (H_2SO_4).
Uranium	Denison Mines Ltd.	Elliot Lake, Ontario	1,319 (metal).
Do.	Cameco 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 contained).
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, Kimberley, British Columbia	70 (Pb-Zn contained).
Do.	do.	Smelter, Trail, British Columbia	300 (slab zinc).
Do.	Curragh Resources Inc. (Banco Español de Crédito, S.A., 100%)	Faro Mine, Yukon Territory	184 (Pb-Zn contained).

[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 9

CANADA: RESERVES OF MAJOR MINERALS, 1992

(Thousand metric tons unless otherwise specified)[1]

Commodity		Reserves
Asbestos, fiber		e39,000
Coal, all types		e6,371,000
Copper, metal content		11,115
Gold, metal	metric tons	[2]1,430
Gypsum		[3] e500,000
Iron ore, iron content		e1,314,000
Lead, metal content		4,955
Molybdenum, metal content		182
Natural gas	billion cubic meters	[4]2,060
Nickel, metal content		5,691
Petroleum crude	million barrels	[4]6,766
Potash, K_2O equivalent	million tons	e14,000
Salt		[3]314,000
Silver, metal	metric tons	19,000
Sodium sulfate		[3]92,000
Sulfur		e140,000
Uranium		[5]271
Zinc, metal content		16,448

eEstimated.

[1]1992 Canadian Minerals Yearbook, Energy, Mines and Resources Canada, unless noted.

[2]Excludes metal in placer deposits.

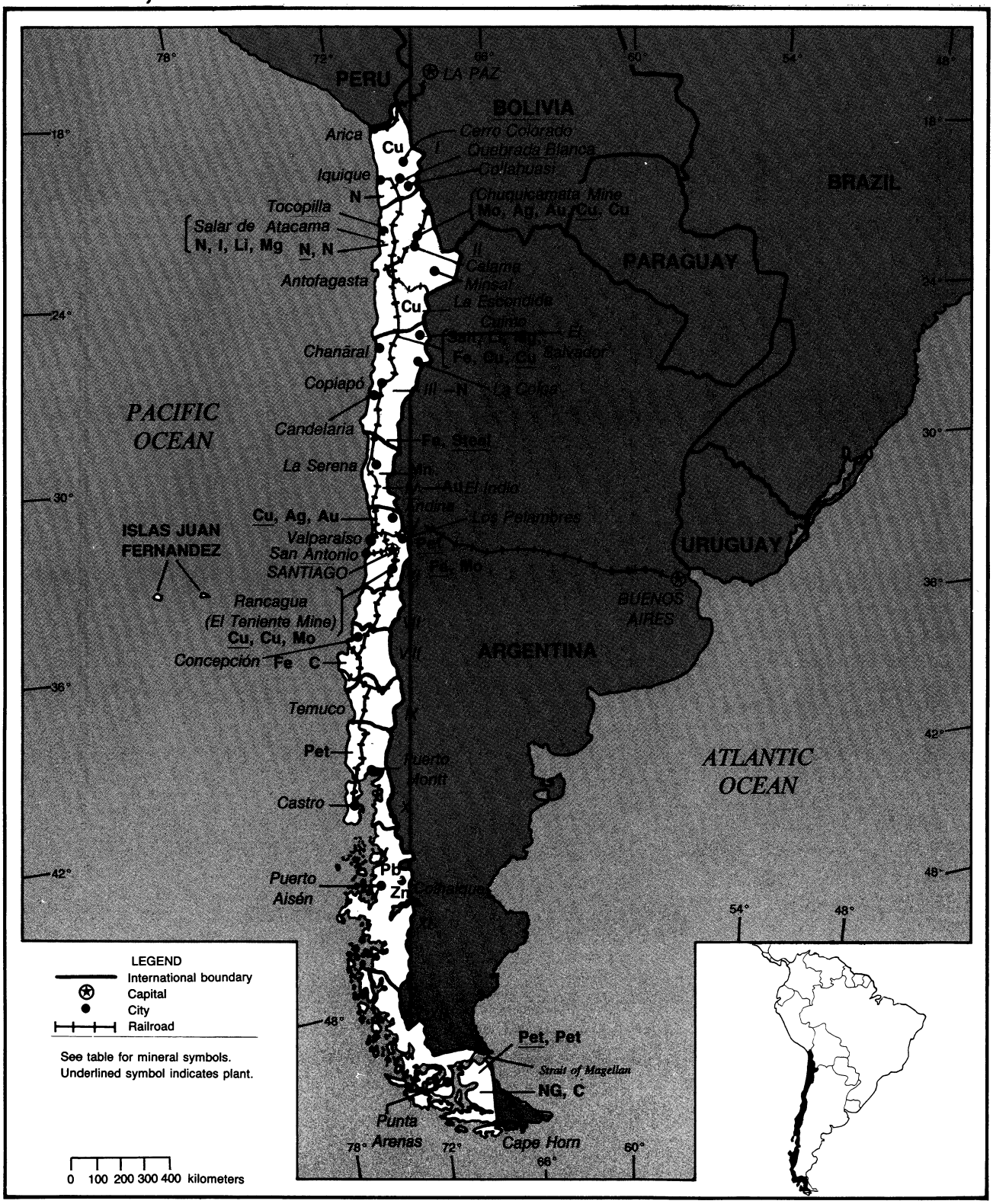
[3]Data in thousand short tons, unless noted.

[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 13.5 million**



THE MINERAL INDUSTRY OF

CHILE

By Pablo Velasco

In 1992, Chile continued to be the largest producer and exporter of copper in the world, with an output of 1.93 Mmt. According to the Chilean Copper Commission (Cochilco), total mineral exports increased 5.7% to $4.63 billion (f.o.b.) compared to those of 1991 and accounted for about 46% of Chile's total exports. Copper exports totaled $3.8 billion, 5.5% higher than those in 1991. The mining sector's income gains were realized on the estrength of larger export volumes because prices for mineral commodities declined in the international markets.

Chile's copper production accounted for 23% of the total output of the market economy copper-producing countries and was expected to maintain this lead in the foreseeable future because of the startup of the large Escondida Mine in late 1990. This new giant copper mine produced almost 337,000 tons of copper in concentrates in the second full year of operation, up 12.8% relative to 1991 and above its design capacity of 320,000 mt/a. 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.

Chile produced record amounts of gold and silver in 1992. Chile possesses approximately 21% of the world's copper reserves, as well as important reserves of lithium, 58%; rhenium, 40%; iodine, 23%; selenium, 21%; and molybdenum, 20%.

Preliminary data indicated that the Chilean economy had one of its best years ever in 1992. Gross domestic product grew 10.4% compared with the 6% rate in 1991 to about $40.0 billion[1] in 1992, the fifth highest annual rate in the past 33 years, while per capita income increased 26.4% to $2,971. The economy rebounded into a more dynamic mode after adjusting policies that had caused a sluggish 2.1% growth in 1990.

GOVERNMENT POLICIES AND PROGRAMS

There are two laws regulating foreign investment in Chile: Decree Law No. 600, of 1974, also referred to as "Foreign Investment Statute"; and Title I , Chapter XIX (Compendium of Foreign Exchange Rules issued by the Central Bank of Chile), referred to as Conventions on Investments Relative to Foreign Debt Papers. As stipulated by this law, foreign investors as individuals, corporations, and other kinds of agencies based in a foreign country may use Chilean foreign-debt titles payable abroad, maturing within 365 days, to invest in the country such money resources as those deriving from collection of these credit instruments from the corresponding Chilean debtor. 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 new labor code, law 18,620 of 1980, as amended in 1987, and the new Mining Code of 1984 allowed ownership of mining concessions and granted owners the right to extract ore from the concession. The first mineral depletion allowance amendment, the creation of the Ministry of Mining's Environmental Unit, aimed at advising the Ministry in the design of environmental policies and regulation and at controlling their implementation. An important example of this has been the enactment of Executive Decree D.S. No. 185 and the Law of Environment Bases, D.S. 185, enacted in January 1992, aimed at regulating SO_2 emissions, particulate material, and arsenic from fixed sources in the country.

The Special Operation Contract for the Exploration and Exploitation of Hydrocarbon's Law of 1975, as subsequently amended, established the rules for Petroleum Operation Contracts (POC's).

The most important pieces of new mining legislation were as follows: Chile's first Mineral Depletion Allowance; the CODELCO-Chile Mining Property Law; the Mining Patents Law; the amendment to Chile's Mining Code; the First Sulfur Dioxide Emissions Decree; and the Petroleum Price Stabilization Fund Law.

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 submitted new environmental legislation to Congress in September 1992.

The legislation would mandate the development and implementation of environmental standards, require environmental impact statements for new projects, and define civil liability and penalties. Regional Environmental Commissions constituted under the legislation would be responsible for monitoring and protecting the nation's biomass, marine, and natural resources. The legislation would establish equal rights and responsibilities for both public

and private enterprises. The Government intends to phase in the legislation's provisions gradually once it becomes law to minimize disruptions to the economy and to allow time to develop monitoring and enforcement capabilities. The legislation was expected to become law before the end of 1993. While Congress reviews the proposal, Government regulators have taken an active approach to Chile's environmental problems. 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 and introduced legislation to manage old-growth forests. In addition, the Government established a special National Environmental Commission (CONAMA) to control and regulate the environmental framework of the country.

The Chilean Development Agency (CORFO) announced that it intends to privatize a number of subsidiaries and sell stock holdings in others during 1993. CORFO specified that it will sell its 22.4% stake in LanChile, the country's largest airline. CORFO also will sell the Aysen Mining Co. and others. The Foreign Investment Committee, an interministerial body of the Chilean Government, reported that inflows of foreign investment in 1992 totaled an unprecedented $1.39 billion, a 21.8% increase compared with $1.14 billion posted in 1991. In 1992, materialized mining investments accounted for $395 million, followed by services, $278.5 million; industry, $91.9 million; construction, $23.7 million; agriculture, $8,7 million; and forestry, $5.8 million.

At the committee's last meeting for 1992, new investments totaling $994 million were authorized, bringing the year's overall authorization to about $3 billion for 357 projects. Most 1992 authorized investments (73.2%) were earmarked for the mining sector, 15.9% went to the services sector, and 8.7% to industry.

By country of origin, Canada was the leader, accounting for 39.3% of authorized investments, followed by Finland, 20.3%; South Africa, 10.2%; the United States, 10.1%; the United Kingdom, 4.9%; and the Cayman Islands, 3.5%, among the largest participants.

To implement its free trade policy, the Government of Chile was vigorously pursuing initiatives to open bilateral free trade negotiations with several countries in the region. By yearend, Chile held trade talks with Brazil, Ecuador, and Venezuela. Chile has been mentioned as a prime candidate to enter the Canada-Mexico-United States North American Free Trade Agreement (NAFTA) once completed. To prepare for free trade talks with the U.S. and the other NAFTA parties, the Chilean Government was drafting appropriate social, labor, and environmental legislation.

Chile is not a member of any regional bloc, while Ecuador and Venezuela are members of the Andean Pact and Brazil belongs to the Mercosur trading bloc. In recent years, Chile has negotiated bilateral agreements with countries from around the world. Some of these deal specifically with eliminating trade barriers and promoting free market access, while other initiatives formalize measures for the protection of investors. Most recently, the Government signed a number of agreements with the Scandinavian countries during the visit of the President to that part of the world. With Mexico, a specific trade agreement aiming for freer commercial exchange has already borne fruit and promises to increase benefits for the participants in the agreement signed between Chile and Mexico in September 1991. Trade between the two countries grew 42% to $246 million in 1992, the first year the agreement was in force.

The first U.S.-Chile Trade and Investment Council Meeting was held in Santiago, Chile, on June 14, 1992, under the Framework Agreement on Trade and Investment previously signed.

Trade relations with neighboring Argentina have been increasing steadily in importance. Following a recently signed free trade agreement between Chile and Bolivia, Santiago's Chamber of Commerce and the National Chamber of Commerce in La Paz signed a formal Cooperation Agreement binding both institutions to promote trade and economic cooperation between Chilean and Bolivian companies.

PRODUCTION

The Chilean mining industry experienced another year of continued growth in 1992 as a result of new foreign investment and in particular the startup of the giant Escondida Mine in late 1990, which added 320,000 mt/a of copper production. According to COCHILCO, most of the foreign investment in the mining sector was concentrated in the following projects: Region I and II—(1) Cerro Colorado (copper), (2) Quebrada Blanca (copper), (3) Collahuasi (copper), (4) Lince (copper), (5) Ivan-Zar (copper), (6) San Cristobal (gold), (7) Minsal (salts), (8) Zaldívar (copper), (9) Escondida (copper), (10) Yolanda (sodium nitrate), (11) Las Luces (copper). Regions III, IV, and Metropolitan Region—(1) La Coipa (gold), (2) Marte (gold), (3) La Pepa (gold), (4) Refugio (gold), (5) Candelaria (copper), (6) Andacollo (gold), (7) Andacollo (copper), (8) Los Pelambres (copper), and (9) Los Bronces (copper). Some of these projects were already initiated or in advanced construction stages.

Review of the production statistics for 1992 shows the effective contribution of the medium-scale mining sector in comparison with the large-scale mining sector, which was handled entirely by CODELCO-Chile. CODELCO-Chile's copper production maintained leadership with another record-high output amounting to 60% of the total copper produced in the nation. The small- and medium-size mining sectors produced the remaining 40% of the copper.

Output of copper, gold, manganese, molybdenum, silver, sulfur, calcium carbonate, lithium carbonate, pumice, ulexite, and gypsum increased, while production of coal, lead, zinc, iron ore, sodium sulfate, iodine, and crude oil decreased compared with those of 1991. The production of copper increased 6.5%

to 1.93 Mmt, another record high. Output of gold and silver was also at a record-high level. Molybdenum; a large percentage of the gold and silver, as well as metal doré; and sulfuric acid were produced as byproducts of copper. CODELCO-Chile accounted for all of the output of molybdenum in the form of molybdenum trioxide and concentrate. In addition, CODELCO-Chile produced sulfuric acid. *(See table 1.)*

TRADE

In 1992, 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 $3.9 billion (82.5% of the total mineral exports). Other metallic minerals exported were valued at $664 million (14.%). Industrial minerals and others totaled $157.8 million (3.3%). Mineral exports from Chile totaled $4.7 billion or 47% of all exports for 1992. 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 1,255,000 tons of fine copper in 1992, of which 67.4% was electrolitic copper, 10.6% fire-refined, 10.5% blister, and 11.5% concentrates.

Revenues from byproduct sales during 1992 were $316 million. The most significant byproduct was molybdenum, sales of which amounted to $68 million for shipments of 13,342 tons, fine content. Doré metal sales was valued at $49.5 million. The United States was Chile's principal trading partner, accounting for about 18% of Chile's imports and 20% of Chile's exports. According to U.S. Department of Commerce data in 1992, U.S. exports to Chile amounted to $1.58 billion and U.S. imports from Chile totaled $1.60 billion. *(See tables 2, 3, and 4.)*

STRUCTURE OF THE MINERAL INDUSTRY

The Chilean Government through the Ministry of Mines exercised dominant control over the mineral industry through three large mining enterprises and four regulatory agencies: CODELCO-Chile; ENAMI; and CORFO, which includes Cía. de Acero del Pacífico, S.A. de Inversiones (CAP), Empresa Nacional del Petróleo, S.A. (ENAP), Empresa Nacional del Carbón S.A. (ENACAR), Cía. Chilena de Electricidad, S.A. (CHILECTRA), 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 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 had a total production of 1.2 Mmt of fine copper in 1992. 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; precipitates and minerals for direct smelting; and anodes and blister for its smelters and refineries. The company 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 mining projects; guarded against potential environmental harm from mining production; and bought ores for flotation and leaching at its own plants. Under study by ENAMI are the following: (1) smelter modernization: the feasibility study for the modernization of Las Ventanas and Paipote smelters, for $490,000 is under study and (2) North Area Smelter: The prefeasibility study was done in 1991 and the feasibility study is about to be completed, with a cost of about $850,000 paid by all the partners. 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, seeks to stimulate the development of a smelting and refining business with the participation of private capitals to increase the value added of Chile's exports, making the best use of the availability of concentrates in Chile. CORFO was created in 1939 to develop economic programs for the promotion of manufacturing activities by exploiting natural resources. These objectives led to the birth of other major enterprises such as ENAP, CAP, Empresa Nacional de Energia S.A. (ENDESA), and ENACAR. The total labor force, including staff and office personnel, working directly in the minerals sector numbered 77,920, representing about 1.6% of the total labor force (4,843,000) in the country. Approximately 4.9% of the total labor force was unemployed during the year. The metals sector's labor force was 61,445, about 79% of the mineral sector labor force total, of which 47,408 were copper workers. The industrial minerals sector labor force was 3,400, and the mineral fuels sector was 13,075, 84.7% of which was coal miners. CODELCO-Chile employed about 26,841 copper workers in 1992, or about 56% of the total metals sector employees. *(See table 5.)*

COMMODITY REVIEW

Metals

Copper.—Chile's increased copper production in 1992 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 1.93 Mmt of copper in 1992. The increase in copper production of 6.5% over that of the previous year was due to the additional output from the new private-sector La Escondida Mine that produced about 337,000 tons, an increase of 13%. Total output would have been even greater but for technical and production problems in the two largest CODELCO mines, El Teniente and Chuquicamata. CODELCO's copper production increased by only 2.7% in 1992 compared with that of 1991, owing mainly to the lower average price of copper (1.04 cents/lb) and precious metals in the world market. CODELCO-Chile, to stem the production slide and bolster output, has asked the Treasury for an increase in 1992 investment budget of $450 million, arguing that the $343 million of the year before was to hold production at current levels. Now the company wants to produce more copper, or at least make up for falling output from its main mines.

Of the $450 million, CODELCO will have to set aside $241 million, about 54%, to projects already under way, where the company is to spend $190 million in production areas directly, $39 million for improving services, and $12 million for research. The total price tag for these projects under execution, excluding the ones that cost $2.5 million or less, is $704 million over a 5-year period. These are ventures that CODELCO believes have attractive rates of returns on investment of 35% and above. For 1992, CODELCO plans to spend 34% of its investment money in construction, 6% in engineering, and 60% in equipment acquisition. What remains of the $450 million is $209 million for new projects. The candidates are: Chuqui Norte (known also as Radomiro Tomic Mine, part of the Pampa Norte), 8 km north of the great Chuquicamata open pit; and the El Abra deposit, another project being considered by CODELCO. A feasibility study on the development of El Abra is currently being done by Pincock, Allen & Holt of the United States. The oxide ore body has reserves of about 400 Mmt grading about 0.7% copper. Development of a typical open pit heap-leaching operation producing 30,000 to 50,000 mt/d ore and a solvent extraction/eletrowinning (SX-EW) plant will cost about $400 million. The El Abra project is also the first CODELCO property that will be open for joint venture with private companies based on the new CODELCO law passed the first week of March. The other projects being considered by CODELCO are the Quebrada Teniente, at el Teniente Mine, and the Andina Expansion at the Andina Mine. At a cost of $500 million, he three projects should produce 285,000 mt/a of copper, fine content, by 1997, thus compensating for depleting output from the overgrown Chuquicamata pit and rockburst-prone Sub-Level Six at El Teniente Mine. A significant part of this investment, unlike those made in previous years, has been channeled into intensified environmental cleanup plans.

Chuquicamata output reached 626,200 tons of fine copper in 1992, 2.4% 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, 314,200 tons; El Salvador, 85,000 tons; and Andina, 126,900 tons.

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 by one-half and will play a key role in Chile's drive to add value to its copper riches. The expansion will lift output at Escondida from 336,000 tons this year to 390,000 tons in 1993, 420,000 tons in 1994, and 480,000 tons 1 year later. A substantial amount of increased output will be derived from a new $164 million SX-EW cathode plant. The new facilities, to be built near the port of Coloso, 14 km from Antofagasta, will incorporate ammonia leaching developed by BHP, one of the partners in the joint venture. Moreover, the recent slump in copper prices has not deterred the mine owners—BHP Australia (57.5%), RTZ Corp. PLC, United Kingdom (30%), a Japanese consortium led by Mitsubishi Corp. (10%), and IFC (2.5%)—from pushing ahead with the expansion. Exxon's Disputada de las Condes in 1992 had a combined copper production from its El Cobre and Los Bronces Mines of 131949 tons (up from 107,000 tons in 1991), from which the Chagres smelter produced 73,901 tons of blister copper. El Soldado produced 60,622 tons of copper, and the San Francisco concentrator 71,327 tons. During the year a $400 million expansion of the Los Bronces operation and the relocation of the San Francisco concentrator to Las Tortolas, in Peldehue, just north of Santiago, was completed. This facility had doubled the ore treating capacity of San Francisco. Output in 1993, therefore, is expected to reach 180,000 tons of copper in concentrates and, after Las Tortolas is fully on-stream, production capacity will reach 200,000 mt/a copper with 130,000 tons from the expanded Los Bronces operation and 70,000 tons from El Cobre. Because the ore averages 0.016% Mo, Exxon also will build a molybdenum recovery plant. Exxon is also in the process of spending $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 de Mantos Blancos, S.A. is owned jointly by Anglo-American Corp. of the Republic of South Africa (68.5%), Inversiones Sud-Americana, S.A. (5.7%), and Inversiones La Protectora, S.A. (11.2%). Mantos

Blancos was planning to develop a $150 million open pit copper mine, called Mantoverde in northern Chile, with its own SX-EW plant, which will have a capacity of 35,000 to 40,000 mt/a of copper cathodes.

Bechtel-Chile has recently started a study on Mantoverde. The deposit is estimated to have reserves of 85 Mmt grading 0.86% copper and is expected to be producing by mid-1995. Mantoverde should produce 200,000 mt/a at a cost of about $700 million. Empresa Minera Mantos Blancos 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 would pay $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 base price for the tender was $9 million.

Anglo American Corp-controlled Minorco and Minera de Mantos Blancos acquired a one-third interest in the Collahuasi copper project in northern Chile from Chevron Corp., United States 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. 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.

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 to 23,000 mt/a of copper, up from 11,500 mt/a. The copper will be shipped out in the form of concentrates. La Candelaria in 1992 continued its financial search for the $500 million of financing. 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 was expected to come on-stream in 1995, representing the biggest new copper investment since BHP-Utah's La Escondida Mine was inaugurated in early 1991. La Candelaria is slated to produce about 350,000 mt/a of concentrates with a 30% copper content and a plant capacity of 28,000 mt/d.

Proven reserves stand at 350 Mmt. The average ore grade is 1.14% copper. To date, Phelps Dodge has disbursed $23 million on La Candelaria to finance feasibility studies and exploration.

Other copper projects that looked viable in 1992 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. of Canada and had been granted the right, jointly with ENAMI, to develop the copper deposit. Cominco has 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 was estimated to have 78 Mmt of copper with an average grade of 1.4%. An additional 250 Mmt of copper with an average grade of 0.5% is also present. The project is expected to produce approximately 75,000 mt/a of fine copper. Cominco management stated 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 the end of the year the 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. The company was negotiating project financing with a large U.S. bank. Production could begin in 1993. Total planned investment was estimated at $290 million.

The Compañía Minera Doña Inés de Collahuasi S.A. was preparing the groundwork to launch a key feasibility study in 1993 that would set the stage to develop the large Collahuasi copper deposit. The company, owned by a consortium of Falconbridge Ltd., of Toronto; the Shell Group, of The Hague and London; and Chevron Corp. of San Francisco, was completing 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, 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, although geologists say the figure could grow to 1.0 billion tons with an average grade of 1.0% copper. At any rate, in September, Collahuasi cast aside the idea of a starter pit to establish a minable resource of 30 to 40 Mmt of oxide and enriched sulfides to produced 80,000 tons of copper. That alone would have meant an investment of $250 to $300 million, similar to nearby Quebrada Blanca. The company estimated that the feasibility study would cost up to $10 million and that Collahuasi could come on-stream in 1995 or 1996.

Compañía Minera Los Pelambres, slated to produce 60,000 tons of copper concentrates per year, was negotiating a long-term contract to have four-fifths of its production purchased by Lucky Goldstar International, Seoul, which owns 40% of the venture. Commercial production was scheduled for January 1992 and the first shipment 1 month later. The remainder of its production was being negotiated with smelters in Chile, Europe, and Japan. The concentrates will have a 37% copper content, which means that total output will be about 22,000 mt/a in copper content. Los Pelambres concentrates are free of arsenic, mercury, and other impurities sometimes common in the Chilean Andes. The mine lies 380 km north of Santiago, near the border with Argentina. The Luksic Group, of Santiago and London, owns 20% of the mine. Midland Bank plc, London, which financed its contribution to the joint venture in a chapter XIX debt-swap deal, owns the remaining 40%. The company is mining a high-grade section of Los Pelambres, one of the world's largest low-grade deposits. Located on the east end of the billion- ton porphyry deposit, the ore body section has 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 has an average grade of 1.47%. 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. Construction will cost about $60 million.

RAYROCK Yellowknife Resources Inc., of Toronto, Canada, expected to wrap up a $20 million finance package for Iván-Zar, a copper project 35 km northeast of Antofagasta, in early 1992. Iván-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 Iván-Zar should commence in the first half of 1993.

Compañía Minera Lince Ltda. expected to begin commercial production of copper cathode by December 25, 1992, after successfully starting up its crushing circuit in November. The project, which uses avant-garde seawater heap-leaching technology, is coming on-stream on schedule and, the company states, very close to budget. Investment was estimated at $62 million. Output is to be 20,000 mt/a of copper cathodes. Lince is negotiating an agency agreement with Outokumpu Oy, Espoo, Finland, to market the cathodes. Outokumpu owns a 15% stake in the venture, purchased for $9.4 million. The Luksic Group, of London and Santiago, owns another 25% through Carolina de Michilla SA, one of its mining operations. The remaining 60% is owned by Offshore Equities, a wholly owned subsidiary of the Chemical Bank Corp., New York, part of the equity financing brought in via chapter XIX.

Gold and Silver.—The low gold and silver prices induced owners to market a number of the gold-silver prospects. Low prices also caused major project delays and reduced production. Nevertheless, the large projects are expected to increase Chile's future gold and silver production. SERNAGEOMIN, an agency under the Ministry of Mines, reported that gold production in 1992 increased 17% to 33,774 kg (another record high for Chile) and silver production increased 52% to 1,028,560 kg in 1992 (another record high for Chile). The medium- and small-size mines produced 93.4% of the gold and 77.3% of the silver in the country, followed by the large-size mines of CODELCO, with 6.6% of the gold and 21.7% of the silver, primarily as byproducts of its copper operation. 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, followed by La Coipa owned by Placer Dome and TVX Gold of Canada. Other medium- and small-sized 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 496,000 kg in 1992, more than 48% of the country's total output, followed by CODELCO. Other important producers were El Indio, San Cristobal and Niugini heap-leach operations, which should contribute 1,700 kg of gold in doré bars. Production at Marte Mine was suspended in September by Anglo American, owing to multiple technical problems, including solution freezing at high altitude. CODELCO increased its gold output 12.3% to 2,214 kg in 1992 compared with that of 1991 as a byproduct of its electrolytic copper refining.

At the north end of the country, 3,400 km away, SCM Vilacollo Ltda., the company formed by Shell, Citibank, and Northgate to operate the Choquelimpie Mine near the Bolivian border, was seeking new reserves near the mine. Marte, Anglo American Corp., Johannesburg, was involved with certain geological and metallurgical problems. Production at Marte Mine was suspended in September. The mine, in the bleak high-altitude Maricunga region, was launched officially in January 1990. It lost $24 million in its first year of operation and produced at a rate of 28% of its installed capacity. The mine operator was Cía. Minera Tres Cruces SCM, a company formed by Anglo

American, 54%; Cominco, 26%; and Chemical Bank, New York, 20%. La Coipa, operated by Cía. Minera Mantos de Oro Ltda., was operating at its full capacity of 15,000 mt/d of ore since September. Output was reported in 1992 at 5,425 kg of gold and 496,000 kg of silver. Gold output increased 149% over 1991's output. But most dramatic was the increase in La Coipa's silver output. The 496,000 kg produced at La Coipa in 1992 ranked Chile as a world class silver producer. Mantos de Oro was carrying out a $600,000 exploration program at Coipa Norte, where the company estimates 9.2 Mmt of reserves with an average content of 171 g/mt of silver but only 0.2 g/mt of gold.

Amax completed the purchase of a 50% interest for $3.15 million and restricted common shares in the Refugio Project from Bema Gold Corp.'s Chilean partners late in December, making the two companies partners in the project. The two companies are now reviewing financing plans to raise the required $135 million capital cost. 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 Mmt of gold. The ore extraction would require an open pit with a stripping ratio of 1:1. The study recommends a plant with a processing rate of 33,000 mt/d. At that rate, Bema would produce 7.2 mt/a of gold, or 20 kg/d, for 13 years.

Gold production from the Can Can deposit in northern chile is expected to begin in April 1993. It should produce 778 kg of gold and 3,732 kg of silver in 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 deposit has proven reserves of 1.2 Mmt of ore grading 8 g/mt of gold and 60 g/mt of silver. However, potential resources could reach 5.5 Mmt of ore. COCAR also has invested in gold mining and purchased a 60% interest in Can Can in 1991 from Chevron. This ore body is right by the La Coipa Mine, and is being developed at 700 mt/d with an investment of $20 million. It is scheduled to come on-stream in mid-1993 with a production of about 130 kg/month of gold. Also being evaluated is an alluvial gold operation near Pecket, in Tierra del Fuego, in partnership with Belfi, which could produce 500 to 1,000 kg/a of gold.

Iron Ore, Manganese, and Steel.—Chilean iron production, including iron ore pellets, was 8.3 Mmt in 1992, a decrease of 4.9% compared with that of 1991. Revenues in 1992 reached $8.4 million, a decreased of 20% compared with that of the previous year. Production of pellets was about 4.0 Mmt in 1992. Compañía Minera del Pacífico 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 abovementioned 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 Mines in Region IV; MASA also bought ore from other producers in the same region.

In 1992, production of manganese ore reached almost 50,000 tons, 14% more than that in 1991. Most of the manganese produced by MASA was bought by the Huachipato smelter. Manganese sales in 1992 were estimated at about the same level as those in the previous year.

Cía. Siderúrgica Huachipato, S.A., an affiliated company of CAP, had a net profit in 1992 of $20 million, a decrease of 10.3% compared with that of 1991. Revenues from sales of steel products in the domestic market increased only 3.8% as compared with those of 1991 owing to lower prices despite increased shipments. The production of steel ingots at Huachipato amounted to 994,000 tons in 1992 compared with 805,000 tons in 1991.

Lead and Zinc.—Chile's lead production declined drastically for the fourth consecutive year, by 72% in 1992 compared with that of 1991. The decline was due mainly to the closure of Cía. Minera Catemu Ltda. The production of lead in 1992 was derived from zinc concentrates. The El Toqui Mine, in Aysen, is now the main zinc-lead producer. It has been expanding since Lac Minerals acquired it from Metallgesellschaft in 1989, so zinc output only dropped slightly. The small state-owned Minera Aysen is still working, though the operator, CORFO, has asked for bids to privatize.

Production of zinc decreased 4.1% in 1992 to 29,730 tons, of which 91% was from SCMT owned by Minera Lac Chile, S.A., a subsidiary of Lac Minerals established in 1987. Lac Minerals completed an expansion program, which was largely responsible for the notable increases in Chilean zinc production over the past 3 years. However, low zinc prices have induced Lac Minerals to postpone its plans to expand its El Toqui zinc mine near Coihaique.

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 1992 reached 10,823 tons, a 26.2% increase compared with that of the previous year. The only producer of lithium in Chile was Sociedad Chilena del Litio, Ltda.

(SCL). SCL is now the Chilean-based, wholly owned subsidiary of Cyprus-Foote Minerals. In 1992 production was from brines pumped to solar evaporation ponds in the south side of the Salar de Atacama, at the level of 10,823 tons of lithium carbonate and about 60,000 tons of potassium chloride. Exports were 10,276 tons of lithium carbonate. SCL was looking to invest about $4.5 million during 1992 to improve the quality of the lithium and also to step-up production of potassium sulfate from the current level of 58,000 mt/a worth $3.2 million in local sales. Sociedad Minera Salar de Atacama, Ltda. (MINSAL), a consortium of AMAX Exploration, Inc., 63.75%; CORFO, 25%; and Molíbdenos y Metales, S.A. (Molymet), 11.25%, was established in 1986 to develop the mixed salts project in the Atacama salt flat in Region II. The project was designed to produce lithium carbonate, potassium chloride, potassium sulfate, and boric acid.

AMAX has sold its 63.75% interest in the MINSAL project to Sociedad Quimica y Minera de Chile SA. (SQM) for an undisclosed amount. SQM's interest is primarily in obtaining cheaper potassium chloride for its potassium nitrate business, and it has announced that it will invest about $80 million to produce 300,000 mt/a potassium chloride. But CORFO, with a 25% interest on approving the sale to SQM, still holds to the original $300 million project. MINSAL has not revealed any plans for the production of lithium from the salar brines. When the project of MINSAL is completed, lithium production could rise to about 25,000 mt/a. The Chilean project has been reportedly compared with the El Hombre Muerto project in Argentina and the Uyuni salt project in Bolivia. The Chilean project appears to be in a more favorable competitive position because of higher salt content and better infrastructure.

Nitrates and Iodine.—SQM, the largest inorganic chemicals producer in Chile, has seen a significant increase in its share prices on the local stock exchange, doubling its market value over the past 6 months to 850 pesos per share in March 1993. The increase has been attributed to the shares having been reclassified to pension fund investment grade. This has encouraged SQM's management to list the shares on the New York stock exchange.

Molíbdenos y Metales, S.A. (Molymet) agreed to sell and transfer to Soquimich Potasio, S.A., a subsidiary of SQM, its 11.5% interest in the MINSAL joint venture. With this purchase SQM will hold 75% ownership of MINSAL. CORFO will retain the remaining 25% interest, which it will rent to SQM Potasio until the year 2030. The initial phase of the project calls for the construction of a plant for chloridification of potassium that will handle 300,000 mt/a of mineral and will enable SQM Potasio to produce potassium chloride. According to the established program the installation of the potassium chloride plant will be completed in 1994, and during the current year all the engineering studies and detail will be completed, projecting that initially the plant output will be about 300 mt/a of potassium chloride. SQM's physical production is not reported to the Ministry of Mines, thus the figures in table 1 for sodium nitrate, potassium nitrate, and sodium sulfate output are estimated, base on domestic consumption and exports, which were 145,850 tons for KNO_3 and 5,839 tons for iodine, of which about 1,000 tons can be attributed to independent producers. SQM completed a research and development center to provide technical support for the company.

Kap Resources, Ltd. entered into a 50-50 joint venture with Atacama Resources, Ltd., known as the Taltal Joint Venture, in which North Lily Mining Co. was retained as the operator and will receive a 10% share in the profits. North Lily Mining Co. released the results of assays on the sodium sulfate content of samples taken from its Yolanda property in northern Chile that indicate an average sodium sulfate content of 9.3%.

Geostatistical estimates of the sodium sulfate reserves conducted by Davy McKee Corp. by solution mining process indicated that the sodium sulfate could be recovered as a byproduct of the heap leaching of the nitrate-iodine ore or "caliche." The Yolanda property was sampled extensively during 1989, and the reserves of iodine and nitrate were announced earlier this year. Using a cutoff grade of 8% sodium nitrate, Davy MaKee calculated that the deposit holds in excess of 20 Mmt of caliche grading 11.8% sodium nitrate and 237 parts per million of iodine. At current prices, the iodine and nitrate content of the deposit is worth about $900 million. The IIC of the IDB has approved a $7 million loan to Minera Yolanda plus a $2 million equity investment to finance the development of the company's Yumbes nitrate deposit in Chile's Region II, about 90 km north of the El Taltal. Yolanda is the Chilean subsidiary of Kap Resources. Total costs are estimated at $78 million. Yolanda plans to mine about 1.7 Mmt/a of ore to produce about 180 tons of iodine and about 3 Mmt of sodium and potassium nitrate products. IIC has been retained as financial advisor to assist in obtaining cofinancing for an additional $34 million. The project should create about 600 to 700 direct and indirect jobs and generate about $30 million annually in hard currency from exports.

Sulfur.—Chile has been an importer and producer of sulfur for many years. In 1991, Chile imported about 41,000 tons of sulfur, 33.5% less than that in the previous year, mostly from Canada and Bolivia. Chile's native sulfur production derived from caliche increased 27.3% to 24,034 tons. Chile's total production of sulfur, including sulfur derived from smelters and oil refineries, was maintained at more than 420,000 tons. Its main use was as raw material to produce sulfuric acid. Chile has large reserves of volcanic sulfur, at more than 4,000 m above sea level. Its costly extraction historically has not been able to compete with less expensive imported sulfur. Therefore, exploitation is carried out sporadically when the price increases.

Among the sulfur deposits currently under exploration or development are the Sillajuaya Volcano where the R.M.S. Group of Canada announced an

investment of $85 million in a plant to process 5,000 mt/d of caliche. The greatest expense in this project was found to be the construction of facilities in addition to metallurgical problems in the flotation circuit. The project has been delayed indefinitely. The Tacora Volcano, on the Peruvian border, had an estimated reserve of 7 Mmt. Azufrera Chile, Ltda. was formed by DEVCO Overseas of the United States and Saudi Sulfur Co. (SAUSULCO) of Saudi Arabia to analyze an investment of $10 million in a project to produce 120,000 mt/d of sulfur pellets from this deposit.

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

Empresa Minera y de Transportes Hermani extracted caliche from the Purico Volcano, in Region I, for the production of sulfuric acid. Output of refined sulfur from this deposit reached 1,100 mt/a. This company has another plant in Calama where it supplies Chuquicamata with 8,000 mt/a.

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 to more than 1.8 Mmt/a. As a result, Chile will significantly lower sulfur imports. In the medium term, the country could become a net exporter of this product. In Chile, sulfuric acid was produced from gases from four copper smelters: Chuquicamata, Las Ventanas, Paipote (Hernán Videla Lira), and Chagres. These plants have a production capacity of 1.7 Mmt/a: 1,280,000 tons from Chuquicamata (three plants), 290,000 tons from Las Ventanas, 60,000 from Paipote, and 70,000 from Chagres. 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 decreased 30.6% to 1.9 Mmt in 1992. 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 13.5 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 COCAR, which strip mines subbituminous coal in Pecket, near Punta Arenas. Otherwise, coal is obtained from underground mines in the region south of Conception.

The main operating companies are ENACAR, Carbonífera Schuager, S.A., and Carbonífera Victoria de Lebu, S.A. These three Region VIII companies in 1992 produced 1,341,530 tons, while COCAR's output in Region XII was 1,262,850 tons. Another 136,190 tons was produced by a half dozen small operators in Region X. ENACAR had losses of $17.5 million in 1992, and very probably will shut down in 1994. The quality of Chile's domestic coal is not adequate for coking, so the steel industry imports its requirements, which in 1992 were 850,000 tons of coking coal.

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 40 km 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. COCAR is examining a number of expansion options. Pecket Mine could be expanded by moving into an underground operation. 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 de Riesco deposit (which could be an open pit), about 40 km from Pecket on the other side of the Seno Otway; COCAR needs to come to a decision by the second half of this year. The budgeted new capital requirements for this area are $40 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. Beginning in 1992, Chile expects to import about 850,000 mt/a long term. The steel plant has a new coke battery of 500,000-ton capacity, and it is expected to maintain pig iron production at about 900,000 mt/a. In 1992, imports of metallurgical coal reached approximately 1.8 Mmt, mainly for use in thermal powerplants. Of the total amount imported, 1.2 Mmt corresponded to Chilgener, which bought coal from Australia, Canada, Colombia, the Republic of South Africa, and the United States. The remainder, which was metallurgical coal, was imported by Siderúrgica of Huachipato. A subsidy has been put into place to make up the difference between the cost of producing at these mines and the cheaper price of importing coal from Colombia and Venezuela. The Council of Chilean coal producers has complained that the Colombian coal is subsidized and has asked for Government protection. The Minister and President of the National Energy Commission subsequently announced on August 16 that the Colombian coal was not subsidized. Nevertheless, because of the potential damage to the domestic coal industry, the Government will withdraw the

preferential Latin American Free-Trade Association (LAFTA) tariff of 13.5% for Colombian coal, which will then be subject to the standard import tariff of 15%.

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 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 1992, 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. Chile's recent return to international standards of creditworthiness is expected to be a positive factor in securing financing for the $1 billion pipeline project.

ENAP's natural gas from southern Chile is compressed into liquid form (propane or butane) and moved into central Chile by ship. In addition to the liquid propane and butane shipped from the south, gas manufactured as a byproduct of petroleum refining enjoys some use in the main cities of central Chile, Santiago and Valparaíso, and in the central city of Concepción as does gas processed from coal.

Petroleum.—Chilean production of crude oil suffered a further decrease of 17% in 1992, to 5.4 Mbbl. Imports of crude oil in 1992 were 43.3 Mbbl compared with 39.1 Mbbl in 1991. 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 Yacimientos Petroliferos Fiscales (YPF).

The most interesting project on which a letter of intent has been signed is the construction of a 425-km, 41-cm oil pipeline from Neuquen (Argentina) to ENAP's refinery in Conception, which will be capable of transporting nearly one-half Chile's normal requirements of about 63,000 bbl/d. As it progresses, the project will require about 350 workers to carry out other stages of the project such as building a 1,100-m-long tunnel, setting up a pumping station in Argentina and a receiving terminal in Chile, and laying pipeline, which is scheduled to start in March. The $295 million project is being carried out by a consortium formed by ENAP, YPF, and Banco Rio de La Plata of Argentina. 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. Petrox, an ENAP subsidiary, currently refines 75,500 bbl daily and is expanding its capacity to 88,000 bbl/d. Petrox refines 50% of Chile's crude oil, of which 85% is imported, primarily from Colombia, Venezuela, and north Africa. Importing oil from neighboring Argentina would ensure supplies as well as lower Chile's transportation costs for these imports. In addition, there is a $1 billion project to build a 1,200-km pipeline to supply Conception and Santiago with natural gas from Argentina. Construction is targeted for completion in early 1996.

Chile's demand for petroleum has increased in recent years while domestic production has steadily declined, thus creating an increased dependence on imports.

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 twelve 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 areas. However, abundant and varied mineral and energy resources are in this area. Its vast reserves of copper, iron ore, nitrates, and lithium carbonate constitute a major asset to the Chilean economy. Continuing south from 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 here. Southern Chile's resources are concentrated in the area lying east of the mountains. These natural resources include coal, natural gas, and petroleum.

The railway system of Chile 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, Valparaíso, Tocopilla, Cruz Grande, Talcahuano, and San Antonio, which handle almost 60% of the total tonnage.

Crude oil, refined products, and natural gas are transported to consumption centers by three major pipelines that are 785 km, 755 km, and 320 km, respectively. In addition, a 425-km, 41-cm 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

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 1.9 Mmt in 1992 to more than 2 Mmt in 1993, while gold is projected to increase from 33,700 kg to 40,000 kg and silver is projected to increase from 1.03 Mkg to about 1.5 Mkg 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 1.9 Mmt in 1992 to about 3 Mmt in 1993. The Chilean Government has encouraged greater domestic coal production as a means of reducing Chile's dependence on imported petroleum. The Pecket coal mining project 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. Chile's domestic petroleum production has declined from 54% of national consumption in 1981 to 11% in 1992. This percentage is expected to continue to drop in the coming years because of the exhaustion of Chile's existing oil reserves, Chile's rapid economic growth, and the growing consumption of petroleum.

The largest and most visible foreign investment that came on-stream ahead of schedule in 1990 was the $1.2 billion La Escondida copper project. The list of U.S., Canadian, and other countries' companies that expect to continue active in Chile include: Utah International, Exxon Minerals, Phelps Dodge, Cyprus Minerals, AMAX, Homestake, Chevron Resources, Freeport, Newmont, Hunt Oil, Pecten, and Maxus Energy; Canadian companies: Rayrock Yellow Knife Resources Inc., Placer Dome Inc., Dayton Development Corp., LAC Minerals Ltd., Rio Algom Ltd., Bema Gold Corp., Anglo American/Cominco, Cominco Resources International Ltd., and other countries: BHP of Australia, Anglo American Corp. South Africa, Coeur d'Alene Mines Corp., Royal Dutch Shell London, Sociedad Minera Tizona Ltda/Bridger Resources Inc., Outokumpu Oy.

Citibank and Bankers Trust have taken an equity interest in two important mining projects, a practice that is expected to be followed by a number of other U.S. banks. Similarly, a number of projects in different stages of study of their feasibility were expected to be completed in 1994. Mining projects that were expected to begin operations in 1993 included: La Candelaria ($500 million), Cerro Colorado ($290 million), Quebrada Blanca ($360 million), Zaldívar ($400 million), and the Refugio ($130 million). Other projects such as Los Pelambres, Collahuasi, Iván and Zar, Las Luces, Yolanda, and Lince were in advanced stages of development. Five large foreign investments are expected to come to a decision in the near future. These include Exxon's (United States) $380 to $400 million Los Bronces copper expansion project; Cyprus/CORFO's (United States) $200 to $250 million MINSAL lithium, potassium chloride, potassium sulfate, and boric acid project; Phelps Dodge's (United States) $150 to $250 million Geolar and La Candelaria project; and Magellan International Nitrogen Co. (MINCO) and Combustion Engineering's (United States) $380 to $400 million ammonia-urea plant in Cabo Negro in Region XII. In addition, there were Placer Dome's (United States) $140 to $160 million Ladera-Farellon gold project, Placer Dome and TVX Mining's (United States) $230 million Minera Mantos de Oro-La Coipa project, COMINCO (Canada) and ENAMI's (Chile) $135 million Minera Quebrada Blanca S.A. (Chile) project, Outokumpu's (Finland) $100 million Zaldívar project, and Midland Bank (United Kingdom) and Minera Anaconda's (Chile) $66 million Minera Los Pelambres Ltda. copper project.

[1]Where necessary, values have been converted from Chilean pesos (Ch$) to U.S. dollars at the rate of Ch$363 = US$1.00, the average exchange rate for 1992.

OTHER SOURCES OF INFORMATION

Agencies

Corporación Nacional del Cobre de Chile (CODELCO-Chile)
Huérfanos 1270
Santiago, Chile
Telephone: 56-2-6903000
Fax: 56-2-6903151

Comisión Chilena del Cobre (COCHILCO)
Agustinas 1161 Piso 4, Casilla: 9493
Santiago, Chile
Telephone: 56-2-6726219
Fax: 56-2-6723584

Servicio Nacional de Geología y Minería (SERNAGEOMIN)
Ave. Santa María 0104, Casilla: 1046
Santiago, Chile
Telephone: 56-2-6375050
Fax: 56-2-6372026

Ministerio de Minería
Teatinos 120.Piso 9, Casilla: 54, correo 21
Santiago, Chile
Telephone: 56-2-6714373; 56-2-6986593
Fax: 56-2-6989262

Empresa Nacional de Minería (ENAMI)
McIver 459, Casilla: 100-D
Santiago, Chile

Telephone: 56-2-6396061
Fax: 56-2-6384094

Corporación de Fomento de la Produción (CORFO)
Moneda 621, Casilla: 3836
Santiago, Chile
Telephone: 56-2-6380521
Fax: 56-671105

Comité de Inversiones Extranjeras
Teatinos 120, Piso 10
Santiago, Chile
Telephone: 56-2-6984254
Fax: 56-2-6989476

Publications

Comisión Chilena del Cobre, Santiago: Boletín Estadístico del Cobre.

Compañía de Acero del Pacífico, S.A. de Inversiones, Santiago: Annual Report.

Corporación de Fomento de la Producción, New York: Chile, Economic Report.

Corporación Nacional del Cobre de Chile, Santiago: Annual Report.

Empresa Nacional de Minería, Santiago: Annual Report.

Empresa Nacional del Petróleo: Annual Report.

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

Servicio Nacional de Geología y Minería, Santiago: Anuario de la Minería de Chile.

U.S. Embassy, Santiago, Chile: Industrial Outlook Report-Minerals, prepared by the Regional Resources Officer.

TABLE 1

CHILE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[e]
METALS						
Arsenic trioxide		3,207	5,000	r5,831	r6,822	3,6,016
Copper:						
Mine output, Cu content[4]		1,451,000	1,609,300	1,588,400	1,814,300	3,1,932,700
Metal:						
Smelter, primary[5]		1,189,400	1,266,600	1,328,500	1,296,100	3,1,326,500
Refined:[6]						
Fire, primary refined[e]		200,100	163,600	113,900	141,000	3,154,200
Electrolytic[e]		812,600	907,400	1,077,700	1,087,300	3,1,088,100
Total		1,012,700	1,071,000	1,191,600	1,228,300	3,1,242,300
Gold, mine output, Au content	kilograms	20,614	22,559	27,503	28,879	3,33,774
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand tons	7,710	r9,030	r7,903	8,692	8,270
Fe content[e]	do.	5,089	5,478	5,035	3,5,824	3,5,540
Metal:						
Pig iron	do.	776	679	675	703	750
Ferroalloys:						
Ferromanganese		6,935	7,492	3,587	r—	3—
Ferrosilicomanganese		683	180	985	r1,674	400
Ferrosilicon		5,686	6,370	4,662	r5,516	5,600
Ferromolybdenum		1,191	2,990	2,283	r2,673	3,200
Ferrochromium		2,212	2,840	1,868	r2,509	2,100
Total		16,707	19,872	13,385	r12,372	11,300
Steel, crude[7]	thousand tons	909	800	772	805	3,994
Semimanufactures (hot-rolled)	do.	664	643	516	587	3,776
Lead, mine output, Pb content		1,359	1,241	1,120	1,050	3,298
Manganese ore and concentrate:						
Gross weight		43,655	43,806	39,697	43,767	3,49,857
Mn content		14,511	13,865	12,450	12,500	12,600
Molybdenum, mine output, Mo content		15,515	16,550	13,830	14,434	3,14,840
Rhenium, mine output, Re content[e]	kilograms	3,6,940	6,800	6,800	6,500	6,600
Selenium	do.	47,051	48,200	49,400	50,600	50,000
Silver	do.	506,501	545,412	654,603	r678,339	3,1,028,560
Zinc, mine output, Zn content		19,182	18,370	r25,056	30,998	3,29,730
INDUSTRIAL MINERALS						
Barite		43,135	59,873	3,038	r3,183	3,2,434
Bentonite		529	2,005	r1,207	1,054	3,1,008
Borates, crude, natural (ulexite)		32,122	130,512	131,763	97,135	3,202,716
Cement, hydraulic	thousand tons	1,885	2,010	2,115	2,251	3,2,645
Calcite (chalk)	do.	3,647	3,746	3,776	3,998	4,000
Clays:						
Cimita		1,488	1,405	2,969	r2,802	3,495
Kaolin		54,464	58,512	32,416	r63,063	3,58,937
Other (unspecified)		18,769	20,100	18,563	16,026	3,20,311

See footnotes at end of table.

TABLE 1—Continued

CHILE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[e]
INDUSTRIAL MINERALS—Continued						
Diatomite		2,919	3,315	3,877	5,557	[3]5,693
Feldspar		4,569	8,081	2,980	4,006	[3]5,744
Gypsum:						
Crude		315,904	277,276	253,744	335,678	[3]423,659
Calcined		92,135	104,300	105,786	[e]100,000	[3]100,000
Iodine, elemental		3,939	4,640	5,000	5,700	[3]6,308
Lapis lazuli	kilograms	[e]8,000	[e]8,000	192	450	[3]138
Lime, hydraulic[e]	thousand tons	1,200	1,300	1,300	1,200	1,300
Lithium carbonate		7,332	7,508	9,082	8,575	[3]10,823
Nitrogen: Natural crude nitrates:						
Sodium		546,560	528,020	[e]550,000	[e]600,000	[3]515,087
Potassium (KNO_3)		276,230	266,850	[e]250,000	[e]250,000	[3]330,516
Total		822,790	794,870	[e]800,000	[e]850,000	[3]845,603
Phosphates:						
Guano		4,052	3,127	1,452	1,308	[3]139
Rock (apatite)		9,161	14,354	13,986	13,338	[3]16,736
Total		13,213	17,481	15,438	14,646	[3]16,875
Pigments, mineral, natural: Iron oxide		8,542	23,653	15,557	6,761	[3]22,945
Potash, K_2O equivalent[e]		[3]25,343	25,000	25,000	20,000	20,000
Potasium chloride (KC)		—	—	45,135	[e]45,000	46,000
Pumice (includes pozzolan)		277,179	299,834	305,147	320,928	[3]384,744
Quartz, common		495,484	477,497	541,714	[r]486,351	[3]479,202
Salt, all types	thousand tons	1,043	904	1,835	1,676	[3]1,672
Sodium compounds, n.e.s.: Sulfate[8]		62,879	66,490	[e]73,000	[e]70,000	[3]35,436
Sand and gravel (silica sand)[e]	thousand tons	300	300	300	300	300
Stone:						
Limestone (calcium carbonate)	do.	3,647	3,746	3,776	[r]3,998	[3]4,862
Marble		2,022	1,115	1,347	1,170	[3]894
Sulfur:						
Native, other than Frasch:						
Refined		16,924	[r]15,963	[r]28,582	[r]18,884	[3]24,034
Caliche		20,725	[e]500	347	400	450
Byproduct, (from smelters and oil refining)[e]		[3]416,266	400,000	400,000	400,000	400,000
Total[e]		[3]453,915	[r]416,463	[r]428,929	[r]419,284	424,484
Talc		1,070	835	898	536	[3]1,325
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous and lignite	thousand tons	2,470	2,404	2,729	[r]2,741	[3]1,901
Coke: Coke oven	do.	287	[r]277	[r]350	[r]400	300
Gas, natural:						
Gross	million cubic meters	4,279	4,236	4,198	4,067	[3]4,039
Marketed	do.	1,990	1,962	2,121	[r]2,295	[3]1,999
Natural gas liquids:						
Natural gasoline	thousand 42-gallon barrels	706	698	695	[r]746	690
Liquefied petroleum gas	do.	2,657	2,520	2,154	[r]2,094	1,999
Total	do.	3,363	3,218	2,849	[r]2,840	2,689

See footnotes at end of table.

TABLE 1—Continued

CHILE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[e]
Petroleum:						
Crude	thousand 42-gallon barrels	8,934	8,063	7,157	[r]6,499	[3]5,423
Refinery products:						
Liquefied petroleum gas	do.	2,422	2,849	2,774	[r]2,497	[3]7,736
Gasoline:						
Aviation	do.	69	126	126	[r]109	[3]53
Motor	do.	9,642	12,416	12,309	[r]12,466	[3]13,288
Jet fuel	do.	1,157	1,705	1,767	[r]2,289	[3]2,378
Kerosene	do.	1,434	1,648	1,365	[r]1,647	[3]2,189
Distillate fuel oil	do.	11,454	13,259	14,410	[r]15,165	[3]17,922
Residual fuel oil	do.	6,925	8,586	9,246	[r]8,487	[3]1,767
Unspecified	do.	2,743	1,836	1,973	[r]3,467	[3]2,079
Total	do.	35,846	42,425	43,970	[r]46,127	[3]47,412

[e]Estimated. [r]Revised.

[1]Table includes data available through Sept. 1993.

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

[3]Reported figure.

[4]Figures are the nonduplicate copper content of ore, concentrates, cemented copper, slags and minerals, copper as a byproduct of gold and silver precipitate, and other copper-bearing products measured at the last stage of processing as reported by Comisión Chilena del Cobre (COCHILCO). Mine production reported by Servicio Nacional de Geología y Minería (SERNAGEOMIN) was as follows, in metric tons: 1988—1,472,841; 1989—1,628,269; 1990—1,616,261; 1991—1,840,000; and 1992—not available.

[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 not available; although based on current plant capacities, electrowon copper production is estimated to be approximately 55 metric tons per year.

[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. Electrowon copper reported by CODELCO-Chile was as follows, in metric tons: 1988—24,992; 1989—63,604; 1990—77,693; 1991—68,964; and 1992—69,000 (estimated).

[7]Excludes castings.

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

TABLE 2

CHILE: EXPORTS OF COPPER AND MOLYBDENUM ORE, BY DESTINATION[1]

Destination	Copper (thousand metric tons)			Molybdenum (metric tons)
	Ore and concentrate, Cu content[2]	Blister	Refined	Ore and concentrate, Mo content
1991:				
Argentina	(3)	—	r26.3	—
Austria	—	—	.3	—
Belgium-Luxembourg	—	r8.5	30.6	238.0
Brazil	r66.9	—	61.5	—
Canada	r1.4	—	—	—
China	r23.1	—	.8	—
Finland	r13.5	—	—	—
France	—	—	140.8	—
Germany: Western states	r47.8	14.6	110.2	—
Greece	—	—	10.4	—
Hong Kong	—	—	5.6	—
Hungary	—	.2	.2	—
Indonesia	—	—	26.9	—
Italy	—	—	r112.0	—
Japan	r177.7	4.6	212.4	—
Korea, Republic of	r53.2	r17.4	46.8	—
Malaysia	—	—	14.8	—
Mexico	—	1.5	.5	—
Netherlands	—	r1.1	14.3	r9.0
Philippines	r22.3	—	—	—
Poland	15.8	—	—	—
Portugal	—	—	12.0	—
Singapore	—	—	6.5	—
Spain	r61.3	—	r13.9	—
Sweden	r6.8	—	r13.9	—
Taiwan	.1	—	r158.5	—
Thailand	—	—	3.8	—
Turkey	—	1.0	.5	—
United Kingdom	—	.4	50.5	—
United States	(3)	r42.9	51.8	—
Venezuela	—	—	1.6	—
Yugoslavia	—	.3	3.0	—
Other	14.9	—	.1	—
Total	r504.8	r92.5	r1,130.5	r247.0
1992:				
Argentina	—	—	37.3	—
Austria	—	2.2	—	—
Belgium-Luxembourg	2.1	3.0	—	—
Brazil	84.3	—	55.9	—
Canada	1.5	—	—	—
China	25.1	25.4	124.9	—
Finland	18.1	—	—	—
France	—	—	124.1	—

See footnotes at end of table.

TABLE 2—Continued

CHILE: EXPORTS OF COPPER AND MOLYBDENUM ORE, BY DESTINATION[1]

Destination	Copper (thousand metric tons)			Molybdenum (metric tons)
	Ore and concentrate, Cu content[2]	Blister	Refined	Ore and concentrate, Mo content
1992—Continued:				
Germany	65.4	6.6	63.7	—
Greece	—	—	16.2	—
Hong Kong	—	—	29.4	—
Indonesia	—	—	39.2	—
Italy	—	5.7	134.7	—
Japan	222.9	4.8	135.5	(3)
Korea, Republic of	28.0	17.3	84.6	—
Malaysia	—	—	15.3	—
Mexico	—	.5	—	—
Netherlands	—	—	10.8	183.0
Philippines	24.5	—	—	—
Poland	31.4	—	—	—
Portugal	—	—	9.0	—
Russia	28.3	—	—	—
Singapore	—	—	18.1	—
South Africa, Republic of	3.1	—	—	—
Spain	59.8	—	14.4	—
Sweden	18.7	—	8.3	—
Taiwan	—	—	147.6	—
Thailand	—	—	3.4	—
United Kingdom	—	—	63.9	—
United States	(3)	61.5	41.3	—
Venezuela	—	—	.4	—
Other	17.8	—	—	—
Total	631.0	127.0	1,178.0	183.0

[r]Revised.
[1]Table prepared by H. D. Willis.
[2]Includes cement copper and secondary copper.
[3]Less than 50 tons.

Source: Comisión Chilena del Cobre.

TABLE 3

CHILE: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
METALS					
Aluminum: Metal including alloys:					
Scrap		260	101	—	Japan 72; unspecified 29.
Unwrought		20	41	—	All to Peru.
Semimanufactures		115	194	(2)	Bolivia 115; Ecuador 45; Argentina 25.
Chromium:					
Ore and concentrate		21	6	—	All to Argentina.
Oxides and hydroxides		—	6	—	Mainly to United Kingdom.
Copper:					
Ore and concentrate	thousand tons	544	[3]1,247	(2)	Japan 505; Spain 176; Republic of Korea 139.
Matte and speiss including cement copper		1,037	NA		
Metal including alloys:					
Scrap		2,740	1,990	37	Brazil 627; Republic of Korea 425; North Korea 217.
Unwrought	thousand tons	1,321	1,225	152	Japan 224; France 124.
Semimanufactures		20,207	23,412	3,639	Colombia 3,431; Ecuador 2,044.
Germanium: Metal including alloys, all forms	value, thousands	$5	$6	—	All to Germany.
Gold: Metal including alloys, unwrought and partly wrought	kilograms	96,327	48,609	11,158	United Kingdom 25,948; France 9,858.
Iron and steel:					
Iron ore and concentrate	thousand tons	6,528	6,306	103	Japan 3,403; Republic of Korea 1,153; Germany 996.
Metal:					
Scrap		28,864	12,877	—	Argentina 12,016; Spain 603; Peru 195.
Pig iron, cast iron, related materials		16	4,872	—	All to Argentina.
Ferroalloys:					
Ferrochromium		54	380	—	Argentina 300; Australia 59; Peru 15.
Ferromanganese		—	65	—	All to Peru.
Ferrosilicon		679	1,270	—	Colombia 730; Peru 387; Ecuador 150.
Unspecified		5,731	5,419	545	Belgium-Luxembourg 1,690; Japan 1,442; Netherlands 798.
Steel, primary forms		68,282	72,203	—	Ecuador 38,784; El Salvador 13,740; Costa Rica 8,984.
Semimanufactures:					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		61,412	77,465	—	Ecuador 28,783; Costa Rica 15,323; Argentina 10,210.
Clad, plated, coated		2,475	8,362	—	Argentina 4,196; Ecuador 1,380; Nicaragua 1,004.
Of alloy steel		16	36	—	Peru 24; Bolivia 12.
Bars, rods, angles, shapes, sections		4,605	437	—	Bolivia 219; Australia 121; Peru 91.
Rails and accessories		5	—		
Wire		887	1,494	658	Peru 658; Costa Rica 80.
Tubes, pipes, fittings		1,811	891	426	Argentina 150; Bolivia 122.

See footnotes at end of table.

TABLE 3—Continued

CHILE: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
METALS—Continued					
Lead:					
Ore and concentrate		1	—		
Metal including alloys:					
Scrap		1,027	1,503	—	Argentina 1,336; India 111; Thailand 20.
Unwrought		1,113	199	—	Japan 89; Argentina 70; Brazil 40.
Semimanufactures		—	5	2	Bolivia 3.
Manganese:					
Ore and concentrate, metallurgical-grade		13	—		
Metal including alloys, all forms		10	16	16	
Mercury		—	1	—	All to Peru.
Molybdenum: Ore and concentrate:					
Roasted		26,268	25,633	2,039	Japan 8,881; United Kingdom 5,334; Belgium-Luxembourg 2,726.
Unroasted		—	1,705	776	Netherlands 705; United Kingdom 224.
Nickel: Metal including alloys, semimanufactures	value, thousands	—	$5	—	Peru $4; Bolivia $1.
Platinum-group metals: Metals including alloys, unwrought and partly wrought	do.	$47	—		
Silver: Metal including alloys, unwrought and partly wrought	do.	$91,713	$59,630	$29,928	Brazil $11,631; Japan $6,546.
Tin: Metal including alloys, semimanufactures	do.	$3	$5	—	All to Ecuador.
Titanium: Oxides		—	1	—	Do.
Zinc:					
Ore and concentrate		53,133	59,949	—	Japan 21,142; Finland 16,475; Greece 15,100.
Oxides		—	7	—	Bolivia 4; Paraguay 3.
Metal including alloys:					
Scrap		16	—		
Unwrought		—	21	20	Bolivia 1.
Semimanufactures		—	54	—	Argentina 31; Bolivia 23.
Other:					
Base metals:					
Oxides and hydroxides		1,222	1,333	203	Netherlands 1,005; Germany 112.
Ashes and residues		42	174	—	Argentina 72; Philippines 56; Japan 32.
Base metals including alloys, all forms		5	12	12	
Metalloids[4]		41	74	—	Netherlands 24; Brazil 17; Argentina 9.
Precious metals, n.e.s.:					
Ores and concentrates	kilograms	74,483	62,246	—	Japan 56,640; Brazil 5,606.
Waste and scrap	do.	40,923	—		
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		25	—		
Grinding and polishing wheels and stones	value, thousands	$7	$2	—	Argentina $1; Bolivia $1.

See footnotes at end of table.

TABLE 3—Continued

CHILE: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Boron materials:					
Crude natural borates		5,600	7,353	501	Colombia 4,249; Republic of South Africa 1,003; Singapore 590.
Oxides and acids		23,545	20,495	1,457	Belgium-Luxembourg 4,452; Japan 2,087; United Kingdom 2,005.
Bromine[5]		4,196	5,667	1,951	Belgium-Luxembourg 2,488; Netherlands 711.
Cement		42,928	71,298	—	French Polynesia 62,034; Peru 5,081; Samoa 1,509.
Chalk		50	—		
Clays, crude:					
Bentonite		2	NA		
Kaolin		11	1	—	All to Venezuela.
Unspecified	value, thousands	$2	$5	—	All to Ecuador.
Diatomite and other infusorial earth		1,481	2,234	—	Argentina 1,058; Colombia 424; Peru 375.
Fertilizer materials:					
Crude, n.e.s.		144	155	77	Ecuador 60; Japan 18.
Manufactured:					
Ammonia		13	6	—	All to Bolivia.
Nitrogenous		1,643	4,538	18	Bolivia 3,158; Argentina 648; Ecuador 504.
Phosphatic		5	—		
Potassic		13	—		
Unspecified and mixed		137,783	131,081	21,859	Brazil 98,572; Belgium-Luxembourg 4,830.
Gypsum and plaster		48	46	—	Bolivia 26; Ecuador 20.
Lime		—	201	—	All to Peru.
Magnesium compounds:					
Magnesite, crude		21	—		
Oxides and hydroxides		—	2	—	All to Bolivia.
Mica:					
Crude including splittings and waste	value, thousands	—	$1	—	All to Argentina.
Worked including agglomerated splittings	do.	—	$3	—	Argentina $2; Peru $1.
Nitrates, crude		351,230	303,733	102,926	Belgium-Luxembourg 84,643; China 52,500.
Phosphates, crude		98	229	—	Bolivia 147; Peru 82.
Pigments, mineral: Iron oxides and hydroxides, processed		23	48	—	Colombia 38; Peru 10.
Precious and semiprecious stones other than diamond: Natural	value, thousands	$757	$318	$108	Italy $94; Argentina $40.
Salt and brine	thousand tons	1,075	939	468	Japan 263; Canada 112.
Sodium compounds, n.e.s.:					
Soda ash, natural and manufactured		61	121	—	All to Bolivia.
Sulfate, natural and manufactured		14,776	6,628	—	Argentina 2,694; Brazil 1,606; Ecuador 994.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		—	37	—	Argentina 23; Canada 13.

See footnotes at end of table.

TABLE 3—Continued

CHILE: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Stone, sand and gravel—Continued:					
Dimension stone—Continued:					
Worked		9	84	43	Japan 21; Bolivia 9.
Quartz and quartzite	value, thousands	$5,427	$1	—	All to Ecuador.
Sand other than metal-bearing		15	—		
Sulfur:					
Elemental: Crude including native and byproduct		107	209	—	Argentina 206; Paraguay 3.
Dioxide		17	44	—	All to Peru.
Sulfuric acid		104	—		
Other:					
Crude		47	198	—	Venezuela 162; Argentina 35; Japan 1.
Slag and dross, not metal-bearing		28,223	22,844	—	Philippines 22,840; Peru 4.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		17	2,062	—	Bolivia 1,716; French Guiana 323; British Virgin Islands 22.
Coal: Bituminous		110	50	—	All to Argentina.
Coke and semicoke		15	15	—	All to Bolivia.
Petroleum refinery products:					
Liquefied petroleum gas	42-gallon barrels	70	93	—	Peru 47; British Virgin Islands 46.
Bitumen and other residues	do.	376	73	—	All to Bolivia.
Bituminous mixtures	do.	830	54,473	—	Bolivia 48,874; Argentina 5,424; British Virgin Islands 170.
Unspecified	thousand 42-gallon barrels	1,561	1,711	1,166	Germany 231; Colombia 162.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Copper content 506.7 thousand metric tons. Complete breakdown available in table 2.
[4]Reported under SITC item number as "selenium, tellurium, phosphorus, arsenic, etc."
[5]Includes fluorine and iodine.

TABLE 4

CHILE: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS					
Alkali and alkaline-earth metals:					
Alkali metals	value, thousands	$8	$1	—	All from Germany.
Alkaline-earth metals	do.	$19	$3	$2	Germany $1.
Aluminum:					
Ore and concentrate		4,151	3,576	1	Guyana 3,575.
Oxides and hydroxides		438	2,328	742	Germany 771; United Kingdom 615.
Metal including alloys:					
Unwrought		6,924	8,041	2,040	Argentina 5,541; Brazil 396.
Semimanufactures		5,313	5,654	571	Argentina 1,527; Germany 1,426; Brazil 1,223.
Antimony: Metal including alloys, all forms		16	21	(2)	China 19; Bolivia 2.
Cadmium: Metal including alloys, all forms		2	4	1	Peru 2; China 1.
Chromium:					
Ore and concentrate		9,388	13,023	190	U.S.S.R. 5,866; Philippines 4,383, Republic of South Africa 2,574.
Oxides and hydroxides		225	274	30	Argentina 195; China 34.
Metal including alloys, all forms		13	3	3	
Cobalt:					
Oxides and hydroxides		23	10	8	United Kingdom 2.
Metal including alloys, all forms	value, thousands	$6	$27	$5	Canada $9; Germany $9.
Columbium and tantalum: Tantalum metal including alloys, all forms	do.	$6	—		
Copper:					
Ore and concentrate		493	141	—	Bolivia 139; Belgium-Luxembourg 2.
Metal including alloys:					
Unwrought		50	38	1	United Kingdom 36; Germany 1.
Semimanufactures		314	454	45	Brazil 136; Mexico 120.
Gold: Metal including alloys, unwrought and partly wrought	kilograms	2	1	—	All from Germany.
Iron and steel:					
Iron ore and concentrate		(3)	43,998	(2)	Mainly from Peru.
Metal:					
Scrap		42	—		
Pig iron, cast iron, related materials		472	1,016	84	Brazil 478; Germany 403; Brazil 278.
Ferroalloys:					
Ferrochromium		515	225	1	Republic of South Africa 147; United Kingdom 68; Zimbabwe 9.
Ferromanganese		86	361	16	United Kingdom 121; Republic of South Africa 98; France 67.
Ferrosilicon		345	223	75	Argentina 140; Brazil 8.
Ferrosilicochromium	value, thousands	—	$1	—	All from Brazil.
Ferrosilicomanganese		15	367	—	Argentina 327; Republic of South Africa 40.
Unspecified	value, thousands	$531	$756	$16	Brazil $716; United Kingdom $17.
Steel, primary forms		7,314	2,970	1	Poland 1,998; Brazil 971.

See footnotes at end of table.

TABLE 4—Continued

CHILE: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Iron and steel—Continued:					
Metal—Continued:					
Semimanufactures:					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		153,154	194,486	4,555	Brazil 137,577; Republic of South Africa 15,758; Argentina 9,854.
Clad, plated, coated		35,586	45,765	551	Republic of South Africa 10,935; Japan 11,432; United Kingdom 4,457.
Of alloy steel		10,255	10,401	425	Germany 2,527; Republic of South Africa 1,695; Brazil 1,245.
Bars, rods, angles, shapes, sections		85,402	161,025	755	Brazil 79,576; Argentina 33,847; Republic of South Africa 15,556.
Rails and accessories		6,964	10,065	1,395	Canada 3,852; Argentina 2,088; United Kingdom 1,500.
Wire		4,111	4,354	220	Spain 1,074; Brazil 846; Belgium-Luxembourg 628.
Tubes, pipes, fittings		48,262	25,944	2,232	Republic of South Africa 9,945; Argentina 4,901; Brazil 4,733.
Lead:					
Oxides		216	151	7	Peru 137; Germany 7.
Metal including alloys:					
Unwrought		1,851	2,375	438	Peru 1,937.
Semimanufactures		66	80	80	
Magnesium: Metal including alloys:					
Unwrought		2	9	—	All from U.S.S.R.
Semimanufactures		79	15	1	Germany 13; Canada 1.
Manganese:					
Oxides		98	38	6	Belgium-Luxembourg 20; Netherlands 11.
Metal including alloys, all forms		60	29	3	Republic of South Africa 26.
Mercury		18	14	—	Algeria 6; United Kingdom 6; Spain 1.
Molybdenum:					
Ore and concentrate, unroasted		—	3	1	Canada 2.
Metal including alloys:					
Unwrought including waste and scrap	value, thousands	$3	—		
Semimanufactures	do.	$48	$48	$27	Belgium-Luxembourg $21.
Nickel: Metal including alloys:					
Unwrought		34	100	3	Norway 43; Colombia 32; Canada 9.
Semimanufactures		78	60	15	Norway 15; France 5.
Platinum-group metals:					
Metals including alloys, unwrought and partly wrought, unspecified	value, thousands	$25	$23	—	Spain $21; Switzerland $1.
Silicon, high-purity[4]		35	71	1	Argentina 35; China 35.
Silver: Metal including alloys, unwrought and partly wrought	value, thousands	$202	$295	$30	Germany $173; Brazil $43; Italy $33.
Tin: Metal including alloys:					
Unwrought		300	540	—	Bolivia 506; Brazil 31; Peru 3.
Semimanufactures		5	3	(2)	Bolivia 1; Germany 1.

See footnotes at end of table.

TABLE 4—Continued

CHILE: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Titanium:					
Ore and concentrate		343	186	2	Republic of South Africa 184.
Oxides		105	213	56	Hong Kong 81; Germany 41.
Metal including alloys:					
Unwrought including waste and scrap	value, thousands	$2	$6	—	Sweden $5; Italy $1.
Semimanufactures		50	5	3	Sweden 2.
Tungsten: Metal including alloys:					
Unwrought including waste and scrap	value, thousands	$22	$33	$13	Spain $14; Germany $6.
Semimanufactures	do.	$88	$12	$7	Germany $4; Spain $1.
Uranium and thorium: Oxides and other compounds	do.	$2	—		
Vanadium: Metal including alloys, unwrought including waste and scrap		2	—		
Zinc:					
Ore and concentrate	value, thousands	$1	$2	$2	
Oxides		260	324	79	Peru 145; China 50.
Metal including alloys:					
Unwrought		4,792	4,762	—	Peru 4,737; Mexico 25.
Semimanufactures[5]		441	685	5	United Kingdom 589; Republic of South Africa 64; Poland 22.
Zirconium:					
Ore and concentrate		96	124	—	Australia 121; Republic of South Africa 2; Argentina 1.
Metal including alloys, unwrought:					
Unwrought including waste and scrap		18	18	—	Mainly from Republic of South Africa.
Semimanufactures	value, thousands	$9	$22	$3	Brazil $12; France $6.
Other:					
Ores and concentrates	do.	$1	$119	—	All from Canada.
Oxides and hydroxides		350	1,162	55	Argentina 1,052; Norway 18.
Ashes and residues		1	40	—	All from Germany.
Base metals including alloys, all forms	value, thousands	$678	$1,088	$58	Canada $790; Peru $224.
Metalloids[6]		158	69	37	Germany 15; Canada 6.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		r842	765	21	Argentina 597; Germany 119.
Artificial:					
Corundum		443	304	2	Brazil 273; Canada 26.
Silicon carbide		44	61	(2)	Argentina 44; Brazil 17.
Dust and powder of precious and semiprecious stones including diamond	value, thousands	$29	$38	$35	Germany $2.
Grinding and polishing wheels and stones		1,103	1,266	39	Switzerland 459; Brazil 346; Germany 91.
Asbestos, crude		7,791	9,627	622	Canada 7,971; Brazil 941.
Barite and witherite		287	54	—	Argentina 53; Germany 1.
Boron materials:					
Crude natural borates		—	1	—	Mainly from Germany.
Oxides and acids		12	6	(2)	France 3; Germany 3.

See footnotes at end of table.

TABLE 4—Continued

CHILE: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Bromine, fluorine, iodine		2	1	—	Mainly from Germany.
Cement		37,338	8,808	26	Peru 4,170; Argentina 3,009; France 1,294.
Chalk		165	112	—	Peru 90; Colombia 22.
Clays, crude:					
Bentonite		4,771	5,337	2,266	Argentina 1,745; Bolivia 818.
Kaolin		8,944	7,657	7,116	Argentina 451; Germany 61.
Unspecified		733	2,383	2,201	Argentina 161; Republic of South Africa 21.
Cryolite and chiolite		1			
Diamond, natural:					
Gem, not set or strung	value, thousands	$18	$18	—	Belgium-Luxembourg $15; Israel $3.
Industrial stones	do.	$674	$681	$426	Canada $200; United Kingdom $50.
Dust and powder	do.	(2)	—		
Diatomite and other infusorial earth		89	206	—	Mexico 201; Peru 5.
Feldspar		323	712	—	Argentina 672; Sweden 30; Norway 10.
Fertilizer materials:					
Crude, n.e.s.		55	35	35	
Manufactured:					
Ammonia		33,524	25,704	8,010	Venezuela 12,190; Colombia 5,494.
Nitrogenous		293,752	338,567	156,618	Canada 42,080; Netherlands 35,735.
Phosphatic		146,062	160,019	160,019	
Potassic		153,142	171,318	41,316	Canada 80,822; Israel 49,138.
Unspecified and mixed		76,716	90,117	83,786	Republic of South Africa 5,721; Belgium-Luxembourg 321.
Fluorspar		536	4,461	—	Mexico 4,008; Argentina 335; Republic of South Africa 60.
Graphite, natural		117	191	4	Brazil 114; China 41; Mexico 20.
Gypsum and plaster		214	133	3	Argentina 71; Germany 57.
Lime		2,729	13,164	—	All from Argentina.
Magnesium compounds:					
Magnesite, crude		260	641	447	Germany 175; Brazil 8.
Oxides and hydroxides		9,947	12,820	137	Brazil 11,455; Israel 589; Austria 246.
Mica:					
Crude including splittings and waste		100	53	15	Argentina 30; India 6.
Worked including agglomerated splittings		9	5	3	France 1; Germany 1.
Nitrates, crude	value, thousands	$1	—		
Phosphates, crude		16,897	34,357	31,203	Peru 3,152; Netherlands 2.
Pigments, mineral: Iron oxides and hydroxides, processed		(3)	170	12	Germany 74; Brazil 72.
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	$30	$20	$8	Brazil $11; Peru $1.
Synthetic	do.	—	$3	$2	Germany $1.
Salt and brine		270	229	55	Germany 168; France 6.
Sodium compounds, n.e.s.:					
Soda ash, natural and manufactured		66,711	70,201	59,129	Belgium-Luxembourg 7,173; Germany 2,394.
Sulfate, natural and manufactured		11	15,117	15,108	Germany 9.

See footnotes at end of table.

TABLE 4—Continued

CHILE: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		423	160	—	Argentina 65; Bolivia 44; Italy 36.
Worked		3,680	4,153	107	Italy 1,817; Argentina 1,384; Spain 326.
Dolomite, chiefly refractory-grade		12,248	20,812	16,063	Argentina 4,749.
Gravel and crushed rock		30	10	(2)	Mainly from France.
Quartz and quartzite		867	692	—	Argentina 681; Germany 11.
Sand other than metal-bearing		155	539	181	Argentina 225; Italy 123.
Sulfur:					
Elemental:					
Crude including native and byproduct		128,022	40,460	3,304	Canada 26,888; Bolivia 10,254.
Colloidal, precipitated, sublimed		260	307	258	Spain 41; Argentina 6.
Dioxide		(2)	24	—	Mainly from Argentina.
Sulfuric acid		175,719	137,627	2	Japan 53,328; Mexico 33,569; Peru 22,097.
Talc, steatite, soapstone, pyrophyllite		1,974	2,757	1,054	Peru 905; Italy 348.
Vermiculite, perlite, chlorite		29	786	5	Argentina 766; Brazil 15.
Other:					
Crude		9,631	1,891	1,260	Mexico 454; Brazil 86.
Slag and dross, not metal-bearing		129	194	—	All from United Kingdom.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		433	489	119	Trinidad and Tobago 368; United Kingdom 2.
Carbon: Carbon black		7,985	10,273	80	Venezuela 7,910; Argentina 1,961; Colombia 167.
Coal:					
Anthracite		389	115	—	Belgium-Luxembourg 54; Germany 31; Peru 30.
Bituminous	thousand tons	1,770	1,518	141	Australia 653; Canada 296; Venezuela 260.
Lignite including briquets		1	1	1	
Coke and semicoke		80,795	8,530	26	Colombia 8,504.
Peat including briquets and litter		36	346	—	Canada 340; Argentina 6.
Petroleum:					
Crude	thousand 42-gallon barrels	40,613	37,141	—	Nigeria 7,457; Gabon 7,196; Ecuador 4,876.
Refinery products:					
Liquefied petroleum gas	42-gallon barrels	1,647,710	2,512,862	459,209	Argentina 1,257,811; Venezuela 476,052.
Mineral jelly and wax	do.	82,934	72,616	5,564	Argentina 26,986; Germany 20,808; Brazil 6,123.
Bitumen and other residues	do.	19,756	24,440	48	Argentina 24,392.
Bituminous mixtures	do.	376	133	18	Brazil 103; Germany 12.
Petroleum coke	do.	16,115	20,966	962	Argentina 19,894; Germany 110.
Unspecified	thousand 42-gallon barrels	3,348	4,274	709	Venezuela 1,827; Netherlands Antilles 643.

[r] Revised.
[1] Table prepared by H. D. Willis.
[2] Less than 1/2 unit.
[3] Unreported quantity valued at $4,000.
[4] Includes silicon metal.
[5] Includes zinc dust, powders, flakes.
[6] Reported under SITC item number as "selenium, tellurium, phosphorus, arsenic, etc."
[7] Reclassified as "Abrasives: Dust and powder of precious stones including diamond."
[8] Unreported quantity valued at $247,000.
[9] Unreported quantity valued at $1,000.

TABLE 5

CHILE: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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 Carbón, S.A. (ENACAR), CORFO's subsidiary (Government, 100%)	Carlos Cousino 199, Lota Province	750.
Do.		Carbonífera Schwager, S.A. (61%; Agencias Universales, S.A., 39%; 1,500 private shareholders)	Recinto Schwager S/N, Coronel Province	400.
Do. (subbituminous coal)		Cía. de Carbones de Chile, S.A. (COCAR) [Cía. de Petróleos de Chile, S.A., 81%; International Finance Corp. (I.F.C.) (U.S.), 10%; and Northern Strip Mining Ltd. (U.S.), 9%]	Moneda 920, Santiago	1,300.
Copper		Corporación Nacional del Cobre de Chile (CODELCO-Chile)	Huérfanos 1270, Santiago	1,125.
		Chuquicamata Div. of CODELCO	Chuquicamata, Colama Province, Region II	650.
		El Teniente Div. of CODELCO	Millan 1020, Rancagua Province, Region VI	290.
		Andina Div. of CODELCO	Villa Saladillo, Los Andes Province	115.
		El Salvador Div. of CODELCO (Government, 100%)	Avda. Bernardo O'Higgins 101, Diego de Almagro. El Salvador	90.
Do.		Empresa Minera Escondida, Ltda. (BHP, 57.5%; RTZ Corp. PLC, 30%; JECO, 10%; IFC, 25%)	Escondida, Km 135 caminoa Socompa, Antofagasta	320.
Do.		Empresa Nacional de Minería (ENAMI) (Government, 100%)	MacIvers 459, Santiago	270.
Do.		Cía. Minera Disputada de Las Condes, S.A. [(Exxon (U.S.), 87%; ENAMI—Government, 13%)]	Ave. Pedro de Valdivia 291, Providencia, Santiago	200.
Do.		Cía. Minera Mantos Blancos, S.A. (Anglo-American Corp., 88%; I.F.C., 12%)	Ave. Pedro de Valdivia 295, Providencia, Santiago	100.
Gold	kilograms	Cía. Minera San José, Ltda. (El Indio Mine, owned by LAC Minerals of Canada, 83%)	Barrio Industrial, Sitio No. 58, Alto Panuelas, Coquimbo	15,000.
Do.	do.	ENAMI (Government, 100%)	Planta Taltal, Av. Matta 2235, Ciudad Taltal	9,000.
			Planta Salado, Av. Condell S/N, Ciudad El Salado	
			Planta Matta, Camino Publico S/N, Ciudad Copiapo	
			Planta Vallenar, Vallenar. Tel: 56-54-612242	
Do.		CODELCO-Chile (byproduct from copper) (Government, 100%)	Huérfanos 1270, Santiago	2,000.

TABLE 5—Continued

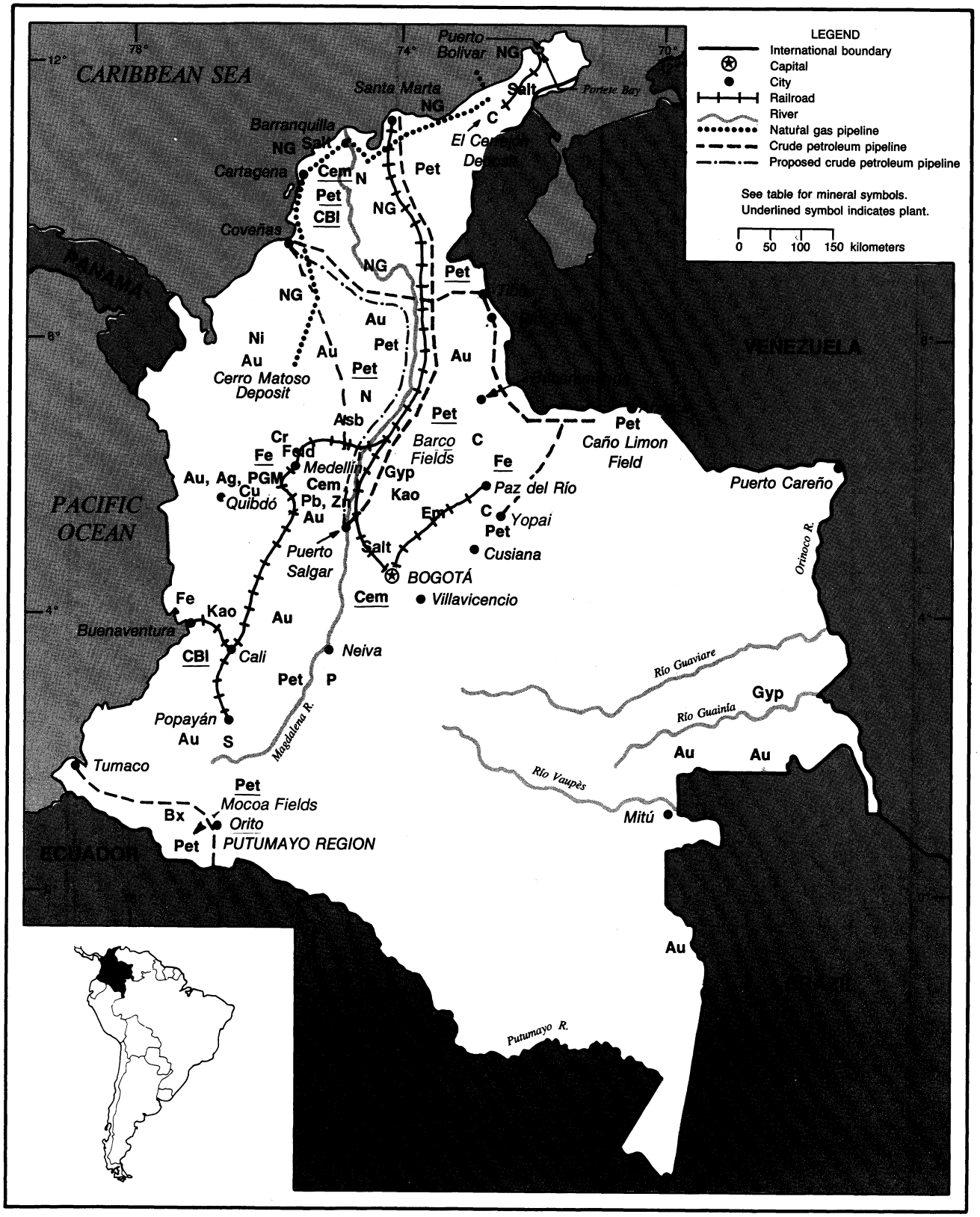
CHILE: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Major commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iodine	metric tons	Sociedad Química y Minera de Chile, SOQUIMICH, subsidiary of CORFO (Government, 35%; private, 65%)	Miraflores No. 222, Santiago	5,500.
Potassium nitrate	do.	do.	Planta María Elena, María Elena, Telephone 055-63220	250.
Sodium nitrate	do.	do.	Planta Pedro de Valdivia, Pero de Valdivia	600.
Sodium sulfate	do.	do.	Oficinia Antofagasta, Anibal Pinto 3228	70,000.
Iron ore		Cía. Minera del Pacífico, S.A., CAP's subsidiary (100% private)	Pedro Pablo Muñoz 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 Ltda. (SCL, subsidiary of Cyprus Foot Minerals Co. of the U.S.) (100% private)	Huérfanos 669, Santiago	8.6.
Manganese		Manganesos Atacama, S.A., CAP's subsidiary (100% private)	Vulcano 75, Planta Guayacán, Coquimbo	43.7.
Molybdenum		CODELCO-Chile (byproduct from copper) (Government, 100%)	Huérfanos 1270, 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)	Huérfanos 1270, Santiago	275,000.
Do.		Cía. Minera San José, Ltda. El Indio Mine, (Lac Minerals of Canada, 83%)	Barrio Industrial, Alto Panielas, Coquimbo	57,000.
Steel		Cía. Siderúrgica de Huachipato S.A., CAP subsidiary (100% private)	Huérfanos 669, Santiago	800.

COLOMBIA

AREA 1.14 million km² **POPULATION 34.3 million**



THE MINERAL INDUSTRY OF

COLOMBIA

By George A. Rabchevsky

Colombia is the only nation named after Christopher Columbus. Located at the northwestern corner of South America, it is about the size of California and Texas combined. It is the only South American country with coastlines on both the Caribbean Sea and the Pacific Ocean. The country also possesses a number of islands. 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 is known worldwide for its emeralds. Colombia was the leading producer of coal, kaolin, and platinum and a major producer of asbestos, cement, ferronickel, gold, salt, and crude petroleum and natural gas in Latin America.

The value of output of Colombia's mineral industry increased by 3.9% in 1992. This was mainly due to the increased production of oil and natural gas, and to a lesser extent of precious metals such as gold and platinum.

The mining industry continued to make gains in relative importance in Colombia's economy. In 1992, the mineral industry in Colombia contributed about 3% to the GDP, worth about $3.5 billion.[1] The petroleum sector contributed significantly to the Colombian economy. A number of major projects were planned for the following 2 to 3 years, including anticipated expansion of coal exports from the La Loma project, estimated to start up in 1994.

Colombia's GDP grew by an estimated 3.3% in 1992 to $47 billion in current prices. Conservative economic policies kept inflation and unemployment near 25.1% and 10.5%, respectively.

GOVERNMENT POLICIES AND PROGRAMS

The new mining code (Código Minero), which became law in late 1989, was crafted to facilitate and encourage mineral exploration and development, to facilitate and expedite the processing of claim applications in its contained provisions, to improve the security of mineral concessions, and to establish a fund to provide financial assistance to small- and medium-scale miners.

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.

Colombia's foreign investment law treats foreign and local investments similarly. Foreign firms may be involved in nearly all sectors of the economy, and no special prior permission or procedures are required to invest in the country. The Coinvertir agency, created in November 1991, promotes foreign investment. Foreign investment rose 45% to $855 million in 1992, 60% of which went into the petroleum industry.

Colombia relied on the capital and technical expertise of large, specialized companies to promote continued development of its mineral resources. Companies included Carbones de Colombia S.A. (Carbocol), the state coal mining enterprise; Cerro Matoso S.A., the mixed-equity nickel mining company; Empresa Colombiana de Minas (Ecominas), the state company that implemented mining projects; Empresa Colombiana de Petróleos (Ecopetrol), the state petroleum enterprise; and associated foreign petroleum companies. During the first part of the year, Ecominas' name was changed to Minerales de Colombia, S.A. (Mineralco).

Government policy encourages the development of the Colombian coal industry and welcomes foreign investment. The mining sector, particularly the coal industry, became one of the target sectors of the Government's macroeconomic development program. The Ministry of Mines and Energy delegated the management of all aspects of the coal industry in Colombia to Carbocol.

PRODUCTION

According to 1992 statistics, Colombia was the world's 4th largest platinum producer and 10th largest gold producer. Gold production set a new volume record in 1991, then decreased 8% in 1992. Production of ferronickel remained the same in 1992, while other metals increased slightly. Output of steam coal reached a historic level. Colombia ranked as the third largest coal producer in the Western Hemisphere after the United States and Canada. Output of crude oil and refined petroleum products increased slightly relative to 1991 to historic highs. Almost all industrial minerals, except salt, showed increases in output, especially diatomite and emeralds. *(See table 1.)*

TRADE

Colombia is a member of the Andean Pact and of GATT. It was also a beneficiary under the U.S. Generalized System of Preferences. In January 1991, the country became eligible for the EC's 4-year Andean Program, which reduced

tariffs on many Colombian exports. In December 1991, it became eligible for broader access to the U.S. market as a beneficiary under the Andean Trade Preference Act.

Four Central American countries reached a framework agreement for free trade with Colombia and Venezuela. El Salvador, Guatemala, Honduras, and Nicaragua would have free access to Colombian and Venezuelan markets within 3 years, extending to all goods within 6 years. Trade barriers on Colombian and Venezuelan goods entering Central America would be dropped within 5 to 10 years. The pact is subject to ratification, expected by mid-February of 1993. Foreign trade between Colombia and Venezuela reached $1 billion in 1992. About 21% of Venezuelan nonpetroleum exports was purchased by Colombia. Venezuela was Colombia's second largest investor after the United States.

Total exports from Colombia in 1992 fell 7%, while imports increased by 21% to $5.2 billion. In 1992, the total value of Colombian exports was approximately $7.2 billion. Oil displaced coffee in 1991 as Colombia's largest export commodity; the oil sector attracted $328 million, one-half of the total, in foreign investment in 1992. The total value of mineral fuel exports composed 27% of the total value of exports for 1992. The entire mineral output accounted for 39% of the total value of exports. The United States received 44% of the exports. East Asia accounted for only 4% of Colombia's exports.

Colombia was the fourth largest coal exporter in the world, with about 16 Mmt, mostly steam coal, in 1992. Coal became the third largest export earner in 1992. *(See table 2.)* The principal importers of Colombian coal continued to be Western Europe (85%), the United States (8%), the Mediterranean area (4%), and the Far East (3%).

Crude oil exports by Colombia increased 16% to about 72 Mbbl in 1992.

STRUCTURE OF THE MINERAL INDUSTRY

Colombia had three major regions of economic activity—the central, north coast, and western regions. The primary center of activity in the central region was Bogotá, the country's capital city. The central area had a significant share of the nation's petroleum production and important coal deposits. The region also produced most of the country's refined petroleum products in 1992. In addition, the cement and steel plants in this region were the major domestic producers. The western region had large hydroelectric resources with an installed capacity of 3,810 MW. The north coast or Caribbean region contained the second largest petroleum refinery and large chemical and petrochemical production facilities. The Cerro Matoso nickel mine and plant, as well as the extensive El Cerrejón coal mining complex, were in this region.

According to a recently completed mining census, 35 minerals were exploited on a national basis. It was determined that Colombia had about 7,300 mines, more than one-half of which were associated with the mining of gold. The following mineral commodities are listed in the order of number of operating mines: gold, coal, other industrial minerals, platinum, clays, limestone, marble, and emeralds. It also was found that 74% of the mines were surface operations with the remainder being underground. Approximately 19% of the mining was still being done in the traditional manner, with pickax and shovel or by washing placer deposits.

Two Government agencies were created to administer mining exploration and development: Instituto Nacional de Investigaciones Geológicas y Mineras (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.

The major part of Colombia's mining industry was privately owned. This was especially true with the industrial minerals, iron and steel, and the precious metals. Although oil and natural gas exploration was funded primarily by private companies, production was effectively controlled by the Government entity Ecopetrol. Foreign investors could enter the mineral industry through fixed-term concessions or with an association contract with a state enterprise.

Ninety-two of the 320 association contracts signed with Ecopetrol remained in effect at the end of 1991. Exploration risk was primarily borne by foreign investors. Ecopetrol reimbursed 50% of producing wells' costs and assumed 50% of the contracts' working interest only when the field had been determined to be commercially viable. In addition to the standard association contract, approximately 14 of the 89 associate contracts in effect at the beginning of the year contained a risk-sharing clause. Under the shared-risk contracts, Ecopetrol assumed 30% of the exploration costs. *(See table 3.)*

COMMODITY REVIEW

The mining and production of metals in Colombia has been small and sporadic, and the country depended on imports for almost all major metals. In the 1991-92 period, $180 million worth of metals was imported. Coal, gold, and oil attracted new foreign interests. Proposed coal and petroleum projects were primarily export oriented. There were a number of proposed projects under consideration, including the Guainía gold project, the Mocoa copper-molybdenum project in Putumayo Department, a phosphate project north of Bogotá, and the La Guajira gypsum prospect. Mineralco also was promoting manganese, uranium, and zinc projects as well as an aluminum plant in the Cauca Valley, an area of abundant electrical power.

Metals

Bauxite.—Lateritic bauxite was produced by small operations in the

Upper Cauca Valley, southwest of Bogotá. Production from the Jamundí area, ranging from 1,000 to 3,000 mt/a, was utilized by the nation's chemical industry to make aluminum sulfate. Colombian bauxite reserves were estimated at 380 Mmt. grading 40% alumina in Antioquia, Valle de Cauca, Meta, and Norte de Santander.

Copper.—Copper in Colombia was mined at El Roble, southwest of Medellín, with reserves of about 1 Mmt of ore grading 4.5% copper, 3 g/mt of gold, and 10 g/mt of silver. El Roble Exploración Y Explotación S.A. began operations in 1990 at the new copper mine northwest of Medellín. About 14,000 tons of copper concentrate was shipped for refining to the Hibi Kyoda Smelting Co. in Tamano, Japan.

Other porphyry copper deposits were at Acandi, El Dovio, Mocoa, Murindo, and Pantanos. The Murindo deposit was considered to be the most promising future target because of its high gold content.

Gold.—In Colombia, gold mining can be traced to pre-Columbian times. In 1992, Colombia ranked fourth in gold production in the Western Hemisphere after the United States, Canada, and Brazil. In 1988, 31,950 people worked in precious-metal mines, 28,845 of which were in gold mines, with the rest in platinum mines. In 1991, Colombian gold exports totaled $408 million. Reportedly, exports of gold contributed $387 million to the country's economy in 1992. About 75% of Colombian gold output was produced from alluvial deposits. Most of the main rivers, and their tributaries, have been mined for many years for placer gold, and in some cases for associated platinum, especially in the Upper San Juan Valley.

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 from Córdoba Department came from placers and from Bolivar Department from hard-rock mining. Those two Departments accounted for 30% of total gold production. Table 4 shows the relative importance percentage of gold-producing areas in Colombia.

About 80% of gold was produced by small operations using rudimentary methods. There were 4,733 gold production permits issued to small-scale prospectors in Colombia. Annual revenues from the Central Bank's sales amounted to $400 million in 1992, or about 6% of total exports. Because of lack of infrastructure and geological maps, the remote location of deposits, and the unavailability of good equipment, 99% of proven reserves are classified as placers.

Mineralco was promoting a large-scale gold project in the Guainía region. A large gold deposit was discovered in southern Guainía in the area of the Serranía de Naquen. The Government built an airstrip near the discovery area, this being the only means to reach the Naquen deposit in the dense jungle. Production in the Amazon Basin was still insignificant. There was still extensive small-scale gold activity in the Amazon Basin. Exploration in Vaupes was still in its early phase, but the identified surface deposits have proved even more attractive than those in Guainía region.

Greenstone Resources Ltd. of Canada began production at the Oronorte Mine near Zaragoza, Department of Antioquia, in November 1990. The mine produced about 500 kg in 1992, or a little more than 1% of Colombia's total gold production. Concentrates were shipped to Nippon Mining Co. Production at Oronorte Mine was projected to more than double during the next 2 years.

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

Iron and Steel.—Iron ore production increased 6.5% and crude steel production increased 9% in 1992. The Paz del Río Mine, approximately 248 km northeast of Bogotá, was the only source of oolitic iron ore for Acerías Paz del Río, S.A., Colombia's only fully integrated steel mill. In 1992, the mine produced 674,000 tons of iron ore. Proven reserves of the deposit were at 150 Mmt averaging 45% Fe. The mine was close to its steelworks at Belencito in Boyacá Department. Other undeveloped iron ore deposits occurred at Cerro Matoso, Porvenir, and Queresa. Colombia was largely dependent on imports of iron ore and manufactured and finished products, including stainless steel. Semiintegrated steel plants in other parts of the country utilized electric furnaces to produce steel from pig iron and scrap. Colombia produced mostly reinforced bars and structural beams.

A steel industry cooperative agreement with Venezuela was approved in late 1991. The agreement will allow Colombian steel mills until December 1994 to modernize.

Lead and Zinc.—Colombian lead and zinc mines are in Antioquía Department, operated by Frontino Gold Mines. Output of lead doubled in 1991 and remained at the same level in 1992, while output of zinc remained almost the same as in the past 2 years.

Nickel.—Colombia produced about 2% of the world's nickel and was the world's fourth largest producer of ferronickel, after New Caledonia, Canada, and Japan. The country's nickel production came from the Cerro Matoso Mine at Montelíbano, Department of Córdoba. The mine and ferronickel complex came on-stream in 1983. The open pit mine was the country's sole source of nickel ore and was reputed to be one of the world's most cost-effective lateritic nickel mining operations. Reserves of nickel ore were estimated at 20 Mmt grading 2.6% nickel and another 41 Mmt grading 1.5% nickel. Planeta Rica and Ure prospects to the north and south of Cerro

Matoso have estimated reserves of 10 Mmt grading 1.24% to 1.60% nickel. The operator, Cerro Matoso S.A., was 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 entity. The mine extracted about 850,000 tons of ore in 1992, grading 2.7% nickel. The plant was prepared to increase the capacity of its rotary furnace from 20,000 mt/a to 30,000 mt/a of contained nickel. The Government had not announced a decision on this development to the public.

It was anticipated that ownership of the concession will revert wholly to the Government in the year 2007. All production was exported, with 75% shipped to Europe. Ferronickel exports contributed more than $125 million to the country's economy in 1992.

Platinum.—Colombia was in fourth place worldwide in the production of platinum, with only 1% of total world production. Platinum production increased again in 1992, by 20% over that of the previous year. Colombian platinum sales generated about $16 million per year, or 0.2% of the country's foreign exchange earnings from exports. Mining was on the small scale, and there was only one company of any size, Mineros del Choco A.S., using modern dredges and equipment. But its operations were suspended for legal reasons.

Almost all platinum production came from placer deposits, tributaries of the Atrato and San Juan Rivers in Chocó Department. Additional production was from placers of the Nechí River in Antioquia Department. Small amounts of gold, palladium, rhodium, and other metals also occur in those deposits. The state research institute, Ingeominas, recently made a more detailed study of the primary showings of platinum in cooperation with the German Institute of Geosciences. Results are being evaluated.

Titanium.—Several titanium-bearing black sands were identified in the beaches along the Caribbean and the Pacific coasts, and also in heavy minerals from gold exploitation on the Nechí and San Juan valleys. No appreciable reserves of titanium were identified, because there was no specific exploration program for that mineral. However, the potential for important titanium discoveries was considered high.

Industrial Minerals

Asbestos has been mined in Colombia since 1982. About one-third of the country's production came from the Campamentos Mine in the Department of Antioquia, and was till rising. Limestone is widely found in Colombia. Most of the cement plants were near limestone mines. The primary phosphate rock deposits are principally along the eastern range of the Andes Mountains, with the largest deposit about 250 km northeast of Bogotá at Neiva.

Cement.—Production of hydraulic cement increased 9% in 1992, to a record high for Colombia. About 20% of cement was exported. Colombia's installed cement capacity was 9.1 Mmt/a. Cementos del Valle S.A., at Puerto Isaacs near Yumbo, was expanding its capacity to 1.2 Mmt/a, and Cementos Diamante's Ibaqué Project, a 1-Mmt/a coal-fired dry-process plant, was scheduled to come on-line in 1993. Cía. Colombia de Clinker added a new gas-fired oven and cement mill in the expansion of its capacity to 1.03 Mmt/a. Other companies planned to expand during the next 4 to 5 years, including Acerías Paz del Río at Belencito and Cementos Ríoclaro, S.A. at Puerto Triunfo.

Emeralds.—Colombian emeralds are famous worldwide for their high quality. Colombia was the leading emerald producer in 1992, producing 60% of the world's finest emeralds. Most of Colombia's emeralds came from mines in the Department of Boyacá north of Bogotá, most notably the Chivór, Coscuez, Gachala, Muzo, Quípama, and Ubala. The Chivor and Muzo districts have been operating continuously for more than 500 years, since the colonial period. About 400 miners worked in the Quipama operations. In addition to mine personnel, an estimated 35,000 prospectors scavenged the emerald mine dumps in Colombia. In 1992, reportedly the world's largest emerald deposit was discovered in Coscuez, sending the price tumbling 75% from $221.70/carat to $55.32/carat during 1992.

Colombia's emerald trade was unrestricted. Most emeralds were exported as uncut stones. The export of emeralds contributed $180 million to the country's economy in 1992, ranking fourth among mineral exports. Japan continued as the single largest market of emeralds (70%), followed by the United States, European countries, and others. Illegal exports are estimated to double the official export statistics. Emerald producers proposed to establish a cartel, including Colombia, Brazil, Zambia, and Zimbabwe. Producers also planned to establish an international emerald exchange in Bogotá.

Gypsum.—In 1992, Colombian gypsum production came from Guainía Department in the central eastern area of the country and was still in an upward trend. Gypsum also was imported from Mexico and used in cement plants on the Caribbean Coast.

Phosphate Rock.—Colombia produced only 25% of the domestic consumption of phosphate, the rest being imported. Three phosphate deposits in Columbia are along the eastern Andes Range: the Sardinata deposit in Norte de Santander, the Iza/Pesca deposit in Boyacá, and the Aipe/Baraya/Tesalia deposit in Huila Departments. Total proven reserves were estimated at 20 Mmt with grades between 20% and 30% P_2O_5.

Salt.—Salt was produced from both seawater evaporation basins along the north coast and from Zipaquira, an underground mine north of Bogotá.

Marine salt comes primarily from Manaure and Galerzamba areas on the Caribbean coast. By 1993, more than 150 Mmt of rock salt reserves will become accessible to Concesión de Salinas, the state salt mining company.

Sulfur.—Sulfur was produced from both mines and as a byproduct of petroleum processing. The only active mine in Colombia was the Mina El Vinagre near Puracé in Cauca Department. Proven ore reserves were estimated at 3 Mmt with grades between 25% to 31% sulfur. Ecopetrol produced more than 9,000 mt/a of sulfur at the Barrancabermeja refining complex. A 13,000-mt/a modified Claus unit was to be installed at the Cartegena refinery in 1992. The country's sulfur production satisfied only 55% of the domestic consumption.

Mineral Fuels

Colombia is endowed with substantial primary energy resources, including coal, natural gas, petroleum, and hydropower. Since 1965, output of primary energy had lagged behind overall economic growth. Electric power has been the fastest growing form of energy in Colombia. Its share of total energy consumption has risen from 14% in 1960 to 23% in 1978. Since 1971, production of electricity has been growing at an annual rate of 9.7%, one and one-half times as fast as the growth rate of GDP. Major projects were being executed and others prepared to expand hydroelectric power generation, and incentives were being given to private foreign companies for accelerated exploration and development of the country's petroleum, natural gas, and coal potential.

Coal.—Colombia was the third largest steam coal producer in the Western Hemisphere after Canada and the United States. Colombia was the fourth largest coal exporter after Australia, the Republic of South Africa, and the United States. More than 70% of Colombian coal produced was exported. Coal exports accounted for about 12.5% of Colombia's total export earnings in 1992. Coal exports in 1992 declined from 16.1 Mmt in 1991 to 15.6 Mmt valued at $555 million. The United Kingdom was the largest importer of Colombian coal, accounting for about 20% of its total coal exports. Coal exports also were supplied to Brazil, Denmark, France, Ireland, and the Netherlands. More than 75% of coal exported came from the Cerrejón North Mine, valued at $448 million. Cerrejón's principal importers were Europe (89%), followed by the Far East (2%) and North America (9%). Less than 30% of the total production was for domestic consumption. The coal industry employed about 29,000 workers, about 35% of which are located at the Cerrejón coal mine.

Colombia possessed the largest coal reserves in Latin America, principally of steam coal. About one-half of the country's reserves occurred along the north coast, concentrated in the La Guajira Peninsula. Colombia had an estimated 6.5 billion tons of economic reserves. Table 5 shows the Colombian coal reserves by region.

About 55% of Colombian coal, or 13 Mmt, came from the Cerrejón Mines. Cerrejón Norte Mine was the main producer. Production at the Cerrejón Central Mine was suspended in 1992. The coal from this region was an excellent quality steam coal having a sulfur content of less than 1% and an ash content not exceeding 8%. The mine was operating at a minimum capacity because of reduced demand as reflected by the low price of coal in the world market. The Cerrejón mining complex was constructed in 1981, with its own railroad and a sea port in one of Colombia's most isolated regions. In partnership with Carbocol, a state-owned company, Cerrejón was operated by Intercor A.S., a subsidiary of Exxon Inc. Intercor employed about 9,000 people, about 4,800 of which are hired directly, the rest under a contract. The Cerrejón Mine has greatly impacted the economy of the region, in particular the development of the Guajira Department.

Other large producers were on the north coast and in the Departments of Cundinamarca and Boyacá. Domestic consumption increased by 22%, from 5.0 Mmt in 1991 to 6.1 Mmt in 1992. Table 6 presents coal production in Colombia by region.

Drummond Ltd., a subsidiary of Drummond Coal Co. of Jasper, Alabama, continued to develop the La Loma coal deposit, with reserves estimated at 100 Mmt. The terminal at Ciénaga on the Caribbean coast was being built. Drummond expects to ship coal to the U.S. gulf ports in 1995. Drummond's investment was estimated at $581 million.

Prodeco, S.A., the principal private coal producer, operated a number of steam and metallurgical (coking) coal plants in central Colombia. The company restarted production from the Cerrejón Central Zone with an estimated production of up to 3 Mmt/a. The mine had 150 Mmt of coal in reserves. 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 César. The open pit mine had estimated reserves of about 40 Mmt, with estimated production of 3 Mmt/a.

Carbones del Caribe, the other significant private coal producer, operated the mines at Puerto Libertador, Córdoba Department. The reserves were estimated at 300 Mmt, with production of about 1 Mmt. Coal was sold to local cement companies and exported. The company planned to bring a number of projects on-line in 1992-93, including the San Jorge Mine in the Department of Córdoba and the Oreganal Mine in El Cerrejón Central Zone. Carbones del Caribe also planned to join the approximately 20 companies working La Jagua de Ibirico Zone in the Department of César.

The semiprivate Carbones de Boyacá S.A. purchased coal from the approximately 1,400 family owned and operated coal mines in Boyacá Department. The coal was then sold to Acerías Paz del Río. Other private coal companies included Atlantic Coal de Colombia, Carbo Fuels and Minerals, and Carbones de los Andes.

Carbocol continued exploration and/or

feasibility studies on the Amagá, El Descanso, San Luis, Tadu, and Tibú Coalfields.

In 1992, Carbocol and the Chinese National Corp. agreed on a $5 million briquetting plant for Colombia. About 2 Mmt of coal from the Amaga area in the Antioquia Department will be used to produce 10,000 mt/a of steam-coal briquettes. The purpose of the agreement is to encourage the use of coal as a substitute for firewood in an environmentally important forest area. Carbocol was authorized to set up similar plants throughout Latin America and sell the Chinese briquetting technology.

Natural Gas and Petroleum.—Of the estimated 5.2 billion m^3 of natural gas produced, about 4.2 billion m^3 was marketed domestically. Much of the nation's natural gas reserves are located either offshore or on the La Guajira Peninsula and in the Department of Meta. Natural gas reserves in Colombia were estimated at 204 billion m^3. Natural gas supplied only 10% of Colombia's fuel needs. The Government intends to quadruple the gas usage by the year 2005.

Production of crude oil in Colombia continued to increase, by 6% in 1992, to a historic high level. Oil represented about 22% of Colombia's export earnings and one-half of 1992 foreign investment. The country exported crude oil worth $1,540 million in 1992. Petroleum company profits in Colombia declined 17% in 1992, mainly due to a 9.4% drop in the volume of petroleum exports resulting from guerrilla attacks on the petroleum infrastructure. The only company reporting significant profits (a 67% increase over 1991) was Occidental Petroleum Co. About 88% of total petroleum revenues go to the Government in the form of royalties, taxes, and state participation in production. Ecopetrol reported its profits increased by 17% over those of 1991, but guerrilla attacks on the oil infrastructure reduced Ecopetrol's profit by $150 million. Ecopetrol also was forced to suspend crude oil exports for 35 days in November 1992 as a result of the guerrilla attacks, thus reducing the average of exported crude oil from 92,276 bbl/d in 1991 to 91,378 bbl/d in 1992. Guerrillas launched 106 attacks on Colombian pipelines spilling 228,245 bbl of crude oil and a production loss of 10 Mbbl of oil. Colombia was forced to import crude from Ecuador to keep the Cartagena refinery running, the first time in 7 years the country had to import crude.

Colombia's proven oil reserves have doubled to at least 4 billion bbl, dispersed among seven 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 Casanare basin contained one-half of the country's total reserves, thus becoming the richest source of low sulfur oil in Colombia. British Petroleum Ltd. (BP) and Ecopetrol discovered oil in the Casanare/Cupiagua/Cusiana basins in Colombia's eastern Andes, about 60 km east of the capital. BP and Total Ltd. held 38% shares, and Triton Energy Ltd. 24%. Once the Government grants a commercial license to develop the properties, Ecopetrol will take 50% stake in the development costs and in the oil. The recoverable reserves of good quality light crude oil was estimated at 1.5 billion bbl in the nearby Casanare area and 500 Mbbl in the nearby Cupiagua area. Gas reserves were estimated at 85 billion m^3. Of the six oil wells completed in the Cupiagua/Cusiana basin, only the Buenos Aires 1 well was in production, with about 10,200 bbl/d since September. A pipeline is being finished to transport crude oil from the area to the Covenas terminal on the Caribbean coast. The Cusiana production is expected to rank Colombia with Mexico and Venezuela as major oil exporters in Latin America and provide an estimated annual revenue of $4 to $5 billion.

The Government formed an army battalion at Yopal, the capital of Casanare, to protect BP and its partners Total and Triton. The security force in the Cusiana/Cupiagua area was formed with a 2,500-strong 16th Brigade. BP also employed more than 600 security officers to guard its officials. Local health officials also disrupted the operations by oil companies in the Casanare area. Accusations that BP had violated environmental regulations resulted in the shutdown of one well and the temporary closure of another.

BP also held a 100% interest in three contracts north of the Cusiana Field (Pauto, Sacama, and Tamara contracts) and continued exploration work in the Casanare area. Six other international companies also were doing exploration work in the Casanare area. Oil discoveries also were made by Esso, Shell, and Lasmo oil companies in the Upper Magdalena area, and the deposits are now being developed.

About 85% of Colombia's oil reserves have been discovered by foreign oil companies. More than 50 companies were operating in Colombia, including Chevron, Hocol, Occidental, and Texaco. Occidental Petroleum, which operated the Caño Limón Fields, acquired a new association contract in the Cauca Valley. Other producing companies included Lasmo, which had a series of exploration successes in 1992, and Aviva Petroleum/Garnet, which raised production at its Santana Block from 2,950 bbl/d to 6,560 bbl/d. Garnet Resources Corp., Houston, Texas, also was exploring the Putumayo basin. About 300,000 bbl/d of Colombia's production came from joint-venture operations between Ecopetrol and foreign oil companies, and 91,000 bbl/d came from fields wholly owned by Ecopetrol. Concessions, in which Ecopetrol did not participate, produced the balance.

Refineries operated by Ecopetrol included the industrial complex at Barrancabermeja, Santander Department, which had a capacity of 196,000 bbl/d; the operations at Cartagena in Bolivar Department, which had a capacity of 70,700 bbl/d; the Orito refinery in Putumayo Department, which was rated at 2,400 bbl/d; and the refinery at Tibú in Norte de Santander Department, which had a capacity of 5,000 bbl/d. A proposed 105,000-bbl/d refinery at Puerto Triunfo in the Middle Magdalena Valley was temporarily postponed to evaluate the

impact of the Cusiana discovery. Refining capacity was insufficient to supply the domestic market, therefore 28,000 bbl/d of petroleum products was imported to make up the short fall.

Reserves

Colombia contained the largest coal reserves in Latin America. It also was among the leaders in asbestos, emerald, gold, natural gas, petroleum, and phosphate rock. Colombia's reserves of major minerals are included in table 7.

INFRASTRUCTURE

Colombia had a total of 75,450 km of roads, 9,350 km of which was paved. Colombia, Mexico, and Venezuela agreed to study the completion of the Inter-American Highway through Panama.

Colombia contained 3,236 km of single-track, 0.914-m-gauge railroads. About 20% of track crosses mountainous regions where the low quality of the track created bottlenecks and the speed of trains is reduced to 20 mph. The only significant rail traffic involves a few relatively short stretches, such as for transporting coal to the export terminals on the Caribbean coast, to which most of the coal production is shipped. Ferrovías, S.A. was responsible for construction and maintenance of track, station, and related facilities, and the Colombian Railway Transport Co. was responsible for rail service operations.

There was 14,300 km of inland waterways navigable by riverboats. 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. Privatization of the Colombian port system was under consideration.

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. Ecopetrol was to complete a 470-km crude oil pipeline from the Cusiana area to Coveñas in 1992. Promigas S.A. was examining the possibility of installing an additional 4,424 km of gas pipeline. Colombia, Mexico, and Venezuela agreed to investigate the feasibility of constructing a Colombia-Venezuela gas pipeline system and eventually extending it north into Central America.

Hydropower furnished about 75% of the total installed electrical generating capacity of 9,624 MW; the rest was supplied by thermoelectric powerplants. In December, the hydroelectric plant at Guavio River came on-stream providing 200 MW from the first turbine. Four other turbines of the same size are due to come into service at midyear 1993, as well as the 322.5-MW plant at Ríogrande. The electrical system link with Venezuela was completed in November, providing an additional 100 MW to the Colombian grid. In 1992, Colombia experienced a severe energy crisis, caused by its most serious drought in 40 years.

Thermoelectric plants accounted for approximately 25% of the total installed electrical generating capacity. Thermal plants did not operate at full capacity because of the country's hydroelectric focus. The most important coal-fired thermal plants to be developed were: the Guajira plant, to supply electricity to the Cerrejón coal mine; Cartagena IV plant; Loma plant, César Department; San Jorge plant, Córdoba Department; Amaga plant, Antioquia Department; San Luis plant, at Santander; Tasajero II plant, one of the largest thermal expansion projects. Carbocol is planning to invest $2.6 billion on building eight new thermoelectric power stations. Foreign and private investors will be invited to participate. The eight stations should have a generating capacity of at least 1,600 MW; five will be 150-MW stations and three will be 300-MW stations.

OUTLOOK

The outlook for increased gold output looks favorable providing adequate exploration and development of the Guainía region takes place. Emerald and nickel production at current levels is expected to continue for the next 15 to 20 years. New cement handling facilities were under construction at Buenaventura, Cartagena, and Tolú to enable Colombia to increase its sizable exports of cement. Foreign investment will continue to be needed to fund Colombia's hydrocarbon exploration and development. With the increased availability of steam coal, the Government has identified 11 proposed coal-fired thermal plants as prospective investment projects. New coal export facilities are planned for Barranquilla and Ciénaga. Mexico's coastal power stations are expected to become operative in 1993; thus, there is the possibility to increase Colombian exports of coal to Mexico from the present 1 Mmt/a to the 2.5 Mmt/a.

Ecopetrol was planning to double oil and gas production in the next 6 years, provided the Cusiana/Cupuagua Fields become operational. The Government is willing to invest more funds in the development of the fields and its infrastructure.

According to recent studies, the country contains at least 308 additional potential hydroelectric plant sites that are economically feasible. There were plans for construction of an additional 1,362 MW of hydroelectrical generating capacity by the turn of the century. The Government was interested in privatizing about 30 regional companies that generate or transmit electricity.

[1]Where necessary, values have been converted from Colombian pesos (Col$) to U.S. dollars at the average rate for 1992 of Col$526.00=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Ministerio de Minas y Energía
División de Minas
Carretera 7, 7-56
Santa Fé de Bogotá, Colombia
Telephone: (571) 222-1559
Fax: (571) 222-3651
Carbones de Colombia, S.A. (Carbocol)
Carrera 7 No. 31-10

Santa Fé de Bogotá, Colombia
Telephone: (571) 612-2262
Fax: (571) 287-3278

Cerro Matoso, S.A.
Carretera 7ma. No. 26-20, Piso 8
Santa Fé de Bogotá, Colombia
Telephone: (57-1) 288-7066
Fax: (57-1) 285-7974

Empresa Colombiana de Petróleos, S.A. (Ecopetrol)
Apartados Aéreos 5938-6813
Santa Fé de Bogotá, Colombia
Telephone: (571) 285-6400

Instituto de Fomento Industrial (IFI)
Calle 16 No. 6-66
Apartado Aéreo 4222
Santa Fé de Bogotá, Colombia
Telephone: (571) 282-2055
Fax: (571) 286-4166

Instituto Nacional de Investigaciones Geológico y Mineras (Ingeominas)
Diagonal 53, 34-53
Santa Fé de Bogotá, Colombia
Telephone: (571) 222-1811
Fax: (571) 222-3597

Instituto Nacional de los Recuerdos Renovables (Inderena)
Carrera 10 #20-30
Santa Fé de Bogotá, Colombia
Telephone: (571) 284-1700
Fax: (571) 283-3458

Minerales de Colombia, S.A. (Mineralco)
Calle 32 No. 13-07
Santa Fé de Bogotá, Colombia
Telephone: (571) 287-5588
Fax: (571) 287-4606

Publications

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

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

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

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

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

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

TABLE 1

COLOMBIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992[p]
METALS						
Bauxite		e1,500	1,500	1,640	1,716	e1,750
Copper, mine output, Cu content		—	—	304	3,643	3,935
Gold	kilograms	29,014	29,506	29,352	34,844	32,118
Iron and steel:						
Iron ore and concentrate	thousand tons	609	573	628	r450	674
Pig iron	do.	309	297	323	305	304
Steel, crude	do.	754	706	701	664	e725
Semimanufactures, hot-rolled	do.	597	598	592	581	e590
Lead:						
Mine output, Pb content		31	394	331	r611	620
Refined (secondary)e		4,000	3,500	3,500	3,600	3,600
Manganese:						
Mine output, Mn content		3,580	3,600	500	552	e600
Nickel:						
Mine output, Ni content		19,979	21,425	22,439	20,590	23,063
Ferronickel, Ni content		r17,502	r16,939	r18,424	r20,194	20,195
Platinum-group metals	kilograms	815	973	1,316	1,603	1,956
Silver	do.	6,563	6,847	6,591	8,036	8,291
Zinc, mine output, Zn content		138	394	356	266	277
INDUSTRIAL MINERALS						
Asbestos:						
Mine output		152,896	158,149	159,600	160,332	e160,500
Fibere		7,600	7,900	8,000	2 7,825	2 7,900
Barite		e4,000	5,460	5,380	r9,288	9,380
Cement, hydraulic	thousand tons	6,764	6,643	r6,253	r6,202	6,807
Clays:						
Bentonite		e3,000	2,950	3,100	3,178	e3,500
Common clay and kaolin	thousand tons	1,306	1,800	1,920	1,984	e2,000
Diatomite		—	3,600	3,100	3,890	4,356
Feldspar		37,136	40,850	34,800	r45,575	e45,600
Fluoritee		300	300	2780	2894	900
Gemstones, precious and semiprecious: Emerald[3]	carats	1,095,650	1,200,000	3,100,000	1,075,232	2,313,735
Gypsum	thousand tons	307	553	r608	639	e650
Lime, hydrated and quicklimee	do.	1,300	1,300	1,300	1,300	2671
Magnesite		17,760	20,425	19,300	18,768	18,840
Mica		e55	60	r60	r50	54
Nitrogen: N content of ammoniae		284,100	291,800	90,000	90,000	90,000
Phosphate rock		35,000	31,200	r31,000	31,516	31,516
Salt:						
Rock	thousand tons	209	190	209	219	230
Marine	do.	473	470	478	482	317
Total	do.	682	660	687	701	547
Sodium compounds, n.e.s.: Sodium carbonate		114,087	e115,000	r120,615	r120,600	e121,000
Stone and sand:						
Calcite		8,736	12,060	7,208	5,758	e6,000
Dolomite	thousand tons	33	45	45	46	45

See footnotes at end of table.

TABLE 1—Continued

COLOMBIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992[p]
INDUSTRIAL MINERALS—Continued						
Stone and sand—Continued:						
Limestone[e]	thousand tons	[2]11,980	12,000	17,000	[2]15,660	16,000
Marble		[e]17,500	30,000	32,200	33,380	34,603
Sand excluding metal-bearing		654,800	[e]700,000	790,000	858,784	[e] 860,000
Sulfur:						
Native (from ore)		42,795	45,575	31,686	[r]37,563	39,178
Byproduct, from petroleum[e]		8,200	8,000	8,000	[r]9,000	9,200
Total		50,995	53,575	39,686	[r]46,563	48,378
Talc, soapstone, pyrophyllite		12,800	9,196	10,113	11,064	13,340
MINERAL FUELS AND RELATED MATERIALS						
Carbon black[e]		18,000	18,000	[2]20,400	20,000	23,600
Coal:						
Metallurgical[e]	thousand tons	[2]585	650	700	[r]800	900
Steam	do.	14,315	18,252	[r]19,834	[r]19,231	22,876
Total	do.	14,900	18,902	[r]20,534	[r]20,031	23,776
Coke, all types[e]	do.	550	550	[2]339	400	450
Gas, natural:						
Gross	million cubic meters	5,029	5,113	[e]5,600	5,202	[e]5,200
Marketed	do.	4,062	[e]4,100	[e]4,500	4,248	[e]4,450
Natural gas liquids	thousand 42-gallon barrels	1,384	[e]1,400	[e]1,500	2,239	[e]2,300
Petroleum:						
Crude	do.	136,760	147,563	[r]160,431	155,329	[e]160,600
Refinery products:						
Liquefied petroleum gas (propane)	do.	4,745	[e]4,500	[e]4,500	4,855	[e]4,900
Gasoline:						
Aviation	do.	255	[e]260	[e]265	301	[e]320
Motor	do.	27,120	[e]28,500	[e]29,000	32,120	[e]32,200
Jet fuel	do.	3,650	[e]3,800	[e]4,000	3,956	[e]4,000
Kerosene	do.	2,190	[e]2,200	[e]2,300	1,692	[e]1,700
Distillate fuel oil	do.	14,235	[e]14,300	[e]14,300	16,761	[e]16,900
Lubricants[e]	do.	733	750	750	[2]651	[e]700
Residual fuel oil	do.	23,360	[e]23,500	[e]24,000	26,900	[e]27,000
Asphalt and bitumen	do.	1,127	[e]1,100	[e]1,100	1,205	[e]1,250
Refinery fuel and losses, and unspecified products	do.	3,285	[e]3,500	[e]3,500	422	[e]500
Total	do.	80,700	[e]82,410	[e]83,715	88,863	[e]89,470

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through Aug. 26, 1993.

[2]Reported figure.

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

TABLE 2
COLOMBIA: VALUE OF SELECTED MINERAL EXPORTS

(Millions of U.S. dollars)

Commodity	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992e
Crude oil and refined products	[1]284	[1]378	[1]444	[1]407	619	1,341	953	1,438	1,950	r1,950	1,540
Coal	17	29	59	151	190	360	425	650	545	r630	555
Gold	NA	NA	NA	NA	NA	NA	NA	NA	NA	408	387
Ferronickel	6	56	81	53	48	77	179	190	146	r143	125
Emeralds	41	33	31	25	34	62	90	103	r112	r143	180
Cement	55	34	38	46	25	63	66	70	r37	r48	42
Total	403	530	653	682	916	1,903	1,713	2,451	r2,790	r2,914	2,852
Total exports	3,283	3,176	3,469	3,763	5,434	5,638	5,805	6,364	7,079	7,651	7,152
Selected minerals as percent of total exports	12	17	19	18	17	34	30	39	r39	r38	39

eEstimated. rRevised. NA Not available.
[1]Fuel oil only.

TABLE 3
COLOMBIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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%; and International Colombia Resources Corp. (INTERCOR), Exxon, 50%]	El Cerrejón Norte Mine, La Guajira Department	15,000
Do.		Drummond, Ltd. (Drummond Co., 100%)	La Loma Mine, César Department	10,000[1]
Do.		Prodeco (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)	650
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

See footnotes at end of table.

TABLE 3—Continued

COLOMBIA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
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
Petroleum products do.	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	300
Semiintegrated 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
Do.	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.

TABLE 4
PERCENTAGE OF GOLD PRODUCTION IN COLOMBIA, BY AREA

Department/area	1984	1991
Antioquia	71.1	48.0
Choco	6.2	9.0
Other Pacific (Cauca, Narino, Valle)	4.8	7.0
Caldas (S. Antioquia)	1.4	2.5
Tolima	1.1	1.0
Santander	9.4	1.0
Amazon Basin (Guainía, Vaupes)	—	1.0
Caribbean (Bolívar, Córdoba)	5.7	28.9
Other	.3	1.6
Total	100.0	100.0

TABLE 5
COAL RESERVES IN COLOMBIA, BY REGION

(Million metric tons)

Department/region	Proven	Probable	Total
Boyaca/Cundinamarca	589	11,538	12,440
Guajira	3,670	—	3,670
Santander North	78	290	378
Antioquia	139	140	279
Cauca	58	127	185
César	1,252	712	1,964
Córdoba	572	2,584	3,161
Santander south	140	3	143
Total	6,503	15,392	21,895

TABLE 6
COAL PRODUCTION IN COLOMBIA, BY REGION

(Thousand metric tons)

Department/region	1990	1991	1992	Percent change 1991-92
Guajira	13,277	11,906	12,965	8.9
Cundinamarca	1,690	2,184	2,560	17.2
Boyaca	1,661	1,735	2,228	28.4
César	1,402	1,184	1,867	57.7
Antioquia	1,175	839	994	5.8
Santander North	867	755	1,265	67.4
Valle	798	694	994	43.2
Córdoba	665	531	843	58.9
Total	21,534	20,031	23,776	18.7

TABLE 7

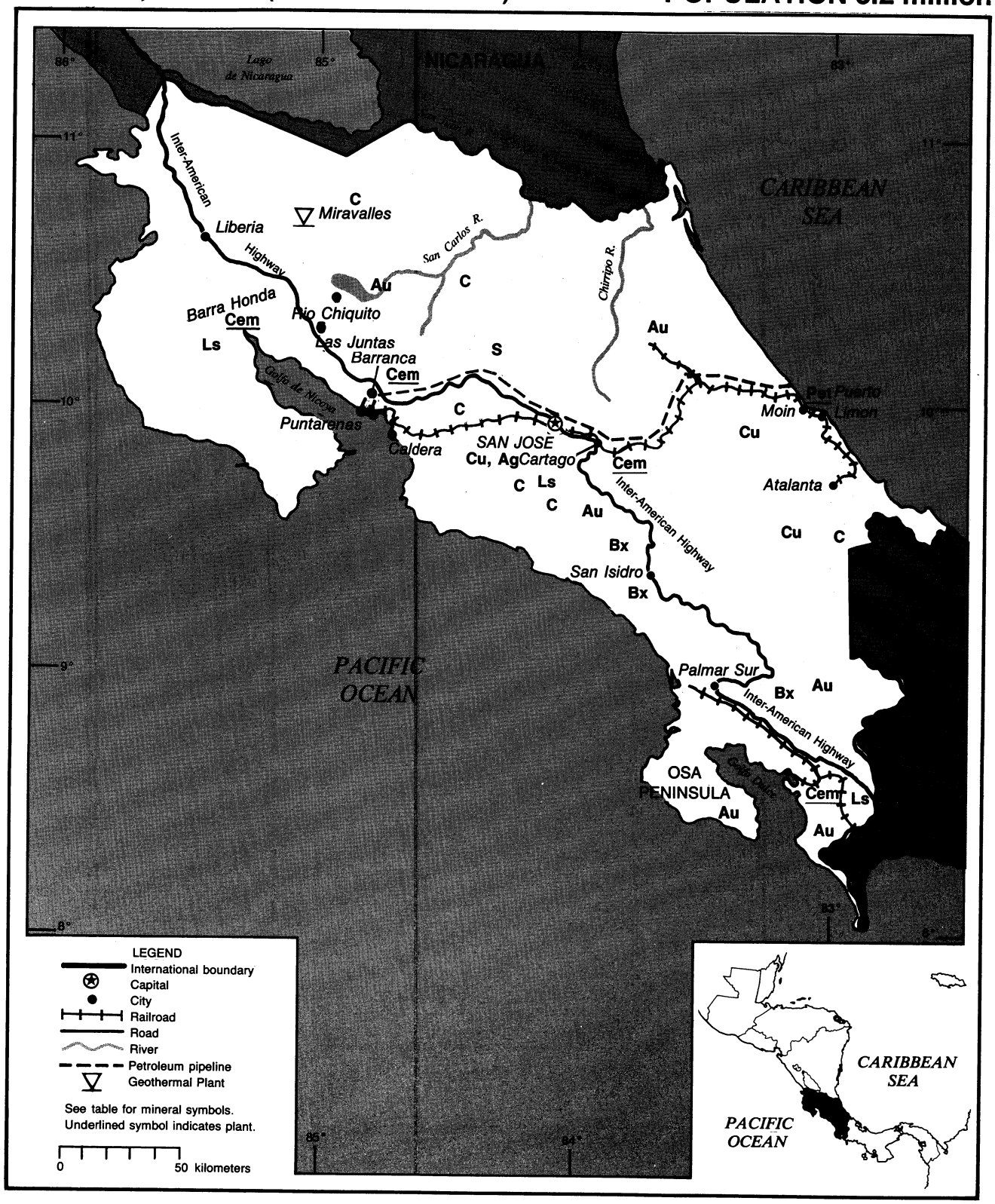
COLOMBIA: RESERVES OF MAJOR MINERAL COMMODITIES FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Reserves
Asbestos, fiber	17,000
Coal, all types	22,000,000
Gold, metal	2
Iron ore, 45% Fe	100,000
Limestone	900,000
Natural gas	
million cubic meters	204,000
Nickel, 2% Ni	62,000
Petroleum	
million 42-gallon barrels	4,000
Phosphate rock	450,000
Platinum, metal	1
Sulfur, 28% to 34% S	300,000

COSTA RICA

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



THE MINERAL INDUSTRY OF

COSTA RICA

By George A. Rabchevsky

The Republic of Costa Rica is a Central American country, sandwiched 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 in the United States. The topography of Costa Rica is rugged from northwest to southeast and surrounded by plains on both coasts. Costa Rica has one of the most stable democratic governments in Central America.

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. Costa Rica was the world's second largest producer of bananas. The agriculture industry grew by 3%, while the construction industry fell by 7.5% in 1992. GDP in 1992 was estimated to grow by about 5.5% to an estimated $6.1 billion[1] at current prices. Inflation was estimated to have decreased to 10%, while unemployment was estimated at 6%.

The mining industry contributed very little to Costa Rica's economy. 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. It is a byproduct of gold mining, and production parallels the trends of gold production. 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 December 1989, Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua signed the Central American Agreement for the Protection of the Environment. This pact established a regional commission to determine the most appropriate strategies to promote environmentally sustainable development of the region's natural resources.

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. In 1992, the value of goods exported to the United States was reported at $1.4 billion.[1] Costa Rica imported $1.3 billion worth of goods from the United States. The country imported crude petroleum from Mexico and Venezuela under the San José Accords. Crude oil also was imported from Colombia and Ecuador. The majority of petroleum products was imported from. Colombia, Ecuador, Mexico, Netherlands Antilles, and the United States. Other trading partners were Germany, Guatemala, Japan, the Netherlands, and the United Kingdom.

In November 1990, Costa Rica and the United States signed a Framework Agreement on Trade and Investment.

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 United States companies were primarily involved in a number of gold and silver exploration and mining operations. *(See table 2.)*

COMMODITY REVIEW

Metals

Gold and silver production in Costa Rica was primarily in the 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. The mine, near Las Juntas, was about 110 km northwest of San José. The Tres Hermanos Mine had an estimated reserve of 2,800 kg of gold. The mill near Matapalo was being expanded. The newly acquired underground mine, San Martín, about 15 km from the Matapalo mill, had 2,300 kg of proven gold reserves. Exploration continued to the north of the mine. The San Martín deposit reportedly is the largest gold producer, previously producing 20,000 tons of gold at an average grade of 18 g/t.

The El Recio gold deposit in the Abangares District was held by Greenstone Resources Ltd., Ontario, Canada. Combined open pit and underground gold reserves were estimated 374 ounces at an average grade of 0.22 oz/t. The company hopes to have the project on-stream during 1993.

The fate of the Río Chiquito open pit gold mine in Guanacaste Province was still unclear. Early in 1992, Newmont Mining Corp. reportedly signed a preliminary 15-month agreement to explore gold on the 6,000-ha property in Río Chiquito. The property was owned by Mallon Resources Corp., Denver, Colorado. Newmont also indicated that proven reserves of the Río Chiquito deposit did not meet its requirements.

Industrial Minerals

Costa Rica produced bentonite, cement, crushed rock, diatomite, lime, limestone and sandstone, sand and gravel, and pumice. Except for clays and lime, most commodities were consumed internally.

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. At present, only the Loma Camastro deposit, northeast of Liberia, is being mined. Limestone was quarried primarily for the use in the manufacture of cement. About 20% of limestone was used to produce aggregate, dimension stone, and lime. Salt was produced by the solar evaporation of brine, primarily around the Golfo de Nicoya. The country was self-sufficient in salt and was able to increase production should the demand arise.

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 demand.

Crude oil and natural gas were not produced in the country. Costa Rica imported most of its oil requirements from Mexico and Venezuela, as well as from other countries. The only company in Costa Rica producing petroleum products was RECOPE. Its Moin refinery was in Limón 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 is best developed on the central plateau. More than 7,000 km of roads was paved, another 7,000 km gravel roads, and about 1,400 km dirt roads. The major ports in Costa Rica are Caldera, Golfito, Moin, Puerto Limón, and Puntarenas. There is a 730-km seasonably navigable inland waterway. There is 950 km of railroad tracks, linking Puerto Limón 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.

The country had 927 MW of installed electrical generating capacity, 85% of which came from the hydroelectric plants. Construction continued on the 32-MW Sandillal hydroelectric plant and the 55-MW Miravalles geothermal plant. Preliminary work was begun on the 90-MW Toro hydroelectric complex.

OUTLOOK

The Government's privatization efforts were expected to continue with emphasis during 1993. Privatization plans[2] in Costa Rica include the following entities: RECOPE, which monopolizes imports of fuel and crude oil and delivery of petroleum products to gas stations; Fertilizantes de Centro America, S.A., controlling the fertilizer industry in the country; and Cementos del Pacífico, S.A., the only Government-owned cement company in Costa Rica. In addition, foreign investors will continue receiving encouragement to explore for new gold deposits, modernize old mines, open new mines, and explore for oil deposits.

Discovery of deposits of copper, gold, lead, silver, zinc, and other metals would be facilitated if more extensive mapping and exploration programs were carried out.

According to the Minister of Energy, Costa Rica will double its electricity capacity and its consumption of oil by the year 2005.

---

[1]Where necessary, values have been converted from Costa Rican colones @ to U.S. dollars at the rate of @139=US$1.00, the average rate for 1992.

[2]Details on these and other possible privatization plans are available from the law firm of Facio & Canas, Barrio Tournon, P.O. Box 5173, San José 1000, Costa Rica. Telephone: 506-21-1255; Fax: 506-55-1510; Telex: 2508 FAYCA; and also from the Minister of National Planning, Apartado 10127, Ministerio de Planificación, Programa Reforma del Estado. Telephone: 506-23-5565; Fax: 506-21-3282.

OTHER SOURCES OF INFORMATION

Agencies

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

Minera Nacional, S.A.
Apartado 5298, Zona 1000
San José, Costa Rica
Telephone: (506) 53-7555
Fax: (506) 57-0697

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

Publications

Berrangé, J. P., S. J. Mathers, M. Nury, and F. Alvarado. The Non-Metallic Industrial Minerals and Rocks of Costa Rica. Proyecto Anglo-Costarricense de Minerales Industriales, San José, Costa Rica, 1990, 181 pp.

Central Intelligence Agency, Washington, D.C.: World Factbook, annual.

Instituto Costarricense de Electricidad. Proyecto Geotérmico Miravalles-Miravalles Geothermal Project Report. San José, Costa Rica, 1989, 6 pp.

Latin American Mining Institute, Washington, DC: Mexico and Central America Investment and Mining Guide, annual.

Mathers, S. J., L. Chávez, F. Alvarado, and S. D. J. Inglethorpe. Detailed Investigations of Selected Costa Rican Diatomites. British Geol. Surv., Technical Report WC/90/35, Keyworth, England, 1991, 37 pp.

Mathers, S. J., J. E. Madrigal, and F. Alvarado. Results of an Initial Exploration Program for Bentonitic Clays in Costa Rica. British Geol. Surv., Technical Report WC/90/36, Keyworth, England, 1991, 24 pp.

Mathers, S. J., D. Harrison, and F. Alvarado. An Assessment of the Potential of the Barra Honda Limestone, Guanacaste Province, Costa Rica. British Geol. Surv., Technical Report WC/90/37, Keyworth, England, 1991, 29 pp.

U.S. Geological Survey, Dirección de Geología, Minas e Hidrocarburos, and Universidad de Costa Rica. Mineral Resource Assessment of the Republic of Costa Rica. Miscellaneous Investigacions Series Map I-1865 (folio), Reston, VA, 1987, 75 pp.

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

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992e
Cement		556,360	610,000	620,000	700,000	700,000
Clays, common e		200,000	[2]506,685	304,700	399,000	400,000
Diatomite e		[2]4,500	4,500	4,400	12,000	12,000
Gold	kilograms	313	387	e460	e550	550
Iron and steel: Semimanufactures		71,628	r86,619	r91,373	r89,757	85,000
Lime e		10,000	10,000	12,700	[2]8,655	9,000
Petroleum refinery products	thousand 42-gallon barrels	4,557	4,724	e4,500	r e2,500	3,000
Pumice		14,000	14,000	e4,900	e8,000	8,000
Salt, marine e		30,000	30,000	40,000	50,000	50,000
Silver e	kilograms	62	[2]194	200	370	400
Stone: e						
Crushed rock and rough stone	thousand tons	[2]1,500	1,500	1,450	[2]944	1,000
Limestone and other calcareous materials	do.	[2]1,015	[2]2,300	1,600	1,300	1,300
Sand and gravel	do.	[2]1,350	1,400	1,020	[2]1,047	1,100
Sandstone		[2]1,000	1,000	650	650	650

eEstimated. rRevised.

[1]Includes data available through July 1993.

[2]Reported figure.

TABLE 2
COSTA RICA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

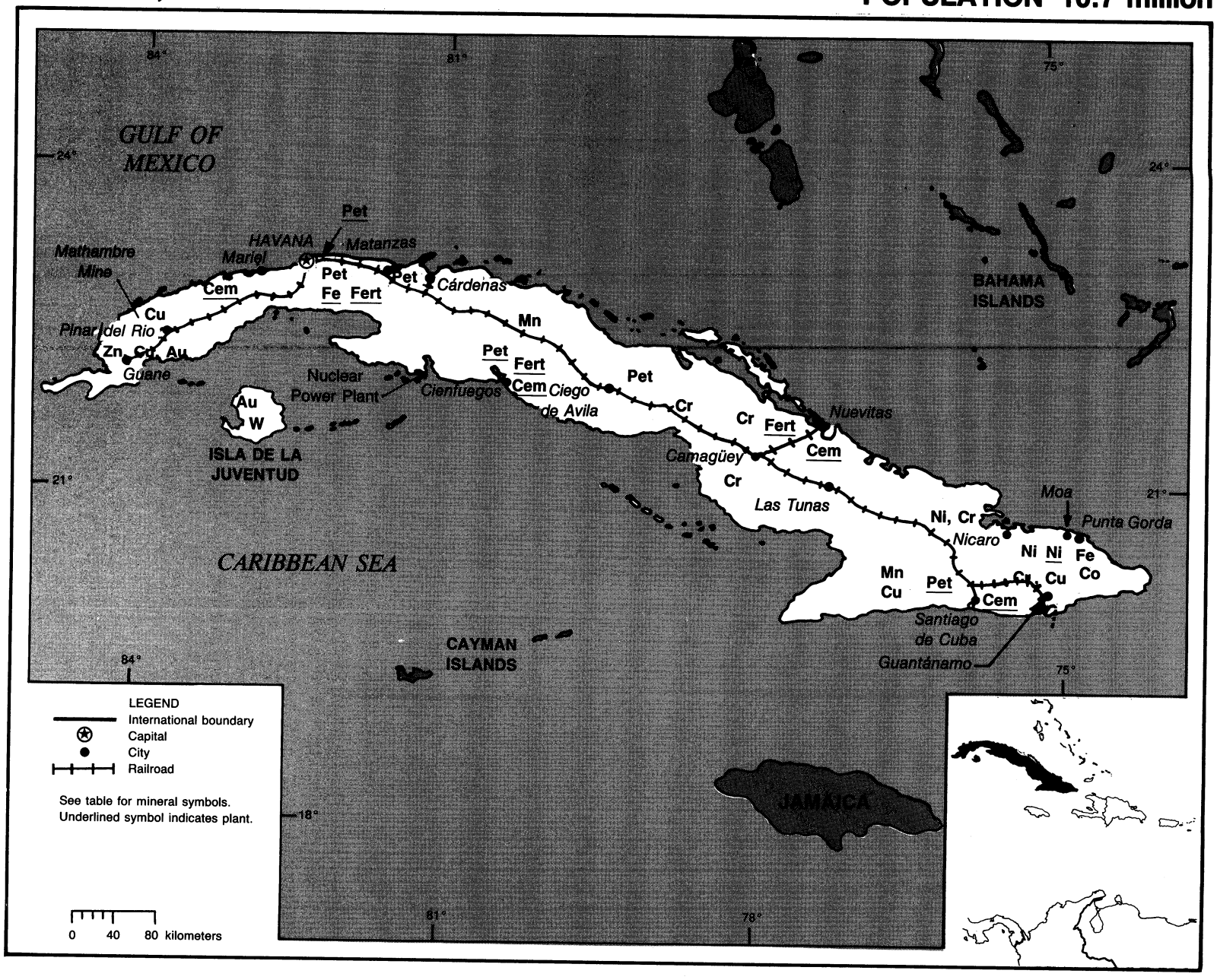
Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Industria Nacional de Cemento S.A. (INCSA) (private, 100%)	Aguas Calientes, Cartago, Cartago Province	425
Do.		Cementos del Pacífico S.A. (CEMPASA) (subsidiary of Corporacion Costarricense 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	[1]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, Limon Province	5,760

[1]Includes 200,000 mt/a of interbedded limestone and shale.

CUBA

AREA 110,861 km²

POPULATION 10.7 million



THE MINERAL INDUSTRY OF

CUBA

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 approximately 1,600 adjacent keys and islands, Cuba accounts for more than one-half of the West Indian land mass.

Mining has traditionally been Cuba's second most important industry after sugar exports. Before the 1959 revolution, Cuba produced between 4% and 9% of the world's nickel. Cuba's nickel reserves are among the world's largest and consist mainly of lateritic deposits. Small deposits of bauxite, chromite, cobalt, copper, gold, iron ore, manganese, and silver also exist, but their exploitation has declined or been discontinued. 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 primarily from the Commonwealth of Independent States and other countries. Recent Cuban exploration for new oil deposits has been unsuccessful.

Sugar was still the country's largest source of foreign exchange. Cuba's 1992 sugar harvest was estimated at 6.5 Mmt, compared with 7.6 Mmt in 1991 and 8.1 Mmt in 1990. Electricity and oil shortages and the lack of raw materials led to the closure of a number of factories and a decrease in the production of sugar. Cuba's gross national product fell by 5% in 1990 and a further 20% in 1991. The economy in 1992 has contracted at least 35%. The 30-year-old U.S. trade embargo was still in place.

GOVERNMENT POLICIES AND PROGRAMS

Cuba's National Assembly approved changes to the 1976 Constitution that would facilitate foreign investment. 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 without central Government permission, and recognizes foreign ownership of property in joint-venture deals. The Government will continue to control prices and wages and ration basic goods.

Cuba amended its constitution in 1992 to allow foreign companies to hold more than 50% equity in petroleum joint ventures with national enterprises. Cuba began offering foreign investors participation in joint oil exploration, drilling, and metal-refining projects. The offer was made when 130 companies from 18 countries met with Cuban officials in Mexico in early June. Foreign investment also has been allowed in agriculture, biotechnology, pharmaceuticals, textiles, and tourism.

Cuba's President also expressed support for constitutional clauses linking economic development with the protection of the environment.

Cuba initiated energy conservation measures, which are summarized as follows:

- In August 1990, gasoline availability for Government vehicles was cut by 50%, with another 30% reduction in December 1991.
- In October 1990, gasoline supply for private cars was cut by 30%, before allowing 1.3 liters per week per car in December 1991.
- In mid-July 1992, electricity usage was cut during peak hours in factories, farms, and homes, and rolling blackouts were instituted in Havana.
- Nickel production was temporarily suspended at the new Soviet-built smelter in Moa.
- Farmers were urged to cultivate fields with oxen rather than tractors.
- Cuba imported about 1 million bicycles from China.
- Cuba cut transmission hours for the two television channels to 5 hours daily, and 9 to 14 hours on Saturday and Sunday.

PRODUCTION

Cuba continued to produce all the mineral commodities reported in 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 oriented toward exports. The disappearance and changing patterns of trade have caused 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 went up, according to some sources. *(See table 1.)*

TRADE

The main exports in Cuba's minerals sector were chromite, nickel-cobalt ore, and nickel metallurgical products.

The Cuban nickel sector has been one of Cuba's export areas hit by the U.S. trade embargo. The U.S. Treasury

Department has prevented metals from any country containing even a minimal percentage of Cuban nickel from entering the United States. Despite the U.S. embargo, Cuba continued to sell its nickel to Canadian and Western European companies and has managed to attract foreign investment in its domestic production sector.

Cuba was conducting far more trade with the West. Cuba's main trading partners in 1992 included Austria, Canada, China, Finland, France, Germany, Ireland, Italy, Japan, Mexico, Spain, Venezuela, and other Latin American countries. China was the country's largest trading partner. Most Cuban trade was based on the hard currency, a revolutionary change from the 1980's.

The National Registry for Foreign Trade Commission Agents, a body 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. There were about 200 foreign firms registered to do business in Cuba.

International trade continued to be important to the Cuban economy. Cuba's imports regularly exceed its exports. The former U.S.S.R. continued to supply Cuba with raw materials. Virtually all petroleum was imported at subsidized prices, primarily from the former U.S.S.R. Cuba supplied 1 Mmt of sugar to Russia in the first half of 1992 in exchange for 1.8 Mmt of oil. The tradeoff was much smaller than the amounts formerly exchanged. A similar agreement was signed with Kazakhstan, but for a smaller amount.

More than 80% of Cuban imports came from the former U.S.S.R. and Eastern Europe until 1989-90, when collapse and chaos replaced the orderly trade system of the Communist bloc. In 1992, the former member countries of the CMEA imported about 7% of Cuba's exports, compared with an 81% share in 1989.

The CIS and Cuba signed agreements on trade and economic cooperation and shipping and initiated a protocol for trade exchanges and payments for 1993. Priority would be given to developing new forms of economic relations, such as bartering, industrial cooperation, and joint ventures. Future financial relations would be based on world market prices.

General trade agreements were signed with six Republics of the U.S.S.R., including Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Tajikistan, and Ukraine, and with Latvia and Lithuania. These agreements will be in force for 5 years.

On March 1, Granma International announced that China and Cuba signed a trade protocol and agreements related to the development of economic cooperation. Cuba was one of China's main trading partners in Latin America. Under this protocol, Cuba will export nickel to China for the first time.

The United Nations Development Program (UNDP) signed an agreement in Havana to continue supporting the Cuban mining industry. This program includes the development of nonferrous minerals (cadmium, chromite, copper, manganese, tungsten, and zinc) and industrial minerals (bauxite, bentonite, calcium carbonate, dolomite, feldspar, gypsum, magnesite, phosphorite, and silica). Pilot plants were planned for Santa Lucia, Pinar del Río Province, and Arroyo Naranjo, Havana city. Reportedly, Cuba has large deposits of these minerals. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

The mineral industry in Cuba was centrally controlled by the Government. The Ministry of Basic Industry managed all geological, mining, and petroleum operations since 1980. The exploration and production of industrial minerals was under the Ministry of Construction Materials Industry (Ministerio de Industria Materia Construcción).

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 National Bank, the Cuban Chamber of Commerce, and with the various Cuban state enterprises. CTM has been assigned overall responsibility for ultimately resolving all questions on joint venture to provide interested investors with rapid and definitive responses. The final approval for any joint venture lies with the former U.S.S.R. the Executive Council of Ministers, usually chaired by President Castro. *(See table 4.)*

COMMODITY REVIEW

Metals

Cobalt.—Cuba's reserves of cobalt were estimated to be the world's largest. The lateritic deposits in the Moa Bay and Nicaro areas of Holguín Province contain on average 0.1% cobalt. Cobalt was produced at the rate of 1,600 mt/a of contained metal in sulfide and oxide form as a byproduct of nickel ore processing at the Moa Bay and Nicaro plants. Potential cobalt production was based as follows: Pedro Soto Alba plant in Moa with 2,000 mt/a, René Ramos Latour plant in Nicaro with 1,300 mt/a, and Ernesto Ché 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 the Western countries. The cobalt concentrate from Pedro Soto Alba plant was reportedly exported to Canada.

Copper and Gold.—Copper mining started in Cuba at the end of the 19th century. Copper is the island's second largest metal industry after nickel. The only copper refinery in Cuba, the Conrado Benítez Enterprise, in San Jose, was under construction. The plant will operate two furnaces, with the capacity of 30,000 tons of blister copper per year. The processing equipment came from Italy and Britain, where the personnel were also trained. Cuba continued to be reliant on copper imports.

Miramar Mining Corp. in Canada and

an Australian company, Matlock Mining, announced in December 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 Río, 285 km west of Havana. The feasibility study estimated copper reserves at 3.9 to 4.85 Mmt grading from 1.3% to 3.47% copper. Copper output in the first 4 years would average 19,000 mt/a. The Delita gold deposit is located on Isla de la Juventud, 80 km south of mainland Cuba. The gold reserves in the Delita deposit were estimated at 9.4 to 15.4 Mmt, grading 0.10 to 0.14 ounces of gold per ton. The gold occurs in a shear zone, about 700 meters long, 10 meters thick, and extending 180 meters deep. The feasibility study specifies plan to mine the gold in an open pit operation. Production from the open pits was planned to start within 12 to 14 months of final approval from Cuba and the completion of project financing.

Gold deposits also were being explored on the Island of Isla de la Juventud and in Pinar del Río in western Cuba.

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 Empresa Metalúrgica José Martí, in Cotorro, Havana Province. In December 1991, Acinox took over that plant and renamed it to the prerevolutionary name of Antillana de Acero.

The second largest steel producer in Cuba, Acinox, in Las Tunas, for the first time produced stainless steel in June, with 150,000 tons of slab. Acinox was the first privately run steel company in Cuba. The plant's 60-ton electric arc furnace was supplied to Cuba under a long-term agreement with Danieli, an Italian firm. Acinox was negotiating agreements with Latin America, the Far East, and Europe to supply slabs.

In 1991, the U.S.S.R continued helping Cuba with the construction of the Antillana iron and steel plant.

Nickel.—Cuba was the world's fifth largest producer of nickel. Reportedly, Cuba's nickel reserves were second only to New Caledonia. Cuba accounted for about 37% of the world's known nickel ore reserves, located on the island's northeast coast near the town of Moa. Cuba's estimated reserves of 19 Mmt of nickel ore have a metal content of 0.8% to 1.4%. Other estimates of the lateritic ore indicate 1 billion tons of nickel ore averaging 1.2% to 1.5% metal content, with 80 Mmt of cobalt, 40 Mmt of manganese, and 18 Mmt of chromite. Most of the nickel produced was recovered from sulfide ores. Cuba nationalized the nickel mines and processing plants in the late 1950's.

All Cuban plants produced nickel sulfate, powdered and granulated nickel sinter, and nickel oxide, with a total capacity of about 77,000 mt/a. Government-run Empresa Niquelífera operated three plants in the Holguín Province of eastern Cuba. The refineries were based on the ammonium carbonate-leaching process. Fifteen tons of fuel oil was necessary for each ton of nickel produced. The largest plant, Ernesto Ché in Punta Gorda, had a capacity of 30,000 mt/a, the Pedro Soto Alba plant in Moa had a capacity of 24,000 mt/a, and the René Ramos Latour plant in Nicaro had a capacity of 23,000 mt/a. The nickel deposits in Nicaro have been mined for the longest period. The minable portions of the deposits covered about 200 km in a mountainous region.

The construction of the fourth nickel plant in Las Camariocas was 65% completed. The plant is near Moa, about 10 km from the Punta Gorda refinery. The U.S.S.R. and CMEA provided technical and financial aid to that plant, but now it is on hold because of adverse economic developments in the U.S.S.R. and Eastern Europe.

On March 20, an earthquake caused some structural damage at the Ernesto Ché Guevara nickel plant. It was not known whether nickel production had been affected. The plant, built with Soviet technology, was temporarily closed in the second half of 1990 because it was using too much fuel after the former U.S.S.R. cut oil supplies to Cuba. At the end of 1991, a Spanish private company, Miesa SA, formed a joint venture with Cuba to introduce energy-saving measures, starting with the modernization of this plant.

Cuba's nickel industry began recovering from the blow dealt to it by the loss of its traditional markets in Eastern Europe and the former U.S.S.R. and by the loss of subsidized fuel it received in part-payment. Until 1989, these markets accounted for more than 80% of Cuba's nickel exports. In 1991, about 70% of its nickel was exported to Europe, with a smaller portion to India and the Far East, and 30% to the U.S.S.R. Reportedly, about 8,000 tons of nickel was exported to Canada in 1991, and perhaps the same in 1992. During the 30 years of the U.S. embargo (1961-90), Cuba exported a total of 1 Mmt of nickel. Cuba currently exports nickel to 45 companies in 25 free-market countries.

Cuba's estimated mine production was about 40,000 tons of nickel in 1992. The decline of production in 1990 and 1991 was attributed to the collapse in trade with the U.S.S.R. and other East European countries. In 1992, Cuba did not provide nickel ore to the Russian Orsk combine in the Urals. In 1992, nickel exports accounted for 14% of the total export market.

The UNDP has contributed more than $4 million since 1966 to Cuba for the development of techniques for processing lateritic minerals in Cuba. In 1992, the UNDP signed an agreement for the completion of a nickel pilot plant in Moa for extracting cobalt and nickel from lateritic ores.

The Canadian mining company, Sherritt Gordon Ltd., entered into a 5-year $1.2 billion investment program in the nickel industry.

Industrial Minerals

Cement.—All of Cuba's cement production has been for local consumption. Six cement plants were operating, the largest in Mariel, accounting for about 30% of total production. Reportedly, several cement plants were shut down because of

shortages of oil, electricity, and spare parts.

Fertilizers.—Cuba depends on imports for its fertilizers. Cuba imports about 100 different fertilizer products. Previously, phosphatic, potassic, and nitrogenous fertilizers were imported from the former U.S.S.R. Cuba's small nitrogenous fertilizer industry is insufficient to supply domestic needs. The nickel industry uses an ammonia-leaching process to extract nickel. The largest ammonia plant is in Cienfuegos, followed by Nuevitas and Raúl Cepero Bonilla.

Marble.—In addition to the Isla de la Juventud, marble deposits occur in four provinces on the mainland. The quarries on the island, 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. The Cuban marbles come in black, green, lilac, pink, and red colors. Marble was exported to Colombia, Europe (primarily to Italy), and Mexico.

Zeolite.—Cuba has about 25 zeolite deposits, with four processing plants. Reserves of zeolite in Cuba were estimated at 200 Mmt. Production of zeolite was estimated at 600,000 tons, 120 times greater than in 1986. The most recently opened mine is at Sierra Najasa, 600 km east of Havana, with about 8 Mmt of reserves. A processing plant was under construction at the mine.

Reportedly, Cuba exported zeolite to Canada, Colombia, Italy, Spain, Venezuela, and other countries.

Mineral Fuels

Cuba is dependent on imported oil to complement its domestic energy supply. Until recently, the former U.S.S.R. supplied 95% of the island's oil needs under a petroleum-for-sugar barter arrangement. Dominating Soviet deliveries were crude (55%), residual fuel (30%), and diesel (10%). On January 1, 1991, Russia revised its commercial relations with Cuba, which had to begin trading its sugar for petroleum largely on the basis of world prices.

The problems with electricity generation continued because of shortage of fuel. More than 90% of electricity is generated in Cuba by using fuel oil. There were 3 to 8 hours of power cuts per day in 1992 affecting all occupied buildings, except hospitals, schools, and tourist hotels. Rationing of gasoline and electricity started on September 26, 1990. The residential sector consumed about 40% of the total electrical power produced in Cuba.

On the Isla de la Juventud, electricity was being generated by using diesel and fuel oil for the first time in Cuba. The island is not connected to the national electric power system.

About 25% of electricity was generated in Ciego de Avila Province using natural gas from oil wells as an alternative source of energy. Biogas and windmills were also being evaluated as alternative sources of energy.

Petroleum.—Cuban oil production, which is derived mainly from 10 fields in the North Cuban Basin in Havana and Matanzas Provinces, rose from 268 bbl/d in 1960, to 5,227 bbl/d in 1980, and to 17,958 bbl/d in 1986, the highest level ever reached. Cuba produces about 15,000 bbl/d of oil from three fields: Boca de Jaruco, Pina, and Varadero. The Varadero field produces 75% of the oil in Cuba. The Cuban oilfields supplied only about 6% of domestic requirements.

The increased production of crude oil in 1992 was attributed to the secondary recovery techniques introduced by a Canadian firm, Canada Northwest Energy (CNE). Almost all crude oil in Cuba is heavy grade with sulfur content of about 4% that must be blended with imports to be refined locally. The area in Ciego de Avila Province produces a small amount of light crude oil, with about 432,400 bbl/a. In that Province tests were conducted to increase the production of oil. The heavy oil was also used in the thermal plant in Mariel and in dry process cement plants.

Reportedly, a small oil deposit was discovered in Ciego de Avila Province, with production estimated at 400,000 to 466,000 bbl/a of crude oil. Information was not available on the current status of that deposit.

The dissolution of the U.S.S.R. greatly diminished technical aid to Cuba's oil sector. Previously Cuba earned almost 40% of its hard currency by reselling part of its subsidized Soviet oil abroad. The decline in sugar production hampered Cuba's ability to earn convertible currency to pay for the imported oil, including freight charges. In 1992, Cuba imported 45 Mbbl, of oil from the U.S.S.R., compared with 63 Mbbl in 1991, 73.5 Mbbl in 1990, and 95.6 Mbbl in 1989.

Cuba attempted to find other oil suppliers, including China, Colombia, Ecuador, Kazakhstan, Nigeria, Venezuela, and others. Between 1990 and 1991, Ecuador exported to Cuba almost 4 Mbbl of crude oil through the U.S.S.R. in a triangular agreement: the U.S.S.R. transported oil from Ecuador to clients in Europe, while Ecuador shipped crude oil to Cuba. To compensate for the loss of Eastern European expertise and to attempt to drill 60 wells per year, compared with 73 in 1990 and 63 in 1991, the Cuban Government signed a 6-year agreement with French companies Total and Compagnie Europeene des Petroles (CEP) in December 1990. They will explore a 2,000-km^2 block off the northern coast of Santa Clara, adjacent to the Cárdenas Bay area where the Soviets reportedly found oil and gas. Seismic work would precede the drilling of at least four wells, beginning in 1993.

Cuba continued its oil exploration program in the north of the Matanzas Province and south of the Camaguey Province. In May, Cuba announced two 4-year exploration agreements with Petrobrás Brasileiro, SA, Brazil (Braspetro), for onshore and offshore areas on the north coast of Cuba. Braspetro has the rights on block 12, a 3,100-km^2 onshore area in Mantanzas 220 km east of Havana, and on the adjacent 3,000-km^2 offshore area and a completely unexplored block IV area.

CNE signed three contracts with Cuba.

CNE was acquired in 1991 by Sherritt-Gordon in Toronto, which is a Canadian mining corporation importing nickel concentrates from Cuba.

Taurus Petroleum AB, a small Swedish oil exploration company, signed a contract to reinterpret seismic data from unsuccessful Russian wildcat efforts in a 17,190-km^2 area off the southern shore of Camaguey Province.

Cuba's oil reserves total only 75 to 100 Mbbl, with about 30 to 50 Mbbl in the offshore Varadero field and 20 to 30 Mbbl in Guanabo field, west of the Varadero field. Cuba's major sources of oil production in the 1950's were the Jatibonico and Cristales fields in west Camaguey Province, with only 210,000 bbl/a. Of less importance were the older Bacuranao, Cruz Verde, and Jarahueca fields. Later, new deposits were found with Soviet and Romanian help, such as Boca de Jaruco (1964), Guanabo (1968), Camarioca (1971), and Varadero (1971). The Soviets also discovered oil in Cárdenas Bay, southeast of Varadero. Both of these fields are adjacent to the tourist beaches.

Cuba operated five oil refineries, in the cities of Cabiguan, Cienfuegos, Havana, and Santiago de Cuba. The capacity of these refineries was about 53 to 61 Mbbl/a. Santiago de Cuba's Hermanos Díaz refinery was opened in 1989 with a capacity of about 14 to 22 Mbbl of crude oil and 180,000 tons of asphalt. The refinery in Cienfuegos became operational in 1992.

The Juragua nuclear powerplant, near Cienfuegos Bay on the south coast of Cuba, with two 440-MW reactor units, still stands incompleted. Construction of the first reactor is more than 90% complete, and 37% of the reactor equipment has been installed. The second reactor is 20% to 30% complete. Construction started in 1980, involving 300 to 450 Soviet technical advisers. The status of the reactor equipment for this unit is uncertain. Work was suspended on the plant on September 5, 1992. The U.S.S.R. began negotiating with Cuba to resume work on the plant. Guarantees also were needed to ensure the future supply of nuclear fuel for the plant.

INFRASTRUCTURE

Principal ports in Cuba were Cienfuegos, Havana, Mariel, Matanzas, and Santiago de Cuba, with 40 minor ports. The Havana port was the most important port in Cuba, handling about 40% of Cuba's cargo. Cuba had about 26,400 km of roads, of which about 14,400 km was paved, and the rest with gravel base. Less than 15,000 km was in railroad tracks, 5,300 km of which was standard gauge. Cuba's railroads were used primarily by the sugar industry.

Imported crude oil was offloaded in the large supertanker terminal 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

Cuba's economy in the near future is expected to remain in recession, especially for sugar and petroleum. The nickel industry also is expected to be badly affected by low prices and large stocks. However, according to the Cuban news agency Prensa Latina, Cuba plans to produce 80,000 tons by 1996 and 100,000 tons beyond that date. The three existing nickel plants are to be modernized and a fourth completed and brought into production under a 10-year investment plan at a cost of about $1.2 billion. The continued lack of fuels and capital will affect all mining and production facilities in Cuba.

The U.S.S.R. will most likely continue trading oil for Cuban sugar. In 1992, an economic and trade agreement was signed, providing for 1993 delivery of about 66,000 bbl/d of Russian crude oil and refined products in exchange for 1.5 Mmt of Cuban sugar.

Cuba expects to diversify its trade with Asia, Canada, the EC, and Latin America over the near term. Latin America will probably be its primary focus.

OTHER SOURCES OF INFORMATION

Agencies

Chamber of Commerce of Cuba
Havana, Cuba.
Ministerio de Industria Básica
Havana, Cuba.
Unión de Empresas del Níquel
Holguín, Cuba.

Publications

Anuario Estadístico de Cuba, Estatal de Estadísticas
Havana, Cuba: Annual report.
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]		1988	1989	1990	1991	1992e
Cement, hydraulic	thousand tons	3,566	r3,138	r e3,000	r e2,000	2,000
Chromite	do.	52	51	e50	e50	50
Cobalt[3]		1,783	1,825	e1,600	e1,600	1,500
Copper, mine output, Cu content		2,951	1,825	e2,800	e3,000	2,500
Gas, natural:e						
Gross	thousand cubic meters	21,900	34,000	34,000	34,000	36,000
Marketed	do.	4,524	4,000	4,000	4,000	4,500
Gypsume	thousand tons	130	130	130	130	125
Iron and steel: Steel, crude	do.	314	336	e270	e270	250
Lime e	do.	4179	180	180	180	160
Nickel:						
Mine output, Ni-Co content of oxide and sulfide		r43,928	46,509	r e42,000	r e34,000	40,000
Metallurgical products, Ni content:[3]						
Granular oxide and powder		12,620	14,354	e11,000	e10,000	11,000
Oxide sinter		11,211	11,856	e11,000	e10,000	11,000
Sulfide		18,314	18,475	e16,400	e16,400	17,000
Total		42,145	44,685	e38,400	e36,400	39,000
Nitrogen: N content of anhydrous ammonia	thousand tons	135	134	e140	e140	135
Petroleum:						
Crude[5]	thousand 42-gallon barrels	4,768	r4,775	r4,975	r5,150	5,300
Refinery products e	do.	4 50,839	55,000	53,000	53,000	55,000
Salt	thousand tons	201	206	e200	e200	185
Silica (industrial-sand and gravel)e		550	550	500	500	450
Sulfur, byproduct of petroleum e	do.	5	r6	5	r4	5

eEstimated. rRevised.

[1]Table includes data available through May 1993.

[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]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.

[4]Reported figure.

[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		1989	1990[p]	Principal destinations, 1990
METALS				
Aluminum:				
Ore and concentrate		971	NA	
Ash and residue containing aluminum		691	625	All to Netherlands.
Metal including alloys:				
Scrap		1,638	629	Do.
Unwrought		423	NA	
Chromium: Ore and concentrate		16,020	10,312	Germany 4,495; Austria 3,563; Mexico 1,530.
Copper:				
Ore and concentrate		[2]2,783	NA	
Ash and residue containing copper		28	459	All to Netherlands.
Metal including alloys:				
Scrap		1,804	2,548	Do.
Unwrought		9	NA	
Semimanufactures		NA	12	All to Indonesia.
Gold:				
Waste and sweepings	value, thousands	$9,595	NA	
Metal including alloys, unwrought and partly wrought	kilograms	NA	386	All to Germany.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite		NA	5,064	All to Spain.
Metal:				
Scrap		11,056	8,899	Italy 8,141; Netherlands 632; Germany 126.
Steel, primary forms		20	NA	
Semimanufactures:				
Flat-rolled products:				
Of iron or nonalloy steel: Not clad, plated, coated	value, thousands	$2	$11	All to Mexico.
Of alloy steel		NA	1	All to Spain.
Bars, rods, angles, shapes, sections		51,863	1,753	All to Mexico.
Wire		1,000	127	All to Spain.
Tubes, pipes, fittings		9	NA	
Lead: Metal including alloys:				
Scrap		2,404	1,923	All to Netherlands.
Unwrought		NA	187	All to Yugoslavia.
Semimanufactures		NA	90	Do.
Lithium: Oxides and hydroxides		144	1	All to Germany.
Nickel:				
Matte and speiss		339	4,107	Italy 3,500; Yugoslavia 250; Austria 142.
Oxides and hydroxides, Ni content		2	NA	
Sinter, Ni content		1,205	NA	
Metal including alloys:				
Scrap		409	NA	
Unwrought		813	149	All to Italy.
Semimanufactures		7	7	All to France.
Platinum-group metals: Waste and sweepings	value, thousands	$2,343	$2,617	All to Germany.

See footnotes at end of table.

TABLE 2—Continued

CUBA: APPARENT EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990[p]	Principal destinations, 1990
METALS—Continued				
Silver: Waste and sweepings	value, thousand	$7,811	NA	
Titanium: Metal including alloys, semimanufactures		1	2	All to Italy.
Vanadium: Ash and residue containing vanadium		117	104	All to Netherlands.
Zinc:				
Ash and residue containing zinc		585	NA	
Metal including alloys, scrap		391	314	All to Netherlands.
Other:				
Ores and concentrates		NA	18	All to Mexico.
Oxides and hydroxides		59	44	Argentina 43; Venezuela 1.
Ashes and residues		6	NA	
INDUSTRIAL MINERALS				
Asbestos, crude		206	NA	
Cement		[2]14,183	NA	
Clays, crude:				
Bentonite	kilograms	NA	88	All to Mexico.
Unspecified		12	54	All to Italy.
Diamond: Natural:				
Gem, not set or strung	carats	141	NA	
Industrial stones	do.	NA	3,850	All to United States.
Fertilizer materials: Manufactured:				
Nitrogenous		18	NA	
Phosphatic		650	NA	
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked		2,618	2,378	Colombia 1,245; Italy 795; Spain 200.
Worked		224	341	Spain 251; Netherlands 52; Mexico 38.
Gravel and crushed rock		NA	500	All to Germany.
Other:				
Crude		NA	58	Italy 45; Colombia 13.
Slag and dross, not metal-bearing		19	676	Spain 662; Netherlands 14.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum:				
Crude	thousand 42-gallon barrels	684	268	Italy 233; Spain 35.
Refinery products:				
Gasoline	do.	2,241	85	Germany 51; United Kingdom 34.
Lubricants	do.	NA	5	All to Norway.

[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. Unless otherwise specified, these data have been compiled from UN information and data published by the partner trade countries.

[2]Anuario Estadistico de Cuba, 1989.

TABLE 3

CUBA: APPARENT IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990[p]	Principal sources, 1990
METALS				
Alkali and alkaline-earth metals:				
Alkali metals		NA	4	All from Spain.
Alkaline-earth metals		NA	11	All from United Kingdom.
Aluminum:				
Oxides and hydroxides		92	185	China 184; Japan 1.
Metal including alloys:				
Unwrought		80	NA	
Semimanufacture		[2]15,500	1,484	Mexico 856; Yugoslavia 330; Argentina 251.
Arsenic: Metal includings alloys, all		1	NA	
Cadmium: Metal including alloys, all forms		2	NA	
Chromium: Oxides and hydroxides	kilograms	780	NA	
Cobalt: Oxides and hydroxides		NA	6	All from United Kingdom.
Columbium and tantalum: Ore and concentrate including vanadium		NA	66	All from Mexico.
Copper:				
Oxides and hydroxides	kilograms	5,000	11,353	Germany 11,000; Switzerland 353.
Metal including alloys:				
Unwrought		[2]7,815	22	Spain 21; Venezuela 1.
Semimanufactures		2,933	3,468	Mexico 1,647; Yugoslavia 1,461; Spain 118.
Gold: Metal including alloys, unwrought and partly wrought	kilograms	15	1,216	Canada 1,202; Italy 14.
Iron and steel:				
Iron ore and concentrate excluding roasted pyrite		217	597	Netherlands 369; United Kingdom 228.
Metal:				
Pig iron, cast iron, related materials		NA	13	Italy 10; Spain 3.
Ferroalloys:				
Ferrochromium		1,057	NA	
Ferromanganese		33	NA	
Ferrosilicomanganese		NA	483	All from France.
Steel, primary forms		316	9	Spain 5; Italy 3; United Kingdom 1.
Semimanufactures:				
Flat-rolled products:				
Of iron or nonalloy steel:				
Not clad, plated, coated		6,011	4,850	Brazil 3,058; Germany 875; Netherlands 380.
Clad, plated, coated		366	4,588	Brazil 3,180; Venezuela 653; Spain 390.
Of alloy steel		1,233	1,631	Brazil 620; Mexico 395; Spain 318.
Bars, rods, angles, shapes, sections		6,734	3,033	Spain 1,984; Germany 283; United Kingdom 225.
Universals, plates, sheets		[2]969,284	3,960	Colombia 3,921; Argentina 39.
Rails and accessories		50	NA	
Wire		7,873	11,977	China 8,720; Mexico 2,131; Venezuela 568.
Tubes, pipes, fittings		[2]84,709	8,868	Spain 3,388; Japan 1,505; Mexico 1,377.
Castings and forgings, rough		[2]239,544	71	All from China.
Lead:				
Oxides		105	66	Mexico 36; France 30.

See footnotes at end of table.

TABLE 3—Continued

CUBA: APPARENT IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990[p]	Principal sources, 1990
METALS—Continued				
Lead—Continued:				
Metal including alloys:				
Unwrought		1,494	933	All from Mexico.
Semimanufactures		122	144	Yugoslavia 75; Mexico 51; Spain 15.
Lithium: Oxides and hydroxides		1	NA	
Manganese:				
Oxides		265	152	Brazil 100; China 52.
Metal including alloys, all forms		264	26	All from Mexico.
Mercury		23	15	United Kingdom 6; China 5; Spain 4.
Molybdenum:				
Oxides and hydroxides	value, thousands	$13	NA	
Metal including alloys, semimanufactures		2	NA	
Nickel: Metal including alloys:				
Unwrought		NA	2	All from Germany.
Semimanufactures		NA	6	Germany 4; Spain 2.
Platinum-group metals: Metals including alloys, unwrought and partly wrought:				
Palladium	value, thousands	$4	NA	
Platinum	do.	$35	NA	
Silver: Metal including alloys, unwrought and partly wrought	do.	$21	$37	Canada $19; Venezuela $12; Mexico $5.
Tin: Metal including alloys:				
Unwrought		NA	53	China 52; Germany 1.
Semimanufactures		163	125	Mexico 124; Spain 1.
Titanium:				
Oxides		74	1	All from Spain.
Metal including alloys, all forms		1	2	All from Japan.
Zinc:				
Oxides		2,212	1,787	All from China.
Metal including alloys:				
Unwrought		48	118	Belgium-Luxembourg 50; Canada 50; Spain 18.
Semimanufactures		NA	6	Canada 4; Venezuela 2.
Zirconium: Ore and concentrate		NA	17	Spain 11; Mexico 6.
Other:				
Ores and concentrates		134	NA	
Oxides and hydroxides	value, thousands	NA	$9	Italy $6; Mexico $3.
Ashes and residues		NA	3	All from Italy.
Base metals including alloys, all forms		NA	3	All from Mexico.
Metalloids including elemental arsenic, phosphorus, and tellurium		NA	10	All from China.
Precious metals waste and scrap	kilograms	NA	12	All from Venezuela.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc.		12	4	All from Japan.
Artificial:				
Corundum		410	160	China 154; Germany 6.

See footnotes at end of table.

TABLE 3—Continued

CUBA: APPARENT IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990[p]	Principal sources, 1990
INDUSTRIAL MINERALS—Continued				
Abrasives, n.e.s.—Continued:				
Artificial—Continued:				
Silicon carbide		25	1,038	All from China.
Grinding and polishing wheels and stones		88	80	Italy 43; Spain 36; United Kingdom 1.
Asbestos, crude		2,013	1,063	Canada 500; China 400; Brazil 163.
Barite and witherite		2,015	NA	
Boron materials: Oxides and acids		355	201	China 200; Germany 1.
Cement		22,000	2,809	China 2,619; Spain 172; Argentina 18.
Chalk		17	NA	
Clays, crude:				
Bentonite		24	300	All from Spain.
Fuller's earth		NA	160	Do.
Kaolin		60	27	All from United Kingdom.
Unspecified		6,268	NA	
Diatomite and other infusorial earth		268	55	Mexico 52; United Kingdom 2; Switzerland 1.
Feldspar, fluorspar, related materials:				
Feldspar		NA	377	All from China.
Unspecified		172	NA	
Fertilizer materials:				
Crude, n.e.s.		NA	1	All from France.
Manufactured:				
Ammonia		[2]73,000	24	Germany 19; United Kingdom 5.
Nitrogenous		[2]623,000	59	All from Germany.
Phosphatic (total)		337,000	NA	
Of which:				
Superphosphate, simple		[2]311,000	NA	
Superphosphate, triple		[2]26,000	NA	
Potassic (total)		414,000	NA	
Of which:				
Potassium chloride		[2]394,000	NA	
Potassium sulfate		[2]20,000	NA	
Unspecified and mixed		336	NA	
Graphite, natural		NA	1	All from Japan.
Gypsum and plaster		368	357	Germany 300; Spain 30; Canada 27.
Iodine		4	5	All from Germany.
Magnesium compounds: Oxides and hydroxides		81	50	All from Austria.
Mica:				
Crude including splittings and waste		78	22	France 17; Mexico 5.
Worked including agglomerated splittings		147	64	Mexico 51; Spain 12; United Kingdom 1.
Phosphorus, elemental	kilograms	NA	1,018	All from Canada.
Pigments, mineral:				
Natural, crude		51	NA	
Iron oxides and hydroxides, processed		435	388	China 140; Spain 132; Germany 85.
Precious and semiprecious stones other than diamond:				
Natural	value, thousands	$14	$85	All from United Kingdom.
Synthetic	do.	$14	NA	

See footnotes at end of table.

TABLE 3—Continued

CUBA: APPARENT IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1989	1990[p]	Principal sources, 1990
INDUSTRIAL MINERALS—Continued				
Salt and brine		33	195	Germany 191; Switzerland 4.
Sodium compounds, n.e.s.:				
Soda ash, manufactured		3	9	All from Germany.
Sulfate, manufactured		88	NA	
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked		5,341	8	All from Colombia.
Worked		45	30	Argentina 16; Mexico 14.
Gravel and crushed rock		62	NA	
Sand other than metal-bearing		NA	70	Netherlands 63; Mexico 7.
Sulfur:				
Elemental:				
Crude including native and byproduct		NA	39,625	Mexico 19,921; Canada 19,704.
All forms		[2]154,191	NA	
Sulfuric acid		36	3	All from Switzerland.
Talc, steatite, soapstone, pyrophyllite		NA	20	All from Canada.
Other:				
Crude		NA	86	All from United Kingdom.
Slag and dross, not metal-bearing	value, thousands	NA	$1	All from Mexico.
MINERAL FUELS AND RELATED MATERIALS				
Carbon: Carbon black		2,815	4,854	Mexico 4,487; Colombia 279; China 88.
Coal:				
Anthracite		[2]193,861	NA	
Lignite including briquets		202	71	All from Mexico.
Coke and semicoke		[2]66,860	1,300	All from Colombia.
Peat including briquets and litter		151	114	All from Germany.
Petroleum:				
Crudebarrels		243,312	NA	
Refinery products:				
Liquefied petroleum gas	do.	NA	72,402	All from Mexico.
Gasoline	do.	27,582	36,145	Trinidad and Tobago 35,496; Netherlands 603; United
Mineral jelly and wax	do.	33,961	11,455	China 8,794; United Kingdom 1,881; Germany 441.
Kerosene and jet fuel	do.	306,295	71,052	All from Trinidad and Tobago.
Distillate fuel oil	do.	482	522,588	Trinidad and Tobago 522,454; Germany 134.
Lubricants	do.	192,479	164,304	Netherlands 65,646; Italy 60,270; France 35,434.
Residual fuel oil	do.	1,210,329	1,561,224	All from Trinidad and Tobago.
Bitumen and other residues	do.	1,575	NA	
Bituminous mixtures	do.	NA	103	All from United Kingdom.
Petroleum coke	do.	38	NA	

[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. Unless otherwise specified, these data have been compiled from UN information and data published by the partner trade countries. The United States reported no mineral commodity exports to Cuba in 1990.

[2]Anuario Estadístico de Cuba, 1989.

TABLE 4

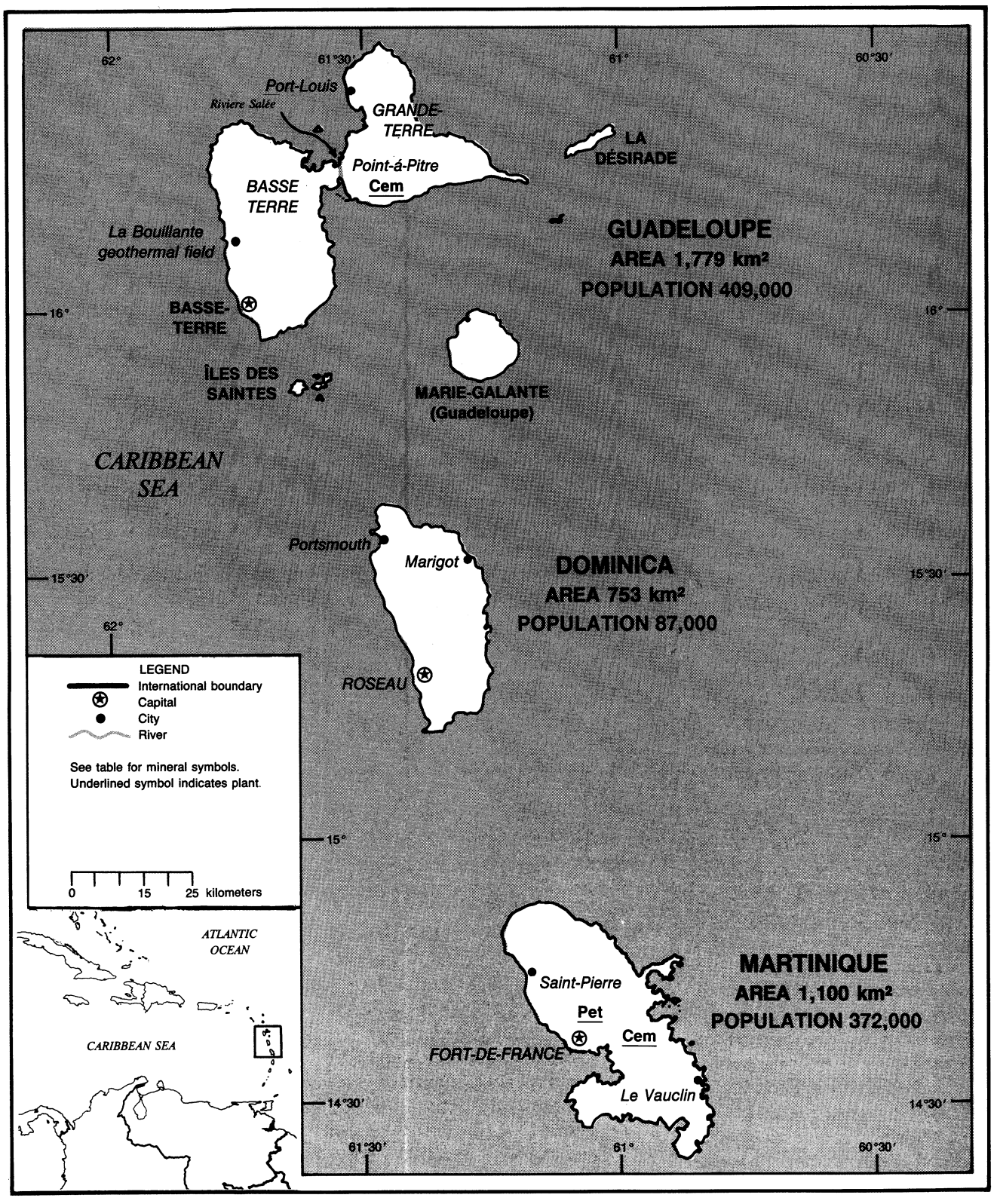
CUBA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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	40
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, Holguín 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	23
Petroleum:				
Crude	42-gallon barrels	Empresa de Perforación y Extracción de Petróleo (Government, 100%)	Northern coast area between Havana and Cárdenas	16,000
Refinery products	do.	Instituto Cubano del Petróleo (Government, 100%)	Refineries at Cienfuegos, Havana, and Santiago de Cuba	160,000
Steel		Antillana de Acero[1] (Acinox, 100%)	Cotorro, Havana Province	1,000
Do.		Acinox (Government, 100%)	Las Tunas, Las Tunas Province	150

[1]The name of Empresa Metalúrgica José Martí was changed in Dec. 1991.

DOMINICA, GUADELOUPE, AND MARTINIQUE



THE MINERAL INDUSTRIES OF

DOMINICA, GUADELOUPE, AND MARTINIQUE

By George A. Rabchevsky

DOMINICA

The island of Dominica is about 550 km southeast of Puerto Rico in the Caribbean Sea. The area of the island is slightly more than four times the size of Washington, DC. The rugged island is of volcanic origin, containing several hot and warm springs and a boiling lake.

Dominica is an independent state within the British Commonwealth. The economy of Dominica depends on the agriculture, which accounts for about 30% of the GDP, and employs 40% of the labor force. The tourist industry remained undeveloped because of a rugged coastline and the lack of an international airport. The unemployment rate in Dominica was about 10%.

Dominica produced clay, limestone, pumice, volcanic ash, and sand and gravel primarily for domestic consumption. Dominica was the leading producer of fresh water with exports to the other Caribbean islands. The electrical energy generating capacity in Dominica was 10 MW, about 60% of which was generated by hydroelectric plants and the rest from diesel. Dominica Electricity Services Ltd. was considering building additional hydroelectric plants and investigating geothermal prospects.

Dominica was dependent on imports for raw and semimanufactured materials. Metals were purchased from Antigua and Barbuda, Canada, Germany, Trinidad and Tobago, and the United Kingdom. Industrial minerals were imported from Barbados, Canada, France, the United Kingdom, and other countries. Dominica imported almost all of its gasoline from Venezuela. Dominica exported sand and gravel and crushed stone primarily to Guadeloupe and the Virgin Islands.

There was 750 km of roads, 370 km of which was paved. Roseau and Portsmouth were the major ports on the island.

GUADELOUPE

Guadeloupe, an Overseas Department of France, includes the islands of Basse-Terre, Grande-Terre, Iles des Saintes, La Desirade, Marie-Galante, St. Barthelemy, and the French side of Sint Maarten. The island is about 500 km southeast of Puerto Rico in the Caribbean Sea. The area of the island is about 10 times the size of Washington, DC. The Basse-Terre portion of the island is volcanic in origin, and the Grand-Terre area is composed of limestone formations.

Guadeloupe is dependent on France for large subsidies and imports. The economy depends on agriculture, tourism, light industry, and services. The unemployment rate in Gaudeloupe is high, about 40%. About 25% of the population was employed by industry, 20% by agriculture, and less than 1% by the mining industry.

The mineral policy of Guadeloupe is the same as other Latin American Overseas Departments of France. Mining played a small part in the island's economy. Industrial minerals were the only commodities produced on the island, including cement, lime, pumice, salt, sand and gravel, and stone. About 140,000 bbl/a of oil was refined on the island, from imported crude oil. *(See table 1.)* The electrical generating capacity of Guadeloupe was 171.5 MW.

Except for some cement and sand and gravel, all products were used domestically. Societe des Ciments Antillais, with an annual capacity of 500,000 tons, was the only operational cement company. In Guadeloupe, a cement plant was located in Pointe-a-Pitre and in Martinique in Fort de France. *(For trade, see tables 2 and 3.)*

The railroad was privately owned and used mostly by the plantations. Guadeloupe had a total of 1,940 km of roads, 1,600 km of which was paved. The shipping ports were Pointe-a-Pitre on the Grande-Terre and Basse-Terre on the Basse-Terre islands. Guadeloupe was the third largest container port of France.

MARTINIQUE

The island is 625 km southeast of Puerto Rico in the Caribbean Sea. The area of Martinique is slightly more than six times the size of Washington, DC. The island is a dormant volcano.

The island of Martinique, as Guadeloupe, is an Overseas Department of France. It also depended on France for large subsidies and imports. The economy of Martinique was based on fruit production, tourism, and light industry. The majority of the work force was employed in the services sector and in administration. About 7% of the population was employed by industry, with less than 1/2% in the minerals industry. The unemployment rate in Martinique was about 35%.

Mineral production on Martinique contributed little to the island's economy. The mineral policy of Martinique is the same as that of Guadeloupe. Industrial

minerals produced in Martinique included cement, clays, pumice, salt, sand and gravel, and stone. Petroleum products were refined by the Societe Anonyme de la Raffinerie des Antilles at Fort-de-France from imported crude oil. The capacity of the electrical energy generation was 113.1 MW, all from thermal plants.

Sand and gravel and petroleum products were exported to Guadeloupe. Fertilizers and crushed rock were also exported to the nearby islands. Imports were made up of cement, crude petroleum, fertilizers, gypsum, petroleum products, and steel semimanufactures. *(See tables 4 and 5.)*

There was 1,680 km of roads, 1,300 km of which was paved. The only major port on the island, Fort-de-France, is on the west coast.

OTHER SOURCES OF INFORMATION

Agencies

Bureau de Recherches Géologiques et Minieres
Abymes, Guadeloupe, French West Indies
Bureau de Recherches Géologiques et Minieres
Fort-de-France, Martinique, French West Indies
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

Publications

Central Intelligence Agency, Washington, DC: The World Factbook, annual.
U.S. Department of Commerce, International Trade Administration: Foreign Economic Trends and Their Implications for the United States, Dominica, annual.
Foreign Economic Trends and Their Implications for the United States, Guadeloupe, French Guiana, and Martinique, annual.

TABLE 1
GUADELOUPE AND MARTINIQUE: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992e
Guadeloupe:						
Abrasives, natural: Pumice e		220	220	220	230	220
Cement		241	215	225	r240	235
Martinique:						
Cement, hydraulic		240	244	250	r245	240
Lime e	metric tons	5,000	5,000	5,000	5,000	5,000
Petroleum refinery products e	thousand 42-gallon barrels	4,800	4,800	4,800	4,800	4,800
Pumice e		130	140	140	150	140
Salt e		200	200	200	200	200

eEstimated.
[1]Table includes data available through May 1993.
[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 2
GUADELOUPE: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1990	1991	Principal destinations, 1991
METALS			
Alkali metals	39	—	
Aluminum: Metal including alloys:			
Scrap	31,221	542	All to France.
Semimanufactures	1,585	2	All to Martinique.
Copper: Metal including alloys:			
Scrap	43,293	59	All to France.
Semimanufactures	49	—	
Iron and steel: Metal:			
Scrap	1,321	12	All to France.
Semimanufactures:			
Flat-rolled products:			
Of iron or nonalloy steel:			
Not clad, plated, coated	1,770	(4)	All to Dominica.
Clad, plated, coated	6,837	124	Trinidad and Tobago 90; France 17; St. Lucia 17.
Bars, rods, angles, shapes, sections	1,623	132	France 70; Martinique 62.
Wire	480	6	All to St. Lucia.
Tubes, pipes, fittings	814	2	All to French Guiana.
Nickel: Metal including alloys, semimanufactures	400	—	
Other: Ashes and residues	2,088	41	All to France.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.: Grinding and polishing wheels and stones	12	—	
Asbestos, crude	—	1	All to French Guiana.

See footnotes at end of table.

TABLE 2—Continued

GUADELOUPE: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Principal destinations, 1991
INDUSTRIAL MINERALS—Continued				
Cement		149,250	4,088	All to French Guiana.
Fertilizer materials: Manufactured:				
Ammonia		5,616	73	All to Martinique.
Unspecified and mixed		—	41	Martinique 21; French Guiana 20.
Salt and brine		94	8	Martinique 7; French Guiana 1.
Stone, sand and gravel:				
Dimension stone, worked		581	6	All to Martinique.
Gravel and crushed rock		2,400	—	
Quartz and quartzite	value, thousands	—	$2	France $1; Martinique $1.
Other: Crude		2,220	—	
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Liquefied petroleum gas	42-gallon barrels	19,790	197	Dominica 162; France 35.
Bituminous mixtures	do.	23	6	All to St. Lucia.
Unspecified	do.	637	43,463	Panama 43,400; Martinique 35; Dominica 14.

[1]Table prepared by H. D. Willis. Guadeloupe did not report any exports of mineral commodities to the United States during 1991.
[2]Unreported quantity valued at $1,000.

TABLE 3

GUADELOUPE: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

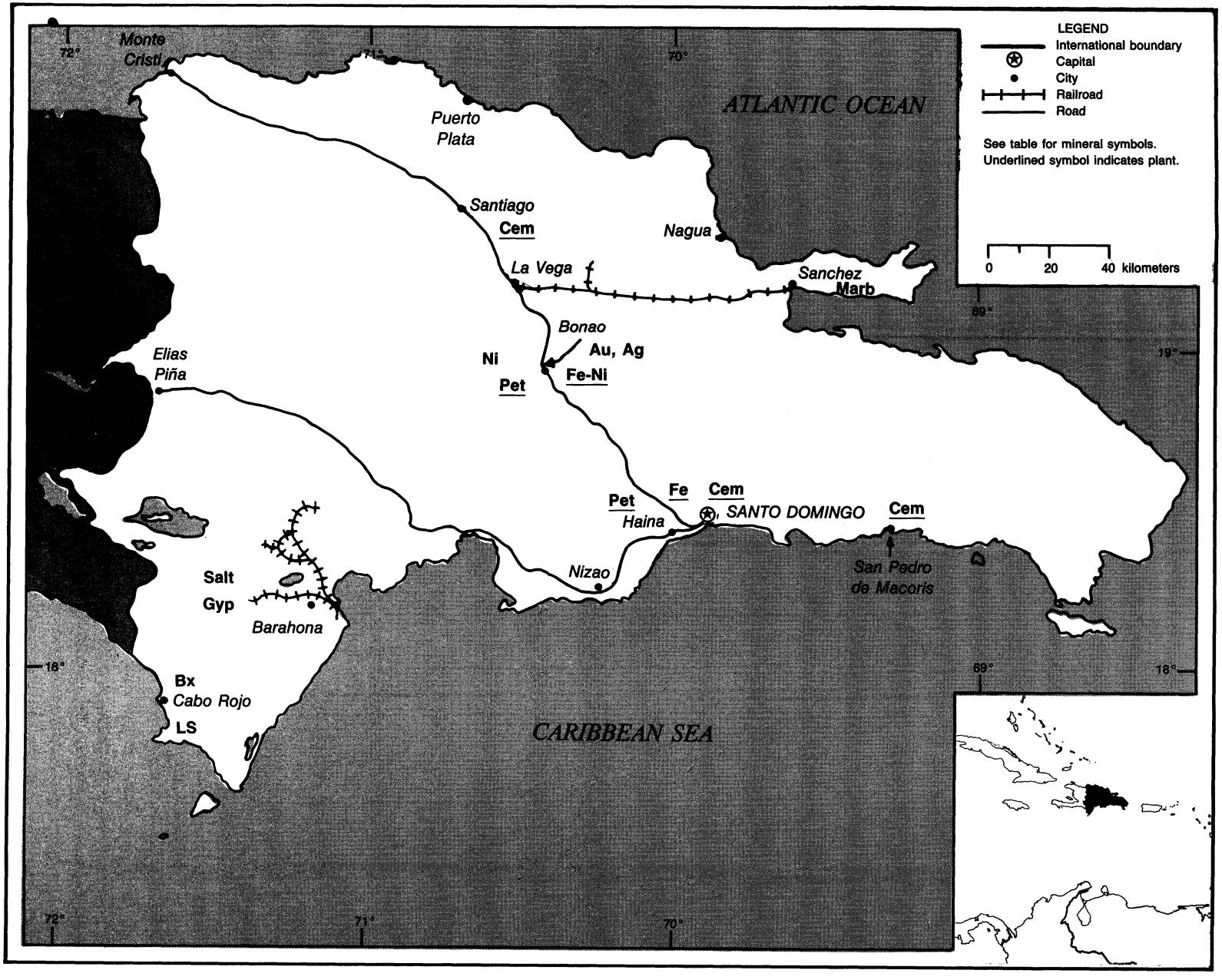
Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS					
Alkali metals		195	—		
Aluminum: Metal including alloys, semimanufactures		88,929	902	420	France 418; Germany 53.
Bismuth: Metal including alloys, all forms	value, thousands	—	$2	—	All from France.
Chromium:					
Oxides and hydroxides		552	1	—	Do.
Metal including alloys, all forms	value, thousands	—	$2	—	Do.
Cobalt: Metal including alloys, all forms		1	—		
Copper: Metal including alloys:					
Unwrought		36	—		
Semimanufactures		24,420	206	7	France 193; Austria 2.
Gold: Metal including alloys, unwrought and partly wrought	kilograms	400	12	—	Mainly from French Guiana.
Iron and steel: Metal:					
Pig iron, cast iron, related materials		1,100	16	—	All from France.
Ferroalloys:					
Ferrosilicon		1	—		
Silicon metal		—	7	—	All from France.
Steel, primary forms		—	1	—	Do.

See footnotes at end of table.

DOMINICAN REPUBLIC

AREA 48,700 km²

POPULATION 7.5 million



THE MINERAL INDUSTRY OF

THE DOMINICAN REPUBLIC

By David B. Doan

Production of the principal exportable minerals in the Dominican Republic generally declined slightly in 1992 compared with the previous year. World markets for gold and nickel continued sluggish at best, and prices weakened for both during the year. The 1992 GDP was estimated to be about $7.5 billion,[1] versus about $6.5 billion in 1991. Dominican mineral commodity production and marketing, a significant factor in its foreign-exchange position, thus was not greatly stimulated in the midst of high fuel costs and problems with the national power grid. One positive economic feature, however, was the conspicuous deceleration of inflation after the increases of 41% in 1989 and 101% in 1990. Monetary and fiscal austerity was finally invoked on a scale that produced results. Internal credit was held tight by stricter enforcement of reserve requirements for commercial banks and by suspending net internal financing (printing money) to satisfy deficits in the public sector. The fiscal picture was helped by removing costly consumption subsidies and spending less on public works. By thus holding the inflationary increase to 4% in 1991 and 7% in 1992, the Government demonstrated that it was in control.

The weakest link in the economy seemed to be the frequent and unpredictable electrical power outages that hit industrial and residential areas throughout the country. In early 1992 the lack of rain affected water impoundment and hydroelectric power generation, although by August the dams were filling again. But the underlying problem was that the country's 2,200-MW total generating capacity included 975 MW of private generators and only 40% of the population had access to electricity. The World Bank projects that the Corporación Dominicana de Electricidad will have to increase its output by 820 MW over the next 10 years. The tourist industry has boomed in the past few years, but a shortage of electricity could act to discourage tourism, which has brought in harder currencies and helped stimulate the economy.

GOVERNMENT POLICIES AND PROGRAMS

In March 1983, the Government introduced Decree 900 to redefine and clarify the role of the state in mining as established by Mining Act 146 of June 1971. The intent was to broaden opportunities for the private sector to join in common participation with the public sector in mining projects, merging state ownership of the resources with the technology and capital investment of the private sector. No major restrictions were imposed on foreigners, and 100% foreign ownership was not excluded. However, this mineral policy continued to be considered too restrictive, and investment has lagged. Also, low prices for mineral commodities in world markets have not helped to encourage potential investors to risk exploration capital. The Government's Director General of Mining commented that other Latin American governments are moving faster than the Dominican Republic to capitalize on mineral resources. He regretted that United States and Canadian firms were finding Bolivia, Chile, and Mexico more attractive because of their "streamlined" regulations governing exploration and mining. He noted that Mexico has literally revolutionized its mining laws, lowered taxes, allowed duty-free import of equipment, and done away with red tape while still maintaining international environmental standards.[2]

The situation seemed to be improving by mid-1992. Mitsubishi Corp. of Japan, Canyon Resources of Denver, Colorado, and Battle Mountain of Texas have all signed contracts with the Government to evaluate and develop precious- and base-metal deposits. Beyond these, Falconbridge, Ltd., through Falconbridge Dominicana (Folconda), began to exert new exploration efforts and ecological studies that would provide further mining opportunities through the year 2000.

The Government announced that, starting in 1993, Rosario Dominicana would commence gold extraction in the sulfide zone of the mine. After having taken over complete ownership of the mine from AMAX Inc. near the end of 1989, the Government continued a study of the potential for acid mine-water contamination of ground-water and surface-water supplies in a comparatively rich agricultural area, and concluded that appropriate techniques of mining and processing could preclude damage to water resources and supply. New processing facilities, dedicated to recovery from sulfide ore, required at least $200 million and probably 6 years of lead time. Tenders for bids issued by the Government led to a short list of bidders, with the winner to be selected in early 1993.

PRODUCTION

The continued sag in nickel prices on world markets hurt production of nickel generally and ferronickel in the Dominican Republic. Gold prices

worked somewhat lower through 1992. Silver did not live up to projected price rises and remained lethargic, as has been true for several years. All in all, the Dominican Republic's premier mineral products, gold, nickel, and silver, offered little by way of new market-driven mining incentive in 1992. Falconbridge Dominicana, however, was able to net a profit of about $21 million in the midst of lowered nickel prices by virtue of its relatively low operating costs.

Rosario Dominicana's gold output, showing a conspicuous downtrend since 1988, suffered not so much from the influence of world prices as from the effect of having mined out the oxidized zone and much of the transition zone at Pueblo Viejo in preparation for attacking the sulfide zone. The new equipment and processing circuits were not ready for handling sulfide ore, and probably would not be ready for many months if not years.

Other mineral-related commodities produced in the country included cement, gypsum, lime, limestone, marble, petroleum refinery products, salt, and steel. Output of bauxite dropped to zero, continuing a trend of a number of years.

TRADE

The Dominican Republic relied traditionally on its export revenues from bauxite, ferronickel, gold, and silver for income in hard currency, although bauxite has essentially disappeared as an export factor in the past 3 years. In order of decreasing value, metallic mineral commodity exports were tentatively projected at roughly 27,170 tons of ferronickel valued at $145 million, 2,230 kg of gold valued at $24 million, and 13,471 kg of silver valued at about $53,000. Among the industrial minerals, exports of gypsum approached 80,000 tons valued at $600,000, assuming $7.50 per ton. Limestone shipments totaled 115,217 tons, of uncertain pricing, mostly to foreign purchasers.

The United States imported a large proportion of these commodities, part of a total of about $2.1 billion of imports from the Dominican Republic in 1992. U.S. exports to the Dominican Republic were about $2.37 billion in total value.

Imports of mineral commodities centered on coal, crude oil, and petroleum derivatives. In order of decreasing value, projected import data for 1990 showed about 22.5 Mbbl of petroleum and derivatives valued at $508.7 million as well as an undetermined amount of coal valued at $5 million. Although these data are for 2 years prior, they can be taken to represent approximations for 1992. In past years more than one-half of the Dominican Republic's imports of petroleum crude were from Venezuela and secondarily from Mexico. The degree to which the country benefits from the San Jose Agreement on pricing of Mexican oil imports is not clear, partly because of the competitive nature of purchase agreements.

STRUCTURE OF THE MINERAL INDUSTRY

The Government agency responsible for promoting mining and metallurgical development, the Dirección General de Minería, is under the Secretaría de Estado de Industria y Comercio. Its functions cover technical, administrative, and legal matters. The Corporación Dominicana de Empresas Estatales (CORDE), a holding company, controls most of the mining entities owned by the Government.

Ownership of the mineral industry of the Dominican Republic, already somewhat mixed, is tending toward privatization. Rosario Dominicana, S.A. in Pueblo Viejo is owned by the Government, which has the majority interest in Fábrica Dominicana de Cemento in Santo Domingo; the two other cement companies, Cementos Cibao S.A. and Cementos Nacionales S.A., are privately owned. The Government has a minority interest in Falcondo, a subsidiary of Falconbridge Ltd. of Canada. The Refinería Dominicana de Petróleo in Haina is owned by the Government (50%) and Shell Internationale Petroleum Maatschappij B.V. (50%). In 1991, steps were begun toward joint-venture operations and possibly eventual private ownership in the gypsum and salt mining industries. *(See table 2.)*

COMMODITY REVIEW

Metals

Gold and Silver.—Output of gold and silver was down about 29% and 39%, respectively, compared with production in 1991. Although probably operating at a level below profitability, the mine has been kept in operation, nonetheless, because it generated hard currency that was more important to the cash-short Government than domestic peso profit or loss in the usual accounting terms.

Once the largest known single gold deposit in the Western Hemisphere, the Pueblo Viejo Mine began as a private venture in 1975 but was purchased by the parastatal company Rosario Dominicana in 1979. Although Rosario manages the mine, the central bank owns the gold and silver produced. In the face of exhaustion of gold ore in the oxide zone of its Pueblo Viejo Mine, Rosario Dominicana won Government permission to commence mining in the sulfide zone of the gold ore body, where it had been feared that mine waters would develop a sulfuric acidity and exert a deleterious effect on surrounding civil water supplies. A series of studies showed that formation of acid mine water could be controlled and perhaps even utilized for commercial production of sulfuric acid. Transition-zone mining would require about 3 years at a projected output of 17 to 24 kg/d. Sulfide-zone mining would then last for 15 to 30 years depending upon rate of extraction, tentatively put at anywhere from 30 to 68 kg/d. The gold-to-silver ratio of the transition zone is about 1 to 4, indicating a potential silver production there of 68 to 96 kg/d.

Mining of the sulfide ore will require construction of processing facilities costing on the order of $200 million. Bidding got under way in December 1991, and by yearend 1992 the best three proposals had been submitted by Davy-McKee Co. (United States), Paolo ABIB-

Andrade Guitierrez (Brazil), and MINPROC Corp. (Australia). Meanwhile, Rosario opted for fine grinding and flotation of sulfide-zone ore, rather than roasting, for reasons of both lower costs and better returns. What appeared to be a significant new gold discovery in the Cordillera Central west of Bonao came to light as drilling results showed about 2.3 Mmt grading 5.1 g/mt, including at least one zone grading 10 g/mt. The potential ore body was drilled only to relatively shallow depths, averaging 30 to 50 m, so that it remains open in two directions horizontally and also open in depth. The discovery is in the El Higo exploration concession taken out by Minera Hispaniola SA, a Dominican company owned by Canyon Resources Corp. (40%) and Battle Mountain Gold Co. (60%). A mining license has been applied for, and further exploration was to be carried on into 1993.

Nickel.—Smelter production of ferronickel included 27,535 tons of contained nickel, a decrease of about 5% compared with that in 1991, restoring the gentle downtrend that started in 1988. Price weakness continued from the previous year, quotations having dropped to a low of $2.39 per pound versus the previous year's low of $3.35 per pound late in 1991. The parent company in Sudbury, Canada, likewise reduced its output during the year in light of the weakness in prices.

Demand for nickel on world markets was generally good, but more nickel came into the market, particularly from Russia, than could be readily absorbed. This led several major producers to reduce their output as a means of stabilizing prices.

Falcondo, the country's only nickel producer, mined, milled, smelted, and refined nickel-bearing laterite ore extracted by surface mining. Output in 1992 represented about 86% of capacity. Despite low prices, Falcondo estimated that, having probably the lowest production costs in the world, it could still earn a profit at lower market prices than for most of the industry.

The company owned and operated a 20-MW powerplant near the mine and smelting facilities, hence protecting its production and export earnings. Excess electricity was routinely sold to the state-owned electric utility for the national power grid, thus helping to alleviate chronic power shortages.

Priority work continued at Falcondo on reducing gas and dust emissions at the plant, including new ventilation systems and changes in plant maintainance. Reforestation of mined-out areas continued, with trees planted on about 30 ha during 1992. In related work, water drawn from the Yuna River to be recirculated for cooling purposes at the pyrometallurgical plants has been neutralized and clarified and then monitored closely for quality before being returned to the river.

Industrial Minerals

Gypsum.—Output of gypsum in 1992 declined sharply to about 83,000 tons from 118,000 tons the previous year. Plans for a joint-venture gypsum mine on Government-owned land in the southwest part of the Province of Barahona were worked out during 1991, with a U.S. firm, Caribbean International Enterprise (CIE), having agreed to invest at least $3.25 million for quarry equipment and new docking facilities at the port city of Barahona. For its part, CORDE would dredge the harbor and upgrade the rail facilities for transport of the gypsum from mine to port. Expansion of output to a level of 1 Mmt/a was projected, with CIE agreeing to pay $5.50 per ton for material exported, for which the prevailing price had varied between $7.50 and $8.00. The Dominican Republic and Jamaica are the only sources of gypsum in the Caribbean, other than Cuba, but the Dominican product is reportedly of higher quality.

Marble.—Dominican marble comes in 14 varieties from a number of quarries owned by the Government in the northeast corner of the country on the Samana Peninsula as well as others in the southwestern Province of Barahona. Nearly all the marble produced is used locally for decorative pieces, tabletops, steps, and the like, with output catering to private homes and tourist projects, but not able to meet even local demand. This demand, thought to be 8,000 to 9,000 m^2/month, has induced plans for expansion of the industry. Several Italian, Japanese, and Taiwanese companies have expressed interest in importing these various marbles pending organization of production and modernization of the physical plants for finishing the material.

Mineral Fuels

Petroleum exploration has been undertaken on and off for several decades, particularly in the area of the north coast where past drilling resulted in oil shows. Production was achieved for a time during World War II in south-central Dominican Republic. Three companies were active in exploration in 1992: Mobil Dominican Exploration Inc., Petrolera Once Once, and Consolidated Development, the latter in the western Cibao Basin and the offshore shelf along the north coast. Mobil has concentrated its effort offshore along the southern coast.

Reserves

Falconbridge Dominicana estimated its nickel reserves at about 56.8 Mmt (dry) grading 1.60% nickel. Rosario Dominicana's reserves at Pueblo Viejo in the sulfide zone of the ore body were estimated at 70 Mmt with gold and silver contents of 4.0 and 19 g/mt, respectively. Reserves in the transition zone were estimated at 13 Mmt with 2.8 and 13 g/mt of gold and silver, respectively.

INFRASTRUCTURE

The Dominican Republic had 12,000 km of roads, including 5,800 km of paved roads, 5,600 km of gravel or other loose surface, and about 600 km of unimproved earth surface that may be seasonally impassable. The country had

1,655 km of railroads in four different gauges ranging from 0.558 m to 1.435 m. A total of 44 airports had been built at various times in past decades, but only 30 are presently in condition to be used. Of these, 12 have paved runways, 3 with runways from 2,440 to 3,659 m long, and 9 with runways 1,220 to 2,439 m long.

Major seaports include Santo Domingo, Haina, San Pedro de Macoris, Puerto Plata, and Barahona. A number of smaller ports line the coast, some of which may grow into major ports upon further development. Electricity is generated at diesel-fueled powerplants, having a total capacity of 2,200 MW, situated in various parts of the country. Private sources such as Falconbridge Dominicana sold excess electricity into the national grid. About 4.41 thousand GW·h of electric power was produced in 1991, or roughly 597 kW·h per capita, versus a Latin American regional average of about 1,110 kW·h per capita. As power distribution responded to need, increased tourism expanded the need.

OUTLOOK

The geology of the Dominican Republic has always suggested mineral wealth not yet known or tapped. Increased exploration can change this, and has to some extent, as demonstrated by the new El Higo gold discovery. The Government has been making a determined effort to get its fiscal house in order but not without stress to the overall economy. The Government also realized that the future of the Dominican Republic depends heavily on its existing mineral resources as well as those yet to be discovered. It is not only emphasizing the mineral search but calling international attention to the attractiveness of the exploration arrangements that can be made.

Although much will depend on agricultural production, as well as maintenance of fiscal and monetary stability, the mineral sector may well be the vehicle for increased stability and prosperity for the Dominican Republic.

[1]Where necessary, values have been converted from Dominican Republic pesos (RD$) to U.S. dollars at the assumed 1992 average rate of RD$12.76=US$1.00.

[2]State Department telegram 00960, U.S. Embassy, Santo Domingo, Dominican Republic. Jan. 31, 1992, p. 5.

OTHER SOURCES OF INFORMATION

Agencies

Dirección General de Minería
Edificio Gubernamental
Avenida México
Santo Domingo, República Dominicana
Tel. 685-8191-95

Corporación Dominicana de Empresas Estatales
Ave. Gral. Antonio Duvergé
Esq. José Contreras
Santo Domingo, República Dominicana

Publications

U.S. Embassy, Santo Domingo. Economic Trends Report. Airgram A-ll, Aug. 9, 1991, 12 pp.

Ellis, G. The Hispaniola Report. Gold in the Dominican Republic and Haiti. 1988.

De León, R. O. Museo Nacional de Historia Natural. Geología de la Sierra de Bahoruco. 1989, 112 pp.

International Monetary Fund (Washington, DC). International Financial Statistics, monthly and annual yearbooks.

Latin American Mining Institute, Washington, DC: Mexico and Central America Investment and Mining Guide, annual (includes a section in Dominican Republic.)

TABLE 1

DOMINICAN REPUBLIC: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[e]
Aluminum: Bauxite, dry equivalent, gross weight	thousand tons	168	151	85	7	—
Cement, hydraulic	do.	1,495	[r]1,600	1,060	1,231	1,300
Coal, subbituminous[e]		600	600	600	600	600
Gold	kilograms	5,785	5,238	4,354	3,160	[3]2,229
Gypsum	thousand tons	153	171	78	118	[3]83
Iron and steel:						
Ferroalloys, ferronickel		73,363	78,170	71,753	72,655	[3]68,838
Steel, crude		75,327	54,855	35,772	39,102	35,000
Lime		[e]36,000	18,000	4,000	—	—
Limestone		525,946	1,127,397	491,265	448,654	450,000
Mercury	kilograms	207	35	—	—	—
Nickel:						
Mine output, Ni content		29,345	31,264	28,700	29,062	[3]27,535
Metal:						
Smelter, Ni content of ferronickel		29,345	31,264	28,700	29,062	[3]27,535
Shipments, Ni content of ferronickel		32,377	28,944	28,696	28,028	[3]27,170
Petroleum refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	237	378	272	318	320
Gasoline, motor	do.	2,900	3,035	2,213	2,348	2,350
Kerosene and jet fuel	do.	1,038	1,042	692	1,144	1,150
Distillate fuel oil	do.	2,486	2,162	2,053	2,763	2,800
Residual fuel oil	do.	2,617	2,619	2,686	3,728	3,750
Total	do.	9,278	9,236	7,916	10,301	10,370
Salt[4]		37,532	30,258	11,339	[r]11,400	12,000
Silver	kilograms	39,595	22,614	21,630	21,954	[3]13,471

[e]Estimated. [r]Revised.

[1]Table includes data available through June 21, 1993.

[2]In addition to commodities listed, crude construction materials (sand and gravel, stone, etc.) also may 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 1992

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bauxite		Ideal Dominicana S.A. (Government, 100%)	Sierra de Bahoruco, Pedernales Province	200
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	561
Doré (gold and silver)	kilograms	Rosario Dominicana S.A. (Government, 100%)	Pueblo Viejo Mine, Cotui, Sánchez Ramírez Province	30,000
Gypsum		Sal y Yeso C. por A (Government, 100%; may privatize)	Barahona Province	NA
Nickel		Falconbridge Dominicana C. por A (Government, 10%; Falconbridge Ltd., 90%)	Mine and plant at Bonao, La Vega Province	30
Petroleum products	thousand 42-gallon barrels per day	Refinería Dominicana de Petróleo S.A. (Government, 50%; Shell Oil Co., 50%)	Haina, Distrito Nacional	30
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	NA
Steel		Metaldom (Government, 100%)	Santo Domingo, Distrito Nacional	100

NA Not available.

ECUADOR

AREA 283,560 km² (including Galapagos Islands) **POPULATION 10.9 million**

THE MINERAL INDUSTRY OF

ECUADOR

By Pablo Velasco

The mineral sector of Ecuador, despite its potential for gold, silver, and base metals mining, continued to be dominated by the petroleum sector's success and contributed almost one-half of the country's export revenues and Government budgetary revenues and 13% of the gross domestic product (GDP) annually over the past 6 years. In contrast, mining remains a marginal, unstructured, and little regulated activity. In 1992, formal mineral production amounted to about $119 million and generated less than 1% of the country's formal nonpetroleum-generated GDP and export revenues.

Following several oil discoveries in Ecuador's Amazonian region and new studies by the French Petroleum Institute, the country's proven reserves have almost tripled from 1.46 to 4.3 billion barrels in 1992. At the present rate of production the country's reserves will last well into the next century. Crude oil, unprocessed or semiprocessed oil, agricultural, fishing, and forestry products account for most of Ecuador's exports. The relatively small industrial sector produces largely for a protected domestic market. Exports of crude oil and its products accounted for 42.3% of the country's export earnings in 1992. Other major export commodities were bananas (25.5%), shrimp (17.5%), coffee (2%), and other minor exports (12.7%). The Ecuadorean economy grew in 1992 by a revised 3.5% in real terms, according to figures recently released by the Central Bank, continuing the economic reactivation that was initiated in 1990. The GDP totaled $12,483 billion,[1] in current U.S. dollars, with per capita income of $1,162. In 1992, the economy was led by the petroleum and the agricultural sectors, which grew by 4.7% and 4.9%, respectively. The petroleum and mining sectors grew by 4.8% owing mainly to the increase in production of crude oil by 4.7% as increased oil production offset weak oil prices. Manufacturing turned in a surprisingly strong performance, expanding by 4.5%, up from 2.5% in 1991, while the petroleum and mining sectors grew by about 4.9% and exports rose 12.3%. The construction sector remained in the doldrums. During the current administration the inflation rate went up from 49% in 1991 to 60.2% in 1992. The mining sector has been stated by Government officials "to be the future alternative source of the National income," should oil reserves deplete. However, this objective has remained largely neglected; much foreign investment is needed to create adequate infrastructure and the right environment to stimulate exploration.

In 1992, the nonfuel mineral sector registered an estimated 60% growth, mainly in the areas of industrial minerals and, to a lesser extent, metallic minerals, mainly gold. Ecuador, unlike its neighbors Peru and Bolivia, is not a country with a long established industrial mining history, and more than 90% of mineral production is in nonmetallic minerals. Crude oil production amounted to about 320,142 bbl/d in 1992; this was up 6.0% from that of 1991. This was far above the limits of 275,000 bbl/d stipulated by OPEC. In 1992, the newly established state-owned oil holding corporation, Petróleos del Ecuador (Petroecuador), continued to press expansion of the country's oil infrastructure. Construction was under way on a 130-km, small-diameter products pipeline between Santa Elena and Manta in Manabi Province to serve that coastal region. At present, the only underground producing mine in the country is the San Bartolomé Mine (Pb, Ag, Au, Zn). This mine was being operated by Armenonic del Ecuador S.A., at present a wholly owned subsidiary of Ag Armeno Mines & Minerals Inc. (previously Armeno Resources Inc.), a Canadian company based in Vancouver, British Columbia. Gold mining was of some importance.

GOVERNMENT POLICIES AND PROGRAMS

Ecuador continued its efforts to create a favorable investment climate to foreign and domestic investors in exploration and mining activities. These activities had been stimulated by both the country's mineral potential and by implementation of the Mining Law of August 1985 (Decree Law 06). Further reforms to the country's mining legislation have been discussed in Congress before being submitted to the President. The proposed new law would emphasize rapid exploration and development of mineral resources; encourage private, national, and foreign investments; and at the same time regulate the disorder prevalent in the small-scale gold mining activity. To promote the development of Ecuador's natural resources and in particular the nonrenewable ones, the National Congress enacted the Mining Law under Decree No. 126 of May 22, 1991. Legislation codifying the Mining Law has been set through Decree No. 2831 of October 24, 1991. The resulting law establishes the relations between the state and persons or entities engaged in all mining activities, excluding exploitation of hydrocarbons, reactive mineral, and medicinal waters. Supplementary

legislation as the Civil Code, Civil Procedures Code, Commercial Code, Investment Law, Law of Companies, and other related legal dispositions would apply wherever the Mining Code did not give express rules. The state could grant permits to private or legal persons and entities, national or foreign, for mining activities that were subject to Ecuadorean laws and jurisdictions. The law prohibited foreign entities to file claims through diplomatic or judiciary international organizations. Among the basic tenets of the new code were the inalienable and imprescriptible domain of the state over all mineral deposits in the national territory of Ecuador and the declaration of mining activities as of public utility. Nonetheless, the Ministry of Energy and Mines (MEM), through its Subsecretariat of Mining (SM), was the state office that granted permits to persons interested in the exploration and exploitation of mineral substances. This agency had the authority to plan and implement the mining policies of the country while the National Directorate of Mining (DINAMI) of the same MEM administered the procedures of granting concessions and terminating mining rights.

The Corporation for Geological, Mining and Metallurgical Research and Development (CODIGEM) was responsible for undertaking Government geological investigations and operations for developing possible economic ore deposits, either by itself or in association with other parties; also, CODIGEM will be playing a roll in providing technical assistance to small miners and any other entities involved in mining activity. Foreign technical missions through Government-to-Government agreements worked together with CODIGEM in the field of geological surveys and mineral exploration programs. Technical missions from Belgium, Germany, Italy, Japan, and the United Kingdom were currently involved directly in such tasks.

The new Mining Law dismantled the Ecuadorean Mining Institute (INEMIN) that had monopolized the granting of mining concessions and had created corruption and unnecessary bureaucratic confusion in the mining sector. It was replaced by four other new Government agencies aforementioned. The general overview of the Ecuadorean investment laws is provided in the Constitution approved by referendum in 1978 and in laws issued by the National Congress. Laws are regulated by the President of the Republic and applied by the different bodies of the administration. The greatest weakness of the Mining Law from the point of view of potential investors is its 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%. Another major problem that needs to be addressed, in the view of the industry, lies not in the Mining Law but in the Tax Code. Ecuador imposes a 25% corporate income tax. However, profits remitted abroad are subject to an additional 11% tax. Foreign investors dislike this tax, not only because of the financial burden, but because of the signal it sends that foreign capital does not enjoy all the same rights as domestic capital. The new Mining Code grants some relief specifically to mining investment. It holds that foreign investors may remit profits and dividends up to 20% of their capital per year, paying only the domestic corporate tax rate. Unfortunately, the necessary implementing regulation for this provision had not yet been issued. Most foreign investors seemed confident that the new Government would follow through on this pledge swiftly.

The environmental impact of mining was beginning to be recognized as an issue in Ecuador. The 1991 code included a provision requiring that an environmental impact statement be filed before mining activity. The statement would include a management plan to deal with issues such as protection of flora and fauna, avoidance of contamination of water supply, and cleanup plans in the event of spills. The large foreign investors looking at Ecuador have not found the prospect of strict environmental regulation to be objectionable as they have long since confronted this issue in their home countries. However, they note that Ecuadorean environmental expertise is limited and directed more at the problems associated with the petroleum industry than those of mining. Ecuador's main environmental problem arises from the small-scale informal gold mining conducted by the "claim jumpers" in districts such as Nambija and Bella Rica. These operations used mercury in processing, which has been burned off into the air and become harmful to the miners themselves. Water contaminated with arsenic and other harmful elements commonly has been discharged directly into streams, which have become unpotable. The water pollution caused by these mines has begun to cause concern in Ecuador's coastal regions where aquaculture-raised shrimp have become a major nontraditional industry. However, a tough enforcement effort has not been made in these remote mining districts.

Ecuador, which has long ignored its potential as a minerals producer, could be the site of important investments in the medium term. Large multinational companies have undertaken exploration programs, while two small firms have begun production of gold and silver. The recent election of a free-market-oriented president should hearten potential investors, but some major policy changes were still needed to attract major investments. High royalties and discriminatory taxes on foreign investment needed to be addressed. The Government needed also to deal with the problem of small-scale miners who took over properties without legal rights. Ecuador's labor regime is inflexible, though companies probably could work around the difficulties. Environment was an emerging issue. Currently, it was the small-scale miners who were polluting the soil and water, while big firms were confident that they could meet any reasonable standards. If all were to go well, the first major foreign investment project in mining could be announced in the next 2 to 3 years.

The Energy and Mines Minister

officially communicated to OPEC Ecuador's decision to withdraw from the organization as an active member. The Minister said Ecuador would consider any request by OPEC for Ecuador to remain affiliated as an associated member or as an observer. The Energy and Mines Minister announced Ecuador would hold a seventh round of petroleum concessions, probably in the first half of 1993. Plans to open areas currently reserved for the state-owned Petroecuador have aroused the interest of foreign oil companies in the seventh round. Foreign investors had declined to participate in the sixth round, which offered only high-risk properties. The Government of Ecuador announced plans to increase the capacity of the Trans-Ecuadorean pipeline to 400,000 bbl/d. The pipeline was currently operating at its maximum capacity of about 320,000 bbl/d. The increase will be needed to handle new production expected to come on-stream between 1993 and 1995.

PRODUCTION

Industrial minerals make up the principal volume of the mining sector's present formal output, which is largely used by the domestic construction industry: clays, limestone, gypsum, feldspar, siliceous sands, kaolin, and some marble. Their production has declined since 1987-88, possibly reflecting difficulties in the construction industry. After the earthquake and 6 months of oil stoppage in 1987, the economy took a downturn, and the construction industry suffered a decline in 1989 and, to a lesser extent, in 1991 and 1992. Imports of these minerals, however, are significant and now exceed $3 million per year, indicating a potential for additional production. Pumice stone is the only nonmetallic mineral exported by the sector. Production of nonfuel minerals showed modest growth in 1992 and contributed about 1% to the GDP, although limited to a few commodities: gold from placer operations; lead, silver, and zinc from polymetallic mines; and some industrial minerals aforementioned. The total value in 1992 of formal mineral production amounted to about $19 million, 1.5% of the total minerals exported, but was expected to become increasingly important in the future. The total value of mineral output was estimated at $1.27 billion in 1992 compared with $1.06 billion in 1991.

The mineral fuels and their derivatives accounted for 98% of the total value. Production of crude oil increased in 1992 by about 7.1% from that of 1991, owing to the increase in the international market price from an average of $16.38 per barrel in 1991 to $16.74 per barrel in 1992. Although having been producing near capacity in response to increased prices, Ecuador increased oil production by 7.1% to about 320,142 bbl/d. Crude oil production increased in valued at $1.251 billion, an increase of about 14.0% compared with that of the previous year. *(See table 1.)*

TRADE

Crude oil exports in 1992 were up 14% compared with those of 1991, to 74.4 Mbbl (203,800 bbls/d), with an additional 7.4 Mbbl in exports of refined products. This compares with 65.3 Mbbl of crude exports and 9.4 Mbbl of refined products in 1991. In 1992, total exports reached $3.008 million, $157 million more than that in the previous year. Of this, petroleum exports decreased 18.2% while the nonfuel exports increased 30.2% compared with those of 1990. However, the mineral fuels sector was by far the most important in terms of its contribution to state revenues and foreign exchange earnings, generating 42%, or $1.251 billion, somewhat less than one-half of central Government revenues because of lower crude export prices. A trade surplus of $981 million was recorded in 1992, 52% higher than that of 1991. Total exports grew by about 5.5%, while imports decreased by 8.2%.

The United States continued as the principal trading partner of Ecuador. During 1992, the value of exports to the United States reached $1.34 billion (45.0%), while imports reached $999 million, representing 50% of total imports. The export value of crude oil to the United States represented 42.3% of the total, followed by Chile (8.0%), Panama (6.8%), Peru (5.3%), and Taiwan (4.9%). Ecuador also exported a small amount of petroleum products to the United States, mostly residual fuel oil valued at $64.8 million. During 1992, Ecuador's total imports value was $2 billion, $180 million lower than the level of 1991. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

The Ecuadorean Government exercised dominant control over the mineral industry through a new joint Committee for Mining Contracts Board of Directors, composed of the Ministers of Energy and Mines, Finance, Industry, and Commerce; the Chief of the Joint Command of the Armed Forces; the Director General of the Central Bank; the Secretary General of Planning of the National Development Council; the President of the National Chamber of Mines; and a representative of the mining community. The institutional arrangement consisted of MEM, the state office that includes SM, as the head of the sector, coordinator, and policy setter as approved by the President of the Republic. The new mining law reassigned sector's functions previously handled by a single agency, INEMIN, to different institutions. The law has created an autonomous institution, CODIGEM, to promote private mining activities; develop and maintain mining and geological information and thematic data base; support mining, geological, metallurgical, and seismic research; and generally represent the corporate function of the state in the sector. Line agencies within MEM, headed by DINAMI, depending on SM and including the Regional Directorates and the Technical Service for the National Mining Cadastre (SETCAM), are in charge of policy implementation regarding the granting, maintenance, cadastral registration, and extension of mining rights. In addition, another line agency of MEM's—the National Directorate for the Environment

(DINAMA), depending on its Subsecretariat of the Environment—is in charge of activities relating to all environmental concerns, among them administering and enforcing the new law's strict environmental provisions regarding mining activities. The Dirección Nacional de Hidrocarburos, under the Minister of Energy and Mines, oversaw the activities of the mineral industry. The country's mineral industry was dominated by the petroleum industry in terms of contribution to the Ecuadorean GDP, employment, and export earnings. Crude oil and natural gas were produced by companies with production-sharing agreements with the Government, namely, between the Petroecuador-Texaco Consortium (45.83%-27.50%), Northeastern Petroecuador (24.33%), Petroecuador-City Association (2.0%), and Petroecuador Santa Elena Peninsula (0.33%). Petroecuador-Texaco combined was also joint owner of the Trans-Ecuadorean 800-km-long crude oil pipeline with a 300,000-bbl/d capacity. On October 1, 1989, Petroecuador took charge of the administration of the Trans-Ecuadorean oil pipeline. Ever since, the operations were given to Petrotransporte, a subsidiary of Petroecuador. In November 1989, by Government decision another subsidiary of Petroecuador, Petropenínsula, took charge of the refinery operations of the Anglo Refinery, known now as Refinería La Libertad. In August 1990, the state took charge of the administration of the refinery Repetrol. In July 1990, Petroamazonas took charge of the administration and operation of the oilfields of the Petroecuador-Texaco Consortium. Petroamazonas was authorized to invest in exploration, drilling one well in 1990 and three wells in 1991 to discover primary reserves of 100 Mbbl.[2] In 1991, three new blocks in the Amazon region were offered to Mobil Oil, Arco-Mobil, and Conoco of the United States for an estimated investment of about $100 million. Petroecuador was considering expanding the pipeline's capacity to 350,000 bbl/d by mid-1992 by adding an additional pumping unit at each existing station and further expanding capacity to 400,000 bbl/d by 1994 by adding another new pumping station. This 400,000-bbl/d capacity would be the limit of the pipeline's designed capacity. Petroecuador is the most important oil company in Ecuador, with sales of more than $1.2 billion in 1992. The company produces, refines, stores, transports, and delivers crude oil and petroleum products.

In 1992, the total national work force was 3.4 million workers distributed as follows: 31% in the agricultural sector, 11% in manufacturing, 14% in commerce, and 28% in services and other activities. The mining and extractive industries employed approximately 21,000 persons, which represented less than 1% of the total labor force. Organized labor constituted less than 15% of the total. Petroecuador had a work force of about 4,300.

According to the 1992 membership list of the Ecuadorean Chamber of Mines, more than 150 small mining companies operated in the country. Ecuador's metallic mining activity was concentrated in the following eight major mining provinces: El Oro Province (stibnite, gold), Azuay Province (copper, gold, silver), Zamora-Chinchipe Province (gold, silver), Napo Province (gold), Cotopaxi Province (gold), Esmeralda Province (gold), Pichincha Province (gold), and Loja Province (copper, gold).

In 1991-92, several major multinational mining companies were present in Ecuador, all in exploration. Newmont Mining Corp. (United States) was one of the most advanced with several properties identified in the central valley and an exploration budget of about $1 million. Gold Fields of South Africa Ltd. (Republic of South Africa) was looking to develop its Nambija area property, though it had been plagued by illegal claim jumpers. Río Tinto Zinc Corp. PLC. (RTZ, United Kingdom), Noranda Exploration Co., Ltd. (Canada), and Placer Dome, Inc. (Canada) also have maintained exploration programs. Below this level were a number of projects, varying from the speculative to the highly dubious, mounted mainly by foreign geologists resident in Ecuador who were seeking to market them to majors or raise money from traditional sources of mining capital such as the Vancouver Stock Exchange (VSE).

Small-scale industrial mineral operations included marble—Industria Marmolera Ecuatoriana S.A., Mármoles Andinos Cía. Ltda., Mármoles Santa Rosa Cía Ltda., and Marmolera Chimborazo; calcium carbonate—Cecal. S.A.; bentonite—Mineral M.D.K. and Mineral Bentonite Charasol; and barite—Mineral Bomboiza. *(See table 4.)*

COMMODITY REVIEW

Metals

Copper.—The long-known prospects in Ecuador, the "Chaucha" and "Fierro Urco," kept stagnant in the hands of the earlier Government, will be reopened by AG Armeno Mines and Minerals Inc. (Armeno) as it has been granted the rights over the properties by the present Government. Under the new approach, exploration and further development will be conducted in these two prospects for base and precious metals bulk mining.

The Chaucha prospect is a large porphyry copper system that contains several copper-molybdenum mineralization zones, the Naranjos zone being the main one. From the extensive diamond drilling performed in the ore deposit and existing geological data, a preliminary resource appraisal indicates approximately 78 Mmt grading 0.44% copper (oxide plus secondary enriched zone) and 76 Mmt grading 0.32% copper (primary zone). Armeno, the owner of the property, has signed a joint-venture agreement with Kookaburra Gold Corp. (VSE) of Vancouver, British Columbia, Canada, to acquire up to a 65% interest in the Chaucha copper project in Ecuador. Kookaburra could earn an initial 50% interest in the property for cash payments to Armeno of $375,000 plus 200,000 shares as well as spending $3.5 million on exploration and development over a 4-year period. The company could earn an additional 15% interest by paying Armeno $2.5 million

and spending a further $2.5 million on the property.

The property contains a large porphyry ore body measuring about 8 km by 8 km covering at least eight copper targets, only one of which has been tested. Two UN-sponsored teams drilled a total of about 7,620 m in 70 holes on the Naranjos area in the late 1960's and early 1980's. The drilling outlined a large, shallow, and gently sloping supergene enrichment blanket measuring 1,219 m by 549 m and varying in thickness from 30.5 m to 122 m. Reserves in the zone, which is overlain by an oxidized zone and underlain by an untested copper-sulfide system, are estimated at about 60 Mmt grading 0.50% copper at 0.20% copper cutoff grade. The preliminary reserve figure includes a potential open pit, including about 27 Mmt grading 0.56% copper. A further extension to the south of the reserve is estimated to contain about 14.5 Mmt grading 0.34% copper. Kookaburra stated that it was highly impressed with the business climate in Ecuador and believed the Chaucha project has an excellent chance of being developed into a heap-leach solvent extraction and electrowinning (SX-EW) operation. Kookaburra officials said the option agreement with Armeno should be finalized by the end of October 1992. To develop the Chaucha copper project, prefeasibility studies were being conducted for which Koocaburra engaged Fluor Daniel Wright Engineers to undertake the task. The preliminary evaluation indicates that the Chaucha copper project could be minable to SX-EW process copper leaching techniques. Armeno and Kookaburra foresee diluted minable reserves of 60 Mmt grading 0.46%, processed at a rate of approximately 15,000 mt/d, would produce 22,000 mt/a of copper cathode. This project could well change the image of the mining industry in Ecuador. The Fierro Urco prospect is another project in which Armeno also owns 100% of the property rights by means of an exploration mining title granted by the Government. In this area the geological setting, reinterpretation of data from previous preliminary work and latest reconnaissance surveys carried out by Armeno suggest that the Fierro Urco prospect could be a porphyry copper-gold deposit. The work aforementioned has revealed significant intervals of copper-gold mineralization—up to 0.51% copper over an interval of 25 m and 0.23% copper over an interval of 242 m. Gold grades ranging up to 0.63 g/mt are associated with the disseminated copper mineralization; higher gold values up to 21.5 g/mt in the quartz veins and brecciated zone surrounding the copper mineralization have been reported recently. Thus, the company's management has proposed a multiphase exploration program to begin with a drilling campaign within the main copper anomaly. The Fierro Urco prospect appears to be another promising target for bulk mining.

Other significant exploration programs targeted for bulk mining copper and gold situations are being currently undertaken by companies such as RTZ Exploration, Newmont, and Cogema. RTZ, after scouting most of the country without major luck, has concentrated its efforts at the San José de Salinas prospect, where preliminary exploration work appears to indicate a porphyry-type environment. The company's management has approved a drilling program. Under a similar work scheme, Newmont Overseas Exploration was eagerly involved in the country to test and confirm several potentially anomalous areas, mainly at its Nabon and Cima prospects. Cogema at its Santa Isabela property, also known as the San Fernando, has also started drilling to test anomalies revealed from preliminary prospecting surveys. It has been reported that values up to 0.5 g/mt of gold were obtained throughout the area. The group Cominesa was also prospecting and exploring for epithermal deposits in central and northwestern parts of Ecuador. It claimed that the prospects Peltetec and Ximena have yielded interesting results from random sampling along veins, with grades up to 31.1 g/mt of gold. The group of interest to Noranda Exploration was targeting for base metal deposits.

Gold.—Gold potential in Ecuador is a fact, and small-scale gold mining by informal miners and small entrepreneurs is spread throughout the country. Mostly, these activities are restricted to small tunneling, diggings, and dogholing from which the ore is extracted and sent to small cyanidation plants for gold recovery; some gold is also obtained by amalgamation methods. Many attractive, potential, and prospective gold areas (hard rock and alluvial) have been outlined within the Portovelo-Zaruma, Nambija, and Ponce Enríquez gold districts, where activity is conducted as aforementioned. Unfortunately, because of the conflicting social implications of these activities, it is practically impossible to point to a solid, safe, and continuous producing area. Thus, it is clear that the role to be played by the Government with regard to implementing measures to guarantee rational and safe gold mining practices and operations is urgent and imperative.

It was reported that Goldfields Ltd., at present in the country, is attempting to get involved in exploration and further development of certain prospecting sectors within the Nambija gold district. Unofficial reports indicate that gold production in all districts totals approximately 11 to 12 mt/a. Alluvial gold operations are also numerous; however, the only one worth mentioning is the one being undertaking by Odin Mining & Investing Co., Ltd., an Australian-financed group. As reported, it could be the largest formal gold producer in the country. From its two placer alluvial areas called the Biron Mine and the Río Chico Mine, more than 622 kg/a of gold was produced in 1992. It also has been reported that, due to increasing operational costs, difficult mining conditions and diminishing ore reserves at Rio Chico, the company will look as an alternative to expand operations at its Biron Mine, where an average production of 933 kg/a over the period 1993-96 is thought to be possible.

More than 90% of gold production is now being mined by more than 40,000 small-scale and informal miners (this figure includes miners themselves and

other people engaged in auxiliary functions, sometimes with entire families work together). Until registered under the terms of the new Mining Law, these are illegal activities in that these miners have not been issued any mining rights. Informal miners either work individually or in groups for mining firms often "owned" by Ecuadorean businesses (including jewelers). In some instances, rather loose-knit cooperatives have been formed, principally because cooperatives can obtain legal rights. For example, the cooperative of Bella Rica in the Ponce Enríquez area has recently obtained a concession of 1,350 ha. The mining activities undertaken by members of these cooperatives are, however, often poorly organized and are claimed to be "controlled" in some cases by numerous traders. These activities are concentrated in the south of the country in the El Oro, Azuay, and Zamora-Chinchipe Provinces, particularly around the areas of Portovelo-Zaruma, Nambija, and Ponce Enríquez. Although this unstructured, unregulated, and untaxed activity creates employment, it has very serious drawbacks. Nonrenewable resources are wasted due to the inadequate technology employed. The primitive ore treatment plants only recover between 50% to 70% of contained gold. A normal industrial plant would recover 80% to 90% or more. In addition, many of the gold recovery processes involved use considerable quantities of mercury. This mercury is then released into the environment where, given the right conditions, it may be transformed into its bio-available, organic form, methyl mercury. Besides mercury, other heavy metals associated with gold, such as cadmium, copper, lead, and zinc, that are not recovered are released into the environment. These could be a potential source of environmental pollution. The tremendous influx of people into the "gold rush" area of Nambija also has caused serious sanitary, social, health, and safety problems. Nambija is a shanty gold-rush town of plastic and stick shacks built on the side of a mountain and completely lacking infrastructure, including running water and sanitation. Home to more than 10,000 persons, Nambija is the ancient site of Inca mines. Since its rediscovery in 1980 it has been Ecuador's principal gold mining center. The area is widely considered to be an ecological disaster; approximately 2,000 to 3,000 informal miners work the mines using only the most rudimentary technology. Mercury, arsenic, and other harmful elements are freely released into the environment by the miners; the area has been deforested; so many tunnels have been dug (some to a depth of 300 m) that the town resembles a swiss cheese. The Government of Ecuador has been aware of the potential hazards in Nambija for years, but up to now has not taken the necessary steps to control the situation for fear of putting thousands of informal miners out of work. Nambija has suffered landslides in the past, and more are expected. This year a landslide killed 10 people.

Industrial Minerals

Industrial minerals make up the volume of the mining sector's present formal production, and Ecuador has some potential in nonmetallic minerals, though this is largely for internal consumption. The most important operations were in the cement and cement-related industries involving limestone and clays and in lesser degree gypsum, feldspar, siliceous sands, kaolin, and some marble.

Cement.—Production of cement decreased 2.2% from that of 1991 to an estimated 2.3 Mmt. Domestic sales in 1992 likewise totaled 2.3 Mmt. Most cement production was under Government control and managed by regional development corporations.

La Cemento Nacional, C.A. (LCN), the largest manufacturer of cement in Ecuador, produced about 67% of the total output in the country. LCN was an established and well-organized cement company serving the entire Ecuadorean market and had been in the local cement business more than 60 years. The Swiss-owned Cía de Cemento Nacional, a highly successful producer of cement, clays, and other construction materials, is a potential model for foreign mineral investors, as it enjoys high profits, as well as excellent public and governmental relations.

Pumice.—Production of pumice stone and pumicite in 1992 was reported to have increased in 1991. A steadily increasing volume of this stone was exported to the United States via the Port of New Orleans from Ecuador, Mexico, and Turkey. There was increased U.S. use of the floating stone, better known as pumice, in producing so-called stonewashed blue jeans. Pumice stone is the only nonmetallic mineral export of the sector. The 34,000 tons of pumice stone exports earned close to $3 million in 1992.

Mineral Fuels

Gas.—During 1992, Ecuador produced 180 Mm^3 of natural gas. Most of the domestically produced gas was processed at the Petroecuador gas plant in the Shushufindi Oilfield in the Oriente region. To meet domestic demand, an additional quantity of natural gas was imported from Colombia. LPG was bottled and distributed by four private firms as well as by Petroecuador.

Petroleum.—Crude oil production in 1992 totaled 117.2 Mbbl, or 320,142 bbl/d, an increase of 7.1% from that of the previous year. Ecuador exported 74.4 Mbbl of crude oil (203,800 bbl/d), with an additional 7.4 Mbbl of refined products in 1992 for a total value of $1.25 billion, an increase of 18.1% compared with that of 1991. The increase in crude oil output was apparently due to the decrease in oil prices and in response to the withdrawal from full membership from OPEC, owing to a lack of any real benefit of membership. Although Ecuador's quota was 273,000 bbl/d, Ecuador was producing 321,000 bbl/d, of which 210,000 bbl was exported. The Government, since early summer 1992, has moved quickly to approve a number of key development projects. It was

perhaps no coincidence that the most important conference on Ecuadorean petroleum prospects in recent years was timed to coincide with the government's public confirmation of the pullout. The seminar, sponsored by the MEM, was held in Quito October 28-29. All foreign companies operating in Ecuador attended, with details disclosed of projects planned or under way. With one exception, all key development projects still pending last summer have been approved. Two projects among those approved last spring and summer are producing oil: Oryx Energy Co., about 5,000 bbl/d, and Ecuador's Tripetrol, S.A., about 1,500 bbl/d. Additional new production is expected after May 1993 by Occidental Petroleum Corp., Ste. Nationale Elf Aquitaine, and Maxus Energy Co. at a combined initial rate of about 20,000 bbl/d, to be increased to about 60,000 bbl/d by yearend. Oxyx and Tripetrol expect also to increase output in 1993. Among other issues raised at the seminar, environmental concerns garnered the most attention, notably because of controversy over oilfield development in sensitive rain forest areas. Maxus disclosed the painstaking steps it has taken to mitigate the effects of its operations on the indigenous native population and the regions. A second important issue given focus at the seminar was the need for stability in petroleum law and compliance with contractual terms. Foreign operators also contend some changes in current oil legislation are needed to provide adequate incentives to companies to carry out additional exploration on their blocks, along the lines of exploration incentives currently in effect in other countries seeking foreign investment.

Oxy's block 15 project was the first to be signed as a service risk contract in Ecuador. Oxy's development plan for block 15 was approved by the Government in July 1992. Work progress was on schedule. First production was expected in May 1993 at an initial rate of 15,000 bbl/d, to be increased to 30,000 bbl/d 2 months later. Total development investment over the life of the project will reach $225 million.

A group of operators—Elf, 40%; Brazil's Braspetro, S.A. 35%; and Argentina's Yacimientos Petrolíferos Fiscales, 25%—plans to develop the Wanke-Sunka Field in the west-central section of block 14. Tripetrol, a 100% Ecuadorean owned and operated company, acquired the former Belco Petroleum Corp.'s rights in blocks 1 and 2, mostly offshore along the Santa Elena Peninsula. After acquiring Belco's rights, Tripetrol discovered the Pacoa structure near the coast, about 30 km north of Ancon Fields, which have been producing for about 50 years. ARCO strike the discovery of apparently a substantial reservoir in the eastern province of Pastaza by a Unit of ARCO remains under study for determination of commercial feasibility.

Oryx Ecuador Energy Co. acquired British Petroleum Co. PLC's rights on block 7 in September 1990. Previously, BP Petroleum had invested $44.8 million shooting 1,100 line km of seismic and drilling seven wells—five exploratory and two appraisal—to confirm five fields: Payamino, Jaguar, Oso, Mono, and Lobo. Oryx's long-term goal is to search for new prospects, possibly stratigraphic traps. Oryx is also preparing development plans for the Gacela, Jaguar, Lobo, and Mono Oilfields, for a combined investment estimated at $97 million. Current plans call for drilling about 30 horizontal and vertical wells. Total production from these fields, excluding Coca-Payamino, would reach about 27,000 bbl/d in 1996.

Petroecuador company's outlook for Ecuador's petroleum sector for 1993-96 is in line with the Government mandate. Several important prospects in the Oriente and on the Santa Elena Peninsula have yet to be explored, and additional reserves may be added in the future. To achieve this goal, huge investments are required, mainly by the private capital under attractive new terms. Thus far, Petroecuador and predecessor CEPE have drilled 43 exploratory wells, 3 of them offshore. Thirty flowed oil, with a success ratio of about 70%, the highest in Latin America.

Reserves

Ecuador was believed to have gold reserves on a par with those of Peru and Colombia, and because gold mining essentially stopped after the colonial era (16th and 17th centuries), most of Ecuador's gold remained unexploited.

Ore reserves of metallic minerals and industrial minerals were small in world terms, but considered significant in Latin America. Following several oil discoveries in Ecuador's Amazon region and new studies by the French Petroleum Institute, the country's proven reserves of crude oil have almost tripled from 1.46 to 4.3 bbl. At the present rate of production the country's reserves will last well into the next century. To tap other potential reserves in the area, Petroecuador will hold another round of bidding for exploration in the near future. Before exploiting the new reserves, five more exploratory wells are planned for the area. Furthermore, 190 km of road and 300 km of pipeline need to be constructed northwest to Lago Agrio, from where the Trans-Ecuadorean pipeline will transport the oil across the Andes to the Pacific ports. Petroecuador calculates that the project requires an investment of $280 million over 6 years. The fields' production time is estimated at 22 years, with a maximum daily output of 45,000 bbl/d.

INFRASTRUCTURE

Ecuador is limited in the development of its infrastructure. The transportation network was composed of a total of 28,000 km of highways: 3,600 km paved, 17,400 km gravel and improved earth, and 7,000 km unimproved earth.

The railroad system consisted of 965 km total; all was 1.067-m-gauge single track. Mine production was transported by truck and rail to processing plants and shipping ports. The railroad system was operated by the state, with the main line running north-south. Crude oil and refined products were transported by two pipelines that were 800 and 1,358 km long, respectively, to Esmeraldas terminal and Quito from the oilfields in the

Oriente region and to Napo Province for final processing, domestic distribution, and export. Four major ports served the country on the Pacific coast. The first (in order of importance) was Guayaquil, through which about 60% of the cargo by volume was channeled, followed by Esmeraldas, Puerto Bolívar, and Manta.

For international air transportation, there were two airports, one in Quito and the other in Guayaquil. Ecuatoriana de Aviación was the major domestic airline that covered several routes throughout Latin America and the United States. Ecuador had an installed electrical generating capacity of 1,657 MW, of which 46% came from thermal stations and 54% came from hydroelectric sources. Early in 1991 this ratio changed in favor of hydroelectric power.

OUTLOOK

For a long time the potential to develop mining in Ecuador had been seen as promising. To promote the development of Ecuador's natural resources and, in particular, the nonrenewable ones, the National Congress enacted the Mining Law under Decree No. 126 of May 22, 1991. Legislation regulating the Mining Law has been set through Decree No. 2831 of October 24, 1991. The present law rules the relations between the state and persons or entities engaged in all mining activities, excluding exploitation of hydrocarbons, radioactive minerals, and medicinal waters. This new law enacted during 1991 would offer the prospect of enhanced contributions of the mining sector to the national income of the country.

The new state petroleum company Petroecuador was expected to expand its productive and transport capacity, most notably the construction of a LPG terminal and petroleum product pipelines. An increase in oil reserves may result from the 10 foreign consortia carrying out exploration activities and from the 7 blocks that were being offered for exploration. Development of two of the exploration blocks was begun during 1991. Observers believed that Ecuador has good potential for finding oilfields beyond those already discovered, although probably of smaller and lower quality than Ecuador's currently producing oilfields. The mining sector has been said by Government officials, "to be the future alternative source of the national income, should oil reserves deplete." However, this objective has remained largely neglected.

[1]Where necessary, values have been converted from Ecuadorean sucres (S/) to U.S. dollars at the rate of S/1,553=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Ministry of Energy and Mines (MEM)-Subsecretariat of Mining (SM)
Ave. Santa Prisca 223
Quito, Ecuador

Petróleos del Ecuador (Petroecuador)
Alpallana y 6 de Diciembre
Edif. Alpallana P.O. Box 5007-8
Quito, Ecuador

Petroecuador-Texaco (Petroamazonas)
Ave. 6 de Diciembre 4226 y Gaspar Cañero
Quito, Ecuador

Ministry of Energy and Mines
National Directorate of Mining (DINAMI)
Corporation for Geological Mining and Metallurgical Research and Development (CODIGEM)
Directorate of the Environment (DINAMA)
Casilla 23-A, Ave. 10 de Agosto #5540 y Villalengua
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 No 15 1993.

Banco Central del Ecuador-Division Técnica; Boletín Anuario No 607 1992.

Economic Trends Report June 1993, prepared by U.S. Embassy-Quito.

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

TABLE 1

ECUADOR: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992e
METALS						
Cadmium, mine output, Cd content[e]	kilograms	300	300	250	200	260
Copper, mine output, Cu content[e]		100	100	100	100	100
Gold, mine output, Au content	kilograms	10,200	10,390	r10,710	r12,200	12,000
Iron and steel:						
Steel, crude		r23,459	r23,370	r19,798	r20,464	20,000
Semimanufactures		170,538	r177,936	r172,550	r201,724	190,000
Lead concentrate, Pb content[e]		200	200	200	200	200
Silver, mine output, Ag content[e]	kilograms	60	60	60	60	60
Zinc, mine output, Zn content[e]		100	100	100	100	100
INDUSTRIAL MINERALS						
Cement, hydraulic[e]	thousand metric tons	2,200	2,250	2,250	2,300	2,250
Clays:						
Bentonite		r70	r360	r760	r135	2393
Common:						
For cement	thousand metric tons	r5,773	r4,836	r3,886	r3,243	3,000
Other		r388,688	r370,780	r372,000	r280,000	2277,789
Kaolin		r3,399	r14,660	r7,883	r16,217	26,835
Feldspar		r10,562	r7,463	r8,127	r5,010	23,251
Gypsum (for cement)		r8,118	r10,670	r24,200	r—	24,000
Sand:						
Silica (glass sand)		r51,718	r40,292	r42,399	r23,239	235,509
Ferruginous		6,000	15,334	e10,000	e10,000	15,000
Stone, sand and gravel:						
Limestone (for cement manufacture)	thousand metric tons	r5,773	r4,836	r3,886	r3,243	23,079
Marble		r1,442	r1,633	r2,171	r1,740	21,963
Pumice		e90,000	144,836	r e34,000	r33,510	35,000
Sulfur:[e]						
Native		4,500	4,300	4,000	4,000	4,000
Byproduct:						
From petroleum		5,000	5,000	5,000	5,000	5,000
From natural gas		5,000	5,000	5,000	5,000	5,000
Total		14,500	14,300	14,000	14,000	14,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, lignite		r1,283	r527	r—	r—	—
Gas, natural:[e]						
Gross	million cubic meters	2177	r152	r214	r239	2195
Marketed	do.	299	100	100	90	90
Natural gas, liquids:						
Natural gasoline	thousand 42-gallon barrels	232	r181	r289	r364	2397
Liquefied petroleum gas	do.	r1,528	r1,368	r1,713	22,234	2,500
Total	do.	r1,760	r1,549	r2,002	r2,598	22,897
Petroleum:						
Crude	do.	112,553	102,953	r104,442	r109,387	2117,172
Refinery products:						
Liquefied petroleum gas	do.	1,549	1,368	1,714	2,234	22,548

See footnotes at end of table.

TABLE 1

ECUADOR: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992[e]
MINERAL FUELS AND RELATED MATERIALS—Continued						
Petroleum—Continued:						
Refinery products—Continued:						
Gasoline	thousand 42-gallon barrels	11,028	10,244	10,013	11,160	[2]11,497
Jet fuel	do.	1,336	1,279	1,368	1,418	[2]1,532
Kerosene	do.	1,387	1,871	1,402	1,140	[2]786
Distillate fuel oil	do.	8,709	7,888	9,215	10,308	[2]10,543
Lubricants	do.	[r]176	[r]184	[r]151	[r]208	[2]256
Residual fuel oil	do.	15,012	14,834	17,439	17,996	[2]16,628
Unspecified	do.	921	496	[r]534	[r]458	[2]374
Total	do.	[r]40,118	[r]38,164	[r]41,836	[r]44,922	[2]44,164

[e]Estimated. [r]Revised.

[1]Includes data available through Nov. 1992.

[2]Reported figure.

TABLE 2

ECUADOR: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc.		33,994	33,294	17,680	Colombia 11,326; Venezuela 4,272.
Aluminum: Metal including alloys, semimanufactures		330	323	10	Colombia 183; Peru 104; Dominican Republic 19.
Copper: Metal including alloys, semimanufactures		—	9	(2)	Mainly to Argentina.
Gold: Metal including alloys, unwrought and partly wrought	kilograms	213,921	1,275,680	1,275,680	
Fertilizer materials: Manufactured, nitrogenous		—	1,928	—	All to Peru.
Iron and steel: Metal:					
Scrap		13	—		
Semimanufactures:					
Bars, rods, angles, shapes, sections		1	277	—	All to Peru.
Wire		—	20	—	All to Panama.
Tubes, pipes, fittings		279	306	—	Peru 153; Chile 118; El Salvador 26.
Lime		—	50	—	All to Peru.
Manganese: Oxides	value, thousands	—	$5	—	All to Mexico.
Petroleum:					
Crude	do.	$1,258,401	$1,058,982	$440,806	Republic of Korea $244,334; Peru $140,165.
Refinery products:					
Gasoline	do.	NA	$7,344	$3,390	Panama $3,954.
Kerosene and jet fuel	do.	NA	$85,623	$61,456	Mexico $12,759; Panama $5,521.
Residual fuel oil	42-gallon barrels	NA	291	—	All to Peru.
Bituminous mixtures	do.	NA	224	—	All to Costa Rica.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		(3)	134	—	Colombia 131; Chile 3.
Worked		—	5	4	Belgium-Luxembourg 1.
Quartz and quartzite		2	—		
Sulfur: Sulfuric acid		38	—		
Other base metals: Ores and concentrates		1	—		

NA Not available.

[1]Table prepared by H. D. Willis.

[2]Less than 1/2 unit.

[3]Unreported quantity valued at $5,000.

TABLE 3
ECUADOR: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS					
Alkali and alkaline-earth metals:					
Alkali metals	value, thousands	$1	$7	$4	Colombia $3.
Alkaline-earth metals	do.	$2	—		
Aluminum:					
Ore and concentrate		2,250	6,282	—	French Guiana 3,132; United Kingdom 2,350; Suriname 800.
Oxides and hydroxides		895	813	536	Brazil 113; Colombia 90.
Metal including alloys:					
Scrap		356	419	—	Canada 319; Venezuela 100.
Unwrought		103,428	4,453	8	Canada 2,998; Argentina 1,190; Venezuela 238.
Semimanufactures		2,340	3,158	276	Venezuela 738; Canada 491; Germany 387.
Cadmium: Metal including alloys, semimanufactures	value, thousands	$2	$6	$6	
Chromium:					
Ore and concentrate		—	99	(2)	Mainly from France.
Oxides and hydroxides		20	18	11	Germany 3; unspecified 4.
Metal including alloys, all forms		1	1	1	
Cobalt:					
Oxides and hydroxides		2	3	3	
Metal including alloys, semimanufactures	value, thousands	$1	$1	$1	
Copper:					
Matte and speiss including cement copper		36	4	—	All from Chile.
Metal including alloys:					
Unwrought		136	100	100	
Semimanufactures		3,744	3,529	274	Peru 1,552; Chile 1,054.
Germanium: Metal including alloys all forms		—	1	1	
Iron and steel:					
Iron ore and concentrate: Pyrite, roasted		—	3	—	All from Italy.
Metal:					
Scrap		872	—		
Pig iron, cast iron, related materials		43	85	43	Canada 18; Colombia 11.
Ferroalloys:					
Ferrochromium		9	—		
Ferromanganese		353	200	22	Mexico 160; Brazil 14.
Ferrosilicon		144	66	—	Chile 54; Brazil 8; Canada 4.
Ferrosilicomanganese		—	3	—	All from Spain.
Silicon metal		1	1	1	
Steel, primary forms		126,216	142,926	10,348	Venezuela 39,389; Republic of South Africa 31,483; Chile 21,873.
Semimanufactures:					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		183,645	212,622	1,659	Brazil 119,431; Chile 31,703; Republic of South Africa 23,775.

See footnotes at end of table.

TABLE 3—Continued

ECUADOR: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Iron and steel—Continued:					
Metal—Continued:					
Semimanufactures—Continued:					
Flat-rolled products—Continued:					
Of iron or nonalloy steel—Continued:					
Clad, plated, coated		49,788	38,500	1,138	Japan 23,815; Republic of South Africa 3,790; Brazil 2,592.
Of alloy steel		5,744	1,685	489	Brazil 330; Mexico 212.
Bars, rods, angles, shapes, sections		37,266	68,869	4,766	Trinidad and Tobago 36,993; Venezuela 9,512; Republic of South Africa 8,611.
Rails and accessories		278	504	54	Colombia 418; Spain 8.
Wire		653	840	10	Republic of Korea 289; United Kingdom 201; Brazil 106.
Tubes, pipes, fittings		48,784	28,193	5,932	Argentina 15,787; Brazil 2,476.
Lead:					
Oxides		1,404	1,641	4	Peru 844; Panama 456; Mexico 282.
Metal including alloys:					
Scrap		—	22	17	Peru 5.
Unwrought		1,290	1,312	—	Peru 634; Panama 418; Colombia 249.
Semimanufactures		77	58	1	Germany 7; unspecified 50.
Magnesium: Metal including alloys:					
Unwrought		1	1	1	
Semimanufactures		3	5	5	
Manganese:					
Oxides		710	492	49	Brazil 311; Germany 127.
Metal including alloys, all forms		—	1	1	
Mercury		6	18	3	U.S.S.R. 12; Germany 2.
Molybdenum:					
Ore and concentrate, unroasted	value, thousands	—	$1	$1	
Metal including alloys, semimanufactures	do.	$1	—		
Nickel:					
Matte and speiss		—	143	—	All from Canada.
Metal including alloys:					
Unwrought		1	—		
Semimanufactures		21	16	3	France 2; Canada 1.
Silver: Metal including alloys, unwrought and partly wrought	value, thousands	$60	$93	$2	Chile $90; Germany $1.
Tin: Metal including alloys:					
Unwrought		7	8	(2)	Peru 4; Bolivia 3.
Semimanufactures		20	26	1	Bolivia 16; Germany 2; Peru 2.
Titanium:					
Oxides		357	760	155	Germany 325; Finland 38.
Metal including alloys, semimanufactures	value, thousands	—	$49	$2	Italy $47.
Tungsten: Metal including alloys:					
Unwrought	do.	r—	$2	$2	
Semimanufactures	do.	r$1	$13	$8	Switzerland $4.

See footnotes at end of table.

TABLE 3—Continued

ECUADOR: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Uranium and thorium:					
Oxides and other compounds	value, thousands	r$11	$156	$1	France $104; Canada $51.
Uranium metal including alloys, all forms	do.	$8	—		
Vanadium: Metal including alloys, all forms		—	1	1	
Zinc:					
Oxides		98	234	31	Mexico 66; Peru 48.
Blue powder[3]		47	6	1	Netherlands 5.
Metal including alloys:					
Unwrought		2,649	3,909	2	Peru 2,871; Canada 987; Argentina 49.
Semimanufactures		3	15	5	Peru 10.
Zirconium:					
Ore and concentrate		162	240	162	Australia 60; Mexico 18.
Metal including alloys, semimanufactures		—	107	1	Mexico 106.
Other:					
Ores and concentrates		—	5	5	
Oxides and hydroxides		63	58	13	Netherlands 19; Norway 14.
Ashes and residues		32	1	NA	NA.
Base metals including alloys, all forms		—	1	1	
Metalloids[4]		11	9	—	Canada 7; Italy 2.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		184	273	46	Costa Rica 126; Brazil 60.
Artificial: Corundum		27	79	—	All from Brazil.
Dust and powder of precious and semiprecious stones	value, thousands	$3	—		
Grinding and polishing wheels and stones		315	4,741	6	Brazil 4,527; Italy 80; United Kingdom 21.
Asbestos, crude		1,151	515	1	Canada 343; Republic of South Africa 149; Uruguay 17.
Barite and witherite		1,901	95	—	Peru 70; Brazil 18; Netherlands 6.
Boron materials:					
Crude natural borates		—	9	—	Mainly from Germany.
Oxides and acids		423	253	(2)	Chile 202; Peru 51.
Bromine[5]		1	3	1	Chile 1; Germany 1.
Cement		11,033	10,298	29	Colombia 5,200; Peru 4,828; Brazil 150.
Chalk		653	573	—	Belgium-Luxembourg 360; United Kingdom 108; Colombia 100.
Clays, crude:					
Bentonite		203	337	56	Colombia 150; Costa Rica 80.
Kaolin		2,284	4,054	3,931	Colombia 103; Netherlands 10.
Unspecified		257	509	457	Panama 24; United Kingdom 18.
Diamond: Natural:					
Gem, not set or strung	value, thousands	—	$3	—	All from Brazil.
Industrial stones	do.	$192	$118	$3	Belgium-Luxembourg 115.
Diatomite and other infusorial earth		245	327	69	Mexico 232; Chile 20.

See footnotes at end of table.

TABLE 3—Continued

ECUADOR: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Feldspar, fluorspar, related materials:					
Feldspar		65	102	—	Peru 90; Italy 12.
Fluorspar		37	27	—	All from Switzerland.
Fertilizer materials:					
Crude, n.e.s.		15	69	—	Chile 60; Canada 9.
Manufactured:					
Ammonia		26	30	14	Belgium-Luxembourg 14; Germany 2.
Nitrogenous		121,042	104,443	31,758	Yugoslavia 22,592; Trinidad and Tobago 19,355.
Phosphatic		8,971	4,191	4,048	Netherlands 90; Belgium-Luxembourg 50.
Potassic		35,867	43,440	26,107	Germany 12,216; U.S.S.R. 5,101.
Unspecified and mixed		32,069	24,671	21,830	Germany 1,109; Colombia 1,056.
Graphite, natural		17	16	(2)	Mainly from Germany.
Gypsum and plaster		8,501	68,962	311	Mexico 63,480; Peru 5,000.
Magnesium compounds:					
Magnesite, crude		5	3	—	Germany 2; Switzerland 1.
Oxides and hydroxides		33	47	36	Mexico 5; Colombia 4.
Mica:					
Crude including splittings and waste		28	13	5	Switzerland 8.
Worked including agglomerated splittings	value, thousands	$1	$5	$1	Germany $3.
Nitrates, crude		66	203	1	Chile 200; Poland 2.
Phosphates, crude		38	39	—	Chile 24; Colombia 15.
Pigments, mineral: Iron oxides and hydroxides, processed		302	273	10	Germany 115; Spain 60; Mexico 42.
Potassium salts, crude		9,946	4,209	4,209	
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	$60	$18	—	Brazil $9; Thailand $9.
Synthetic	do.	$18	$39	$10	Panama $1; unspecified $28.
Quartz crystal, piezoelectric	do.	$2	—		
Salt and brine		254	194	13	United Kingdom 159; Germany 22.
Sodium compounds, n.e.s.:					
Soda ash, natural and manufactured		4,558	2,418	156	Germany 1,772; Colombia 180; France 180.
Sulfate, natural and manufactured		6,030	5,238	10	Mexico 4,035; Chile 1,040; Peru 639.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		22	73	38	Italy 22; unspecified 13.
Worked		—	157	71	Italy 86.
Dolomite, chiefly refractory-grade		958	1,022	—	Peru 480; Colombia 442; Brazil 65.
Quartz and quartzite		377	1	1	
Sand other than metal-bearing		130	72	49	Colombia 23.
Sulfur:					
Elemental:					
Crude including native and byproduct		464	1,914	73	Colombia 1,820; Germany 12.
Colloidal, precipitated, sublimed		57	51	44	Colombia 5; Germany 2.

See footnotes at end of table.

TABLE 3—Continued

ECUADOR: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Sulfur—Continued:					
Dioxide		18	16	9	Colombia 6.
Sulfuric acid		8,050	7,108	2,005	Peru 4,489; Germany 387.
Talc, steatite, soapstone, pyrophyllite	value, thousands	$496	$7,586	$143	Italy $7,252; Brazil $68.
Vermiculite[6]		(7)	7	1	Belgium-Luxembourg 5; Venezuela 1.
Other: Crude		237	7	1	Mexico 4; Venezuela 1.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		849	27	2	Colombia 25.
Carbon: Carbon black		3,594	3,790	40	Colombia 2,454; Venezuela 1,205; Malaysia 48.
Coal:					
Anthracite		26	272	6	Brazil 236; Colombia 30.
Bituminous		—	29	1	Colombia 28.
Lignite including briquets		69	1	1	
Coke and semicoke		370	672	—	All from Colombia.
Petroleum:					
Crude	42-gallon barrels	15	15	15	
Refinery products:					
Liquefied petroleum gas	do.	47	12	12	
Gasoline	do.	NA	76	26	Germany 8; unspecified 42.
Mineral jelly and wax	do.	35,470	44,237	3,943	Germany 15,716; China 7,713.
Lubricants	do.	NA	246,281	21,700	Netherlands Antilles 118,223; France 83,608.
Bitumen and other residues	do.	618	558	558	
Bituminous mixtures	do.	970	1,406	976	Colombia 339; Costa Rica 55.
Petroleum coke	do.	—	38	—	All from Spain.
Unspecified	do.	821,205	—		

[r]Revised. NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Includes zinc dust, powder, flakes.
[4]Reported under SITC item number as "selenium, tellurium, phosphorus, arsenic, etc."
[5]Includes fluorine and iodine.
[6]Includes chlorite and perlite.
[7]Unreported quantity valued at $2,000.

TABLE 4

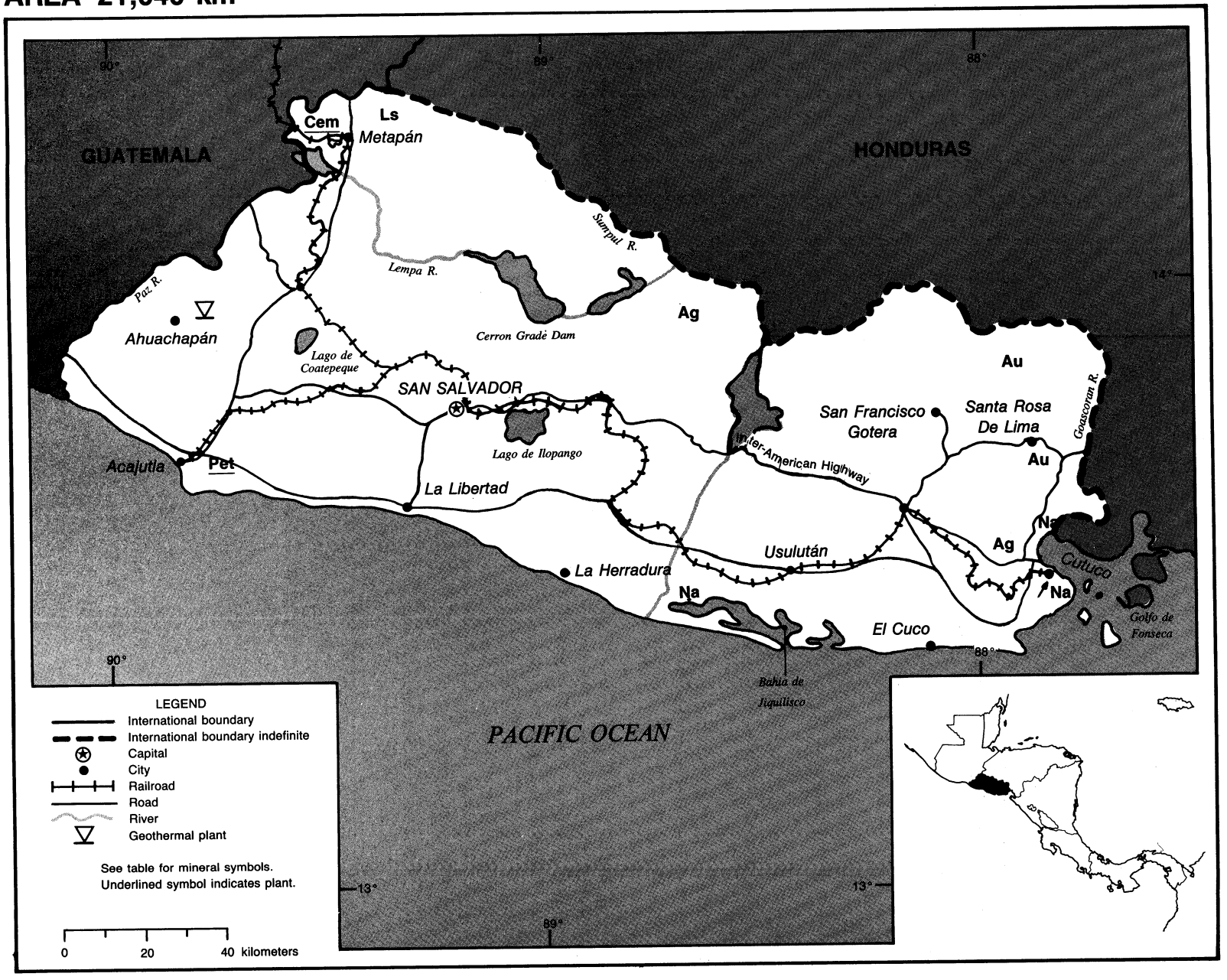
ECUADOR: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Cementos Selva Alegre, S.A. (Government, 100%)	Near Octavalo, Pichincha Province	350
Do.		Cementos Chimborazo, C.A. (Government, 100%)	Near San Juan Chico, Riobamba Province	250
Do.		La Cemento Nacional, C.A. [Corporación Financiera Nacional (CFN), 47%; Government-owned DFC-Holderbank, 47%; private Ecuadorean investors, 3.1%; IFC (U.S.), 2.9%]	7.5 kilometers via a Salinas, Guayaquil Guayas Province	150
Do.		Empresa Industrias Guapan, S.A. (Government, 100%)	Azogues, Canar Province	100
Do.		Cemento Cotopaxi, C.A. (private, 100%)	Near Latacunga, Cotopaxi Province	50
Polymetallic (Au, Ag, Cd, Pb, Zn)		Cía. Armeno Resources Inc. of Vancouver, British Columbia, Canada (Jointly owned by Armenco Resources Inc. of Canada, 50%; Nissho Iwai Corp. of Japan, 50%)	San Bartolome Mine, Azuay Province, 30 kilometers southeast from Cuenca	100
Polimetallic (Au, Ag, Cu, Pb, Zn)		Minera Toachi, S.A. (Owned by Outokumpu Oy of Finland, 33%; Cía. Buenaventura of Peru, 24%; International Finance Corp. of United States, 7%; Ancomin Ltd., 16%; and Vollmer Group, 12%)	La Plata Mine, 113 kilometers southwest of Quito, Cotopaxi Province (currently stagnant)	24
Do.		Ecuadorean Mining Institute (INEMIN) (Government, 100%)	Portovelo Mine, south of Ecuador Del Oro Province	6
Gold	kilograms	Cia. Minera Los Lilenes, S.A. (Osborne & Chapel, 50%; Government, 50%)	Machala River gold placer, Del Oro Province	120
Do.	metric tons	Coperativa Gordillera Nambija (Goverment, 40%; private, 60%)	Cordillera Tunantza, southeast of Ecuador, 25 kilometers north of Zamora Chinchipe	10
Do.	kilograms	Coperativa Orquídea de Los Andes & Cía. Mineral Cumbinamasa, S.A.	Cordillera Las Brisas, Villa 4, Machala	10
Petroleum, crude	thousand 42-gallon barrels per day	Petroecuador (Formerly CEPE-Texaco, Inc.) (Government, 100%)	Lago Agrio, Sacha, Auca, Shushufindi-Aguarico Oilfields, Oriente region, Napo Province	243
Do.		do.	Shushuqui, Shuara, Secoya, Cuyabeno and other oilfields in the northeastern sector, Napo Province	45
Refinery products		do.	Esmeralda refinery, at Esmeralda city and Shushufindi refinery in the Oriente region	21
Do.		Petropenínsula, La Libertad (Government, 100%) (Formerly Anglo & Repetrol refineries)	Santa Elena Peninsula, Guayas Province	13

EL SALVADOR

AREA 21,040 km² **POPULATION 5.6 million**



THE MINERAL INDUSTRY OF

EL SALVADOR

By Philip M. Mobbs

In the past, gold and silver mining had been one of the principal industries of El Salvador, but it declined rapidly, primarily due to escalating fuel costs. Industrial minerals, especially limestone mined for the domestic cement plants, now dominate the country's mineral extraction industry.

Clays, limestone, salt, sand, and tuff production made up most of the country's mineral output in 1992. Mineral-related production also included the country's cement, petroleum refining, and steel industries. *(See table 1.)* The mineral industry was governed under the Mining Code of 1922, as amended by the Complementary Mining Law, Decree 930 of 1953.

Private operations dominated the mineral extraction industry. Near Metapán, Cemento de El Salvador SA operated a 684,000-mt/a cement plant and Cemento Maya SA ran a 240,000-mt/a plant. Exxon Corp. (60%) and Royal Dutch/Shell (40%) owned the 5.8-Mbbl/a Refinería Petrólera Acajulta SA. The Government set prices for petroleum products and locally produced Portland grey cement.

The road and rail facilities that connected the two major ports, Acajutla on the Pacific and the La Unión and Cutuco complex, off the Golfo de Fonseca, were part of the nation's 602 km of track and 10,000-km road network.

The country had 669 MW of installed electrical generating capacity, primarily hydroelectric. The continuing drought forced electric power rationing during 1992.

Volcanic rocks cover about 80% of the country. There is the potential for exploitation of the volcanic material, especially perlite and pumice deposits. Significant expansion of mineral operations in El Salvador is not expected in 1993. However, the January 1, 1992, signing of a peace agreement between the Government and the Frente Farabundo Martí de Liberación Nacional (FMLN) that ended the nation's 12-year civil war brightens mining's prospects. Increased demand for industrial mineral production may be expected as the country's infrastructure is rebuilt. Work on reopening precious-metal mines is expected to interest foreign investors.

OTHER SOURCES OF INFORMATION

Agency

Dirección de Recursos Mineros
Ministerio de Economía
4a Avenida Norte No. 233
San Salvador, El Salvador

Publications

Central Intelligence Agency, Washington, DC: The World Factbook, annual.
Lorenz, W. Industriemerale, Steine und Erden in der Republik El Salvador, Mittlamerika. Geologisches Jahrbuch, Reihe D. Hanover, 1986, 90 pp.
U.S. Department of Commerce, International Trade Administration: Foreign Economic Trends and Their Implications for the United States, annual.

TABLE 1
EL SALVADOR: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992e
Aluminum metal, including alloys, semimanufactures		1,681	1,795	2,040	1,612	1,600
Cement		623,224	632,651	640,943	679,723	680,000
Fertilizer materials:						
Phosphatic		11,702	11,702	7,998	—	—
Other mixed chemical		43,794	45,484	53,430	48,697	49,000
Gypsum[e]		4,500	4,500	4,500	5,000	5,000
Iron and steel: Metal:						
Steel, crude		11,269	11,700	e12,000	e11,000	11,000
Semimanufactures		32,934	37,804	37,847	41,273	41,000
Limestone		1,450,000	1,600,000	1,700,000	1,900,000	1,900,000
Petroleum refinery products	thousand 42-gallon barrels	5,113	5,000	4,856	5,662	5,000
Salt, marine		3,200	5,000	8,000	15,000	15,000

eEstimated.
[1]Table includes data available through Aug. 3, 1992.
[2]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.

TABLE 2

EL SALVADOR: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	Destinations, 1991	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Unwrought		23	18	Guatemala 5.
Semimanufactures		2,713	59	Guatemala 1,639; Costa Rica 376; Honduras 283.
Copper: Metal including alloys:				
Unwrought		131	126	Guatemala 5.
Semimanufactures		137	16	Guatemala 115; Honduras 6.
Iron and steel: Metal:				
Scrap		74	55	Guatemala 14; Sweden 5.
Semimanufactures:				
Bars, rods, angles, shapes, sections		5,030	—	Guatemala 1,981; Honduras 1,795; Costa Rica 747.
Universals, plates, sheets		621	—	Nicaragua 524; Panama 94; Costa Rica 3.
Wire		82	—	Mainly to Guatemala.
Tubes, pipes, fittings		39	—	Nicaragua 20; Guatemala 19.
Castings and forgings, rough		304	25	Guatemala 150; Honduras 120.
Lead:				
Oxides		347	—	Nicaragua 206; Guatemala 120; Honduras 12.
Metal including alloys, semimanufactures		40	—	All to Guatemala.
Other: Ores and concentrates	value, thousands	$1	$1	
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Natural: Corundum, emery, pumice, etc.		56	—	All to Costa Rica.
Cement		11,841	—	All to Guatemala.
Chalk		297	—	Guatemala 248; Honduras 49.
Clays, crude		998	—	Panama 530; Costa Rica 468.
Fertilizer materials: Manufactured:				
Nitrogenous		2,147	—	All to Honduras.
Unspecified and mixed		2,285	—	Honduras 2,242; Guatemala 42.
Graphite, natural		26	—	All to Guatemala.
Lime	value, thousands	$1	—	All to Honduras.
Salt and brine		11	—	All to Nicaragua.
Sodium compounds, n.e.s.: Sulfate, manufactured		20	—	Nicaragua 11; Guatemala 9.
Sulfur:				
Elemental: Crude including native and byproduct		40	—	All to Honduras.
Sulfuric acid		3,191	—	Guatemala 2,000; Costa Rica 754; Nicaragua 432.
Other: Crude		92	—	All to Honduras.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural		1,087	—	Belize 727; Guatemala 360.
Petroleum refinery products:				
Liquefied petroleum gas	42-gallon barrels	12	—	All to Guatemala.
Gasoline	do.	60	—	Do.
Lubricants	do.	108,101	—	Panama 79,667; Guatemala 15,638; Costa Rica 10,416.
Bituminous mixtures	do.	158	—	Nicaragua 67; Costa Rica 48; Guatemala 42.

[1]Table prepared by H. D. Willis.

TABLE 3

EL SALVADOR: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1991	Sources, 1991	
		United States	Other (principal)
METALS			
Alkali and alkaline-earth metals, unspecified	2	(2)	Germany 1; United Kingdom 1.
Aluminum:			
Oxides and hydroxides	91	39	United Kingdom 28; Belgium-Luxembourg 21.
Metal including alloys:			
Unwrought	1,570	1,065	Argentina 505.
Semimanufactures	2,375	349	Japan 572; Hong Kong 359.
Chromium: Oxides and hydroxides	5	4	Mexico 1.
Copper: Metal including alloys:			
Unwrought	8	8	
Semimanufactures	2,654	533	Peru 762; France 689; Mexico 563.
Gold: Metal including alloys, unwrought and partly wrought kilograms	3,855	2,552	Germany 1,303.
Iron and steel: Metal:			
Scrap			
Pig iron, cast iron, related materials	42	1	Spain 17; Nicaragua 9; Germany 4.
Ferroalloys, unspecified	383	52	Mexico 331.
Steel, primary forms	17,284	1,436	Chile 6,501; Netherlands 4,990; Argentina 2,059.
Semimanufactures:			
Bars, rods, angles, shapes, sections	27,937	1,407	Venezuela 8,232; Guatemala 5,422; Nicaragua 3,063.
Universals, plates, sheets	28,067	3,079	Chile 5,215; Germany 3,360; Venezuela 3,337.
Hoop and strip	3,151	85	Germany 1,658; Japan 656; France 256.
Rails and accessories	35	(2)	Guatemala 23; Italy 12.
Wire	2,608	53	Nicaragua 1,252; Guatemala 393; China 217.
Tubes, pipes, fittings	8,118	1,590	Guatemala 4,624; Costa Rica 1,043.
Castings and forgings, rough	430	246	Mexico 116; Venezuela 17.
Lead:			
Oxides	47	1	Mexico 45; Germany 1.
Metal including alloys:			
Unwrought	691	85	Nicaragua 410; Guatemala 176.
Semimanufactures	580	(2)	Mexico 538; Nicaragua 20.
Magnesium: Metal including alloys, semimanufactures	10	10	
Manganese: Oxides	20	19	Germany 1.
Molybdenum: Metal including alloys, unwrought value, thousands	$5	—	All from Netherlands.
Nickel: Metal including alloys:			
Unwrought do.	$1	—	All from Mexico.
Semimanufactures	12	1	Netherlands 8; Germany 2.
Silver: Metal including alloys, unwrought and partly wrought value, thousands	$43	$42	Germany $1.
Tin: Metal including alloys:			
Unwrought	7	7	
Semimanufactures	19	3	United Kingdom 9; Netherlands 3.
Titanium: Oxides	582	158	Mexico 331; Germany 42.
Tungsten: Metal including alloys, unwrought value, thousands	$1	$1	
Zinc:			
Oxides	44	31	Guatemala 6; Mexico 4.

See footnotes at end of table.

TABLE 3—CONTINUED

EL SALVADOR: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1991	Sources, 1991	
		United States	Other (principal)
METALS—Continued			
Zinc—Continued:			
Metal including alloys:			
Unwrought	683	5	Argentina 206; Brazil 196; Peru 154.
Semimanufactures	5	2	Mexico 3.
Other:			
Oxides and hydroxides	34	29	Germany 4; Mexico 1.
Base metals including alloys, all forms	4	(2)	Mexico 4.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc.	196	5	Guatemala 141; Austria 49.
Grinding and polishing wheels and stones	183	5	Germany 82; Brazil 45; Mexico 12.
Asbestos, crude	121	—	Canada 80; unspecified 40.
Barite and witherite	3	NA	NA.
Boron materials: Oxides and acids	36	3	Germany 29; Peru 3.
Bromine[3]	5	2	Germany 3.
Cement	2,789	50	Mexico 2,571; Guatemala 147.
Clays, crude	4,713	1,205	Guatemala 3,268; Mexico 154.
Cryolite and chiolite	35	—	All from Guatemala.
Diamond: Natural: Gem, not set or strung value, thousands	$17	—	All from Germany.
Diatomite and other infusorial earth	303	101	Guatemala 159; Mexico 34.
Fertilizer materials:			
Crude, n.e.s.	33	(2)	Netherlands 18; unspecified 15.
Manufactured:			
Ammonia	62	28	Mexico 16; Guatemala 15.
Nitrogenous	207,409	118,387	Belgium-Luxembourg 27,903; Venezuela 17,545.
Phosphatic	42,511	29,415	Senegal 7,665; Guatemala 1,961.
Potassic	3,043	2,643	Guatemala 300; Germany 85.
Unspecified and mixed	4,907	4,812	Guatemala 51; Germany 25.
Graphite, natural	1	—	All from Germany.
Gypsum and plaster	9,364	6	Guatemala 8,045; Honduras 1,313.
Lime	3,443	—	All from Guatemala.
Magnesium compounds: Magnesite, crude	5	3	Costa Rica 2.
Mica:			
Crude including splittings and waste	13	13	
Worked including agglomerated splittings value, thousands	$1	$1	
Phosphates, crude	51	51	
Pigments, mineral: Iron oxides and hydroxides, processed	101	2	Mexico 52; Germany 22; United Kingdom 13.
Precious and semiprecious stones other than diamond:			
Natural value, thousands	$21	—	Germany $17; Switzerland $4.
Synthetic do.	$2	—	Germany $1; Panama $1.
Salt and brine	4,823	498	Honduras 2,132; Nicaragua 1,463; Mexico 524.
Sodium compounds, n.e.s.: Sulfate, manufactured	3,269	494	Mexico 1,963; Guatemala 188.

See footnotes at end of table

TABLE 3—CONTINUED

EL SALVADOR: IMPORTS OF MINERAL COMMODITIES[1]

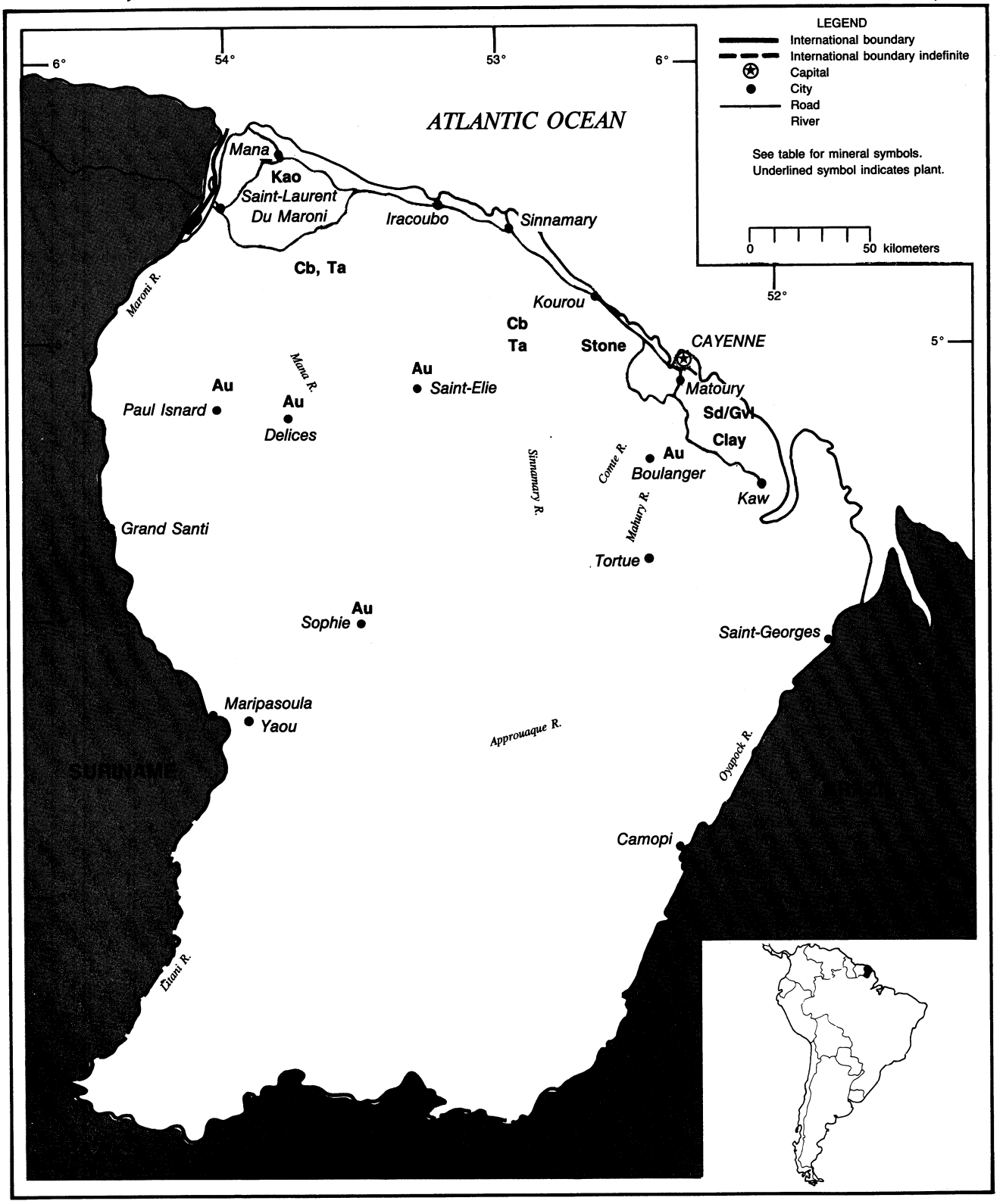
(Metric tons unless otherwise specified)

Commodity		1991	Sources, 1991	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Stone, sand and gravel—Continued:				
Dimension stone:				
Crude and partly worked		2,899	—	All from Guatemala.
Worked		106	(2)	Honduras 81; Guatemala 24.
Dolomite, chiefly refractory-grade		2,197	40	Guatemala 1,986; Mexico 170.
Gravel and crushed rock		6,483	—	Guatemala 6,312; Mexico 148.
Limestone other than dimension		239	—	All from Guatemala.
Quartz and quartzite		114	2	Mexico 102; Guatemala 10.
Sand other than metal-bearing		626	91	Guatemala 413; Mexico 120.
Sulfur:				
Elemental:				
Crude including native and byproduct		2,676	2,600	Belgium-Luxembourg 71; Guatemala 5.
Colloidal, precipitated, sublimed		95	15	Venezuela 40; Mexico 29.
Sulfuric acid	value, thousands	$1	—	All from Japan.
Talc, steatite, soapstone, pyrophyllite		414	148	Guatemala 207; China 39.
Other:				
Crude		5,152	22	Guatemala 5,124; Colombia 5.
Slag and dross, not metal-bearing		43	—	All from Germany.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural		7	7	
Carbon: Carbon black		35	15	Germany 12; Mexico 6.
Coal:				
Anthracite		16	16	
Lignite including briquets		1	1	
Coke and semicoke		366	323	Guatemala 23; Colombia 20.
Petroleum:				
Crude	thousand 42-gallon barrels	3,298	641	Venezuela 1,683; Mexico 973.
Refinery products:				
Liquefied petroleum gas	42-gallon barrels	267,682	108,901	Mexico 112,462; Panama 27,156.
Gasoline	do.	206,814	204,391	Mexico 2,397; Germany 17.
Mineral jelly and wax	do.	18,408	8,704	Dominican Republic 2,802; Germany 2,400.
Kerosene and jet fuel	do.	8	8	
Lubricants	do.	558,943	503,419	Netherlands Antilles 34,419; Guatemala 17,010.
Bituminous mixtures	do.	218	206	Mexico 12.

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

FRENCH GUIANA

AREA 90,909 km² **POPULATION 127,500**



THE MINERAL INDUSTRY OF

FRENCH GUIANA

By Philip M. Mobbs

French Guiana, an overseas Department of France, was almost totally supported by the French Government. Funding of the Kourou Space Center and direct Government payments made up a majority of the gross departmental product. With the exception of small-scale alluvial gold activity, mineral recovery operations have had relatively negligible economic impact in French Guiana. The mineral industry formed a very small part of the heavily forested Department's economy in 1992, lagging considerably behind the contribution of the construction, shrimp, space, sugarcane, and timber industries.

French Guiana was situated in the northeast quadrant of the Guiana Shield. The Department's geology was dominated by weathered Proterozoic granitoid rocks, gneisses, greenstones, and metasediments.

GOVERNMENT POLICIES AND PROGRAMS

The mining laws and regulations of France prevailed in the Department. Mining operations came under the Mining Code, Decree No. 56-838 of August 16, 1956, and subsequent amendments, as well as provisions of the April 21, 1810, Napoleonic Law. Mineral deposits were classified as mines or quarries. The quarry designation included all materials mined for construction.

PRODUCTION

Mineral production consisted primarily of columbite and tantalite, gold, gravel, sand, and stone. Gold had been mined at a number of placer sites in the interior since 1853. Columbite, sand, and tantalite were also 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.)*

TRADE

France dominated French Guiana trade, accounting for more than 50% of total imports and exports. Most of the produced gold was exported to France. Sand and stone were consumed by the local construction industry. The Department depended on imports for its other mineral requirements, especially cement and fuels. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

At the end of 1990, there were 47 mineral concessions and 65 exploration permits in effect. In general, existing mineral companies tended to be small and locally owned; however, the French state company, Bureau de Recherches Géologiques et Minières (BRGM), held a number of exploration permits.

COMMODITY REVIEW

Metals

BRGM continued its exploration and studies of optimum methods for extraction of gold. A privately held gold company based in Saint-Laurent Du Maroni retained concessions on 10 placer sites in French Guiana. Its output was projected to increase to almost 70 kg/month during 1992 from the 45 kg/month reportedly produced in 1991.

Additionally, gold was mined and smuggled out of the country by Brazilian garimpeiros along the southeastern frontier.

Industrial Minerals

The significant increase in the production of construction materials since the mid-1980's can be attributed to the work on the Petit-Saut Dam and continued construction at both the Kourou Space Center and in Cayenne.

INFRASTRUCTURE

Minerals produced in the interior were flown out by airplane or shipped down the rivers. The Department's 700-km road system served to transport mineral commodities to the coastal population centers. Bulk commodities were shipped through the port at Cayenne.

The three diesel and gas-turbine powerplants of Electricité de France had a total installed electricity-generating capacity of 123 MW. Fuel for the power stations was imported. An additional 116 MW of installed capacity was scheduled to become available in 1994 when the hydroelectric station at Petit-Saut was scheduled for completion.

OUTLOOK

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, vanguard companies should spill over into French Guiana.

The demand for stone and sand and gravel should continue to slacken, with the winding-down of the large-scale public works projects by 1994. Production of the bauxite deposits in the

Kaw region is not expected to be economically feasible in the foreseeable future.

OTHER SOURCES OF INFORMATION

Agencies

Direction Regional de l'Industrie, de la Recherche et l'Environnement
B.P. 7001
97307 Cayenne, French Guiana
Bureau de Recherches Géologiques et Minières
B.P. 552
97333 Cayenne Cedex, French Guiana
(594) 30-06-24
Institut National de la Statistique et des Etudes Economiques
Service Régional de la Guyane
1 rue Maillard de la Guyane
B.P. 6017
97306 Cayenne Cédex, French Guiana

Publications

Gédim (Paris, France): Réalités Industrielles, Annales de Mines, monthly.
Central Intelligence Agency: The World Factbook, 1992.

TABLE 1

FRENCH GUIANA: PRODUCTION OF MINERAL COMMODITIES[1]

Commodity		1988	1989	1990	1991	1992e
Clay[e]	metric tons	2,500	4,500	5,000	6,000	5,000
Columbite and tantalite	kilograms	566	1,304	1,076	e1,100	1,100
Gold, mine output, Au content	do.	530	544	870	r1,417	1,600
Sand	thousand metric tons	359	1,925	1,456	e1,500	1,000
Stone, crushed	do.	649	1,189	1,319	e1,500	1,400

eEstimated. rRevised.
[1]Includes data available through Feb. 26, 1993.

TABLE 2

FRENCH GUIANA: EXPORTS AND REEXPORTS OF SELECTED MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Principal destinations, 1991
Abrasives, n.e.s.: Grinding and polishing wheels and stones		1	—	
Alkali metals		75	—	
Aluminum: Metal including alloys:				
Scrap		1,083	10	All to France.
Unwrought		—	7	Do.
Semimanufactures		748	—	
Carbon: Carbon black		772	—	
Copper: Metal including alloys:				
Scrap		4,539	45	All to France.
Unwrought		—	10	Do.
Gold:				
Waste and sweepings	kilograms	—	2	All to Italy.
Metal including alloys, unwrought and partly wrought	do.	48,000	512	France 372; Switzerland 80; Martinique 44.
Iron and steel: Metal:				
Scrap		8,089	47	France 43; Brazil 4.
Steel, primary forms		—	3	All to France.
Semimanufactures: Tubes, pipes, and fittings		75	(2)	Do.
Lead: Metal including alloys, scrap		600	—	
Petroleum refinery products:				
Bitumen and other residues	42-gallon barrels	—	121	All to Trinidad and Tobago.
Unspecified	value, thousands	$41	$8	Suriname $7; France $1.
Stone, sand and gravel:				
Dimension stone, worked		39	—	
Gravel and crushed rock		—	900	All to Suriname.
Zirconium: Ore and concentrate		20	—	
Other metals:				
Ores and concentrates		133	(3)	All to Belgium-Luxembourg.
Oxides and hydroxides		—	1	All to Germany.

[1]Table prepared by H. D. Willis. French Guiana did not report any exports of mineral commodities to the United States during 1991.
[2]Unreported quantity valued at $95,000.
[3]Unreported quantity valued at $13,000.

TABLE 3

FRENCH GUIANA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS					
Alkali metals		36	(2)	—	All from Germany.
Aluminum:					
Oxides and hydroxides		5,035	—		
Metal including alloys, semimanufactures		17,858	177	11	France 114; Martinique 29; Italy 22.
Chromium: Metal including alloys, all forms	value, thousands	—	$3	—	All from France.
Cobalt: Metal including alloys, semimanufactures		10	(3)	—	Do.
Copper: Metal including alloys:					
Scrap		—	20	—	Do.
Unwrought		—	1	—	Do.
Semimanufactures		11,293	77	(4)	France 50; Austria 22; Spain 2.
Iron and steel: Metal:					
Pig iron, cast iron, related materials		2,188	1	—	All from France.
Steel, primary forms		2,356	447	—	France 403; Brazil 44.
Semimanufactures:					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		107,159	3,416	1	France 3,143; Belgium-Luxembourg 272.
Clad, plated, coated		353,017	1,290	2	France 1,072; Spain 77; Belgium-Luxembourg 75.
Of alloy steel		13,843	52	—	France 24; Belgium-Luxembourg 20; Germany 8.
Bars, rods, angles, shapes, sections		794,018	13,080	2	France 10,307; Belgium-Luxembourg 900; Spain 798.
Rails and accessories		113,986	43	—	All from France.
Wire		15,263	114	—	France 92; Italy 20; Brazil 1.
Tubes, pipes, fittings		300,634	1,771	1	France 1,261; Spain 382; Italy 68.
Lead: Metal including alloys:					
Unwrought		35	—		
Semimanufactures		12	2	—	All from France.
Mercury		46	1	1	
Tin: Metal including alloys, semimanufactures	value, thousands	$1	$2	—	France $1; Italy $1.
Titanium: Oxides		—	2	—	All from France.
Zinc: Metal including alloys, semimanufactures		1,322	1	—	Do.
Zirconium: Metal including alloys, semimanufactures		7	—		
Other: Oxides and hydroxides		—	1	—	All from France.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		—	31	—	All from France.
Artificial: Silicon carbide		4	—		
Grinding and polishing wheels and stones		1,621	17	—	France 15; Germany 1; Netherlands 1.
Asbestos, crude		—	2	—	Canada 1; France 1.
Barite and witherite		6,300	—		
Bromine, fluorine, and iodine		97	—		
Cement	thousand tons	9,945	116	—	France 72; Trinidad and Tobago 30; Guadeloupe 5.
Chalk		—	85	—	All from France.

See footnotes at end of table.

TABLE 3—Continued

FRENCH GUIANA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1990	1991	Sources, 1991	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Clays, crude:				
Bentonite	523	—		
Kaolin	—	4	—	All from France.
Unspecified	220,508	230	—	Do.
Diatomite and other infusorial earth	1,412	(3)	—	Do.
Fertilizer materials:				
Crude, n.e.s.	3,906	102	—	Do.
Manufactured:				
Ammonia	1,202	8	—	Mainly from France.
Nitrogenous	150,992	1,856	—	Netherlands 1,782; France 74.
Phosphatic	26,331	136	—	All from France.
Potassic	2,450	48	—	Do.
Unspecified and mixed	130,300	1,063	—	France 1,020; Guadeloupe 40; Germany 3.
Gypsum and plaster	7,328	46	—	All from France.
Lime	17,806	133	—	Do.
Magnesium compounds: Oxides and hydroxides	—	2	—	Do.
Mica: Crude including splittings and waste	—	21	—	Do.
Pigments, mineral: Iron oxides and hydroxides, processed	399	11	—	France 10; Germany 1.
Precious and semiprecious stones other than diamond, natural value, thousands	$18	$8	—	All from Brazil.
Salt and brine	54,237	497	—	Germany 359; France 138.
Sodium compounds, n.e.s.:				
Soda ash, manufactured	972	7	—	All from France.
Sulfate, manufactured	272	(2)	—	Do.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked value, thousands	—	$2	—	Brazil $1; France $1.
Worked	6,819	196	—	France 83; Brazil 77; Spain 21.
Dolomite, chiefly refractory-grade	8,400	75	—	All from France.
Gravel and crushed rock	—	4	1	France 3.
Sand other than metal-bearing	45,478	600	—	France 586; Switzerland 14.
Sulfur:				
Elemental:				
Crude including native and byproduct	52	3	—	All from France.
Colloidal, precipitated, sublimed	107	2	—	Do.
Sulfuric acid	988	48	—	France 47; Germany 1.
Other: Crude	9,184	186	—	France 91; Germany 39; Belgium-Luxembourg 36.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	282,276	1,926	—	All from Trinidad and Tobago.
Carbon black	50	1	—	All from France.
Coal: Anthracite	—	1	—	Do.
Peat including briquets and litter	2,298	42	—	Belgium-Luxembourg 19; Germany 16; France 7.

See footnotes at end of table.

TABLE 3—Continued

FRENCH GUIANA: IMPORTS OF MINERAL COMMODITIES[1]

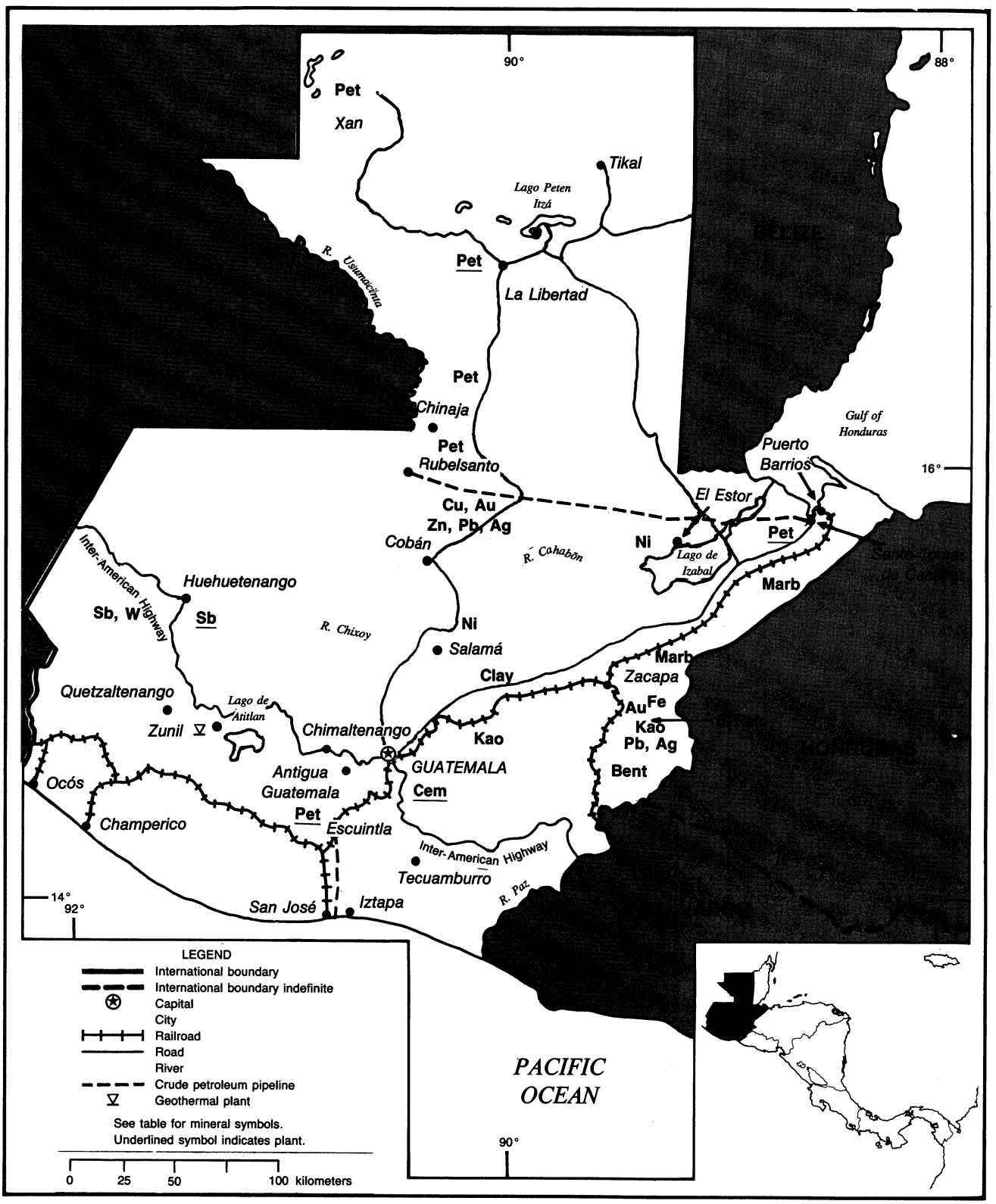
(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS—Continued					
Petroleum refinery products:					
Liquefied petroleum gas	42-gallon barrels	4,255,820	30,079	—	Netherlands Antilles 11,554; Trinidad and Tobago 11,275; Venezuela 6,972.
Mineral jelly and wax	do.	252	(6)	—	All from France.
Bitumen and other residues	do.	1,052,131	20,368	—	Trinidad and Tobago 18,901; Belgium-Luxembourg 970; Spain 497.
Bituminous mixtures	do.	31,700	73	—	All from France.

[1]Table prepared by H. D. Willis.
[2]Unreported quantity valued at $1,000.
[3]Unreported quantity valued at $6,000.
[4]Less than 1/2 unit.
[5]Unreported quantity valued at $4,000.
[6]Unreported quantity valued at $2,000.

GUATEMALA

AREA 108,900 km² **POPULATION 9.8 million**



THE MINERAL INDUSTRY OF

GUATEMALA

By Pablo Velasco

Agriculture is the mainstay of the Guatemalan economy, accounting for about 65% of exports; in contrast, there was only very limited mineral production reported, which included antimony, dolomite, feldspar, gold, gypsum, marble, sand and gravel, silica sand, and crude oil. Other minerals known to occur, but not currently worked commercially, include asbestos, chromite, fluorite, graphite, nickel, and sulfur. Cement was produced by Cementos Progreso S.A. at its San Miguel and La Pedrera, Guatemala City, plants. The two plants together are capable of producing 1 Mmt/a of cement.

In spite of the limited activity in the minerals sector, the Guatemalan Government aims to encourage development of the mining industry, in particular the promotion and negotiation of agreements on a number of gold prospects. The El Pato, the most promising prospect, is reported to contain about 2 Mmt of ore grading 7g/mt of gold and to have attracted interest from several major international mining concerns.

Another official aim has been to reassess the economic feasibility of reviving the former Exploraciones y Explotaciones Mineras Izabal S.A./ Inco Ltda. of Canada (Exmibal/Inco) nickel project, although no decision on renewed development appears to have been taken. The lateritic deposits, estimated to contain 50 Mmt of ore with 1.8% Ni and considered Guatemala's major nonfuel mineral resource, are near El Estor at the western end of Lake Izabal. They were operated by Exmibal a 70% subsidiary of Inco, from 1977 to 1980, producing about 14,000 Mmt/a of nickel ore. Unfavorable economic conditions resulted in the mothballing of the facilities since early 1982, after Inco wrote off its entire $220 million investment in Exmibal. Inco has transferred a 30% equity interest in Exmibal to the Government of Guatemala.

The tight monetary policy being pursued by the Government was bringing about some promising results for the country's economy. Investment opportunities had been created, although there was still no investment code with the guarantees and incentives required by prospective foreign investors.

Political unrest due to sporadic guerilla activity, high inflation, and a general lack of investment by the private sector continued to be a constraint to economic growth. In 1992, the inflation rate dropped to 14.2%. The gross domestic product (GDP) for 1992 was estimated at $10.72 billion[1] in current U.S. dollars, a 4.6% increase in real terms. Agriculture, the traditional and most important sector of the economy, contributed two-thirds to export earnings, including bananas, beans, cardamon, coffee, cotton, and sugar, and accounted for the largest share of GDP, employment, as well as exports. Tourism also had shown strong growth and was virtually tied with coffee as the largest foreign exchange earner. Growth in import demand had outstripped export growth for the past several years. As a result, the trade deficit doubled in each of the past 2 years.

The Government anticipated increased foreign investment in mining and petroleum during 1992-93. Economic growth could be stimulated by new investment.

GOVERNMENT POLICIES AND PROGRAMS

The controlling legislation for mining was Decree Law 69-85 of July 12, 1985. Small-scale mining came under Decree Law 55-90 of December 3, 1990. Petroleum activity was covered by the Hydrocarbon Law, Decree Law 109-83, and associated regulations, especially Government Edicts 1034-83 and 203-84.

In 1992, the Guatemalan Congress virtually completed work on a major fiscal reform program designed to simplify tax rules, broaden the tax base, and increase tax revenues from 7.4% of GDP in 1991 to 10%. Legislation to privatize certain Government operations was expected to be introduced soon. The Government expected to repeat in 1992 its 1991 achievement of a virtually balanced budget. Growth in tax revenues in 1992 was destined to increase the low level of public investment that accompanied 1991's Government austerity program. After 15 months of deliberations, Guatemala's Congress finally approved a new labor law. Although Guatemala's record on labor rights had been severely criticized in the United States over the past decade, the Government always had been able to convince U.S. investigators that matters were acceptable.

In 1991, while Guatemala was updating its labor legislation, which dated back to 1947, the U.S. threat was that, unless Guatemala met minimum labor standards, it would lose its privileges under the Generalized System of Preferences (GSP). In 1992, more than $200 million of Guatemala's total exports of about $900 million to the United States were under GSP provisions.

The new labor code stipulates such things as 2 weeks of holiday per year, a maternity leave of 84 days, the right to organize a union, the right for a worker to take an employer to court in the event

of unfair dismissal, and the rapid recognition of unions. The labor minister admitted that the unemployment rate in the country was at 50%. He stated that this figure covered both unemployment and underemployment. According to the labor committee of the Guatemalan Congress, 40% of all employed Guatemalans do not earn the minimum wage of $80 per month in the cities or $2 per day for agricultural workers.

A comprehensive tax reform was passed in April 1992, eliminating all exemptions to the value added tax and rationalizing the income tax. Combined with better tax administration, these reforms are projected to raise Government revenues from 7.4% of GDP in 1990 to at least 10% in 1993.

Tariffs were being reduced and simplified, with the maximum tariff lowered to 20% as of January 1993. Nontariff barriers were being eliminated and price controls have been abolished.

Direct Government involvement in production was small and shrinking. The Government was planning to eliminate all subsidies to the 38 parastatal enterprises by 1995 and had begun to allow greater private participation in sectors such as energy. The nation's railroads were designated as a preliminary industry to be privatized. Privatization of fuel importation also was proposed for 1992. Companies were to be empowered to import their own fuel without going through the Government.

PRODUCTION

Guatemala's nonfuel mineral production consisted of small amounts of antimony, gold, iron and steel, and lead. Various industrial minerals formed the bulk of the country's production. These were primarily barite, clays, cement, dolomite, feldspar, gypsum, lime, limestone, marble, pumice and related materials, salt, sand and gravel, stone, and talc, all primarily for domestic use. Guatemala was Central America's only crude oil producer. Oil production increased about 52% in 1992, compared with that of 1991, to a historical high. *(See table 1.)*

TRADE

Guatemala became the 103d member of General Agreement on Tariffs and Trade (GATT) when the Congress ratified the accession protocol in October.

Preliminary data indicated that the United States remained the primary destination for 35% of the $1.313 billion Guatemalan export market in 1992. Petroleum exports to the United States increased to 1.7 Mbbl, up from 1.1 Mbbl in 1991. The United States supplied 51.5% of the $2.145 billion Guatemalan imports, followed in importance by Venezuela and Mexico. Imports of crude oil and petroleum products increased by 33% to 1.4 Mbbl compared with those of 1991. In addition Guatemala imported chemicals, electronics, vehicles, and transportation materials. In 1992, Guatemala exported coffee, sugar, garments, fruits, vegetables, and crude oil as the most significant mineral commodities. *(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 of the industry and regulation. Policy for the mineral sector was set by the Ministry of Energy and Mines. This Ministry also formulates policies for the petroleum and electrical power sectors. *(See table 4.)*

COMMODITY REVIEW

Metals

Guatemala was the third largest producer of antimony in Latin America, after Bolivia and Mexico. Both antimony ore and concentrate were produced by Cia. de 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. Output was exported mainly to Laredo, Texas, where it was converted into antimony trioxide and metal.

The Government pursued several projects with funding from the United Nations Revolving Fund for Natural Resources Exploration (UNRFNRE). The UNRFNRE technical report on the El Pato-El Poxte gold project was scheduled to be available early in 1992. It was reported late in 1992 that Consolidated Ramrod Gold Corp. of Canada had been granted an exploration concession covering the 40-km^2 La Ermita property in south-central Guatemala. The company indicated that a feasibility study confirmed proven reserves of 1.89 Mmt of zinc-lead-copper-silver ore having a net smelter return of about $42/ton at July 7, 1992, metal prices. In addition, an extensive diamond drilling of several other anomalies was planned. At yearend, under an agreement signed 20 years ago, Inco transferred 30% equity interest in its Guatemalan subsidiary Exmibal to the Government of Guatemala. The Toronto-based Inco still retains a 70% stake in the Exmibal nickel project, which was constructed in the mid-1970's and operated for 4 years before high energy costs and low nickel prices forced it to shut down in 1982.

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 two cement plants together are capable of providing 1 Mmt/a of cement, and production in recent years appears to have been close to capacity.

Mineral Fuels

Pentagon Petroleum Inc., Baton Rouge, Louisiana, acquired three blocks totaling about 809,371 hectares in Guatemala. Blocks A-2-91 and A-3-91, in the northeast corner of Guatemala, are contiguous with a 104,409-hectare license

Pentagon holds in adjoining Belize. Block A-4-91 is in west-central Guatemala bordering on Mexico's productive Chiapas basin. Pentagon said a 1986-87 speculative survey shot by Western Geophysical Co. along roadways revealed four large structures.

Pentagon indicated that this part of Guatemala, lying in the north Peten basin, contains low-relief structures of large extent in area that could provide reservoirs with large potential. Seismic data obtained on Pentagon's block in northwest Belize indicate a sedimentary thickness of more than 9,144 m.

Gravity and magnetic surveys in this area of Guatemala also have confirmed basin thickness in excess of 7,620 m. Just northwest of the Rubelsanto area, Pentagon said, Petróleos Mexicanos (Pemex) of Mexico has drilled several discoveries. The closest is the Lacantun Field, where a well produced more than 4,000 bbl/d. Pemex also is developing the Chirimoyo, Nazareth, Muspac, and Chanking Fields and has about 80 drill sites spotted. These fields produce from the same type of rock formation as the Rubelsanto wells in Guatemala.

Shell Exploradora y Productora de Guatemala, a unit of Royal Dutch/Shell Group, started seismic surveys on a 3,000-km^2 block in the Lake Izabal region of Guatemala. The block, held under a production-sharing agreement with the Minister of Energy and Mines, covers the lake and a substantial area of swamps and some dry farmland. After an environmental impact study of the area, Shell decided to use air guns to generate seismic impulses offshore and reduced explosive charges onshore.

Major petroleum production occurred in the area of Rubelsanto, Chinaja west, Tierra Blanca, Xan, and Caribe where Basic Resources International is extracting crude from more than 15 commercially producing wells.

Crude oil production in Guatemala in 1992 reached a historical high of 2,051 kbbl; 1,727 kbbl was exported through the port of Santo Tomas de Castilla on the Caribbean Sea. Imports of crude oil and finished products increase by 10% to 1,151 Mbbl compared with 1991. Imports of crude from Venezuela under the San Jose accord totaled 1,761 Mbbl in 1992. In 1992, 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 for the 2 1/2-year project, assisted in equipment procurement, provided field supervision during construction, and directed plant operations during startup.

Deterrents to mineral operations in the north continued to be the lack of infrastructure and the threat of guerilla activity. The northern oil pipeline reportedly was attacked 17 times during the year.

INFRASTRUCTURE

Guatemala has a reasonably well-developed infrastructure. The transportation network is composed of a total of 26,429 km of highways; 2,868 km paved, 11,421 km gravel, and 12,140 km unimproved earth. The Inter-American Highway linking Mexico and El Salvador crosses Guatemala from northwest to southeast. Guatemala is connected to Puerto Barrios in the Caribbean Sea and Puerto Quetzal, Santo Tomás de Castilla in the Pacific Ocean. The railroad system consisted of 884 km of 0.914-m-gauge track, 782 km Government-owned track, and 102 km privately owned track. 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 Jose on the Pacific Coast to Texaco's refinery at Escuintla. Together they would have a combined maximun capacity of 65,000 bbl/d, including the addition of supplemental pumping stations.

The Ministry of Energy and Mines formulates national policies for the electrical power sector and regulates power systems operations. 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 three of the nation's 22 Departments, or States; EEG supplied electricity in Guatemala, Escuintla, and Suchitepequez. The country had an installed generating capacity of 741 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 was 208 kW•h.

The country also had 260 km of inland waterways available for year-round traffic.

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 explorationand production. The lack of adequate infrastructure also will need to be addressed.

[1]Where necessary, values have been converted from Guatemalan quetzals (Q) to U.S. dollars, at the rate of Q5.21=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Ministerio de Energía y Minas
Diagonal 17, entre 20 y 30 Calles, Zona 11
Guatemala City, Guatemala
Telephone: (502) (2) 76-0679 or 76-3091
Dirección General de Minería
Diagonal 17, 29-78, Zona 11
Guatemala City, Guatemala
Dirección General de Hidrocarburos
Diagonal 17, 29-78, Zona 11
Guatemala City, Guatemala
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 America 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, 1989, annual.
U.S. Central Intelligence Agency, Washington, DC: The World Factbook, 1990, 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		1988	1989	1990	1991	1992[p]
METALS						
Antimony:						
Mine output, Sb content		r1,313	r1,335	r1,068	609	582
Trioxide		—	—	—	41	23
Gold	kilograms	—	48	62	31	32
Iron and steel:						
Iron ore, gross weight		8,092	6,541	6,370	5,103	1,445
Steel, crude		22,400	22,460	r20,680	r23,034	e18,000
Steel, semimanufactures		50,400	49,401	r64,198	r79,293	e45,000
Lead metal, including secondary		70	r150	r110	28	49
INDUSTRIAL MINERALS						
Barite		r2,415	3,995	421	—	1,723
Cement	thousand tons	r1,506	r1,613	r1,675	r1,442	e1,400
Clays:						
Bentonite		r4,100	8,236	r9,000	12,000	e12,600
Kaolin		3,459	2,573	2,050	3,281	2,863
Unspecified		3,667	3,200	1,260	1,639	1,597
Feldspar		r7,200	7,000	11,895	6,961	10,091
Gypsum		34,448	57,268	65,560	51,519	67,612
Lime		71,306	79,359	e75,000	r e72,000	e70,000
Pumice and related materials:						
Pumice	cubic meters	22,843	e100	e5,000	6,132	6,591
Volcanic ash[e]	do.	2,500	2,400	2,400	2,400	2,400
Volcanic sand[e]		75,000	137,000	2110,125	100,000	100,000
Volcanic scoria	cubic meters	—	—	2,275	e2,000	e2,000
Volcanic tufa		—	596	610	2,476	2,600
Salt		42,184	r63,100	r60,000	e100,000	e100,000
Stone, sand, and gravel:						
Dolomite		r9,199	10,947	14,900	8,318	9,314
Limestone	thousand tons	r1,108	1,460	1,415	r1,442	1,756
Marble:						
Block		r11,754	17,821	16,839	e17,000	e17,000
Chips and fragments		7,808	9,389	8,260	1,851	1,751
Sand and gravel	thousand tons	r938	865	1,088	r1,009	e1,000
Schist[e]		2254,940	292,000	260,000	250,000	250,000
Silica sand		32,665	e31,000	e30,000	17,300	33,714
Stone, crushed	thousand tons	1,236	1,414	e1,300	e1,000	e1,000
Talc		616	650	545	861	e1,320
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural, gross	thousand cubic meters	16,990	9,282	e10,000	e12,000	e12,000
Petroleum:						
Crude	thousand 42-gallon barrels	1,248	1,328	1,439	1,352	2,051
Refinery products	do.	4,504	4,249	e4,000	4,287	5,696

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through Aug. 18, 1993.

[2]Reported figure.

TABLE 2
GUATEMALA: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1991	Destinations, 1991	
		United States	Other (principal)
METALS			
Aluminum:			
Oxides and hydroxides	1	—	All to Nicaragua.
Metal including alloys:			
Unwrought	288	258	Unspecified 30.
Semimanufactures	126	100	Costa Rica 17; El Salvador 7.
Copper: Metal including alloys:			
Unwrought	184	184	
Semimanufactures	185	144	El Salvador 39; Nicaragua 2.
Iron and steel: Metal:			
Scrap	406	20	El Salvador 293; Nicaragua 60; Mexico 33.
Steel, primary forms	306	—	Mainly to El Salvador.
Semimanufactures:			
Bars, rods, angles, shapes, sections	6,811	—	El Salvador 4,427; Nicaragua 1,051; Honduras 1,018.
Universals, plates, sheets	10,162	(2)	Nicaragua 4,556; El Salvador 3,032; Mexico 2,133.
Hoop and strip	2	—	Mainly to Costa Rica.
Wire	704	—	El Salvador 396; Costa Rica 134; Nicaragua 85.
Tubes, pipes, fittings	8,664	—	El Salvador 4,865; Costa Rica 1,645; Honduras 1,269.
Castings and forgings, rough	101	4	Costa Rica 35; El Salvador 28; Belize 13.
Lead: Metal including alloys, unwrought	195	—	All to El Salvador.
Molybdenum: Metal including alloys, unwrought value, thousands	$2	—	All to Costa Rica.
Tin: Metal including alloys, semimanufactures	1	—	All to El Salvador.
Zinc:			
Oxides	6	—	Do.
Metal including alloys:			
Unwrought	40	—	All to Mexico.
Semimanufactures[3]	15	—	Nicaragua 14; Honduras 1.
Other: Ores and concentrates	36	—	All to Costa Rica.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc.	2,438	537	Venezuela 1,272; Dominican Republic 367.
Grinding and polishing wheels and stones	5	—	Mainly to El Salvador.
Asbestos, crude	7	—	All to Honduras.
Barite and witherite	275	—	All to El Salvador.
Boron materials: Oxides and acids	3	—	All to Nicaragua.
Bromine[4]	1	—	Do.
Cement	405	23	Mexico 211; El Salvador 165.
Clays, crude	4,233	—	El Salvador 3,179; Honduras 594; Costa Rica 460.
Diatomite and other infusorial earth	6	—	Honduras 1; unspecified 5.
Feldspar, fluorspar, related materials	4,210	—	Costa Rica 4,116; El Salvador 73; Nicaragua 20.
Fertilizer materials:			
Crude, n.e.s.	7	—	Mainly to Mexico.
Manufactured:			
Ammonia	55	—	Nicaragua 16; Honduras 15; El Salvador 14.
Nitrogenous	2,357	—	El Salvador 1,166; Honduras 731; Nicaragua 94.

See footnotes at end of table.

TABLE 2—Continued

GUATEMALA: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	Destinations, 1991	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Fertilizer materials—Continued:				
Manufactured—Continued:				
Phosphatic		6,980	—	El Salvador 6,474; Belize 360; Honduras 144.
Potassic		2,182	—	Belize 920; Honduras 752; El Salvador 330.
Unspecified and mixed		1,273	—	Belize 816; Mexico 242; Honduras 85.
Gypsum and plaster		8,824	—	El Salvador 7,686; Costa Rica 983; Honduras 114.
Lime		3,571	—	El Salvador 3,463; Costa Rica 46; Nicaragua 40.
Salt and brine		20	—	All to El Salvador.
Sodium compounds, n.e.s.: Sulfate, manufactured		237	—	El Salvador 148; Honduras 85; Nicaragua 4.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked		8,392	41	El Salvador 2,886; Mexico 1,560; Colombia 1,384.
Worked		113	96	Argentina 6; Honduras 4.
Dolomite, chiefly refractory-grade		2,953	—	El Salvador 1,668; Costa Rica 1,012; Mexico 273.
Gravel and crushed rock		8,192	—	El Salvador 5,735; Mexico 2,402; Costa Rica 41.
Limestone other than dimension		23	—	All to El Salvador.
Quartz and quartzite		70	—	Costa Rica 60; El Salvador 10.
Sand other than metal-bearing		254	—	El Salvador 203; Costa Rica 18; Panama 18.
Sulfur: Elemental: Colloidal, precipitated, sublimed		18	—	El Salvador 10; Honduras 8.
Talc, steatite, soapstone, pyrophyllite		473	—	El Salvador 217; Costa Rica 143; Honduras 43.
Other: Crude		5,167	10	El Salvador 5,143; unspecified 14.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural		27	—	All to Belize.
Carbon: Carbon black		1	—	All to El Salvador.
Coal: Anthracite		2,954	2,954	
Petroleum:				
Crude	thousand 42-gallon barrels	910	910	
Refinery products:				
Gasoline	42-gallon barrels	1,232	—	Honduras 884; El Salvador 348.
Mineral jelly and wax	do.	71	—	Honduras 47; Nicaragua 24.
Lubricants	do.	32,480	—	El Salvador 23,240; Belize 4,305; Honduras 3,878.
Residual fuel oils	do.	3,576	—	El Salvador 3,197; Belize 226; Honduras 127.
Bituminous mixtures	do.	400	—	All to Belize.

[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Includes zinc dust.
[4]Includes fluorine and iodine.

TABLE 3

GUATEMALA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	Sources, 1991	
			United States	Other (principal)
METALS				
Alkali and rare-earth metals		4	3	Germany 1.
Aluminum:				
Oxides and hydroxides		1,098	223	Mexico 618; United Kingdom 166.
Metal including alloys:				
Unwrought		542	—	Mainly from Canada.
Semimanufactures		2,389	528	El Salvador 1,113; Brazil 237.
Chromium: Oxides and hydroxides		1	1	
Cobalt: Oxides and hydroxides	value, thousands	$5	$1	Germany $4
Copper: Metal including alloys:				
Unwrought		5	—	El Salvador 3; Spain 2.
Semimanufactures		521	89	Mexico 323; El Salvador 36.
Gold: Metal including alloys, unwrought and partly wrought	kilograms	1,861	1,809	Germany 52.
Iron and steel: Metal:				
Scrap		12,800	2,822	Canada 5,600; Nicaragua 2,894.
Pig iron, cast iron, related materials		30	23	Mexico 7.
Ferroalloys: Unspecified		1,240	70	Venezuela 804; Brazil 292; Mexico 74.
Steel, primary forms		57,129	41	Chile 15,786; Venezuela 15,145; Brazil 11,539.
Semimanufactures:				
Bars, rods, angles, shapes, sections		102,438	9,897	Argentina 61,626; Venezuela 9,708.
Universals, plates, sheets		89,422	2,467	Venezuela 54,403; Republic of South Africa 6,964; Japan 5,421.
Hoop and strip		2,248	5	United Kingdom 673; Germany 427; Belgium-Luxembourg 287.
Rails and accessories		120	120	
Wire		1,979	542	Mexico 473; Costa Rica 258.
Tubes, pipes, fittings		3,979	2,026	Costa Rica 697; Mexico 643.
Castings and forgings, rough		312	100	El Salvador 100; Mexico 62.
Lead:				
Oxides		662	1	Mexico 560; El Salvador 100.
Metal including alloys:				
Unwrought		18	(2)	Mainly from Honduras.
Semimanufactures		225	(2)	Mexico 154; El Salvador 40; Peru 15.
Magnesium: Metal including alloys, unwrought	value, thousands	$1	$1	
Manganese: Oxides		1,414	54	Mexico 751; Brazil 251; Republic of South Africa 99.
Molybdenum: Metal including alloys, unwrought	value, thousands	$13	$13	
Nickel: Metal including alloys:				
Unwrought		1	1	
Semimanufactures		9	2	Canada 3; Germany 2.
Silver: Metal including alloys, unwrought and partly wrought	value, thousands	$1	—	All from Germany.
Tin: Metal including alloys:				
Unwrought		5	4	Belgium-Luxembourg 1.

See footnotes at end of table.

TABLE 3—Continued

GUATEMALA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1991	Sources, 1991	
		United States	Other (principal)
METALS—Continued			
Tin: Metal including alloys—Continued:			
Semimanufactures	17	4	Belgium-Luxembourg 6; Costa Rica 3.
Titanium: Oxides	562	99	Mexico 247; Germany 147.
Tungsten: Metal including alloys, unwrought	5	3	El Salvador 2.
Zinc:			
Oxides	263	63	Mexico 169; Peru 11.
Metal including alloys:			
Unwrought	550	1	Brazil 449; Belgium-Luxembourg 40; Mexico 40.
Semimanufactures[3]	2,315	46	Brazil 1,149; Mexico 541; Argentina 427.
Other:			
Ores and concentrates	54	21	Netherlands 20; Mexico 10.
Oxides and hydroxides	19	16	Mexico 2; Brazil 1.
Ashes and residues	57	—	Venezuela 55; Netherlands 2.
Base metals including alloys, all forms	32	2	Japan 29; China 1.
INDUSTRIAL MINERALS			
Abrasives, n.e.s.:			
Natural: Corundum, emery, pumice, etc.	46	40	Spain 3; Mexico 2.
Grinding and polishing wheels and stones	223	47	Germany 54; Brazil 50.
Asbestos, crude	40	(2)	Mainly from Canada.
Barite and witherite	6	—	All from Mexico.
Boron materials:			
Crude natural borates	5	—	All from El Salvador.
Oxides and acids	57	3	United Kingdom 41; Peru 7; Germany 5.
Bromine[4]	77	8	Mexico 66; Germany 3.
Cement	15,801	26	El Salvador 12,802; Mexico 2,897; Colombia 50.
Chalk	242	17	El Salvador 225.
Clays, crude	3,954	3,865	Mexico 46; Spain 33.
Diatomite and other infusorial earth	427	32	Mexico 239; Costa Rica 80.
Feldspar, fluorspar, related materials	109	—	Costa Rica 97; Spain 10; Mexico 2.
Fertilizer materials:			
Crude, n.e.s.	20	6	Mexico 7; Nicaragua 7.
Manufactured:			
Ammonia	404	19	Mexico 384; Germany 1.
Nitrogenous	312,195	78,437	Belgium-Luxembourg 105,659; Mexico 52,176.
Phosphatic	27,364	27,313	Mexico 29; El Salvador 21.
Potassic	40,307	16,554	Canada 12,700; Belgium-Luxembourg 9,358.
Unspecified and mixed	30,563	359	Norway 28,143; Netherlands 1,880.
Graphite, natural	26	(2)	Mainly from El Salvador.
Gypsum and plaster	63	63	
Lime	6	—	All from Mexico.
Magnesium compounds: Magnesite, crude	362	16	Mexico 324; Norway 11.
Mica:			
Crude including splittings and waste	8	8	
Worked including agglomerated splittings	1	1	
Phosphates, crude	90	1	Germany 89.

See footnotes at end of table.

TABLE 3—Continued

GUATEMALA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1991	Sources, 1991	
			United States	Other (principal)
INDUSTRIAL MINERALS—Continued				
Pigments, mineral: Iron oxides and hydroxides, processed		141	7	Brazil 55; Germany 36; Canada 18.
Precious and semiprecious stones other than diamond:				
Natural	value, thousands	$7	$7	
Synthetic	do.	$9	—	Austria $4; Switzerland $3; Germany $1.
Salt and brine		2,891	39	Nicaragua 2,307; Panama 201; Mexico 188.
Sodium compounds, n.e.s.: Sulfate, manufactured		7,273	211	Mexico 6,255; Jamaica 399.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked		337	(2)	Mexico 292; Honduras 30; France 9.
Worked		23	13	El Salvador 9; Honduras 1.
Dolomite, chiefly refractory-grade		200	—	All from Mexico.
Gravel and crushed rock		20	—	Do.
Quartz and quartzite		23	—	All from El Salvador.
Sand other than metal-bearing		6,806	5,834	Mexico 473; Venezuela 460.
Sulfur:				
Elemental:				
Crude including native and byproduct		1,156	422	Mexico 328; Venezuela 250.
Colloidal, precipitated, sublimed		230	7	Venezuela 88; Mexico 76; Germany 51.
Sulfuric acid		2,822	1	Mexico 1,480; El Salvador 1,206; Germany 9.
Talc, steatite, soapstone, pyrophyllite		501	296	China 82; Hong Kong 30.
Other: Crude		759	457	Mexico 299; Colombia 3.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural		15,363	7,857	Aruba 3,962; Venezuela 2,982.
Carbon including carbon black		2,642	161	Venezuela 2,066; Mexico 298.
Coal: Anthracite		1	1	
Coke and semicoke		564	524	Mexico 40.
Petroleum:				
Crude	thousand 42-gallon barrels	4,882	245	Venezuela 2,195; Ecuador 2,127; Netherlands Antilles 315.
Refinery products:				
Liquefied petroleum gas	42-gallon barrels	1,084,658	109,991	Mexico 974,609; Brazil 35.
Gasoline	do.	1,749,478	1,321,376	Aruba 408,178; British Virgin Islands 15,572.
Mineral jelly and wax	do.	62,968	10,868	Germany 42,254; Japan 2,487.
Kerosene and jet fuel	do.	217,698	214,776	Aruba 2,922.
Distillate fuel oil	do.	2,781,730	2,170,957	Aruba 570,720; British Virgin Islands 31,802.
Lubricants	do.	86,842	80,549	Mexico 3,010; El Salvador 749.
Residual fuel oil	do.	86,700	12,188	Italy 28,698; Aruba 24,416; El Salvador 15,238.
Bitumen and other residues	do.	976	945	United Kingdom 24; Spain 6.
Bituminous mixtures	do.	406	91	Mexico 261; Colombia 48.

[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Includes zinc dust.
[4]Includes fluorine and iodine.

TABLE 4

GUATEMALA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

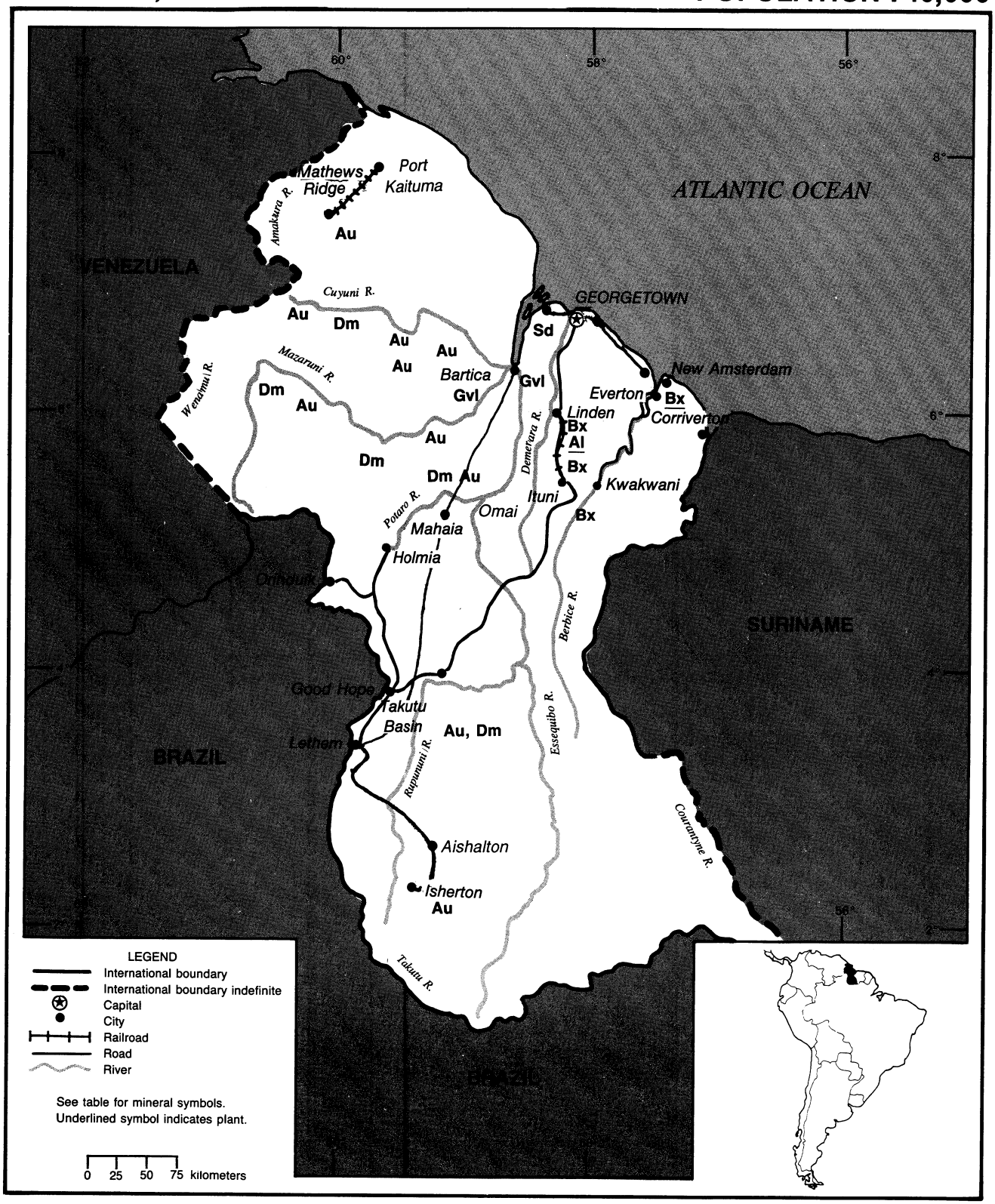
(Thousand metric tons unless otherwise specified)

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
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%; and Government, 30%)[1]]	Mine and processing plant near El Estor, Izabal Department[2]	9
Iron and steel		Hornos, S.A.	Guatemala City	36
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 740,000**



THE MINERAL INDUSTRY OF

GUYANA

By Philip M. Mobbs

Guyana ranked 10th in the world in bauxite production in 1992, with slightly more than 2% of the world's bauxite output. Within Latin America, the country was the fourth largest bauxite producer, after Brazil, Jamaica, and Suriname. Other significant mineral production included diamonds and gold, which have been commercially recovered in Guyana for more than 100 years. The international interest in the Guiana Shield was expected to result in significantly increased gold production by 1993.

The Cooperative Republic of Guyana's economy continued the expected rebound in response to the Government's Economic Recovery Program. Real GDP was projected at a 5% growth rate in 1992, as the nominal GDP rose from $330 million[1] in 1991 to $350 million in 1992. Bauxite and gold accounted for almost 40% of the country's exports.

GOVERNMENT POLICIES AND PROGRAMS

All mineral rights were vested in the state. Mineral concessions were negotiated with Government agencies such as the Bauxite Industry Development Co. Ltd. (BIDCO) (bauxite), the Guyana Geology and Mines Commission (gold and diamonds), and the Guyana Natural Resources Agency (oil). The Guyana Gold Board was the sole official buyer of unprocessed gold. Environmental review of new projects was the responsibility of the Guyana Agency for Health Sciences Education, Environment, and Food Policy.

The Mining Act of 1989 reserved small- and medium-scale mining for Guyanese citizens. Foreigners were restricted to large-scale mining, except in the case where a claim operator specifically requested foreign technical assistance and the 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 the bauxite industry's productivity, reduce debt, and tender the industry to local and foreign investors by 1994.

Peter Harben Inc. of Morris, New York, began a United Nations-sponsored survey of the minerals of Guyana for the Geology and Mines Commission. The commission itself was involved with four exploration programs during 1992, including the Imbaimadai Geomorphological Alluvial Diamond Investigation; the South Savannah Semi-Precious Stone Project, which focused on amethyst, rose quartz, and quartz crystal reserves to the north of Aishalton; the Mabura Hill Dimension Stone Project; and a survey in the Upper Potaro River basin, to study the topaz resources of the Ayanganna area. The commission also studied soapstone from the Kauramenbu Mountains in the Northwest district.

PRODUCTION

Bauxite production continued to recover from the decline posted during 1988-90, aided in part by the startup of the Aroaima Mine. *(See table 1.)*

Declared gold production (the amount sold to the Gold Board) continued to increase. *(See figure 1.)* Miners had traditionally smuggled a significant proportion of produced gold into Brazil or Venezuela; however, since 1990, the Gold Board has paid miners for gold using the market exchange rate (G$125=US$1) rather than the 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 production.

STRUCTURE OF THE MINERAL INDUSTRY

The entire bauxite industry was overseen by BIDCO. Bauxite mining and processing were done by the BIDCO subsidiary Guyana Mining Enterprise Ltd. (Guymine), or under contract to Guymine; however, Minproc Engineering of Sydney, Australia, assumed management of the bauxite industry from Guymine in May. 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 diamonds during 1992. During 1992, five companies held large-scale mining licenses. There were also 17 gold and precious stones prospecting licenses and 15 license applications on file at the beginning of the year. Local subsidiaries of private foreign firms carried out petroleum exploration, both offshore and onshore. *(See table 2.)*

COMMODITY REVIEW

Metals

Bauxite.—Boskalis International N.V. dredged overburden from the Aroama North Mine for Aroaima Bauxite Co.

Linmine's Kara Kara and Northeast Dorabece mines were projected to be mined out in 1 and 2 years, respectively. The bauxite industry used about one-half of the oil that the Government imported from Venezuela.

Gold.—Most gold and diamond mined during early 1992 involved small-scale river dredging operations. The Canadian firms Cambior Inc. and Golden Star Resources began production at the Omai open pit mine. Omai was projected to recover 8,000 kg/a of gold initially. Besides Omai, Golden Star was promoting its placer deposit concession near Mahdia. South American Goldfields reviewed previous work at its Peter's Mine, Akaiwong, Aurora, Five Star, and Quartz Hill properties. During the year, South American Goldfields merged with Golden Star to form Golden Star Resources Ltd.

During November 1991, Patrick Pereira was awarded a 20-year gold mining license for the Honey Camp Prospect.

The Guyanese firm Goldfield Enterprise Mines Ltd. tested gravel from 100 shallow pits on the Arnik Prospect at the end of 1991. Odinga Lumumba acquired the Mariwa-Sardine Hill prospecting license during 1991.

Sutton Resources Ltd. of Vancouver, British Columbia, and Romanex Guyana Exploration Ltd. continued work on the Mazoa Hill prospect in southern Guyana. Exall Resources initiated an exploration program on its concession on the Mazaruni River during 1992. Brex (Guyana) Ltd. was reviewing the dredge configuration for its Mazaruni gold and diamond prospecting license. Black Cliff, Menora Resources, and Noranda Exploration planned to begin exploration operations on their concession in 1993.

The Government expressed interest in constructing a refinery to process the expected increased gold production. The Government also expressed concern during the year about the potential environmental effects of Brazilian garimpeiros' illegal operations in Guyana.

Industrial Minerals

Clays.—Approximately 2,200 tons of clay was extracted for brick production in 1991. An additional 200 tons of Topira Kaolin was mined by Ceramin Ltd. and exported to Trinidad.

Gemstones.—Approximately 2,300 kg (reported as approximately 5,000 pounds) of amethyst was produced near Aishalton in 1991. During 1992, Golden Star continued fieldwork on its alluvial diamond evaluation program at Red Hill Loop, Eping, and Apaikwa.

Stone.—Baracara Quarries and Toolsie Persaud Ltd. produced gravel near Bartica. The Government's Teperu-Itabu Quarry was being rehabilitated. Trans Guyana Mines Ltd. received a 20-year mining license for 645 km^2 of shell beach on the coast of the Northwest District.

Mineral Fuels

At yearend, Guyana Hunt Oil Co. and new partners Yukong (15%), Malaysia Atlantic Equity (5%), and Sunkyong (5%) prepared to spud a well in the Takutu Basin. Mobil Corp. continued exploratory work on its offshore concession.

INFRASTRUCTURE

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. Guyana has 6,000 km of navigable waterways. The railroad connecting the Linden bauxite mines to the Linden plant was part of the country's 187 km of track. There was also 7,665 km of roads, mostly gravel or dirt. The Inter-American Development Bank approved a $23 million loan to partially rehabilitate the nation's coastal road network.

The country had 252 MW of total installed electrical generating capacity.

OUTLOOK

The Government has successfully diversified the formerly bauxite-oriented mineral industry with its 7-year gold and diamonds promotion program. The intensive internationally funded exploration activity is expected to result in increased gold production by 1993. The output from the large-scale gold operations, such as the Omai Mine, will significantly boost the nation's economy.

The Government is gearing up for a gemstone promotion program. The Government is involved in planning for the privatization of the bauxite industry.

[1]Where necessary, values have been converted from Guyanese dollars (G$) to U.S. dollars at the average exchange rate of G$125=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Bauxite Industry Development Co. Ltd. (BIDCO)
71 Main Street
Georgetown, Guyana
Telephone: (592) 2-57780

Guyana Geology and Mines Commission
P.O. Box 1028
68 Upper Brickdam
Georgetown, Guyana
Telephone: (592) 2-53148
Fax: (592) 2-53047

Guyana Gold Board
C/O Guyana Geology and Mines Commission Compound
68 Upper Brickdam
Georgetown, Guyana
Telephone: (592) 2-53173

Guyana Natural Resources Agency
41 Brickdam and Boyle Place 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.

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

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]		1988	1989	1990	1991	1992e
Aluminum: Bauxite, dry equivalent, gross weight	thousand metric tons	1,339	1,321	1,424	2,204	2,300
Diamonds[3]	carats	4,242	7,842	17,842	r21,909	44,700
Gold, mine output, Au content	kilograms	r2,330	r3,200	r3,500	r4,000	4,500
Stone, crushed	metric tons	34,528	37,820	e42,000	e55,000	65,000

eEstimated. rRevised.
[1]Includes data available through May 8, 1993.
[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.
[3]Quantity of produced stones: 1988—36,707; 1989—66,377; 1990—145,655; 1991—140,300, 1992—180,000 (estimated).1

TABLE 2
GUYANA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

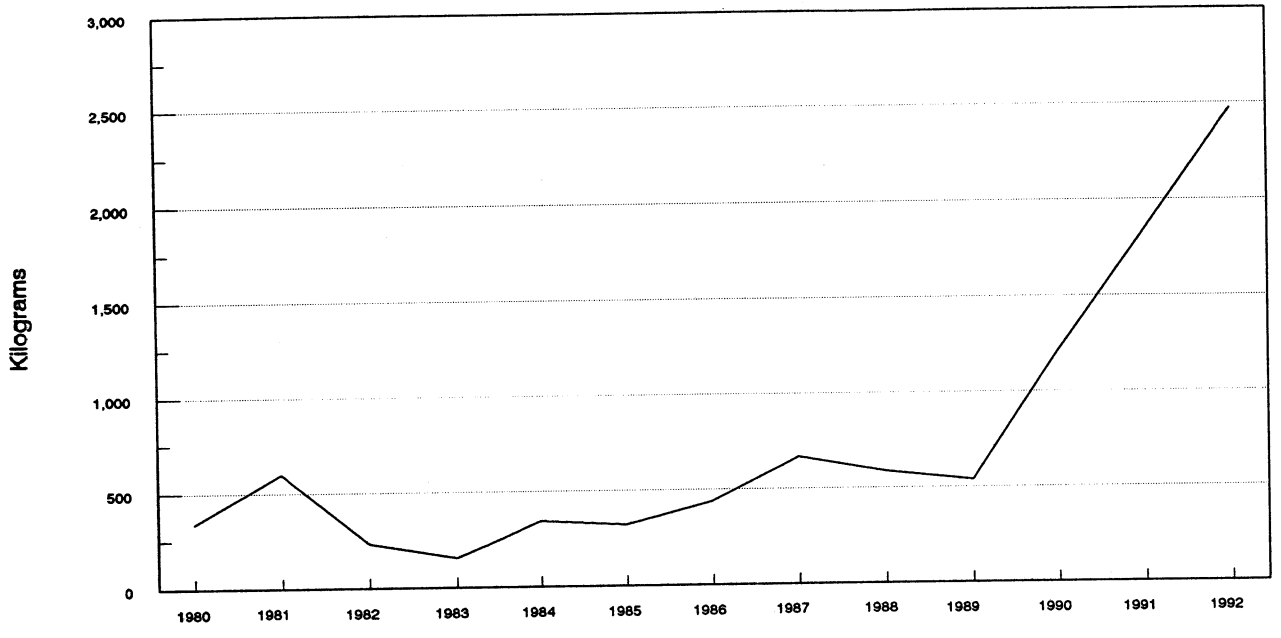
(Thousand metric tons, unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bauxite		Guyana Mining Enterprise Ltd. (Guymine) (Government, 100%)	Kara Kara, Northeast Dorabece, and East Montgomery Mines, Mackenzie, Linden, West Demerara District	3,500
Do.		do.	Block 2 Manaka, North, South Mines, Kwakwani, East Berbice District	1,500
Do.		do.	Processing plant at Linden	900
Do.		do.	Processing plant at Everton, East Berbice District	700
Do.		C.A. Dayco (Private, Venezuela, 100%) (Guymine contract)	Kwakwani area	500
Do.		Green Mining, Inc. (Green Construction Co., United States, 100%) (Guymine contract)	Dacouria Mine, Linden	NA
Do.		Aroaima Mining Co. (Government, 50%; Reynolds International, United States, 50%)	Aroaima, East Berbice District	1,500
Alumina		Guymine	Alumina refinery at Linden[1]	300
Gold	kilograms	Omai Gold Mines Ltd. (Cambior Inc., Canada, 60%; Golden Star Resources Ltd., Canada, 35%; Government, 5%)	Omai Mine, Mazaruni-Potaro District	8,000
Gravel		Baraca Quarries (Private)	Quarry near Bartica, Mazaruni-Potaro District	100
Silica sand		Minerals and Technology Ltd. (Minerals and Chemicals of Texas, United States, 100%)	Sand Hills, Demerara River, West Demerara District	300

NA Not available.
[1]Refinery closed since 1982.

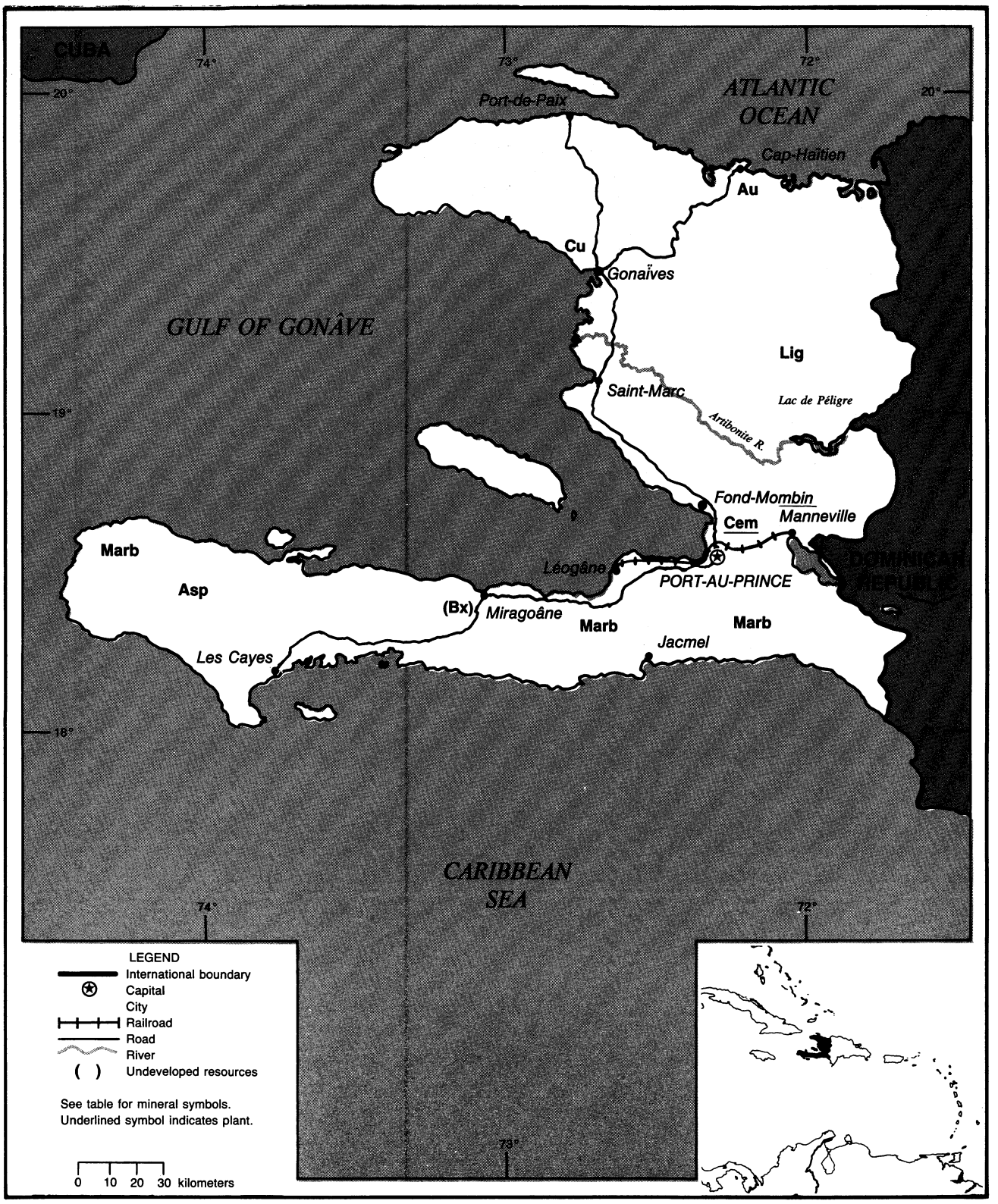
FIGURE 1

GUYANA: OFFICIAL SALES TO THE GUYANA GOLD BOARD



HAITI

AREA 27,750 km² **POPULATION 6.6 million**



THE MINERAL INDUSTRY OF

HAITI

By George A. Rabchevsky

Haiti, being part of the western area of the island of Hispaniola, is in the Caribbean Basin. Haiti is 1,200 km southeast of Miami, the United States, and just east of Cuba. Haiti shares Hispaniola with the Dominican Republic. The size of the country is slightly larger than the State of Maryland of the United States. Haiti's terrain is mostly rough and mountainous.

Haiti has few natural resources. The once important mining of bauxite was terminated in 1982. 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 are small undeveloped deposits of chromite, copper, gold, iron ore, lead, manganese, silver, sulfur, tin, and zinc.

Economic activity remained depressed in Haiti in 1992, reflected in an estimated 5% decline in the GDP. Inflation was more than 40%. The lack of employment opportunities remained the most critical problem facing the country. Haiti is one of the poorest and most underdeveloped nations in the Western Hemisphere and is densely populated. Agriculture and limited mining operations accounted for about 30% of total output in Haiti. A conservative estimate indicates that about 60% of the labor force was unemployed. The export-oriented assembly industry sector, which grew rapidly in the 1970's, accounted for about 75% of total exports in 1991. The lack of water in the agricultural valleys, the lack of fertilizers, and the lack of fuel all contributed to the formation of a deforested countryside with massive erosional problems.

GOVERNMENT POLICIES AND PROGRAMS

The Mining Law of 1976 and the creation of the Ministere des Mines et des Resources Energetiques in 1978 established a framework for orderly relationships between Government and private investment. Mining companies may be privately owned and operated by domestic workers. There were no controls on the repatriation of profits or distinctions between foreign and domestic investors.

PRODUCTION

Haiti's mineral industry was dominated by construction material production. Cement, marble, and sand and gravel led the industry in terms of value. *(See table 1.)*

TRADE

The Organization of American States imposed a trade embargo in October 1991 after a September military coup against the elected civilian President. Several other countries, including members of the European Community and Japan, supported the embargo. Canada, France, and the United States suspended aid to protest the military takeover. Many companies moved their operations to neighboring Dominican Republic, other Caribbean nations, Mexico, and to Central America. Some have closed permanently. The United States used to be the largest foreign investor in the country. The United States in 1991 accounted for more than 80% of Haiti's exports. France, Italy, and Belgium, in that order, were the other leading markets for Haitian products. After the United States, Haiti's significant sources of imports were Argentina, Brazil, Canada, France, Germany, Japan, Korea, Taiwan, The Dominican Republic, Venezuela, and others. These imports included electronic components, industrial machinery, metals, minerals, crude oil, petroleum products, plastics, and textiles.

STRUCTURE OF THE MINERAL INDUSTRY

Mineral-related industries in Haiti were owned primarily by private firms. The Government had an active interest in the country's 350,000-mt/a-capacity cement plant at Fond-Mombin, operated by Le Ciment D'Haiti S.A.

COMMODITY REVIEW

Bauxite deposits in Haiti occur south of the Miragoane city and at other locations. The production of bauxite ceased in Haiti in 1982 because of high costs and low yields.

Gold production used to be carried out in small alluvial deposits in the northeast coastal plains. Alluvial gold concentrations have been known in the valleys of Giseaux, Jasse, Lamatry, and Maboule. In the 1970's, gold was also discovered in the Blondin and Douvray copper deposits, in the northeast portion of the country. Reportedly, the Blondin deposit contains 50 Mmt of ore averaging 0.56% copper, and the Douvray deposit contains 180 Mmt of ore averaging 0.59% copper. The gold deposit at Morne Bossa in the Milot area, south of Cap-Haitien, is considered to be the richest, containing 2 Mmt of ore with 2.25 g/mt of gold.

Le Ciment D'Haiti S.A. was the only cement plant in Haiti. The plant was

located at Fond-Mombin, with a 350,000-mt/a capacity. Clay and limestone were mined for the production of cement products. Marble deposits in Haiti are located in the Gerard-Dunis, Gonaives, Jacmel, Jeremie-Julie, and Thomazeau areas. In places, the topography is karstic with a very steep relief.

Deposits of lignite in Haiti occur in east-central Haiti. About 6 Mmt of lignite reserves has been outlined at Maissade, primarily for use in electricity generation and briquetting. Other lignite deposits have been identified at Hinche and in other locations of central Haiti. Asphalt deposits are found near the Massanga town.

INFRASTRUCTURE

There were about 4,000 km of roads in Haiti, 950 km of which was paved. The privately owned companies operated 40 km of railroad, used primarily for the transport of sugarcane. There was only one major port in Haiti, Port-au-Prince. There were also at least 20 minor ports. The Cap-Haitien Port on the northern shore of the island was handling small cargo vessels.

Only one electrical generating company, Electricite d'Haiti (EdH), was operative in Haiti. EdH had a total capacity of 230 MW from diesel fuel and hydroelectric stations. Another 20 MW was independently produced, almost all of it from cement plants. Haiti's largest facility is the 47-MW Peligre hydro plant on the Artibonite River. Because of the trade embargo, fuel deliveries were stopped to the diesel-burning hydroelectric generators. Water was diverted from the irrigation canals in the Artibonite Valley to the hydroelectric turbines for the production of electricity for Port-au-Prince. The diversion of irrigation water and the lack of fertilizers caused hardships in the agricultural sector. The supplies of propane were also cut by the embargo, forcing hotels, households, and restaurants to use charcoal and wood to cook and heat water. About 90% of household energy demand was met by firewood and charcoal.

OUTLOOK

Haiti has not had the financial and technical resources to develop its natural resources. The future return to political stability with the lifting of the trade embargo can be expected to encourage domestic and foreign investment in developing Haiti's limited mineral resources.

OTHER SOURCES OF INFORMATION

Agency

Bureau des Mines et des Resources Energetiques
Port-au-Prince, Haiti

Publications

Central Intelligence Agency, Washington, DC: The World Factbook, annual.
United Nations Industrial Development Organization, Vienna, Austria: Special Reports.
U.S. Department of Commerce, International Trade Administration, Washington, DC: Foreign Economic Trends and Their Implications for the United States, Haiti, annual.

TABLE 1

HAITI: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991e	1992e
Cement, hydraulic e		250,000	215,000	200,000	250,000	200,000
Clays, for cement		27,083	42,890	48,000	40,000	30,000
Sand and gravel:						
Gravel	cubic meters	2,405,646	3,809,700	3,967,928	3,900,000	3,000,000
Sand	do.	1,368,328	2,166,952	2,256,952	2,200,000	2,000,000
Stone:						
Limestone, for cement		208,118	322,949	286,600	250,000	220,000
Marble e	cubic meters	595	595	595	600	500

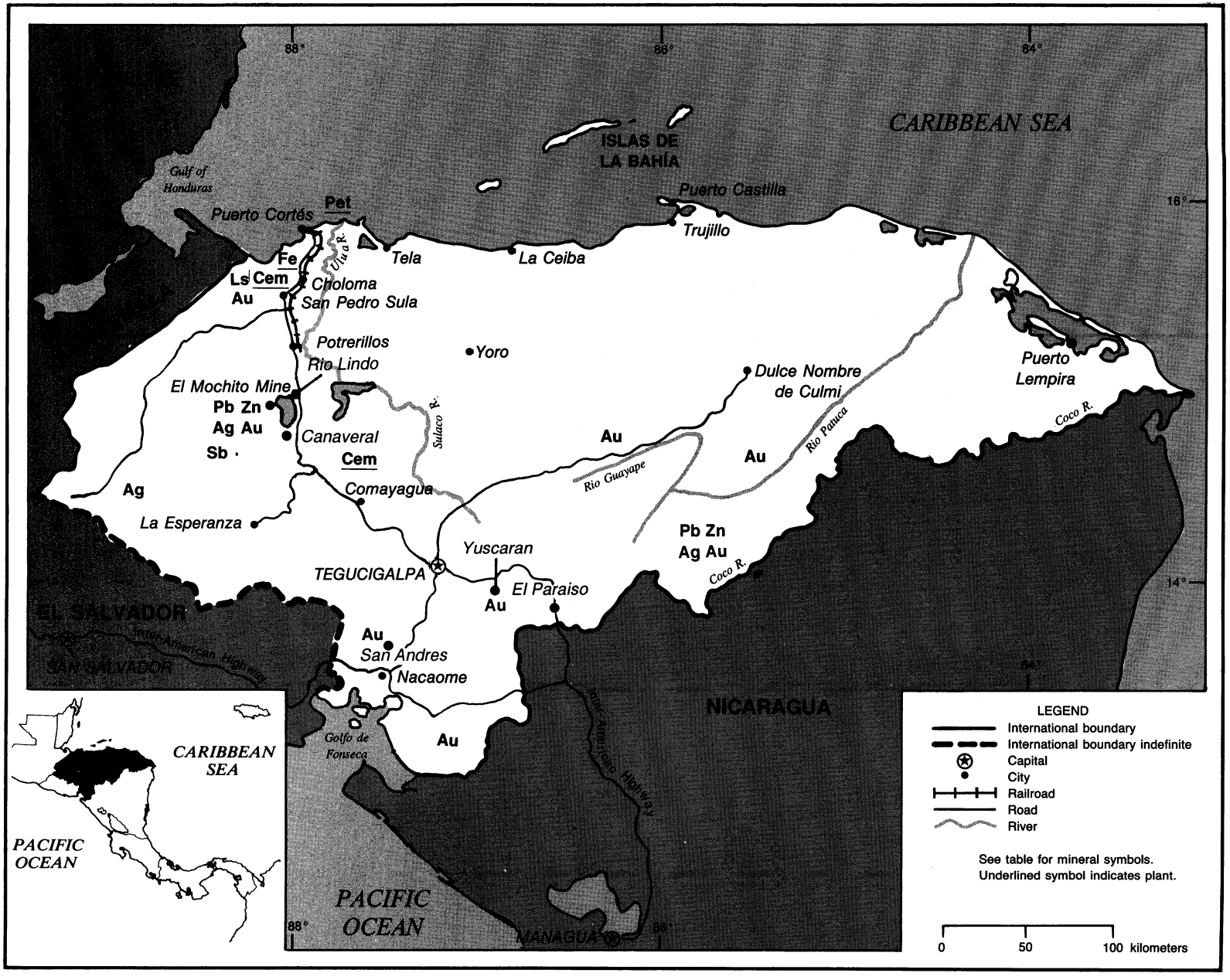
eEstimated.

[1]Table includes data available through May 1993.

[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.

HONDURAS

AREA 112,100 km² **POPULATION 5.3 million**



THE MINERAL INDUSTRY OF

HONDURAS

By George A. Rabchevsky

The Republic of Honduras is in the middle of six republics comprising the Central American Isthmus between Mexico and Panama. Honduras is slightly larger than Tennessee, of the United States. 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 of the country and is geologically the oldest and tectonically the most stable terrain in Central America. There are no active volcanoes in the country.

The country's economy was based on plantations, timber, and subsistence agriculture. Agriculture, the most important sector of the economy, accounted for more than 25% of GDP and employed 62% of the labor force. The rural population represents about 65% of the total population. Honduras, with 5.2 million people, was one of the poorest countries in the Western Hemisphere. The GDP growth declined significantly after 1988 to about zero growth in 1990, then the economy in Honduras began to improve. In 1991, the GDP increased by about 2.2%. In 1992, the economy grew by 4.2%. The inflation trend increased from 10% in 1989 to more than 35% in 1990, then decreased to 25% in 1991. Reportedly, the inflation in Honduras in 1992 was also 25%. The unemployment rate in Honduras was about 15%, declining from 20% in 1989, depending on how it was reported.

Despite Government efforts at reform and large-scale foreign assistance, the economy still was unable to take advantage of its sizable natural resources. The metallic mineral resources of Honduras consisted of antimony, coal, copper, gold, iron ore, lead, silver, and zinc. Contribution by mining to the GDP was negligible. The mining industry generates about $30 million in export revenues per year. 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.

GOVERNMENT POLICIES AND PROGRAMS

Government agencies promoted and supported exploration projects, with support from the Canadian International Development Agency; the Inter-American Development Bank; the Japanese International Development Agency; the United Nations Development Program, which provides institutional assistance to the Dirección General de Minas e Hidrocarburos; and the United Nations Revolving Fund for Natural Resources Exploration. Exclusive exploration concessions are granted for 4 years and are renewable for 2 years. Mining concessions are granted for 40 years.

The mining laws in Honduras date to 1968, 1982 (Decree 79), and 1987 (Decree 168). The hydrocarbon law, Decree 194-84, covers the petroleum industry. A mining company must be formed to conduct business in minerals in Honduras. There are no special rules that apply to foreign investors or entrepreneurs; they must follow the same procedure as a Honduran investor. All companies must be registered with the appropriate Government Ministry, such as Ministry of Natural Resources for mining companies. All companies in Honduras are required to have a labor force that is 90% Honduran. All equipment brought into Honduras is subject to duty up to a maximum of 20% of its value. All individuals, including domestic and foreign companies, are subject to taxation, assessed on a progressive scale ranging from zero to a maximum of 40%.

The petroleum and minerals operations law, Decree 123-90, was passed in October 1990. It granted duty-free imports of machinery and exploration equipment and allowed deduction of a portion of exploration expenses for companies initiating operations before October 1991.

Three loans totaling $105 million have been granted by the Inter-American Development Bank for a program of policy reforms and investment to increase the reliability and lower the cost of energy. Policy reforms will include the adoption of an energy pricing system, strengthening energy-sector management, improving the financial and operational performance of the electricity subsector, promoting more efficient energy production and consumption, and encouraging oil and gas exploration. The program's investment component includes rehabilitating two thermal generation plants and distribution networks in seven major cities. The investment component, whose total cost was estimated at $63 million, will be carried out by the Empresa Nacional de Energía Eléctrica.

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 is a member of the Central American Common Market, formed in 1960. Honduras was a beneficiary of both the Caribbean Basin Initiative and the Generalized System of Preferences. In terms of value, Honduras exports about 40% of metals (gold, lead, and zinc) to Belgium and 30% to the United Kingdom. The remainder was exported principally to Germany, Italy, Japan, Mexico, the United States, and Venezuela. In 1992, the United States accounted for more than 50% of Honduras' total exports and supplied about 38% of its imports.

All locally produced gold in Honduras was exported in the form of ore for refining. 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 to Honduras under the San José Accord.

Four Central American countries reached a framework agreement for free trade with Colombia and Venezuela. El Salvador, Guatemala, Honduras, and Nicaragua would have free access to Colombian and Venezuelan markets within 3 years, extending to all goods within 6 years. Trade barriers on Colombian and Venezuelan goods entering Central America would be dropped within 5 to 10 years. The pact is subject to ratification, expected in mid-February of 1993.

STRUCTURE OF THE MINERAL INDUSTRY

Mineral, petroleum, and natural gas deposits are regarded as national patrimony, and are 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 Honduran Government did not participate in mineral operations, although the Dirección General de Minas e Hidrocarburos (DGMH) took part in the Mineral Inventory Program administered by the French Bureau de Recherches Geologiques et Mineres (BRGM). The DGMH issued mining and petroleum concessions and registered exploration and production companies. The El Mochito Mine, the major nonfuel mineral operation, was owned by a Canadian company, Breakwater Resources, Ltd. There were several small mines, some operated by United States and Canadian companies. Individuals and groups operated small gold placers and small prospects. *(See table 2.)*

COMMODITY REVIEW

Metals

In 1992, there were two significant operating metal mines in Honduras. The El Mochito Mine produced mostly lead and zinc, with some cadmium and gold. The San Andrés Mine produced gold. Antimony, copper, and mercury have been mined in the past, and manganese and iron ore deposits are known, but none of these are reported to be mined at present.

Gold and Silver.—Most of Honduras' gold and silver production came from the El Mochito Mine in the west of the country. In 1981, Honduras led all Central American countries in silver production, producing about 75,000 kg. The metals contamination in water around the El Mochito Mine was receiving wide attention. Breakwater Resources, Ltd. initiated efforts to closely coordinate the development of the new "Nacional" ore body and its local exploration program with the Honduran Government. The Government also participated in the improvement of the road from the San Andrés Mine to the main highway. Favorable exploration results continued to ensure future ore supplies at the mine. In conjunction with this activity, the company also was assessing several nearby projects that have the potential to supply ore to the mill.

The San Andrés deposit was one of the first major gold discoveries in Honduras, and the San Andrés Mine is the second largest gold producer in the country. The San Andrés gold project, managed by Fischer-Watt Gold Ltd. (FWG), is about 150 kilometers southwest of San Pedro Sula, in the Province of Copán. The gold ore was mined and heap leached. Compañía Minerales de Copán S.A. de CV continued its 450-mt/d heap-leaching operation, producing 115 kg of gold in 1992. During the year an option agreement was signed with FWG to acquire the property for $30 million. Gold reserves of that deposit were estimated at 1 million tons with 0.003 kg/mt of gold. FWG also was exploring in the Minas de Oro copper-gold property, the Suyatal lead-silver-zinc property, and the Tembladera gold property.

Melinga Resources Ltd. (MR), Vancouver, Canada, discovered gold in three areas of its Vueltas del Río and Nelson zones on the Macuelizo concession in northwest Honduras. MR held a 100% interest in the El Zapotal concession. The 9,310-ha property was sporadically mined and explored for gold since the Mayan times. The property remained dormant. Within the El Zapotal concession, MR also held the rights to the 607-ha Macuelizo property. The company delineated preliminary gold reserves of 9.4 Mmt contained in a copper-gold porphyry zone, grading 0.002 kg/mt of gold. Separately, second phase diamond drilling started on the Nelson zone.

The Dirección General de Minas e Hidrocarburos also was involved in

drilling several targets with the assistance of BRGM and financing by the Inter-American Development Bank.

Smaller gold placer operations were operated by other foreign companies and individuals. The valleys in southern Honduras, Río Jalan, Río Patuca, and Río Guayape are known for occurrences of gold in placers. Prospectors obtained gold southwest of these valleys, close to the towns of El Paraíso and Yuscaran; some were worked 30 years ago by a U.S. company, Paul Bondy Inc. Northeast of the Río Guayape, white gold nuggets were found, also containing platinum-group metals in the valleys of the Olancho district. Southwest of Yuscaran, gold was being explored on the Chaparrales property.

Lead and Zinc.—El Mochito was the largest lead-zinc mine in Central America, near the Las Vegas town, Department of Santa Bárbara, about 130 km northwest of Tegucigalpa, the capitol. The mine is above Lake Yojoa. The mine, operated by Cía. Minera Santa Bárbara, is in impressive, 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. Cía. Minera Santa Bárbara continued its exploration program for gold, lead, silver, and zinc. The company was a wholly owned subsidiary of Breakwater Resources. The mine was originally opened in 1948, but the ownership was changed in 1990. In 1992, management control was assumed by Arimetco International Inc. from Breakwater Resources. About 1,000 workers were employed in the mine. Ore was transported by trucks from the mine to the mill, about 1.5 km away. The mill used conventional floatation process to separate lead and zinc concentrates. Concentrates were then trucked 123 km to Puerto Cortés for shipment. Power for El Mochito operations was drawn from the Government-owned hydroelectric plants at Río Lindo and Cañaveral. The operating costs at El Mochito to mine and process 1 ton of ore in 1992 as compared to 1991 was reduced by 30%. Overall operating costs declined from $52/mt of ore in 1991 to $36/mt in 1992. In 1992, the focus of the company's development efforts was in delineating the "Nacional" and "Salvavidas" ore bodies within the El Mochito Mine. The "Nacional" ore body, within 1,000 m of the San Juan deposit, had estimated reserves of 2.3 Mmt grading 0.15% copper, 0.79% lead, 11.74% zinc, and 0.075 kg of silver. Table 3 provides data on the production and reserves of the El Mochito Mine.

Steel.—The State-owned steel company, Aceros de Honduras S.A. (AH), in Choloma, has a capacity of about 14,000 mt/a. AH was seeking bids for the privatization of that electric arc furnace plant. Iron ore and scrap were imported as raw materials.

Industrial Minerals

The Venezuelan-Canadian consortium and a local investor group became owners of the state cement plants in Honduras. Cementos de Honduras S.A. (CH), with a capacity of 600,000 mt/a, was the largest cement company, followed by the Industria Cementera Hondureña S.A. de C.V., with 450,000 mt/a of capacity. Most of the cement produced was used internally. CH was the only plant exporting small quantities of cement and clinker to neighboring countries.

Honduras produced salt by solar evaporation primarily in the southwest area of the country, in the Choluteca district.

Mineral Fuels

Oil and gas have been sought in Honduras, both onshore and offshore, not only on the coastal plain and in the Caribbean Sea, but also in small intermontane basins. Honduras has a number of unexploited oil basins, including Matique, Mosquitia, Olancho, Tela, and Ulua. Oil exploration almost had ceased in Honduras, because of high costs and risks. The Mosquitia oil basin was being explored by a number of companies. The only producing oil well in Honduras is offshore, operated by the Texaco company, near the Mosquitia coast. About 1,400 bbl is pumped out each day. Mexico and Venezuela supplied crude petroleum to Honduras under the San José Accord.

INFRASTRUCTURE

There was 8,950 km of roads in Honduras, with only 1,700 km paved. There was 785 km of railroad tracks, confined to the banana zone along the Caribbean coast. The access to many rural areas remained generally difficult. There was about 465 km of navigable inland waterways, mostly used by small craft.

There are coastal ports on both the Caribbean Sea and Pacific Ocean. Puerto Cortés serves as a shipping port for exports of metals. Other Caribbean ports included La Ceiba, Puerto Castilla, Tella, and Trujillo. San Lorenzo port served the Pacific coast activity.

The National Electric Power Co. of Honduras or Empresa Nacional de Energía Eléctrica (ENEE), government-owned, had installed capacity of 575 MW. Honduras suffered insufficient supply of electrical energy in 1992. The El Cajón hydroelectric plant was built in the 1980's and was relied on for supplies of electricity through the year 2000. From 1986 to 1991, Honduras had a surplus of energy and sold it to neighboring countries. Then, the electricity demand increased sharply, growing by about 7% from 1991 to 1992. The growth in demand occurred for many reasons. The rainfall also declined for a number of reasons, including deforestation. This led to lower water levels in El Cajón reservoir and less energy production. There also have been problems with the turbines.

ENEE began repairing the Cortes and La Ceiba thermal powerplants. The country relied on those plants before 1980 and hoped to return them on-line soon. The Río Lindo hydroelectric power station was being repaired for the first time since it was built. The Honduran Government subsidized all energy-related projects.

OUTLOOK

The Honduran Government intends to proceed with its privatization program. The Government considers that the privatization process has been a success, and it is taking measures to ensure that the subsequent phases also will be successful.

Exploration efforts are expected to continue at the El Mochito Mine, and costs are further targeted to be reduced to $30/mt by the end of 1993. Work force and inventory levels are expected to continue to be reduced with a further 20% reduction planned for 1993.

The energy supply in Honduras is expected to persist as a problem in 1993. Electricity outages and rationing are expected to occur. Policy reforms will include improving the operational performance of the electricity subsector, promoting more efficient energy production and consumption, and encouraging oil and gas exploration. Petroleum will continue to be imported, as well as the refined petroleum products, once Texaco closes the country's only refinery.

[1]Where necessary, values have been converted from Honduran lempiras (L) to U.S. dollars at the annual average rate of L5.85=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Dirección General de Minas e Hidrocarburos
Ministerio de Recursos Naturales
Boulevard Miraflores
Tegucigalpa, DC
Honduras, CA
Telephone: (504) 32-7848
Fax: (504) 32-5375

Dirección General de Inversiones y Promoción de Exportaciones
Ministerio de Economía y Comercio
Plaza Peatonal, Edif. Salame, 4to. Nivel
4ta. Calle, 4ta. Avenida
Tegucigalpa, DC
Honduras, CA

Fundación Para la Inversión y Desarrollo de las Exportaciones
(Apartado Postal 2029)
Centro Comercial Maya, 2do. Nivel
Boulevard Morazan
Tegucigalpa, DC
Honduras, CA
Telephone: (504) 32-0937
Fax: (504) 32-1808

Honduras Information Service
501 Fifth Avenue, Suite 1611
New York, NY 10017

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

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		1988	1989	1990	1991	1992[e]
Antimony, mine output, Sb content		19	e10	—	—	—
Cadmium, Cd content of lead and zinc concentrates		276	350	372	212	400
Cement		560,065	648,763	652,111	693,040	650,000
Copper, Cu content of lead and zinc concentrates		538	2,419	1,388	e1,000	1,600
Gold	kilograms	127	160	156	r180	2163
Gypsum[e]		22,000	25,000	25,000	27,000	26,000
Iron and steel:[e]						
Steel, crude		7,200	8,000	8,000	7,500	7,400
Semimanufactures		12,000	17,210	15,000	15,000	15,000
Lead, mine output, Pb content		16,906	9,610	5,785	8,719	9,000
Petroleum refinery products	thousand 42-gallon barrels	e1,500	3,299	3,106	e3,000	3,000
Salt[e]		30,000	30,000	30,000	30,000	30,000
Silver	kilograms	58,447	49,559	18,246	39,359	39,000
Stone:						
Limestone[e]		450,000	450,000	460,000	500,000	450,000
Marble	square meters	33,175	74,250	84,400	95,937	100,000
Zinc, mine output, Zn content		23,475	37,184	29,628	38,280	32,000

[e]Estimated. [r]Revised.

[1]Includes data available through Aug. 31, 1993.

[2]Reported figure.

[3]Prior to 1989, official marble production was reported in metric tons.

TABLE 2

HONDURAS: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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	1,500
Do.	do.	Cía. Minerales de Copán, S.A. (Madeleine Mines, 25.5%; Milner Consolidated Silver Mines, 25.5%)	San Andrés Mine, Copán Department	400
Lead		Cía. Minera Santa Bárbara (Breakwater Resources, Ltd., 100%)	El Mochito Mine, Santa Bárbara Department	24
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	NA
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

NA Not available.

TABLE 3

HONDURAS: PRODUCTION AND RESERVES OF THE EL MOCHITO MINE

(Metric tons unless otherwise specified)

Production		1991	1992
Ore mined		441,361	522,076
Lead:			
Average ore grade	Pb%	2.44	2.31
Concentrate production		12,944	14,260
Concentrate grade	Pb%	67.36	67.05
Zinc:[1]			
Average ore grade	Zn%	9.20	7.20
Concentrate production		72,693	62,172
Concentrate grade	Zn%	52.66	52.60
Total concentrate production		85,637	76.43 2

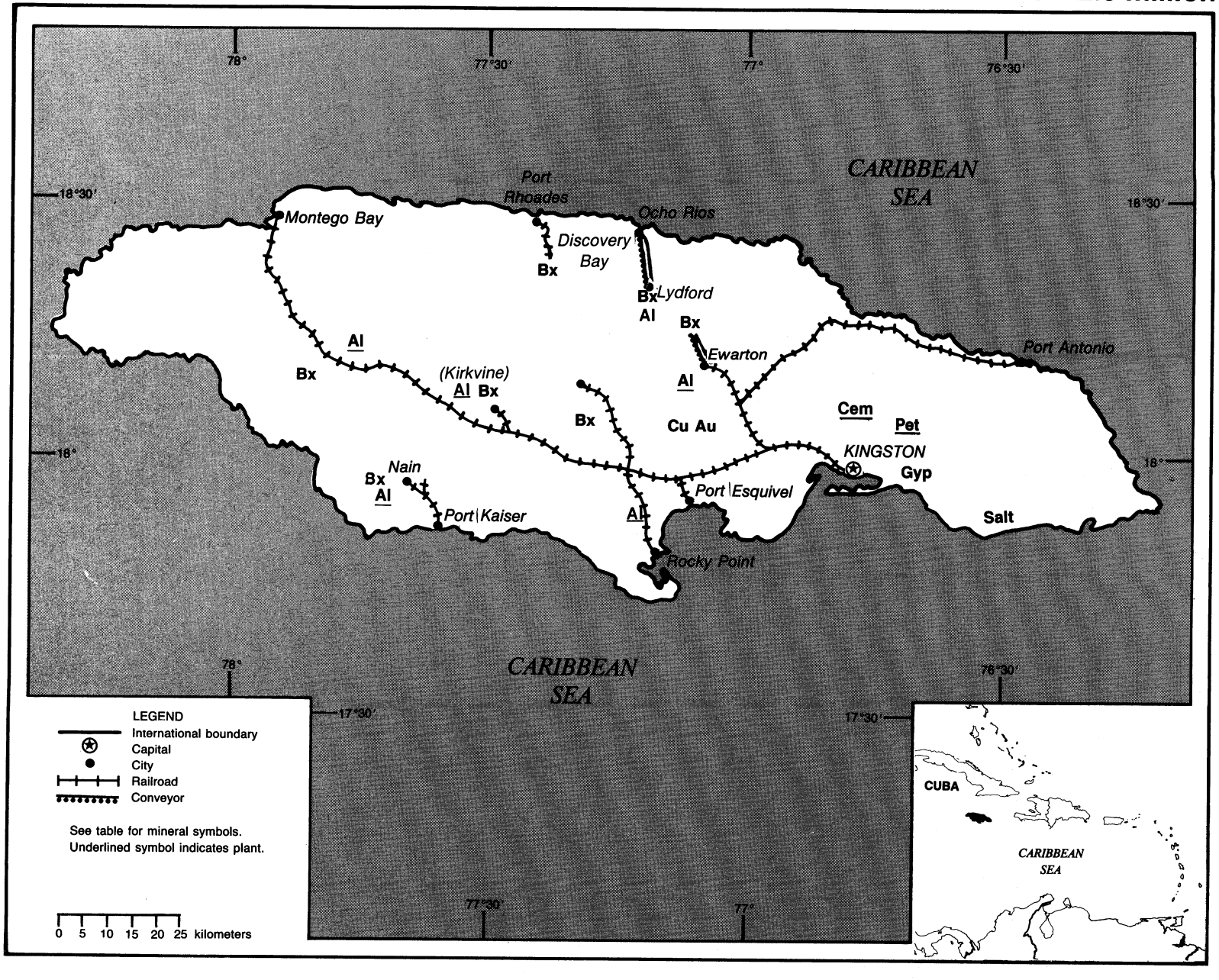
Reserves	Mmt	Copper	Gold	Lead	Silver	Zinc
December 31, 1991:	4.33	0.27%	—	1.89%	77.0 g/mt	7.92%
December 31, 1992:	4.36	.15%	—	1.17%	75.0 g/mt	10.44%

[1]Zinc grade declined substantially as mining efforts concentrated in the lower grade San Juan ore body.

Note.—Reserves are defined as "active geological reserves" and include those in the proven and probable categories.

JAMAICA

AREA 11,000 km² **POPULATION 2.5 million**



THE MINERAL INDUSTRY OF

JAMAICA

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 tropical karst topography. The older Cretaceous igneous rocks contain copper and gold occurrences, currently attracting exploration firms.

The chief contributors to the Jamaican economy were bauxite mining, alumina production, agriculture, and tourism. Manufacturing has developed into an important sector in both the domestic and export markets.

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 60% to the total export value.

One-half of Jamaica's land mass is used for bauxite mining and alumina production. 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.

In 1955, bauxite mining represented almost 5% of the GDP, and in 1992, this contribution had remained almost the same. The inflation rate in Jamaica was about 30%, while the general unemployment rate was at 20% to 25%. About 6,000 workers were employed in the mining and refining sectors, representing less than 1% of the total work force.

GOVERNMENT POLICIES AND PROGRAMS

The first mining law in Jamaica was known as the Petroleum Law 1940 (Law 26 of 1940). A series of laws regulating mining in Jamaica were issued in 1947. In 1950, Law No. 12, the Bauxite and Alumina Industries (Encouragement) Law, was enacted. In the early 1960's, four active mining companies began to exchange properties and consolidate their holdings into more practical and exploitable blocks. The consortium formed in 1966, Alumina Partners of Jamaica (Alpart), was one result of this consolidation effort. In the following years various regulations were issued by the Government concerning the payment of royalties and, especially, land restoration. The mining companies in Jamaica were always required to restore the mined land to its former level of productivity. New mining legislation was being prepared.

In 1988, the Government revised the bauxite production levy of 1974 (which indexed the local price of bauxite to the price of aluminum ingots) and incorporated a tax on firms' profits, a measure designed to lessen reliance on the levy and improve Jamaican companies' global competitiveness. The bauxite levy, which is indexed to world market prices for aluminum, is currently approximately $5.00[1] per ton of bauxite mined, is adjusted every 6 months, and is paid by aluminum companies monthly.

Raw materials are generally 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.

Companies, whether incorporated or registered in Jamaica, are subject to the Jamaica Income Tax Act. However, the Government grants exemptions from corporate profit tax.

PRODUCTION

Jamaica remained an important world producer of bauxite and alumina. Jamaica 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. Production decreased in 1992 because of the economic and political changes in almost all countries of the world. *(See table 1.)*

TRADE

From the earliest days of bauxite mining, this industry dominated Jamaica's export trade. Bauxite and alumina commodities in Jamaica accounted for about 60% of total exports, amounting to about $560 million in 1992. The United States was Jamaica's major market for bauxite and alumina. Puerto Rico and the Virgin Islands continued to be Jamaica's trading partners. Jamaica also conducted trade with the United Kingdom, Trinidad and Tobago, and Canada.

Jamaica imported petroleum refinery products, primarily from Mexico and Venezuela and some from Ecuador.

STRUCTURE OF THE MINERAL INDUSTRY

From the beginning of the Jamaican bauxite industry, the Government retained ownership of the mining companies. Initially, mining and refining were performed by foreign-owned subsidiaries of North American aluminum companies. In the 1970's, the Jamaican Government

purchased 51% of the local operations of Kaiser and Reynolds companies, and 6% and 7% of Alcoa and Alcan, respectively. In return, these companies were granted 40-year mining leases. Reynolds has since withdrawn from Jamaica.

Norway owns 35% of Alumina Partners of Jamaica (Alpart), with the remaining 65% of Alpart's alumina production operation owned by Kaiser.

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, assist in the modernization of industries, and to export Jamaican made products. The primary aim of JAMPRO is the creation of more jobs and foreign exchange inflows. *(See table 2.)*

COMMODITY REVIEW

Metals

Except for bauxite, there were no other basic metals produced in Jamaica, although copper and gold mining was attempted in the 19th century and earlier. In the 1960's, copper, lead, and zinc were produced at the Hope Mine, east of Kingston.

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 four alumina plants. Jamaican bauxite is at or near the surface, under 0.3 meters or less of soft topsoil. The ore is scooped up with front-end loaders and draglines. Bauxite is plentiful and it is inexpensive to mine it in Jamaica. After mining, pits are contoured and topsoil is respread. Grass is then planted and periodically plowed back, with the objective of returning the mined land to its former productivity.

The bauxite industry in Jamaica started in the 1940's, emerging as the world's largest bauxite producer. In the 1970's, Australia and Guinea overtook Jamaica in bauxite production. Jamaica's bauxite output fluctuated between a high of 12 Mmt in 1981 and a low of 6.2 Mmt in 1985, with 1990-92 production in the 10- to 12-Mmt range. The variation in bauxite output was a response to the market demand, which is a reflection of economic conditions.

In 1944, Reynolds Metals Co. began exploration and land acquisition, primarily in St. Ann Parish on the north side of the island. The first shipment of bauxite from Jamaica to the United States occurred in 1952. That bauxite was mined by Reynolds in the Lydford town, St. Ann Parish. Reynolds' name was eventually changed to Jamaica Bauxite Mining Ltd. The Lydford Mine was closed in 1984 because of high production costs and low market prices. The agreement to reactivate the mine with the Republic of Ukraine did not take place as a result of a combination of uncertainty over legal ownership of the Ukrainian operation and the economic contraction in the former U.S.S.R.. The Ukrainian Nikolaev Alumina plant continued to import bauxite from Jamaica.

In 1992, 4.1 Mmt of bauxite and 2.9 Mmt of alumina were exported, representing a 3.1% and 3.0% decline, respectively, from that of the previous year. The declines in production and exports were caused primarily by the termination of a contract to supply 1 Mmt of ore to the former U.S.S.R. Since 1984, Jamaica has been supplying the U.S.S.R. with bauxite under an agreement that expired in 1991. About 35% of the bauxite ore was shipped unprocessed, primarily to the United States. The balance was processed locally at four 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 the Discovery Bay, St. Ann Parish. Kaiser has been operating at this location since 1967. Kaiser's first ore shipment to the United States was from Port Kaiser, St. Elizabeth Parish.

The alumina industry in Jamaica started in 1952. The first plant built in 1952 was in Kirkvine, Manchester Parish. The second plant was opened in Ewarton, St. Catherine Parish, in 1959. By 1968, the total capacity of these two plants was 1.1 Mmt of alumina. The bauxite ore used in these plants was mined in Kirkvine and in St. Catherine Parish. Eventually, the company's name was changed to Alcan Jamaica Co. (Jamalcan).

Alpart was the island's largest alumina refinery on the island. Alpart was formed in 1966. The Alpart plant, owned by Kaiser Aluminum Corp. (65%) and Hydro Aluminum Jamaica (35%), was undergoing an expansion, from 1.2 Mmt/a to 1.8 Mmt/a in 1995.

The second largest alumina company, Jamalcan, was the only Canadian-owned alumina producer on the island. Alcan has been in Jamaica since 1942.

The third largest refinery, the Jamalco refinery with a capacity of 750,000 mt/a, was being expanded to 1 Mmt/a by 1994. Before 1986, the plant was producing about 500,000 mt/a. The Halse Hall alumina plant in Clarendon became operational in 1972.

The construction of a 1-Mmt/a refinery was planned at Trelawny in the northwest of the island. Employment during the construction phase could exceed 3,000 jobs, and once built, the plant would employ 750 workers. The total cost of the project was estimated at $1.5 billion.

Copper and Gold.—The Vancouver-based Golden Ring Resources Ltd. was engaged in the exploration for copper and gold. The Connors, Camel Hill, 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. 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 its cement requirements. Caribbean Cement Co. Ltd., privately owned, was the only operating cement company in Jamaica. About 5% of its production was exported to neighboring islands.

Other Industrial Minerals.—Jamaica produced gypsum, lime, marble, salt, construction and industrial sand and gravel, and crushed stone.

Jamaica mined marble in the Edge Hill Quarry, Hellshire, St. Catherine Parish. The headquarters of the Hellshire Marble Ltd. company were in Kingston. The capacity of the quarry depends on the market demand.

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. Limestone is primarily used in Jamaica in road construction. 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 signed a $350,000 funding agreement with the European Investment Bank, in Luxembourg, to begin a feasibility study of building a caustic soda plant in Jamaica. The country's alumina plants usually imported about 275,000 tons of caustic soda, mostly from Canada and the United States. The plant will use locally available limestone and soda ash for the production of caustic soda.

Mineral Fuels

The Jamaican economy is highly energy intensive. Jamaica's sources of indigenous energy are limited, and the country relied on imports, almost exclusively oil, to meet its energy needs. Petroleum product consumption is closely linked to the bauxite-alumina sector, consuming about 55% of all petroleum products. Petrojam, a wholly owned Government company, is the only petroleum company in Jamaica. Jamaica imported all of its oil primarily from Venezuela under the special provisions of the San Jose accord. The accord allows the Government to convert a portion of the petroleum payments to low-interest, long-term development loans.

The Jamaica Public Service Co. installed a 544-MW powerplant, about 97% of which consists of oil-fired units.

Reserves

The estimated reserves of bauxite in Jamaica were 2.5 billion tons. Gypsum reserves were estimated to be 5 Mmt. Reserves of high-purity limestone were estimated at 150 billion tons.

INFRASTRUCTURE

The highways in Jamaica totaled 18,200 km, about 70% of which was paved. Railroads, 294 km, carried most of Jamaica's bauxite and alumina. The country's mining sector transported ore by road, railroad, and conveyor. Jamaican bauxite mines are close to ports, and the ports are relatively close to the American refiners and smelters.

Jamaica had 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.

Petroleum products were distributed through a 10-km pipeline.

OUTLOOK

Industry experts project that both bauxite ore and alumina production will remain steady through 1993, with increases to follow. The local industrial minerals sector will continue growing gradually throughout 1993.

[1]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

Geological Survey Division Ministry of Production, Mining and Commerce
Kinston, Jamaica
Commissioner of Mines Ministry of Production, Mining and Commerce
Kingston, Jamaica
The Jamaican Bauxite Institute Ltd.
Kingston, Jamaica
Petroleum Corp. of Jamaica
Kingston, Jamaica

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: World Factbook.

TABLE 1

JAMAICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992e
Aluminum:						
Bauxite, dry equivalent, gross weight	thousand tons	7,305	9,601	10,921	r14,139	212,233
Alumina	do.	1,514	2,221	2,869	3,015	22,297
Cement, hydraulic	do.	371	436	442	395	2481
Gypsum		145,500	78,010	r82,210	135,844	2144,977
Iron and steel: Steel, crude		27,578	36,732	23,820	e25,000	25,000
Lead, refined (secondary)e		1,000	1,000	1,000	1,000	1,000
Limee		80,000	90,000	90,000	95,000	2179,059
Petroleum refinery products	thousand 42-gallon barrels	9,801	5,928	8,203	r6,890	7,000
Salt		15,466	15,621	12,124	e14,000	14,000
Silica sand		13,000	15,200	16,643	15,622	215,622
Stone:						
Limestone	thousand tons	5,984	6,800	r6,046	5,480	24,298
Marble, cut and/or polished		2,700	5,000	4,000	12,000	4,620
Marl and fill	thousand tons	7,020	7,560	7,830	2,950	3,000
Sand and gravel	do.	2,025	2,250	2,375	1,214	1,347

eEstimated. rRevised.

[1]Table includes data available through June 1993.

[2]Reported figure.

TABLE 2

JAMAICA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
METALS					
Aluminum:					
Ore and concentrate	thousand tons	3,886	4,261	3,838	U.S.S.R. 423.
Oxides and hydroxides	do.	2,885	3,036	490	Canada 588; Netherlands 545.
Metal including alloys:					
Scrap		3,272	846	732	Japan 101; Canada 13.
Semimanufactures		659	222	54	Trinidad and Tobago 132; Belize 18.
Copper:					
Matte and speiss including cement copper		—	15	15	
Metal including alloys:					
Scrap		1,186	707	493	United Kingdom 144; Taiwan 65.
Semimanufactures		—	150	132	Hong Kong 18.
Iron and steel: Metal:					
Scrap		698	116	116	
Semimanufactures:[2]					
Flat-rolled products: Of iron or nonalloy steel:					
Not clad, plated, coated		NA	200	—	All to Trinidad and Tobago.
Clad, plated, coated		NA	90	—	St. Lucia 72; Belize 18.
Bars, rods, angles, shapes, sections		128	1	—	Mainly to Guyana.
Universals, plates, sheets		1,143	NA		
Hoop and strip		7	NA		
Tubes, pipes, fittings		4,907	1	1	
Lead: Metal including alloys:					
Scrap		750	249	118	Panama 131.
Semimanufactures		16	—		
Tin: Metal including alloys:					
Scrap		299	260	260	
Semimanufactures		20	40	40	
Zinc: Metal including alloys, scrap		—	25	—	All to United Kingdom.
Other: Ashes and residues		—	68	68	
INDUSTRIAL MINERALS					
Abrasives, n.e.s.: Grinding and polishing wheels and stones	kilograms	74	—		
Cement		29,371	20,277	16,106	Turks and Caicos Islands 2,569; Dominica 1,182.
Diamond: Natural: Dust and powder	value	—	$21,336	—	All to Canada.
Gypsum and plaster		59,473	74,437	31,615	Colombia 19,420; Martinique 17,214.
Salt and brine		10,660	2,752	—	Trinidad and Tobago 1,636; Barbados 497; Dominica 187.
Stone, sand and gravel:					
Dimension stone, worked		289	—		
Gravel and crushed rock		201	83	65	St. Lucia 18.
Limestone other than dimension		3,566	36,299	31,863	Trinidad and Tobago 3,880; unspecified 556.
Sand other than metal-bearing		1	—		
Sulfuric acid		634	437	—	Trinidad and Tobago 278; Haiti 95; Barbados 36.
Talc		21	8	—	All to Trinidad and Tobago.

See footnotes at end of table.

TABLE 2—Continued

JAMAICA: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Liquefied petroleum gas	42-gallon barrels	2,220	—		
Gasoline	do.	20,102	321	44	Netherlands Antilles 277.
Mineral jelly and wax	do.	—	13	—	All to Trinidad and Tobago.
Kerosene and jet fuel	do.	11,510	—		
Distillate fuel oil	do.	260,543	103,637	100,172	Unspecified 3,465.
Lubricants	do.	55,922	50,798	1	Suriname 17,268; Guyana 11,360; Trinidad and Tobago 10,385.
Residual fuel oil	do.	27,631	73,547	64,458	Panama 6,516; Spain 2,289.
Bitumen and other residues	do.	—	215	—	Mainly to Trinidad and Tobago.

NA Not available.

[1]Table prepared by H. D. Willis.

[2]As a result of changes in trade code classifications, data for 1990 and 1991 are not completely comparable.

TABLE 3

JAMAICA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS					
Aluminum:					
Ore and concentrate		—	16,629	16,629	
Oxides and hydroxides		30	39,945	39,915	Canada 27; United Kingdom 3.
Metal including alloys:					
Unwrought		762	—		
Semimanufactures		2,081	2,100	1,319	Belgium-Luxembourg 223; United Kingdom 101.
Antimony: Metal including alloys, all forms	kilograms	—	998	998	
Beryllium: Metal including alloys, all forms	do.	1	—		
Chromium: Oxides and hydroxides		—	5	5	
Copper:					
Sulfate		3	1	(2)	NA.
Metal including alloys:					
Scrap	value	$1,259	—		
Unwrought	do.	$503	$1,796	$1,796	
Semimanufactures		2,853	828	492	United Kingdom 172; Hong Kong 133.
Gold:					
Waste and sweepings	kilograms	26	NA		
Metal including alloys, unwrought and partly wrought	do.	10	84	77	Canada 7.
Iron and steel:					
Iron ore and concentrate: Pyrite, roasted		19	—		
Metal:					
Scrap		(3)	2	2	
Pig iron, cast iron, related materials		45	4	4	
Ferroalloys:					
Ferrosilicon		—	2	2	
Silicon metal[4]	kilograms	—	1,045	845	United Kingdom 200.
Steel, primary forms		12,996	31,996	3,857	Venezuela 27,814; United Kingdom 315.
Semimanufactures:[5]					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		NA	12,300	1,423	Trinidad and Tobago 3,319; United Kingdom 2,573; Venezuela 1,965.
Clad, plated, coated		NA	821	281	Venezuela 249; Belgium-Luxembourg 154.
Of alloy steel		NA	2,402	203	United Kingdom 1,227; Japan 399.
Bars, rods, angles, shapes, sections		22,337	23,049	2,493	Trinidad and Tobago 14,322; Venezuela 2,399.
Universals, plates, sheets		10,885	NA		
Hoop and strip		1,861	NA		
Rails and accessories		1,213	166	166	
Wire		2,826	1,967	89	Trinidad and Tobago 862; Venezuela 399; United Kingdom 306.
Tubes, pipes, fittings		9,022	4,186	2,749	United Kingdom 426; Japan 269.
Castings and forgings, rough		96	NA		
Unspecified		635	—		

See footnotes at end of table.

TABLE 3—Continued

JAMAICA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Lead:					
Oxides		109	95	38	Germany 25; Panama 14.
Metal including alloys:					
Unwrought	value	$192	—		
Semimanufactures		286	135	118	Panama 13; United Kingdom 3.
Magnesium: Metal including alloys, semimanufactures	kilograms	(e)	875	873	United Kingdom 2.
Manganese:					
Ore and concentrate		36	—		
Oxides	kilograms	—	6	6	
Molybdenum: Metal including alloys, semimanufactures	do.	13	—		
Nickel:					
Matte and speiss	value	$608	—		
Metal including alloys, semimanufactures		5	15	12	Germany 3.
Platinum-group metals: Metals including alloys, unwrought and partly wrought	kilograms	108	29	14	United Kingdom 8; Canada 7.
Rare-earth metals including alloys, all forms	do.	—	55	51	United Kingdom 4.
Selenium, elemental	do.	—	182	182	
Silver: Metal including alloys, unwrought and partly wrought	do.	75	21	11	Canada 11.
Tin: Metal including alloys:					
Unwrought	value	$3,937	$1,258	$1,258	
Semimanufactures		6,283	5,401	1	United Kingdom 3,110; Netherlands 2,156; France 134.
Titanium: Oxides		852	668	564	United Kingdom 80; Germany 20.
Tungsten: Metal including alloys, semimanufactures	kilograms	577	191	185	United Kingdom 6.
Uranium and thorium: Metal including alloys, all forms	do.	300	—		
Zinc:					
Ore and concentrate		18	—		
Oxides		188	226	205	Germany 21.
Blue powder	kilograms	r1,800	1	1	
Metal including alloys:					
Scrap		—	79	—	All from United Kingdom.
Unwrought		16,445	(2)	—	Do.
Semimanufactures		36	75	15	Peru 42; United Kingdom 18.
Other:					
Ores and concentrates					
Oxides and hydroxides		25	37	11	Germany 14; France 12.
Base metals including alloys, all forms	kilograms	15	—		
Precious metals, waste and scrap	do.	—	20	20	
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		32	34	32	Canada 2.
Artificial:					
Corundum		—	9	9	
Silicon carbide		NA	6	4	Norway 1.

See footnotes at end of table.

TABLE 3—Continued

JAMAICA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Abrasives, n.e.s.—Continued:					
Grinding and polishing wheels and stones		24	19	7	Netherlands 4; Germany 3.
Asbestos, crude		4	21	21	
Barite and witherite	kilograms	3,000	2	2	
Boron materials:					
Crude natural borates	do.	—	8	8	
Oxides and acids		—	11	2	Germany 9.
Bromine	kilograms	—	[8]240	232	United Kingdom 8.
Cement		4,274	1,838	210	Belgium-Luxembourg 514; Spain 297; Denmark 276.
Chalk	kilograms	59,000	33	31	Japan 2.
Clays, crude:					
Bentonite		NA	3	3	
Kaolin		NA	53	52	United Kingdom 1.
Unspecified		341	264	236	United Kingdom 28.
Diamond: Natural:					
Gem, not set or strung	value	$11	$179,467	$179,467	
Industrial stones	kilograms	—	12	12	
Diatomite and other infusorial earth		27	22	20	Germany 2.
Feldspar, fluorspar, related materials:					
Feldspar		NA	12	12	
Unspecified		11	—		
Fertilizer materials:					
Crude, n.e.s.		40	8	8	
Manufactured:					
Ammonia		159	178	145	Trinidad and Tobago 29; Netherlands 4.
Nitrogenous		13,016	22,110	6,682	Canada 14,707; United Kingdom 700.
Phosphatic		14	333	4	Dominica 323; Taiwan 6.
Potassic		400	404	3	United Kingdom 401.
Unspecified and mixed		6,442	26,149	59	Canada 26,023; Belgium-Luxembourg 60.
Graphite, natural		2	6	1	United Kingdom 5.
Gypsum and plaster		21,234	286	99	Germany 118; Venezuela 35.
Iodine	kilograms	—	141	118	Germany 15; United Kingdom 8.
Lime		89	—		
Magnesium compounds:					
Magnesite, crude	kilograms	—	6	6	
Oxides and hydroxides	do.	(9)	1,047	45	Netherlands 1,000; United Kingdom 2.
Sulfate		47	44	30	Germany 6; United Kingdom 6.
Mica:					
Crude including splittings and waste		153	157	29	Norway 112; United Kingdom 16.
Worked including agglomerated splittings		3	10	5	Mexico 5.
Nitrates, crude	kilograms	—	272	272	
Phosphates, crude		1	441	124	NA.
Phosphorus, elemental		—	7	7	

See footnotes at end of table.

TABLE 3—Continued

JAMAICA: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Pigments, mineral:					
Natural, crude		2	—		
Iron oxides and hydroxides, processed		137	145	4	Germany 119; United Kingdom 10; Spain 7.
Potassium salts, crude		(2)	19	19	
Precious and semiprecious stones other than diamond:					
Synthetic	value	—	$8,274	—	All from Brazil.
Pyrite, unroasted		—	10	10	
Salt and brine		15,162	26,075	25,959	Canada 107; United Kingdom 8.
Sodium compounds, n.e.s.:					
Soda ash, manufactured		4,670	4,123	3,985	Germany 58; France 40.
Sulfate, manufactured		7,915	4,160	2,575	Mexico 1,000; Belgium-Luxembourg 418.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		84	558	517	Italy 41.
Worked		12	293	292	Germany 1.
Dolomite, chiefly refractory-grade	value	$1,099	—		
Gravel and crushed rock		72	19	19	
Quartz and quartzite		733	6	6	
Sand other than metal-bearing		18,196	840	840	
Sulfur:					
Elemental:					
Crude including native and byproduct		32	4	4	
Colloidal, precipitated, sublimed		6,010	6,033	6,032	Saudi Arabia 1.
Sulfuric acid		4,757	21	16	United Kingdom 5.
Talc, steatite, soapstone, pyrophyllite		758	671	615	Norway 52; Canada 3.
Vermiculite including chlorite and perlite	kilograms	—	136	136	
Other: Crude		8	1	1	
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		23	1,319	1,317	Venezuela 2.
Carbon including carbon black		820	1,065	238	Venezuela 826; Taiwan 1.
Coal:					
Bituminous		39,772	—		
Briquets of anthracite and bituminous coal		22	(2)	(2)	
Lignite including briquets		17	—		
Coke and semicoke		34	43,810	43,808	United Kingdom 2.
Peat including briquets and litter		(2)	(2)	—	All from United Kingdom.
Petroleum:					
Crude	thousand 42-gallon barrels	(2)	6,912	79	Mexico 3,430; Venezuela 3,403.
Refinery products:					
Liquefied petroleum gas	do.	555	707	616	Mexico 47; Panama 39.
Gasoline	do.	852	935	302	Netherlands Antilles 576; Venezuela 55.
Mineral jelly and wax	do.	11	11	3	China 2; Japan 2.
Kerosene and jet fuel	do.	674	5,476	4,929	Netherlands Antilles 301; Venezuela 191.
Distillate fuel oil	do.	3,934	1,197	324	Netherlands Antilles 733; Panama 83.

See footnotes at end of table.

TABLE 3—Continued

JAMAICA: 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					
Petroleum—Continued:					
Refinery products—Continued:					
Lubricants	thousand 42-gallon barrels	67	72	19	Netherlands Antilles 45; Trinidad and Tobago 6.
Residual fuel oil	do.	13,137	11,143	10,123	Netherlands Antilles 496; Trinidad and Tobago 200.
Bitumen and other residues	do.	6	(2)	(2)	Mainly from Venezuela.
Bituminous mixtures	do.	1	2	(2)	Mexico 1; Venezuela 1.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Unreported quantity valued at $91.
[4]May include high-purity silicon.
[5]As a result of changes in trade code classifications, data for 1990 and 1991 are not completely comparable.
[6]Unreported quantity valued at $1,300.
[7]Includes zinc powder and flakes.
[8]Includes fluorine.
[9]Unreported quantity valued at $48.

TABLE 4

JAMAICA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

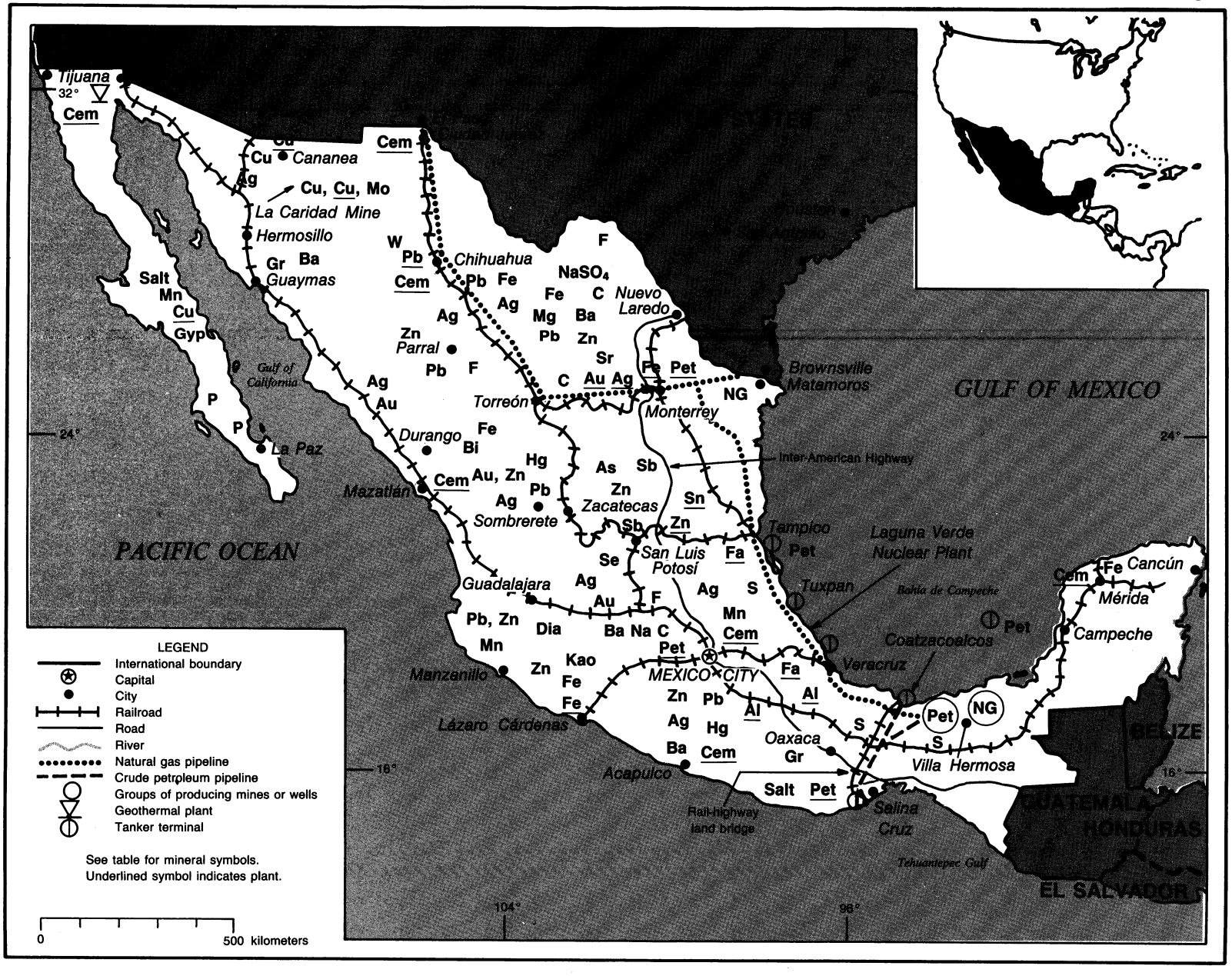
(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina	Jamalco (Aluminum Co. of America/Government, 50%; Clarendon Alumina Production Ltd., 50%)	Halse Hall plant at Clarendon, Clarendon Parish	750
Do.	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	547.5 547.5
Bauxite.	Jamaica Bauxite Mining Ltd. Lydford Mines (Jamaica Bauxite Mining Ltd., 100%)	Lydford, St. Ann Parish	2,500
Do.	Kaiser Jamaica Bauxite Co., Ltd. (Government, 51%; Kaiser Aluminum Corp., 49%)	Kirkvine, Manchester Parish; Water Valley, Discovery Bay, St. Ann Parish	4,500
Cement	Caribbean Cement Co. Ltd. (Private, 100%)	Rockfort, St. Andrews Parish	830
Petroleum products thousand 42-gallon barrels	Petrojam Ltd. (Petroleum Corp. of Jamaica, 100%)	Kingston, St. Andrews Parish	12,958

MEXICO

AREA 1.97 million km²

POPULATION 92.4 million



THE MINERAL INDUSTRY OF

MEXICO

By Gary R. Peterson[1]

Mexico, one of the world's leading mineral producers, ranked first in the production of silver and celestite (strontium mineral) in 1992. It was among the top five producers of antimony, white arsenic, barite, bismuth, cadmium, fluorspar, graphite, and mercury. The production of copper, diatomite, feldspar, gypsum, lead, lime, nitrogen in ammonia, sulfur, and zinc was of world significance also. In those commodities, Mexico was among the top 10 producers. In the Western Hemisphere, only Brazil and Mexico produced manganese in significant quantities.

Several mines closed during 1992 and early 1993. The Frisco Group closed the Lampazos silver mine in July 1992. The Real de Angeles silver mine continued to supply the flotation plant from the ore stockpile and finally closed in early 1993. The Frisco Group also closed Minera San Francisco del Oro near Hidalgo del Parral in Chihuahua State in February 1993. The Bolaños Mine in Jalisco State closed in May 1992. Minera Santa Maria de La Paz y Anexas mined only copper minerals. The Santa María de La Paz mines used to produce gold, silver, lead, and zinc.

Several new projects were being studied or developed during 1992. These included Minera Bismark, a zinc-silver mine in Chihuahua; La Cienega, a gold and silver mine in Durango; Tizapa, a silver, lead, and zinc mine in the State of Mexico; Rey de Plata, a lead and zinc mine in Guerrero; Concheño, an underground gold and silver project in Chihuahua; Santa Fe, a gold and silver prospect in Chiapas; San Felipe, a gold project in Baja California Norte; San Martín, a gold project in Querétero State; and La Choya, an open pit, heap-leach gold project in Sonora. The cement industry also is increasing its annual capacity, up to 39 Mmt by 1994. The industry is investing $1.17 billion from 1992 to 1994 in several projects and plants.

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 2.67 Mbbl/d in 1992, about the same as that in 1991. In the Western Hemisphere, only the United States (at 7.36 Mbbl/d) produced more oil than Mexico. Venezuela, the second leading producer of crude oil in Latin America, produced about 89% of that produced by Mexico. During 1992, Mexico exported crude oil to 23 countries. Petróleos Mexicanos (PEMEX) exported 900,000 bbl/d of crude oil to the United States, or about 66% of its total crude oil exports. Spain was the second largest market, receiving 17% of PEMEX's crude oil exports, followed by Japan. Japan, which used to import about 150,000 bbl/d of crude, only imported 80,000 bbl/d in 1992, amounting to 4% to 7% of PEMEX's production in any given month. In 1991, 56.4% of Mexican crude oil exports went to the United States, followed by Spain (18.1%), Japan (10.6%), France (3.5%), and Israel (2.1%). 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 value of total exports in 1982 to approximately 37% in 1990, 29% in 1991, and increasing slightly to 30.2% in 1992. Approximately 89% of the value of petroleum exports (including petrochemicals) was from crude oil, about the same as that in 1990 and 1991.

Mexico's gross domestic product (GDP) was estimated at $323.4 billion in current prices, up from $283.6 billion in 1991.[2] Real GDP growth was 2.6% in 1992, compared with 3.6% in 1991. The world economic slowdown, particularly in the United States, Western Europe, and Japan, significantly impacted Mexico's 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. The current pact, an extension of the Pact for Stability and Economic Growth, was announced on November 20, 1992, and will expire on December 31, 1993. In 1992, inflation, as indicated by the consumer price index, decreased to 11.9%, compared with 18.8% in 1991. Inflation levels continued to be low when compared with those of previous years, except in 1989, when it was 19.7%. In 1987 and 1988, inflation had been 150% and 57%, respectively. The Government's goal was to reduce inflation to single digits in 1992. Even though that goal was not met, the 1992 inflation rate was the lowest in almost 20 years.

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 $105 billion, approximately 79% of which was held by the public sector. Total external debt as a proportion of GDP fell from 37.3% (revised) in 1991 to about 32.5% in 1992 and is projected to increase slightly as a ratio to GDP in 1993.

GOVERNMENT POLICIES AND PROGRAMS

The Government's privatization efforts continued during 1992 with success in the area of the commercial banking and telecommunications industry. The most important privatizations completed in 1991 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 early 1992, there were 223 companies left in the public sector, and approximately 87 of those companies were in the process of being privatized. 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 for $30 million plus the assumption of $100 million of debt. The company was purchased by a joint venture comprised of Grupo Acerero del Norte (51%) and Mission Energy of the United States (49%). The Government continued to solicit new offers for Minera Autlán, the manganese producer. Minera Autlán was offered for sale in 1991 but has yet to attract a buyer. The Government hoped to complete a sale by mid-1993. Two of the three investor groups qualified to make final bids were Grupo Minera Mexico and Ispat Mexicana. Other mining properties that the Government may offer in 1993 include 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.

In 1991, the Mexican Government removed 1.8 Mha from the National Mining Reserves in the States of Baja California Sur, Chiapas, Chihuahua, Guanajuato, Guerrero, Hidalgo, Jalisco, Mexico, Michoacán, Nayarit, Nuevo León, Puebla, San Luis Potosí, Sinaloa, Tabasco, and Veracruz. Between February 1990 and February 4, 1992, 2.5 Mha had been removed from the National Mining Reserves. In addition, from January 1990 through November 1991, 67 concessions that were canceled, disapproved, or surrendered back to Secretaría de Energía, Minas e Industria Paraestatal (SEMIP) were opened up for other companies to explore and obtain concessions.

PRODUCTION

The value of Mexican nonfuel mineral output plus coal (mining and metallurgical sector) increased about 1.3% from the 1991 value of $2.67 billion. Individually, copper was the most important metal in terms of value ($663 million), followed by zinc ($377 million) and silver ($293 million). Gray portland cement was the most valuable nonfuel mineral product in Mexico with a value of $1.47 billion in 1992. In the industrial minerals sector (excluding cement), sulfur was the most important in terms of value, at $149.5 million, followed by limestone ($127.5 million), gypsum ($121.9 million), and salt ($88.6 million).

In general, the production of primary aluminum, copper, molybdenum, and zinc declined in 1992 compared to that of 1991, while production of gold, iron, lead, manganese, and silver increased. Among the major nonmetallics, production of barite, cement, lime, and limestone increased, while that of celestite, fluorspar, phosphate rock, salt, and sulfur decreased.

Output from the large mining sector represented by Grupo Industrial Minera México (IMMSA), Corporación Industrial Sanluís, Empresas Frisco, and Industrias Peñoles dominated mining production. Mexico's newest group is Autrey-Ancira, which owns Real del Monte y Pachuca, Bastan del Cobre, Barita de Sonora, and in 1991 purchased Altos Hornos from the Mexican Government. 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 Cementos Mexicanos, S.A. de C.V. (CEMEX), Cementos Apasco, S.A. de C.V. (APASCO) and Cementos Cruz Azul, S.A. de C.V. (Cruz Azul). *(See table 1.)*

TRADE

In 1992, total Mexican exports (f.o.b.), excluding exports from maquiladoras, totaled $27.53 billion, an increase of 1.5% over those of 1991. Nonfuel minerals plus coal and coke contributed about 4.2% of export revenues, valued at $1.15 billion. Relative to total trade, the United States was Mexico's leading trading partner. Other important partners were France, Japan, and Spain. Approximately 69.7% of Mexico's total exports was to the United States, while about 62.1% of its total imports came from the United States. The mineral trade between the United States and Mexico was just as important to Mexico. In 1989, the last year for which information was available, about 63% of Mexico's mineral exports went to the United States, while 65% of its mineral imports was from the United States. *(See tables 2 and 3.)*

Total value of hydrocarbons exports, including refinery products, was about the same as that in 1991—$7.9 billion (30.2% of total exports). Mexico's hydrocarbon imports totaled about $1 billion; therefore, net export earnings were $6.87 billion, a slight increase over those of 1991.

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. *(See table 4.)*

In June 1990, the Presidents of Mexico and the United States, after meeting in the United States, announced their endorsement of the objective of entering into a free trade agreement between the two countries. In late September 1990, after the President of Mexico officially requested such agreement and the Prime Minister of Canada requested participation in a trilateral agreement, the President of the United States notified the U.S. Congress of his intention of entering into an agreement among the three

countries. In May 1991, the U.S. Congress authorized the extension of the "fast track" negotiating authority. Formal negotiations among Canada, Mexico, and the United States began in June 1991. Six general categories of issues were negotiated in 19 working groups: (1) market access, including tariffs, rules of origin, and government procurement; (2) trade rules; (3) services; (4) investment; (5) intellectual property rights; and (6) dispute settlement. Negotiations for the proposed agreement, which became known as the North American Free Trade Agreement (NAFTA), were completed in August 1992.

On December 17, 1992, NAFTA was signed by President Bush of the United States, President Salinas of Mexico, and Prime Minister Mulroney of Canada. For Mexico, NAFTA culminates 6 years of trade liberalization begun in 1986 when it joined the General Agreement on Tariffs and Trade (GATT). The parties involved expect the agreement to create jobs and generate economic growth in all three countries, although Mexico undoubtedly conceded more than either the United States or Canada because Mexico still has the most protected economy.

The legislative branches of the three NAFTA partners must approve the agreement for it to be brought into force as scheduled on January 1, 1994. President Clinton of the United States stressed early in 1993 that he favors 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. The new U.S. Trade Representative met with Canadian and Mexican counterparts, and they voiced optimism that these agreements can be successfully concluded. Negotiations on the parallel agreements began on March 17, 1993.

Mexico signed a free trade agreement with Chile in September 1991 that will eliminate tariffs on most traded goods over a 4-year period commencing in January 1992. Tariffs on more sensitive products will be phased out over 6 years. The agreement has increased and developed bilateral economic and trade relations between Mexico and Chile (trade increased 50% during January to June 1992 compared to the same period in 1991), but trade between the two countries remained relatively small.

Mexico was continuing a series of formal free trade discussions with several Latin American countries. Commerce with various Central and South American trading blocks had grown rapidly. Trade with the 11 members of the Latin American Integration Association (LAIA) group of South American countries and with the Central American Common Market (CACM) grew by 30% and 32%, respectively, during January to June 1992 compared to the same period in 1991. These 15 countries, however, represented only 5% of Mexico's external trade, compared with the U.S. share of 65%.

In January 1991, Mexico and five Central American countries (Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua) signed the Tuxtla Gutiérrez Framework Agreement, which outlined general guidelines for future bilateral trade agreements. Mexico held bilateral consultations with each country with the aim of signing a framework agreement to create a free trade zone of 110 million people by 1996. These bilateral consultations resulted in an agreement signed in August 1992 to eliminate barriers to trade between the participants. The agreement contains the basic principles that bilateral treaties signed with countries of the region should include.

Within the LAIA framework, and with a view toward strengthening trade and capital flows with the other countries in Latin America, the Government of Mexico intended to conclude free trade agreements with other countries of the region. Negotiations were under way for the establishment of a free trade area with Colombia and Venezuela, and a proposal for a framework agreement to facilitate bilateral negotiations had been submitted to the Andean Pact countries.

Mexico signed a Cooperation Agreement with the EC in April 1991. It is expected to promote and diversify Mexico's foreign trade; encourage economic, scientific, and financial cooperation; promote investment; and increase protection of intellectual property. The agreement led to the establishment of consultation machinery to promote trade with Italy and France. Similar instruments were being negotiated with Spain and Germany. These bilateral agreements contain specific measures to raise flows of trade and investment and to foster industrial cooperation.

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 concession 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, both 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 SEMIP, which among other things, allowed more flexibility in foreign ownership through exploration and production trusts under the 1975 Mining Law.

Mexico's new mining law, which became effective in September 1992, regulates Article 27 of the Constitution. Regulations of the new mining law were expected to be published in the first quarter of 1993. The law and regulations will be enforced by the Federal Executive Branch through the SEMIP.

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, is decontrolling 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 to be 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:

- 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, where 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 3.9 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 to 7.1 Mha.

In 1992, the nonfuel mineral 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 and was a way for industry and Government to communicate and cooperate. In this industry group, both the private and Government companies were represented. One union represented the mineral industry workers, the Sindicato Nacional de Trabajadores Mineros, Metalúrgicos y Similares de la República Mexicana. In addition, various

professional associations complemented the industry.

In the private sector, four large and diversified companies dominated the production of nonfuel minerals. These were Corporación Industrial 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, at about 200,000, was 20,000 less than that in 1991. The outlook for 1993 indicates that the work force will decrease again owing to the closing of several large mines.

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 reorganizes 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 and the manufacture of petroleum products and basic petroleum derivatives and their distribution systems.
- Gas y Petroquímica Básica, charged with 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 sale of its products. They 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 1992, PEMEX had approximately 125,000 employees (including temporary employees), most of whom were represented by the Petroleum Workers Union. This figure was down from 215,000 in 1987 and reflected the various measures undertaken by PEMEX to reduce its costs and improve its efficiency. *(See table 5.)*

COMMODITY REVIEW

Metals

Copper.—Total copper production in 1992 decreased 0.7% from the production level of 1991. Mine production decreased almost 11% from production in 1991. Mexicana de Cobre, S.A. was the leading producer with 52% of total output, from its La Caridad Mine, followed by Mexicana de Cananea, S.A. de C.V., with 23%. In 1991, Mexicana de Cobre and Cananea had produced 51% and 31%, respectively, of the total copper produced in Mexico. In 1992, 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 25% to 228,166 tons in 1992, with most of the increase coming from the Mexicana de Cobre complex in Nacozari, which increased copper in anode production to about 165,000 tons in 1992 compared with 112,300 tons in 1991. Mexicana de Cobre accounted for 72% of Mexican smelter production in 1992, Mexicana de Cananea's share of production declined to 11%, and Industrial Minera México, a subsidiary of Grupo IMMSA and ASARCO Incorporated, accounted for 17%.

Mexico's production of 191,140 tons of refined copper was almost 20% above that of 1991. The Cobre de México refinery accounted for 121,700 tons, Mexicana de Cananea produced 27,940 tons of electrolytic copper, and the Cobre de Pasteje refinery increased its production from 6,500 tons in 1991 to 41,500 tons in 1992. 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, S.A. de C.V., a joint venture between Empresas Frisco (51%) and Cominco Resources International (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. An additional 15,000 tons of ore grading 12.8% copper was toll milled early in 1992 at the Cumobabi concentrator owned by Empresas Frisco. Total copper production of the María Mine amounted to slightly more than 18,000 tons.

The Cumobabi Mine, a Frisco subsidiary in the State of Sonora, was shut down in 1991. A significant

increase in stripping ratio had made the operation uneconomic. Frisco began an extensive exploration program in the area to increase reserves, as well as a study on the possibility of copper leaching.

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 the La Caridad Mine and Cananea, 1,670 Mmt with an average grade of 0.618% copper for concentrate to be smelted, in addition to 850 Mmt of semioxidized or low-grade ore averaging 0.250% copper for solvent extraction and electrowinning (SX-EW).

Gold.—The most important development for Mexican gold in 1991-92 was the increased interest by both Mexican and foreign mining companies in exploring for gold in Sonora, Baja California, Chihuahua, Durango, and Sinaloa. Many foreign companies have established investment trusts that allow 100% foreign ownership for their exploration efforts in Mexico. On November 25, 1991, the Santa Gertrudis open pit gold mine was inaugurated in the Cucurpe municipality of Sonora. The mine is owned 51% by the Grupo Aristegui of Mexico and 49% by Phelps Dodge. The total investment was about $30 million.

During the year, total gold production increased by 17% to 10,412 kg, about 0.4% of world output. Mine production of gold decreased slightly, however, to 9,891 kg compared with 10,142 kg in 1991. The gold-producing area of Guanajuato, with the Guanajuato Group, the Santa Fe Mining Cooperative, and El Cubo Mine, accounted for slightly less than one-third of Mexico's annual gold production. All of these mines produce silver as their primary product. Gold production from Guanajuato decreased about 1,000 kg compared to 1991 production, slightly offsetting the gain of 910 kg of gold production from Sonora. 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 36% over that of 1991 to 1,151 kg. Guanajuato continued to be the leading producing State, contributing about 30% of the national volume of production, followed by Sonora (25%), Durango (19%), Sinaloa (6%), Chihuahua (5%), and Zacatecas (4%). Gold production in Sonora increased by 57% from 1991 to 1992, largely as a result of a full year's production from Santa Gertrudis. Production from the Municipio of Cucurpe, which includes Santa Gertrudis, increased 113% in 1992 compared with that of 1991, with production of 1,723 kg compared with 809 kg in 1991. Santa Gertrudis produced 1,633 kg in 1992.

The gold picture will continue to change through 1993 and 1994 as Minera Hecla's La Choya operation in northwestern Sonora begins production at the end of 1993. The La Colorada property held by Eldorado Corp. Ltd. will begin 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 tons 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 Sanluís will finish development of the San Martín project in Querétero State in 1993, which will increase the company's production by about 400 kg/a. The Promontorio Project of Sanluis, 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 15% to 3.4 Mmt, and production of directly reduced (sponge) iron decreased 0.7% to 2.39 Mmt. Mexico was the second largest producer of steel in Latin America after Brazil. Together, Brazil and Mexico produced more than 78% of Latin American output. Mexico's share of the Latin American output was slightly more than 20%. Mexican production of crude steel increased about 7% over that of 1991 and represented about 1.2% of the world total. Brazilian production increased by 5.5%, from 22.6 Mmt in 1991 to 23.87 Mmt in 1992, and Venezuela showed an increase of 9.2%, from 3.119 Mmt in 1991 to 3.409 Mmt in 1992.

The largest steel producer in 1992 was Altos Hornos de México S.A. (AHMSA), with 2.55 Mmt, followed by Hylsa de México S.A. (HYLSA) in Monterrey, with an output of 1.91 Mmt, and Siderúrgica Lázaro Cárdenas-Las Truchas S.A. (SICARTSA), with an output of 1.19 Mmt. IMEXA, which was known as SICARTSA II in 1991, was the fourth largest producer of steel with 954,000 tons. 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 380,000 tons. TAMSA's most important domestic client was PEMEX. *(See tables 4 and 5.)*

In terms of process, 55.6% of crude steel was produced by electric furnace and 44.4% was produced by basic oxygen furnace (BOF). The open-hearth process was no longer used in 1992.

Mexico exported about 1.68 Mmt of semifinished and finished steel products with a value of $963 million, while it imported 3.04 Mmt of semifinished and finished products with a value of $2.25 billion. Exports of semifinished and finished products in 1991 were 1.43 Mmt (revised) valued at $1.0 billion, while imports of semifinished and finished products in 1991 were (revised) 2.51 Mmt valued at $1.8 billion. Mexican steel producers continued to be concerned because steel production in Mexico increased by 6.9% in 1992 while imports increased by 21%. This was an improvement over that of the previous year, however, when imports surged 118%.

Lead and Zinc.—Mexico is the sixth largest producer in the world of both lead and zinc. Total production of lead

increased by 7.6% to 172,563 tons in 1992, while zinc production decreased about 3.9%, from 300,706 tons to 289,119 tons. 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. Mexico produced 5.4% of the world mine output of lead and 3.9% 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 Industrias Peñoles, S.A., together producing more than 80% of the lead and zinc output in Mexico. Frisco continued as the leading producer of lead. Together, Frisco's subsidiaries, Minera Real de Angeles S.A. de C.V. and Minera Francisco del Oro S.A. de C.V., produced about 32% of the total lead and 24% of the zinc output. Grupo Industrial Minera Mexico was the leading Mexican zinc producer. During the year, its subsidiary IMMSA, through México Desarrollo Industrial Minero, S.A. de C.V. (MEDIMSA), which is owned 31.2% by Asarco, produced 55% of the zinc and 21% of the lead. Peñoles produced about 29% of the lead and 13% of the zinc. The five leading States in the production of lead in 1992, in order of importance, were Chihuahua, Zacatecas, Hidalgo, Durango, 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 1992 was the Real de Angeles Mine (owned 51% by Empresas Frisco) located at Noria de Angeles in Zacatecas, which produced 40,848 tons of contained lead and 40,703 tons of zinc. Frisco's other major producer, the San Francisco del Oro Mine, near Hidalgo del Parral in Chihuahua, produced 14,401 tons of contained lead and 14,401 tons of zinc in 1992. Both mines were shut down in early 1993, indicating a significant decrease for Mexican lead and zinc production in 1993 compared with that of 1992. When Real de Angeles does reopen, it will have increased processing capacity, which 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 approximately 20,000 tons of zinc in 1992 and is expected to produce approximately 50,000 mt/a of zinc beginning 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 1992. 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 1992. Total silver production was 2,317 tons representing more than 16% of total world output. This represents a 4.2% increase over production levels of 1991. Mine production of silver amounted to 2,098 tons in 1992, a decrease of 8.6% from that of 1991. In 1992, 86.3% of Mexican silver production came from six States: Zacatecas (39.2%), Durango (14.8%), Chihuahua (13.5%), Guanajuato (7.1%), Sonora (6.4%), and Hidalgo (5.3%). The top mine producers were Peñoles (about 720,000 kg), Frisco (349,975 kg, 254,147 kg of which was from Real de Angeles S.A. de C.V.), and Grupo IMMSA (328,571 kg). In addition, byproduct silver from Mexicana de Cobre amounted to 66,499 kg of contained silver, and contained silver from Mexicana de Cananea amounted to 11,534 kg. The Fresnillo Mine in Fresnillo, Zacatecas, a joint venture between Peñoles (60%) and AMAX (40%), produced about 401,000 kg (12.9 million ounces) of contained silver in 1992 but lost first place as the world's largest individual silver producer. The La Coipa gold-silver mine in Chile produced more than 501,600 kg (16.1 million ounces) in 1992 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. In June 1993, the Government was expected to begin producing 20-peso silver coins. Production of coins containing silver could possibly represent consumption of 10% of the national silver production. With the purpose of adding value to its 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 produced jewelry from 20% of its refined silver.

Industrial Minerals

Cement.—Mexican cement production increased about 7% in 1992 compared with that of 1991. In 1992, the Mexican cement industry produced 26.9 Mmt compared with 25.1 Mmt (revised) 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 $1.48 billion in 1992. In 1991, about 87% of Mexican cement production was for the domestic market and 13% was exported. 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 the GATT declared that the compensatory duties levied by the United States on cement exported from Mexico to the United States to be illegal, according to the terms of the antidumping code of the 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.

CEMEX was the leading producer of cement with about 75% of the national capacity of about 32 Mmt and 63% of domestic sales. With 17 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. In September 1991, CEMEX established a stock exchange deposit facility (ADR) in the United States so that U.S. investors may invest in CEMEX stock without being subject to the limitations and logistical difficulties of buying stock in Mexico. The most important event for CEMEX in 1992 was the acquisition of the two most important cement companies in Spain, Valenciana, Ltd. and Sansón, Ltd. After purchasing the remaining outstanding shares of both companies, CEMEX controlled 98% of Valenciana and 97.1% of Sansón. Valenciana's headquarters are in Valencia, and it has approximately 15% of the Spanish domestic market with a total production capacity of 6.8 Mmt. Sansón, in Barcelona, has 14% of the domestic market and a total production capacity of 4.7 Mmt, including adjusted sales of the concrete market. With the acquisition of Valenciana and Sansón, CEMEX became the major cement producer in Spain. CEMEX acquired a total of 13 cement-producing plants, more than 150 ready-mixed concrete and aggregates plants, and several land and maritime distribution terminals.

CEMEX continued to increase its cement production capacity during 1992. The expansion of the Atotonilco Plant was finished, and work continued on the expansion of the Huichapan Plant, a project that will increase the plant's annual capacity by 2 Mmt, and will begin operations during the second half of 1993. The construction of a new plant in Tepeaca, Puebla State, was well advanced in 1992 and is designed to produce 3 Mmt of cement annually when it begins production.

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 five plants. Cementos Cruz Azul, a worker's cooperative with two plants, was Mexico's third largest cement producer. Along with CEMEX, Cruz Azul and Apasco have expansion plans that may increase Mexico's cement capacity to 34 Mmt by the end of 1993 and 39 Mmt by the end of 1994.

Most Mexican cement plants have switched to fuel oil from natural gas because the first priority for natural gas is Mexico's petrochemical sector, followed by industries in cities with environmental problems. Many cement plants would prefer to burn natural gas if it were available.

Fluorspar.—Mexican production of fluorspar plunged to slightly more than 370,000 tons in 1991, a decrease of 41% from a production of 633,814 tons in 1990. In 1992, estimated production was 286,640 tons, a decrease of 23% from that of 1991. Approximately 95,252 tons of 1992 production was metallurgical-grade material and 74,638 tons acid-grade material. The balance of production was fluorspar contained in concentrates. 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 is found in many lead-zinc-silver veins and is recovered as a byproduct of mining operations in the Hidalgo del Parral, Santa Bárbara, San Francisco del Oro region of Chihuahua. Mexico's largest fluorspar producer is Cía. Minera Las Cuevas, S.A. 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. Minera 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 59% owned by Mexican nationals and 41% 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 México, S.A. de C.V. 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, behind the Republic of Korea and India. Graphite production in 1992 amounted to approximately 48,038 tons, a 29% increase over 1991 production

(revised) of 37,258 tons. Approximately 98% of Mexican graphite production is 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, subsidiaries of Grafitos Mexicanos, S.A., 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 32% of the U.S. demand for imported graphite during the period 1988-91.

Gypsum.—Mexico ranks as the number three producer of gypsum in the Western Hemisphere, behind the United States and Canada, and is the ninth largest producer in the world. Most gypsum mined is used in the production of wallboard. Other uses range from the manufacture of plaster, a cement additive to retard setting time, a soil enhancer, a 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 Rosalía, 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 Rosalía, 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.

Gypsum production in 1992 amount to 4.6 Mmt, a 4.2% decrease from 1991 production.

Sulfur.—Total sulfur production from the Frasch process and PEMEX in 1992 was 1,484,983 tons, a decrease of 18.2% from that of 1991. Two companies with large Government equity participation, APSA and CEDI, produced about 710,000 tons of Frasch sulfur in 1992, a decrease of 32% from 1991 production of 1.04 Mmt, which was a decrease of 28% from that of 1990. PEMEX produced about 775,000 tons of sulfur as a byproduct of petroleum and natural gas operations in 1992. Sulfuric acid plants at Mexican smelters produced 2.5 Mmt of sulfuric acid in 1992, with an estimated sulfur content of 817,000 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. (4.00%), Roca Fosfórica Mexicana S.A. (0.01%), and Minera Carbonífera Río Escondido (0.01%). CEDI also was majority owned by the Government entities Comisión de Fomento Minero (51%) and Fertilizantes Mexicanos (13%), and by Texas Gulf Inc. (34%), and 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. The company's three sulfur mines closed in November following the company's 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 2/3 share of CEDI. The Fertimex fertilizer plant at Lázaro Cárdenas, which has a production capacity of 1.3 Mmt/a of sulfuric acid, was sold to Fertilizantes Guadalajara in December. About 62% of the elemental sulfur produced in Mexico was exported in 1992.

Mineral Fuels

Hydrocarbons output continued to dominate Mexico's energy sector. Production of crude oil and natural gas in 1988 (the last year for which energy source information was available) represented about 90% of all energy produced compared with that of 1975, when hydrocarbons accounted for about 80% of the total. In 1988, the remaining 10% of primary energy produced was from coal (1.6%), firewood and sugarcane (4.9%), geothermal (0.9%), and hydroelectric sources (2.6%).

Coal.—Production (run of mine) of steam and metallurgical coal decreased about 7.5% from that of 1991 to 8.7 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 Grupo IMMSA (0.01%), was privatized in 1992. In September, the Government of Mexico offered MICARE, in northern Mexico, for privatization, which was purchased in October for $30 plus the assumption of $100 million of debt. The company was purchased by a joint venture comprised of

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 in 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 coal is mined by Minerales Monclova S.A. (MIMOSA), and the remaining production is from 10 or 11 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 1992, 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 1991, ranked third in the production of crude and fifth in the production of natural gas. In 1992, average daily crude oil production was 2.67 Mbbl, a decrease of 0.2% compared to that of 1991. Mexican output of natural gas averaged 101.5 m^3/d in 1992, a decrease of 1.4% from that of the previous year. Total production of refinery products decreased slightly from the record-high levels in 1991. PEMEX increased the production of unleaded Magna Sin gasoline by 67% in 1992 in an effort to alleviate air pollution.

For administrative purposes and to further simplify reporting, Mexico's national territory has been divided into three regions, North, South, and Marine. The North Region includes the Northeast Frontier, North, South, Poza Rica, and the Papaloapán Basin producing Districts. The South Region includes the Agua Dulce, El Plan, Nanchital, Ciudad Pemex, Comalcalco, and Villahermosa Districts. The Marine Region refers to the Bay of Campeche. Oil- and gas-producing fields are found in each of the Districts. The most important producing regions in 1992, the Marine and South Regions, produced 71.8% and 24.5%, 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 54.3% of Mexico's natural gas output in 1992. The Marine Region (Bay of Campeche) accounted for 32.8% of total natural gas output for the year and the Northern Region 12.9%.

In 1991, Mexico completed 41 exploration wells, of which only 15 were not productive. PEMEX's oil drilling success rate increased in 1992 to 59%, the highest in a decade. The productive wells included 9 that had crude oil, 2 which produced noncommercial crude (in the Northern Region), and 11 wells located natural gas and condensate. Of the 15 nonproductive wells drilled, 9 yielded salt water and 6 were dry. This result represents 8 more completed exploration wells than in 1990, with 11 more productive wells. PEMEX found 14 new hydrocarbon fields in 1992: 4 to produce crude, 8 to produce natural gas and condensates, and 2 to produce gas. Seven of the new fields are in the Campeche Marine Region, two in the Southern Region, and five in the Northern Region. The most important oil discovery in Mexico during the year was the discovery of the Ayin Field in the Marine Region. The field contains three deposits, and the deepest well produces 5,759 bbl/d of 23° API crude. Another important well in the same area produces 5,100 bbl/d of 22° API crude.

According to PEMEX, yearend 1992 proven hydrocarbon reserves were 65.05 billion bbl of oil equivalent, a slight increase over those of yearend 1991. Although the net variation from the previous year was minimal, reserves increased slightly for the first time since 1983. About 57.5% of the oil, 43.7% of the condensate, and 16% of the gas reserves are found in the Marine Region.

PEMEX provided 30.2% of Mexico's total export earnings in 1992 and brought in about one-third of all public-sector income (via domestic and export sales, tax payments, and gas taxes), about the same level as that in 1991. Exports of crude averaged 1.37 Mbbl/d, about the same as that in 1991, but the value of exports increased 2.1% over 1991 because of higher prices. PEMEX announced that petrochemical production for 1992 increased by about 4% to 19.2 Mmt. This was the highest level in the history of the company. Revenues from crude oil exports reached $7.42 billion, compared with $7.27 billion from crude oil exports in 1991. In 1992, 58.3% of PEMEX's oil exports went to the United States.

Imports of natural gas from the United States surged in 1992 to an average of 7.1 m^3/d compared with an average of 4.6 m^3/d in 1991. Imported natural gas cost Mexico $179.5 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 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, which has a daily 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. *(See tables 7 and 8.)*

Reserves

Most of the mineral reserves data were developed between the U.S. Bureau of Mines Divisions of Mineral Commodities and Resource Evaluation based on the definitions by the U.S. Bureau of Mines and the U.S. Geological Survey as published in the Geological Survey Circular 831, 1980. 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 sixth each (4% each). It also ranked seventh in reserves of molybdenum (1.6% of world reserves) and eighth for copper and manganese (less than 0.5%), respectively. Mexico had 5% of sulfur reserves, ranking eighth in the world. 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 9.)*

INFRASTRUCTURE

To eliminate inefficiency, Mexico is undertaking major expansion and upgrading projects in all four areas of transportation: highways, rail lines, ports, and airports. The Government of Mexico was expected to spend approximately $10 billion on infrastructure in 1992 alone.

Mexico had 26,400 km of railroads in 1992. It contained 240,000 km of roads, of which 42,000 are toll roads, 62,000 are State highways, 98,000 are rural roads, and 33,000 are byroads. As part of the Toll Highway Program, which 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 4 bridges across the border. The Government is financing expansion of 2,100 km of highways to four lanes. The Government 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, if NAFTA is adopted, United States and Canadian trucking lines, after a 3-year waiting period, will be able to avoid transloading delays at the border by directly transporting freight across national boundaries to destinations in Sonora, Chihuahua, Nuevo Leon, and Coahuila. Mexican carriers will have 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 with 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 to be submitted for Congressional approval in mid-1993.

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, 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 against 7.25 Mmt in 1991. 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 44,800 freight cars, moved approximately 47 Mmt in

1991. 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 the 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 also is 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. At yearend 1992, PEMEX owned and operated more than 60,000 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.

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 had planned to increase mining output by 2% to 2.6% by 1991 and by 4.5% to 5% by 1994. Government programs were aimed at facilitating mining activities by simplifying administrative procedures, removal of 2.4 Mha from National Mining Reserves, opening more areas for exploration, and modernizing the tax regime.

The Mexican Government has been highly successful in promoting investment, both foreign and domestic, in the mining sector. However, continuing low prices for base metals (except copper) and precious metals have had a negative effect on the mining industry worldwide. As a result of major mine closings, Mexico likely will lose its position as the world's largest silver producer in 1993. When prices do begin to recover, Mexico will be well placed to meet or surpass its mining output objectives, particularly from the gold and copper projects in the northern part of the country.

Looking toward 1993 and beyond, the 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 the United States and Canada. As a result, Mexico is expected to attract more foreign investment and its mining industry should continue to increase in importance.

---

[1]Much of the general and commodity information in this report was provided by Ing. Javier Moya R., Minerals Specialist at the Embassy of the United States in Mexico City. Mr. Moya's efforts have been invaluable in providing a detailed, timely report. Mr. Moya not only compiles the annual Minerals Questionnaire, but he also is the author of the comprehensive annual Minerals Outlook Report.

[2]Where necessary, values have been converted from Mexican pesos (Mex$) to U.S. dollars at the rates of Mex$3,018=US$1.00 and Mex$3,094.3=US$1.00 for the years 1991 and 1992, respectively.

OTHER SOURCES OF INFORMATION

Agencies

U.S. Embassy-Mexico City
Miguel de la Peña
Regional Resources Officer
Paseo de la Reforma, 305
México 5, D.F., México
Telephone: (525) 211-0042, Ext. 4745
Fax: (525) 208-3373

Secretaría de Energía, Minas e Industria Paraestatal
Ave. Insurgentes Sur 552
Colonia Roma Sur
06769, México, D.F., México
Telephone: 564-9640, 564-9759

Secretaría de Energía, Minas e Industria Paraestatal
Dirección General de Minas
Arcos de Belén 30
Colonia Doctores
06720 México, D.F., México
Telephone: 639-3575, 639-5076
Fax: 639-3327, 639-4451

Consejo de Recursos Minerales
Blvd. Felipe Angeles
Carretera México-Pachuca, Km. 93.5
42000 Pachuca, Hidalgo, México

Fideicomiso de Fomento Minero
(formerly Fideicomiso de Minerales No-Metálicos)
Puente de Tecamachalco 26
Lomas de Chapultepec
11000 México, D.F., México
Telephone: 520-3705, 540-6369, 540-3400
Fax: 202-0702

Cámara Minera de México
Sierra Vertientes 369
Lomas de Chapultepec
11000 México, D.F., México
Telephone: 540-6788, 540-6789
Fax: 540-6061

Cámara Nacional de la Industria del Hierro y del Acero A.C.
Amores 338
Colonia del Valle
03199 México, D.F., México

Cámara Nacional del Cemento A.C.
Leibnitz 77
Colonia Anzures
11590 México, D.F., México

Instituto Mexicano del Aluminio A.C.
Francisco Petrarca Número 133-9no Piso
Col. Polanco
11560 México, D.F., México

Publications

Petróleos Mexicanos (PEMEX), México City:
Memoria de Labores, Annual Report.
Statistical Yearbook, Annual Report.
Indicadores Petroleros (Production and trade), Monthly.

Consejo de Recursos Minerales, México City:
Anuario Estadístico de la Minería Mexicana, Annual Report.

National Autonomous University of Mexico, Geological Institute: Geological Map of the Mexican Republic, 1:2,000,000 scale, 5th ed.
Explanatory Text prepared with Geophysical Institute, México City, 1992, 74 pp.

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.

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.

Latin American Mining Institute, Washington, DC: Mexico and Central America Investment and Mining Guide, annual.

Mining and mineral-related companies: Annual operations reports.

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]		1988	1989	1990	1991	1992[p]
METALS						
Aluminum:						
Primary		68,337	71,691	67,515	50,827	24,806
Secondary		4,474	13,172	56,803	63,823	83,619
Antimony:						
Mine output, Sb content		2,185	1,906	r1,672	r1,469	—
Metal (in mixed bars and refined)[3]		1,207	1,192	942	1,284	1,604
Arsenic[4]		5,164	5,551	4,809	4,922	4,293
Bismuth[5]		958	883	733	651	807
Cadmium:						
Mine output, Cd content		1,726	1,439	r1,973	1,797	1,879
Metal, refined		1,117	976	882	688	602
Copper:						
Mine output, Cu content[6]		273,544	r e250,000	r307,234	r299,037	266,175
Metal:						
Blister (primary only)		150,334	174,294	175,374	182,565	228,166
Refined:						
Primary[7]		119,097	124,058	131,689	139,085	191,140
Secondary[e]		21,750	r22,970	r31,000	r53,000	80,000
Total		140,847	r147,028	r162,689	r192,085	271,140
Gold:						
Mine output, Au content	kilograms	9,098	r e10,000	r9,682	r10,142	9,891
Metal, refined	do.	6,369	5,919	5,789	5,022	5,739
Iron and steel:						
Iron ore, mine output:						
Gross weight[e]	thousand tons	r12,000	r15,000	r15,000	r13,000	15,000
Fe content	do.	5,564	r e7,000	r7,112	r6,596	7,236
Metal:						
Pig iron	do.	3,678	3,230	3,665	2,962	3,404
Sponge iron	do.	1,686	2,164	2,525	2,462	2,394
Total	do.	5,364	5,394	6,190	5,424	5,798
Ferroalloys:						
Ferromanganese	do.	165	168	186	147	131
Silicomanganese	do.	80	99	71	67	57
Ferrosilicon	do.	17	9	7	6	—
Ferrochromium	do.	9	3	(8)	(8)	(8)
Other	do.	1	(8)	(8)	(8)	(8)
Total	do.	272	279	264	220	188
Steel, crude	do.	7,779	7,851	8,726	7,883	8,435
Rolled products	do.	6,207	5,959	6,705	6,249	6,236
Forgings and castings	do.	107	74	68	61	60
Lead:						
Mine output, Pb content		171,337	r e170,000	r187,116	r167,684	169,610
Metal:						
Smelter:						
Primary		171,087	162,478	178,947	163,186	162,724
Secondary (refined)[e]		70,000	75,000	65,000	r10,000	10,000
Total[e]		241,087	237,478	243,947	r173,186	172,724

See footnotes at end of table.

TABLE 1—Continued

MEXICO: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[p]
METALS—Continued						
Lead—Continued:						
Metal—Continued:						
Refined:						
Primary (including lead content of antimonial lead)		168,093	160,035	167,191	151,817	166,582
Secondary[e]		70,000	75,000	65,000	r10,000	10,000
Total[e]		238,093	235,035	r232,191	r161,817	176,582
Manganese ore:						
Gross weight[9]		443,613	394,408	365,395	r187,169	341,519
Mn content		168,573	149,875	138,850	r78,451	137,746
Mercury, mine output, Hg content		345	651	735	r340	21
Molybdenum, mine output, Mo content		4,456	4,189	e2,000	1,716	1,458
Selenium, mine output, Se content		13	20	12	3	—
Silver:						
Mine output, Ag content	kilograms	2,358,907	r e2,400,000	r2,484,402	r2,295,131	2,097,500
Metallurgical products:						
Impure bars	do.	247,619	241,211	224,897	210,114	384,467
Mixed bars	do.	76,423	83,801	72,809	73,112	99,050
Metal, refined, primary	do.	1,975,996	1,904,286	1,895,527	1,778,739	1,773,912
Other	do.	16,585	28,251	77,485	161,682	59,994
Tin:						
Mine output, Sn content		274	11	5	12	1
Metal, smelter, primary		1,812	4,752	5,004	2,262	1,907
Tungsten, mine output, W content		206	170	183	194	162
Zinc:						
Mine output, Zn content		262,228	r e300,000	r306,656	r317,101	294,408
Metal, refined, primary		192,529	193,279	199,295	189,082	151,615
INDUSTRIAL MINERALS						
Abrasives, natural[e] [10]		[11]15,458	[11]22,022	25,000	25,000	25,000
Barite		534,954	324,739	r305,716	203,975	443,782
Cement, hydraulic	thousand tons	22,513	22,766	23,824	r25,100	26,900
Clays:						
Bentonite		163,916	123,927	144,895	145,347	135,993
Common		r e3,800,00	r3,838,156	r3,829,807	r3,922,208	4,166,043
Fuller's earth		37,226	24,603	29,865	41,078	41,111
Kaolin		162,415	141,519	156,140	167,238	144,121
Diatomite		36,524	44,920	51,084	45,966	46,443
Feldspar		83,170	121,978	163,011	151,678	159,451
Fluorspar:						
Acid-grade	thousand tons	338	359	268	132	75
Ceramic-grade	do.	27	27	11	—	—
Metallurgical-grade	do.	253	225	192	90	95
Submetallurgical-grade	do.	138	168	163	148	117
Total	do.	756	779	634	370	287
Graphite, natural:						
Amorphous		47,871	38,304	22,553	35,315	47,053
Crystalline		1,735	1,942	2,365	1,943	985
Gypsum and anhydrite, crude (yeso)		4,779,827	5,390,391	5,433,804	4,774,130	5,157,950
Lime, hydrated and quicklime[e]	thousand tons	6,000	6,000	6,000	6,500	6,500

See footnotes at end of table.

TABLE 1—Continued

MEXICO: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[p]
INDUSTRIAL MINERALS—Continued						
Magnesium compounds:						
Magnesia[12]		141,014	125,210	121,897	111,987	125,108
Magnesite		5,384	4,229	579	e600	e—
Mica, all grades		6,228	4,510	5,863	5,587	5,866
Nitrogen: N content of ammonia		2,067,330	2,100,154	2,163,672	2,221,374	2,202,500
Perlite		39,169	37,354	42,439	48,860	42,637
Phosphate rock[13]		835,093	655,477	623.481	596,392	451,659
Salt, all types	thousand tons	6,788	6,703	7,135	7,533	7,395
Sodium compounds, n.e.s.:						
Carbonate (soda ash):[14]						
Natural[e]		r190,000	190,000	190,000	190,000	160,000
Synthetic[e]		245,000	267,000	259,000	259,000	280,000
Sulfate, natural (bloedite)[15]		422,000	478,000	545,157	517,600	534,445
Stone, sand and gravel:						
Calcite, common		436,183	444,000	445,415	457,925	475,607
Dolomite		340,671	469,564	482,168	470,668	466,490
Limestone[16]	thousand tons	24,741	r26,127	27,405	r29,477	31,766
Marble		468,000	524,160	681,408	749,548	712,000
Quartz, quartzite, glass sand (silica)		926,166	1,216,443	1,298,283	1,330,693	e1,400,000
Sand and gravel:						
Sand	thousand cubic meters	51,904	42,773	44,700	44,012	44,496
Gravel	do.	33,477	36,801	37,737	39,747	41,337
Strontium minerals: Celestite		51,626	67,658	66,254	62,180	61,097
Sulfur, elemental:						
Frasch process	thousand tons	1,628	1,531	1,441	1,040	710
Byproduct:						
Of metallurgy[e]	do.	240	286	290	280	817
Of petroleum and natural gas	do.	510	555	682	754	775
Other	do.	—	—	—	20	—
Total[e]	do.	2,378	2,372	2,413	2,094	2,302
Talc		13,645	13,534	13,477	11,883	19,559
Vermiculite		218	300	132	r117	125
Wollastonite		10,506	10,618	11,442	13,877	27,392
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Run-of-mine:						
Metallurgical	thousand tons	6,439	5,847	r5,794	r4,536	3,696
Steam	do.	4,147	4,136	r4,220	r4,865	e5,004
Total	do.	10,586	9,983	10,014	9,401	8,700
Washed metallurgical coal	do.	2,340	2,761	2,850	2,206	1,605
Coke:[17]						
Metallurgical	do.	2,322	2,260	2,315	2,005	1,877
Imperial	do.	5	6	6	3	2
Breeze	do.	5	4	16	98	144
Total	do.	2,332	2,270	2,337	2,106	2,023

See footnotes at end of table.

TABLE 1—Continued

MEXICO: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		1988	1989	1990	1991	1992[p]
MINERAL FUELS AND RELATED MATERIALS—Continued						
Gas, natural:						
Gross	million cubic meters	36,046	36,919	37,741	[r]37,550	37,141
Marketed	do.	34,512	30,414	34,138	33,655	32,661
Natural gas plant liquids	thousand 42-gallon barrels	133,320	139,254	155,575	[r]164,739	165,279
Petroleum:						
Crude	thousand 42-gallon barrels	917,416	917,355	930,023	[r]976,668	976,387
Lease (field) condensate	do.	1,857	2,355	1,831	1,444	1,644
Total	do.	919,273	919,710	931,854	[r]978,112	978,031
Refinery products:						
Liquefied petroleum gas	do.	75,704	79,530	88,639	91,357	89,351
Gasoline:						
Aviation	do.	430	409	372	75	—
Motor, leaded and unleaded	do.	137,044	140,988	153,731	[r]152,555	148,681
Jet fuel	do.	16,495	15,890	18,598	22,502	23,623
Kerosene	do.	9,961	9,075	5,778	3,577	4,300
Distillate fuel oil (diesel)	do.	75,465	85,518	94,387	[r]100,759	101,682
Lubricants	do.	2,842	2,727	2,678	2,803	2,940
Residual fuel oil	do.	154,003	155,832	158,811	[r]152,041	157,256
Asphalt	do.	5,463	5,484	5,765	7,825	8,536
Unspecified and refinery fuel and losses	do.	44,667	44,400	43,467	[r]48,551	41,931
Total	do.	522,074	539,853	572,226	582,045	578,300

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through Dec. 31, 1993.

[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 reliable estimates of output levels.

[3]Sb content of antimonial 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]Series as reported by CAMIMEX. Tonnages reflect a 2.5% metal loss in smelter.

[7]Includes cathode copper from the Cía. Mexicana de Cananea, S.A. de C.V. electrowinning plant, in metric tons, as follows: 1988—11,380; 1989—10,299; 1990—26,945; 1991—32,059; and 1992—27,940.

[8]Less than 1/2 unit.

[9]Includes nodules and battery grade ore; excludes manganese carbonates.

[10]Based on exports, comprised mostly of pumice stone and emery (a granular, impure variety of corundum).

[11]Reported figure.

[12]Reported by Industrias Peñoles, S.A. de C.V. as the only major producer.

[13]Includes only output used to manufacture fertilizers.

[14]Total sodium carbonate reported by Asociación Nacional de la Industria Química.

[15]Series reflects output reported by Industrias Peñoles plus an additional 22,000 tons estimated production by Sulfato de Viesca.

[16]Excludes that for cement production.

[17]Includes coke made from imported metallurgical coal.

TABLE 2

MEXICO: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Destinations, 1991	
				United States	Other (principal)
METALS					
Alkaline-earth metals		24	—		
Aluminum:					
Ore and concentrate		155	69	5	Argentina 59; Guatemala 5.
Oxides and hydroxides		28,903	158	42	Panama 89; Chile 15.
Metal including alloys:					
Scrap		17,041	18,052	17,857	Japan 192; Guatemala 3.
Unwrought		1,476	299	172	Austria 20; Japan 6.
Semimanufactures		3,713	[2]73	5	Germany 32; Philippines 23; Colombia 11.
Antimony:					
Ore and concentrate		819	773	458	United Kingdom 224; Spain 91.
Metal including alloys, all forms		237	494	482	Uruguay 11; El Salvador 1.
Arsenic: Metal including alloys, all forms		5,203	3,848	3,848	
Beryllium: Metal including alloys, all forms	value, thousands	$2	—		
Bismuth: Metal including alloys, all forms		871	1,504	534	Belgium-Luxembourg 919; United Kingdom 36.
Cadmium: Metal including alloys, all forms		691	520	344	Belgium-Luxembourg 144; Brazil 31.
Chromium:					
Ore and concentrate		2	—		
Oxides and hydroxides		410	NA		
Metal including alloys, all forms	kilograms	215	1	1	
Cobalt:					
Ore and concentrate		5	—		
Metal including alloys, all forms	kilograms	14	1,214	96	Austria 568; Sweden 550.
Columbium and tantalum: Ore and concentrate including vanadium		271	NA		
Copper:					
Ore and concentrate		286,724	212,310	124,890	Japan 82,420; Cook Islands 5,000.
Matte and speiss including cement copper		17,517	3,615	2,591	Belgium-Luxembourg 987; United Kingdom 37.
Metal including alloys:					
Scrap		12,311	16,914	16,632	Germany 227; Spain 54.
Unwrought		56,258	60,545	14,919	Belgium-Luxembourg 45,626.
Semimanufactures		42,406	[3]12,198	11,983	North Korea 36; Republic of Korea 21.
Gold:					
Waste and sweepings	kilograms	41	29,110	29,110	
Metal including alloys, unwrought and partly wrought	do.	687,921	200,201	139,531	Italy 60,521; United Kingdom 125.
Iron and steel:					
Iron ore and concentrate:					
Excluding roasted pyrite		579	62,940	735	Trinidad and Tobago 62,200; France 4.
Pyrite, roasted	kilograms	1,000	19	—	All to France.
Metal:					
Scrap		44,569	42,380	41,748	Japan 326; United Kingdom 127.
Pig iron, cast iron, related materials		662	105	63	Costa Rica 42.
Ferroalloys:					
Ferrochromium		69	NA		
Ferromanganese		51,598	NA		

See footnotes at end of table.

TABLE 2—Continued

MEXICO: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Destinations, 1991	
				United States	Other (principal)
METALS—Continued					
Iron and steel—Continued:					
Metal—Continued:					
Ferroalloys—Continued:					
Ferrosilicomanganese		24,976	18,000	14,098	Brazil 2,000; Peru 1,200.
Ferrosilicon		3,084	NA		
Unspecified		35	NA		
Steel, primary forms		569,769	NA		
Semimanufactures:					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		114,035	NA		
Clad, plated, coated		129,587	NA		
Of alloy steel		46,153	NA		
Bars, rods, angles, shapes, sections		278,585	NA		
Rails and accessories		75	NA		
Wire		5,113	NA		
Tubes, pipes, fittings		382,160	NA		
Lead:					
Ore and concentrate		3,080	233	233	
Oxides		27,138	NA		
Metal including alloys:					
Scrap		935	208	208	
Unwrought		111,698	92,453	37,284	Japan 15,188; Hong Kong 11,438.
Semimanufactures		1,505	[2]53	—	United Kingdom 41; Venezuela 12.
Magnesium: Metal including alloys:					
Scrap		161	71	53	Brazil 18.
Unwrought		74	NA		
Semimanufactures		40	123	123	
Manganese:					
Ore and concentrate		65,263	15,255	5,983	Colombia 2,710; Germany 2,323.
Oxides		816	NA		
Metal including alloys, all forms		206	NA		
Mercury	kilograms	23,186	328	—	Colombia 300; Nicaragua 28.
Molybdenum:					
Ore and concentrate, unroasted		22,693	3,130	3,130	
Metal including alloys:					
Unwrought	value, thousands	[4]$3	NA		
Semimanufactures		1	NA		
Nickel: Metal including alloys:					
Scrap		38	—		
Unwrought		4	—		
Semimanufactures		27	—		
Platinum-group metals:					
Waste and sweepings	grams	—	42,186	52	Spain 42,133; Germany 1.
Metals including alloys, unwrought and partly wrought:					
Palladium	do.	—	17	17	
Platinum	do.	[r]10,429	2,191	410	Spain 1,781.
Unspecified	value, thousands	$43	NA		

See footnotes at end of table.

TABLE 2—Continued

MEXICO: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Destinations, 1991	
				United States	Other (principal)
METALS—Continued					
Selenium, elemental	kilograms	118	—		
Silver:					
Ore and concentrate		2,463	2,003	2,003	
Waste and sweepings	kilograms	[5]9	—		
Metal including alloys, unwrought and partly wrought	do.	[r]135,167	22,115	21,940	Hong Kong 99; France 44.
Tin:					
Ore and concentrate		39	—		
Metal including alloys:					
Scrap		24	NA		
Unwrought		1,986	NA		
Semimanufactures		807	NA		
Titanium:					
Oxides		706	NA		
Metal including alloys:					
Unwrought		[4]1	—		
Semimanufactures		187	10	8	Hong Kong 1; Italy 1.
Tungsten:					
Ore and concentrate		333	418	418	
Metal including alloys:					
Unwrought		[4]36	NA		
Semimanufactures		2	NA		
Vanadium: Ash and residue containing vanadium		926	242	242	
Zinc:					
Ore and concentrate		239,115	225,533	34,264	Switzerland 95,153; Belgium-Luxembourg 36,102.
Oxides		33,189	NA		
Blue powder		[r]431	277	244	Venezuela 18; Uruguay 7.
Ash and residue containing zinc		528	2,357	2,357	
Metal including alloys:					
Scrap		306	377	313	Uruguay 64.
Unwrought		94,033	78,969	59,270	Belgium-Luxembourg 5,917; Japan 5,138.
Semimanufactures		[r]2,030	1,522	1,507	Nicaragua 10; Chile 4.
Zirconium: Ore and concentrate		334	547	—	Chile 352; Ecuador 108; Uruguay 54.
Other:					
Base metals:					
Ores and concentrates		1,122	44	40	Panama 4.
Oxides and hydroxides		5,439	NA		
Ashes and residues		[r]1,705	NA		
Base metals including alloys, all forms		34	14	14	
Metalloids		[6]24	NA		
Precious metals, n.e.s.: Ores and concentrates	kilograms	848,713	207,668	172,151	Japan 35,517.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc		15,957	15,639	15,380	Spain 210; Costa Rica 41.
Artificial: Corundum		226	174	165	Japan 9.
Dust and powder of precious and semiprecious stones including diamond	kilograms	2	245	5	Belgium-Luxembourg 240.
Grinding and polishing wheels and stones		180	81	67	Colombia 9; Cuba 3.
Asbestos, crude	value, thousands	$1	—		

See footnotes at end of table.

TABLE 2—Continued

MEXICO: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Destinations, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Barite and witherite		41,395	34,491	34,491	
Boron materials:					
Crude natural borates		2	—		
Oxides and acids		5	NA		
Bromine		[r]19	NA		
Cement	thousand tons	2,054	3,471	NA	NA.
Chalk		208	451	451	
Clays, crude:					
Bentonite		1,127	2,410	752	Venezuela 842; Guatemala 789.
Fuller's earth	kilograms	6,293	1,159	42	Italy 1,117.
Fire clay		33	83	27	Cuba 42; Argentina 9.
Kaolin		92	94	(e)	Colombia 70; Italy 14; Guatemala 10.
Unspecified		113	110	20	Colombia 41; Guatemala 24.
Cryolite and chiolite	kilograms	229	—		
Diamond, natural:					
Gem, not set strung	do.	[r]15	—		
Industrial stones	do.	[r]45	322	322	
Diatomite and other infusorial earth		5,192	7,727	959	Brazil 2,347; Germany 2,136.
Feldspar		10,227	20,143	17,038	Taiwan 3,104; Japan 1.
Fertilizer materials:					
Crude, n.e.s.		33	NA		
Manufactured:					
Ammonia		540,290	NA		
Nitrogenous		412,525	NA		
Phosphatic		6,920	NA		
Potassic		6	NA		
Unspecified and mixed		422,504	NA		
Fluorspar		381,353	170,296	114,765	United Kingdom 36,266; Brazil 9,991.
Graphite, natural		10,586	10,403	10,308	Germany 48; Japan 21.
Gypsum and plaster	thousand tons	1,520	1,977	1,783	Japan 147; New Zealand 32.
Lime		28,031	27,370	26,410	Belize 951; Costa Rica 4.
Magnesium compounds:					
Magnesite, crude		50	(e)	(e)	
Oxides and hydroxides		64,215	61,063	24,277	Belgium-Luxembourg 19,503; Austria 5,070.
Mica:					
Crude including splittings and waste		5	246	246	
Worked including agglomerated splittings		64	3	1	Germany 1; Guatemala 1.
Phosphates, crude		—	15	15	
Pigments, mineral:					
Iron oxides and hydroxides, processed		3,925	NA		
Potassium salts, crude		4	—		
Precious and semiprecious stones other than diamond:					
Natural	kilograms	[r]17,864	24,223	18,938	Italy 1,647; Japan 1,371.
Synthetic	do.	17,750	745	40	Argentina 237; Italy 217; Spain 101.
Pyrite, unroasted		[r]5	—		
Quartz crystal, piezoelectric	kilograms	—	1	1	
Salt and brine	thousand tons	4,899	4,692	2,332	Japan 1,847; Panama 365.
Sodium compounds, n.e.s.: Sulfate, manufactured		159,148	NA		

See footnotes at end of table.

TABLE 2—Continued

MEXICO: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Destinations, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		22,276	3,991	267	Italy 2,083; Taiwan 825; Cuba 285.
Worked		22,655	23,576	20,348	Canada 1,107; Italy 417.
Dolomite, chiefly refractory-grade		790	359	(e)	El Salvador 120; Germany 120; Guatemala 119.
Gravel and crushed rock	thousand tons	878	1,531	1,531	
Limestone other than dimension		38	—		
Quartz and quartzite		17	48	48	
Sand other than metal-bearing		13,683	8,896	78	Costa Rica 8,256; Guatemala 427; El Salvador 121.
Sulfur:					
Elemental:					
Crude including native and byproduct	thousand tons	1,331	1,064	980	Cuba 40; Morocco 23.
Colloidal, precipitated, sublimed		29	94	—	Guatemala 73; Costa Rica 15; El Salvador 6.
Sulfuric acid		141,274	NA		
Talc, steatite, soapstone, pyrophyllite		255	120	120	
Vermiculite, perlite, chlorite		142	993	—	Brazil 885; Venezuela 72; Colombia 18.
Other:					
Crude		45,517	34,803	34,687	Panama 69; Japan 18.
Slag and dross, not metal-bearing		17,015	NA		
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		6	4	3	Belize 1.
Carbon black		58,575	NA		
Coal:					
Bituminous		4	3	3	
Briquets of anthracite and bituminous coal		6,472	459	—	All to Germany.
Lignite including briquets		326	348	—	All to Cuba.
Coke and semicoke		3,962	29,799	29,760	Guatemala 39.
Peat including briquets and litter	value, thousands	$3	NA		
Petroleum:					
Crude	thousand 42-gallon barrels	454,244	499,539	281,670	Spain 90,192; Japan 52,779.
Refinery products:					
Liquefied petroleum gas	do.	16,815	13,468	NA	NA.
Gasoline	do.	269	NA		
Mineral jelly and wax	do.	46	NA		
Kerosene and jet fuel	do.	5,388	6,059	NA	NA.
Distillate fuel oil	do.	17,234	2,810	NA	NA.
Residual fuel oil	do.	11,369	—		
Bitumen and other residues	do.	16	NA		
Bituminous mixtures	do.	1	NA		
Petroleum coke	do.	1	(e)	(e)	

[p]Preliminary. [r]Revised. NA Not available.

[1]Table prepared by H. D. Willis. As a result of changes in trade code classifications, some data for 1990 and 1991 are not completely comparable.

[2]Includes powder and flakes; excludes other semimanufactures.

[3]Includes powder and flakes, bars, rods, and profiles; excludes other semimanufactures.

[4]Includes waste and scrap.

[5]May include other precious metals.

[6]Reported under SITC item number as "selenium, tellurium, phosphorus, arsenic, etc."

[7]Includes fluorine and iodine.

[8]Less than 1/2 unit.

TABLE 3

MEXICO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Sources, 1991	
				United States	Other (principal)
METALS					
Alkali and alkaline-earth metals:					
Alkali metals		4,575	NA		
Alkaline-earth metals		472	243	187	Canada 30; Netherlands 26.
Aluminum:					
Ore and concentrate		46,030	29,798	12,803	China 11,092; Guyana 5,817.
Oxides and hydroxides		182,094	135,062	132,644	Germany 1,509; Japan 398.
Ash and residue containing aluminum		465	—		
Metal including alloys:					
Scrap		16,460	10,724	10,693	Germany 31.
Unwrought		32,969	44,458	33,080	Venezuela 11,304; Canada 60.
Semimanufactures		67,800	[2]86	15	Brazil 51; Germany 17.
Antimony:					
Ore and concentrate		59	1	—	All from Austria.
Metal including alloys, all forms		495	450	255	China 174; Belgium-Luxembourg 20.
Arsenic: Metal including alloys, all forms		7	39	4	Hong Kong 18; Taiwan 17.
Beryllium: Metal including alloys, all forms		3	1	1	
Bismuth: Metal including alloys, all forms	kilograms	322	146	146	
Cadmium: Metal including alloys, all forms		3	6	6	
Chromium:					
Ore and concentrate		29,037	12,207	3,291	Philippines 7,292; Republic of South Africa 1,623.
Oxides and hydroxides		539	NA		
Metal including alloys, all forms		49	—		
Cobalt:					
Ore and concentrate		1	—		
Oxides and hydroxides		182	NA		
Metal including alloys, all forms		31	49	15	Germany 13; Belgium-Luxembourg 11.
Columbium and tantalum:					
Ore and concentrate		[3]18	NA		
Tantalum metal including alloys, all forms	value, thousands	$160	NA		
Copper:					
Ore and concentrate		(4)	1,168	1,167	Canada 1.
Matte and speiss including cement copper	kilograms	[r]1	4,364	6	Germany 4,356; Canada 2.
Metal including alloys:					
Scrap		25,679	9,534	8,607	Venezuela 867; Colombia 19.
Unwrought		11,576	29,298	8,947	Peru 14,099; United Kingdom 1,724.
Semimanufactures		14,783	[2]291	287	Germany 2; United Kingdom 1.
Gold:					
Waste and sweepings	kilograms	1,507	—		
Metal including alloys, unwrought and partly wrought	do.	8,216	271,347	94,087	Italy 117,356; Germany 30,001.
Iron and steel:					
Iron ore and concentrate:					
Excluding roasted pyrite		1,854	31,899	1,089	Sweden 30,790; Germany 14.
Pyrite, roasted		4	9	9	
Metal:					
Scrap		737,344	389,910	367,290	Canada 20,169; Germany 1,155.
Pig iron, cast iron, related materials		361,297	114,310	20,928	Venezuela 84,386; Brazil 6,886.
Ferroalloys:					
Ferrochromium		6,219	NA		

See footnotes at end of table.

TABLE 3—Continued

MEXICO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Iron and steel—Continued:					
Metal—Continued:					
Ferroalloys—Continued:					
Ferromanganese		308	NA		
Ferronickel		54	NA		
Ferrosilicomanganese		282	NA		
Ferrosilicon		14,078	NA		
Silicon metal		[3]3,507	NA		
Unspecified		3,353	NA		
Steel, primary forms		17,356	54,581	30,671	Canada 30,036; Brazil 14,908.
Semimanufactures:					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		444,796	NA		
Clad, plated, coated		338,075	NA		
Of alloy steel		139,384	NA		
Bars, rods, angles, shapes, sections		308,737	56,707	39,957	Brazil 14,879; Canada 703.
Rails and accessories		143,984	56,877	56,715	Canada 162.
Wire		15,999	NA		
Tubes, pipes, fittings		108,004	NA		
Lead:					
Ore and concentrate		15,058	49,190	1,566	Peru 36,631; United Kingdom 5,117; Bolivia 3,122.
Oxides		4,416	NA		
Metal including alloys:					
Scrap		2,671	1,073	1,073	
Unwrought		59	123	123	
Semimanufactures		185	79	79	
Magnesium: Metal including alloys:					
Scrap		29	23	11	Germany 12.
Unwrought		771	887	732	Canada 155.
Semimanufactures		420	NA		
Manganese:					
Ore and concentrate		137,416	45,136	26,033	Gabon 18,520; Switzerland 560.
Oxides		2,390	NA		
Metal including alloys, all forms		314	NA		
Mercury		1	2,152	1,136	Netherlands 1,013; Spain 2.
Molybdenum:					
Ore and concentrate:					
Roasted		38	100	—	All from Chile.
Unroasted		4,744	—		
Metal including alloys:					
Unwrought[6]		12	23	22	Germany 1.
Semimanufactures		21	7	6	Germany 1.
Nickel:					
Matte and speiss	kilograms	36,689	275	275	

See footnotes at end of table.

TABLE 3—Continued

MEXICO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Nickel—Continued:					
Metal including alloys:					
Scrap		3	1	1	
Unwrought		1,885	1,641	554	Canada 871; Netherlands 111.
Semimanufactures		839	[7]7	5	Germany 2.
Platinum-group metals: Metals including alloys, unwrought and partly wrought:					
Palladium	kilograms	4	106	100	Switzerland 6.
Platinum	grams	[r]4,312	8,604	8,597	Germany 6; France 1.
Iridium, osmium, ruthenium	do.	—	13,117	13,108	Germany 9.
Unspecified	value, thousands	$1,285	—		
Selenium, elemental		45	40	32	Philippines 7; Canada 1.
Silver:					
Ore and concentrate[8]	kilograms	70,051	2,959	2,959	
Waste and sweepings[8]	do.	1,102	NA		
Metal including alloys, unwrought and partly wrought		[r]48	1,031	842	Germany 178; France 5.
Tin:					
Ore and concentrate		8,732	5,866	4,053	Portugal 1,059; Canada 538.
Metal including alloys:					
Scrap		266	211	211	
Unwrought		512	477	136	Bolivia 306; Cayman Islands 35.
Semimanufactures		161	[2]25	24	Unspecified 1.
Titanium:					
Ore and concentrate		123,280	97,642	205	Australia 97,437.
Oxides		2,470	NA		
Metal including alloys:					
Unwrought		[6]108	NA		
Semimanufactures		128	NA		
Tungsten:					
Ore and concentrate	kilograms	[r]633	230	230	
Metal including alloys:					
Unwrought		[6]39	8	6	France 1; Germany 1.
Semimanufactures		161	1,495	1,481	Unspecified 14.
Uranium and thorium:					
Thorium ore and concentrate	value, thousands	$21	NA		
Oxides and other compounds	do.	$10	NA		
Uranium metal including alloys, all forms	do.	$9	NA		
Vanadium: Metal including alloys, unwrought[6]	kilograms	(4)	2	2	
Zinc:					
Ore and concentrate		7,121	60	60	
Oxides		923	NA		
Blue powder[9]		618	481	480	Unspecified 1.
Ash and residue containing zinc		7	—		
Metal including alloys:					
Scrap		119	19	19	
Unwrought		925	1,322	1,285	Italy 37.
Semimanufactures		288	NA		

See footnotes at end of table.

TABLE 3—Continued

MEXICO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Zirconium:					
Ore and concentrate		76	408	408	
Metal including alloys, all forms		2	—		
Other:					
Ores and concentrates		171	NA		
Oxides and hydroxides		1,329	NA		
Ashes and residues		39,394	NA		
Base metals including alloys, all forms		[r]48	12	12	
Metalloids		[10]3,744	NA		
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		922	1,077	988	Germany 67; Australia 20.
Artificial: Corundum		5,811	4,695	1,366	Brazil 2,605; Austria 553.
Dust and powder of precious and semiprecious stones excluding diamond	kilograms	[r]319	166	166	
Grinding and polishing wheels and stones		1,749	110	59	Taiwan 13; Italy 12.
Asbestos, crude		39,316	48,621	4,425	Canada 26,658; Zimbabwe 6,940.
Barite and witherite		36,085	59,930	3,136	Taiwan 40,692; China 16,100.
Boron materials:					
Crude natural borates		1,088	691	691	
Oxides and acids		3,677	NA		
Bromine and fluorine[11]		348	NA		
Cement		15,440	NA		
Chalk		143	109	108	Germany 1.
Clays, crude:					
Bentonite		4,671	4,970	4,965	Germany 5.
Chamotte or dinas earth		698	617	617	
Fuller's earth		511	305	284	Spain 21.
Fire clay		160,963	193,141	188,585	China 4,500; Germany 51.
Kaolin		104,613	113,317	112,570	Dominica 240; United Kingdom 192.
Unspecified		[r]179,804	6,278	6,173	Brazil 48; Japan 22.
Cryolite and chiolite		92	171	50	Denmark 115; Germany 4.
Diamond, natural:					
Gem, not set or strung	kilograms	52	32	30	Belgium-Luxembourg 2.
Industrial stones	do.	3,001	28,876	28,743	Thailand 100; Japan 27.
Dust and powder	do.	6,061	236,901	229,548	Belgium-Luxembourg 7,103; Spain 242.
Diatomite and other infusorial earth		522	398	398	
Feldspar, fluorspar, related materials					
Feldspar		[r]1,050	979	946	Germany 14; Switzerland 10.
Fluorspar		[r]387	4,496	4,492	Germany 4.
Unspecified[12]		60,214	29,768	29,396	Canada 372.
Fertilizer materials:					
Crude, n.e.s.		1,413	NA		
Manufactured:					
Ammonia		892	NA		
Nitrogenous		5,549	NA		
Phosphatic		2,307	NA		
Potassic		98,578	102,773	78,911	Canada 23,376; Germany 306.
Unspecified and mixed		7,969	NA		

See footnotes at end of table.

TABLE 3—Continued

MEXICO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Graphite, natural		1,746	1,478	691	Hong Kong 251; Brazil 237.
Gypsum and plaster		42,409	40,996	40,876	Japan 100; Spain 11.
Lime		3,800	3,757	3,483	Guatemala 254; United Kingdom 20.
Magnesium compounds:					
Magnesite, crude		8,611	7,445	6,293	Japan 890; Austria 236.
Oxides and hydroxides		23,975	24,203	22,069	China 1,549; Argentina 300.
Mica:					
Crude including splittings and waste		280	728	583	Germany 11; Taiwan 11.
Worked including agglomerated splittings		72	201	136	Japan 47; North Korea 11.
Nitrates, crude		13,580	NA		
Phosphates, crude	thousand tons	2,278	1,296	427	Morocco 569; Togo 277.
Pigments, mineral:					
Natural, crude		4	5	5	
Iron oxides and hydroxides, processed		1,731	NA		
Potassium salts, crude	kilograms	*240	—		
Precious and semiprecious stones other than diamond:					
Natural	do.	11,838	14,801	9,476	Thailand 3,217; Brazil 1,067.
Synthetic	value, thousands	$540	NA		
Pyrite, unroasted		148	NA		
Quartz crystal, piezoelectric	value, thousands	$4	NA		
Salt and brine		37,266	79,343	79,067	Germany 274.
Sodium compounds, n.e.s.:					
Soda ash, manufactured		189,638	NA		
Sulfate, manufactured		3,187	NA		
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		5,044	3,924	929	Italy 2,045; Guatemala 582.
Worked		18,665	19,967	14,108	Italy 3,076; Argentina 895.
Dolomite, chiefly refractory-grade		11,378	18,156	15,597	Guatemala 2,549; Japan 10.
Gravel and crushed rock		2,597	8,797	8,669	France 86; United Kingdom 20.
Limestone other than dimension		38	28	28	
Quartz and quartzite		507	158	73	France 72; Belgium-Luxembourg 9.
Sand other than metal-bearing		114,591	81,702	80,441	British Virgin Islands 857; United
Sulfur:					
Elemental:					
Crude including native and byproduct		517,159	233,733	93,710	Canada 139,992; Germany 30.
Colloidal, precipitated, sublimed		372	772	772	
Dioxide		3	NA		
Sulfuric acid		134,052	NA		
Talc, steatite, soapstone, pyrophyllite		97,153	99,931	94,658	China 5,000; United Kingdom 162.
Vermiculite, perlite, chlorite		4,589	1,964	1,964	
Other:					
Crude		12,232	3,555	3,485	France 20; Netherlands 20.
Slag and dross, not metal-bearing		5,182	5,135	5,135	
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		8,240	41,605	41,605	
Carbon black		6,713	NA		

See footnotes at end of table.

TABLE 3—Continued

MEXICO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991[p]	Sources, 1991	
				United States	Other (principal)
MINERAL FUELS AND RELATED MATERIALS—Continued					
Coal:					
Anthracite		10,365	11,351	11,351	
Bituminous		268,997	546	546	
Briquets of anthracite and bituminous coal		6,631	11,168	55	Canada 5,806; Colombia 5,307.
Lignite including briquets		1,631	1,743	1,736	France 7.
Coke and semicoke		123,937	86,154	85,279	Bermuda 864; Germany 9.
Gas, natural, liquefied	value, millions	$31	$106	$106	
Peat including briquets and litter		136	58	42	Canada 16.
Petroleum:					
Crude	barrels	12,002	NA		
Refinery products:					
Liquefied petroleum gas	thousand 42-gallon barrels	r7,521	7,811	NA	NA.
Gasoline	do.	10,306	25,076	NA	NA.
Mineral jelly and wax	do.	382	NA		
Distillate fuel oil	do.	999	17,009	NA	NA.
Residual fuel oil	do.	25,373	—		
Bitumen and other residues	do.	34	NA		
Bituminous mixtures	do.	35	NA		
Petroleum coke	do.	639	502	502	

[p]Preliminary. [r]Revised. NA Not available.

[1]Table prepared by H. D. Willis. As a result of changes in trade code classifications, some data for 1990 and 1991 are not completely comparable.

[2]Includes powder and flakes; excludes other semimanufactures.

[3]Includes vanadium.

[4]Less than 1/2 unit.

[5]Includes high-purity silicon.

[6]Includes waste and scrap.

[7]Includes bars, rods, profiles and wire; excludes other semimanufactures.

[8]May include other precious metals.

[9]Includes zinc dust, powders, and flakes.

[10]Reported under SITC item number as "selenium, tellurium, phosphorus, arsenic, etc."

[11]Includes iodine.

[12]Includes leucite, nepheline, and nepheline syenite.

TABLE 4
MEXICO: ROLE OF MINERALS IN MEXICO'S EXPORT SECTOR

(Value in million U.S. dollars)

	1970	1975	1980	1985	1986	1987	1988	1989	1990	1991	1992
Value of total Mexican exports	1,290	3,062	15,308	21,867	16,031	20,600	20,800	22,700	26,800	27,100	27,530
Value of crude oil exports	—	438	9,449	13,296	5,572	7,876	5,854	7,281	8,914	7,272	7,421
Crude oil share percent	—	14.3	61.7	60.8	34.8	38.2	28.1	32.0	33.3	26.8	27.0
Value of mining, metallurgical exports	196	484	1,347	906	968	1,172	1,410	1,556	1,526	1,246	1,154
Mining, metallurgical share percent	15.2	15.8	8.8	3.8	6.0	5.7	6.8	6.9	5.7	4.6	4.2

Sources: CAMIMEX and PEMEX.

TABLE 5
MEXICO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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	Cía. Minera y Refinadora Mexicana, S.A. (private Mexican, 51%; Cookson Ltd., 49%)	San José mine, Catorce, S.L.P.	NA.
Barite	Barita de Sonora, S.A. (Mexican private, 100%)[2]	Mazatán, Son.	165,
	Minera Capela, S.A. (Peñoles, 100%)	La Minita mine, Michoacán	150.
Cement	Cementos Mexicanos, S.A. de C.V. (private Mexican, 100%)	Monterrey, N.L.; Torreón, Coah.; Huichapan, Hg.; Valles, S.L.P.; Antotonilco, Hgo.; Zapotiltic, Jal; Tolteca, Hgo.; and Mixcoac, Mex.	19,800.[3]
Do.	Cementos Anahuac, S.A. (Cementos Mexicanos, 100%)	México 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 México, S.A., 100%)	Mimosa, Palau mines, Muzquiz Washing Plant at Palau, Coah., and Coking Plant at Monclova, Coah.	2,500.
Do.	Minera Carbonífera Río Escondido, S.A. (MICARE)[4] (Grupo Acerero del Norte, 51%; Mission Energy, 49%)	Mina I, Mina II, and Tajo I at Nava and Piedras Negras, Coah.	4,000.
Copper	Mexicana de Cobre, S.A. (Medimsa, 83.2%; Grupo Perforadora México, 9.8%; other and Workers Union, 7%)	La Caridad Mine and smelter Nacozari de García, Son.	150.
Do.	Mexicana de Cananea, S.A.[5] [Mexicana de Cobre, 76%; ACEC Union Miniere, S.A. (Belgium), 21%; the Workers Union, 2.7%]	Mine and smelter at Cananea, Son.	170.
Do.	Minera María, S.A. de C.V. (Empresas Frisco, 51%; Cominco Resources International, 49%)	Cananea District, Son.	18.
Ferroalloys and manganese	Cía. Minera Autlán, 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.

See footnotes at end of table.

TABLE 5—Continued

MEXICO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities[1]	Annual capacity
Fluorspar		Cía. Minera Las Cuevas, S.A. (Grupo Industrial Camesa S.A.)[7]	Salitrera (Zaragoza), S.L.P.	520.
Do.		Fluorita de México, S.A. de C.V. (Mexican, 51%; AIMCOR, 49%)	Mines at La Encantada range and plant at Muzquiz, Coah.	500.
Gold	kilograms	Cía. Fresnillo, S.A. (Peñoles, 60%; AMAX, 40%)	Fresnillo mine, Zac.	1,866.
Do.	do.	Minas de San Luis, S.A. (Industrials Luismín, 100%)	Tayoltita, Durango	1,400.
Do.	do.	Cía. Minera 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.
Gypsum		Cía. Occidental Mexicana, S.A. (private Mexican, 51%; Domtar, Ltd. of Canada, 49%)	Santa Rosalía on San Marcos Island, B.C.S.	1,500.
Lead and zinc		México Desarollo Industrial Minero, S.A. [Grupo IMMSA, 68.8%; Asarco Inc. (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 at S.L.P.	70 (lead), 150 (zinc).
Do.		Industrias Peñoles, S.A. (private Mexican, 97%; U.S. private, 3%)	La Encantada, Coah.; Fresnillo, Zac.; Naica, Chih. mines; Bismark, Son. (Peñoles, 100%). Rey de Plata, Gro. (Peñoles, 60%; Outokumpu, 40%) Metallurgical complex at Torreón with silver, lead, and zinc smelters and/or refineries operated by Met-Mex Peñoles (Peñoles, 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	thousand 42-gallon barrels per day	Petróleos Mexicanos (PEMEX) (Government, 100%)	Comalcalco, Poza Rica, and Golfo de Campeche districts	3,500.[8]
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 Peñoles, 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 Torreón, Coah.	654,000.
Do.	do.	Mexico Desarollo Industrial Minero, S.A. [Grupo IMMSA, 68.8%; Asarco Inc. (United States), 31.2%]	San Martín 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		Química Magna, S.A. de C.V. (Grupo Peñoles, 100%)	Subsurface brines at Laguna del Rey, Coah.	350.

See footnotes at end of table.

TABLE 5—Continued

MEXICO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities[1]	Annual capacity
Steel	Altos Hornos de México, S.A. (AHMSA), Grupo Acereros de Norte	Steelworks at Monclova, Coah. Iron ore from Peña Colorada Mine in Colima	3,900.
Do.	Hylsa de México, 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.	Siderúrgica Lázaro Cárdenas-Las Truchas, S.A. (SICARTSA) (Grupo Villacero, 80%; Government, 20%)	Port of Lázaro Cárdenas, Michoacán	1,300.
Do.	Siderúrgica del Balsas, S.A. (SIBALSA) (SICARTSA II) (Caribbean ISPAT, 100%)	SICARTSA II Plant Facilities as Lázaro Cárdenas Plus, 29%; share in the Peña Colorada Mine	2,000 (steel), 1,500 (steel plate).
Iron ore	(Acerero del Norte, 29%; Caribbean ISPAT, 29%; Hylsa, 42%)	Peña Colorada Mine and pellet plant near Manzanillo, Col. Colima State	3,000.
Do.	Siderúrgica Lázaro Cárdenas-Las Truchas, S.A. (SICARTSA) (Grupo Villacero, 80%; Government, 20%)	Ferrotepec, Volcán, and Mangó deposits in Las Truchas project area, and pellet plant, Michoacán	1,900 (iron ore).
Strontium (celestite)	Cía. Minera La Valenciana (private Mexican, 100%)	San Agustín Mine in Coah.	50.
Sulfur	Azufrera Panamericana S.A. (APSA)[10] (Government-Fomento Minero, 96%; private, 4%)	Cosachapa, 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 Potosí, S.A. (private Mexican, 100%)	San Luis de Potosí, S.L.P.	6.4.
Do.	Estaño Electro, S.A. (private Mexican, 100%)	Tlalnepantla, México D.F.	1.3.
Do.	Fundidora de Estaño, S.A. (private Mexican, 100%)	San Luis Potosí, 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.), Michoacán (Mich.), Nuevo León (N.L.), Oaxaca (Oax.), Querétaro (Qro.), San Luis Potosí (S.L.P.), Sinaloa (Sin.), Sonora (Son.), Veracruz (Ver.), and Zacatecas (Zac.).
[2]Formerly owned 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, Comisión 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 owned 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 Cía. 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 6
MEXICO: PRODUCTION OF CRUDE STEEL, BY COMPANY

(Thousand metric tons)

Company	1988	1989	1990	1991	1992
Altos Hornos de México, S.A. (AHMSA)	3,083	2,862	3,096	2,659	2,550
Hylsa de México, S.A. (HYLSA)	1,710	1,812	1,882	1,924	1,906
Ispat Mexicana, S.A. de C.V. (IMEXA)[1]	—	—	—	—	954
Siderúrgica Lázaro Cárdenas-Las Truchas, S.A. (SICARTSA)[2]	1,131	1,336	1,802	1,455	1,194
Tubos de Acero de México, S.A. (TAMSA)	540	469	503	517	380
Others (micromills and minimills)	1,315	1,373	1,451	1,409	1,451
Total	7,779	7,852	8,734	7,964	8,435

[1]Known as SICARTSA II until 1991.
[2]Known as SICARTSA I until the beginning of 1992.

TABLE 7
MEXICO: PRODUCTION OF FINISHED STEEL, BY PRODUCT TYPE

Product type	1988	1989	1990	1991[r]	1992
Castings and forgings	107	74	68	63	65
Rolled products:					
Flat-rolled	2,531	2,580	2,685	2,563	2,644
Nonflat products	3,335	2,998	3,604	3,437	3,302
Seamless tubes	341	355	335	404	290
Total	6,314	6,007	6,692	6,467	6,301

[r]Revised.

Source: Cámara Nacional de la Industria del Hierro y del Acero (CANACERO).

TABLE 8
MEXICO: PROVEN HYDROCARBON RESERVES

(Million 42-gallon barrels unless otherwise specified)

Region	Dry natural gas (billion cubic meters)	Liquid hydrocarbons				
		Crude oil	Condensate	Dry natural gas-liquid equivalent	1991 total	1992 total
1991 total	2,009	44,292	6,633	14,075	65,000	XX
1992:						
Marine (Bay of Campeche)	326	25,571	2,964	2,270	30,138	30,805
North[1]	1,036	12,248	1,770	7,260	21,338	21,278
South[2]	622	6,620	2,052	4,295	13,524	12,967
Total	1,984	44,439	6,786	13,825	XX	65,050

XX Not applicable.
[1]Includes North, South, and Northeastern Frontier, Poza Rica, and Papaloapan Basin Districts.
[2]Includes Agua Dulce, El Plan, Nachital, Comalcalco, Villahermosa, and Ciudad PEMEX Districts.

Source: Petróleos Mexicanos, S.A., Statistical Yearbook 1990, México, D.F.

TABLE 9
MEXICO: PETROLEUM AND NATURAL GAS PRODUCTION

Region and district	Natural gas (million cubic meters)			Crude oil[1] (thousand 42-gallon barrels)		
	1990	1991	1992	1990	1991	1992
North region:						
Northeastern Frontier	2,543	2,408	2,467	73	—	—
North	434	434	466	9,235	9,599	9,940
South	206	248	249	6,132	6,169	6,185
Poza Rica	465	507	477	18,360	19,418	17,963
Papaloapan Basin	1,261	1,292	1,150	4,088	3,687	2,190
Total[2]	4,909	4,889	4,809	37,887	38,878	36,279
South region:						
Agua Dulce	734	817	708	14,308	15,257	13,616
El Plan	486	475	418	6,826	7,118	6,954
Nanchital	31	21	31	1,314	1,314	1,464
Ciudad PEMEX	2,201	2,047	1,986	73	182	220
Comalcalco	165	196	135	4,782	4,599	4,173
Villahermosa[3]	17,664	17,116	16,888	210,131	214,266	213,055
Total[2]	21,281	20,672	20,166	237,433	242,725	239,482
Marine region	11,555	11,989	12,166	654,701	695,070	700,626
Grand total[2]	37,741	37,550	37,141	930,023	976,668	976,387

[1]Does not include condensate.
[2]Data may not add to totals shown because of independent rounding.
[3]Referred to as Mesozoic.

Source: Petróleos Mexicanos, Statistical Yearbook 1990, México, D.F.

TABLE 10
MEXICO: RESERVES OF SELECTED MINERAL COMMODITIES, YEAREND 1992

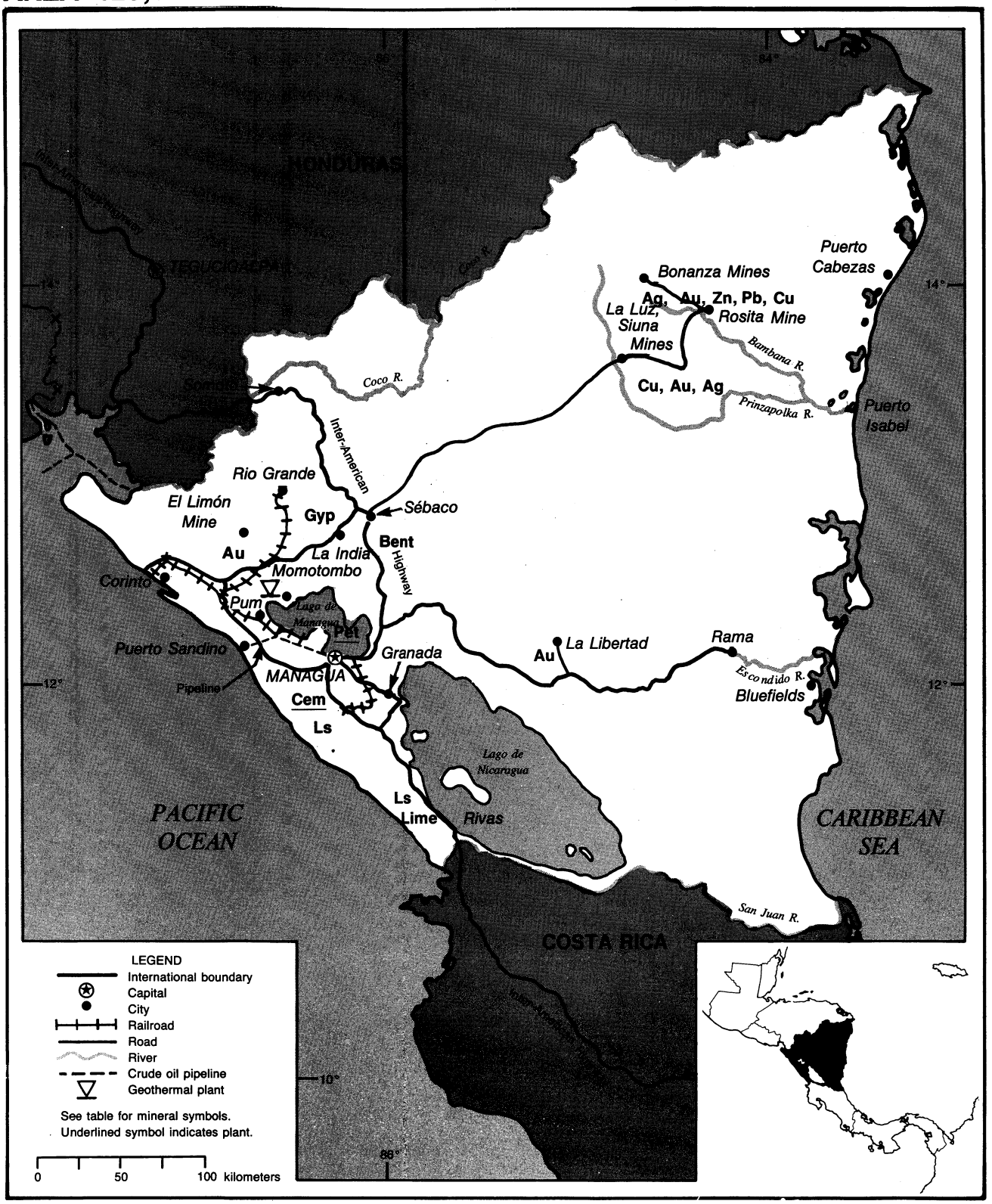
(Thousand metric tons unless otherwise specified)

Commodity[1]		Reserves
Antimony		181
Barite		7,000
Bismuth	metric tons	10,000
Cadmium	do.	35,000
Copper		14,000
Fluorspar[2]		19,000
Gas, natural[3]	billion cubic meters	1,957
Graphite, natural		3,100
Lead		1,000
Manganese		4,000
Mercury	metric tons	5,000
Molybdenum	do.	90,000
Petroleum, crude[3]	million 42-gallon barrels	51,225
Salt		Large
Selenium	metric tons	3,000
Silver	do.	37,000
Sodium carbonate, natural		180,000
Sodium sulfate, natural		165,000
Sulfur[4]		75,000
Zinc		6,000

[r]Revised.
[1]All metals expressed in metal content.
[2]Measured as 100% calcium fluoride.
[3]Yearend 1992. Source: PEMEX Statistical Yearbook 1993.
[4]Sulfur in all forms.

NICARAGUA

AREA 129,500 km² **POPULATION 3.9 million**



THE MINERAL INDUSTRY OF

NICARAGUA

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 country is slightly larger than New York State. The terrain is made up of volcanic peaks, with a wide Atlantic coastal plain and a narrow Pacific coastal plain interrupted by volcanoes. The natural resources of Nicaragua are copper, gold, lead, silver, tungsten, zinc, fish, and timber. Only about 10% of the land is arable.

The manufacturing industry in Nicaragua accounted for about 20% of GDP and agriculture for 15%. About 45% of the work force was employed by the agriculture industry and accounted for 80% of export earnings. The GDP growth rate for 1992 was estimated at 1% and unemployment at 53%. Mining in Nicaragua accounted for about 0.5% of the country's GDP, based primarily on the extraction of gold, silver, and industrial minerals, such as gypsum and marine salt. Other minerals reported to occur in Nicaragua included copper, lead, phosphate, tungsten, and zinc.

Relative to the size of its economy, Nicaragua was the most heavily indebted country in the world, with total debt of $10.8 billion, mostly owed to governments. Reportedly, Nicaragua expected to receive $500 million over the next 4 years to get its economy moving. Over the past few years the International Development Bank approved loans of $270 million to Nicaragua and disbursed $150 million.

The Government privatized about 230 state-owned companies, or about 35% of the total that had been incorporated into a state holding corporation, Corporaciones Nacionales del Sector Publico (CORNAP). Four private banks have been licensed, and the Government has liberalized foreign trade and canceled price controls on most imported goods. More than 50% of the agricultural and industrial firms remained state owned. Foreign investors were eligible to bid on companies sold through public bidding.

GOVERNMENT POLICIES AND PROGRAMS

The basic mining law, the "Ordenanzas de Nueva España" of Carlos III, was replaced in 1876 by the First Mining Law. The Second Mining Law was enacted on April 1, 1906, and was replaced by the Special Law "Exploration and Exploitation of Mines and Quarries" (Decree No. 1067, Official Gazette No. 69 to 72-74, March 27-30, 1965). The latter law rules in conjunction with the General Law Over Exploitation of Natural Resources (Decree No. 316, Official Gazette No. 83, April 17, 1958). The General Law was created to set basic rules for the exploration and exploitation of the state's natural resources. Decree No. 290 of February 8, 1980, prohibits all transactions and transfers of precious metals between individuals. Individuals and companies that produce and trade precious metals must obtain the state's permission. The decree also prohibits all exports of precious metals without authorization from the state.

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. It is also in charge of the management of Nicaragua's natural resources and mining enterprises. INMINE is the governmental agency solely responsible for granting, supervising, and canceling permits, licenses, and exploration and exploitation concessions of minerals.

The Government of Nicaragua approved the new foreign investment law to attract additional foreign resources. Investment incentives included the right to repatriate profits, repatriation of new capital 3 years after the initial investment, freedom to import essential equipment, and the right to bank export earnings in dollar-based accounts instead of in cordoba accounts.

The Government deregulated all exports, except for gold, and imports. Gold exports continued to be controlled by the Government. Import licenses were to be issued to companies registered with the CBN by the Ministry of Economic Affairs and Development (MEAD). Exporters were required to be registered with both the Central Bank of Nicaragua (CBN) and MEAD.

Nicaragua agreed to pay $21 million over the next 20 years to Amax Inc's. subsidiary Rosario Mining S.A. in compensation for assets nationalized in 1979 by the former Sandinista regime. Reportedly, this was seen as an important part of an ongoing political reconciliation process between Nicaragua and the United States.

PRODUCTION

Production of most commodities in Nicaragua increased slightly in 1992. Production of gold and silver in Nicaragua were directed primarily for export. 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. In 1991, Nicaragua signed an agreement on trade liberalization with Costa Rica, El Salvador, Guatemala, Honduras, and Mexico. A bilateral Framework Agreement on Trade and Investment was signed by Nicaragua and the United States. The second meeting of the trade and investment council was held on November 19, 1992.

Nicaragua exported chemicals, clothing, food, machinery, and petroleum products to Latin America (30%), the United States (25%), and the European Economic Commission (20%). 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 José Accord, with some from Mexico.

STRUCTURE OF THE MINERAL INDUSTRY

In Nicaragua, the Government control of the economy historically has been considerable, but the new Government pledged to greatly reduce intervention. INMINE, a subsidiary of the Government holding company, CORNAP, controlled most of the country's mineral exploration and production operations. CORNAP's role includes returning firms to former owners, selling them to private investors, and closing unprofitable companies. The 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 2.)*

COMMODITY REVIEW

Metals

Gold was produced by the Francisco Meza Rojas Mine in Zelaya Province, operated by INMINE since 1979. INMINE also produced gold and silver from the Bonanza, El Limón, and La Libertad Mines. The largest producer of gold, the El Limón underground and open pit mine, 40 km northeast of Leon, previously accounted for about 40% of Nicaragua's gold output. Reportedly, the mine produced about 75 kg/month of gold in 1992 and expects to produced 600 kg once privatized. The Bonanza Mine is about 280 km northeast of Managua. To date, the mine has produced 71,540 kg of gold from 7 Mmt of ore grading 10.3 g/mt. Greenstone Resources Ltd. and local partner Nica Mines Ltd. acquired a 75% interest (37.5% each) in the La Libertad open pit gold mine from the Nicaraguan Government. The remaining 25% will be retained by Fesimini, a Nicaraguan company representing the mine workers. The Government holding company Inversiones Mineras S.A.-Grupo IMISA (IMISA) promotes the privatized affiliated companies. The La Libertad Mine, 165 km east of Managua, produced about 18 kg/month of gold in 1992 and is expected to produce 70 kg/month following programmed investment. Gold occurs in epithermal quartz veins up to 20 m thick. More than 40 such veins have been identified but fewer than one-half have been investigated. Mining was carried out on a small scale since the turn of the century, and the work involved the extraction of higher grade vein ore by underground methods.

The Nicaraguan Government invited bids regarding the sale of some state-owned mineral assets, including two operating mines, that were nationalized when the Sandinista regime was in power. Privatized were the operating Bonanza gold mine and the inactive Siuna gold mine in the country's northeast, the operating El Limón gold mine, and the inactive La India gold mine south of El Limón. The La India Mine also includes two gold prospects—the Topacio east of Managua and the La Reina northeast of Managua. The Siuna gold mine is in the same district as the Bonanza Mine. A number of foreign companies expressed interest in presenting bids.

Reportedly, the Nicaraguan Government agreed to pay $21 million over a 20-year period in compensation to a U.S. company, Amax Inc. The previous Government nationalized Amax's El Rosario five mining concessions for extraction of copper, gold, silver, and other minerals in 1979. The mine was one of the richest gold mines in the country.

Silver was produced in the rehabilitated underground Siuna Mine, Zelaya Province. The capacity of the mine was 2,000 mt/d. The La Luz open pit mine reportedly had reserves of about 2 Mmt averaging 1.24 g/mt of gold and 15.55 g/mt silver. Total proved, probable, and possible reserves in Nicaragua was estimated by INMINE to be about 26 Mmt of gold and silver ore.

Industrial Minerals

INMINE's Empresa Nicaragüense de Minerales No Metálicos controlled the state's four industrial mineral companies, which included: 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.

Already in the private sector is the IMISA, which functions as a holding company dedicated to the promotion and expansion of its affiliated companies. IMISA incorporates Arenas S.A. (producing about 600,000 m^3/a of sand and gravel for construction), Canteras S.A. (producing dimension stone with an output of 3 million units), and Calizas S.A. (producing 7,000 mt/a of grounded limestone of 97% $CaCO_3$ purity for the sugar-refining, paint, and chemical industries).

Mineral Fuels

Nicaragua relied totally on imports for all its mineral fuel needs. Crude oil was imported primarily from Venezuela (94%), Mexico (4%), the United States, Honduras, and Costa Rica. The Government was planning legislation to attract foreign participation in oil exploration. New laws grant renewable exploration permits for initial periods of 4 years on a maximum 4,000,000-Mha area. There is a possibility of oil in Nicaragua according to seismic studies.

INFRASTRUCTURE

Roads and railroad facilities are inadequate in Nicaragua. Road construction was important to the Government. Only about 4,000 km of roads was paved of the total of 26,000 km, including the 369 km of the Pan-American highway. Only 373 km was in railroad tracks. Most mineral products were transported by road, and minerals, such as gypsum, were moved by the railroad system.

Ports on the Pacific coast included Corinto and Puerto Sandino. A 56-km crude oil pipeline extended from Puerto Sandino to the Esso refinery in Managua. Puerto Cabezas, El Bluff, and Rama serviced Caribbean traffic. Inland waterways totaled 2,220 km, including Lake Nicaragua and the San Juan River.

The Government-owned hydroelectrical powerplants had a capacity of 401 MW, operating at 65% of its capacity. Historically, electricity has been rationed every year for the first 2 weeks in May because of the drought, while the rainy season occurs in the second half of May. The Nicaraguan Power Authority also had problems with scattered early rains blowing numerous transformers; several geothermal wells losing pressure; the water cooling system intake tubes at the Managua plant being partially above lake level, thus reducing the plant's efficiency; and one unit at the Puerto Sandino plant being down for repairs.

The Instituto Nicaragüense de Energía operated hydrothermal and geothermal electrical plants. Nicaragua operated one geothermal plant that generated 75 MW. The plant is on the slopes of the Momotombo volcano, near Managua. Nicaragua was negotiating with Russia to build the largest Central American geothermal powerplant, powered by volcanic gases. The plant will be built on the slopes of the San Jacinto-El Tizade volcanic complex, 90 km northwest of Managua. The capacity of the plant is expected to be 105 MW, with the completion date in 1996. Nicaragua continued to pursue geothermal energy as an alternative source because it is inexpensive and decreases reliance on petroleum imports. The country spends 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.

OUTLOOK

Nicaragua privatized at least 120 state-owned companies in 1991, sold 230 in 1992, and planned to sell off 120 more by mid-1993. The country's mines were some of the more profitable enterprises being privatized. Wide-scale protests and strikes followed this privatization program. The Government was hoping that this privatization effort would help reduce the country's deficit. Nicaragua's production of gold was expected to increase 200% by 1994 because of the privatization of the country's state-run mining sector. The Government planned to revive the Nicaragua's mining industry with financial and technical aid from abroad. Privatization of most of the gold mines would encourage inflow of capital into the country and contribute significantly to the country's GDP.

[1]Where necessary, values have been converted from Nicaragua cordobas (C$) to U.S. dollars at the rate of C$5.00=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Corporación Nicaragüense de Minas (INMINE)
Managua, Nicaragua
Corporaciones Nacionales del Sector Público (CORNAP)
Managua, Nicaragua
Inversiones Mineras S.A.
Managua, Nicaragua

Publications

Instituto Nacional de Estadísticas y Censos: Annuario Estadístico de Nicaragua, Managua, Nicaragua, annual.
Latin American Mining Institute, Washington, DC: Mexico and Central America Investment and Mining Guide, annual.
U.S. Central Intelligence Agency, Washington, DC: The World Factbook, 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		1988	1989	1990	1991	1992[p]
Bentonite		8,494	4,164	4,592	5,070	2,816
Cement		e100,000	131,011	219,400	239,300	277,000
Gold, mine output, Au content	kilograms	878	1,410	1,200	1,154	1,322
Gypsum and anhydrite, crude		e7,000	11,570	13,444	16,200	9,115
Lime		e3,500	e3,500	r1,011	2,120	2,003
Petroleum refinery products	thousand 42-gallon barrels	e3,500	e3,500	e4,000	4,543	4,802
Salt, marine[e]		15,000	15,000	15,000	15,000	15,000
Sand and gravel	thousand tons	e1,125	e1,125	1,064	1,170	1,288
Silver, mine output, Ag content	kilograms	776	1,113	1,095	r1,014	2,240

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Includes data available through July 29, 1993. 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.

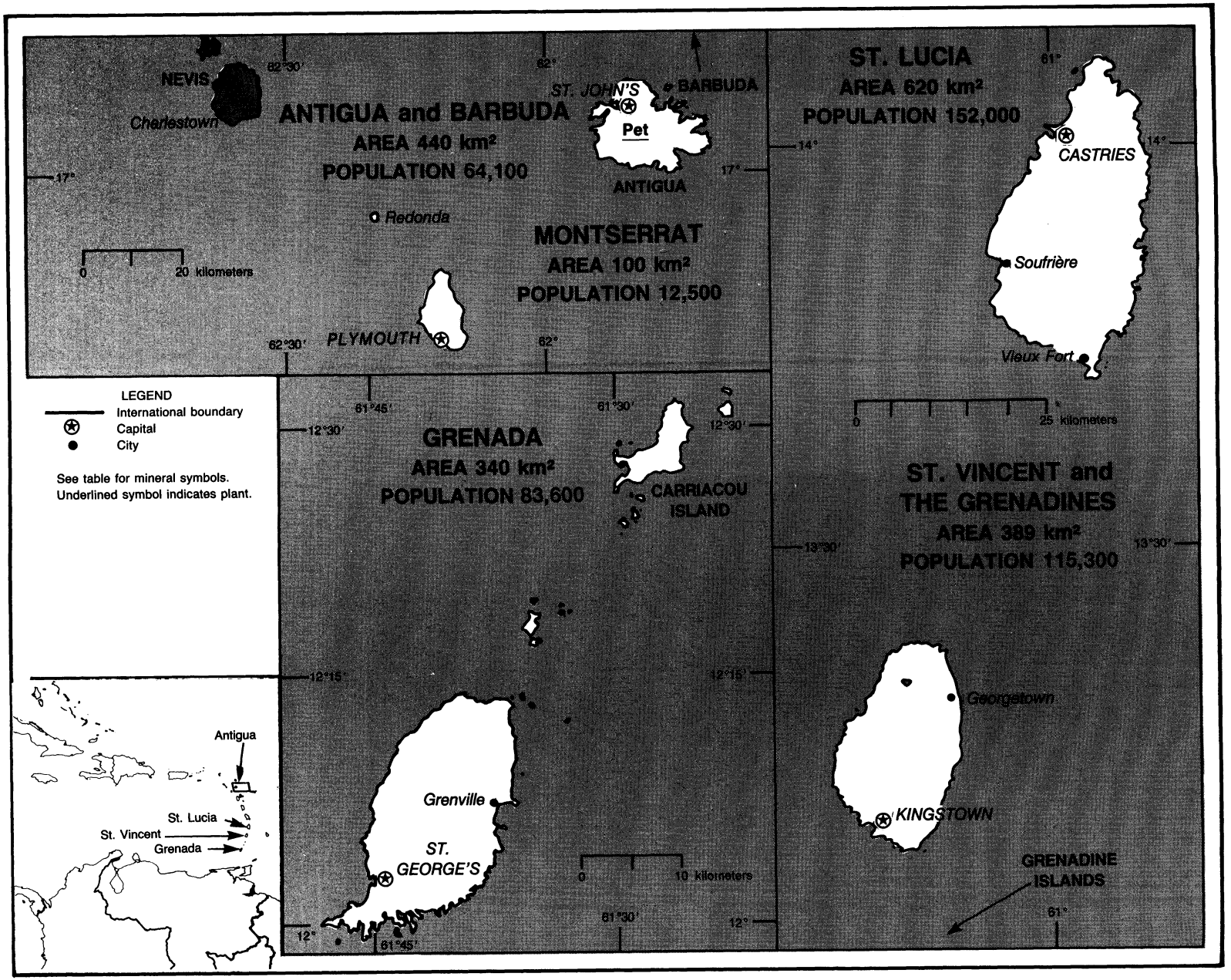
TABLE 2
NICARAGUA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity 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		Compañía Nacional Productora de Cemento (Government, 100%)	San Rafael del 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 Minera 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	15
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 Limón mine, León Department	3,000

[1]The Siuna Mine is inactive.

OTHER LESSER ANTILLES



THE MINERAL INDUSTRY OF

OTHER LESSER ANTILLES

By Philip M. Mobbs

ANTIGUA AND BARBUDA

Antigua, a volcanic island with limestone deposits along the north and east coasts, was one of the first Caribbean islands to promote tourism, boosting mineral-related activity through the construction industry. Barbuda produced a small amount of salt and, in the past, phosphate was collected on the uninhabited island of Redonda.

The three-island Commonwealth member's mineral industry partially supplied the requirements of the construction industry. New construction focused attention on the necessity of additional infrastructure upgrades, especially increased electrical power generation capability and road rehabilitation. Redevelopment of the West Indies Oil Co. Ltd. refinery site as a tourist facility was proposed at yearend 1991. The 6.4-Mbbl/a refinery had been closed in 1983.

GRENADA

The most southern of the Windward Islands, Grenada consists of Grenada and several islands of the southern Grenadines. Local mineral production augmented the needs of the construction industry. A proposal to almost double the island's available tourist accommodations by 1994 was advanced during the year. Privatization of the nation's power company, Grenada Electricity Co., was also proposed.

MONTSERRAT

The economy of this small volcanic island was centered on tourism and construction. Small quantities of sand and gravel and other quarry products constitute the mineral industries of Montserrat. The remainder of the island's mineral requirements were imported through the port of Plymouth, which was still attempting to recover from the severe damage inflicted by Hurricane Hugo in 1989.

SAINT LUCIA

A few small gravel, pumice, and sand operations continued to supply Saint Lucia's construction sector. Hess Oil Saint Lucia Ltd. maintained a petroleum storage and transshipment terminal outside Castries.

A number of public investment projects were continued on the island, including the Roseau Dam Water Management Project, the Ciceron Water Treatment Plant, residential and commercial construction associated with the waterfront development project and expansion of Castries harbor, and rehabilitation of the airport. The demand for semiskilled construction labor resulted in a labor shortage during 1992.

SAINT VINCENT AND THE GRENADINES

Local mineral production was used to augment materials needed for the construction industry. Construction of additional tourist facilities on Bequia was expected with the opening of a new airport on the island 20 km south of Saint Vincent. Eighteen km of road was to be built under a $3.7 million construction contract awarded during 1992.

There was also private salt production in noncommercial volumes.

Diplomatic relations were established with Cuba. Saint Vincent and the Grenadines expected to trade surplus agricultural products for Cuban cement.

[1]Where necessary, values have been converted from East Caribbean dollars (EC$) to U.S. dollars at the rate of EC$2.70=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Ministry of Economic Development and Energy
Queen Elizabeth Highway
Saint John's, Antigua
Telephone: (809) 462-1960

Ministry of Communications Young St.
Saint George's, Grenada
Telephone: (809) 440-3598

Ministry of Trade, Industry, and Agriculture
Castries, Saint Lucia
Telephone: (809) 452-2611

Ministry of Trade, Industry, and Agriculture
Kingstown, Saint Vincent
Telephone: (809) 456-1223

Publications

Central Intelligence Agency: The World Factbook, annual.

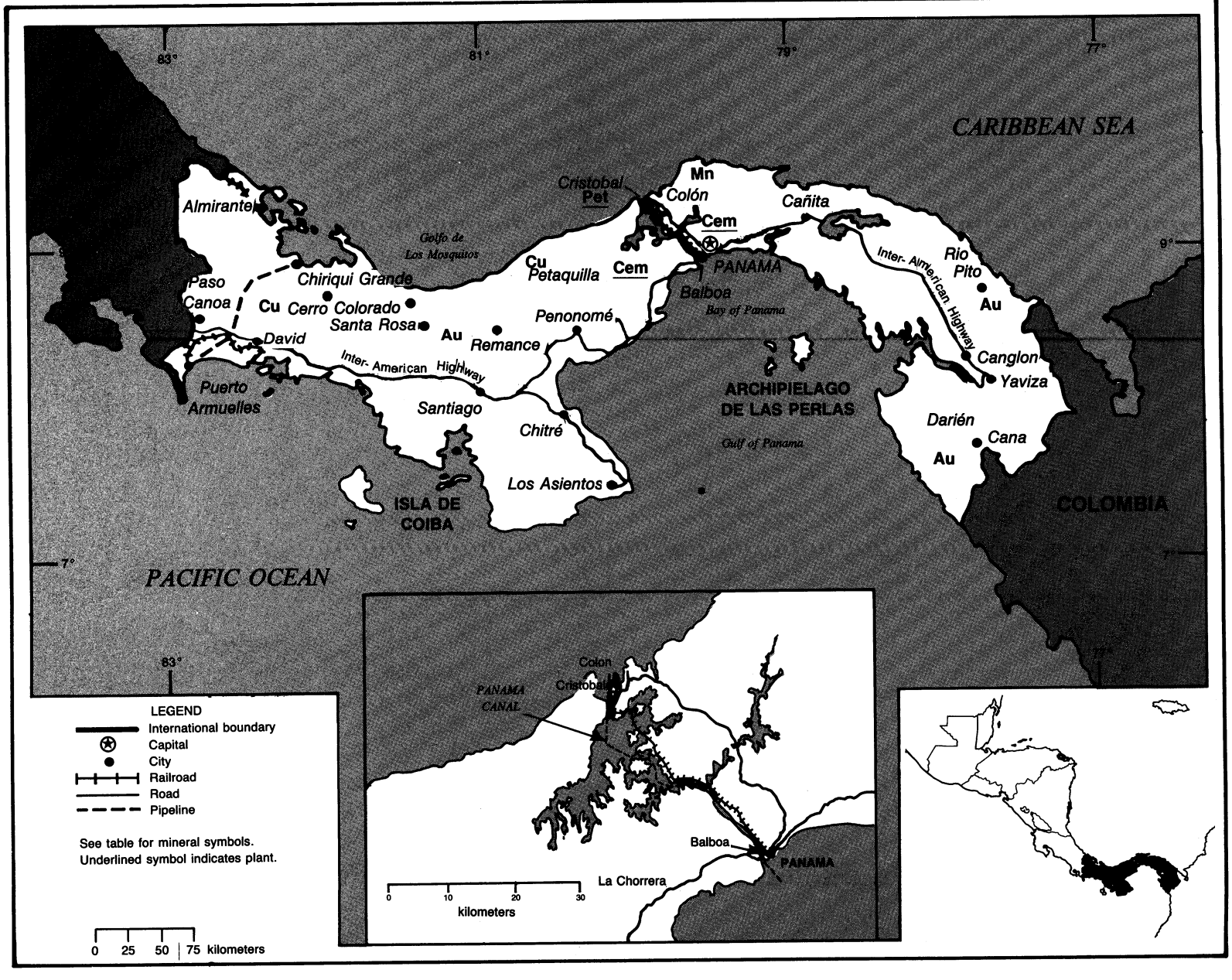
U.S. Department of Commerce, International Trade Administration: Foreign Economic Trends and Their Implications for the United States, Grenada, annual.

Foreign Economic Trends and Their Implications for the United States, Saint Lucia, annual.

Foreign Economic Trends and Their Implications for the United States, Saint Vincent and the Grenadines, annual.

PANAMA

AREA 75,990 km² **POPULATION 2.5 million**



THE MINERAL INDUSTRY OF

PANAMA

By George A. Rabchevsky

Panama is a Central American conutry situated between Costa Rica to the north and Colombia to the south. The north coast is bordered by the Caribbean Sea and the south by the Pacific Ocean. The size of the country is slightly smaller than South Carolina, United States. Almost 70% of the country consists of volcanic rocks. The interior topography is mostly steep with rugged mountains and with upland plains or plateaus. Coastal areas are mostly plains and rolling hills. Panama forms the narrowest and lowest portion of the isthmus that links North and South America. Panama's geographic location and configuration are often considered to be its principal natural resource. The operation of the Panama Canal was vital to the domestic economy because it provided foreign exchange earnings.

The Panamanian economy had experienced several years of recession, with economic decline reaching 20% in 1988. However, in 1992, the GDP increased by about 10%, following growth of 9.3% in 1991 and 4.6% in 1990 and a 0.4% contraction in 1989. Volcanic activity has made the soil very fertile. Agriculture accounted for about 15% of GDP, with 25% of labor force. In 1992, agriculture grew by 5.3%, construction industry grew by 62%, and manufacturing grew by 7.6%. Transport through the canal fell by 2% in 1992. About 5% of the country's economy was credited to mineral transportation and industrial mineral production. Transportation of mineral products, shipped through the canal or sent through the oil pipeline, represented the largest facet of the minerals industry in Panama. However, there were fewer canal transits in 1990, and transisthmus pipeline utilization dropped by 20.8%.

Mining still accounted for less than 1% of Panama's GDP. However, a number of 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 projected for 1995-97. Mineral industry production in Panama was confined to gold and industrial minerals. The country has extensive resources of copper and molybdenum at two deposits (Cerro Colorado and Petaquilla), but depressed world copper prices and the high cost of energy have inhibited development of these resources. The Panamanian Government attempted to pull out of the Cerro Colorado copper project, 250 km west of Panama City. Panama mined gold and some manganese. Industrial minerals produced for domestic use included cement, clays, limestone, salt, and sand and gravel.

GOVERNMENT POLICIES AND PROGRAMS

The controlling legislature for mining was the Code of Mineral Resources, Decree Law No. 23 of August 22, 1963, as amended by Decree No. 126, July 21, 1964; Decree No. 142, August 31, 1964; Cabinet Decree No. 26, August 21, 1969; Cabinet 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 20, 1985; and law No. 3, January 28, 1988. The mining laws of Panama were modified in February 1988 to bring the code in line with the international free market and stimulate foreign and local investors within the mining field. Foreign companies are allowed a 4-year concession to work deposits they discovered, with a 2-year extension. The Government reduced the royalty on mines to 2% of gross production for base metals and 4% for precious metals. The Government also waived import duties on capital equipment.

In 1991, the Panamanian Government proposed to privatize at least 28 state-owned companies, including its interests in a cement company, in its national telephone company, in certain port facilities, and in portions of the national electricity company. In 1992, the Congress continued to contest the privatization bill.

PRODUCTION

Production of almost all mineral commodities increased for the third year in Panama. Gold and silver production almost doubled again in 1992 from that of 1991. The manganese mine was not opened yet. Caribbean Mining Co. Inc. reportedly has plans to reopen the mine. Production of industrial minerals, such as cement, limestone, and sand and gravel, rose significantly in 1992 because of the startup of the construction industry. *(See table 1.)*

TRADE

Panama imported almost all mineral requirements for its industrial base. Mineral-related exports consisted primarily of scrap metal and of petroleum products that were provided to ships and aircraft in transit. Transisthmian oil

pipeline shipments were reduced because of declining Alaskan crude oil shipments. Panama imported about 70% of crude oil from Ecuador and about 22% from Venezuela under the San José Accord. Peru and Saudi Arabia supplied the balance of Panama's crude oil requirements.

Panama was not a member of the Central American Common Market. Panama has, however, 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. The United States was Panama's largest trading partner, accounting for about 40% of Panama's exports and 45% of its imports in 1992. Panama was eligible for trade benefits under the U.S. Generalized System of Preferences and the Caribbean Basin Initiative. In June 1991, a bilateral Framework Agreement on Trade and Investment was signed by Panama and the United States. The general trend of decreasing shipments of metals, ores, coal, petroleum, and petroleum products through the canal continued.

STRUCTURE OF THE MINERAL INDUSTRY

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 RTZ Corp. PLC, 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 2.)*

COMMODITY REVIEW

Metals

Gold.—Panama historically has been well known for its gold, since Columbus visited the Cocuyo District on the Atlantic coast during his fourth voyage. From this area the Spaniards extracted more than 9 tons of gold between 1559 and 1589 in a variety of places. Before the mid-19th century the El Espírito Santo Mine was one of the largest gold producers in the Western Hemisphere. Panama has 13 gold deposits. The existence of gold deposits in Panama is no coincidence. The country is part of the gold-producing circum-Pacific "ring of gold" and its geology offers optimal conditions for the formation of gold-rich deposits.

In 1992, gold mining in Panama included small-scale placer operations in the Darién Province, southeastern area of the country. The Panamanian company Transworld Exploration, S.A. and the Peruvian company Minera Remance operated an underground gold mine northeast of Santiago.

Espíritu Santo de Cana gold mine was operated by the Sociedad de Inversiones IXTAPA, S.A., in the Darién Province.

Greenstone Resources Ltd. became the sole owner of the Panamanian Minas Santa Rosa gold mine, about 40 km north of Santiago. Initial capacity will be 5,500 mt/d yielding 1,900 kg/a of gold. The Greenstone company was negotiating with a prospective joint venturer, or it may remain the sole operator. Reserves of the two concessions adjacent to the Minas Santa Rosa, the Santa Rosa and Alto de la Mina properties, were 7.2 to 7.9 Mmt grading 0.050 ounces of gold per ton. In addition to the Santa Rosa Mine, Greenstone also operated the Oronorte gold mine in northwestern Colombia.

Minnova Inc. of Toronto, Canada, continued its gold exploration program on the Petaquilla copper prospect. Petaquilla was owned by the Panama Resource Development Co., jointly held by a Japanese consortium.

Manganese.—Manganese deposits are known in five areas in Panama. They are Bahía de Mandinga, Bahía de Montijo, Calzada Larga, Nombre de Dios, and Río Boquerón. 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 Co. Inc. to reopen the open pit Cerro Viejo Mine northeast of Colón. The company received a manganese mining concession from the Government on August 5, 1992. The company had previously received authorization to exchange its exploration concession for an extraction one for 300 hectares in June 1992. Caribbean Mining originally had an exploration concession for 12,400 acres in the Colón area. The ore output of the mine was expected to be about 100,000 tons annually and targeted mainly at the U.S. market. New deposits may be discovered by further exploration, but because mining and shipping costs in Panama are high, the deposits may not be minable at a profit except during the periods of high manganese prices. Manganese ore was exported primarily to Germany.

Mineral Fuels

Discovery of oil and gas possibilities in Panama is limited because of the predominance of volcanic rocks. The offshore continental shelf is narrow on the Caribbean coast but rather broad on the Pacific side. Texaco Panama Inc. began its exploration for crude oil off the northwest coast in Bocas del Toro Province. All crude oil was imported by Panama for the refining of its petroleum products.

The enactment of Decree No. 29 on July 14, 1992, and Decree No. 38 on September 9, 1992, liberalized the status of the petroleum market and created Petroleum Free Zones. Within a Petroleum Free Zone, national or foreign corporations may perform multiple operations under a special tax regime.

INFRASTRUCTURE

The highway system was the hub of transportation in Panama. Roads were generally in good condition, especially in and around urban areas. The Inter-American Highway runs to Panama City.

Paved highways accounted for 2,745 km of about 8,500 km of roads. The remainder consisted of gravel or earthen surfaces. There was only 238 km of railroad track in the country.

Oceangoing ships with beams up to 32.3 m can transit through the Panama Canal. Normal maximum transit draft was 12 m tropical freshwater. 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 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 Bahía Las Minas, the site of the oil refinery of Refinería Panamá, S.A., handles and receives oil tankers and other vessels. Balboa, Cristóbal, and certain other ports service regular oceangoing freighters and passenger ships.

Electricity in Panama was generated by the state-owned Instituto de Recursos Hidráulicos y Electrificación. The installed 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 severe drought caused rationing by the nation's hydroelectric plants. The plants were operating at only 40% of their capacity. A geothermal energy region in southwestern Panama had an estimated potential of 400 MW.

OUTLOOK

The agriculture and construction industries are expected to improve, as well as the mineral industry. Increased production of gold and manganese as well as industrial minerals will be a factor in an improved economy. The Panamanian Government promotes and supports the development of the country's mineral resources. Foreign investment in the precious-metals areas is expected to increase because of the incentives provided by law No. 3.

[1]Where necessary, values have been converted from Panamanian balboas (B) to U.S. dollars at the rate of B1.00=US$1.00.

OTHER SOURCES OF INFORMATION

Agency

Dirección General de Recursos Minerales
Ministerio de Comercio e Industrias
Panama 5, Panama

Publications

Dirección de Estadística y Censo, Panama: Panamá en Cifras, annual.
Dirección General de Recursos Minerals, Ministerio de Comercioe Industrias, Panama: The Mining Sector of Panama.
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.

TABLE 1
PANAMA: PRODUCTION OF MINERAL COMMODITIES1

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992e
Cement		220,000	168,500	300,000	r e300,000	500,000
Clays:						
For cement		56,000	43,047	r122,332	r368,582	2415,058
For products		49,553	e36,000	r e90,000	r75,343	272,849
Gold3	kilograms	—	—	85	194	2250
Lime e		1,500	2,000	3,000	1,320	1,500
Petroleum refinery products	thousand 42-gallon barrels	e9,000	6,552	8,466	8,000	9,000
Salt, marine e		r22,795	r17,990	r22,200	r18,000	20,000
Silver	kilograms	—	—	41	91	2162
Stone, sand and gravel:						
Limestone:						
For cement		185,000	181,304	315,955	289,855	2665,720
For other uses		9,358	16,509	77,098	47,968	50,000
Sand and gravel	thousand tons	1,390	e1,000	470	1,941	22,448
Sand, silica		e15,000	e12,000	14,829	17,613	222,600

eEstimated. rRevised.
1Includes data available through July 1993.
2Reported figure.
3An unquantifiable amount of gold was recovered from placer deposits in Darien Province during the period 1988-89.

TABLE 2
PANAMA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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, Darién Province	NA
Petroleum products	million 42-gallon barrels	Refinería Panamá S.A. [Texaco Panama Inc. (U.S.), 100%]	Las Minas, Colón Province	36
Silver	kilograms	Transworld Exploration, S.A. and Minera Remance (Peru)	Remance Mine, Veraguas Province	2,000

NA Not available.

PARAGUAY

AREA 407,000 km² **POPULATION 4.9 million**

THE MINERAL INDUSTRY OF

PARAGUAY

By Alfredo C. Gurmendi

Mining accounted for about 0.5% of Paraguay's GDP, compared to 26.7% for the agricultural sector. Minerals produced in Paraguay included clays, glass sand, gypsum, kaolin, limestone, pigments, small amounts of iron oxide, stone, and talc. Mineral processing activities included manufacture of cement and lime from indigenous raw materials, as well as pig iron, steel, and refined petroleum from imported raw materials. Paraguay's petroleum needs were supplied by Algeria. Exploration for hydrocarbons in Paraguay was limited, and none of the discoveries proved viable. In 1992, Paraguay's economic performance continued at the same level as that of the previous year with a GDP growth of 2.5% to $6.3 billion.[1] Inflation increased from 11.8% in 1991 to 18.0% in 1992, still below the monthly rate in neighboring Brazil. Unemployment increased from 7% in 1991 to 16% in 1992, and the country's international reserves were $963 million.

In 1992, the Government concluded an agreement with the Paris Club and other creditors; by paying $27 million in amortization, the country reduced its foreign debt to $1.5 billion.

The Paraguayan work force in 1992 reached 1.6 million. Employment was distributed as follows: 49% in agriculture, 32% in industry (minerals, cement, and petroleum refining included) and commerce, 16% in services, and 3% in Government.

Discovery of Paraguay's potential mineral resources did not increase, largely because of extremely limited exploration, inadequate infrastructure, large fiscal and trade deficits, scarcity of foreign exchange, and limited private investment. However, business opportunities appeared to exist for developing natural resources such as hydropower, iron ore, limestone, manganese, and timber. The Government announced that projects such as the Yacyretá hydroelectric dam, road paving, rural settlements, and electrification would be open to bidding by U.S. corporations.

The Paraguayan economy encountered difficulties with the established export industries of cotton, soybeans, cattle, and electricity; and the lucrative, yet volatile, petroleum refining and cement industries. The country's export revenues were $700 million in 1992, representing a 4.1% decrease on the $730 million registered in 1991. This drop was blamed on lower prices for the country's leading export crops, cotton and soybeans. Also, exports were hit by the bad weather.

GOVERNMENT POLICIES AND PROGRAMS

Paraguay reinstated itself into western democracy. There have been some positive developments such as in January 1991, under the Generalized System of Preferences (GSP), when the United States lifted sanctions allowing Paraguayan exports to enter the U.S. market with much more ease. This action led to the restoration of the Overseas Private Investment Corp. (OPIC) programs in August 1991. The Government implemented a new tax code, approved by the Congress on December 31, 1991, that reduced the number of taxes from 84 to 7. The most important feature of the new tax system was the value added tax (VAT), implemented in July 1992. The new tax code included an income tax on corporations. On June 25, 1992, the Paraguayan Government implemented a sweeping import tariffs reform.

The signing of the Treaty of Asunción, creating the Southern Cone Common Market (MERCOSUR), on March 26, 1991, will establish a common market by the end of 1994 and bring economic and commercial benefits to the country as a result of all tariff barriers being gradually dismantled and goods, services, capital, and labor will circulate freely among Argentina, Brazil, Paraguay, and Uruguay by January 1995. On June 20, 1991, Paraguay, along with the other MERCOSUR countries, signed a framework agreement on trade and investment with the United States. This agreement will facilitate discussions among the participants on matters of mutual interest and serve as a bridge toward a potential free trade area envisioned by the Enterprise for the Americas Initiative. If MERCOSUR becomes a reality, it will constitute a market and a partner of about 190 million people and a total GDP of approximately $420 billion.

The Paraguayan Congress approved a privatization law on December 31, 1991. It authorizes the Executive to sell state-owned corporations. Five of them were scheduled for privatization: Administration Paraguaya de Alcoholes (APAL), which produces alcoholic beverages for domestic consumption; Líneas Aéreas Paraguayas (LAP), the Paraguayan airline; Aceros del Paraguay S.A. (ACEPAR), the national steel company; Flota Mercante Estatal (FLOMERES), the state merchant fleet; and Ferrocarriles del Paraguay (FCCAL), the Paraguayan railroad. For the sale of other state corporations Congressional approval would be required; the privatization process was moving slowly. The Paraguayan Government was

implementing the following regulatory reforms: simplification of investment procedures, modernization of the intellectual property legislation, strengthening of the investment promotion agency, and the establishment of an arbitration center for the settlement of trade and investment disputes. Once these reforms are in place, there would be tangible economic benefits to Paraguay.

Paraguay's economic development was based upon intensive, unplanned exploitation of its natural resources. Such a process, while producing growth, was causing irreversible damage to the environment. For instance, in the past 2 years deforestation doubled from 200,000 to 400,000 ha/a. Recommendations were made for immediate and medium-term actions to promote the establishment of national environmental and preservation policies. The United Nations Conference on Environment and Development of 1992, in Rio de Janeiro, Brazil, provided a framework for a more rational approach, emphasizing the following: (1) regulation of the exploitation of the forest; (2) encouragement of the growth of secondary and tertiary industries as opposed to the export of raw materials; (3) reforestation of degraded areas; (4) consolidation and enlargement of protected wildlife areas; (5) development of legislation for environmental protection; (6) application of environmental impact criteria to public and private development activities; (7) development of a national land use classification system; (8) introduction of environmental programs into integrated rural development planning, minimizing the effects of agricultural colonization; and (9) emphasis on environmental education.

PRODUCTION

Mineral commodities produced in Paraguay included clays, glass sand, gypsum, kaolin, limestone, and stone, all for internal consumption. Inadequate infrastructure was a major constraint on both exploration and mineral development in Paraguay. Production of petroleum refinery products for domestic consumption was about 70% of apparent refinery capacity. Rolled steel production was 55,000 tons and pig iron 62,000 tons in 1992. To date, none of the petroleum discoveries proved viable. *(See table 1.)*

TRADE

Exports in 1992 amounted to $700 million. Lower production of cotton and soybeans, which accounted for two-thirds of exports, coupled with lower prices for those commodities, resulted in reduced value of exports. The United States maintained a healthy trade surplus with Paraguay, amounting to about $330 million. The value of Paraguayan mineral exports in 1992 was negligible. Imports of crude oil and petroleum products amounted to $250 million. Argentina and Brazil were the primary sources for refinery products and Algeria for crude oil. There were plans for all of Paraguay's fuel needs to be supplied from the Formosa Oilfield in Argentina, with savings in freight estimated at $7 per ton. The total value of Paraguayan imports was $1.3 billion. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

The main mineral activities were the Government-owned cement plants and petroleum refinery. The limestone deposits along the Paraguay River were worked by Industria Nacional del Cemento (INC) for cement production. The Puerto Vallemí cement plant in Concepción Department had a 400,000-mt/a capacity, and the Itapucumi clinker plant in Villeta Department had 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. Production was based on iron ore and coal imported from Brazil. The Villa Hayes steel plant, which cost $290 million, was a joint venture of Brazil and Paraguay. During 1992, the Government-owned company, Petróleos Paraguayos S.A. (PETROPAR), produced in excess of 1,825,000 bbl of refined petroleum products for domestic consumption at its Santa Elisa refinery in Asunción. *(See table 4.)*

COMMODITY REVIEW

Metals

Shortages of raw materials continued to affect output by ACEPAR. The Villa Hayes plant was able to supply only reinforcing bars and some wire. Imports of rolled steel increased by about 10% to 45,000 tons in 1992. Other minerals known to occur included copper, lateritic iron ore, lignite, manganese, peat, pyrite, and uranium. Discussions between the Governments of Bolivia and Paraguay continued concerning imports of 500,000 mt/a of iron ore from the Mutún Mine near the Bolivian border.

Mineral Fuels and Energy

Exploration for hydrocarbons in Paraguay was very limited. In 1992, the following American companies were involved in petroleum exploration: (1) Santa Fe Energy of Texas continued exploration for oil in the Pilar Basin of the Chaco region; (2) Occidental Petroleum Co. identified a potential oil- and natural gas-bearing structure in northwestern Paraguay, near Villazón, and (3) Texaco Co. continued with geophysical surveys in southern Paraguay near the Argentinean border.

The Itaipú Dam complex, a joint Brazilian-Paraguayan hydroelectric powerplant on the Paraná River, operated at full capacity in 1992 with a 12,600-MW output. The Yacyretá-Apipé Dam, a joint Argentinean-Paraguayan hydroelectric project 320 km downstream from Itaipú, will become operational in mid-1993 with a capacity of 2,760 MW.

Reserves

There are large resources of limestone along the Paraguay River. Lateritic iron ore deposits along the Paraná River near Encarnación were estimated at 300 Mmt grading 35% iron. Other minerals known

to occur included azurite, barite, gypsum, lignite, malachite, mica, peat, pyrite, pyrolusite, soapstone, and uranium.

INFRASTRUCTURE

The transportation system in Paraguay improved somewhat in 1992, but remained generally inadequate. The country is linked to the outside world via air and inland river transport. There were 886 airports, of which 768 were usable; 6 had permanent-surface runways ranging from 1,220 to 3,700 m. Other transportation modes comprised inland waterways, 3,100 km; railways, 970 km; and highways, 21,960 km. The National Rural Roads Program, Stage I, mostly financed by the Inter-American Development Bank (IDB), will improve approximately 900 km of the country's rural road system. Paraguay will increase the value of its agricultural products by enhancing competitiveness and reducing transportation costs. There are no restrictions on the participation of firms from all IDB member countries to provide goods and services whenever IDB's foreign exchange was used. The most important commercial transportation connections were with Argentina, and the shipping lanes on the Atlantic Ocean were the navigable Paraguay and Paraná Rivers in this landlocked country. The inland waterways and the Río de la Plata handled about 65% of Paraguay's foreign trade with Argentina, Brazil, Chile, Europe, Japan, and the United States. Most of Paraguay's exports and imports are transshipped to Buenos Aires, Argentina, or Montevideo, Uruguay. The main port of Asunción and nine minor ports on the inland rivers are managed by the Administración Nacional de Navegación y Puertos, a Government-owned corporation.

OUTLOOK

The economic slowdowns in Japan, the United States, and parts of Europe will lessen demand for Paraguay's main exports, leading to downward pressure on prices. Approval by the International Monetary Fund (IMF) of Paraguay's standby program would allow Paraguay access to sizable new multilateral credits. Also, tax and financial reforms in Paraguay will ease loans from the World Bank linked to approval of Paraguay's IMF programs. The decision to restore the U.S. GSP benefits will create favorable conditions for OPIC to resume its operations in Paraguay, leading to capital availability for Paraguay's economic development.

Mineral surveys have identified the presence of iron ore, uranium, and other minerals in Paraguay, particularly lateritic iron ore on the Paraná River near Encarnación. Geophysical surveys have identified oil and natural gas potential in the El Palma Largo and Gran Boquerón Chaco regions in northwest Paraguay. Paraguay's accession to GATT would provide an opportunity to expand its trade position worldwide.

The privatization process and several large investment projects offer opportunities for U.S. corporations in the foreseeable future. Paraguay and Argentina were planning to build the hydroelectric project of Corpus on the Paraná River at Itacua, about 8 km upstream from Encarnación and Posadas. The Hidrovía, a fluvial transportation sector project, aims to improve the navigation system of the River Plate region, including the Paraguay and Paraná Rivers. The project will be a multinational effort involving Argentina, Bolivia, Brazil, Paraguay, and Uruguay. The Hidrovía will be financed by IDB. In 1995, when the Yacyretá dam will be completed, Argentina and Paraguay will become the world's largest exporter of hydroelectric power.

The social, cultural, physical, and economic dimensions of Paraguay's environment were analyzed by the U.S. Agency for International Development (USAID) and the International Institute for Environment and Development (IIED) to identify main environmental features and problems and to recommend specific actions, including legislative revision and land management, to promote the establishment of national environmental and preservation policies.

[1]Where necessary, values have been converted from Paraguayan guaraníes (G) to U.S. dollars at the average market rate of G1,460=US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Aceros del Paraguay S.A. (ACEPAR)
Azara 179
Asunción, Paraguay
Administración Nacional de Combustibles, Alcohol y Portland
Asunción, Paraguay
Palma 1084 y Hernanderías
Asunción, Paraguay
Administración Nacional de Navegación y Puertos (ANNP)
Plazoleta Isabel La Católica y Colón
Asunción, Paraguay
Dirección General de Recursos Minerales (DGRM)
Oliva y Alberdi
Asunción, Paraguay
Industria Nacional del Cemento (INC)
Humaitá 357, Edificio Humaitá 5to Piso
Asunción, Paraguay
Ministerio de Industria y Comercio
Ave. España 477 (Esq. Estados Unidos)
Asunción, Paraguay
Ministerio de Obras Públicas y Comunicaciones
General Días (Esq. Alberdi)
Asunción, Paraguay
Petróleos Paraguayos S.A. (PETROPAR)
Edificio Bank of América
4to Piso, Oliva 299
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).
Inter-American Development Bank, Washington, DC: Economic and Social Progress in Latin America (annual report).
Inter-American Investment Corporation, Washington, DC: Annual Report 1992.
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.
Siderurgia Latinoamericana, monthly.

TABLE 1
PARAGUAY: PRODUCTION OF MINERAL COMMODITIES[1]

Commodity[2]		1988	1989	1990	1991	1992e
Cement, hydraulic	thousand metric tons	321	326	e326	e326	326
Clays:						
Kaolin	metric tons	76,000	74,000	e74,000	e74,000	74,000
Other	thousand metric tons	1,910	1,860	e1,900	e1,900	1,900
Gypsum	metric tons	3,600	4,500	e4,500	e4,500	4,500
Iron and steel:						
Pig iron	do.	62,724	63,000	61,000	60,000	60,000
Steel, crude	do.	62,273	55,000	48,000	61,000	[3]86,000
Lime	do.	96,000	103,000	e100,000	e100,000	100,000
Petroleum refinery products:e						
Liquefied petroleum gas	thousand 42-gallon barrels	[3]96	100	100	100	100
Gasoline	do.	[3]512	560	560	560	560
Jet fuel	do.	[3]146	160	160	160	160
Kerosene	do.	[3]38	40	40	40	40
Distillate fuel oil	do.	[3]675	740	740	740	740
Lubricants:						
Oil	do.	[3]19	20	20	20	20
Grease	do.	[3]5	5	5	5	5
Residual fuel oil	do.	[3]323	350	350	350	350
Refinery fuel and losses	do.	[3]21	25	25	25	25
Total	do.	[3]1,835	2,000	2,000	2,000	2,000
Pigments, mineral: Natural, ocher	metric tons	310	320	e330	e330	330
Sand, including glass sand	thousand metric tons	1,926	1,939	e2,000	e2,000	2,000
Stone:						
Dimension	do.	73	65	e70	e70	70
Crushed and broken:						
Limestone (for cement and lime)	do.	550	566	e600	e600	600
Other	do.	2,070	1,960	e2,000	e2,000	2,000
Marble	metric tons	750	730	e750	e750	750
Talc, soapstone, pyrophyllite e	do.	[3]210	200	200	200	200

eEstimated.
[1]Includes data available through May 1993.
[2]In addition to the commodities listed, common gravel undoubtedly was also produced, but output was not reported, and available information was inadequate to make reliable estimates of output levels.
[3]Reported figure.

TABLE 2

PARAGUAY: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Principal destinations, 1991
Cement		—	2,658	All to Argentina.
Iron and steel:				
Iron ore and concentrate		—	972	All to Belgium-Luxembourg.
Metal:				
Scrap		4,225	2,309	All to Uruguay.
Pig iron, cast iron, related materials		2,650	3,400	Uruguay 2,300; Argentina 1,100.
Steel, primary forms		5,710	11,670	Argentina 6,780; Bolivia 4,890.
Semimanufactures:				
Bars, rods, angles, shapes, sections		1,674	12,327	Argentina 9,977; Bolivia 2,350.
Tubes, pipes, fittings		—	24	Uruguay 15; United Kingdom 6; Argentina 3.
Petroleum refinery products: Residual fuel oil	42-gallon barrels	—	55,580	All to Argentina.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked		6,100	28,241	Argentina 28,240; Chile 1.
Worked		—	67	Mainly to Brazil.
Gravel and crushed rock		14,836	—	
Tin:				
Ore and concentrate		—	1,426	Belgium-Luxembourg 1,285; Australia 100; United States 41.
Metal including alloys, unwrought		41	20	All to Belgium-Luxembourg.

[1]Table prepared by H. D. Willis.

TABLE 3

PARAGUAY: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1990	1991	Sources, 1991	
			United States	Other (principal)
METALS				
Alkali metals	—	1	1	
Aluminum:				
Ore and concentrate	101	202	—	All from Brazil.
Oxides and hydroxides	833	941	4	Brazil 930; Uruguay 4.
Metal including alloys:				
Scrap	—	2	—	All from Brazil.
Unwrought	74	63	—	Mainly from Argentina.
Semimanufactures	466	376	2	Argentina 156; Brazil 134; Germany 34.
Chromium:				
Ore and concentrate	2	—		
Oxides and hydroxides	—	1	—	NA.
Cobalt: Oxides and hydroxides	—	1	—	All from Uruguay.
Copper: Metal including alloys:				
Unwrought	545	255	—	All from Chile.
Semimanufactures	219	543	15	Chile 456; Brazil 56.
Iron and steel:				
Iron ore and concentrate:				
Excluding roasted pyrite	1,500	13,033	—	Brazil 6,913; Bolivia 6,120.
Pyrite, roasted	51,176	192,294	—	Brazil 139,366; Bolivia 52,928.
Metal:				
Scrap	572	—		
Pig iron, cast iron, related materials	50	1,076	—	All from Brazil.
Ferroalloys:				
Ferromanganese	476	1,145	—	Brazil 501; Italy 342; Argentina 302.
Ferrosilicomanganese	15	—		
Ferrosilicon	280	291	—	All from Brazil.
Unspecified	1	1	—	Do.
Steel, primary forms	9	237	237	
Semimanufactures:				
Flat-rolled products:				
Of iron or nonalloy steel:				
Not clad, plated, coated	18,268	11,496	498	Brazil 7,653; Republic of South Africa 1,266.
Clad, plated, coated	9,801	12,447	—	Republic of South Africa 5,477; Argentina 3,761; Brazil 3,059.
Of alloy steel	264	3,457	2,298	Canada 406; Italy 344.
Bars, rods, angles, shapes, sections	6,901	5,457	314	Brazil 2,626; Republic of South Africa 1,736; Italy 448.
Rails and accessories	22	6	—	All from Brazil.
Wire	645	872	(2)	Brazil 576; Argentina 295.
Tubes, pipes, fittings	5,170	15,311	12,293	Argentina 1,648; Brazil 1,179.
Lead:				
Oxides	1	—		
Metal including alloys, semimanufactures	7	—		
Magnesium: Metal including alloys, semimanufactures value, thousands	$22	—		
Manganese:				
Ore and concentrate: Metallurgical-grade	500	1,711	—	Bolivia 1,000; Brazil 711.

See footnotes at end of table.

TABLE 3—Continued

PARAGUAY: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Manganese—Continued:					
Oxides		3	3	—	Germany 2; Argentina 1.
Tin:					
Ore and concentrate		—	47	—	All from Brazil.
Metal including alloys, semimanufactures	value, thousands	$4	—		
Titanium:					
Ore and concentrate		1	—		
Oxides		120	59	1	Mexico 32; Germany 21; Finland 5.
Zinc:					
Oxides		9	9	—	Germany 6; Spain 3.
Metal including alloys:					
Unwrought		34	50	—	All from Peru.
Semimanufactures		10	—		
Other:					
Oxides and hydroxides		16	17	—	Germany 13; Chile 3; Argentina 1.
Ashes and residues		42	85	—	All from Republic of South Africa.
Metalloids[3]	value, thousands	$1	$38	$1	Uruguay $37.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		97	713	—	All from Argentina.
Artificial: Silicon carbide		26	—		
Grinding and polishing wheels and stones		58	36	1	Brazil 33; Argentina 1.
Asbestos, crude		518	193	—	All from Brazil.
Boron materials: Oxides and acids		3	2	—	All from Germany.
Bromine[4]	value, thousands	$17	$1	—	All from Chile.
Cement		1,924	1,544	—	Brazil 1,218; Argentina 326.
Chalk		327	282	—	All from Argentina.
Clays, crude:					
Bentonite		149	301	—	Do.
Kaolin		74	101	—	All from Brazil.
Unspecified		171	160	—	Mexico 120; Brazil 37; Chile 3.
Diatomite and other infusorial earth		124	289	—	Mexico 191; Chile 98.
Fertilizer materials:					
Crude, n.e.s.		300	4,910	—	All from Brazil.
Manufactured:					
Ammonia		181	131	—	Argentina 60; Brazil 43; Germany 28.
Nitrogenous		2,006	1,572	—	Brazil 1,291; Argentina 193; Germany 72.
Phosphatic		3,022	2,945	—	Brazil 2,875; Argentina 46; Israel 12.
Potassic		488	3,666	—	Brazil 1,606; Argentina 1,052; Uruguay 1,004.
Unspecified and mixed		39,501	59,817	—	Brazil 51,716; Republic of South Africa 5,000; Japan 2,043.
Gypsum and plaster		5,667	32,197	—	Argentina 32,196; Brazil 1.
Lime		—	50	—	All from Brazil.
Magnesium compounds: Oxides and hydroxides		—	16	—	Germany 7; Chile 5.
Mica: Worked including agglomerated splittings	value, thousands	$1	—		

See footnotes at end of table.

TABLE 3—Continued

PARAGUAY: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Nitrates, crude		6	—		
Phosphates, crude		74	—		
Pigments, mineral: Iron oxides and hydroxides, processed		63	95	—	Argentina 44; Brazil 41; Spain 5.
Salt and brine		1,125	1,329	—	Argentina 892; Brazil 410; Chile 22.
Sodium compounds, n.e.s.:					
Soda ash, manufactured		4,436	2,455	—	Spain 1,103; Netherlands 556; Poland 431.
Sulfate, manufactured		1	13	(2)	Mainly from Argentina.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		577	597	—	Mainly from Brazil.
Worked		95	541	—	All from Brazil.
Limestone other than dimension		—	55	—	Do.
Quartz and quartzite		5	—		
Sand other than metal-bearing		31	91	91	
Sulfur:					
Elemental:					
Crude including native and byproduct		1,505	2,517	—	Canada 2,150; Uruguay 188; Argentina 150.
Colloidal, precipitated, sublimed		20	118	—	Germany 100; Poland 18.
Sulfuric acid		6	32	—	Brazil 29; Chile 3.
Talc, steatite, soapstone, pyrophyllite		264	252	4	Brazil 197; Italy 34; Argentina 11.
Other: Crude		3	72	—	Brazil 40; Argentina 32.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		6,334	7,004	—	Argentina 5,550; Brazil 1,426; Venezuela 19.
Carbon black		93	6	1	Argentina 5.
Peat including briquets and litter		—	15	—	All from Argentina.
Petroleum:					
Crude	42-gallon barrels	2,214,752	2,061,081	—	Algeria 1,678,441; Argentina 382,640.
Refinery products:					
Liquefied petroleum gas	do.	520,248	563,412	—	All from Argentina.
Gasoline:					
Aviation	do.	20,064	18,360	NA	NA.
Motor	do.	442,274	489,517	NA	NA.
Mineral jelly and wax	do.	661	952	441	Brazil 409; Germany 102.
Kerosene and jet fuel	do.	57,898	71,899	NA	NA.
Distillate fuel oil	do.	1,896,925	1,706,111	NA	NA.
Lubricants	do.	214,738	—		
Residual fuel oil	do.	111,562	26,933	NA	NA.
Bitumen and other residues	do.	2,969	15,501	—	All from Argentina.
Bituminous mixtures	do.	23,295	49,013	—	Brazil 34,239; Argentina 14,762.
Petroleum coke	do.	407	473	—	Brazil 418; Argentina 55.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Reported under SITC item number as "selenium, tellurium, phosphorus, arsenic, etc."
[4]Includes fluorine and iodine.

TABLE 4

PARAGUAY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

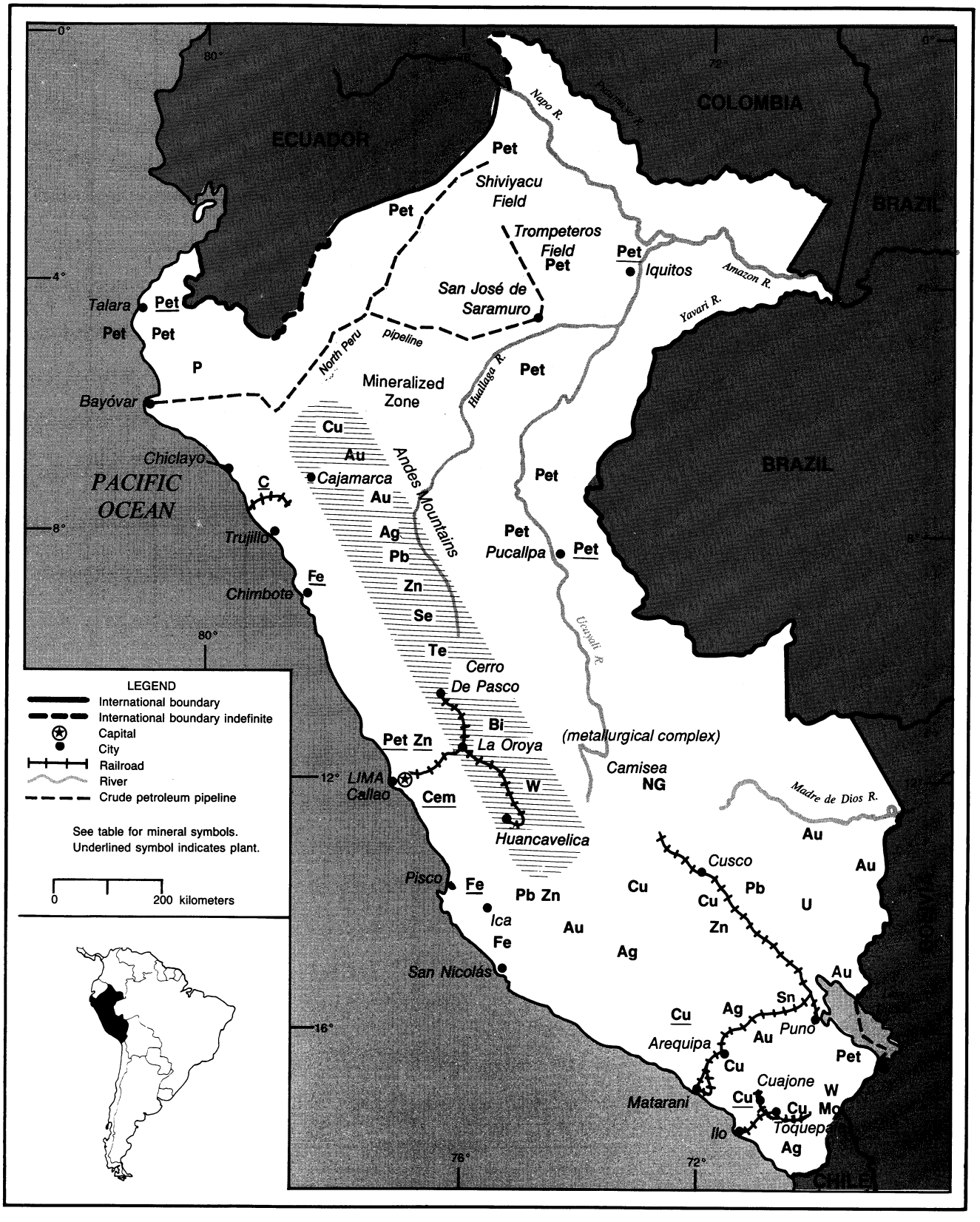
(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Industria Nacional del Cemento (Government, 100%)	Puerto Vallemí, (finished cement) Concepción Department	200
Do.		do.	Villeta, (finished cement) Central Department	300
Do.		do.	Itapucumi (clinker), Central Department	600
Steel products		Aceros del Paraguay, S.A. (ACEPAR) (Government, 60%; Siderúrgica Paraguaya S.A.-Sidepar, 40%)	Villa Hayes, President Hayes Department (20 kilometers north of Asunción)	150
Petroleum products[1]	thousand barrels	Petróleos Paraguayos, S.A. (PETROPAR) (Government, 60%; Refinería Paraguaya S.A., 40%)	Santa Elisa, Asunción (near Asunción)	2,738

[1]Effective capacity is reportedly only 2,190,000 barrels per year.

PERU

AREA 1,285,200 km² **POPULATION 22.8 million**



THE MINERAL INDUSTRY OF

PERU

By George A. Rabchevsky

The Republic of Peru is in the northwest corner of the South American continent and just south of the equator. Peru is the third largest country in South America, almost the same size as Alaska. Its eastern border touches Brazil and the west coast is washed by the Pacific Ocean. Peru shares the famous Lake Titicaca, the highest navigable body in the world, with Bolivia. More than one-half of the country is covered by forests, with the Andes Mountains striking northwest to southeast in the middle of the country. Most of Peru's metals were mined from the Andes and its foothills.

The country's economy depended on the manufacture of clothing, fishing, food processing, mining, processing of a variety of metals, and production of minerals, including petroleum. Peru was a major world source for arsenic, bismuth, copper, gold, lead, molybdenum, silver, and tellurium. Within the Latin American region, Peru was the leading producer of zinc. In 1992, Peru was the third largest producer of silver, following Mexico and the United States. More than 19 metallic and 30 industrial minerals were produced or processed within the country during 1992. Table 1 shows the reserves of the selected Peruvian minerals and the ownership by Mineroperú. The mining and quarrying sectors accounted for 4.7% of the gross domestic product (GDP), and minerals produced accounted for about 40% of the total value of exports. Nonferrous metals refining, iron and steel, and industrial minerals accounted for 6.1%, while hydrocarbon extraction and petroleum refining accounted for 4.6% of GDP. Thus, mining-related production contributed 15.4% to the country's 1992 GDP.

Reportedly, Peruvian GDP declined 2.8% in 1992. The GDP declined during 4 of the past 5 years and is down 23% over that period. The inflation rate, at about 55%, responded to the country's austere economic stabilization policies, fiscal deficits were reduced, and the economy was opened to foreign investors. During December, the construction industry grew by 20.2% and mining was the only sector showing a decline in output by 1.7%.

In 1991, the Government declared that the mining industry was in a state of emergency, thus allowing most companies some relief from taxes and exemption from some labor laws. A record low of 0.81 million employee-hours were lost owing to strikes in 1992, a small fraction of the 1989 record high of 34.46 million employee-hours lost. Most mineral industry companies (60%) reported losses in 1992. Declining international market metal prices, except zinc, affected industry's balance sheets. Mining companies continued working higher grade ores, curtailed exploration and production operations, and reduced plant and equipment expenditures.

The privatization program began in 1992. Ten State-owned companies were sold for a total of $207 million, with new investment commitments of about $750 million. In November 1992, Shougany Corp. of China acquired Hierroperú for $120 million, bidding almost six times the initial base price. Other important sales included Minera Condestable, Solgas, Minpeco, and Quellaveco. Peru has placed 224 companies on the privatization list.

Government-owned mining companies and deposits were listed for privatization. During 1992, rationalization and cuts in employment were necessary. The Peruvian Government has sold the copper-gold deposit of Quellaveco, 80.2% interest in Minera Condestable, S.A., and Empresa Minera de Hierro del Peru, S.A. (formerly of Marcona). After the rationalization program, several Government-owned companies recorded profits. For instance, Centromín made a profit of $19.3 million on sales of $404.9 million in 1992, after accumulated losses of $351.2 million (averaging 14.3% of sales) since 1986. Centromín employed 11,000 people.

GOVERNMENT POLICIES AND PROGRAMS

The Government of Peru promoted private investment in mining by providing the framework to facilitate investment from abroad and from the domestic private sector. 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 officials, mainly from the private sector. During 1992, of the 220 state-owned enterprises, 10 have already been privatized, including the only iron ore Marcona Mine operated by Hierro del Peru (Hierroperú).

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. Government no longer had

exclusive control over exploration, mining, smelting, and refining of metals and fuel minerals. Individuals and private companies were allowed to hold mining permits in Peru. Environmental impact studies for each phase of mining and petroleum activity 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 the present law. Hydrocarbon activities were the responsibility of the Ministry of Energy and Mines. The state-owned Petróleos del Peru, S.A. (Petroperú) managed these activities for the Government, until the passage of the new oil and gas law in August 1993. Petroperú is headquartered in Lima and has offices in Iquitos and Talara, which supervise operations in the jungle and the northwest region, respectively. At the end of 1992, Petroperú had a total of 6,332 employees.

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. The Central Bank has the legal power to buy gold.

In November 1992, the Government enacted the new Electrical Concession Law, which provided the framework for the participation of the private sector in the electrical public service

PRODUCTION

Peru's mining sector saw a deep recession during most of the 1980's owing to a lack of investment, overvalued local currency, State influence in the economy, and high production costs. Financial difficulties experienced by many small- and medium-sized mining companies forced some to suspend or reduce their operations. Production at Peruvian mines and petroleum fields fell 3.2% in 1992, the seventh year in a row of decline. Output of all minerals declined 6.6%, reversing a 6.3% gain in 1991; the 1992 production dropped to 24.4% below its 1987 record level. Gold production was the only mineral that continued to grow. Gas and oil production seemed to hit bottom in 1991, after sharply trending down since 1981, recording a small increase of 0.7% in 1992. Production was less than one-half (48.8%) of its 1980 peak level. *(See table 2.)*

TRADE

Peru was a member of the Andean Group established 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, the Andean Free Trade Zone was created in December 1991 when Peru joined with Bolivia, Colombia, Ecuador, and Venezuela in a preliminary agreement to unify external tariffs. Also in December, Peru became eligible to apply for benefits under the United States Andean Trade Preference Act.

In 1992, the United States imported about 25% of total Peruvian exports. Europe and Asia received a similar percentage of goods.

Exports of metals and minerals accounted for 49.7% of the total f.o.b. value of Peruvian exports, accounting for $1.73 billion. The share reached 55.4% when petroleum and petroleum products were added. In 1992, copper was the country's largest export, accounting for $806 million of a total of $3.48 billion. Copper accounted for 22% of mineral value of total exports, followed by zinc (9%), gold (6%), lead (4%), and others. Gold in 1992 ranked as the third leading mineral export (13%) after copper (48.9%) and zinc (20.3%), surpassing traditional Peruvian commodities such as iron ore, lead, and silver. Table 3 shows the value of mineral exported during 1991 and 1992. *(See table 3.)*

Crude petroleum accounted for 5.6% of total exports in 1992. Petroleum exports almost ceased in 1992 to only 0.11 Mbbl, a decrease of 71.1% from 1991. Imports of crude petroleum in 1992 decreased 11.3% because of the domestic recession. Imports of petroleum products were at 7.706 Mbbl. Main products imported were diesel No. 2 and liquefied petroleum gas.

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 mining companies are Centromín Perú, S.A. (Centromín), Empresa Minera del Perú, S.A. (Mineroperú, S.A.), and Empresa Regional Minera Tintaya S.A. (Tintaya), all state-owned. Southern Perú Copper Corp. (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. Private companies, mostly controlled by local interests, dominated the medium and small mining operations.

The state-owned company, 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 in 1992.

Petroleum activities were administered by Petroperú. 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 Petroperú. *(See table 4.)*

COMMODITY REVIEW

Metals

Copper.—Copper production dropped in 1992, almost 7,000 tons below the 1987 level. Most mines reported a decrease in production because of lower grade ores and the general economic situation. Copper accounted for 47% of total mineral exports value and 23% of total exports in 1992. More than 60% of copper exports went to Europe, including Germany, Italy, and the Netherlands.

SPCC continued to dominate the nation's copper sector, with 65% of total copper mine output. The company also dominated the mineral industry in general. Production of blister copper reached 275,690 tons, a rise of 1% over that in 1991, and its highest annual production since 1979. Copper ore was mined at two porphyry copper deposits—Cuajone and Toquepala. Reserves were estimated at 388 Mmt grading 0.85% copper. Shell has an interest in the Cuajone deposit. The Cuajone open pit mine was Peru's largest copper mine, opened in 1976. The mine produced 143,287 tons and the Toquepala Mine produced 102,723 tons of copper concentrate.

Tintaya was Peru's second largest copper producer, accounting for 13% of total production. Operations at the Tintaya Mine commenced in 1985, with development costs estimated at $330 million. The mine production rose about 21% in 1992, to 50,700 tons of copper concentrate. Tintaya's sales totaled $80 million, losing $7.3 million in 1992, putting it in further debt. SPCC was the major customer of Tintaya. Its copper output comprised 12% of the nation's total production, with reserves of 13 Mmt. Tintaya's principal drawback was that its sulfide ores reserves will run out in 3 to 4 years. The Tintaya Mine also produced silver. The open pit mine is adjacent to three undeveloped copper deposits: Chabuca Este, Chabuca Sur, and Coroccohuayco. All of the properties are expected to be sold as a whole.

Centromín produced 14% (55,043 kg) of Peru's copper from the Andaychagua, Casapalca, Cerro de Pasco, Cobriza, Morococha, San Cristóbal, and Yauricocha Mines and from the ore treated at the Mahr Tunnel concentrator. Reportedly, the Cobriza underground mine was a leading copper producer, with about 25,000 tons. The mine is about 250 km from the La Oroya smelter. The company's La Oroya metallurgical complex accounted for 22% of the nation's refined copper. The La Oroya complex also refined antimony, arsenic, bismuth, gold, lead, silver, and tellurium, blanketing the surroundings with black smoke and smog. There were about 35,000 people living in that city, and the Centromín complex employed about 15,000 people. Centromín is an integrated mining company operating seven separate mines in the central Andean region of Peru. The company was formed in 1974. In 1992, Centromín's sales amounted to $400 million, of which more than 70% represented its exports.

Mineroperú accounted for 9% of Peru's copper output from Cerro Verde in Arequipa. The Cerro Verde complex includes the Cerro Verde and Santa Rosa Mines, three heap-leaching pads, and a concentrator. In 1992, Cerro Verde produced 18,238 tons of copper cathodes and 30,878 tons of copper concentrates. The company began expanding the concentrator from 1,800 mt/d to 3,000 mt/d and proposed an additional 10,000-mt/d concentration plant for the site. Mineroperú also operated the copper refinery at Ilo, which produced 173,000 tons of copper cathodes. In addition, the Ilo plant also refined silver and gold. Mineroperú was exploring the Antamina copper skarn deposit, containing copper, molybdenum, silver, and zinc.

The Quellaveco copper deposit was privatized and sold in 1992 to Empresa Minera de Mantos Blancos, S.A. of Chile, subsidiary of Anglo-American Corp., Republic of South Africa, for $12 million. Additional important mining projects were listed for privatization, such as: Almacén, Alto Chicamal (Callacuyan), Antamina, Bayóver, Berenguela, Canariaco, Cerro Verde, Chalcobamba, Coroccohuayco, Ferrobamba, Iscaycruz, La Granja, Michiquillay, Pashpap, San Antonio de Poto, Sulfobamba, Tambo Grande, and Turmalina.

Gold.—Gold production in Peru increased by 1% in 1992 to 10 tons. Independent estimates put 1991 and 1992 production at 15.1 to 22.5 tons and 15.6 to 23.4 tons, respectively. Newly mined gold can be traded and exported without restriction. Peruvian gold exports increased to $214.5 million in 1992, the highest level ever, compared with $136.6 million in 1991 and $9.1 million in 1990. Gold exports grew 62.1% in 1992, reaching 19.59 tons.

The Buldibuyo, Palaz, and Parcou districts are know in Peru for vein gold deposits. These deposits are on the east side of the Andes in northern Peru. The region between Ica and Arequipa and the Palaz area, a 130-km strip along the east side of the Rio Marañón, were Peru's main sources of vein gold production. The Orcopampa Mine produces about 1,100 kg of gold annually. Mineroperú refines gold from the Ilo copper refinery. The Peruvian Government listed its San Antonio de Poto gold deposit for privatization. The eastern 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.

In late 1992, Minera Yanacocha, S.A. (Newmont Mining Co., 40%; Buenaventura Mines, S.A., 36%; and France's Compagnie Francaise des Mines, 24%) developed the Yanacocha gold heap-leaching recovery process near Cajamanac with facilities capable of handling a production up to about 8,000 kg/a of gold. Newmont has identified and partially measured a geologic resource of more than 186 tons of gold in nine deposits.

Iron and Steel.—There were about 5,700 people employed in the iron and steel industry in Peru, 80% of which was in the steel sector. Almost all raw steel in Peru was produced in the electric furnace.

Hierroperú, formerly owned by the Government, was sold in 1992 to China's Shougang Corp., operating the Capital Steel Corp. of Beijing. The corporation paid $120 million for Hierroperú, assumed debt for $41.8 million, and committed to a 3-year investment program of $150 million. The mine has proven iron ore reserves, primarily magnetite, of 500 Mmt, with 54% iron content. The Marcona Mine produced direct reduction iron pellets, pelletized fines, blast furnace pellets, and sinter feed. The mine was opened in 1952 by Cyprus Mines Corp. and Utah Construction Co. The company's product was exported through the Port of San Nicolás, 15 km from the Marcona Mine. In 1991, iron ore was exported to Argentina, China, Japan, Republic of Korea, the United States, Yugoslavia, and locally to Empresa Siderúrgica del Perú (Siderperú). As a byproduct, the company also produced 940 tons of copper concentrate. Hierroperú also operated its own thermal plant, with generating capacity of 18 MW. The Electro Peru, a State-owned plant, also supplied about 10 MW of electricity to the mine. The mine is in need of more than 80 MW to support its planned production.

Lead and Zinc.—In Peru there were at least 30 lead and zinc mines. Both lead and zinc production decreased in 1992. Lead mine production dropped 10.8% and zinc mine production declined 5.6% from its 1991 record high. Lower ore grades accounted for the decline, while the output of zinc concentrate rose 1.4%. Zinc metal was refined at the Mineroperú's Cajamarquilla plant and at Centromín's La Oroya plant.

Centromín continued as the leading lead-zinc producer, with six mines accounting for 38% of the nation's lead production and 37% of the country's total zinc output. Centromín recorded a total increase of 3.2% in 1992, primarily owing to its Andaychagua, San Cristóbal, and Yauricocha Mines. The Cerro de Pasco open pit mine produced 55,300 tons of lead, 139,100 tons of zinc, 136.2 tons of silver, and some copper. The Cerro de Pasco Mine is east of Lima, providing livelihood for about 30,000 residents. The mine was nationalized in the 1960's and is now operated by Centromín. Tailings and heaps of slag surround the town, and there were no environmental controls.

Cía. Minera Milpo, S.A. operated a lead-zinc-silver deposit in the Central Mining District, Andrés Avelino Cáceres Region, northeast of Lima. The company was founded in 1949. The private company was 73.8% owned by local shareholders and 26.2% by foreign investors. Milpo was the largest medium-scale mining company in Peru. Milpo's production ranked second in the nation in lead, seventh in silver, and fourth in zinc. In 1992, Milpo's concentrates yielded 24,550 tons of lead, 88,000 kg of silver, and 37,300 tons of zinc.

Sociedad Minera San Ignacio de Morococha, S.A. (SIMSA) operated the underground San Vicente Mine, 328 km east of Lima. This private company was established in 1942 and became the country's second largest zinc producer. In 1992, SIMSA produced 62,365 tons of zinc and 2,202 tons of lead from its polymetallic concentrates. The grade of zinc in concentrates ranged between 61.87% to 62.53%, and lead about 69.3%. The concentrate was shipped through the Callao Port, near Lima. The reserves amounted to about 6.2 Mmt of 10.0% zinc and 0.7% lead. About 30 km north of San Vicente is the dormant Pichita Caluga Mine, a former lead producer. The El Metal undeveloped lead deposit is 800 km north of the Pichita Caluga Mine, near the city of Chachapoyas. Zinc and lead occurrences were reported at many points over this entire distance.

Cía. Minera Atacocha, S.A., also operated in the Central Andes Cacaras Region. The mine was located in Yanacocha, 15 km to the northeast of Cerro de Pasco. This medium-scale private company was founded in 1936. In 1992, Atacocha produced about 800 tons of copper, 13,000 tons of lead, 43,650 kg of silver, and 26,000 tons of zinc. An accident occurred in March 1992 in the main shaft, closing the mine for 1½ months, causing a loss of $5.45 million in revenue. The company ranked fifth in lead production and eighth in zinc production for 1992. Atacocha maintained a close relationship with its neighbor Milpo and recently signed a new 12-year concession agreement.

Silver.—Silver production decreased 18.4% to 1,573 tons in 1992, becoming the Third World's largest producer. The medium-sized companies accounted for 55% of total output. Large mining companies contributed 30% of total output, and small companies the remaining of 15%.

Peru operated at least 30 silver mines in 1992. 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.

Centromín led silver producers in the nation's total silver output, with 370,000 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 1992, Buenaventura reportedly produced 156,974 kg of silver. Its Uchucchacua Mine accounted for 75% of its production, and the rest in the Julcani Mine. The company also produced some copper, gold, lead, and zinc. Gold was mined from the Julcani and lead and zinc from the Uchucchacua deposits.

Tin.—Minsur, S.A. was Peru's only

tin producer, established in 1977. Production from its only San Rafael Mine1 in Mariatogui Region amounted to 10,195 tons of tin concentrate, a 36% increase over that of 1991. Proven tin reserves were calculated to be 5.4 Mmt, with 5.24% metal content. Minsur's Santa Barbara Mine, used to produce copper, lead, and silver concentrates, was closed in March 1990. The company's total exports amounted to $40.4 million in 1992, increasing 26% from those in 1991. 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 Minera Regina, S.A., was the largest producer. In 1992, production dropped 35% from that of 1991, mainly because of depressed 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 is 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 1992, about 40% of Peru's total cement output. The company was founded in 1967. The plant employs about 375 people. The 1-Mmt/a-capacity plant is in Atocongo, with its limestone quarries nearby. Most of the cement was exported primarily to Chile via the company'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 mt/a, and the plant utilization was 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, northwestern Peru. They have been under intermittent studies 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 is in the Sechura desert, and the deposits are covered by sand and recent landslides. Only a small amount of phosphate is being produced. The 90,000-mt/a 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, Petroperú also operated five industrial plants. In 1992, Petroperú 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. Traditional fuels accounted for 23% of energy consumption, and electricity met 10% of energy needs. 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. A sudden increase in the demand for fuels in 1992 was caused by the country's worst drought in the past 60 years. Diesel-powered generators were used during extended periods of power rationing.

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 Goyllarisquiza and Jatun Huasi in Cacaras Region, 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. Proven natural gas reserves at the end of 1992 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 was in the Camisea area. The San Martin and the Cashiriari 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 and without developed infrastructure.

In 1992, crude petroleum production in Peru rose 1% to 42,298 kbbl. However, the 1992 production level was less than one-half (40.7%) the peak reached in 1980. The recovery in 1992 was accounted for by Occidental Petroleum Corp. del Perú, a subsidiary of the U.S.-based Occidental Petroleum Corp., with a substantial output expansion of 10.8%. All other companies recorded decreases in production, including Petroperú and its subsidiary Petroleros del Mar, S.A. (Petromar).

Peru's crude oil production came from northern jungle fields operated by Occidental and offshore fields on the northwest coast operated by Petromar. *(See table 5).* These were Peru's main producing areas with 65.8% of the country's total, an increase from 62.7% in 1990. Petroperú produced about 32% of the nation's total crude from its north coast and northern and central jungle fields. Petromar operated Peru's only offshore oilfields. Petromar produced approximately 14% of the nation's crude oil from the offshore Talara basin in the Grau Region. Occidental accounted for the balance of national production, with 45% from its northern jungle operations and 5% from the Oxy/Bridas Exploración

y Producción, S.A. Talara joint venture. Reportedly, Occidental produced more than 60,000 bbl/d of oil in Peru, and 18.7 Mbbl of reserves was added by wells drilled in 1992. The company began oil exploration in the Marañón basin east of the Andes, with 10 wells drilled in 1992.

There were 18 identified oil basins in Peru, 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 360 Mbbl in 1992, compared with the 1981 peak of 835 Mbbl.

In 1992, Petroperú continued with the appraisal work on the Chambira Field. Financial assistance for the development of this field was sought from the Andean Development Fund. Chambira's reserves were estimated to be 18 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 in 1989. Mobil continued seismic and geological studies in the northern portion of its acreage, just south of Petroperú's block 8.

The largest oil refinery in Peru, La Pampilla, with a capacity of about 102,000 bbl/d, processed 86,000 bbl/d in 1992. The La Pampilla refinery stopped for maintenance in April and August. The second largest oil refinery in Peru, Talara, had a capacity of about 60,000 bbl/d. Heavy rains affected operations of the Talara refinery, which stopped for maintenance in September. Smaller refineries were in Conchan, Iquitos, and Pucallpa. Refinery production and volume of crude oil processed has hardly changed in the past few years.

INFRASTRUCTURE

The country had 1,801 km of railroads and 69,942 km of roads, 7,459 km of which was paved. There were 8,600 km of navigable inland waterways, tributaries to the Amazon River system, and 208 km of waterways in the Lake Titicaca. Power and telecommunications lines, railroads, and roads in the Andes were subject to damage by landslides and guerrilla attacks. The highway system needs to be maintained because of the deterioration of all transportation lanes.

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 860-km North Peru crude oil pipeline. Natural gas and natural gas liquids were transported though a 64-km pipeline. Petroperú employs pipelines, coastal tankers, trucks, railway cars, and barges to supply crude oil and products to its six refineries, 20 sales plants, and 6 airport stations located throughout the country.

Peru had an installed electrical generating capacity of 4,896 MW, 60% of which came from the hydroelectric plants. The unprecedented 1992 drought led to the rationing of electricity, which adversely affected productive activities and the population in general. Total energy production fell by 10%. The law authorizing electricity concessions, which regulate activities related to the generation, transmission, distribution, and sale of electricity, was passed in 1992. It allows all individuals or companies to carry out those activities.

OUTLOOK

Reforms are changing the economy of Peru and will bring long-term benefits to the mineral sector. Prospects for the mining sector are improving. Mineral industry output is expected to increase slightly in 1993. In spite of the industry's current problems, which have built up over many years, the medium- and long-term outlook for the mining sector is positive. Government's privatization program is already acting as a catalyst to reactivate the entire mining sector. During the next 2 years several major state enterprises will be privatized, including public utilities such as the electricity companies, and the minerals and energy sectors. The mines to be sold off in 1993 included the Cerro Verde copper mine, the zinc refinery at Cajamarquilla, the San Antonio gold mine, and the copper smelter at Ilo. These four installations were owned by Mineroperú. Its subsidiary, Centromín, also is expected to be privatized.

Although many companies continued to have serious financial troubles, much progress has been made in streamlining operations and reducing costs.

The mining sector is a major beneficiary of several laws approved during 1991 and 1992 to improve the foreign investment regime. The Ministry of Energy and Mines actively promoted minerals development. Investment will continue in the Peruvian mining industry, where many projects are awaiting for investors and substantial potential reserves remain to be explored and developed. Several U.S. and foreign companies are considering investing in Peru's mining industry. They have been inspecting several mines, facilities, and concessions on the privatization list.

Investment studies for new energy production projects are being drafted with the support of the Inter-American Development Bank. There are also plans to privatize the existing power companies in 1993.

[1]Where necessary, values have been converted from Peruvian nuevos soles (S/.) to U.S. dollars using the average exchange rate for 1992 of S/.1.63 = US$1.00.

OTHER SOURCES OF INFORMATION

Agencies

Dirección General de Minería, Ministerio de Energía y Minas
Avenida de Las Artes, Urbanización San Borja
San Isidro, Lima, Peru
Telephone: 750065

Dirección General de Hidrocarburos
Ministerio de Energía y Minas
Avenida de Las Artes, Urbanización San Borja
San Isidro, Lima, Peru
Telephone: 750065

Instituto Geológico Minero y Metalúrgico
Jirón Pablo Bermúdez 211
Apartado 889
Lima 100, Peru
Telephone: 336234

Empresa Minera del Centro del Perú, S.A. (Centromín Perú)
Avenida Javier Prado Este 2155
Lima 41, Peru
Telephone: 761010

Petróleos del Perú (Petroperú)
Paseo de la República 3361
San Isidro
Box 3126 & 1081
Lima 27, Peru
Telephone: 413972
Facsimile: 425416

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: RESERVE BASE OF MINERALS

(Million metric tons, unless otherwise specified)

Minerals		Total	Minero-perú	Percent ownership
Coal		11,110.0	273.00	25
Copper		29.7	20.70	70
Gold	tons	270.6	59.10	24
Lead		4.6	.06	1
Iron ore		1,400.0	—	—
Phosphate		573.0	573.00	100
Silver	thousand tons	33.9	5.90	18
Zinc		11.8	3.10	26

Source: Mineroperú.

TABLE 2

PERU: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992[p]
METALS						
Antimony:						
Mine output, Sb content		e420	r304	r307	r278	339
Metal		246	304	313	227	311
Arsenic, white[2]		828	563	e500	661	607
Bismuth:						
Mine output, Bi content		363	687	e555	e610	e550
Metal		341	646	521	576	418
Cadmium:						
Mine output, Cd content		368	472	378	r526	399
Metal		303	352	265	135	339
Chromium, mine output, Cr content[e]		r368	430	400	410	400
Copper:						
Mine output, Cu content		316,355	368,168	317,706	381,991	369,365
Sulfate (Cu content)		3,185	4,663	e3,500	5,083	3,823
Metal:						
Smelter:		246,879	241,424	195,539	268,784	253,899
Refined		158,466	204,608	165,483	228,228	232,137
Electrowon		21,126	19,652	16,307	17,908	19,004
Total refined		179,592	224,260	181,790	246,136	251,141
Gold:						
Mine output, Au content[4]	kilograms	9,164	9,898	re9,100	r9,934	10,014
Metal	do.	2,392	2,923	1,270	r1,348	1,228
Indium	do.	2,120	3,026	2,801	3,142	3,050
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand tons	4,171	4,507	3,307	3,593	2,848
Fe content	do.	2,839	2,923	2,147	r2,331	1,820
Metal:						
Pig iron	do.	202	199	93	207	147
Sponge iron		51,000	45,746	28,968	24,064	e20,000
Ferroalloys		1,621	r1,426	r1,706	re390	e360
Steel ingots and castings	thousand tons	481	401	284	418	338
Semimanufactures	do.	390	222	243	r251	242
Lead:						
Mine output, Pb content		149,037	192,213	r187,827	199,811	194,225
Metal		56,523	73,402	69,305	74,510	82,488
Manganese, mine output, Mn content[e]		146	150	150	160	160
Molybdenum, mine output, Mo content		2,444	3,177	2,510	r3,031	3,339
Selenium, metal, refined	kilograms	4,937	e9,000	8,913	12,422	14,396
Silver:						
Mine output, Ag content		1,552	1,840	1,762	1,769	1,573
Metal, refined		510	658	623	631	691
Tellurium, metal	kilograms	4,078	e8,000	7,842	13,355	18,631
Tin, mine output, Sn content		4,181	5,082	5,134	6,559	10,195
Tungsten, mine output, W content		432	970	1,536	r1,232	802

See footnotes at end of table.

TABLE 2—Continued

PERU: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992[p]
METALS—Continued						
Zinc:						
Mine output, Zn content		485,429	597,413	583,934	627,824	602,614
Metal		123,125	126,698	120,631	154,294	124,434
INDUSTRIAL MINERALS						
Barite		162,625	e150,000	r e130,000	150,200	16,579
Boron materials, crude (borates)		e15,000	r e24,900	r19,917	r26,390	26,613
Cement, hydraulic	thousand tons	2,514	2,105	2,185	e2,200	2,089
Chalk[e]		470,000	470,000	200,000	391,500	100,000
Clays:						
Bentonite		50,741	e40,000	e45,000	55,300	14,500
Fire clay		5,880	e5,000	e5,000	7,320	9,500
Kaolin[e]		38,449	200	8,000	37,100	5,500
Common clay		94,098	e100,000	e100,000	395,890	67,915
Diatomite[e]		329,650	20,000	20,000	325,500	25,000
Feldspar		2,378	e10,000	e10,000	e3,000	10,021
Gypsum, crude[e]		150,000	160,000	150,000	160,000	35,300
Lime[e]		13,000	13,000	13,000	14,000	14,000
Mica[e]		393	100	100	100	100
Nitrogen, N content of ammonia[e]		95,000	91,000	90,000	95,000	90,000
Phosphates, crude		r13,465	r14,804	r47,333	r18,239	e18,200
Salt, all types		125,500	e200,000	e200,000	e200,000	238,244
Stone, sand and gravel:						
Stone:						
Dolomite[e]		39,200	9,000	9,000	343,800	40,000
Flagstone[e]		300,000	300,000	300,000	300,000	300,000
Granite[e]		31,647	2,000	2,000	2,000	2,000
Limestone	thousand tons	3,650	e3000	e3,000	3,199	1,479
Marble[e]		335,996	20,000	20,000	30,000	310,256
Onyx[e]		350	500	500	500	3204
Quartz and quartzite (crushed)[e]		50,000	40,000	40,000	340,505	40,000
Shell, marl[e]		4,000	4,000	4,000	4,000	4,000
Slate[e]		18,000	18,000	18,000	18,000	18,000
Travertine[e]		5,000	5,000	5,000	5,000	33,990
Sand and gravel:						
Construction	thousand tons	3,877	e5,000	e5,000	3,100	960
Silica sand	do.	158	e75	e100	150	152
Sulfur:						
Elemental:[e]						
Native		100	100	100	100	100
Byproduct of metallurgy		66,000	66,000	66,000	66,000	66,000
Sulfuric acid, gross weight		173,722	e180,000	e150,000	206,828	41,973
Talc and related materials:[e]						
Talc		31,450	1,500	1,500	32,100	2,000
Pyrophyllite		39,200	7,500	7,500	8,000	8,000
Total		310,650	9,000	9,000	10,100	10,000

See footnotes at end of table.

TABLE 2—Continued

PERU: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992[p]
MINERAL FUELS AND RELATED MATERIALS						
Carbon black		7,081	5,028	e5,000	r e3,000	—
Coal:						
Anthracite, run-of-mine		e101,000	e100,000	e125,000	125,300	79,805
Bituminous, run-of-mine		49,200	e50,000	e50,000	25,500	14,485
Total		e150,200	e150,000	e175,000	150,800	94,290
Coke, all types[e]		10,000	10,000	10,000	10,000	10,000
Gas, natural:						
Gross	million cubic meters	1,359	1,125	e1,100	1,012	e1,200
Marketed	do.	435	283	e280	566	e570
Natural gas liquids:						
Natural gasoline and others[5]	thousand 42-gallon barrels	368	e240	226	299	e295
Propane	do.	24	e20	93	—	—
Butane	do.	5	e5	6	4	e4
Total	do.	397	e265	325	303	e299
Petroleum:						
Crude	do.	51,717	47,597	47,050	r41,896	42,298
Refinery products:						
Liquefied petroleum gas	do.	1,649	1,685	1,471	1,476	1,535
Gasoline, motor	do.	11,694	10,916	10,476	9,123	9,087
Jet fuel	do.	1,991	1,970	2,034	2,526	2,171
Kerosene	do.	7,404	6,484	5,699	5,468	5,534
Distillate fuel oil	do.	9,503	8,547	8,578	9,586	11,578
Lubricants	do.	54	48	38	54	38
Residual fuel oil	do.	27,306	24,751	24,762	10,366	24,389
Asphalt	do.	1,009	871	134	264	270
Other[6]	do.	291	298	888	16,704	e848
Total	do.	60,901	55,570	54,080	55,567	55,450

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through Sept. 23, 1993.

[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 3
PERU: F.O.B. VALUE OF MINERAL EXPORTS

(Million dollars)

	1991	1992	Percent change
Exports	3,329.0	3,484.0	4.7
Minerals:[1]	1,518.0	1,710.0	12.7
Copper[2]	738.1	806.1	9.2
Gold	136.6	214.5	57.0
Iron ore	45.7	54.1	18.4
Lead[2]	161.9	160.8	-.7
Silver[3]	67.8	78.0	15.0
Zinc	324.0	335.3	3.5
Other	43.5	61.4	41.1

[1]Excludes crude petroleum and products, alloys, semimanufactures, steel, and industrial minerals.
[2]Includes contained silver, lead-silver, and silver concentrates.
[3]Refined.

TABLE 4

PERU: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity ownership	Location of main facilities	Annual capacity
Antimony	metric tons	Empresa Minero del Centro del Perú (Centromín Perú) (Government, 100%)	Smelter at La Oroya, Andrés A. Cáceres Region	530
Arsenic		Centromín Perú	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	Centromín Perú	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	300
			Smelter at Ilo, José Carlos Mariategui Region	300
Do.		Empresa Regional Minera Tintaya, S.A. (Government, 100%)	Tintaya Mine, Inka Region	60
Do.		Centromín Perú	Cobriza Mine, Libertadores-Wari Region; Casapalca and Yauricocha Mines, Lima Region; Morococha Mine, Andrés A. Cáceres Region	60
			Smelter at La Oroya	70
			Refinery at La Oroya	58
Do.		Empresa Minera del Perú, S.A. (Mineroperú) (Government, 100%)	Cerro Verde Mine, Arequipa Region	33
			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	1,600
			Refinery at Pataz, San Martín La Libertad Region	4,800
Do.	do.	Centromín Perú	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 Caylloníia, S.A.	Caylloníia District, Arequipa Region	190
Iron ore		Shougang Hierro Perú, S.A. (Shougang Corp., 98.4%)	Marcona Mine, Los Libertadores-Wari Region	13,000
Lead		Centromín Perú	Cerro de Pasco, Casapalca, San Cristóbal, Morococha, Yauricocha, and Andaychagua Mines	85
			Smelter at La Oroya	93
			Refinery at La Oroya	87
Do.		Cía. Minera Milpo, S.A. (Milpo) (private, 100%)	El Porvenir Mine, Andrés A. Cáceres Region	24

See footnotes at end of table.

TABLE 4—Continued

PERU: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity ownership	Location of main facilities	Annual capacity
Lead—Continued:		Cía. Minera Atacocha, S.A. (private, 100%)	Atacocha Mine, Los Libertadores-Wari Region	16
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
Do.		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 (Petroperú) (Government, 100%)	Onshore Talara Area, Grau Region; Ucayali Area, Ucayali Region; Marañón area, Amazonas Region	25,000
Do.	do.	Petróleos del Mar, S.A. (Petroperú, 100%)	Offshore Grau Region	10,500
Petroleum products	do.	Petroperú	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	Centromín Perú	Casapalca, Cerro de Pasco, Cobriza, Morococha, San Cristóbal, Yauricocha, and Andaychagua Mines	466
			Refinery at La Oroya	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	Centromín Perú	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		Centromín Perú	Casapalca, Cerro de Pasco, Morooccocha, San Cristóbal, Yauricocha, and Andaychagua Mines	235
			Refinery at La Oroya	70

See footnotes at end of table.

TABLE 4—Continued

PERU: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity ownership	Location of main facilities	Annual capacity
Zinc—Continued:	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.	Mineroperú	Refinery at Cajamarquilla	102

NA Not available.
[1]Operations suspended during 1989.

TABLE 5

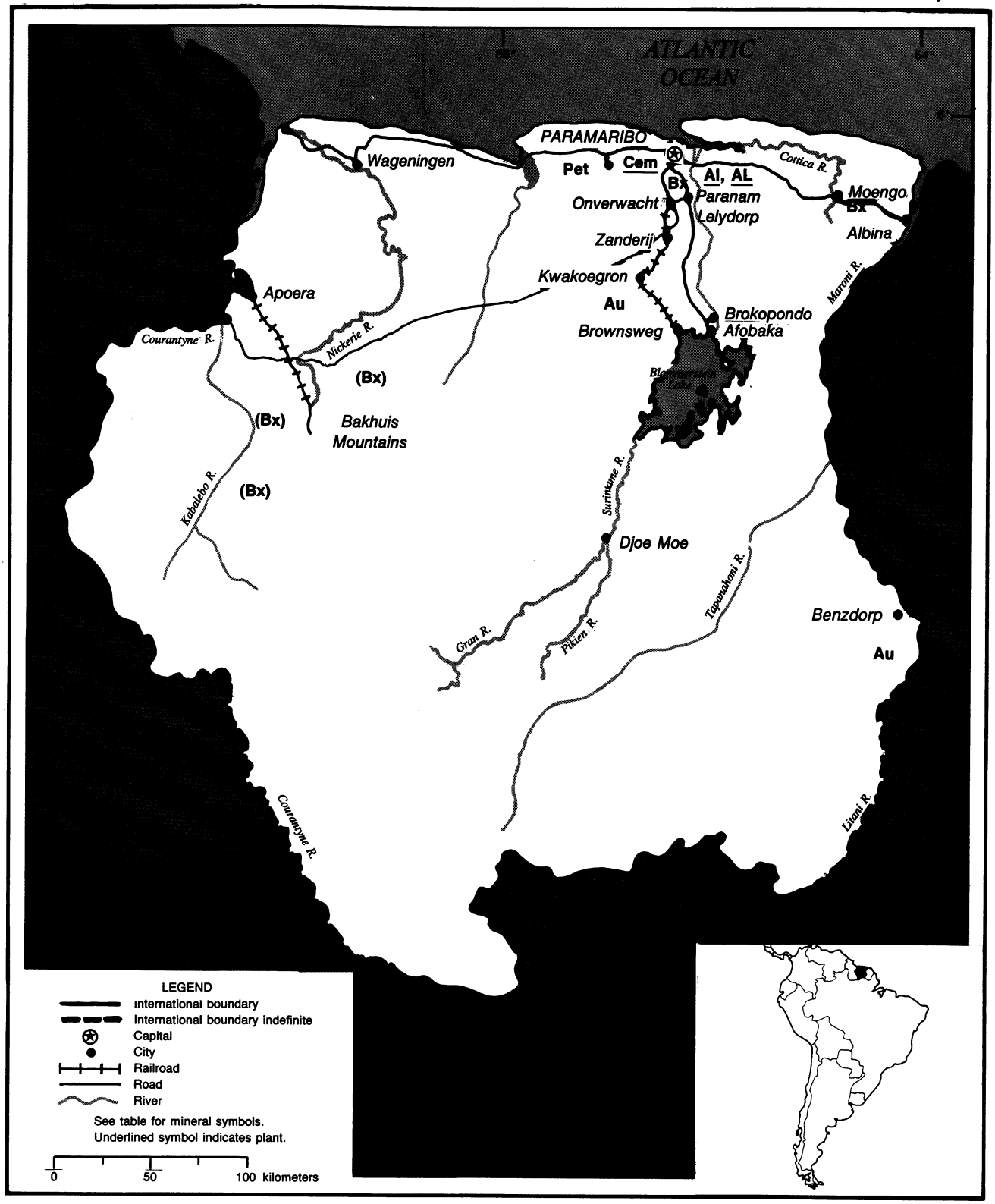
PERU: 1992 DISTRIBUTION OF CRUDE OIL PRODUCTION

(Thousand barrels per day)

Producers	Amount
Petroperú:	
Central jungle	0.8
Chambira	—
Northwest coast	17.5
Northern jungle	17.4
Pavayacu-Corrientes	1.2
Total	36.9
Contractors:	
Northwest coast	.5
Occidental	57.7
Oxy-Bridas	5.3
Petromar	15.5
Total	79.0
Grand total	115.9

SURINAME

AREA 163,270 km² **POPULATION 410,000**



THE MINERAL INDUSTRY OF

SURINAME

By Philip M. Mobbs

Suriname was the seventh largest producer of bauxite and eighth largest producer of alumina in the world. Mineral commodities continued as a key sector of Suriname's economy in 1992. Bauxite and alumina accounted for 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. The nation's dependency on the bauxite industry's ability to raise foreign exchange was expected to be reduced somewhat during the 1990's with the diversification of Suriname's economy. In the mineral sector, the Government was interested in attracting foreign investment and actively promoted the development of the diamond, gold, kaolin, sand, and stone industries.

Suriname's GDP was $2,073 million[1] in 1991, the last year for which data were available. This was a 23% increase from the $1,683 million GDP posted for 1990. During 1992, the Government continued work on an economic reform program. The installation of a structural adjustment program was anticipated by mid-1993.

GOVERNMENT POLICIES AND PROGRAMS

Suriname was interested in forming joint-venture agreements with international companies that would provide for upgrading the technological capabilities of the nation's labor force. The Government wanted environmentally sound mineral investment. Official policy, such as the encouragement of the reclamation of bauxite mining areas and gold placer operations as farmland, which reduced deforestation in the vicinity of mining area communities, was an indication of the Government's intent.

The Mining Law of 1986 was reported to be in the process of being revised. The 1986 law featured 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.

The Council of Ministers approved an agreement with the Overseas Private Investment Corp. (OPIC). Parliament ratification of the agreement was anticipated in 1993.

PRODUCTION

Mineral commodity production data are shown in table 1. Bauxite and alumina continued to dominate the industry's annual tonnage. 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 and garnered more than 40% of the country's exports. Suriname's bauxite companies exported much of the produced alumina to Canada, France, the Netherlands, Norway, and the United States. During the period 1989-91, Suriname accounted for 5% of U.S. alumina imports, ranking the country third behind Australia (82%) and Jamaica (6%) as an international source of alumina for the U.S. market.

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 mining company. Gold was produced by numerous small placer operators and sold to the Government. Golden Star Resources Ltd. of Edmonton, Alberta, Canada, started a gold exploration program 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.—NV Billiton Maatschappij Suriname (Billiton) provided 55% of the feedstock for the Paranam alumina refinery from its Accaribo Mine, near Paranam. The remaining feedstock was obtained from the Suriname Aluminum Company's (Suralco) operations at Coermotibo, 10 km northeast of Moengo, which had replaced the exhausted Moengo operations. Billiton proposed development of a new mine at Lelydorp to replace production from the Accaribo Mines, which was projected to be mined out by 1995-96. The second potline at the Paranam aluminum smelter was being dismantled.

Gold.—According to recent reports, there were more than 700 known gold occurrences in Suriname. However, many of these occurrences had been subject to cursory examination only.

Early in the 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. By May, Golden Star reached an agreement with GRASSALCO concerning the 17,000-ha Gross Rosebel property within the Headley's Reef area. The 1992 exploration program at Gross Rosebel 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 was also 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 was constructing 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 the 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 was also responsible for electricity distribution within the country.

OUTLOOK

There was no bauxite mine development between 1983 and 1988. As higher grade bauxite mines come on-stream over the next 3 years, the older exhausted mines will be phased out. Production costs may remain static with higher labor expenses offsetting decreased operating costs. However, the deterioration of the international alumina market seriously threatens Suriname's economy. Although spot market prices buoyed the alumina industry in the late 1980's, prices have dropped precipitously during the 1990's. Spot prices wavered from $150 per ton to $175 per ton during 1992, down from $250 in late 1990.

With the formal end of the 6-year-old civil war in August, 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 Venezuela and Guyana.

[1]Where necessary, values have been converted from Surinamese guilders (Sf) to U.S. dollars at the rate of Sf1.777=US$1.00.

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

International Bauxite Association, Kingston, Jamaica: IBA Quarterly Review.
U.S. Department of Commerce, International Trade Administration: Foreign Economic Trends and Their Implications for the United States, annual.

TABLE 1
SURINAME: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity	1988	1989	1990	1991	1992e
Aluminum:					
Bauxite, gross weight	3,434	3,530	3,283	3,198	[2]3,250
Alumina	1,632	1,567	1,532	1,510	[2]1,576
Metal, primary[3]	10	28	32	29	[2]32
Cement, hydraulic e	50	50	50	50	50
Clays, common e	16	16	16	16	16
Gold, mine output, Au content e kilograms	22	[2]31	r100	r200	300
Petroleum, crude thousand 42-gallon barrels	1,400	e1,442	1,436	e1,500	1,500
Sand and gravel: e					
Gravel	[2]35	35	35	35	35
Sand, common	160	160	160	160	160
Stone, crushed and broken e	50	50	50	50	50

eEstimated.
[1]Includes data available through Apr. 5, 1993.
[2]Reported figure.
[3]Data represent exports.

TABLE 2
STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

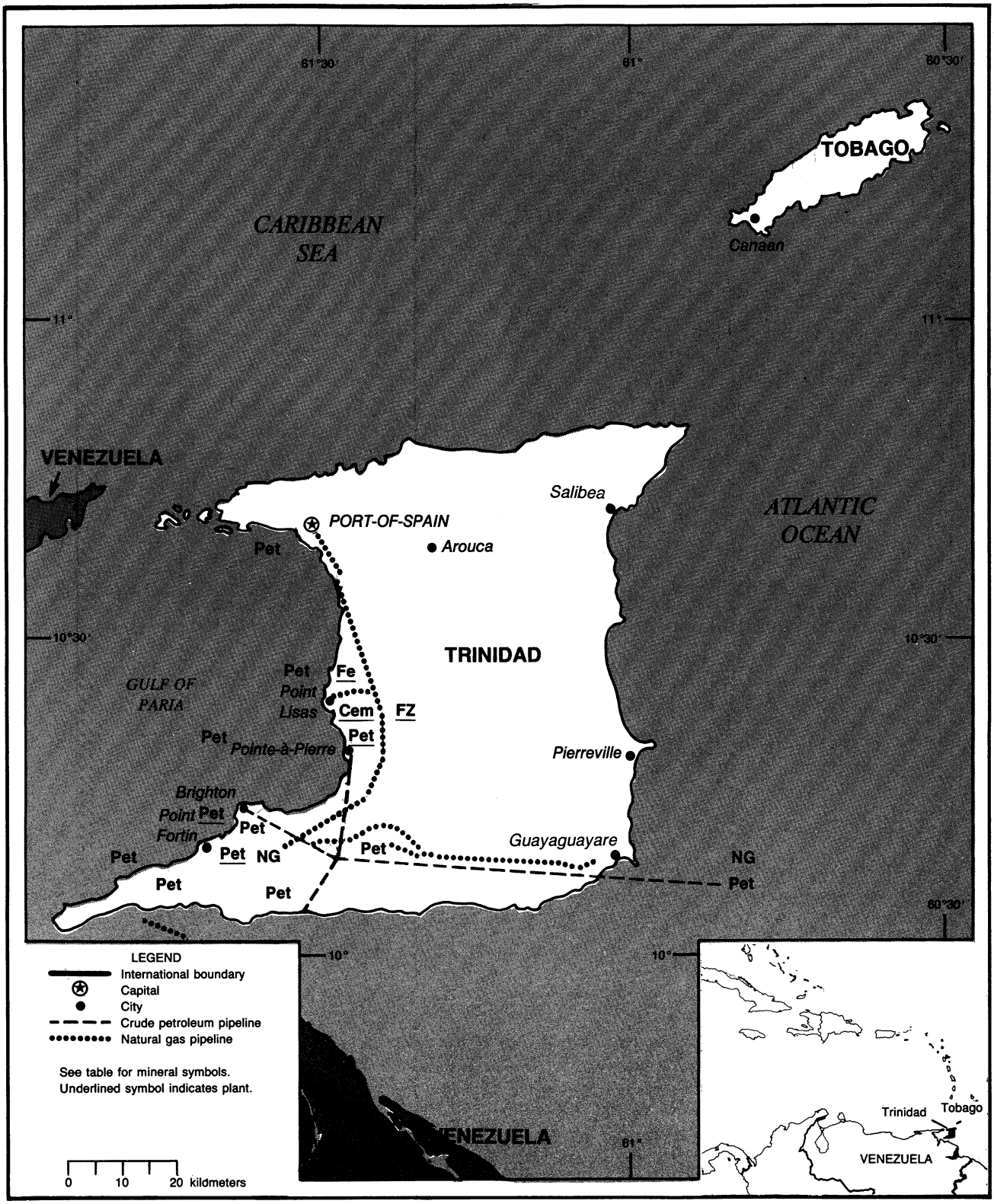
(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina	Suriname Aluminum Co. (Suralco) [Aluminum Co. of America), 55% and NV Billiton Maatschappij (Billiton), (Royal Dutch/Shell Group), 45%]	Refinery at Paranam, District of Para	1,600
Aluminum	Suralco, 100%	Smelter at Paranam, District of Para	34
Bauxite	do.	Mines at Moengo[1] and Coermotibo, District of Marowijne	1,800, 1,500
Do.	Billiton, 76%, and 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

[1]Mine being phased out during 1992.

TRINIDAD AND TOBAGO

AREA 5,130 km² **POPULATION 1.3 million**



THE MINERAL INDUSTRY OF

TRINIDAD AND TOBAGO

By George A. Rabchevsky

The islands of Trinidad and Tobago are 11 km off the coast of Venezuela. The combined areas of Trinidad and Tobago are slightly smaller than the State of Delaware of the United States. Geologically, Trinidad was once part of the South American mainland, and Tobago is part of a sunken mountain chain related to the continent. Trinidad is traversed by three distinct mountain ranges that are a continuation of the Venezuelan coastal cordillera. Although Tobago is volcanic in origin, there are no active volcanoes.

The country had the largest gross domestic product (GDP) of the Caribbean islands, one of the highest per capita GDP levels among the nations of the Western Hemisphere, and one of the highest standards of living in the developing world.

Mining activities and extractions and refining of petroleum accounted for about 40% of the total GDP. The natural resources on Trinidad were asphalt, crude oil, and natural gas. Petroleum had fueled the economy since the early 20th century and in 1992 still represented about 30% of GDP and 80% of exports. New petrochemical plants, utilizing the country's natural gas, came on-stream in the early 1980's and produced ammonia, methanol, and urea. The country produced some iron and steel and secondary lead. Cement and stone were produced for domestic use.

GOVERNMENT POLICIES AND PROGRAMS

The Government continued to maintain a major share of the equity of most state corporations. The Government has increasingly sought direct foreign investment to help fund joint ventures in its downstream petrochemical industry. There were plans to expand the country's oil extraction infrastructure, and refinery facilities were scheduled for upgrading. Also, development of the country's abundant natural gas reserves was one of the Government's priorities to reduce its dependency on crude oil, promote the use of gas, and further develop the gas-based industries.

On October 21, 1992, the Trinidad and Tobago parliament passed the supplemental petroleum tax proposal, which is retroactive to January 1, 1992.

PRODUCTION

The mineral industry of Trinidad and Tobago produced crude oil, industrial minerals, petrochemicals, and some metals. Petroleum production is divided evenly between the state-owned oil companies and American Oil Company. Petroleum production in 1992 was down about 6%, continuing the downtrend of recent past years. The country ranked seventh as a crude oil producer (after Ecuador) in the Latin American region. *(See table 1.)*

TRADE

The United States, Puerto Rico, and the Virgin Islands continued as Trinidad and Tobago's major trading partners. Imports to Trinidad and Tobago from the United States totaled $447 million. The 1992 exports to the United States totaled $862 million. Exports consisted of anhydrous ammonia, crude oil, diesel fuel, methanol, and urea.

In 1992, Trinidad and Tobago became the first Caribbean Community and Common Market member to benefit from a line of credit from the Andean Development Corporation (ADC) to help stimulate trade with the Andean Pact countries. The ADC is a multipurpose bank owned by the Andean Pact member countries (Bolivia, Colombia, Ecuador, Peru, and Venezuela).

Trinidad and Tobago exported oil and gas for hard currency earnings. Nitrogen and sulfur, a byproduct of petroleum, also were exported. Asphalt was exported primarily to Germany, followed by French Guiana, United Kingdom, and the United States. About 50% of its crude petroleum output also was exported to the United States. Trinidad and Tobago exported about 80% of the refined products, 20% of which was exported to the United States. It 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 on the import of metals, mostly from Europe (Belgium-Luxembourg, Finland, Netherlands, and United Kingdom) and South America (Brazil and Venezuela). Industrial minerals also were imported. Cuba approached Trinidad and Tobago about the possibility of buying crude oil to replace lost supplies from Russia. *(See tables 2 and 3.)*

STRUCTURE OF THE MINERAL INDUSTRY

The Government and private sector controlled much of the mineral industry by joint ventures; except one, all petroleum operations were state owned with minority participation by private companies or investors. Major 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. Several mineral producers are completely owned by the Government. *(See table 4.)*

COMMODITY REVIEW

Metals

The state-owned steel company, Iron and Steel Co. of Trinidad and Tobago, was operated by an Indian-based firm, Ipsat Ltd., under a 5-year lease. At the termination of the lease in 1994, the Government indicated its intention to sell the mill, though it would retain a small share of it. The capacity of steel production in the electric arc furnace in Trinidad was estimated at 600,000 mt/a, or about 30% of total production.

The U.S. minimill steelmaker, Nucor Steel Corp. of North Carolina, invested $50 million for the construction of a 300,000-mt/a iron carbide plant for the purpose of shipping the iron units to the United States to feed its steel mills. The availability of inexpensive gas and the proximity of the island to Brazil, where Nucor will source all the 500,000 mt/a of iron ore needed for the module, were some of the reasons for selecting Trinidad as its site. Construction is expected to start by the end of March 1993, with startup anticipated in late 1994.

Industrial Minerals

Ammonia.—Trinidad and Tobago's nitrogenous fertilizer industry was started 30 years ago, when W.R. Grace Inc. of New York established Fedchem, an ammonia plant with a rated capacity of 250,000 mt/a. Thirteen years later a joint venture with the Government was created, Tringen, to operate the 450,000-mt/a ammonia plant. In 1988 the plant was expanded with a rated capacity of 820,000 mt/a. In 1992, following a corporate decision to divest itself of its holdings in fertilizers, W.R. Grace sold its operations to Norsk Hydro AS of Norway. A third ammonia plant, Federation Chemicals, began production in 1981. The only urea producer, Tobago Urea Ltd. (TU), 100% owned by the Government, had a capacity of 600,000 mt/a. The Government planned to sell its 51% holding in Federation Chemicals and in the urea plant.

Of the three ammonia companies operating in the country, Trinidad Nitrogen Co., Ltd. was the largest, followed by Fertilizers of Trinidad and Tobago Ltd. (FTT) and Federation Chemicals. The total capacity of ammonia in Trinidad and Tobago was rated at 1,760,000 mt/a. Two ammonia plants were planned with a combined capacity of 600,000 mt/a.

The U.S. company Arcadian Partners in Memphis, Tennessee, reached an agreement to acquire FTT and TU for a total of $175 million. FTT was owned by the Trinidad and Tobago Government (51%) and by Amoco Oil (49%). TU was wholly owned by the Government.

Cement.—Trinidad Cement Ltd. was the only company producing cement in the country. The plant was on the western coast near Point Lisas. Natural gas was used for the main firing with gypsum supplied from Venezuela. Trinidad relied on its cement production for domestic consumption and exported about 252,250 tons in 1992. Sand and gravel was produced for use primarily in concrete manufacture. Crushed stone was used in the manufacture of cement clinker.

Mineral Fuels

Liquefied Petroleum Gas.—The Phoenix Park Gas Processor Ltd. operated an 18-Mm^3/d plant to extract gas liquids, primarily butane and propane, from crude hydrocarbons. Gas liquids were exported to Barbados, St. Lucia, and Guadeloupe.

Natural Gas.—Domestic energy consumption was heavily weighted toward natural gas. Natural gas accounted for more than 85% of the nation's energy needs. The Government is promoting the use of compressed natural gas in vehicles. Substantial reserves are being developed for natural gas and for liquefied natural gas, directed 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. Amoco Trinidad Oil Co. (ATO) planned to develop the Flamboyant (formerly known as West-East Queen's Beach) and Immortelle (formerly Galeota) Gasfields off eastern Trinidad to meet a new gas supply contract with National Gas Company. Amoco intends to drill as many as 15 wells in the area. Gas from the Flamboyant field is now flowing southwest, past the Immortelle field, to Cassia Gasfield through a 25-cm, 20-km submarine pipeline laid in October 1992. Pipeline between Cassia and the future site of Immortelle is to be installed by mid-1993.

Petroleum.—About 80% of Trinidad and Tobago's oil production comes from offshore fields. The Teak Oilfield offshore of the southeastern coast was the largest producing field in Trinidad. *(See table 5.)* ATO was the only major foreign petroleum company, contributing about 50% of total domestic production. In 1991, plans were made to merge the Trinidad and Tobago Oil Co. Ltd. (TTOC) and Trinidad and Tobago Petroleum Co. Ltd. (TTPC) into a single state company. In 1992, the two companies' exploration and production departments were merged, and further streamlining and consolidation are to occur in early 1993. TTOC and TTPC were established in 1985 when the Government took over Texaco Trinidad Ltd. and Trinidad Tesero Ltd.

The petroleum industry in Trinidad and Tobago was the major income of the nation's economy. In 1990, petroleum accounted for about 30% of the country's GDP. Oil exports in 1990 accounted for about 65% of trade revenue. Including hydrocarbon and petrochemicals, hydrocarbon exports accounted for almost 85% of export earnings. However,

exploration and production of crude oil have stagnated in recent years. Domestic refinery utilization remains low at about 35% because of aging facilities and infrastructure in need of rehabilitation. Gasoline accounted for about 50% of domestic consumption. Consumption of other products included diesel, 20%; liquefied petroleum gas, 9%; kerosene, 8%; and fuel oil, 3%. More than 50% of refined petroleum products was fuel oil. Because natural gas fuels most of the nation's powerplants, 99% of fuel oil was exported.

The Government awarded oil exploration rights to Unocal Trinidad Ltd. for Block 89/3, about 70 km off the east coast of Trinidad. Exploration will last for 3 years, with the first well to be drilled in 1994 in water that averages about 90 m. Unocal holds a 100% interest in the block.

The state-owned TTOC received an $18 million loan from the Caribbean Development Bank to finance a program for onshore and offshore secondary oil recovery and to improve the volume of refinery throughput. The program would cost $411 million, and financing also was obtained from the Inter-American Development Bank, the Japan Import-Export Bank, the Commonwealth Development Corp., the European Investment Bank, and the oil company. The program reportedly will double the capacity of the company's refinery at Pointe-a-Pierre, and the increased demand for crude will be met by improving the secondary oil recovery onshore and offshore.

The country operated two oil refineries, both owned by TTOC. One refinery is at Point-a-Pierre with throughput of about 31 Mbbl/a and the other is at Point Fortin. The latter produces only fuel oil with throughput of about 11 Mbbl/a. Current plans call for expanding the capacity of the Point-a-Pierre refinery to 160,000 bbl/d.

Reserves

Estimated proven crude oil reserves were 550 Mbbl. Reportedly, the prolific Soldado Oilfields in the Gulf of Paria had estimated proven reserves of 660 Mbbl of oil from the Miocene and Pliocene deltaic sands. Potential oil reserves were estimated at 2.9 billion bbl, mostly offshore. The proven natural gas reserves in Trinidad were estimated in 1991 at 485 billion m^3, ranking fourth in Latin America after Venezuela, Mexico, and Argentina. Reserve data on industrial minerals were not available.

INFRASTRUCTURE

Trinidad and Tobago has about 8,000 km of roads, 50% of which is paved. The major three ports are located on the west coast, including Point Lisas, Pointe-a-Pierre, and Port-of-Spain. The 1,032 km of crude oil pipelines extended from the offshore fields on the southeastern coast to Brighton on the southwestern coast and from the south coast north to Pointe-a-Pierre. The 1,904 km of natural gas pipelines was onshore paralleling the petroleum pipeline, and a second gas pipeline extended from the gasfields in the southwestern part of Trinidad along the western coast to Port-of-Spain.

OUTLOOK

Trinidad Cement Ltd. is continuing with a number of investments designed to improve production efficiencies. These include the replacement of the two older kiln lines by one new kiln and the commissioning of a new paper sack manufacturing plant with a capacity of 15 million sacks per year.

The new Government promised to reexamine its energy policy and to create a better environment for foreign investors, especially for oil exploration. Natural gas remains the bright spot in Trinidad and Tobago's petroleum outlook. The nation's longer term goals include increasing gas production to become a significant supplier to export market, while output of crude oil will be decreasing in the future.

[1]Where necessary, values have been converted from Trinidad and Tobago's dollar (TT$) to U.S. dollars at the rate of TT$4.25 =US$1.00.

OTHER SOURCES OF INFORMATION

Agency

Ministry of Energy
Level 11, Riverside Plaza
Besson Street
Trinidad

Publication

Ministry of Energy, The Petroleum Industry of Trinidad and Tobago, monthly **bulletin**

TABLE 1
TRINIDAD AND TOBAGO: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992[p]
Asphalt, natural		21,000	27,231	e19,155	e20,000	24,565
Cement, hydraulic		e360,000	e380,000	437,954	485,396	482,000
Gas, natural:						
Gross	million cubic meters	e7,700	7,146	r6,720	r8,733	e7,000
Marketed[e 2]	do.	4,000	3,833	3,750	3,750	3,750
Iron and steel:						
Iron, sponge		593,000	612,000	697,000	710,000	680,198
Steel, crude		361,000	294,000	372,000	444,000	553,000
Semimanufactures (rolled)		251,000	e250,000	e290,000	e290,000	449,529
Lead, refined (secondary)[e]		1,800	1,800	1,800	1,800	1,800
Natural gas liquids[e]	thousand 42-gallon barrels	40	40	40	40	40
Nitrogen: N content of ammonia	thousand tons	1,388	e1,550	r1,520	1,524	1,142
Petroleum:						
Crude	thousand 42-gallon barrels	56,476	56,189	r55,200	r52,600	e51,000
Refinery products	do.	31,123	28,225	28,130	30,200	e30,000
Stone: Limestone	thousand tons	e600	e600	e600	r1,028	1,420
Sulfur, byproduct of petroleum[e 4]		5,000	5,000	5,000	5,000	5,000

[e]Estimated. [p]Preliminary. [r]Revised.
[1]Table includes data available through July 1993.
[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 AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1990	1991	Destinations, 1991	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys:				
Scrap	1,599	1,113	654	United Kingdom 421; Japan 36.
Unwrought	31	—		
Semimanufactures	65	23	—	St. Lucia 9; Grenada 4; Jamaica 4.
Copper:				
Matte and speiss including cement copper	12	—		
Metal including alloys:				
Scrap	145	517	289	United Kingdom 209; Republic of Korea 18.
Unwrought	75	147	17	United Kingdom 130.
Semimanufactures	96,016	567	530	United Kingdom 18; Netherlands 17.
Iron and steel: Metal:				
Scrap	116,350	215	169	Canada 46.
Pig iron, cast iron, related materials	442,035	159,997	—	Venezuela 80,142; Egypt 52,694; Mexico 25,180.
Steel, primary forms	30,007	5,265	6	Ecuador 4,853; Guatemala 401.
Semimanufactures:[2]				
Flat-rolled products of iron or nonalloy steel:				
Not clad, plated, coated	NA	24	—	Barbados 6; Grenada 4; St. Kitts and Nevis 4.

See footnotes at end of table.

TABLE 2—Continued

TRINIDAD AND TOBAGO: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
METALS—Continued					
Iron and steel: Metal—Continued:					
Semimanufactures[2]—Continued:					
Flat-rolled products of iron or nonalloy steel—Continued:					
Not clad, plated, coated		NA	24	—	Barbados 6; Grenada 4; St. Kitts and Nevis 4.
Clad, plated, coated		NA	82	—	St. Kitts and Nevis 34; St. Vincent and the Grenadines 21; Grenada 12.
Bars, rods, angles, shapes, sections		940,046	424,594	47,733	Japan 70,677; St. Vincent and the Grenadines 53,902.
Universals, plates, sheets		282	NA		
Rails and accessories		—	2	—	All to bunkers.
Wire		1,776	182	—	Netherlands Antilles 60; Jamaica 55; Barbados 35.
Tubes, pipes, fittings		1,061	154	42	Grenada 37; Jamaica 17.
Castings and forgings, rough		(3)	NA		
Lead:					
Oxides		34	27	—	All to Barbados.
Metal including alloys, scrap		35	—		
Magnesium: Metal including alloys, semimanufactures		—	1	—	Mainly to St. Lucia.
Silver: Waste and sweepings[4]	kilograms	807	271	—	All to Canada.
Zinc: Metal including alloys:					
Scrap		—	6	—	Do.
Semimanufactures		—	1	—	Mainly to St. Vincent and the Grenadines.
Other:					
Ores and concentrates		—	1,010	—	All to Barbados.
Ashes and residues		139	—		
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		—	21	—	All to Guadeloupe.
Grinding and polishing wheels and stones		66	3	—	NA.
Asbestos, crude	value, thousands	$1	—		
Cement	thousand tons	2,379	293	7	Guyana 43; Haiti 33; St. Lucia 32.
Clays, crude		—	28	—	All to Suriname.
Fertilizer materials: Manufactured:					
Ammonia	thousand tons	1,555	1,580	1,004	Belgium-Luxembourg 189; Morocco 102.
Nitrogenous	do.	8,793	442	112	United Kingdom 54; Venezuela 52.
Unspecified and mixed		—	4	—	St. Lucia 3; Guyana 1.
Gypsum and plaster		1	—		
Lime		—	1	—	All to Grenada.
Mica: Crude including splittings and waste		—	2	—	All to Barbados.
Pigments, mineral: Iron oxides and hydroxides, processed	value, thousands	$1	$1	—	NA.
Salt and brine		103	900	—	Guyana 751; Barbados 140; St. Lucia 2.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked	value, thousands	—	$1	—	All to Grenada.

See footnotes at end of table.

TABLE 2—Continued

TRINIDAD AND TOBAGO: EXPORTS AND REEXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
METALS—Continued					
Stone, sand and gravel—Continued:					
Dimension stone—Continued:					
Worked		—	8	—	NA.
Gravel and crushed rock		54,152	9,061	—	St. Lucia 7,105; St. Vincent and the Grenadines 1,881; Guyana 50.
Limestone other than dimension		—	111	—	All to Guyana.
Sand other than metal-bearing		29,405	19,064	—	St. Lucia 14,379; St. Vincent and the Grenadines 4,420; Venezuela 129.
Sulfur: Sulfuric acid		—	5	—	All to Guyana.
Talc, steatite, soapstone, pyrophyllite	value, thousands	—	$1	—	Do.
Other:					
Crude		9	—		
Slag and dross, not metal-bearing		11,641	—		
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		27,074	448	—	Montserrat 262; Guyana 150; Grenada 36.
Petroleum:					
Crude	thousand 42-gallon barrels	30,715	27,139	27,139	
Refinery products:					
Liquefied petroleum gas	do.	233	1,047	125	Dominican Republic 228; Brazil 185; Peru 172.
Gasoline	do.	3,367	3,915	1,058	Colombia 950; Barbados 362.
Mineral jelly and wax	do.	(3)	(3)	—	Mainly to Barbados, Grenada, and St. Vincent and the Grenadines.
Kerosene and jet fuel	do.	2,540	3,918	1,425	Barbados 459; Canada 454.
Distillate fuel oil	do.	6,064	6,002	1,623	French Guiana 900; Guadeloupe 592.
Lubricants[5]	do.	51	193	(3)	Venezuela 97; Netherlands Antilles 35.
Residual fuel oil	do.	15,760	22,338	6,264	Netherlands Antilles 5,704; Italy 2,718.
Bitumen and other residues	do.	(3)	40	17	French Guiana 19; St. Lucia 4.
Bituminous mixtures	do.	22	4	—	St. Vincent and the Grenadines 2; Antigua and Barbuda 1.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]As a result of changes in trade code classifications, data for 1990 and 1991 are not completely comparable.
[3]Less than 1/2 unit.
[4]May include other precious metals.
[5]May include nonlubricating oils.

TABLE 3

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1990	1991	Sources, 1991	
			United States	Other (principal)
METALS				
Alkaline-earth metals	—	1	1	
Aluminum:				
Ore and concentrate	160	—		

See footnotes at end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Aluminum—Continued:					
Oxides and hydroxides		91	328	1	United Kingdom 327.
Metal including alloys:					
Scrap		(2)	1	—	All from Jamaica.
Unwrought		21	459	1	Canada 397; Venezuela 61.
Semimanufactures		2,222	44,539	1,104	Venezuela 40,885; Canada 951.
Antimony: Metal including alloys, all forms		—	130	12	Venezuela 116; China 2.
Cadmium: Metal including alloys, all forms	value, thousands	—	$6	$6	
Chromium: Oxides and hydroxides		4	8	2	United Kingdom 6.
Cobalt: Oxides and hydroxides	value, thousands	—	$8	$4	Italy $4.
Copper: Metal including alloys:					
Scrap		19,203	718	659	United Kingdom 59.
Unwrought		4	391	367	New Zealand 20; United Kingdom 4.
Semimanufactures		21,186	752	584	United Kingdom 55; Italy 30.
Iron and steel:					
Iron ore and concentrate	thousand tons	914	587	—	Brazil 528; Venezuela 59.
Metal:					
Scrap		10,170	5,980	4,949	Guyana 1,030.
Pig iron, cast iron, related materials		111	16	15	Netherlands 1.
Ferroalloys:					
Ferromanganese		1,780	155	55	Venezuela 100.
Ferrosilicon		498	903	—	Venezuela 803; Hong Kong 100.
Ferrosilicochromium	value, thousands	NA	$3	—	All from Canada.
Ferrosilicomanganese		NA	4,909	347	Venezuela 2,552; Brazil 2,010.
Unspecified		2,415	11	2	Austria 8; Belgium-Luxembourg 1.
Steel, primary forms		642	810	7	United Kingdom 368; Netherlands 265; Venezuela 150.
Semimanufactures:[3]					
Flat-rolled products:					
Of iron or nonalloy steel:					
Not clad, plated, coated		NA	11,363	550	United Kingdom 3,259; Venezuela 1,884; Germany 1,807.
Clad, plated, coated		NA	15,732	213	Japan 6,836; United Kingdom 3,040; Sweden 1,932.
Of alloy steel		NA	4,209	248	Japan 1,438; Brazil 938; Germany 447.
Bars, rods, angles, shapes, sections		184,939	3,584	390	United Kingdom 2,602; Brazil 116.
Universals, plates, sheets		564,134	NA		
Hoop and strip		2,789	NA		
Rails and accessories		1,154	44	40	Venezuela 4.
Wire		22,134	1,654	121	United Kingdom 1,133; Brazil 214.
Tubes, pipes, fittings		214,297	27,951	12,295	Argentina 4,579; Brazil 2,784.
Castings and forgings, rough	value, thousands	$1	NA		
Lead:					
Oxides		49	9	—	Venezuela 8; United Kingdom 1.
Metal including alloys:					
Scrap		456	1,844	1,557	Barbados 162; Netherlands Antilles 111.

See footnotes at end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Lead—Continued:					
Metal including alloys—Continued:					
Unwrought		234	10	—	All from Venezuela.
Semimanufactures		41,180	928	3	United Kingdom 505; Venezuela 420.
Magnesium: Metal including alloys:					
Unwrought	value, thousands	—	$1	$1	
Semimanufactures		3	2	1	United Kingdom 1.
Manganese: Ore and concentrate		2	—		
Molybdenum: Metal including alloys, semimanufactures	value, thousands	—	$32	$32	
Nickel: Metal including alloys, semimanufactures		1	33	12	Netherlands 21.
Platinum-group metals:					
Waste and sweepings	kilograms	—	5	—	All from Italy.
Metals including alloys, unwrought and partly wrought	value, thousands	—	$1	$1	
Silver: Metal including alloys, unwrought and partly wrought	do.	$142	$67	$15	Canada $52.
Tin: Metal including alloys:					
Unwrought		—	1	1	
Semimanufactures		487	419	10	United Kingdom 197; Japan 112; Colombia 100.
Titanium:					
Ore and concentrate		—	2	2	
Oxides		635	894	339	United Kingdom 523; Finland 25.
Metal including alloys, semimanufactures	value, thousands	—	$5	$5	
Tungsten: Metal including alloys:					
Unwrought	do.	$52	$109	$109	
Semimanufactures		1	5	5	
Vanadium: Metal including alloys, all forms		—	1	—	All from Austria.
Zinc:					
Ore and concentrate		22,229	—		
Oxides		130	206	102	France 43; Venezuela 36.
Metal including alloys:					
Scrap		—	77	38	Canada 38.
Unwrought		25	5	2	United Kingdom 3.
Semimanufactures[4]		19,727	30	16	United Kingdom 5; Norway 4.
Zirconium: Metal including alloys, semimanufactures		—	37	37	
Other:					
Oxides and hydroxides		185	117	106	Germany 3; China 2.
Ashes and residues		360	—		
Base metals including alloys, all forms		10	—		
Metalloids[5]		NA	7	6	China 1.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		57	53	6	Dominica 26; Guatemala 20.
Grinding and polishing wheels and stones		61	91	11	Venezuela 22; United Kingdom 16; Brazil 6.

See footnotes at end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Asbestos, crude		—	18	18	
Barite and witherite		20,687	31,856	1,375	Morocco 30,476; Germany 4.
Boron materials:					
Crude natural borates		456	3	3	
Oxides and acids		—	8	(2)	France 5; United Kingdom 3.
Bromine[6]		—	2	2	
Cement		3,787	3,020	278	Germany 2,301; Belgium-Luxembourg 273.
Chalk		20,485	83	—	All from United Kingdom.
Clays:					
Bentonite		NA	3,188	3,188	
Kaolin		NA	634	124	United Kingdom 359; Guyana 149.
Unspecified		5,111	104	79	United Kingdom 23; Turkey 1.
Diamond, natural:					
Gem, not set or strung	value, thousands	$472	$205	$9	India $82; Belgium-Luxembourg $59; United Kingdom $52.
Industrial stones	do.	—	$3	$3	
Diatomite and other infusorial earth		44	31	28	United Kingdom 2; Germany 1.
Feldspar, fluorspar, related materials:					
Feldspar		NA	217	—	All from United Kingdom.
Fluorspar		NA	288	48	China 200; Mexico 40.
Unspecified		152	—		
Fertilizer materials:					
Crude, n.e.s.		—	45	—	All from Canada.
Manufactured:					
Ammonia		6	38	12	Germany 26.
Nitrogenous		2,564	991	65	Dominican Republic 417; Belgium-Luxembourg 400.
Phosphatic		1,052	665	374	Dominican Republic 267; Jamaica 23.
Potassic		22,178	1,243	1,133	Canada 56; Germany 44.
Unspecified and mixed		8,133	2,717	360	Belgium-Luxembourg 1,130; Dominican Republic 942.
Graphite, natural		—	2	—	All from United Kingdom.
Gypsum and plaster		19,650	24,688	1,642	Venezuela 18,944; Jamaica 4,016.
Lime		3,175	2,965	—	Venezuela 2,927; United Kingdom 38.
Magnesium compounds:					
Magnesite, crude		1,346	1,975	—	Venezuela 1,767; Austria 208.
Oxides and hydroxides		—	3,732	85	Venezuela 3,398; Austria 224.
Mica:					
Crude including splittings and waste		108	106	1	Norway 79; United Kingdom 26.
Worked including agglomerated splittings	value, thousands	$2	$15	$9	United Kingdom $6.
Phosphates, crude		228	—		
Pigments, mineral: Iron oxides and hydroxides, processed		66	67	10	United Kingdom 19; Canada 17; Netherlands 12.
Potassium salts, crude		635	816	816	
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	$2	$12	$7	Canada $5.

See footnotes at end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Precious and semiprecious stones other than diamond—Continued:					
Synthetic	value, thousands	$5	$14	$14	
Salt and brine		89,334	13,892	1,211	Netherlands Antilles 10,058; Jamaica 2,596.
Sodium compounds, n.e.s.:					
Soda ash, manufactured		6,044	86	2	Belgium-Luxembourg 42; United Kingdom 42.
Sulfate, manufactured		1,705	1,579	77	Belgium-Luxembourg 1,461; Costa Rica 40.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		8	128	15	Venezuela 107; China 6.
Worked		85	43	30	Italy 7; Barbados 3.
Dolomite, chiefly refractory-grade		5,484	625	625	
Gravel and crushed rock		15,981	5,514	3,281	Barbados 1,800; China 220.
Limestone other than dimension		48,634	54,249	18	Netherlands Antilles 47,014; Venezuela 4,187; Netherlands 2,902.
Quartz and quartzite		23	24	(2)	Mainly from Netherlands.
Sand other than metal-bearing		1,893	1,387	1,212	Netherlands 105; Guyana 59.
Sulfur:					
Elemental:					
Crude including native and byproduct		—	8	8	
Colloidal, precipitated, sublimed		38	30	29	Netherlands 1.
Sulfuric acid		4,919	5,522	15	Italy 4,956; Jamaica 281; Netherlands 21.
Talc, steatite, soapstone, pyrophyllite		77,895	629	445	Norway 162; United Kingdom 19.
Other:					
Crude		2,530	2,344	2,338	Germany 3; United Kingdom 1.
Slag and dross, not metal-bearing		97	102	101	Netherlands 1.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		32	20	20	
Carbon black		749	684	55	Venezuela 624; United Kingdom 4.
Coal:					
Anthracite		402	1,091	1,067	Canada 24.
Bituminous		—	10	—	All from United Kingdom.
Briquets of anthracite and bituminous coal		—	1	—	All from Netherlands.
Coke and semicoke		123	250	225	Venezuela 20; United Kingdom 5.
Peat including briquets and litter		15,231	74	6	Canada 68.
Petroleum:					
Crude	thousand 42-gallon barrels	5,148	10,970	(2)	Venezuela 10,360; Zaire 307; Suriname 303.
Refinery products:					
Liquefied petroleum gas	42-gallon barrels	35	143,318	42,259	Netherlands Antilles 80,956; Nigeria 20,010.
Gasoline	do.	—	11,058	10,455	Netherlands Antilles 595.
Mineral jelly and wax	do.	4,494	5,304	1,905	United Kingdom 740; China 693.
Kerosene and jet fuel	do.	7,084	287	155	Germany 132.
Distillate fuel oil	do.	369,420	405,279	252,618	U.S.S.R. 119,077; Netherlands Antilles 33,577.

See footnotes at end of table.

TABLE 3—Continued

TRINIDAD AND TOBAGO: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued:					
Petroleum—Continued:					
Refinery products—Continued:					
Lubricants	42 gallon barrels	419,573	102,592	8,288	Venezuela 81,935; Jamaica 10,388.
Residual fuel oil	do.	108,252	359,787	359,780	Germany 7.
Bitumen and other residues	do.	61	12	(2)	Mainly from Netherlands.
Bituminous mixtures	do.	5,151	351	133	United Kingdom 188; Canada 30.
Petroleum coke	do.	1,870	456	456	

NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]As a result of changes in trade code classifications, data for 1990 and 1991 are not completely comparable.
[4]Includes zinc dust, flakes, and powders.
[5]Reported under SITC item number as "selenium, tellurium, phosphorus, arsenic, etc."
[6]Includes fluorine and iodine.

TABLE 4

TRINIDAD AND TOBAGO: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(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.
Do.	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	Amoco Trinidad Oil Co. Ltd. (Amoco International Oil Co. Ltd., 100%)	Poui, Samaan, Teak, and Cassia fields, offshore, east of Guayaguayare	95,000.[2]
Do.	Trinidad and Tobago Oil Co. Ltd. (Government, 100%)	Point Fortin, Ortoire, Penal Forest fields, offshore, east of Guayaguayare	20,000.[2]
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.[2]
Do.	Trinidad and Tobago Petroleum Co. Ltd. (Government, 100%)	Soldado field, onshore; Galeota field, offshore (exported)	24,000.[2]
Products	Trinidad and Tobago Oil Co. Ltd. (Government, 100%)	Point Fortin, St. Patrick Co.	80,000.[2]
Do.	do.	Pointe-a-Pierre, Victoria Co.	220,000.[2]

[1]Capacity based on 340-day operation year.
[2]Barrels per day.

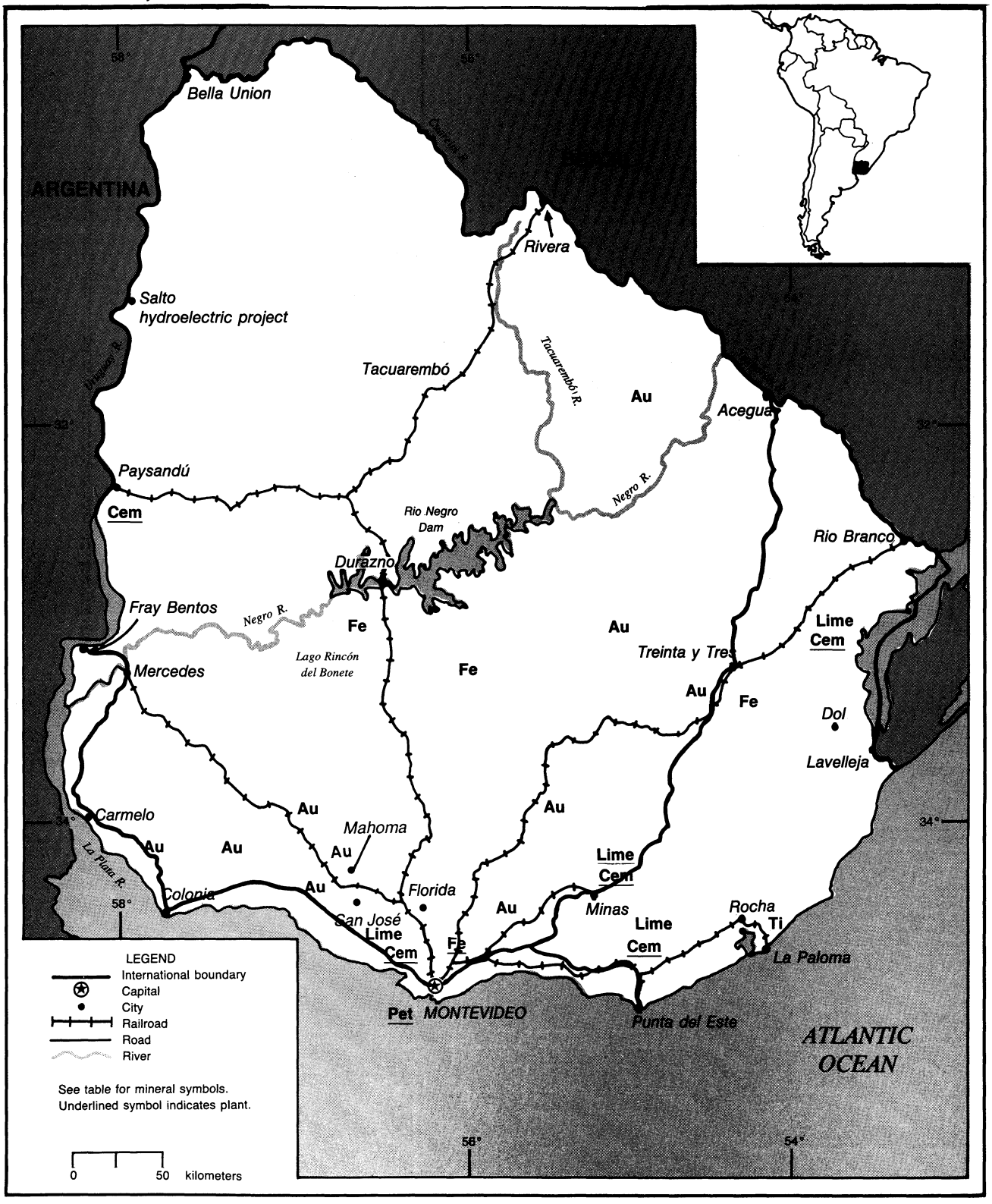
TABLE 5

MAJOR OILFIELDS AND GASFIELDS OF TRINIDAD

Major oilfields	Location
Barrackpore	Onshore, south-central
Columbus Basin	Offshore, south coast
Coora	Onshore, southwest
Couva	Offshore, northwest of Pt. Lisas
Forrest	Onshore, southwest
Fyzabad	Do.
Guapo	Onshore, northwest coast
Immortelle (formerly Galeota)	Offshore, southeast coast
Moruga East	Onshore, southeast coast
Palo Seco	Onshore, southwest coast
Poui	Offshore, southeast coast
Samaan	Offshore, east-central coast
San Francique	Onshore, southwest
Soldado	Offshore, northwest coast
Teak	Offshore, southeast coast
Major gasfields	**Location**
Cassia	Offshore, southeast coast
Flamboyant (formerly West-East Queen's Beach)	Do.
Immortelle (formerly Galeota)	Offshore, southeast coast
Orchid	Offshore, north-central coast
Pointsettia	Offshore, northwest
Teak	Offshore, southeast coast

URUGUAY

AREA 176,000 km² **POPULATION 3.1 million**



THE MINERAL INDUSTRY OF

URUGUAY

By Alfredo C. Gurmendi

Uruguay has a very stable market economy, which is largely agrarian with limited mineral reserves. Its mineral industry made a negligible contribution to the economy, 0.5% of GDP, in 1992. Mineral production for domestic consumption and exports was generally confined to industrial minerals; however, the Mahoma Project was operating since October 1992 at an initial annual production rate of 1,250 kg of gold from a number of high-grade open pits. Uruguayan marble is considered to be of excellent quality. Uruguay has no known oilfields and continued to be heavily dependent on imported crude oil and certain petroleum products. Natural gas reserves remained uneconomical, and coal was of poor quality. The GDP grew by 5% to $9.5 billion,[1] while the rate of inflation was 57% by yearend, which represented a considerable improvement over that of 1991 when it was 81%. This reduction was achieved by large tax increases. The foreign debt decreased to $5.2 billion, unemployment reached 8.4%, 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. Uruguay attracted more than $300 million of new mineral investment in 1992. It was expected that the country would follow the lead of other Latin American nations and begin selling its state-owned enterprises to private local and foreign investors. However, in December 1992, in a national referendum, which also became a plebiscite on the Government, the country voted 72% to 28% against selling the state telephone company, Administration Nacional de Teléfonos. The current administration is likely to lose the 1994 elections to those who championed the antiprivatization policy.

GOVERNMENT POLICIES AND PROGRAMS

The Uruguayan Congress approved the sale of public utilities in 1992. Monetary and exchange rate policy changes were aimed at curbing inflation. The Government appeared to have a tighter grip on public spending. Economic growth recovered somewhat in 1992. An important event for Uruguay on March 26, 1991, was the signing of the Treaty of Asunción, Paraguay, creating the Southern Cone Common Market (MERCOSUR), which would establish a common market by the end of 1994 and bring economic and commercial benefits to the country 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 Government has plans to regulate the "right to strike" and to provide for a secret ballot in union elections.

The growth of the services sector was based largely on the strength of Uruguay as a regional financial center and its serving as a capital refuge for Argentinean and Brazilian investors, who were lured by the free-floating exchange rate, absence of capital controls, and traditional banking secrecy.

The impressive response to the Government's recent offer of debt equity indicated that private investment was recovering, though public investment remained low because of budgetary reasons. Uruguay continued to maintain its liberal import policy and unrestricted foreign exchange market. Uruguay's market share of U.S. exports has excellent opportunities to increase in the 1990's. In 1992, the United States maintained its third place among exporters to Uruguay.

The Export-Import Bank offers a full range of financing and credit insurance programs for exports to the Uruguayan market. The Trade Development Program offers financing grants for major project prefeasibility studies to enhance the competitiveness of U.S. bidders in the Uruguayan mineral industry. Uruguay received loans from the World Bank, the Inter-American Development Bank, and other multilateral institutions for major energy, agricultural services, and mining industries.

The 1972 Mining Code is very workable. Exploration and mining agreements are: prospecting permit is for up to 1,000 km^2 and 2 years' term; exploration permit is for up to 10 km^2 and 2 years' term; mining concession is for a maximum of 5 km^2 and up to 30 years' term. There is real Government interest in foreign investment by making tax exemptions during the construction or investment phases. Major commitments have recently been made in forestation, tourism, new hotels, and mining, particularly gold, in addition to the more traditional agricultural and dairy sectors. The Uruguayan Government encourages foreign investment through its Foreign Investment Act and the Industrial Promotion Act of 1974. 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 profit repatriation. Recent debt-equity swaps amounted to $400 million. A growing number of companies took advantage of Uruguay's liberal foreign investment policies, resulting in increased mineral exploration activities.

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. The mining companies that took advantage of this investment climate and decree were 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 S.A. It was expected that more companies would follow, and no changes of this climate could be foreseen for future investments.

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 in October 1992 at an initial production rate of 1,250 kg/a. Expansion plans would double gold production in early 1994. About 19,000 mt/a of dolomite was mined during the past 4 years for use in the glass and construction industries, for steel, and in refractories. Limestone was produced at about the same level of the previous year, 750,000 mt/a, 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

During 1992, Uruguay's total exports and imports were $1.7 billion and $1.85 billion, respectively. The country exported clays, gravel, limestone, precious stones, and sands valued at $12 million. Imports of crude oil, lubricants, and petroleum products were estimated at $280 million. ANCAP imported crude oil and refined petroleum from Argentina, Brazil, Colombia, Iran, Mexico, and Nigeria. ANCAP and Petro-Canada renewed efforts to explore Uruguay's outer continental shelf and were reprocessing seismic data from previous exploration activities.

Imports from the United States amounted to $103 million. 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 Instituto Nacional de Minería y Geología 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 BIG, and Steel S.A., a subsidiary of Brazil's Mineração e Participacoe, were planning to invest $36 million in precious-metal and other metal exploration. American Resource Corporation (ARC) of Greenbrae, California, developed an initial 1,250-kg/a gold mine at Mahoma, 130 km from Montevideo. Two gold refineries with production of 4 kg/d and 5 kg/d of gold each started operations at the beginning of 1991. 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.

ANCAP operated its cement plants at more than 90% capacity. Uruguay continued its dependency on imports of petroleum and natural gas. During 1992, 80% of its fuel energy requirements was refined by ANCAP at its Teja plant in Montevideo. Minas de Talco Narancio S.A. produced talc in Colonia and Lavalleja Departments for use in the paper industry and in ceramics, cosmetics, pharmaceuticals, and insecticides. Industria Nacional Laminadora S.A. produced 18,000 tons of rolled steel products at its plant near Montevideo, Montevideo Department. *(See table 4.)*

COMMODITY REVIEW

Metals

Uruguay has provided ARC with exclusive rights to explore and develop Mahoma gold leases in San José Department. Operations began in October 1992 with a series of high-grade open pits. The gold ore 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. of Salt Lake City, Utah, continued exploration at its San Juan Hills gold leases in the San José area of San José Department. Big Pony Gold Inc. of Salt Lake City, Utah, 50% owned by Gold Standard, continued exploration over a large tract of Archaen greenstone, locating several gold occurrences. Big Pony's subsidiary, Tormin S.A., continued exploring encouraging 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 is noted for the excellent quality of its marble, mined in Lavalleja, 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 Lavalleja, 250 km east of Montevideo. About 19,000 mt/a of dolomite was mined in Lavalleja and Maldonado Departments for use in construction, glass, the steel industry, and refractories. ANCAP produced limestone in Cerro Largo, Lavalleja, Maldonado, and Paysandú Departments. Titanium-bearing sands suitable for the extraction of ilmenite and monazite were surveyed, and a feasibility study continued in the Rocha Department. Corundum was produced for natural abrasive applications, although demand in the optical lens grinding field continued to be limited.

Mineral Fuels

Exploration did not delineate any oilfields of economic value in 1992. Natural gas reserves remained unquantified, and coal continued to be of poor quality. Recently, ANCAP and Petro-Canada renewed efforts to explore Uruguay's outer continental shelf. In an effort to reduce its heavy dependence on crude oil imports, Uruguay maintained a well-developed hydroelectric power system and has the potential for alternative energy sources from small uranium deposits. ANCAP has also 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, containing an estimated 330,000 tons of ore grading 8.9 g of gold per ton. Uruguay has two iron ore deposits; each has proven reserves of 45 Mmt of 40% iron located 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

Mineral production, including mineral fuels, is transported primarily by the road and rail systems. In 1992, 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 1992, total installed electric power capacity was about 1,700 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

The country encourages free market policies to reactivate its economy in addition to policies of gradual reduction in import tariffs and private investment with foreign participation.

Uruguay has no known gasfields or oilfields and only poor-quality coal. Most of the country's energy requirements will be supplied by hydroelectric plants; however, potential alternative energy resources could be provided by small uranium deposits for nuclear power and biogas generation using garbage. Unless exploration reveals significant exploitable mineral deposits or hydrocarbons, Uruguay's mineral sector is expected to remain of minor importance to the economy.

The gold mining industry is projected to be highly profitable, even at the current depressed gold price. Investors have excellent opportunities to enter this sector through expansion at existing projects and prospects; within 2 years gold production could be doubled to 2,500 kg/a.

In Uruguay, 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.

As most other Latin American countries embrace a new economic order that involves free markets, inflation control, and balanced budgets, Uruguay is slowly moving in that direction. The country eventually will see that change is inevitable.

[1]Where necessary, values have been converted from Uruguayan New Pesos (N$) to U.S. dollars at the average market rate of N$3,470=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.
Siderurgia Latinoamericana, monthly.
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.

TABLE 1

URUGUAY: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992e
Aluminum, secondary e		2 65	42	42	42	42
Barite		15	15	e15	e15	15
Cement, hydraulic		434,000	560,000	e500,000	e500,000	500,000
Clays, unspecified e		2 130,170	150,000	150,000	150,000	150,000
Coke, gashouse e		8,000	8,000	8,000	8,000	8,000
Corundum e		2 45	45	45	45	45
Feldspar		2,787	2,680	e3,000	e3,000	3,000
Gemstones, semiprecious: e						
Agate		2 142	90	100	100	100
Amethyst		2 79	20	80	80	80
Gold	kilograms	—	—	—	—	300
Gypsum e		2 145,105	145,000	145,000	145,000	145,000
Iron and steel:						
Iron ore		2,545	5,000	e5,000	e5,000	5,000
Metal:						
Ferroalloys: Electric-furnace ferrosilicon crust e		250	250	250	250	250
Steel, crude		29,971	37,150	r38,000	r44,000	2 53,000
Semimanufactures e		2 18,000	18,000	18,000	18,000	18,000
Lime e		10,000	2 12,000	12,000	12,000	12,000
Petroleum refinery products: e						
Liquefied petroleum gas	thousand 42-gallon barrels	600	600	2 698	700	700
Gasoline	do.	1,550	1,550	2 1,849	1,850	1,850
Jet fuel	do.	300	300	2 201	200	200
Kerosene	do.	500	500	2 409	410	410
Distillate fuel oil	do.	3,300	3,300	2 2,963	2,970	2,970
Lubricants	do.	60	60	2 60	60	60
Residual fuel oil	do.	2,500	2,500	2 2,573	2,580	2,580
Unspecified	do.	800	800	2 501	500	500
Refinery fuel and losses	do.	20	20	2 29	30	30
Total	do.	9,630	9,630	2 9,283	9,300	9,300
Sand and gravel: e						
Sand, common	thousand metric tons	2 1,240	1,500	1,500	1,500	1,500
Gravel	do.	500	500	500	500	500
Stone: e						
Dimension		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
Dolomite		2 18,990	19,000	19,000	19,000	19,000
Limestone		2 749,636	750,000	750,000	750,000	750,000
Marble		2 2,557	4,000	4,000	4,000	4,000
Marl		7,000	7,000	7,000	7,000	7,000
Quartz		2 279	300	300	300	300
Other, including ballast	thousand metric tons	2,000	2,000	2,000	2,000	2,000
Sulfur, elemental, byproduct e		2,000	2,000	2,000	2,000	2,000
Talc, soapstone, pyrophyllite e		2 1,460	1,500	1,500	1,500	1,500
Tuff: Tufa e		3,500	3,500	3,500	3,500	3,500

e Estimated. r Revised.

[1] Includes data available through May 1993.

[2] Reported figure.

TABLE 2

URUGUAY: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1990	1991	Destinations, 1991	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	2	4	—	All to Paraguay.
Metal including alloys, semimanufactures	663	937	—	Brazil 560; Argentina 314; Peru 24.
Copper: Metal including alloys:				
Unwrought	282	1,019	—	All to Argentina.
Semimanufactures	33	3	—	Mainly to Germany.
Gold: Metal including alloys, unwrought and partly wrought kilograms	1,482	—		
Iron and steel:				
Iron ore and concentrate: Pyrite, roasted	—	17	—	All to Argentina.
Metal:				
Steel, primary forms	2	453	—	Argentina 434; unspecified 19.
Semimanufactures:				
Bars, rods, angles, shapes, sections	350	1,425	—	Argentina 1,419; unspecified 6.
Universals, plates, sheets	1,344	1,082	—	Brazil 866; Argentina 140; Bolivia 50.
Hoop and strip	382	587	—	All to Argentina.
Wire	930	2,205	—	Argentina 2,066; Brazil 110; Chile 29.
Tubes, pipes, fittings	2,484	4,075	—	Brazil 3,436; Argentina 639.
Castings and forgings, rough	2	10	1	Ecuador 5; Argentina 4.
Lead: Metal including alloys, scrap	1,100	—		
Platinum-group metals: Metals including alloys, unwrought and partly wrought value, thousands	$4	—		
Zinc: Oxides	328	420	—	Brazil 395; Argentina 25.
INDUSTRIAL MINERALS				
Cement	37,866	—		
Clays, crude	20	15	—	All to Brazil.
Diatomite and other infusorial earth	—	10	—	All to Argentina.
Fertilizer materials: Manufactured:				
Nitrogenous	—	146	—	Do.
Phosphatic	34,310	18,160	—	Brazil 17,160; Argentina 1,000.
Unspecified and mixed	21,897	12,879	—	Brazil 11,032; Paraguay 1,085; Argentina 706.
Precious and semiprecious stones other than diamond, natural value, thousands	$778	$711	$211	Germany $173; United Kingdom $67.
Sodium compounds, n.e.s.:				
Soda ash, manufactured	86	81	—	Argentina 50; Brazil 20; Paraguay 11.
Sulfate, manufactured	7,650	8,089	—	Argentina 3,783; Brazil 2,455; Venezuela 724.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	14,166	12,029	39	Japan 7,743; Argentina 1,075; Republic of Korea 937.
Worked	1,189	688	50	Argentina 283; Netherlands 108; Italy 100.
Sand other than metal-bearing	97,350	98,980	—	All to Argentina.

See footnote at end of table.

TABLE 2—Continued

URUGUAY: EXPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Destinations, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Sulfur:					
Elemental: Crude including native and byproduct		—	188	—	All to Paraguay.
Sulfuric acid		4,613	2,297	—	Argentina 2,044; Brazil 253.
Talc, steatite, soapstone, pyrophyllite		20	75	—	All to Argentina.
Other:					
Crude		—	28	—	All to Brazil.
Slag and dross, not metal-bearing		187	142	—	Do.
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Gasoline	42-gallon barrels	272	416	—	Finland 178; Brazil 170; Norway 42.
Lubricants	do.	1,708	2,625	—	Brazil 1,806; Ecuador 259; Argentina 189.
Bituminous mixtures	do.	—	48	—	All to Paraguay.

[1]Table prepared by H. D. Willis.

TABLE 3

URUGUAY: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	1990	1991	Sources, 1991	
			United States	Other (principal)
METALS				
Aluminum:				
Oxides and hydroxides	1,335	1,252	12	Brazil 1,124; Germany 99; United Kingdom 15.
Metal including alloys:				
Scrap	2,090	1,899	—	Argentina 1,827; Brazil 70; United Kingdom 2.
Semimanufactures	681	494	2	Brazil 285; Argentina 176; France 13.
Chromium: Oxides and hydroxides	17	16	—	Germany 12; Argentina 4.
Cobalt: Oxides and hydroxides	2	1	—	Mainly from Germany.
Copper: Metal including alloys:				
Unwrought	2	3	—	All from Argentina.
Semimanufactures	1,934	2,149	6	Chile 1,428; Brazil 400; Peru 122.
Gold: Metal including alloys, unwrought and partly wrought kilograms	—	5	NA	NA.
Iron and steel:				
Iron ore and concentrate: Pyrite, roasted	3,919	8,543	—	Brazil 8,451; Argentina 92.
Metal:				
Scrap	4,463	1,823	—	Paraguay 1,478; Panama 188; Cyprus 86.
Pig iron, cast iron, related materials	349	303	3	Paraguay 200; Italy 63; Brazil 24.
Ferroalloys, unspecified	632	544	—	Brazil 457; Argentina 77; United Kingdom 9.
Steel, primary forms	7,583	8,521	36	Argentina 3,741; Brazil 3,679; Republic of South Africa 646.
Semimanufactures:				
Bars, rods, angles, shapes, sections	11,444	12,715	2	Brazil 7,316; Argentina 3,274; Republic of South Africa 1,436.
Universals, plates, sheets	49,300	47,193	21	Brazil 31,222; Argentina 12,317; Chile 1,462.
Hoop and strip	1,512	1,722	205	Brazil 1,150; Germany 244.
Wire	1,149	2,068	2	Brazil 1,546; Argentina 453; Republic of South Africa 40.
Tubes, pipes, fittings	1,849	1,518	4	Brazil 903; Argentina 423; Republic of South Africa 112.
Castings and forgings, rough	515	410	23	Brazil 186; Argentina 93; Spain 57.
Lead:				
Oxides	121	76	—	Mexico 49; Argentina 27.
Metal including alloys:				
Scrap	856	962	—	Mexico 672; Argentina 250; Brazil 40.
Semimanufactures	2	8	—	Argentina 6; Netherlands 2.
Magnesium: Metal including alloys:				
Scrap	4	—		
Semimanufactures	10	11	4	Italy 7.
Manganese: Oxides	9	14	14	
Mercury value, thousands	$47	$7	$3	Germany $2; Japan $1.
Molybdenum: Metal including alloys, unwrought including waste and scrap do.	$12	$23	$8	United Kingdom $8; Netherlands $7.
Nickel:				
Matte and speiss	6	28	—	All from Canada.
Metal including alloys, semimanufactures	14	8	4	Austria 1; Canada 1.

See footnotes at end of table.

TABLE 3—Continued

URUGUAY: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
METALS—Continued					
Platinum-group metals: Metals including alloys, unwrought and partly wrought, unspecified	value, thousands	$12	$11	—	All from Germany.
Silver: Metal including alloys, unwrought and partly wrought	do.	$8	$13	$3	Chile $4; Netherlands $2.
Tin: Metal including alloys:					
Unwrought		14	17	—	Mainly from Brazil.
Semimanufactures		1	1	—	All from Brazil.
Titanium: Oxides		19	10	(e)	Mainly from United Kingdom.
Tungsten: Metal including alloys, unwrought including waste and scrap	value, thousands	$16	$9	$1	Austria $6; Republic of South Africa $2.
Uranium and thorium:					
Oxides and other compounds		(e)	—		
Metal including alloys, all forms	value, thousands	$289	$45	—	Mexico $21; Netherlands $9; Sweden $6.
Zinc:					
Oxides		50	26	10	Argentina 12; France 4.
Metal including alloys:					
Unwrought		1,455	1,689	—	Mexico 1,361; Argentina 276; Peru 40.
Semimanufactures		41	31	1	Argentina 10; Mexico 7; Netherlands 7.
Other:					
Oxides and hydroxides		33	26	10	Italy 6; Argentina 5.
Ashes and residues		285	148	20	Chile 66; Mexico 44.
INDUSTRIAL MINERALS					
Abrasives, n.e.s.:					
Natural: Corundum, emery, pumice, etc.		913	954	8	Argentina 940; Netherlands 6.
Grinding and polishing wheels and stones		187	185	3	Brazil 43; Italy 32; Germany 21.
Asbestos, crude		1,794	853	3	Brazil 713; Canada 59; Zimbabwe 30.
Barite and witherite		25	37	—	Argentina 22; Brazil 15.
Boron materials:					
Crude natural borates		641	738	—	Chile 500; Argentina 238.
Oxides and acids		231	293	3	Argentina 290.
Cement		100	133	28	France 65; Argentina 40.
Chalk		14	19	—	Brazil 13; France 6.
Clays, crude		8,139	5,724	520	Brazil 3,376; Argentina 1,827.
Diatomite and other infusorial earth		195	100	6	Mexico 83; Chile 10.
Feldspar, fluorspar, related materials		120	266	—	Argentina 260; United Kingdom 6.
Fertilizer materials:					
Crude, n.e.s.		6	81	—	All from Chile.
Manufactured:					
Ammonia		359	396	—	Brazil 240; Argentina 156.
Nitrogenous		53,517	36,201	10,837	Brazil 10,828; Belgium-Luxembourg 7,259.
Phosphatic		25,647	15,321	13,085	Tunisia 1,936; Brazil 300.
Potassic		12,936	6,262	—	Germany 5,205; Brazil 1,057.
Unspecified and mixed		55,035	52,734	30,370	Brazil 18,196; Tunisia 2,947.

See footnotes at end of table.

TABLE 3—Continued

URUGUAY: IMPORTS OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1990	1991	Sources, 1991	
				United States	Other (principal)
INDUSTRIAL MINERALS—Continued					
Graphite, natural		27	25	—	Peru 18; Germany 7.
Gypsum, plaster, and calcareous stone		1,474	1,859	—	Argentina 1,196; Germany 663.
Magnesium compounds: Magnesite, crude		51	38	(2)	Germany 16; Brazil 10; France 6.
Mica:					
Crude including splitting and waste		45	56	7	Brazil 49.
Worked including agglomerated splittings		3	1	(2)	Mainly from Spain.
Phosphates, crude		56,236	31,746	—	Panama 21,500; Tunisia 7,246; Brazil 3,000.
Pigments, mineral: Iron oxides and hydroxides, processed		150	199	2	Argentina 126; Germany 56; Brazil 13.
Precious and semiprecious stones other than diamond:					
Natural	value, thousands	$21	$9	$8	Brazil $1.
Synthetic	do.	$25	$9	$3	Switzerland $6.
Salt and brine		67,816	116,169	17	Chile 97,967; Argentina 11,474; Brazil 6,503.
Sodium compounds, n.e.s.:					
Soda ash, manufactured		16,649	12,125	1,910	Spain 4,568; Poland 2,740.
Sulfate, manufactured		2,776	2,746	4	Spain 1,934; Argentina 235; Mexico 224.
Stone, sand and gravel:					
Dimension stone:					
Crude and partly worked		2,042	2,362	—	Brazil 1,391; Argentina 933; Italy 38.
Worked		248	499	—	Argentina 195; Spain 130; Brazil 109.
Dolomite, chiefly refractory-grade		146	16	—	All from Argentina.
Quartz and quartzite		215	80	—	Do.
Sand other than metal-bearing		1	65	(2)	Mainly from Spain.
Sulfur:					
Elemental:					
Crude including native and byproduct		14,000	13,728	13,723	Spain 5.
Colloidal, precipitated, sublimed		2	12	2	Argentina 10.
Sulfuric acid		1	1	—	Mainly from Argentina.
Talc, steatite, soapstone, pyrophyllite		11	139	3	Brazil 117; China 10; Germany 5.
Other:					
Crude		776	699	50	Brazil 240; Republic of South Africa 200; United Kingdom 125.
Slag and dross, not metal-bearing		—	3,776	—	Paraguay 3,773; Argentina 3.
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural		29	—		
Carbon: Carbon black		2,975	2,119	21	Argentina 1,925; Brazil 151.
Coal: Anthracite		247	429	—	All from Argentina.
Coke and semicoke		111	44	—	Do.
Peat including briquets and litter		36	16	—	Do.
Petroleum:					
Crude	thousand 42-gallon barrels	8,864	7,875	—	Iran 3,074; Nigeria 1,812; Venezuela 1,043.
Refinery products:					
Liquefied petroleum gas	do.	(2)	139	—	All from Argentina.
Gasoline	do.	2,013	623	27	Argentina 536; Venezuela 49.

See footnotes at end of table.

TABLE 3—Continued

URUGUAY: 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					
Petroleum—Continued:					
Refinery products—Continued:					
Mineral jelly and wax	thousand 42-gallon barrels	6	5	[2]	Argentina 2; Brazil 2; Germany 1.
Lubricants	do.	8	9	1	Germany 6.
Bitumen and other residues	do.	—	[2]	[2]	
Bituminous mixtures	do.	[2]	[2]	—	All from Brazil.
Petroleum coke	do.	31	17	—	All from Argentina.

NA Not available.
[1]Table prepared by H. D. Willis.
[2]Less than 1/2 unit.
[3]Revised to zero. Reclassified as "Metal including alloys, all forms."

TABLE 4

URUGUAY: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

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. Ltd. (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. (Government, 43%; private, 57%)	Pandos 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 20.7 million**

THE MINERAL INDUSTRY OF

VENEZUELA

By David B. Doan

Petroleum production has dominated the Venezuelan mineral industry, and 1992 was no exception to the trend. 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. In spite of this softness in the petroleum sector, owing primarily to weak market prices, the real engines of economic growth were commerce, up 29%; construction, up 21%; and manufacturing, up 14%, compared with the previous year. All were controlled by the private sector.

The nation survived coup attempts in February and November of 1992. Despite related fiscal crises and immediate capital flight in each instance, much or most of the capital returned as economic growth overtook fear.

By the end of 1992, political unrest still had not abated. The gross domestic product (GDP) climbed about 7% from the year before to a new high estimated at about $57.3 billion.[1] The real growth rate was still probably the highest in the hemisphere, rivaled only by certain Southeast Asian countries. Inflation was a factor to be reckoned with, however, amounting to about 34% for the year. Although petroleum industry revenues accounted for approximately 23% of the nation's GDP, the nonfuel mining sector's estimated contribution was only about 1% in 1991 and probably less than twice that in 1992.

The newly evolving legal machinery for accommodating much-desired investment, particularly foreign investment in Venezuela's petroleum industry, had been unattractive because of excessive taxation and alleged lack of enforcement of private contracts, giving rise to wariness on the part of some potential sources. However, in addition to the recent passage of more moderate tax laws, there was reason to hope that the problems were understood in political circles and would receive increased attention.

GOVERNMENT POLICIES AND PROGRAMS

Efforts continued to shift Venezuela's economy from Government control to one operated by free market forces. Income tax law reform included lowering of the rate for corporations from 60% to 30%. This included those firms engaged in mining "... and certain joint venture hydrocarbon activities." The exploitation tax was reduced from 6% to 2%, and foreign-made equipment was allowed to enter the country duty free. The new law went into effect in September of the previous year, and it was hoped that it would work to expand the mining and hydrocarbon sectors. Economic contracts, however, have been subject to frequent intervention by the Government in the areas of prices and wages, vitiating to some extent the reforms in taxation.

The new tax laws left PDVSA, however, in somewhat different straits. 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.

Although the Government sought international tenders covering operations for production enhancement at 55 marginal old oilfields, believed to hold altogether not more than 350 Mbbl, the offer suffered from a lack of any clearly defined legal or fiscal terms. Near the end of the year negotiations were under way on only 9 of the 55 fields after submittals by Shell, Teikoku (Japan), Benton Oil and Gas (United States), and Vincler, a private-sector Venezuelan company. Shell, in particular, stood fast on its insistence, an axiom of its foreign investment policy, that any disputes be solved by international arbitration. Such action was unconstitutional in Venezuela, but if the country did not alter this prohibition it was questionable that any foreign investor would put large sums of money into the development of high-risk reserves such as heavy crude or bitumen.

In other matters involving the mineral sector, the new mining law itself, aside from reforms in overall taxation, seemed somewhat complex in terms of claims, concessions, and prospecting permits. Prospecting required statements as to the minerals prospected for, schedules, quarterly reports, and a final report with appendixes. Prior rights played a role: anyone who discovered a mineral on lands for which no exclusive permit was in effect, and who did not apply for a concession, was entitled for a period of 10 years to 1% of the value of any mineral extracted under a concession within a radius of 500 m from the exact point of excavation (discovery).

Upon expiration of a concession for any reason, all lands, works, physical improvements, machinery, tools,

supplies, and equipment were to be transferred to the Government free of taxes or charges.

PRODUCTION

The value of mineral production in 1992 increased by 58% measured in Venezuelan bolivars, but with an inflation estimated at 34% during the year, the increase in dollars was somewhere in the 25% range. 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 79% greater than in 1991, led the list of metals in terms of increased production during the year. Output of direct-reduced iron, ferroalloys, crude steel, and hot-rolled steel was up slightly in each case compared with that of 1991. Bauxite production decreased 42% from that of 1991. Output of alumina, aluminum, and iron ore was down slightly in each instance compared with the previous year.

Among the industrial minerals, production of diamond climbed sharply. Gem-quality diamond output increased almost 200% and industrial diamond yield by 58%, compared with that of the previous year. Production rose for cement, feldspar, sand and gravel, and silica sand. Output declined for amphibolite, common clay, gypsum, kaolin, industrial nitrogen, phosphate rock, salt, and stone.

Production of coal, natural gas, and petroleum crude grew moderately compared with 1991. Output of refinery products was estimated to have been down slightly compared with that of the previous year.

Because the mining sector has customarily played a minor role in the Venezuelan economy, particularly in comparison with the petroleum industry, the Government has been encouraging increased mining activity. 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 was described by various press observers as being in the midst of a difficult transition from a closed (economic) system to an open, export-oriented economy. In June, Venezuela signed an export-restraint agreement with Mexico having the aim of avoiding suits by third countries that would allege dumping of steel, especially flat products, by overconcentrating exports from the two countries. In September, the Central American and Venezuelan economy ministers signed a free trade agreement under which 312 products could be exported to Venezuela duty free. In October, the Government of Venezuela concluded an agreement with Peru to remove tariffs between the two countries. The Peruvian Government announced that the purpose of the agreement was to prevent exporters from suffering from the Government's decision to interrupt its liberalization under the Andean Pact. Also in October, a trade pact was signed between Venezuela and Trinidad and Tobago to allow more of each other's products market access at reduced tariffs. At the same time, the two nations agreed to begin a petroleum exploration study of border areas between the two nations.

In December, Venezuela's 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.

Venezuela's principal export was petroleum crude, and its biggest customer was the United States. At least 91% of U.S. imports from Venezuela consisted of fuels and raw materials, including about 310 Mbbl of petroleum crude in 1991 compared with 280 Mbbl sold to the United States in 1990. Venezuela was followed by Mexico in terms of volume of crude supplied by Latin American countries.

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 of precious and semiprecious stone dusts and powders was also marketed abroad.

STRUCTURE OF THE MINERAL INDUSTRY

Historically, the major mineral producers have been essentially State-owned, but beginning in 1989 the Government worked to privatize Venezuela's mineral industry, which comprised 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.—Although production of alumina was up slightly in 1992 compared with that of the previous year, output of the parent material, bauxite, as well as that of metallic aluminum, was

significantly lower for both 1991. That year, however, marked a historical high in production of both than in aluminum and, especially, bauxite.

The aluminum industry in Venezuela suffered, in various ways, the price consequences of aluminum dumping on world markets by the former Soviet Union. After completing a U.S. $350 million expansion that increased its capacity from 1.3 Mmt/a to 2 Mmt/a, Interamericana de Alumina C.A. (Interalumina), the country's only alumina producer, operated way below capacity in 1992, processing bauxite from the Los Pijiguaos Mine. C.V.G. Bauxita Venezolana C.A. (Bauxiven), the only bauxite mining company operating at Los Pijiguaos, had projected that bauxite output would increase to the 3.5- to 4.0-Mmt/a level by mid-1992 when the main crusher and new ore transportation and storage systems were operational, but instead production settled at slightly more than 1 Mmt. Through 1991 Bauxiven had invested about U.S. $85 million on upgrading mine facilities. Nonetheless, Bauxiven aimed for output capacity of 6 Mmt/a in 1993 and ultimately 8 Mmt/a.

Interalumina itself, however, was moving forward on setting up its third alumina production line, intended to be ready sometime during 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 Industria Venezolana de Aluminio C.A. (Venalum), Venezuela's principal State-owned aluminum producer, announced that it had lost $82 million in 1992 because of the fall in world market prices for aluminum, attributed to dumping by the former Soviet Union. Officials of Venalum projected that the market still had to digest 500,000 tons of aluminum largely from the aforesaid dumping, but that the price could well advance after that. Venalum had reduced its production costs to $1,300 per ton, but this remained above the market price lows of approximately $1,100 per ton. Venalum's Japanese partners reportedly were forecasting that, with production cutbacks and a strong economic recovery in the United States, prices would reach $1,400 per ton. Other market observers were predicting a possible recovery to as much as $1,400 per ton by 1994, but the source of this optimism was not clear. All in all, the Venezuelan aluminum situation looked better in 1992 than in 1991, but there seemed to be no good information on how much more aluminum would be dumped, if any, by the former Soviet Union.

Gold.—Venezuela's 1992 gold output, 7,553 kg, was up smartly compared with the 4,215 kg produced in 1991 and almost equal to the alltime high of 7,700 kg recovered in 1990. Data represented only reported production and did not include output by unlicensed miners. An industry spokesperson blamed the 1991 decline on "... a change to more environmentally friendly gold mining techniques." During the years 1988 to 1990, Venezuela's gold production had grown at a rate of 2%, then 10%, and finally 99% before the slump in 1991. Although it was beyond dispute that environmental measures have been enforced in many areas, particularly with respect to mercury pollution resulting from its use in gold recovery, it was also true that policing reduced the activities of unlicensed miners.

Virtually all news of gold exploration and discovery during 1992 centered on the so-called Kilometre 88 district of southeastern Bolivar State in the Precambrian 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 for years by unlicensed miners including, but not limited to, illegal immigrants (garimpeiros) mostly from Brazil, all of whom were thought to have removed more than 62,000 kg 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 were resolved by expert Venezuelan legal advice. The geology is very similar to that of the greenstone belts of the Canadian Shield.

Increased attention was attracted by Placer Dome's apparent major discovery at Las Cristinas, and concessions have been established virtually throughout an area of roughly 30 km by 45 km. 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.

Iron Ore.—Production of iron ore dropped about 15%, retreating to the 18-Mmt range from the 21-Mmt range in 1991. 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 for the previous 2 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 pelletizing facilities to expand 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.

Steel.—C.V.G. Siderurgica del Orinoco C.A. (Sidor) would be at least partly privatized according to Venezuela's President Carlos Andres Perez' remarks late in the year at the Latin American Iron and Steel Congress. He said that the private sector would take over services to, and management of, the 3-Mmt/a producer of raw steel. Services to be privatized included oxygen, gas, and infrastructure supply.

Soon after, 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 Istituzione Per La Ricostruzione Industriale (IRI), which also owns the airline, Alitalia. 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.

Along with several other countries, Venezuela was accused in midyear of dumping ferrosilicon in the United States. Although investigation by the International Trade Administration was continuing at the end of the year, 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 are relatively cheap owing to an abundance of local hydroelectric power and that all the raw materials required for FeSi production were found not far from the plant.

Nickel.—A nickel resource has been identified, in the Loma de Hierro laterite deposit in Miranda State, that includes an estimated 39 Mmt of material grading 1.55% Ni and 0.05% cobalt. Jordex Resources Inc., a Canadian company based in Vancouver, has formed an equal-equity joint venture with the Venezuelan company Grupo Federal, to be named Corporacion Federal de Minas. The venture has been doing development drilling in support of feasibility analysis of mining the deposit.

Industrial Minerals

Cement.—Output of hydraulic cement, at 6.585 Mmt, was up about 4% compared with the previous year. Demand for cement within Venezuela in 1992 climbed 17.6% over that for 1991, a reflection of the general vigor of construction.

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 was to the United States, or 2.5 Mmt 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. The basis for the suspension was an agreement by the Government of Venezuela to offset or eliminate completely all benefits provided by the Government that DOC had found to constitute bounties or grants on exports of cement and clinker to the United States.

Phosphate.—The South West Venezuela Regional Corp. signed an agreement with Cuba's Ministry of Basic Industry for joint exploitation of phosphate deposits in Venezuela using expertise said to have been developed in Cuba.

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 were mainly 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, at 2.88 Mmt, was up about 7% in 1992 compared with that of 1991 as Venezuela's coal industry continued to develop. Exports included 2.1 Mmt from PDVSA and smaller volumes from several other sources for a total approximating 2.5 Mmt in 1992.

In May it was announced that the United Kingdom-based Young Group PLC had tendered an option to the U.S. company Peabody Coal to buy Young's investment in Carbones Naricual SA (Carbonar) for $6.6 million. A smaller stake in Carbonar would cost $2 million for something on the order of 30% to 40%. Carbonar owned opencast mining concessions on about 4,454 ha in Venezuela producing high thermal value, low sulfur bituminous coal near the north coast about 250 km east of Caracas.

The Ministry of Mines had approved a long-term permit for the British Young Group PLC to expand the coal reserves of Carbonar. 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 43.425 billion m^3, with

about 9% of this having been utilized in the field and the remaining 91% marketed. Natural gas liquids output was estimated at 74.485 Mbbl of liquefied petroleum gas and 18.600 Mbbl of natural gasoline.

Almost all natural gas produced in Venezuela has been associated gas, and until recently all gas produced was reinjected, sold for power generation, used for feedstock (and power) in refineries, or consumed as petrochemical feedstock. 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 1992 amounted to slightly more than 865 Mbbl, a decrease of less than 1% compared with output the previous year. Revenues to PDVSA were $15.08 billion, of which $13.78 billion represented exports and the remainder, about $1.30 billion, came from domestic sales.

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 it must be noted that the 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. Moreover, the emulsion burns 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 many more agreements are being negotiated. PDVSA hoped that the 1996 requirement would be on the order of 40 Mmt.

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 Government officials, 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 308 airports, 287 of them in usable condition; 135 of them had paved runways. No runway exceeded 3,659 m in length; 14 had runways 2,440 to 3,659 m long; and 88 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. 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 midyear was expected to stimulate foreign investment in the hydrocarbon and other mineral industries, but it was clear that more than tax reform might be needed. Venezuela's legal requirements were blocking the very international investment the country hoped to attract. The rules for prospecting, claiming, and mining were so detailed, and potentially legally complex, that prospectors in Canada and the United States over the past 100 to 150 years would probably have turned to farming or ranching instead. 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 complication. Establishment of a single, uncomplicated, comprehensive mining law could stimulate activity in all sectors of the mineral industry of Venezuela.

This nation is endowed with natural resources that could make the country relatively wealthy provided political stability, technology, and infrastructure are encouraged to develop in such a way as to 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.

[1]Where necessary, values have been converted from Venezuelan bolivars (Bs) to U.S. dollars at the rate of Bs68.45=US$1.00, the average exchange rate for 1992.

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 (SPR429), 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		1988	1989	1990	1991	1992[p]
METALS						
Aluminum:						
Alumina	thousand tons	1,284	e1,350	1,293	1,295	1,308
Bauxite		521,504	701,770	771,422	1,992,348	1,052,052
Metal, primary, unalloyed		436,703	539,647	590,379	600,544	561,354
Gold, mine output, Au content	kilograms	3,502	3,867	7,700	4,215	7,553
Iron and steel:						
Iron ore and concentrate	thousand tons	18,932	18,390	20,365	21,241	18,050
Metal:						
Pig iron	do.	503	489	314	—	—
Direct-reduced iron	do.	2,710	2,773	3,085	r4,050	4,300
Total	do.	3,213	3,262	3,399	r4,050	4,300
Ferroalloys:						
Ferrosilicomanganese	do.	34	32	e29	e30	e31
Ferrosilicon[e,2]	do.	351	55	55	55	56
Total	do.	85	e87	84	85	87
Steel, crude	do.	3,165	2,941	3,176	3,119	3,200
Semimanufactures, hot-rolled	do.	2,994	2,734	2,335	2,609	2,880
Lead, secondary, smelter		10,000	13,000	14,000	r15,000	e15,000
INDUSTRIAL MINERALS						
Amphibolite	thousand tons	174	144	188	212	200
Cement, hydraulic	do.	6,199	4,510	5,230	6,337	6,585
Clays:						
Kaolin	do.	28	15	12	39	37
Other	do.	2,239	1,903	3,057	2,747	1,629
Diamond:						
Gem	carats	53,704	69,724	e85,000	102,034	302,000
Industrial	do.	74,701	184,846	e248,000	111,523	176,000
Total	do.	128,405	254,570	e333,000	213,557	478,000
Feldspar	thousand tons	97	97	91	138	169
Gypsum	do.	221	332	201	244	175
Nitrogen, N content of ammonia	do.	481	532	r557	r450	404
Phosphate rock	do.	e100	237	165	162	10
Pyrophyllite[e]	do.	32	32	32	32	32
Salt, evaporated		e500,000	365,000	439,400	430,000	317,700
Serpentinite, crushed[e]	thousand tons	580	550	550	550	550
Stone, sand and gravel:						
Stone:						
Dolomite	do.	313	383	300	e300	275
Granite	do.	353	440	262	370	47
Limestone	do.	16,775	15,371	12,563	11,440	14,266
Marble	do.	101	—	—	—	—
Sand and gravel	do.	7,305	5,789	5,332	4,608	4,944
Silica sand	do.	455	378	443	343	703
Sulfur, byproduct of petroleum and natural gas		e125,000	e125,000	105,760	82,855	e85,000
MINERAL FUELS AND RELATED MATERIALS						
Carbon black[e]	thousand tons	60	60	60	60	60

See footnotes at end of table.

TABLE 1—Continued

VENEZUELA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		1988	1989	1990	1991	1992[p]
MINERAL FUELS AND RELATED MATERIALS—Continued						
Coal, bituminous	thousand tons	1,072	2,113	2,190	2,700	2,880
Gas, natural:						
Gross	million cubic meters	e28,500	38,097	40,516	42,326	43,435
Marketed	do.	e12,750	e14,160	15,600	25,427	39,960
Natural gas liquids:[4]						
Natural gasoline	thousand 42-gallon barrels	7,290	7,380	e7,500	e8,190	18,600
Liquefied petroleum gas	do.	27,248	29,963	e30,044	e33,290	74,485
Total	do.	34,538	37,343	e37,544	e41,480	93,085
Petroleum:						
Crude[5]	do.	690,916	696,407	770,133	871,762	907,025
Refinery products:						
Liquefied petroleum gas	do.	3,650	3,650	2,920	e3,000	e3,500
Gasoline:						
Aviation[e]	do.	240	300	178	[3]350	300
Motor	do.	96,360	93,440	e122,111	115,227	e105,000
Naphtha[e]	do.	15,000	17,000	22,000	6,000	12,000
Jet fuel	do.	22,995	21,535	e24,000	28,058	e29,000
Kerosene	do.	2,920	2,190	2,325	803	e1,000
Distillate fuel oil	do.	94,170	84,680	99,934	106,952	e100,000
Lubricants	do.	2,920	2,920	e2,975	2,946	e2,950
Residual fuel oil	do.	105,850	100,000	e89,217	106,952	e105,000
Asphalt and bitumen	do.	e9,000	e9,000	12,120	9,037	e10,000
Refinery fuel gas[e]	do.	8,500	8,200	9,000	9,100	9,000
Unspecified[e]	do.	3,760	10,030	1,365	1,213	1,500
Total	do.	365,365	352,945	388,145	389,638	e379,250

[e]Estimated. [p]Preliminary. [r]Revised.

[1]Table includes data available through July 1, 1993.

[2]Figures represent combined 45% silicon content and 75% silicon content production.

[3]Reported figure.

[4]From nonassociated natural gas only.

[5]Includes associated natural gas lease condensate and natural gasoline. Lease condensate is included as follows, in thousand 42-gallon barrels: 1988—68,620; 1989—58,400; 1990—13,505; 1991—14,600; and 1992—not available. Natural gasoline is included as follows, in thousand 42-gallon barrels: 1988—35,770; 1989—39,420; 1990—41,610; 1991—not available; and 1992—not available.

TABLE 2

VENEZUELA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1992

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina	Interamericana de Alumina C.A. (Interalumina) (Government, 88.7%; Aluminio Suizo S.A., 11.3%)	Ciudad Guayana, Bolívar State	1,300
Aluminum	Aluminio del Caroni S.A. (Alcasa) (Government, 72%; Reynolds International, Inc., 27.9%)	do.	300
Do.	Industria Venezolana de Aluminio C.A. (Venalum) (Government, 80%; 6 Japanese companies, 20%)	do.	366
Bauxite	C.V.G. Bauxita Venezolana C.A. (Bauxiven)	Los Pijiguaos, Bolívar 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, Bolívar State	.9
Iron ore	Corporación Venezolana de Guyana (C.V.G.) Ferrominera del Orinoco C.A. (Government, 100%)	Cerro Bolívar, El Pao, Los Barrancos, and San Isidro Mines, Bolívar State	20,000
Petroleum (thousand 42-gallon barrels per day)	Petróleos de Venezuela S.A. (PDVSA) (Government, 100%)	Fields in Anzoatequi, Apara, Falcón, Guarico, Monagas, and Zulia States	1,822
Petroleum products (do.)	do.	Major refineries at Amuay Bay and Cardón, both in Falcón State	1,588
Steel	C.V.G. Siderúrgica del Orinoco C.A. (Sidor) (Government, 100%)	Ciudad Guayana, Bolívar State	4,300

[1]Established by Carbones 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)

Commodity		Reserves
Bauxite		300,000
Coal		10,200,000
Gold	metric tons	8,000
Iron ore		1,961,000
Natural gas	million cubic meters	3,582,000
Petroleum:		
Light and medium grades		60,000
Heavy and super-heavy grades		270,000

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	Ds
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
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
Salt	Salt
Sand and gravel	S/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
Yttrium	Y
Zinc	Zn
Zircon	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 significant resource

UNITS OF MEASURE AND ABBREVIATIONS

Unit of Measure

a =	year
° API =	American Petroleum Institute gravity
bbl =	barrel(s)
cal =	calorie(s)
c =	centi (prefix)
cm =	centimeter(s)
m^3 =	cubic meter(s)
d =	day(s)
dwt =	ton(s), deadweight
G =	giga (prefix)
GW =	gigawatt(s)
GW•h =	gigawatt hour(s)
g =	gram(s)
g/mt =	gram(s) per metric ton
ha =	hectare(s)
k =	thousand
kcal =	kilocalorie(s)
kg =	kilogram(s)
kL =	kiloliter(s)
km =	kilometer(s)
km^2 =	square kilometer(s)
kmt =	thousand metric ton(s)
kV =	kilovolt(s)
kW =	kilowatt(s)
kW•h =	kilowatt hour(s)
L =	liter(s)
M =	mega (prefix)
MW =	megawatt(s)
MW•h =	megawatt hour(s)
m =	meter(s)
M =	million
Mmt =	million metric ton(s)
m^2 =	square meter(s)
mt =	ton(s), metric
SCE =	standard coal equivalent
V =	volt
W =	watt
W•h =	watt hour

Abbreviation

APEC =	Asia and Pacific Economic Cooperation
API =	American Petroleum Institute
ASEAN =	Association of Southeast Asian Nations
EC =	European Community
EFTA =	European Free Trade Association
FTA =	Free Trade Agreement
GATT =	General Agreement on Tariffs and Trade
GDP =	gross domestic product
GNP =	gross national product
LNG =	liquefied natural gas (methane)
LPG =	liquefied petroleum gas (propane-butane)
NAFTA =	North American Free Trade Agreement
OECD =	Organization for Economic Cooperation and Development
OPEC =	Organization of Petroleum Exporting Countries
UN =	United Nations
UNDP =	United Nations Development Program

☆ U.S. GOVERNMENT PRINTING OFFICE:1994-368-152