

THE MINERAL INDUSTRY OF

MEXICO

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In 1998, Mexico's gross domestic product (GDP) increased by 4.8%, one of the largest registered worldwide. The GDP grew despite a significant decrease in the price of petroleum, the reduction of foreign capital available, and lower external demand resulting from a soft world economic situation (Secretaría de Comercio y Fomento Industrial, 1999, p. 1). Inflation increased to 18.6% from 15.7% in 1997. Total exports increased by 6.4%, and imports increased by 14.1%. Investment and private consumption increased by 16.9% and 6.45%, respectively (Secretaría de Comercio y Fomento Industrial, 1999, p. 4). Direct foreign investment exceeded \$10 billion² (Secretaría de Comercio y Fomento Industrial, 1999, p. 3).

Total investment in the mining-metallurgical sector by companies associated with the Cámara Minera de México (Mexican Chamber of Mines) decreased by 17.4% to \$991 million (Cámara Minera de México, 1999, p. 26). About 83% of the investment was from the largest Mexican mining-metallurgical companies. More than 50% of the investment was by the largest copper producer, Grupo México S.A. de C.V.

Government Policies and Programs

Under the Mexican Constitution, minerals are part of the national patrimony. The mining law, under Article 27 of the Constitution, is the Government legislation that governs Mexico's mining industry. The mining law of 1992 became effective in September 1992 and was amended in 1996 (Mexican Mining Information Center, [undated], Modification to Mexico's federal mining law, accessed January 5, 2000, at URL <http://mexmin.com/lawmod.asp>). The amendment was published in the daily official register on December 24, 1996. Its regulations were published in the daily official register of March 25, 1993. Revisions to the regulations, being prepared during 1998, had not been published at yearend. The mining law covers exploration, production, and beneficiation of minerals.

The mining law removes many of the restrictions of the

¹Much of the general and commodity information in this report was provided by Ing. Javier Moya Ruíz, Minerals Specialist and Mr. Victor Méndez, Petroleum Officer of the Embassy of the United States in Mexico City, whose joint efforts have been invaluable in providing a comprehensive, detailed, and timely report. Ing. Moya not only compiles the annual Minerals Questionnaire, but is also the author of the comprehensive annual Mexico's Outlook Report used extensively as source material for this report. Any datum, or information in text not referenced elsewhere may be assumed to be from their current (1999) Mexico Mining Report—1998.

²Where necessary, values have been converted from Mexican pesos (Mex\$) to U.S. dollars at the rate of Mex\$9.148=US1.00.

previous law regarding the participation of private and foreign companies in the Mexican mining industry at a time when the Government was privatizing State mining companies and decontrolling its mining reserves. The mining law permits direct investment, with up to 100% ownership of equity, in exploration works and activities and allowed up to 100% foreign participation in production through a 30-year trust mechanism.

This law permits the participation of the private sector in the production of some minerals previously reserved to the Government, such as coal, iron, phosphorus, potassium, and sulfur. Minerals or substances exempted from the law are hydrocarbons, radioactive minerals, substances contained in suspension or dissolution in subterranean waters as long as they did not originate from mineral deposits different from the components of the land, rocks or their fragmentation that could only be used for the fabrication of materials for construction or ore destined for such purposes, products derived from the fragmentation of the rocks mined principally by open pit, and salt formed by evaporation of brines from salt pits.

The exploration concessions are awarded for 6 years and are not renewable. Exploitation concessions are awarded for 50 years, renewable for a similar period. The 1992 law eliminates the concession for ore beneficiation plants.

In 1994, the responsibility for the mining sector was transferred to the Secretaría de Comercio y Fomento Industrial (SECOFI). SECOFI's Dirección General de Minas had the responsibility for revisions to the mining law and its regulations.

Environmental Issues

Although various environmental laws and regulations have been promulgated since 1946, protection of the environment became a priority for the Government of Mexico as the population has increased and the mining industry has grown in size and importance. Accordingly, a key element of environmental legislation, The General Law of Ecological Balance and Environmental Protection (LGEEPA) was passed in 1992 (Ordal and Moya, 1996, p. 5). Environmental responsibilities residing in various Government agencies were transferred to the Secretaría del Medioambiente, Recursos Naturales, y Pesca (Ministry of Environment, Natural Resources, and Fisheries) (SEMARNAP) in 1994. Enforcement of environmental regulations was buttressed by the Environmental Attorney's Office.

Under SEMARNAP, mineral exploration and mining required a number of environmental permits and authorizations

to conform to the statutes of LGEEPA starting with a preliminary environmental impact statement for all major activities or projects. Besides an operating license, the necessary permits for any mine or plant included water well usage, water discharge, land use, explosives, and hazardous materials handling. Other regulations were concerned with noise, gas and dust emissions, dumps and tailings, storage of oil and fuel, and electrical transformers.

Water discharge regulations were specified in the Federal Law Concerning Water Rights (LFDMA) of January 1992 and the National Water Law of December 1992. According to LFDMA, water pumped from mining works is not subject to discharge fees as long as it is not used in the “exploitation and/or metallurgical treatment of ore” or for other industrial or domestic use. Discharge fees, however, are required for water containing more than 2,500 milligrams per liter of total dissolved solids, unless the discharged water can meet the minimum quality standards set by the Consejo Nacional de Agua (CONAGUA). Although water discharged to runoffs or water basins is also exempted from payments of a discharge fee if it meets CONAGUA water-quality standards, all other types of water discharge require payment of a fee according to schedules set in LFDMA.

In 1998, SEMARNAP published the Norma Oficial Mexicana NOM-120-ECOL.1997 in the official register. The law established environmental protection for direct exploration activity in dry and temperate climate zones.

Production

In 1998, Mexico was an important mineral producer, ranking among the top world producers in a variety of nonfuel minerals. It was the world’s leading producer of silver, bismuth and celestite and a significant supplier of mining and mineral products to the United States. (See table 1.) According to the U.S. Geological Survey world production data, in 1998, Mexico maintained its position as a world producer—fluorspar, 2d; graphite, 3d; arsenic, 4th; molybdenum, 5th; barite, lead (mine), and zinc (mine), 6th; cadmium, gypsum, and salt, 7th; sulfur, 8th; manganese ore (metal content), 9th; copper (mine), 10th; cement, 12th; gold, 14th; and crude steel, 16th.

In 1998, the total value of Mexico’s mining production in 1998 prices was \$3.8 billion, with metals contributing 60% of the total, or \$2.3 billion (Consejo de Recursos Minerales, 1999, p. 25). Despite a decrease in copper prices during the year, copper continued to be the most important mineral commodity, contributing \$599 million, or about 15.8% of the total mining value and 26% of the metal value. Sand and gravel combined was in second place with a total of \$569 million, representing about 15% of the total mining production and about 38% of the value of industrial mineral production of \$1.5 billion. Silver and zinc followed with 13.2% and 11.0%, respectively, of the total mining value. The value of coal production was \$187.4 million, or 4.9% of total mining value and 12.5% of industrial mineral value.

In terms of value, 4 of the 31 States and the Distrito Federal produced 47.6% of Mexico’s mineral production (Consejo de Recursos Minerales, 1999, p. 24). The State of Sonora, the

leading producer of copper and gold, was the overall leading producer with 18% of the total; followed by the State of Zacatecas, the leading producer of silver (11%); the State of Chihuahua, the leading producer of cadmium, lead, and zinc (9.9%); and the State of Coahuila, the leading producer of coal (8.6%).

Petroleum continued to dominate Mexico’s mineral sector despite the decrease of international prices. *Petróleos Mexicanos S.A. de C.V. (PEMEX)*, Mexico’s national petroleum company, had revenues of \$27.2 billion (*Petróleos Mexicanos S.A. de C.V.*, 1999, p. 112) and provided \$15 billion in tax revenues, one-third of the total (Financial Times, 1999). Mexico was the world’s seventh largest producer of crude petroleum (U.S. Department of Energy, December 29, 1999, Table 2.2. World crude oil production, 1989-1998, accessed February 24, 2000, at URL <http://www.eia.doe.gov/emeu/iea/table22.html>). In the Western Hemisphere, only the United States and Venezuela produced more crude petroleum.

Trade

In 1998, Mexico's total exports were \$117.4 billion (Consejo de Recursos Minerales, 1999, p. 26). Of that total, mining exports, including coke, accounted for \$2.197 billion, in 1998, or 1.9% of the total. Metal exports totaled \$1.7 billion, or 77% of mining exports. Total imports were \$125.2 billion (Consejo de Recursos Minerales, 1999, p. 27). Of that total, mining, including coke, accounted for \$2.247 billion, or 1.8% of the total. Since 1995, imports of metals and industrial minerals (nonmetals) have more than tripled (Consejo de Recursos Minerales, 1999, p. 28); 1998 was the first time that their value exceeded that of exports. In 1998, exports of metal and industrial minerals decreased by 6.9% and 1.5%, respectively; imports of metals increased by 22%; and imports of industrial minerals decreased by about 1%.

Silver was the largest source of foreign exchange with \$495 million, or 22.5% of total metal and industrial minerals exports, including coal and coke, followed by gold (\$321 million) and copper (\$255 million) (Consejo de Recursos Minerales, 1999, p. 121). Salt led the exports of industrial minerals, including coal, with \$76.6 million, or 3.5% of the total mining exports. In terms of value, the United States received 81% of Mexico's mining exports, followed by the United Kingdom (3.3%) and Japan (3.1%) (Consejo de Recursos Minerales, 1999, p. 126).

Metal imports were led by iron and copper with 22.9% and 17.2%, respectively, of the value of total metal and industrial mineral imports, including coal and coke (Consejo de Recursos Minerales, 1999, p. 130). Industrial mineral imports were led by coal and coke with 5.7% and 5.1%, respectively, of the value of total metal and industrial mineral imports. In terms of value, Mexico received 47.9% of its mineral requirements from the United States, followed by Chile (13%) and Brazil (7.8%) (Consejo de Recursos Minerales, 1999, p. 134).

Mexico exported 627 million barrels (Mbbbl) of crude petroleum for a value of \$7 billion. Mexico, however, was a net importer of natural gas and refinery products (*Petróleos Mexicanos S.A. de C.V.*, 1999, p. 312-313). Of the total, about 77% of the petroleum exported went to the United States

followed by Spain (8%) and the Netherlands Antilles (5%) (Petróleos Mexicanos S.A. de C.V., 1999, p. 317).

Structure of the Mineral Industry

Since 1994, Government responsibilities for the mining sector were transferred from the Secretaría de Energía, Minas e Industrial Paraestatal (SEMIP) to SECOFI. SEMIP then became the Secretaría de Energía maintaining the responsibilities for petroleum and electricity.

The Coordinación General de Minería, SECOFI's highest office, is charged with mining policies with the purpose of fostering new investment and maintaining a healthy mining sector and is supported by the Dirección General de Minas, the Dirección General de Promoción Minera, the Fideicomiso de Fomento Minero, and the Consejo de Recursos Minerales (CRM). The main functions of the Dirección General de Minas are to award mining concessions and to maintain the national mining and mapping registers. The Dirección General de Promoción Minera is responsible for promotion of the mining sector, including incentives for the domestic and foreign investment in the sector. The Fideicomiso de Fomento Minero is responsible for financial, administrative, and technical assistance to the mining sector by the Government. The CRM is responsible for integrating the inventory of Mexico's national resources.

The Cámara Minera de México (Mexican Mining Chamber) is another important organization in Mexico's mining sector. It promotes the interest of the private sector and maintains the dialogue between the private mining sector and the Government.

Nearly all miners were represented by the Sindicato Nacional de Trabajadores Mineros, Metalúrgicos y Similares de la República Mexicana. The Confederación de Trabajadores de México, the largest Mexican Union, represented the cement employees.

Five large diversified companies—Corporación Industrial San Luis S.A. de C.V., Empresas Frisco S.A. de C.V. (Frisco), Industrias Peñoles S.A. de C.V. (Peñoles), Grupo México, and the Grupo Acerero del Norte S.A. de C.V. (GAN)—dominated the production of nonfuel minerals. (See table 2.) These companies operated about 40 mining units throughout the country. The medium-sized mining sector operated 20 mining units and produced 100% of the celestite, feldspar, fluor spar, gypsum, and silica sand and almost 90% of the graphite. The small-sized mining sector operated 170 mining units and produced almost 75% of the kaolin.

Interest in exploration of Mexico's mineral resources continued in 1998 when 145 new companies were registered in the public mining registry (Secretaría de Comercio y Fomento Industrial, 1999, p. 55). More than 440 foreign mining companies, most of them from Canada (43%) and the United States (39%), invested in Mexico's mining sector in 1998 (Secretaría de Comercio y Fomento Industrial, 1999, p. 56). Exploration by foreign companies was in 17 States, especially in the States of Chihuahua, Sonora, and Zacatecas.

Mexico's cement industry was dominated by Cementos Mexicanos S.A. de C.V. (CEMEX), one of the world's leading

producers of cement. Cementos Apasco S.A. de C.V. and Cooperative Manufacturera de Cemento Portland La Cruz Azul S.C.L. were also important producers of cement in Mexico.

The production of crude petroleum, natural gas, and basic petrochemicals, also reserved for the Government under Article 27 of the Constitution, was entrusted to PEMEX. It operated through Pemex Exploración y Producción (Pemex Exploration and Production), Pemex Refinación (Pemex Refining), Pemex Gas y Petroquímica Básica (Pemex Gas and Basic Petrochemicals), and Pemex Petroquímica (Pemex Petrochemicals). At yearend 1998, PEMEX's total employment was about 131,000.

Commodity Review

Metals

Copper.—Mine production of copper decreased by 1.5% to about 384,600 metric tons (t). Refinery production, however, increased by about 50% to 447,000 t. Grupo México, the largest copper producer, produced about 82% of Mexico's copper mine production and more than 50% of the total refinery production through its subsidiaries, Mexicana de Cobre S.A. de C.V., Mexicana de Cananea S.A. de C.V., and Industrial Minera México S.A. de C.V. (IMMSA). Most of Grupo México's production came from two mines, Cananea and La Caridad, in the State of Sonora. In 1998, these two mines produced 90% of Grupo México's copper mine output. The remaining 10% came from IMMSA mines—Santa Bárbara, Chihuahua; Charcas, San Luis Potosí; Velardeña, Durango; and San Martín, Zacatecas.

Production from Mexicana de Cananea decreased slightly because work at the mine, smelter, and solvent extraction-electrowinning (SX-EW) plants stopped in November because of a dispute over productivity pay that led to a strike (Metals & Minerals Latin America, 1999). Prior to the strike, mill capacity expansion from 62,000 dry metric tons per day to 80,000 dry metric tons per day had been completed (Grupo México S.A. de C.V., 1999, p. 17). During the year, construction of new 55,000-t SX-EW plants at Cananea continued.

Mexicana de Cobre completed the expansion of its smelter at La Caridad mining-metallurgical complex to 330,000 metric tons per year (t/yr) (Grupo México S.A. de C.V., 1999, p. 14), the construction of its new refinery with a design capacity of 330,000 t/yr of copper cathode, and the construction of the copper rod plant with a capacity of 150,000 t/yr. Mexicana de Cobre planned to further expand its smelter capacity to 400,000 t/yr by the third quarter of 2000 (Grupo México S.A. de C.V., 1999, p. 30). During the year, the company continued the construction of a gold and silver refinery with a planned capacity of 467 t/yr (reported as 15 million troy ounces per year per year silver) and about 3,110 kilograms per year (kg/yr) (reported as 100,000 ounces per year) of gold (Grupo México S.A. de C.V., 1999, p. 30).

Because of low metal prices, work at Frisco's the Mariquita copper project in the State of Sonora was stopped (Metals & Minerals, 1998a). Construction of the 20,000-t/yr SX-EW plant

had begun and was 60% complete at the time of work cessation. The plant would have been supplied from ore from the Mariquita open-pit (heap-leach) mine, which was scheduled to be developed after the plant construction. Plans for the mine were also halted.

Gold.—Despite low world prices, Mexican mine production of gold remained at almost 26,000 kilograms (kg). Production of refined gold decreased by 2.4% to 25,427 kg. The State of Sonora was the principal producer with 29% of the national production, followed by the States of Durango (20%) and Baja California Norte (11%). San Felipe, in Mexicali, State of Baja California Norte, owned by Frisco, was the leading producer in 1998 with 2,746 kg. Peñoles' Minera-Mex La Ciénega S.A. de C.V. in the State of Durango was the second largest producer of gold with 2,716 kg. Production from La Choya, owned by Minera Hecla S.A. de C.V., a subsidiary of Hecla Mining Co. of the United States, decreased by almost 50% to 1,243 kg; in 1997, La Choya had been the second largest producer of gold in Mexico. Hecla planned to begin production from its nearby Noche Buena project in 2000 or 2001 because reserves at La Choya Mine were almost depleted (Metals & Minerals, 1998b). Capital investment for the Noche Buena project was estimated to be \$12 million to \$15 million.

Also in the State of Sonora, the San Francisco Mine, owned by Geomaque Explorations Ltd. of Canada, produced 1,840 kg (reported as 59,153 ounces) in 1998. The open pit heap-leach mine, which began production in 1995, had an expected mine life of 6 years at a production rate of 70,000 about 2,180 kg/yr (reported as 70,000 ounces per year). As of December 31, Geomaque reported a total gold reserve of about 34,200 kg (reported as 1,100,000 ounces) with minable gold reserves of about 19,200 kg (reported as 618,000 ounces) (Geomaque Explorations Ltd., 1999).

Construction of the open pit Herradura Mine in the State of Sonora by Minera Penmont S.A. de C.V. was completed, and production began in July. Minera Penmont was a joint venture between Peñoles (56%) and Newmont Gold Inc. (44%). The Herradura, a disseminated gold deposit, had estimated reserves that exceeded 50,000 kg (reported as 1.6 million ounces) of gold equivalent (Industrias Peñoles S.A. de C.V., 1999, p. 68). Expected production was about 4,700 kg/yr of gold (reported as 150,000 ounces per year gold).

Tepmin S.A. de C.V. of Belgium began operations of its Testera gold-silver mine in El Triunfo-San Antonio mining district in the State of Baja California Sur in July 1998. The beneficiation plant had an initial capacity of 200 metric tons per day (t/d) with a projected capacity of 500 t/d (Secretaría de Comercio y Fomento Industrial, 1999, p. 56).

Grupo México was constructing a precious metal refinery in its Mexicana de Cobre metallurgical complex. The refinery, expected to begin operations in the first quarter of 1999, had a planned capacity of about 3,100 kg/yr gold (reported as 100,000 ounces per year gold) (Grupo México, 1999, p. 30).

Iron and Steel.—In 1998, production of steel remained at the 1997 level of 14.2 million metric tons (Mt). It was the second largest producer of steel in Latin America, after Brazil.

Three companies produced 68% of the total—Altos Hornos de México S.A. de C.V. in the State of Coahuila was the largest producer with 3.68 Mt, ISPAT Mexicana S.A. de C.V. in the State of Michoacán produced 3.12 Mt, and Hylsa de México S.A. de C.V. (HYLSA) produced 2.8 Mt; HYLSA began production of iron ore from its San Ramón and Aquila mines.

Lead and Zinc.—Mexico's mine production of lead decreased by 4.9% to 166,060 t; this represented about 5% of the total world production. Mexico was the sixth leading producer of mined lead in the world and was the second largest producer in Latin America, after Peru. Estimated production of refined lead (including antimonial lead) decreased by 2.8% to about 173,600 t. The State of Chihuahua produced 46% of Mexico's mined lead. The largest producer was the Naica Mine in the State of Chihuahua, a subsidiary of Peñoles through its Cía. Fresnillo S.A. de C.V. (Fresnillo). San Francisco del Oro, owned by Frisco and Santa Bárbara, the second and third largest producers, respectively, were also in the State of Chihuahua; Frisco and Santa Barbara were owned by Grupo México. The State of Zacatecas, the second leading producer of lead, produced 30% of Mexico's total lead mine output.

Mexico's production of mined zinc increased by 4.3% to 395,391 t. Production of refined zinc (primary) decreased by less than 1% to 230,325 t. Mexico was the sixth leading producer of mined zinc in the world and the second most important producer in Latin America after Peru. Mexico produced 5% of the world total and 24% of Latin America's output. The State of Chihuahua was the largest producer with 41% of Mexico's mine output. The largest individual producer, with 51,209 t, was Charcas in the State of San Luis Potosí, owned by Grupo México through IMMSA. The second leading producer was Peñoles' Minera Bismark S.A. de C.V. in the State of Chihuahua with 49,366 t. The third leading producer was IMMSA's San Martín in the State of Zacatecas with 47,912 t.

Peñoles concluded exploration of the Francisco I. Madero project in Jerez, State of Zacatecas (Industrias Peñoles S.A. de C.V., 1999, p. 17). The company also concluded negotiations for the surface land usage for the project. Peñoles expected this to become Mexico's largest zinc mine with a capacity of 100,000 t of zinc. Reserves were estimated to be 30 Mt of ore with 4.7% zinc, 1.1% lead, and 42 grams per metric ton silver (Secretaría de Comercio y Fomento Industrial, 1999, p. 60).

Met-Mex Peñoles S.A. de C.V., a subsidiary of Peñoles' metal division, began the expansion of its zinc plant to 220,000 t/yr from 150,000 t/yr in its metallurgical complex in Torreón, Coahuila (Industrias Peñoles S.A. de C.V., 1999). The estimated cost of the expansion was \$150 million, with a planned completion date for the end of 1999 (Metallurgical & Mineral Processing Development, 1998). Peñoles invested \$50.4 million in expansion, construction of an electrostatic precipitator and a solvent extraction plant, and environmental controls (Industrias Peñoles S.A. de C.V., 1999, p. 50).

Manganese.—In 1998, production of manganese ore decreased by 4.5% in 1998 to 510,000 t. Cía Minera Autlán S.A. de C.V., the sole producer, produced manganese ore from

three mines—Molango, Naopa, and Nonoalco in the State of Hidalgo. Production from Naopa, an open pit, began in 1998. Naopa mine reserves were 8.4 Mt with an average stripping ratio of 6.5 to 1 and a manganese content of 28% (Cía Minera Atlán S.A. de C.V., 1999, p. 8).

Molybdenum.—The only producer of molybdenum in Mexico was Grupo México through its subsidiary Mexicana de Cobre, owner of La Caridad Mine in the State of Sonora. Production in 1998 increased by almost 23% to 5,949 t of molybdenum in concentrates. The concentrates were shipped to the nearby Molymex S.A. de C.V., a subsidiary of the Chilean company Molibdenos y Metales S.A., to produce molybdenum oxide. In 1998, Molymex increased its production annual capacity from about 6,800 to 18,100 t (reported as an increase of 15 million to 40 million pounds) of molybdenum oxide (Secretaría de Comercio y Fomento Industrial, 1999, p. 57).

Silver.—Mexico, with a mine production of almost 2.7 million kilograms (Mkg) of silver and almost 2.9 Mkg of refined silver, was the world's largest producer of this commodity. The leading producing State was Zacatecas with 40% of the country's output. The largest producer was the Proaño Mine in the Fresnillo District, State of Zacatecas, a subsidiary of Peñoles through Fresnillo. In 1998, this mine, the world's largest, produced 645,543 kg of silver. Fresnillo began the construction of a 1-million-metric-ton-per-year (Mt/yr) plant to recover silver from its tailings (Industrias Peñoles S.A. de C.V., 1999, p. 18).

Grupo México was constructing a precious metal refinery in its Mexicana de Cobre metallurgical complex. The refinery, expected to begin operations in the first quarter of 1999, had a planned capacity of about 467 t/yr silver (reported as 15 million ounces per year of silver) (Grupo México, 1999, p. 30).

Industrial Minerals

Cement.—In 1998, Mexico produced 27.7 Mt, or about 63% of the country's installed capacity of 44 Mt/yr cement. It was the second largest producer of cement in Latin America, after Brazil. Sales of cement in 1998 totaled \$3.3 billion, a 10% increase from those of 1997 (Moya and Mendez, 1999). Production came from 30 plants owned by 5 companies and their subsidiaries. The largest producer was CEMEX with an installed capacity of 27 Mt. Cementos Apasco S.A. de C.V., the second largest company and a subsidiary of Holderbank Financière Glaris Ltd., had six plants with a capacity of about 9 Mt. These two companies, with about 80% of Mexico's cement capacity, also have recently, expanded their production capacities outside Mexico. CEMEX owned or was part owner of cement companies in Colombia, the Dominican Republic, the Pacific Rim, Panama, Spain, and Venezuela, and Cementos Apasco had a minority interest in the Honduran company Cementos del Norte. The other three producers were Cooperativa Manufacturera de Cemento Portland La Cruz Azul S.C.L. (5.6 Mt/yr capacity), Cementos de Chihuahua S.A. de C.V. (1.9-Mt/yr capacity), and Cementos Portland Monctezuma

(about 500,000-t/yr capacity).

Mexico consumed about 85% of its production and exported the remainder mainly to the United States, the Caribbean, and Central America.

Fluorspar.—Mexico was the second largest world producer of fluorspar, after China. Production of fluorspar was about 598,000 t in 1998, an 8% increase from that of 1997. Of the total, 331,000 t was acid grade, and 267,000 t, metallurgical grade. Of the production, 72% was from San Luis Potosí. The largest company was Cía. Minera Las Cuevas S.A. de C.V.

Wollastonite.—Nycor Minerals Inc., a Canadian company, was developing a wollastonite mine in Hermosillo, State of Sonora. The Pilares Mine, which began operations in 1998, had a production capacity of 150,000 t/yr, with a plan to increase production to 400,000 t/yr in the second phase of the project.

Mineral Fuels

Coal.—Mexican production of coal decreased by 2.6% to 12.4 Mt. The principal producer was Minera Carbonífera Río Escondido S.A. de C.V. in the State of Coahuila. Almost the entire coal production in Mexico in 1998 was from the State of Coahuila.

Petroleum, Crude, and Natural Gas.—In 1998, production of crude petroleum by PEMEX increased by 1.6% compared with that of 1997. About 77% of the production was from offshore oilfields. More than two-thirds of the offshore production was from the northeastern region (Gulf of Mexico). Mexico exported about 627 Mbbbl of crude petroleum (about 56% of total production), a slight decrease from the 1997 total. The value of crude exports, the bulk of the exports, decreased by 38% to \$6.4 billion because of a significant decrease in international petroleum prices (Petróleos Mexicanos S.A. de C.V., 1999, p. 312). The average export price of Mexican crude was \$10.16 per barrel, \$6.17 lower than that of 1997 (Petróleos Mexicanos, S.A. de C.V., 1999, p. 316). Exports went mainly to the United States (76.7%), Europe (10.7%), and the Netherlands Antilles (5%). About 2.6% of the crude was exported to Latin America under the San José Accord (Petróleos Mexicanos, S.A. de C.V., 1999, p. 317). Mexico's net export value for petroleum also decreased to \$4.8 billion from \$8.5 billion in 1997. Mexico was a net importer of refinery products.

Gross production of natural gas increased by 7.2% compared with that of 1997. Of the internal sales, about 59% was used by the industrial sector, and 36%, by the electricity sector.

Refinery Products.—PEMEX invited companies to bid for refurbishing three of its refineries in the States of Hidalgo, Querétaro, and Tamaulipas (Petroleum Economist, 1998). With the revamp of these refineries, PEMEX would decrease its dependence on foreign gasoline by increasing its gasoline production by 74,000 barrels per day (bbl/d) and its diesel output by 33,000 bbl/d (Financial Times, 1999).

Infrastructure

Mexico had 26,725 kilometers (km) of railroads and 306,119 km of roads. As part of the Toll Highway Program that began in 1989, more than 5,680 km of new highways were being constructed. In addition, private companies were constructing 33 toll highways, 1,600 km of roadways, and 4 bridges across the U.S. border with Mexico. Although the Government was financing the expansion of 2,100 km of highways to four lanes, it allowed the private sector to participate in such projects, including toll roads. The concession holder was allowed to charge tolls on projects developed until construction costs had been recovered and a reasonable profit made, at which time ownership of the highway would revert to the Government.

To streamline transportation of freight within Mexico, the Government modified regulations governing the trucking industry in 1990. After elimination of route control by private companies, Mexican carriers could move freight anywhere in the country. In addition, under the North American Free Trade Agreement, U.S. and Canadian trucking lines would be able to avoid transshipment delays at the border by transporting freight directly across national boundaries to destinations in the States of Chihuahua, Coahuila, Nuevo León, and Sonora. Mexican carriers had reciprocal rights to operate in Arizona, California, New Mexico, and Texas.

The country had 21 ports and 2,900 km of navigable rivers and coastal canals. Of the 64 ships in the merchant marine, at least 44 were available for the transportation of mineral products. Within Mexico, most ore and metallurgical products were transported by truck. During the 1980's, railways declined in importance as the volume of freight and passenger transport dropped by more than 25% owing to increasingly poor and unreliable service. In 1991, railroads accounted for only 9% of Mexico's total freight traffic and were used mainly for bulk items, such as coal, coke, and iron ore. Gray portland cement, for example, was transported by roads (61%), railroads (26%), and ship (13%).

In 1998, Ferrocarriles Nacionales de México sold its last of three concessions—the southeastern portion of railroad lines, which were auctioned as part of Mexico's privatization program to Grupo Tribasa, a construction firm, for \$322 million (*Journal of Commerce*, 1998). The line, slightly less than 1,513 km long (reported as slightly less than 940 miles long), links Mexico City to Puerto Veracruz and the Coatzacoalcos. The other two concessions had been sold to a consortium between Peñoles and GAN and to Comunicación y Transporte de Tijuana, a construction company, in 1997. These sales became possible in 1995 when the Mexican Congress approved the Constitutional amendment permitting concessions of up to 50 years.

Hydrocarbon output continued to dominate Mexico's energy sector. Crude oil and natural gas generally represented about 90% of all energy produced. The remaining 10% of primary energy production typically was from wood and sugar cane (4.3%), hydroelectric sources (3%), coal (1.5%), geothermal wells (0.7%), and nuclear energy (0.5%).

Crude oil and natural gas were transported mainly through pipelines within Mexico. Of the country's nine refineries, eight

received crude oil by pipeline.

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TABLE 1
MEXICO: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/ METALS	1994	1995	1996	1997	1998
Aluminum, metal:					
Primary	--	10,413	61,458	66,358	61,848
Secondary	145,216	128,618	84,982	123,179	217,857
Antimony:					
Mine output, Sb content	1,800 e/	266	--	849	338
Metal 4/	1,758	1,783	983	1,909	1,301
Arsenic 5/	4,440	3,620	2,942	2,999	2,573
Bismuth:					
Mine output, Bi content 6/	1,047	995	1,070	1,642	1,204
Metal, refined	836	924	957	990	1,030
Cadmium:					
Mine output, Cd content	2,579	1,385	1,455	1,327	1,197
Metal, refined	646	689	784	1,223	1,275
Copper:					
Mine output, Cu content					
By concentration or cementation	268,889	294,647	295,303	342,319	335,822
Leaching (electrowon)	25,799	38,918	45,407	48,217	48,819
Total	294,688	333,565	340,710	390,536	384,641
Metal:					
Anode and blister	271,741	274,356	280,462	348,290	378,302
Refined:					
Primary	170,599 r/	179,418 r/	225,507 r/	282,217 r/	432,000
Secondary	26,501 r/	32,782 r/	16,493 r/	14,800 r/ e/	15,000
Total	197,100	212,200	242,000	297,017 r/	447,000
Gold:					
Mine output, Au content kilograms	13,888	20,292	24,477	26,001	25,982
Metal, refined do.	6,449	8,355	8,635	26,030	25,427
Iron and steel:					
Iron ore, mine output:					
Gross weight thousand tons	9,193	9,375	10,182	10,467	10,557
Fe content do.	5,516	5,625	6,109	6,280	6,334
Metal:					
Pig iron do.	3,501	4,142	4,230	4,450	4,532
Direct-reduced iron do.	3,216	3,700	3,794 r/	4,440	5,584
Total do.	6,717	7,842	8,024	8,890	10,116
Ferrous alloys: 7/					
Ferromanganese do.	117	109	126	132	154
Silicomanganese do.	72	77	105	117	115
Total do.	189	186	231	249	269
Crude steel do.	10,260	12,147	13,172	14,254	14,213
Rolled products 8/ do.	7,598	8,738	10,341	11,309 r/	10,609
Lead:					
Mine output, Pb content	170,322	164,348	173,831	174,661	166,060
Metal:					
Smelter:					
Primary 9/	161,695	166,862	150,971	169,510	163,645
Secondary (refined) e/	10,000	10,000	10,000	10,000	10,000
Total e/	171,695	176,862	160,971	179,510	173,645
Refined:					
Primary 10/	160,734	165,868	150,395	168,164	163,206
Secondary e/	10,000	10,000	10,000	10,000	10,000
Total e/	170,734	175,868	160,395	178,164	173,206
Manganese ore: 11/					
Gross weight	307,000	472,200	485,000	534,000	510,000
Mn content e/	112,300	174,200	173,380	192,825	187,103
Mercury, mine output, Hg content e/	12	15	15	15	15
Molybdenum, mine output, Mo content	2,610	3,883	4,210	4,841	5,949

See footnotes at end of table.

TABLE 1--Continued
MEXICO: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/	1994	1995	1996	1997	1998
METALS--Continued					
Silver:					
Mine output, Ag content kilograms	2,214,638	2,324,348	2,527,875	2,679,090	2,686,021
Metallurgical products, Ag content:					
In copper bars do.	469,712	389,620	375,325	378,557	395,251
Mixed gold and silver bars do.	123,648	169,744	240,677	243,188	237,868
Metal, refined, primary do.	1,696,283	1,781,111	1,744,464	1,928,812	2,100,493
Other do.	122,500	108,762	175,998	149,828	134,487
Tin:					
Mine output, Sn content	3	1	2	5	5
Metal, smelter, primary 771 r/		415 r/	1,234 r/	1,188 r/	102
Tungsten, mine output, W content	--	287	188	179	130
Zinc:					
Mine output, Zn content	381,689	363,658	377,599	379,252	395,391
Metal, refined, primary	209,200	222,748	221,736	231,444	230,325
INDUSTRIAL MINERALS					
Abrasives, natural 12/	25,000 e/	8,234	9,922	8,271 r/	12,167
Barite	86,605	248,367	470,028	236,606	161,555
Cement, hydraulic	29,674	24,042	25,366	27,548	27,744
Clays:					
Bentonite	92,476	72,599	69,810	111,503	185,729
Common	4,553,635	3,697,053	4,048,458	5,078,048	5,601,071
Fuller's earth	21,377	15,755	41,800	51,430	48,016
Kaolin	193,034	221,685	253,602	235,278 r/	339,013
Diatomite	52,100	50,200	52,494	59,463	66,812
Feldspar	133,441	121,779	139,972	155,760	197,866
Fluorspar:					
Acid-grade thousand tons	129	270	279	291	331
Metallurgical-grade do.	103	252	245	262	267
Submetallurgical-grade do.	3 e/	--	--	--	--
Total do.	235	522	524	553	598
Graphite, natural:					
Amorphous	29,903	32,938	38,967	46,707	42,893
Crystalline 960 e/		1,450	1,445	1,275	568
Total	30,863	34,388	40,412	47,982	43,461
Gypsum and anhydrite, crude (yeso)	5,040,400	4,854,339	6,064,682	5,869,175	7,045,197
Lime, hydrated and quicklime e/ thousand tons	6,500	6,580	6,600	6,500	6,500
Magnesium compounds:					
Magnesite	1,120	250	200	231	274
Magnesia 13/ 91,887 r/		80,517 r/	83,348 r/	72,621 r/	73,845
Mica, all grades	5,753	5,028	4,273	975	890
Nitrogen, N content of ammonia	2,030,000	1,992,000	2,053,900	1,448,300	1,449,300
Perlite	31,918	33,529	37,417	51,758	54,840
Phosphate rock 14/	546,857	622,354	682,079	713,662	756,349
Salt, all types thousand tons	7,458	7,670	8,508	7,933	8,412
Sodium compounds, n.e.s.: e/					
Carbonate (soda ash), synthetic	290,000	290,000	290,000	290,000	290,000
Sulfate, natural (bloedite) 15/	565,000	588,000	603,000	616,200 r/	590,600
Stone, sand and gravel:					
Calcite, common	389,749	362,715	325,199	490,531	592,412
Dolomite	588,000	931,770	929,933	902,710	785,516
Limestone thousand tons	36,020	32,873	37,641	43,706	44,372
Marble	1,086,237	898,990	659,192	516,805	663,945
Quartz, quartzite, glass sand (silica)	1,360,549	1,292,265	1,424,825	1,564,348	1,733,439
Sand thousand cubic meters	50,982	45,086	55,344	60,104	54,703
Gravel do.	44,899	37,970	40,179	43,636	43,947
Strontium minerals, celestite	111,485	138,342	141,142	134,707	118,230
Sulfur, elemental:					
Byproduct:					
Of metallurgy e/ thousand tons	300	359	359	417	474
Of petroleum and natural gas do.	877	882	921	923	913
Total e/ do.	1,177	1,241	1,280	1,340	1,387

See footnotes at end of table.

TABLE 1--Continued
MEXICO: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/	1994	1995	1996	1997	1998	
INDUSTRIAL MINERALS--Continued						
Talc	14,900	11,134	10,100	13,586	18,843	
Vermiculite	300	225	350	295	--	
Wollastonite	29,000	20,194	28,365	20,655	41,264	
MINERAL FUELS AND RELATED MATERIALS						
Coal:						
Run-of-mine:						
Metallurgical	thousand tons	5,157 r/	4,617 r/	5,131 r/	4,479 r/	4,823
Steam	do.	6,275 r/	7,183 r/	8,616 r/	8,228 r/	7,566
Total	do.	11,432	11,800 r/	13,747 r/	12,707 r/	12,389
Washed metallurgical coal	do.	1,800 e/	1,800 e/	1,712 r/	1,906 r/	2,141
Coke: 16/						
Metallurgical	do.	1,933	2,097	2,141	2,100	2,166
Imperial	do.	3	--	--	--	--
Breeze	do.	49	51	43	37	37
Total	do.	1,985	2,148	2,184	2,137	2,203
Gas, natural:						
Gross	million cubic meters	37,458 r/	38,842 r/	43,348 r/	46,158 r/	49,506
Marketed	do.	30,038 r/	30,038 r/	32,022 r/	34,296 r/	37,292
Petroleum:						
Crude	thousand 42-gallon barrels	980,025	955,205	1,043,170	1,103,030	1,120,550
Condensate (natural gas liquids)	do.	165,345 r/	162,425 r/	152,935 r/	141,620 r/	156,585
Total	do.	1,145,370 r/	1,117,630 r/	1,196,105 r/	1,244,650 r/	1,277,135
Refinery products:						
Liquefied petroleum gas	do.	24,017 r/	22,411 r/	22,740 r/	13,980 r/	10,512
Motor gasoline	do.	156,841 r/	154,213 r/	152,023 r/	141,730 r/	150,344
Jet fuel	do.	27,120 r/	25,587 r/	22,520 r/	20,440	20,842
Kerosene	do.	3,760 r/	2,409 r/	2,555	1,132 r/	694
Distillate fuel oil (diesel)	do.	103,806 r/	93,002 r/	98,404 r/	100,521 r/	105,850
Lubricants	do.	2,482 r/	2,446 r/	2,446 r/	2,044 r/	1,971
Residual fuel oil	do.	153,264 r/	152,059 r/	152,570	155,563 r/	162,717
Asphalt	do.	11,571 r/	10,841 r/	8,505 r/	9,417 r/	10,841
Other, refinery fuel, and losses	do.	26,132 r/	24,234 r/	21,388 r/	20,877 r/	21,241
Total	do.	508,993 r/	487,202 r/	483,151 r/	465,704 r/	485,012

e/ Estimated. r/ Revised.

1/ Data previously published for 1994 were rounded by the U.S. Bureau of Mines to three significant digits. With very few exceptions, data in the present table have been unrounded to their original state.

2/ Table includes data available through February 14, 2000.

3/ In addition to the commodities listed, additional types of crude construction materials are produced, but output is not reported; available information is inadequate to make estimates of output levels.

4/ Sb content of antimonial lead and impure bars plus refined metals.

5/ Arsenic content of white and black (impure) arsenic trioxide.

6/ Refined metal plus bismuth content of impure smelter products.

7/ Reported by Cámara Nacional del Hierro y del Acero. Cía. Minera Autlán reported salable production of ferromanganese, in metric tons: 1995--58,000; 1996--69,000; 1997--68,000; and 1998--88,000. For silicomanganese, Autlán reported, in metric tons, the following: 1995--67,700; 1996--93,000; 1997-98--105,000;

8/ Includes flat, nonflat, and seamless pipe steel products.

9/ Lead content of impure bar, antimonial lead, plus refined metal.

10/ Includes lead content of antimonial lead.

11/ Mostly oxide nodules; includes smaller quantities of direct-shipping carbonates and oxide ores for metallurgical and battery applications.

12/ Based on exports comprising mostly pumice stone and emery (a granular, impure variety of corundum).

13/ Reported by Industrias Peñoles S.A. de C.V. as the only major producer.

14/ Includes only output used to manufacture fertilizers.

15/ Series reflects output reported by Industrias Peñoles plus an additional 40,000 tons estimated output by other producers.

16/ Includes coke made from imported metallurgical coal.

TABLE 2
MEXICO: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity
Aluminum	Aluminio S.A. (Nacobre, 77.8%; Carso Group, 20%)	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.	365.
Barite	Barita de Sonora S.A. (Grupo Acerero del Norte S.A. de C.V. (GAN), 100%)	Mazatán, Son.	219.
Do.	Cía. Minera Capela S.A. de C.V. (Industrias Peñoles S.A. de C.V. (Peñoles), 100%)	La Minita Mine, Chichicuila, Mich.	NA.
Do.	Minerales y Arcillas S.A. de C.V. (private Mexican, 100%)	The San Francisco del Huerto Mine in San Pedro, Coah., La Escondida and Angelita Mines and plant in Galeana	55.
Do.	Barita de Santa Rosa S.A. de C.V. (private Mexican, 100%)	Muzquiz, Coah.	256.
Cement	Cementos Mexicanos S.A. de C.V. (CEMEX), private Mexican, 100%	Monterrey, N.L.; Torreón, Coah.; Huichiapan, Hgo.; Valles, S.L.P.	8,970 (Monterrey group).
Do.	Cementos Anahuac S.A. (CEMEX, 100%)	León, Gto.; Merida, Yuc.; Tlanepantla, Mex.; Tamuín, S.L.P.	6,970 (Maya group).
Do.	Cementos Tolteca S.A. (CEMEX, 100%)	Atotonilco, Hgo.; Zapotiltic, Jal.; Tula, Hgo.; Hornillos, Sin.; Hermosillo, Son	7,150 (Tolteca group).
Do.	Cementos Guadalajara S.A. (CEMEX, 100%)	Ensenada, B.C.N.; Guadalajara, Jal.; Hermosillo, Son.; Hidalgo, N.L.	4,445 (Cegusa group).
Do.	Cementos Apasco S.A. de C.V. (Holderbank Financière Glaris, Ltd., 49%)	Apasco, Hgo.; Ramos Arizpe, Coah.; Macuspana, Tab.; Caleras, Col.; Orizaba, Ver.; Acapulco, Gro.	9,000.
Do.	Cooperativa Manufacturera de Cemento Portland La Cruz Azul S.C.L. (private Mexican, 100%)	Jasso, Hgo.; La Cruz Azul, Oax.	5,600.
Do.	Cementos de Chihuahua S.A. de C.V. (CEMEX, 36%; private Mexican, 64%)	Chihuahua, Ciudad Juárez, and Samalayuca, Chih.	1,900.
Coal	Minerales de Monclova S.A. (Altos Hornos de Mexico, S.A. de C.V. (AHMSA), 100%)	Mimosa, Palau Mines, Muzquiz washing plant at Palau, Coah., and coking plant at Monclova, Coah.	3,000
Do.	Carbonifera de San Patricio S.A. de C.V. (private Mexican, 100%)	Progreso, Coah.	1,314.
Do.	Industrial Minera México S.A. de C.V. (IMMSA) (Grupo Minero México S.A. de C.V., 100%)	Nueva Rosita, Coah.	1,500.
Do.	Minera Carbonifera Río Escondido S.A. (MICARE) (GAN, 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. de C.V. (Grupo Minero México S.A. de C.V., 96.4%)	La Caridad Mine, smelter, refinery and rod plant at Nacoziari de García, Son.	330 smelter, 22 SX-EW. 330 refinery. 150 rod plant.
Do.	Mexicana de Cananea S.A. de C.V. (Grupo Minero México S.A. de C.V., 98.5%)	Mine and smelter at Cananea, Son.	60 smelter, 33 SX-EW.
Ferroalloys	Cía. Minera Autlán S.A. de C.V. (Grupo Ferrominero, 54%; Minas de Basis S.A. de C.V., 32%, Broken Hill Proprietary Co. Ltd., 14%)	Plant in Tamós, Ver. Plant in Teziutlán, Pue. Plant in Gómez Palacio, Dgo.	140. 38. 35.
Fluorspar	Cía. Minera Las Cuevas S.A. de C.V. (Grupo Industrial Camesa S.A. de C.V.) 2/	Salitera (Zaragoza), S.L.P.	520.
Do.	Fluorita de México S.A. de C.V. (Corp. Alfil, 51%; Applied Industrial Minerals Corp., 49%)	Mines at La Encantada district and plant at Muzquiz, Coah.	150
Gold kilograms	Cía. Fresnillo S.A. de C.V. (Industrias Peñoles S.A. de C.V. (Peñoles), 100%)	Fresnillo Mine, Zac.	1,866.
Do.	do. Minas de San Luis S.A. (Industriales Luismín, 100%)	Tayoltita and Santa Rita, Dgo.; San Antonio, Sin; San Martín, Qro.; La Guitarra, Mex.	2,700.
Do.	do. Cía. Minera de Santa Gertrudis (Grupo Ariztegui, 51%; Phelps Dodge, 49%)	Santa Gertrudis Mine, Son.	1,600.
Do.	do. Exploraciones El Dorado S.A. de C.V. (70%), Minerales Sotula (30%)	La Colorada Mine, Son.	800.
Do.	do. Minera Hecla S.A. (Hecla Mining Co. of United States 100%)	La Choya Mine, Son.	2,000.
Do.	do. Walhalla Mining Co. NL (private foreign, 100%)	Amelia Mine, Son.	1,300.
Do.	do. Cía. Minera las Torres S.A. de C.V. (Peñoles, 100%)	Guanajuato, Gto.	730.

See footnotes at end of table.

TABLE 2--Continued
MEXICO: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity
Gold--Continued:	kilograms	Cía. Minera El Cubo S.A. de C.V. (private Mexican, 100%)	Guanajuato, Gto.	128.
Do.	do.	Sociedad Cooperativa Minero Metalúrgica Santa Fe de Guanajuato (private Mexican, 100%)	do.	438.
Graphite		Grafitos Mexicanos S.A. (Cummings Moore Graphite Co. of United States, 25%; private Mexican, 75%)	Lourdes and San Francisco Mines, Son.	60.
Do.		Grafito Superior S.A. de C.V. (Superior Graphite Co., 100%)	Covalmar, Santa Clara, and Río Mayo Mines, and plant in Son.	25.
Gypsum		Cía. Occidental Mexicana S.A. (private Mexican, 51%, Domtar, Ltd. of Canada, 49%)	Santa Rosalía on San Marcos Island, B.C.S.	2,500
Iron ore		Consorcio Minero Benito Juárez Peña Colorada S.A. de C.V. (ISPAT International, 50%; Hylsamex S.A. de C.V., 50%)	Peña Colorada Mine and pellet plant near Manzanillo, Col.	3,500.
Do.		AHMSA (Grupo Acerero del Norte S.A. de C.V. (GAN), 74%)	La Perla Mine, Chih.; Hércules Mine, Coah.; and Cerro de Mercado Mine, Dgo.	5,000.
Do.		Siderúrgica Lázaro Cárdenas-Las Truchas, S.A. (SICARTSA) (Grupo Villacero, 100%)	Ferrotepec, Volcán, and Mango deposits in Las Truchas project area and pellet plant, Mich.	1,900.
Do.		Hylsamex S.A., de C.V. (Grupo Industrial ALFA, 100%)	San Ramón and Aquila Mines	1,500.
Lead and zinc		Industrial Minera México S.A. de C.V. (IMMSA) (Grupo Minero México S.A. de C.V., 100%)	Charcas, S.L.P.; San Martín, Zac.; Santa Eulalia, Chih.; Taxco, Gro.; Rosario, Sin.; Santa Bárbara, Chih.; Velardeña, Dgo; lead refinery at Monterrey, N.L.; zinc refinery at S.L.P.	70 (lead), 110 refined zinc.
Do.		Industrias Peñoles S.A. de C.V. (private Mexican, 97%; private United States, 3%)	Mines at La Encantada, Coah.; Fresnillo, Zac.; Naica, Chih.; Bismark, Son; Rey de Plata, Gro. (Peñoles, 60%; Outokumpu Oy, 40%); metallurgical complex at Torreón, Coah., with silver, lead, and zinc smelter and/or refineries operated by Met-MexPeñoles (Peñoles, 100%)	160 refined lead, 135 refined zinc.
Do.		Minera San Francisco del Oro S.A. de C.V. (Empresas Frisco, S.A. de C.V., 100%)	San Francisco del Oro, near Hidalgo del Parral, Chih.	15 (lead), 21 (zinc).
Do.		Minera Real de Angeles S.A. de C.V. (Empresas Frisco, S.A. de C.V., 100%)	Noria de Angeles, Zac.	45 (lead), 47 (zinc).
Manganese		Cía. Minera Autlán S.A. de C.V. (Grupo Ferrominero S.A. de C.V. 81.75%; private Mexican, 18.25%)	Molango, Naopa, and Nonoalco Mines, Hgo.	600 ore and concentrate
Molybdenum		Mexicana de Cobre S.A. (Grupo Minero México S.A. de C.V., 100%)	La Caridad Mine, molybdenum plant, Son.	6.
Petroleum thousand 42-gallon barrels per day		Petróleos Mexicanos S.A. de C.V. (PEMEX) (Government, 100%)	Comalcalco, Poza Rica, Ver., and Gulf of Campeche, Cam. districts	3,500. 3/
Salt		Exportadora de Sal S.A. (ESSA) (Fideicomiso de Fomento Minero, 51%; Mitsubishi Corp., 49%)	Solar salt complex at Guerrero Negro, B.C.S.	6,000.
Silver	kilograms	Peñoles (private Mexican, 97%, private United States, 3%) 4/	Naica, Chih.; Fresnillo, Zac.; Las Torres, Gto.; Cuale, Jal.; La Negra, Qro.; La Encantada, Coah.; La Minita, Mich.	654,000.
Do.	do.	IMMSA (Grupo Minero México S.A. de C.V., 100%)	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. (Empresas Frisco S.A. de C.V., 100%)	Open pit mine and concentrator at Noria de Angeles, Zac.	924,000.
Sodium sulfate		Química del Rey, S.A. de C.V. (Peñoles, 100%)	Plant at Laguna del Rey, Coah.	620.
Steel		AHMSA (GAN, 74%)	Steelworks at Monclova, Coah.	3,700, 3,550 pellet.
Do.		Hylsamex S.A. de C.V. (Grupo Industrial ALFA, 100%)	Steel works and direct-reduction units at Monterrey, N.L., and Puebla, Pue. Pelletizing plant in Col.	3,100, 1,500 pellet.

See footnotes at end of table.

TABLE 2--Continued
MEXICO: STRUCTURE OF THE MINERAL INDUSTRY IN 1998

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities 1/	Annual capacity
Steel--Continued:	DEACERO S.A. de C.V. (private Mexican, 100%)	Steelworks at Saltillo, Coah. and Celaya, Gto.	1,450.
Do.	ISPAT Mexicana S.A. de C.V. (ISPAT International, 100%)	SICARTSA II Plant Facilities at Lázaro Cárdenas, Mich.	3,000, 3,500 pellet.
Do.	Siderúrgica Lázaro Cárdenas-Las Truchas S.A. de C.V., Grupo Villancero, 100%)	Port Lázaro Cárdenas, Mich.	2,350, 1,850 pellet.
Do.	Tubos de Acero de México S.A. (private Mexican, 100%)	Veracruz, Ver.	1,000.
Strontium (celestite)	Cía. Minera La Valenciana (private Mexican, 100%)	San Agustín Mine in Torreón, Coah.	50.
Sulfur	Petróleos Mexicanos S.A. de C.V.	Nationwide petroleum operations	890,000.
Tin 5/	Fundidora Marni S.A.	San Luis Potosí, S.L.P.	NA.
Do.	PIZUTO S.A.	do.	NA.

NA Not available.

1/ State abbreviations: Baja California Norte (B.C.N.), Baja California Sur (B.C.S.), Campeche (Cam.), Chiapas (Chia.), Chihuahua (Chih.), Coahuila (Coah.), Colima (Col.), Distrito Federal (D.F.), Durango (Dgo.), Guanajuato (Gto.), Guerrero (Gro.), Hidalgo (Hgo.), Jalisco (Jal.), Mexico (Mex.), Michoacan Mich.), Nuevo Leon (N.L.) Oaxaca (Oax.), Puelba (Pue.), Queretaro (Qro.), San Luis Potosi (S.L.P.), Sinaloa (Sin.), Sonora (Son.), Tabasco (Tab.), Veracruz (Ver.), Yucatan (Yuc.), and Zacatecas (Zac.).

2/ Grupo Industrial Camesa S.A. de C.V. is owned by Banco Internacional (34%), Banco del Atlántico (34%), Banamex (17%), Noranda Inc. of Canada (4%), Free Float (12%).

3/ PEMEX operates nine refineries with an installed capacity of 1.68 million barrels per day.

4 Includes capacity from Cía. Fresnillo S.A. de C.V.

5/ Smelter output from mostly imported concentrates.