THE MINERAL INDUSTRY OF

CHILE

By Pablo Velasco

In 1995, Chile continued to be the world's top producer and exporter of copper (in terms of volume and value) producing 35% of the world's new mined copper. Chile also was recognized by the world mining community as the single most active mining country in the world in terms of new development and investment.

The strong performance of the copper subsector affected production in the molybdenum, gold, and silver subsectors, which also increased at the rates 15.9%, 10.1%, and 5%, respectively. Chile was also one of the world's significant producers and exporters of potassium nitrate and sodium nitrate and ranked second after the United States in world production of iodine, lithium, molybdenum, and rhenium.

According to government officials, in 1995, the Chilean economy had its best year in a decade in 1995. The economy registered growth of the gross domestic product (GDP) of 8.2% to about $62 billion;[1] and investment reached 31% of GDP, the eighth highest annual investment rate in the past 36 years. Per capita income increased by 6.4% to about $4,700. The improvement in the economy in 1995 was due mainly to the strong price of copper, which averaged $1.33 per pound compared with $1.05 per pound in 1994.

New foreign investment; the increase in output from the private sector's Cerro Colorado, Quebrada Blanca, La Candelaria, Ivan-Zar, and Zaldivar Mines; and the new expansion of the giant La Escondida Mine, with its new copper cathode plant capable of producing 80,000 metric tons per year (t/yr) of high-grade copper were largely responsible for the continued growth in 1995. Following an additional $520 million investment, La Escondida was expected to increase production to 800,000 t/yr by 1997, making it (in terms of production) the largest copper mine in the world.

According to the Chilean Copper Commission (COCHILCO), most of the foreign investment in the country mining sector was concentrated during the last 7 years in 20 projects shown in table 3. Some of these projects were recently initiated; others were already in production or in advanced stages of construction.

Government Policies and Programs

Significant political and economic reforms carried out in Chile during the 1970's and 1980's consolidated the country as a market economy. The transformation of Chile's economy became a model for policymakers in other Latin American nations.

In 1995, two laws regulated foreign investment in Chile. One was Decree Law No. 600 of 1974, which was amended in 1977 and reformed in 1993. This law, also referred to as the "Foreign Investment Statute," established a standard that became the model for many countries in Latin America and was the benchmark for foreign investment legislation in Chile. The second law was Title I, Chapter XIX (Compendium of Foreign Exchange Rules, issued by the Central Bank of Chile). As stipulated by this law, foreign investors, either as individuals or corporations, may use Chilean foreign-debt titles, payable abroad and maturing within 365 days, to invest in the country. This law provided the legal framework guaranteeing the rights of foreign investors and established maximum tax rates, offshore accounts, and a minimum period after which profits and capital could be repatriated.

The Government of Chile made protecting the environment a priority. A new Environmental Framework Law known as the Basic Law on the environment, was signed by the President of Chile on March 1, 1994. This law established legally the National Commission on the Environment, Comision Nacional del Medio Ambiente (CONAMA), and 12 Regional Environmental Commissions, Comisiones Regianales del Medio Ambiente (COREMA') to coordinate environmental protection activities among governmental agencies. The commissions would oversee developing and coordinating environmental policies and setting up modern tools for the implementation and enforcement of these policies. The most important environmental protection policies were enacted in mid-1994. Regulations implementing the Basic Law were signed by the President on the same day that the Basic Law was enacted in March 1, 1994.

Environmental Issues

CONAMA had the legal mandate to define Chile's environmental policy, propose environmental legislation, and develop and maintain the resources necessary for administration and enforcement of environmental regulations. CONAMA was represented in the 12 Chilean regions by the COREMA'. Each COREMA was presided over by a Regional Administrator (an appointed official approximately

equivalent to a U.S. Governor) and was composed of regional-government, private sector, and nongovernmental organization representatives. The COREMA'S were charged with the implementation and enforcement of new regulations and, through its regional subsidiaries, authorized pollution prevention and abatement plans and advised the Ministry of Mining on designing environmental policies and the regulations implementing these policies, on diagnosing environmental impacts, and developing general environmental objectives and policy responses.

Regulations implementing the Basic Law on the environment established equal rights and responsibilities for public and private enterprises. The Government planned to phase in the legislation's provisions gradually to minimize disruptions to the economy and to allow time to develop monitoring and enforcement capabilities. The Government promulgated two decrees intended to reduce fixed-source air pollution (including Decree Law No.185 of 1991, wich regulated sulfur dioxide emissions) and was implementing regulations pertaining to the disposal of waste water from mine tailings in coastal zones. It also took some initial steps to contain and eventually reduce the difficult problem of Santiago's severe air pollution.

Decree Law No.185 divided Chile into two zones, the mining district (Zone 1, which covers more than one-half of the country, from Rancagua, site of the El Teniente smelter, to the border with Peru) and the agricultural-industrial part of the country (Zone 2, from the area south of Rancagua to Tierra del Fuego). The decree stipulated that Zone 1 must meet emission standards published by the U.S. Environmental Protection Agency and that Zone 2 must meet the considerably higher air quality standards in force in Scandinavia.

Under pressure from the Atacama Environmental Health Service and the Chilean Federal Government, Empresa Nacional de Mineria (ENAMI) will install a sulfur-recovery plant to control sulfur dioxide emissions at its Hernan Videla Lira (Paipote) smelter. During 1995, CONAMA was to determine if ENAMI' Paipote smelter had met its emissions reduction obligations. ENAMI will continue a $8.6 million contract with a Santiago-based construction company to install an additional sulfuric acid plant at Paipote. The acid plant will be moved to Paipote from the old Chagres smelter, which was replaced by a new Flash Furnace Smelter by Exxon's Cía. Minera Disputada de-Las Condes S.A. in the Catemu Valley 90 kilometers (km) north of Santiago.

At Corporación Nacional del Cobre de Chile (CODELCO's) El Teniente Division, the commitment to maintaining productivity while exercising environmental responsibility has become a top priority over the past several years. Two specific objectives were identified at El Teniente, (1) reducing emissions and monitoring the living conditions of employees and local inhabitants and (2) utilizing the vast amount of waste water from mine tailings. El Teniente has announced a 3-stage plan which will involve the construction of three sulfuric acid plants, the installation of four additional environmental monitoring stations, a community action plan involving the study of the environmental impact of pollutants on mining workers and their families, and an upgrade of the environmental control measures currently in existence. This project will focus on the Caletones smelter and the neighboring towns of Caletones and Coya. The total cost of these measures would be around $300 million. CODELCO has already announced early in 1995 that the contract for the construction of this first plant has been awarded to Mitsubishi of Japan. The cost of this construction alone will be $50 million.

When completed, the plant will have the ability to neutralize 36% of the sulfur and 49% of the arsenic currently found in the gas emission from the Caletones smelter. The second and the third acid plants will see that the Caletones smelter comply completely with the environmental measures demanded by the Supreme Decree No. 185. In total, anhydrous sulfur emissions will be reduced by 97%, arsenic by 98%, and 99% of all particulate material matter released by the smelter will be captured.

El Teniente had also placed a high priority on the disposal or storage of water used in the mining process. To this end, surplus water has been stored in several reservoirs at Arena, Agua Amarga, Barahona, Cauquenes, and Colihues. The most recent reservoir built for this purpose by CODELCO was at Caren Reservoir. The reservoir is fed by a number of drainage channels that take the water from the mine to the tailings dam.

Minera Escondida's operations west of Antofagasta was subject to high environmental management standards. Prior to its production startup, Escondida carried out ecological base line studies in its operation areas. In the case of the Coloso port, Escondida prepared an environmental impact study, and it designed a wide monitoring and environmental control program of its activities. The study was analyzed and approved by the COREMA of Region II, where the mine is located.

Production

COCHILCO reported that Chilean copper production increased 12.1% to 2.49 million metric tons per year (Mt/yr) compared with that of 1994, of which 1.32 Mt/yr was contributed by the private sector (53%) and the remainder (47%) by CODELCO. The National Mining and Geology Service, an agency under the Ministry of Mines, reported that gold production in 1995 increased 10.1% to 42,700 kilograms (kg) (another record high for Chile), and silver production increased 5.0% to 1,032,000 kg in 1995. The medium- and small-size mines produced 92.7% of the gold and 71.6% of the silver in the country, followed by the large-size mines of CODELCO, with 7.3% of the gold and 28.4% of the silver produced primarily as byproducts of their copper operation.

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

The increase in production of copper by the private sector in 1994 and 1995 established a new benchmark in Chile's historical copper output chiefly because of the startup operation of five new copper mine projects, La Candelaria, Cerro Colorado, Quebrada Blanca, Ivan-Zar, and Zaldivar and the increase in output of the expanded La Escondida and El Indio mines and the second phase of the copper cathodes production of the Minera Michilla project.

Beginning in 1994 with addition of several new copper and gold mining projects, the output of copper cathodes had increased from 7% to about 14% in 1995 making Chilean mining highly competitive in the world economy.

Trade

According to Central Bank of Chile, mining products led the Chilean exporting sector in 1995 and totaled a record of $7.9 billion in shipments overseas. Chile's total exports for 1995 were $16.04 billion, an increase of 38% compared with that of the previous year. The Central Bank announced that total value of exports in 1995 actually double those of 1990, when they were $8.37 billion. The Bank added that mining despatches represented 49.4% of Chile's total exports and rose 51% compared with that of 1994. Chile's main export was worth $6.7 billion, or about 41.8% of the total exports. This was due mainly to the relatively high average price of $1.33 per pound maintained throughout the year. Besides copper, Chile's main minerals exports were ferromolybdenum, gold, iodine, iron ore, iron pellets, silver, sodium nitrate, lithium carbonate, molybdenum oxide, nitrate, potash, and zinc. CODELCO shipped 1.06 (Mt) of fine copper in 1995, 6.3% higher than in 1994, of which electrolytic copper (copper cathodes) was 74.5%; blister, 4.3%; concentrates, 11.2%; and other, 10%.

Revenues from copper sales by CODELCO in 1995 were about $3.6 billion, $1 billion more than those in 1994. Revenues from byproduct sales during 1995 were $353 million, $183 million more than those in 1994. The most significant byproduct was molybdenum, sales of which amounted to $25.6 million for shipments of 2,590 metric tons (t), fine content. Doré metal, silver, selenium, molybdenum oxide and other were valued at $316 million. According to COCHILCO, copper exports totaled $6.3 billion, 41.4% higher than those in 1994. During 1995, foreign investment in Chile totaled $3.1 billion, of which $1.8 billion was in mining. Mining continued as the most attractive sector for foreign investment, contributing approximately 58% of the total achieved foreign investment in 1995. The positive impact of the startup of new copper projects also affected mineral exports. An increase of 41.6% was registered in copper exports in 1995; it was due mainly to the startup operation of new copper and gold projects and to the increase in the price of copper.

Structure of the Mineral Industry

The Chilean Government through the Ministry of Mines exercised dominant control over the mineral industry through three large state-owned mining companies and four regulatory agencies. The mining companies were CODELCO, ENAMI, and Corporacion de Fomento de la Production (CORFO). CORFO included Cía. de Acero del Pacífico, S.A. de Inversiones (CAP); Empresa Nacional del Petróleo, S.A., (ENAP); Empresa Nacional del Carbón S.A. Cía. Chilena de Electricidad, S.A.; and Sociedad Química y Minera de Chile S.A. (SQM). The four regulatory agencies were SERNAGEOMIN, COCHILCO, the Foreign Investment Committee, and CONAMA.

CODELCO, the largest copper producer and exporter in the world, was composed of four divisions: Chuquicamata; El Teniente; Andina; and El Salvador, which produced 47% of all Chilean copper production in 1995. CODELCO 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 established as part of its mission the promotion, development, and processing of Chile's small- and medium-size nonferrous metals mines output. ENAMI also purchased concentrates of copper, gold, and silver; precipitate and minerals for direct smelting; and anodes and blister for its smelters and refineries. ENAMI served as a market regulating force by determining rates for minerals and mining products bought from producers in potentially attractive mining zones, provided credit to miners who lacked access to standard sources of financing, facilitated miners' access to banking sources, and provided training and support programs to small-size miners. Furthermore, ENAMI produced, sold, and distributed sulfuric acid; participated with private investors in the development of small- and medium-size mining projects; guarded against potential environmental harm from mining production; and bought ores for flotation and leaching at its own plants.

The total labor force, including staff and office personnel working directly in the minerals sector, numbered 92,900, representing about 1.9% of the total labor force of nearly 5 million in the country. The metals sector's labor force was 61,000, about 66% of the mineral sector labor force total, of which 47,000 were copper workers. The industrial minerals sector labor force was 3,400; and the mineral fuels sector was 13,000, of which 85% were coal miners. CODELCO employed about 39,000 people, including its own copper workers and contractors' personnel in 1995, or about 64% of the total metals sector employees.

Commodity Review

Metals

Copper.—Chile's increased copper production in 1995 reinforced its position as the world's largest producer and exporter of copper. According to official statistics released by the Ministry of Mines through its agencies COCHILCO and SERNAGEOMIN, Chile produced another record high of 2.49 Mt of copper in 1995. The increase in copper production of 12.1% from that of the previous year was due to the additional output from the new private sector's La Candelaria, Cerro Colorado, Ivan-Zar, Quebrada Blanca, Zaldivar, and La Escondida mines. CODELCO's copper production decreased by only 1.9% in 1995 compared with that of 1994 owing to the decline in the average grade of copper from 1.15% in 1994 to 1.10% in 1995, except for the Andina Division where the copper ore grade had increased from 1.28% in 1994 to 1.37% in 1995, and the higher volume of ore treated in the Chuquicamata and El Salvador Divisions. CODELCO's investments in 1995 were $349.4 million, 6.6% less than those in 1994, and were chiefly directed toward developing the corporation's new projects productive capacity and resolving its environmental problems. During the first half of the year, CODELCO contributed $772 million to the national treasury, an increase of about 80% compared with the same period of 1994.

Among other CODELCO investments were the startup of operation at Radomiro Tomic Mine; the continuation of the Andina expansion project, the geological exploration in association with private companies of the Mamina, Puren, Agua de la Falda, Cerro Coya, Picacho, and El Cabrito Copper Projects; and the selection of a strategic partner in the Tocopilla thermal powerplant project.

Under study by ENAMI were the following two projects, one of which was the feasibility study for the modernization of Las Ventanas and Paipote smelters. ENAMI was developing an environmental protection plan including installation of a modified El Teniente-type converter and a new electric furnace at Las Ventanas smelter; startup of a sulfuric acid plant in Las Ventanas, permitting a 30% reduction in gaseous emissions and a 60% in particulates; and investment of a $14 million in an oxygen plant to produce 300 t/yr of SO_2 delivered to the smelter for concentrate treatment.

Production at Minera Escondida's solvent extraction-electrowin (SX-EW) cathode plant at Coloso, 14 km south of Antofagasta, should be at capacity levels of 6,700 metric tons per month by yearend 1995. Unexpected problems have kept the plant considerably below capacity since its startup in January 1995, but most of these were reported to have been solved. Escondida uses ammonia leaching for concentrates followed by electrowinning to produce copper cathodes. Production reached 466,913 t/yr in 1995 of fine copper, 20,000 t lower than projected. Escondida embarked on phase 3 of its mine expansion, which will see production rise to 800,000 t/yr of fine copper in 1996.

The Chilean copper producer Refimet is now moving ahead with the expansion of its copper smelter near Antofagasta. The expansion, which includes oxygen enrichment, anode casting facilities, and a second sulfuric acid plant, will see capacity rise from 90,000 t at present to some 150,000-160,000 t/yr by 1997. Total investment in the expansion, not including the oxygen enrichment plant, is just under $50 million. Refimet currently produces blister copper, but the move to produce anode is aimed at securing greater added value and access to a long-term sales contracts. Refimet has already secured a long-term contract, starting in January 1997, to supply CODELCO's Chuquicamata refinery with an undisclosed tonnage, with the balance likely to be exported. Refimet is also hoping to boost sulfur dioxide capture to around 85% with the installation of this second acid plant, as well as cut unit production costs. To feed the expanded smelter, the company recently secured a 10-year concentrates supply contract with Minera Escondida. Refimet had been taking concentrates, at a rate of around 60,000 t/yr, from Escondida since its inception in August 1993, but the tonnage has been increased to 160,000 t/yr and extended to 10 years from 1996. At current prices, the contract is worth around $200 million per year and will account for 67,000 t/yr of the smelter's output. Refimet is now owned by the Canadian companies Barrick (25.1%) and Noranda (24.8%) and by original share holders of a consortium of local Chilean investors and management (50.1%).

EXXON's Cia. Minera Disputada de-Las Condes S.A. in 1995 lifted the production stoppage which it had imposed on its blister contracts in mid-April 1995 after technical problems at its Chagres smelter. Officials at Chagres are continuing to monitor the progress of repairs to the smelter's new flash furnace which shut down in April because of technical problems. The smelter is monitoring the modifications made to resolve the problems which arose in the first stage of the startup of new technology. Empresa Minera Mantos Blancos, S.A.'s new Manto Verde SX-EW project, 85 km southeast of the port of Chanaral, was based on seawater leaching of 5.4 Mt of 0.9% copper oxide ore from an open pit mine and would produce 53,500 t/yr of copper cathodes.

The Anglo-American Corporation, which controlled Minorco and Mantos Blancos, acquired a one-third interest in the Collahuasi copper project in northern Chile from Chevron Corp. of San Francisco, California, for $190 million. The two-Anglo American companies formed a new entity, Minera/Mantos Minorco, to complete the acquisition. The other two partners in the project are Falconbridge Ltd. of Toronto, Canada, and the Shell Group of the Netherlands. The property consisted of two deposits, Ujina and Rosario. The Ujina deposit, totaling more than 100 Mt and grading an average 2% copper, would be processed through a heap-leaching and SX-EW plant with startup slated for 1997.

Mantos Blancos sold its copper deposit, Lomas Bayas, in Sierra Gorda (Region II), to Gibraltar Mines, a Canadian mining company, for $19 million in November.

The Santa Barbara and Manto Verde SX-EW copper operations in Chile, owned by Minorco subsidiary Mantos Blancos, are now operating following the go-ahead by the company late in 1995. Santa Barbara is an expansion of an opencast mine operated by Mantos Blancos north of Antofagasta. The investment, which included the installation of a new primary crusher, conveyor system and a 30,000-t/yr cathode SX-EW circuit, totaled $68.2 million. The company has also extended the mine's life to year 2010. Production should continue at current levels of around 77,400 t/yr of which 46,000 t/yr will be in the form of copper in concentrates until the middle of the next decade. The new SX-EW circuit produced 2,633 t of copper cathode in December, its first full month of operation. The old smelter at Mantos Blancos is being dismantled. At Manto Verde, the new SX-EW plant has so far produced some 570 t of cathode with output in the first year of operation projected at 30,000 t. Manto Verde is an opencast, heap-leach operation near El Chanaral in the Atacama region. The project has cost some $180 million and is schedule to produce 15,000 metric tons per day (t/d) of ore and 38,400t/yr of cathode over a period of 16 years.

La Candelaria, owned 80% by Phelps Dodge and 20% by Sumitomo, Corp., of Tokyo, Japan, began its operation in August 1994. The plant was scheduled to process some 28,000 t/d of ore, producing 125,000 t of copper in concentrate (30% copper content) and more than 2,532 kg of gold per year. La Candelaria partners have invested $560 million in opening the mine and constructing the plant and new port facilities at Caldera. Expansion plans were under consideration, and a decision to possibly double production would be made in 1995. Candelaria had an investment approval from the Government of Chile for $1.5 billion, the third largest ever, after seeking funds from Far Eastern and European sources. Sumitomo, the world's largest copper trader, agreed to take a 20% ownership stake in La Candelaria for $40 million and support its share of debt financing. The Overseas Private Investment Corp. (OPIC), a U.S. Government insurance agency, awarded a $50-million loan to La Candelaria. In addition, La Candelaria was expected to obtain risk insurance coverage for $100 million from OPIC. La Candelaria is near Copiapo on the southern edge of the Atacama Desert. The mine began production in July 1994. It has estimated reserves of 366 Mt with an average grade of 1.29% copper and 0.26 gram per metric ton (g/t) of gold and 4.5 g/t of silver. The mine had an expected lifespan of 34 years, and, when completed, would represent the biggest new copper investment since Broken Hill Proprietary Company Limited (BHP), BHP-Utah's La Escondida Mine was inaugurated in early 1991.

Other copper projects included Quebrada Blanca in northern Chile in Region I,[2] about 170 km southeast of Iquique and at 4,300 meters (m) above sea level. The deposit was owned by Compania Minera Quebrada Blanca S.A., a joint venture of Cominco Ltd. of Canada (38.25%); Teck Resources International, Ltd. (29.25%); Cominco International, Ltd. (9.0%); ENAMI (10%); and Sociedad Minera Pudahuel Ltd. (13.5%). Quebrada Blanca reserves were estimated at 90 Mt of copper with an average grade of 1.3% in its secondary enrichment zone, enough to keep the mine in operation for 14 years. An additional 400 Mt of copper sulfide ore with a average grade of 0.5% also was reported, The mineral was being processed by heap leaching using the bacterial leaching techniques. The project started production in September 1995 and was expected to produce approximately 75,000 t/yr of fine copper.

Compañía Minera Cerro Colorado, S.A., the Chilean subsidiary of Río Algom Ltd., of Vancouver, Canada, completed a partial financial package of $150 million for the copper project east of Iquique, high on the northern plateau. As a result of new drilling, Rio Algom reported an increase in ore reserves at Cerro Colorado to 193 Mt of ore grading 1.08% copper from 79 Mt grading 1.39% copper. According to officials, the additional reserves will enable the mine to produce for much more than 20 years (at an expanded mining rate) and to provide the company with the potential for further production expansions in the future. The project was expected to produce 45,000 t of copper cathodes in 1995. The open pit mine used bacteria heap leaching and the SX-EW process. The initial startup investment was $290 million.

Falconbridge Ltd. and Minorco Plc., announced a deal in late December to sell 12% of the huge Collahuasi copper project in Chile's Region I to a consortium of Japanese smelters in return for a long-term smelting contract. Mitsui & Co., Nippon Mining & Metals Co. and Mitsui Mining & Smelting Co., have agreed to take a 12% equity stake in Collahuasi in return for a long-term contract to buy 250,000 t/yr of copper concentrate.

Mitsui & Co. also agreed to provide $200 million in customer financing, while the consortium also shares project expenses and pays a $6.8-million premium on the smelting contract. Falconbridge and Minorco will see their equal 50% stakes in Collahuasi drop to 44% each after the deal closes, expected by mid 1995. The deal paved the way for project financing for Collahuasi which will cost about $1.75 billion to put into production at a rate of 330,000 t/yr of copper concentrate and 50,000 t/yr of copper cathodes by 1999. The purchase price was based on Shell's sale of its one-third stake in Collahuasi to Falconbridge and Minorco in May 1995. In September 1993, Collahuasi decided to focus its exploration in and around the Rosario, Ujina, and Huinquintipa areas. Reserves at Rosario, its main deposit, were estimated to contain at least 800 Mt of primary ore with an average grade of 0.8% copper and 25 Mt of secondary ore grading 1.7% copper. The Ujina reserves surpassed 500 Mt with about the same grade ore as Rosario.

Rayrock Yellow Knife Resources Inc. of Toronto, Canada, began production at the Ivan-Zar Mine, 40 km northeast of Antofagasta. The SX-EW project is operating at about 50% capacity and is expected to reach its annual production rate of 8,000 t/yr of copper cathodes by yearend 1995. The project consisted of 85 square kilometers. of mining claims containing two deposits (the Ivan-Zar and Emperatriz) and 97 square kilometers of exploration claims. Copper is produced by using a combination of openpit and underground mining methods and bacteria-assisted sulfuric acid technology to leach the metal from oxide and sulfide ores. The solution is combined at the electrowinning process to produce a cathode of high purity. The total minable reserves at the two deposits amounted to 4.6 Mt of ore averaging 2.5% copper, indicating a minable reserve life of 10 years.

The Zaldivar copper mine and leach operation successfully started operations in 1995. The project, which shipped its first electrowon cathode in June, should see total production of 23,000 t in 1995 and 85,000 t in 1996, rising to full capacity of 125,000 t/yr by 1997. The mine was owned by Cia. Minera Zaldivar S.A., a 50-50 subsidiary of Placer Dome Inc. of Canada and Outokumpu Copper Resources Chile B.V., and is 175 km east of Antofagasta in the north of Chile and at about 3,000 m above sea level. The openpit mine has reserves of 425 Mt of ore grading 0.78% copper, which is sufficient for 19 years of production at the planned rates. Over its lifetime, Zaldivar is expected to produce 1.9 Mt of copper cathode.

Gold and Silver.—Among the gold-producing companies in Chile, the El Indio Mine remained the largest. It was owned by Barrick Gold Corp. of Canada, which acquired the properties from Lac Minerals Ltd. also of Canada in 1994. In 1994, Barrick Gold Corp. planned to spend about $500 million to expand its rich El Indio and and other gold properties in Chile and was expected to spend about $200 million in 1995 on the El Indio and the El Tambo Mines and to finalize the feasibility study of its Nevada gold project in Chile. According to latest studies, Barrick's El Indio gold deposit holds reserves greater than originally estimated and will allow the company to increase its expected production from 31.1 t/yr to about 46.7 t/yr and to 62.2 t/yr. The total reserves of gold of the El Indio deposits was estimated to be about 273.7 metric tons.

The second largest gold producer in the private sector in Chile was La Coipa Mine, owned by Dayton Development Corp., Placer Dome, and TVX Gold Inc. of Canada.

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 about 430,000 kg in 1993, 43.7% of the country's total output. La Coipa, operated by Cia. Minera Mantos de Oro Limitada., was operating at its full capacity of 15,000 t/d of ore by yearend 1994. Followed by CODELCO, other important producers of byproduct silver were El Indio, La Escondida, and El Bronce de Petorca. Niugini heap-leach operations contributed 1,700 kg of gold in doré bars. CODELCO maintained its level of output of gold at about 2,200 kg in 1994 as a byproduct of its electrolytic copper refining. Other precious metal producers included Choquelimpie (Vilacollo); El Hueso (Homestake); San Cristóbal (Niugini); La Escondida, El Bronce de Petorca, and El Guanaco project owned by AMAX Gold Inc.

SCM Vilacollo Ltd., the company formed by Shell, Citibank, and Northgate to operate the Coquelimpie Mine near the Bolivian border, was seeking new reserves near the mine. SCM Vilacollo Ltd. and Cia Minera Mantos de Oro Ltd. were reviewing financing plans to raise the required $135 million capital investment. According to the feasibility study completed by Mineral Resources Development Inc., ore extraction at El Refugio would require an open pit with a stripping ratio of 1:1. The study recommended a plant with a processing rate of 33,000 t/d. At that rate, Bema Gold Company would produce 7.2 t/yr of gold for 13 years.

Iron Ore, Manganese, and Steel.—In 1995, Chilean iron production and exports decreased 2.0% to 8.2 Mt and 5.6% to 6.6 Mt, respectively. In 1995, pellet production was 3.0 Mt, similar to the year before. The Algarrobo Mine output, which feeds the pellet plant, would be depleted by the end of this decade. Cia Minera del Pacifico S.A. (CMP) the owner, has entered into joint venture with the company MC Inversiones Limitada. a subsidiary of Mitsubishi Corp., to expand the iron deposit Los Colorados, a property of CMP in the Province of Huasco in Region III. This joint venture, Compania Minera Huasco S.A., is a closed corporation with a straight 50-50 ownership. To finance the project, the company signed a loan contract with MV Cayman Ltd. for the sum of $71.7 million. The total investment of the project is estimated at $107 million. The reserves of Los Colorados are calculated to be roughly 245 Mt of iron ore grading 45%. The expansion of the deposit will enable CMP to process the preconcentrate into pellets in its plant in Huasco, thereby producing 4 Mt of pellets per year by 1998. CAP is currently producing around 1 Mt/yr of iron concentrate from the deposit, and the project aimed at increasing output by mid-1998. Mitsubishi was to supply all the investment required for the expansion program, while CAP would contribute the mining rights and other assets to the equally held joint venture. Manganesos Atacama, S.A., a subsidiary of CAP, a Swiss-Chilean industrial group, owned iron mines and Chile's largest steel plant, producing ferromanganese and ferrosilicon alloys and manganese as well as steel cones for mills for the domestic market in a plant in Coquimbo. The company produced manganese ore at the El Corral Quemado and Los Loros Mine in Region IV; MASA also bought ore from other producers in the same region.

Most of the manganese produced by MASA was bought by the Huachipato smelter. The production of steel ingots at Huachipato amounted to 1.0 Mt in 1995, the same as in 1994. CAP reported that in order to increase the production

capacity at its Huachipato smelter and to reduce operating costs, the holding company was considering an investment of $350 million to modernize the plant between 1995-98.

Lead and Zinc.—Lac Minerals-owned Sociedad Contractual Minera el Toqui continued production despite problems resulting from low zinc prices. El Toqui, Chile's largest zinc miner, produced some 63,000 t of concentrate in 1994 containing 31,000 mt of zinc. A temporary shutdown of El Toqui's zinc operations would cost the company some $5 million; so, Lac opted for continued production while at the same time reducing costs at the 1,500 t/d concentrator at Coyhaique in the far south of Chile. Production of zinc increased 5.2% in 1995 to 30,968 t, of which 91% was from SCMT. Lac completed an expansion program in 1993, which was largely responsible for the notable increase in Chilean zinc production for the past 3 years. However, low zinc prices have induced Lac to postpone its plans to expand its El Toqui zinc mine near Coyhaique.

Industrial Minerals

Lithium and Potassium.—Chile was the second largest producer of lithium in the world after the United States. Production of lithium carbonate in 1995 was estimated to be 14,000 t, 34% more than that of the previous year. (SQM), the private nitrate and iodine producer, announced investment plans totaling $230 million for the next 4 years. This investment followed $60 million in 1994, focusing primarily on the Minsal project on the edge of the Atacama salar and a new potassium nitrate plant at Coya Sur, just south of Maria Elena in Region II and inaugurated in October. The new plant added a productive capacity of 100,000 t of potassium nitrate to SQM's previous 260,000 t. The plant, which cost $13 million to construct, would produce technical-grade products for industrial and agricultural use. The first phase of the Minsal project would require a $75 million investment and have a production capacity of 300,000 t of potassium chloride. At present, SQM spends some $35 million on imported potassium chloride for use in potassium nitrate production. SQM, acquired full control of the Minsal project at yearend 1995 from the state holding company CORFO. The transaction was about $7 million. Before the deal, SQM owned 81.2%. SQM will now have the right to name the fifth director of Minsal. Cocar S.A. sold all of its shares of the subsidiary, the Chilean salt company Cosal S.A., to SQM for an undisclosed amount. The shares represent 55% of the parent company.

Nitrates and Iodine.—Cia Minera Yolanda S.A., a Chilean subsidiary of KAP Resources Ltd. of Canada in the Taltal zone of Region II, was planning to produce roughly 300,000 t/yr of sodium nitrate, 357,000 t/yr of potassium nitrate, and 180 t/yr of iodine using heap-leaching methods by utilizing seawater and solution concentration by solar evaporation in ponds before crystallization. The company planned that part or all of the sodium nitrate produced would be converted to potassium nitrate, utilizing an additional potassium chloride treatment and recrystalization, and iodine would be extracted from the residual waters. A feasibility study was first completed for the Yolanda iodine-nitrate property in Chile's Atacama Desert in 1990 and then updated a few years later. Now held by a wholly owned subsidiary of KAP Resources Ltd., in 1995, the project has advanced to the point where a financing package for the mine development is being arranged. KAP has received commitments in 1995 for the $41-millon debt package from a consortium of four banks and the Inter-American Investment Corp. To raise the remainder of the required equity, KAP has entered into an engagement letter with First Marathon Securities. The investment firm will endeavor to raise about $25 to $30 million of common equity and equity equivalent. Assuming the financing is arranged, KAP will release its fixed price contract for the start of construction activity during July 1995. Production would begin about 18 months later. At last report, the project hosted reserves of over 120 Mt of ore containing an estimated recoverable resource of 40,500 t of iodine and sodium nitrate adequate to produce 13.3 t of potassium nitrate.

With the aim of doubling its production of iodine, SQM started development of a $23-million expansion program in Regions I and II. The first stage of the plan has been completed and plans the startup of the expansion at the Florencia nitrate plant 100 km north of Antofagasta, which is expected to produce 1,000 t of iodine in 1996. The program, which was being carried out by the subsidiary of Sociedad Química y Minera de Chile S.A. (SOQUIMICH), SQM Yodo, also plans the construction of two additional plants at Pinto in Region II and another in Region I. Soquimich reports that the expansion is to allow the company to offer iodine manufactured under the strictest pharmaceutical industry standards of the United States and Europe, utilizing two patents that it obtained in Chile for the product's commercialization. The company reports that because of the plan, it expects to produce some 8,000 t of iodine in 1997, about half of the world demand for the product.

Sulfur.—Chile has been an importer and producer of sulfur for many years. In 1995, Chile imported about 42,000 t of sulfur, 27.5% more than that of the previous year, mostly from Bolivia, Canada, and the United States, valued at $2.5 million. Chile's native sulfur production derived from caliche decreased almost 96% to 937 t. Chile's total production of sulfur, including sulfur derived from smelters and oil refineries, as well as imported, was used as raw material to produce sulfuric acid in various industrial plants spread from Regions I through VIII. About 94% of the acid was used in mining and metallurgy. The balance, around

10,000 t, was applied mainly as a fungicide. Condesa Mining Corp. of the United States received authorization from the Foreign Investment Committee to carry out at $25-million development in two sulfur mines near San Pedro de Atacama with a capacity to treat 1,000 t/yr. The project would include construction of a concentrating plant, a refining plant, and a pipeline to the Port of Coloso, south of Antofagasta. No startup date had been reported.

Chuquicamata, as part of a $323-million investment to reduce SO_2 emissions by a third, added a new 620,000 t/yr acid plant (No.4) to replace the 180,000 t/yr old No.1 plant, for a total production of 1.3 Mt. Meanwhile, Refinadora Metalurgica (Refimet) would produce 90,000 t/yr of acid in its new copper smelter. Refimet and Minera Escondida signed a contract to smelt 160,000 t/yr of Escondida's copper concentrate. This agreement increases significantly the volume of copper concentrate from Escondida that would be processed in local smelters. It will also facilitate the expansion of Refimet's installations, which will include the construction of a second sulfuric acid plant and other measures to reduce environmental contamination by eliminating emissions of sulfuric gases. The contract has a duration of 10 years beginning in 1996; and, at current price levels, represents an annual transaction of a approximately $200 million. Consumption of sulfuric acid in Chile amounted to 900,000 t/yr. Startup of new sulfuric acid plants using gases from the smelters would increase CODELCO's production of more than 1.8 Mt/yr. As a result, Chile would significantly lower sulfur imports. Sulfuric acid also was produced from gases from four copper smelters: Chuquicamata, Las Ventanas, Paipote (Hernan Videla Lira), and Chagres. These plants have a production capacity of 2.0 Mt/yr, of which 1.3 Mt/yr was from Chuquicamata; 290,000 t/yr from Las Ventanas; 60,000 t/yr from Paipote; and 330 t/yr from Exxon's Chagres smelter to replace its old 70,000 t/yr facility. Also, about 20 smaller sulfuric acid plants between Arica and Rancagua were using sulfur as raw material. The capacity of these plants totaled approximately 500,000 t/yr.

Mineral Fuels

Coal.— Bituminous coal output in 1995 was estimated at 1.5 Mt. The Chilean Government has encouraged greater domestic coal production as a means of reducing Chile's dependence on petroleum. Chile, with a population of more than 13.7 million, has a small coal market in which the most important consumers were electric utilities. Demand for electricity was concentrated in the central part of the country, where 93% of the population lived, and in the northern area associated with mining and minerals refineries. The largest coal producer in Chile was Cia. de Carbones de Chile S.A. (COCAR), which strip-mined subbituminous coal in Pecket, near Punta Arenas. It was reported that COCAR was still considering a number of plans for future coal output. Its current production from the Pecket Mine was 1.2 Mt/yr. COCAR has a long-term contract with CODELCO (expiring in 1997 but expected to be renewed sooner) to supply CODELCO's Tocopilla powerplant with 850,000 t/yr. However, Tocopilla was taking all Pecket's output. Additional potential power stations projects for later this decade included 150-megawatt (MW) plants at Huasco and Tocopilla and a 400-MW facility in the north of the country. By the end of the 1990's, these could increase total coal demand to 4.5 Mt/yr. COCAR was examining a number of options. Pecket could be expanded by moving into an underground operation, and it has been reported that prefeasibility studies have examined the development of a further 100 Mt of reserves at Pecket for an output of 1 Mt/yr. The second possibility was to develop the Isla Riesgo deposit, which would be an open pit, some 40 km from Pecket Mine.

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 Chilean Electricity Generator (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, north of Antofagasta, essentially to supply Escondida's expanding needs.

COCAR, at its Pecket strip mine, would have to double its capacity to supply the additional demand for an output of 1 Mt/yr. Bituminous coal was found in underground deposits in Region VIII. Operations were carried out in this area by the state-owned Empresa Nacional de Carbon S.A. (ENACAR) that produced around 500,000 t/yr, with Carbonifera Schwager contributing 340,000 t/yr.

The shareholders of ENACAR approved an increase in the company's capital of $62.5 million, which will be financed with emission of more than 3.8 billion shares. ENACAR's official in 1995 stated that the increase will finance expansion and improvement of operations and that the new infusion of capital will finance the company's debt. ENACAR receives financing not only through stocks but also directly from the Government. However, the continued capital flow from the state is conditional. The company needs to prove the existence of 2.5 Mt of coal by the end of 1996, or that financing will be cut off in 1998.

Natural Gas.—The principal natural gas reserves of the country were found in the Magallanes Basin in the far south of Chile. Natural gas production increased slightly to 4,300 million cubic meters, continuing the declining trend since 1990. Of the total production, about 51% was reinjected; and 49% was marketed internally. The natural gas that was reinjected by Empresa Nacional del Petroleo (ENAP) in the

straits of Magellan Region in the past were to be used to produce 150,000 t/yr of ammonia and 570,000 t/yr of urea at Cabo Negro. During 1995, 55% of the natural gas was produced from offshore, 23% from onshore, and 22% from Tierra del Fuego.

Official of the National Energy Commission (CNE) said that next year efforts would be directed at the approval of the geothermal energy law and the passage of the bill to modify the Gas Law, establishing regulations for the pipeline transportation of liquid hydrocarbons. CNE had carried out studies of the gas pipeline projects' progress, outlining that the Gas Andes project was the most advanced and was expected to be operational in May 1997. Both the Gas Andes and the Trans Gas (Gaseoducto Transandino/Gas de Chile) consortium are planning to import natural gas from the Neuquen area of Argentina, the Gas Andes across the Andes near Santiago, and the Trans Gas near Conception. The CNE official indicated that the Gas Andes consortium plnned to invest a total of $284 million in this gas pipeline project, of which $110 million will be invested in Chile. CNE reported that the Trans Gas consortium is at the stage where its gas transport concession has been granted. However, Trans Gas has not yet presented its environmental impact study. The investment by the Trans Gas consortium is estimated to be $689 million, of which $484 million is to be in Chile. The Gas Sur pipeline project proposal is currently at its "open season" stage.

Petroleum.—Chilean production of crude oil sustained a further decrease of 15% in 1995 to 3.8 million barrels (Mbbl). Imports of crude oil in 1995 were 47.7 Mbbl compared with 43.3 Mbbl in 1994. The new 105,000-barrels-per-day (bbl/d), 450-km oil pipeline from the southwestern Argentina Province of Neuquén to the Chilean Port of San Vicente on the Pacific Ocean which was expected to be opened in early 1995, has been delayed momentarily for environmental reasons. The most important private infrastructure project so far in the Southern Cone region of South America, the pipeline would provide Chile with more than two-thirds of its import needs. The pipeline also set the stage for much wider energy integration in the Southern Cone. A $220- million pipeline was built by Oleoducto Trasandino S.A., a company formed by Chile's state oil company ENAP and Argentina's Yacimientos Petroliferos Fiscales (YPF) and Banco Rio de La Plata (Argentina). Banco Rio de La Plata provided all the credit for the project in the form of medium-term loans that will be refinanced as long-term credits with other banks. YPF held 57.75% of the shares; Banco Rio de La Plata, 30%; and the balance by ENAP. Scheduled to be completed in early 1996, the pipeline would transport crude oil from Argentina's Puesto Hernandez oilfields to Chile's terminal in Talcahuano. Plans called for about 94,000 bbl/d of petroleum to be pumped into Petrox's terminal. Petrox was expected to process 37,700 bbl/d, and the remainder was to be shipped from the Port of San Vicente to Chile's Concon refinery.

ENAP reported $110-million profit in 1995 as a result of a 25% increase in output to 1 Mm^3 of crude from the Strait of Magellan. The Petrox and ENAP refineries contributed $65 million and $27 million, respectively, to ENAP's total profit.

In 1995, ENAP and Cardinal Resources of the United States have agreed to jointly explore for oil in a 5,000-square-km area near the country's border with Peru in the area named the "Arica Depression." The contract was for 35 years and involved a minimum investment of $500,000 during the contract's first 6 years, $4 million was expected to be spent in the oil search. Currently, Chile produces enough oil to satisfy 8% of its needs.

Reserves

In 1995, CODELCO produced 47% of the total copper in the country and held more than 9 billion t of copper reserves with an average ore grade content of about 0.9%, or the equivalent of more than 70 years of production at present levels representing about 20% of known global reserves. Its molybdenum production reached 17,884 t in 1995, making CODELCO the world's second most important producer. Confirmed copper reserves at the El Abra deposit are 669 Mt of copper oxide with an average ore content of 0.6% copper and 523 Mt of copper sulfide grading 0.6% copper.

Some of the private sector's reported copper reserves, listed as estimated figures and average grades were as follows: Escondida, 1,800 Mt, 1.6% copper; Cerro Colorado, 105 Mt, 1.3% copper; Quebrada Blanca, 85 Mt of 1.3% copper and 250 Mt of 0.5% copper; Zaldivar, 316 Mt of 0.9% copper and 680 Mt with 0.6% copper. The Collahuasi deposit had three areas with the following reserves and grades: Rosario, 800 Mt of 0.8% copper and 0.25 Mt of 1.7% copper; Ujina, more than 500 Mt of 0.8% copper and 200 Mt of 1.6% copper; and Huinquintipa, 7 Mt of 1.2% oxide copper. La Candelaria reported more than 360 Mt of ore reserves grading 1.09% copper and 0.25 g/t of gold; Andacollo, more than 25 Mt grading 1.3 g/t of gold and 250 Mt grading 0.6% copper; Manto Verde, 93 Mt grading 0.82% copper; and El Refugio, 112 Mt grading 1 g/t of gold containing about 90 t of gold. According to latest studies, the Canadian company Barrick's El Indio gold deposit holds reserves greater than originally estimated. The total reserves are reported to be at about 274 t of gold. The El Can Can deposit had proven reserves of 1.2 Mt of ore grading 8 g/t of gold and 60 g/t of silver. However, potential resources could reach 5.5 Mt of ore. It came on-stream in 1994 at a production of about 160 kilograms per month of gold.

The Colorado iron ore deposit contained some 245 Mt of minable ore, forming the basis for a 20-year project life and feeding Compania Acero del Pacifico's 4-Mt/yr pellet plant.

Infrastructure

Chile extends approximately 4,200 km along the Pacific Coast of South America and has an average width of approximately 180 km between the coastline and the Andes Mountains. Chile is divided into 13 regions, including the Metropolitan Region, which is not
numbered like the other 12 regions, beginning with Region I at the northern border with Peru and continuing in sequence to Region XII at the southern end, with each region having a 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. 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 of Chile. 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 area of Chile (from Region XI to Region XII) is one of the wettest and stormiest parts of the world. Less than 2% of the population resides in this area. Southern Chile's resources are concentrated in the area lying east of the mountains. These natural resources include coal, natural gas, and petroleum.

The railway system of Chile served 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 was similar to that of its railways. The road system totaled 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, was handled through the Ports of Arica, Antofagasta, Valparaiso, Tocopilla, Cruz Grande, Talcahuano, and San Antonio, which handled almost 60% of the total tonnage.

Crude oil, refined products, and natural gas were transported to consumption centers by three major pipelines that are 785 km, 755 km, and 320 km in length, respectively. In addition, a 450-km, 41-centimeter-diameter oil pipeline was 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 was coming closer to reality as negotiations continued to show progress.

Outlook

Chile is attractive as an investment center, especially for export-related activities. The current prosperity of Chile is based on free market initiatives and a stable political system. A record $4.10 billion was posted during 1995 for achieved foreign investment, an increase of 0.1% from 1994, according to Chile's Minister of Economy and Executive Vice-President of the Foreign Investment Committee. Of the total of achieved foreign investment, $7.4 billion entered the country through its Foreign Investment Statute (D.L. 600), $407.1 million through chapter XIV of the Central Bank's International Exchange Norms, and $1.72 billion through issues of American Depository Receipts in 1995. The amount entering through Chile's D.L. 600 marked a 47.7% increase from the previous year's figures and was divided into $1.56 billion of direct capital investment, and $971.3 million in associated credits. The three primary destinations of achieved direct investment (D.L. 600) in 1995 were mining with $1.81 billion (58%); followed by industry, $320.7 million (12.7%); and services, $314.4 million (12.4%).

In 1995, officials of the United States, Canada, and Mexico were consulting closely with Chile to keep alive Chile's bid to join the North American Free-Trade Agreement (NAFTA) in the face of a trade policy impasse in the United States.

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 was expected to grow from 2.49 Mt in 1995 to about 4.4 Mt by the year 2000, an increase of nearly 75%, representing more than 35% of world supply. Gold was projected to increase from about 39,180 kg in 1995 to 43,800 kg by 1996, representing an increase of nearly 12%; and silver was projected to increase from 1,032,000 kg in 1995 to about 1,040,000 kg during the same period.

The production of bentonite, boric acid, diatomite, iodine, lithium carbonate, nitrates, potassium chloride, potassium sulfate, and sulfuric acid were also expected to increase by significant amounts.

In the energy sector, coal production declined from 1.5 Mt in 1995 to 1.4 Mt in 1996. 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.

As highlighted earlier in this report, a total of more than $2 billion in new foreign investment is projected to be spent in Chile in the near future, firmly establishing its reputation as one of the most active mining countries in the world.

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[1]Where necessary, values have been converted from Chilean pesos (Ch$) to U.S. dollars at the rate of Ch$412=US$1.00, the average exchange rate for 1995.

[2]Chile's geographic regions are more fully described in the infrastructure section of this report.

Major Sources of Information

Ministerio de Mineria
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Comision Chilena del Cobre (COCHILCO)
Agustinas 1161 Piso 4, Casilla 9493
Santiago, Chile
Telephone: 56-2-6726219
Fax: 56-2-6723584
Servicio Nacional de Geologia y Mineria (SERNAGEOMIN)
Ave. Santa Maria 0104, Casilla 1046
Santiago, Chile
Telephone: 56-2-6375050
Fax: 56-2-6372026

Major Publications

COCHILCO: Estadisticas del Cobre y otros Minerales.
CODELCO: Annual Report.
SERNAGEOMIN: Anuario de la Mineria de Chile.

TABLE 1
CHILE: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
METALS						
Arsenic trioxide		6,820	6,020	6,200 e/	6,300 e/	6,400
Copper:						
Mine output, Cu content 3/	thousand tons	1,814	1,933	2,055	2,220	2,488 4/
Metal:						
Smelter, primary 5/	do.	1,150 r/	1,160 r/	1,205 r/	1,234 r/	1,280 4/
Refined: 6/						
Fire-refined, primary	do.	120 r/	136 r/	155 r/	201 r/	358 4/
Electrolytic	do.	1,108 r/	1,106 r/	1,113 r/	1,076 r/	1,127 4/
Total	do.	1,228 r/	1,242	1,268 r/	1,277 r/	1,485 4/
Gold, mine output, Au content	kilograms	28,900	33,800	33,600	38,786	39,180
Iron and steel:						
Iron ore and concentrate:						
Gross weight	thousand tons	8,690	7,640	7,010	8,341 r/	8,174 4/
Fe content	do.	5,820	5,120	4,390	5,223 r/	5,119 4/
Metal:						
Pig iron	do.	703	873	917	883 r/	850
Ferroalloys:						
Ferrochromium		2,509	2,110	680	1,579 4/	2,730 4/
Ferromanganese		6,779	7,460	8,916	8,500 e/	8,500
Ferromolybdenum		2,673	2,310	2,202	2,300 e/	2,300
Ferrosilicomanganese		1,674	1,564	1,612	1,700 4/	1,600
Ferrosilicon		5,516	3,830	7,550	5,600 e/	5,600
Total		19,151 r/	17,274 r/	20,960 r/	19,653 r/	19,500
Steel, crude 7/	thousand tons	807	1,010	1,060	1,030 r/	1,013
Semimanufactures	do.	587	776	816	742 r/	779
Lead, mine output, Pb content		1,050	298	344	1,008	1,010
Manganese ore and concentrate:						
Gross weight		43,800	49,900	63,000	62,870	62,000
Mn content		13,233	14,915 4/	18,771 4/	18,175 4/	17,900 4/
Molybdenum:						
Mine output, Mo content		14,400	14,500	14,900	16,028 r/	17,889 4/
Oxides		10,700	10,400	10,500 e/	11,300 e/	13,300
Rhenium, mine output, Re content e/	kilograms	6,500	6,600	6,400	6,000	5,500
Selenium e/	do.	50,600 4/	50,000	49,500	45,000	46,000
Silver		678	1,030	970	983 e/	1,032 4/
Zinc, mine output, Zn content		30,998 r/	29,730 r/	29,435 r/	31,038 r/	30,000
INDUSTRIAL MINERALS						
Barite		3,153 r/	2,514	2,035	3,670 r/	3,000
Bentonite		1,054	1,081	989	1,213	1,000
Borates, crude, natural (ulexite)		97,135	202,716	117,072	85,935 r/	90,000
Cement, hydraulic	thousand tons	2,251	2,645 r/	3,021 r/	2,995 r/	2,900
Calcite (chalk)		4,000	4,890	5,650 r/	6,300 r/	6,300
Clays						
Cimita		2,600	405	-- r/	-- r/	--
Kaolin		63,083	59,083	66,939	73,081 r/	70,000
Other (unspecified)		16,000	20,300	17,000	37,600	30,000
Diatomite		5,560	5,900	5,770	10,129	10,000
Dolomite		--	--	--	47,287	48,000
Feldspar		4,010	5,740	4,150	9,967 r/	10,000
Gypsum:						
Crude	thousand tons	336	424	511	552	550
Calcined	do.	118 r/	161 r/	190 r/	201	200
Iodine, elemental		5,447	5,839	5,550 e/	5,600 e/	5,000
Lapis lazuli	kilograms	450	138	250	220	200
Lime, hydraulic e/	thousand tons	1,200	1,300	1,300	1,250	1,006 4/
Lithium carbonate		8,575	10,823	10,369	10,439	14,000
Nitrogen, natural crude nitrates:						
Sodium ($NaNO_3$)	thousand tons	473	515	532 e/	500 e/	500
Potassium (KNO_3)	do.	317	331	342 e/	300 e/	300
Total	do.	790	846	874 e/	800 e/	800
Phosphates:						
Guano		1,308	139	-- r/	-- r/	--
Rock (apatite)		13,338	17,546	14,560	9,975 r/	10,000
Total		14,646 r/	17,685 r/	14,560 r/	9,975 r/	10,000

See footnotes at end of table.

TABLE 1--Continued
CHILE: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1991	1992	1993	1994	1995 e/
INDUSTRIAL MINERALS--Continued						
Pigments, mineral, natural, Iron oxide		6,761	22,945 r/	7,106 r/	3,283 r/	3,000
Potash, K_2O equivalent e/		55,000	55,000	55,000 4/	50,000	50,000
Potassium chloride (KCL)		58,000	58,800	60,000 e/	55,000 e/	55,000
Pumice (includes pozzolan)	thousand tons	321	385	448	452 r/	450
Quartz, common	do.	486	484	459	543 r/	500
Salt, all types	do.	1,680	1,670	1,440	3,178 r/	3,000
Sodium compounds, n.e.s.: Sulfate e/ 8/		33,800 4/	46,400	46,400	46,400	47,000
Sand and gravel (silica) e/	thousand tons	300	300	300	300	300
Stone:						
Limestone (calcium carbonate)	do.	3,400	4,890	5,650	6,300	6,300
Marble		1,170	894	872	2,376 r/	2,000
Sulfur:						
Native, other than Frasch:						
Refined		16,884 r/	24,034	444 r/	-- r/	--
Caliche		-- r/	-- r/	493 r/	-- r/	--
Byproduct, (from smelters and oil refining)		278,000	306,000	385,000	350,000 e/	360,000
Total		294,884 r/	330,034	385,937	350,000 r/	360,000
Talc		548 r/	1,493	5,058	5,351 r/	5,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous and lignite	thousand tons	2,760 r/	2,125 r/	1,800 r/	1,667 r/	1,500
Coke, coke oven e/	do.	400 4/	300	350	350	350
Gas natural:						
Gross	million cubic meters	4,067	4,038	4,196	4,244 r/	4,300
Marketed	do.	1,772 r/	1,999	1,951 r/	2,185 r/	2,000
Natural gas liquids: e/						
Natural gasoline	thousand 42-gallon barrels	746 4/	690	680	650	640
Liquefied petroleum gas	do.	2,090 4/	2,000	1,970	2,000	2,100
Total	do.	2,836 4/	2,690	2,650	2,650	2,740
Petroleum:						
Crude	do.	6,500	5,420	5,190 r/	4,492 r/	3,800
Refinery products:						
Liquefied petroleum gas	do.	2,500	7,740	7,930	8,000 e/	6,000
Gasoline:						
Aviation	do.	109	53	53	50 e/	50
Motor	do.	12,500	13,300	13,600	13,400 e/	13,500
Jet fuel	do.	2,290	2,380	2,440	2,400 e/	2,450
Kerosene	do.	1,650	2,190	2,250	2,300 e/	2,350
Distillate fuel oil	do.	15,200	17,900	18,400	18,500 e/	18,450
Residual fuel oil	do.	8,490	1,770	1,810	1,800 e/	1,900
Unspecified	do.	3,470	2,080	2,120	2,100 e/	2,200
Total	do.	46,209 r/	47,413	48,603	48,550 e/	46,900

e/ Estimated. r/ Revised.

1/ Table includes data available through Sept. 1996.

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

3/ Figures are the nonduplicate copper content of ore concentrates, cement copper, slags and minerals, and copper as a byproduct measured at the last stage of processing as reported by Comision Chilena del Cobre. Mine production reported by Servicio Nacional de Geologia y Mineria was as follows, in thousand metric tons: 1993--2,078; 1994--2,234; and 1995--2,510.

4/ Reported figure.

5/ Detailed statistics on electrowinning are now available and reported by the International Copper Study Group Copper Bulletin (Jan. 1996) as follows, in metric tons: 1991--146.1 (revised); 1992--166.6 (revised); 1993--183.8 (revised); 1994--225.5 (revised); and 1995--358.9.

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, as reported by the Chilean Copper Commission.

7/ Excludes castings.

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

TABLE 2
CHILE: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Coal (bituminous)	Empresa Nacional del Carbon, S.A. (ENACAR), CORFO's subsidiary (40% Government, 60% private)	Regions VIII, X and X11	1,300.
Do.	Carbonifera Schwagner, S.A. (61%; Agencias Universales, S.A., 39%; 1,500 private shareholders)	Regions X and XII	170.
Do. (subbituminous coal)	Cia. de Carbones de Chile, S.A. (COCAR) [(Cia. de Petroleos de Chile, S.A., 81%; International Finance Corp. (I.F.C.) (U.S.), 10% and Northern Strip Mining Ltd. (U.S.), 9%)]	Region XII Isla Riesco	1,300.
Copper	Corporacion Nacional del Cobre de Chile (CODELCO-Chile) (100% Government owned)	Mines:	
		Chuquicamata	580
		El Teniente	320
		Andina	145
		Salvador	85.
		Total	1,130
Do.	Do.	Smelters:	
		Chuquicamata	460.
		El Teniente	360.
		El Salvador	140.
		Total	940.
Do.	Do.	Refineries	
		Chuquicamata (sulfide)	600.
		Chuquicamata (oxide)	85.
		El Salvador	130.
Do.	Do.	SX-EW plants:	
		Chuquicamata (oxide)	130.
		El Salvador	1.
		El Teniente	2.
Do.	Do.	Sulfuric acid plants:	
		Chuquicamata (3 plants)	830.
		El Teniente	30.
Copper	Empresa Minera de Mantos Blancos S.A. (private 100%; Anglo-American Corp., 88%; IFC, 12%)	Plant,Mantos Blancos	90.
Do.	Do.	Smelter, Antofagasta	30.
Do.	Do.	SX-EW plant, Mantos Blancos	20.
Do.	Do.	Sulfuric acid plant:	
		Mantos Blancos (shutdown)	200.
Do.	Empresa Minera Escondida Ltda. (BHP, 57.5%; RTZ Corp. PLC, 30%; JECO, 10%; IFC, 2.5%)	Escondida, Km 135 caminoa Socompa, Antofagasta	800 Cu. 3,300 (Kg, Au).
Copper, gold, and silver	Empresa Nactional de Mineria (ENAMI) (100% Government owned)	Plants: Taltal, Salado, Matta, Vellenor Chancado	270.
Do.	Do.	Smelters:	
		Las Ventanas	145.
		Paipote	80.
Do.	Do.	Refinery:	
		Las Ventanas	200.
Do.	Do.	SX-EW plants:	
		Vallenar, Chancado	20.
Do.	Do.	Sulfuric acid plant:	
		Ventanas	225.
Do.	Exxon's Cia., Minera Disputada de-Las Condes, S.A. (Exxon, U.S. 87%, ENAMI 13%)	Mines:	
		Las Bronces	70.
		El Soldado	60.
		El Cobre	18.
Do.	Do.	Smelter:	
		Chagres	75.
Do.	Do.	Sulfuric acid plant, Chagres	100
Do.	Do.	SX-EW plan, Tortolas:	3.

TABLE 2- Continued
CHILE: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Gold	kilograms	Cia. Minera San Jose, Ltda. owned by Barrick Gold Corp. of Canada, 83%.	El Indio and El Tambo. Alto Panuelas, Coquimbo	5,900 Au. 2,600 Au.
Do.	do.	CODELCO-Chile (byproduct from copper) (Government, 100%)	Chuquicamata El Tenieante, El Salvador and Andina	2,200.
Gold and Silver	do.	Cia. Minera El Bronce-de Petorca (Private 100%)	Carmencita 240, Las Condes Santiago, Chile	52,700 Au.
Iodine	metric tons	Sociedad Quimica y Minera de Chile, Subsidiary of CORFO (Government, 35%; private, 65%)	Miraflores No. 222, Santiago	5,500.
Potassium nitrate		Do.	Planta Maria Elena, Maria Province	250.
Sodium nitrate		Do.	Planta Pedro de Valdivia, Pedro de Valdivia Province	600.
Sodium sulfate		Do.	Oficinia Antofagasta, Anibal Pinto 3228	70,000.
Iron ore		Cia Minera del Pacifico, S.A., CAP's subsidiary (100% private)	Pedro Pablo Munoz 675, La Serena Province	8,400.
Iron ore pellets		Do.	Minas El Romeral, El Algarrobo, Planta de Pellet, La Serena Province	4,000.
Lead and zinc		Soc. Contractural Minera El Toqui Ltda., (LAC Minerals of Canada, 100%)	Las Urbinas No 53, Providencia, Santiago	1.0 lead 31.0 zinc.
Lithium carbonate		Soc. Chilena de Litio Ltda. (subsidiary of Cyprus Foote Minerals Co. of the United States) (100% private)	Huerfanos 669, Santiago	8.6.
Molybdenum		CODELCO-Chile (byproduct from copper) (Government, 100%)	Huerfanos 1,270, Santiago	14.4.
Natural gas	million cubic feet	ENAP subsidiary of CORFO (Government, 100%)	Ahumada 341, Santiago	4.
Petroleum	million barrels	Do.	do.	6.5.
Silver	kilograms.	CODELCO-Chile (byproduct from copper)	Huerfanos 1270, Santiago	235,000.
Do.	do.	Cia Minera San Jose, Ltda. El Indio Mine, Barrick Gold Corp.of Canada, 83%)	Barrio Industrial, Alto Panielas, Coquimbo	48,000.
Steel		Cia. Siderurgica de Huachipato S.A., CAP subsidiary (100%, private)	Huerfanos 669, Santiago	800.

TABLE 3
CHILE: MAJOR MINERAL INVESTMENTS 1994-97e/

Region	Project	Commodity	Owner/s	Investment (US$millions)	Startup date
I	1. Cerro Colorado	Copper	Rio Algom (Canada)	60	1996
I	2. Quebrada Blanca (expansion)	do.	Comminco, Ltd., and Teck Resources Intnl. Ltd. of Canada, Pudahuel and ENAMI of of Chile.	373	1996
I	3. Collahuasi (Ujina and Rosario)	do.	Falconbrige Ltd. and Minorco Plc.(Canada) Minorco.	1,760	1997
II	4. El Abra	do.	Cyprus AMAX (U.S.), CODELCO (Chile)	1,000	1997
II	5. Zaldivar	do.	Outokumpu (Findland), Placer Dome (Can.)	600	1995
II	6. Leonor	do.	Equatorial Treasure Ltd. (Australia)	100	1997
II	7. Santa Barbara (expansion)	do.	Mantos Blancos S.A. (Chile) and Anglo American (South Africa)	160	1995
II	8. Lomas Bayas	do.	Gibraltar Mines Ltd. (Canada)	200	1997
II	9. Escondida (expansion)	do.	BHP (Australia), RTZ (U.K.) JECO (Japan), IFC (U.S.)	1,100	1997
II	10. Yolanda	Nitates/iodine	KAP Resources Ltd. (Canada) 10224 Yukon Ltd. (Canada)	89	1997
II	11. Minsal	Potassium chloride lithiium carbonate	Sociedad Quimica y Minera de Chile S.A. Soquimich (SQM)	290	1994
II	12. Ivan - Zar	do.	Rayroc Yellow knife Resources Inc. (Canada)	36	1996
III	13. Manto Verde	do.	Anglo American Corp.(South Africa) Minorco and Mantos Blancos Subsidiaries	180	1995
III	14 La Candelaria	do.	Phelps Dodge (U.S.), Sumitomo Corp. of Japan, Minorco Services Ltd. Falconbridge Ltd.	1,500	1994
III	15 Refugio	Gold	AMAX Gold Refugio Inc. (U.S.) Bema Gold (Canada)	130	1996
III	16. La Coipa	Gold/silver	Placer Dome (Canada) TVX Mining (Canada)	400	1992
IV	17. Los Pelambres (expansion)	Copper	The Luksic Group (Chile)	1,000	NA
IV	18. Andacollo Oro	do.	Andacollo Gold Inc. , La Serena Inc. (Dayton Mining Co. (Canada)	50	1996
IV	19. Nevada.	Gold	Cia. Minera San Jose Inc.	168	1997
	Tambo (Expansion)	do.	El Indio Property	105	1995
	Quebrada de Pascua	do.	American Barrick (Canada)	300	NA
XI	20. Fachinal	Gold/Silver	Coeur d'Alene Mines Corp. (U.S.)	85	1996

e/ Estimated. NA Not available.