THE MINERAL INDUSTRY OF

CHILE

By Pablo Velasco

In 2000, Chile, which continued to be the top producer and exporter of copper in terms of volume and value, produced about 35% of the world's mined copper. Copper remained the country's most important export product and accounted for about 40.5% of export earnings in 2000. Chile was also one of the world's significant producers and exporters of potassium nitrate and sodium nitrate and the largest producer of iodine in the world followed by Japan. Chile also ranked first in lithium and third in molybdenum production.

During the past decade, the Chilean mining industry, which has been pivotal to economic growth, has accounted for 8.5% of the gross domestic product (GDP) and 47% of all exports. Chile's economy has grown by 7% per year, which has made it one of the fastest growing economies in the world. Moreover, investment in mining activities during the 1990s accounted for 34.9% of all foreign investment realized in Chile. In 2000, investment totaled $1.36 billion[1]; this is expected to increase to $1.94 billion in 2001 owing to a number of expansion projects in progress.

The economy has recovered in 2000 with Asian markets rebounding and copper prices edging up. In 2001, GDP growth was expected to be in the 5% to 6% range. The Government's limited role in the economy, Chile's openness to international trade and investment, and the high domestic savings and investment rates that propelled Chile's economy to average growth rates of 8.5% during the decade before the recession were still in place. The military Government that was in power from 1973 to 1990 sold many state-owned companies, and the three democratic Governments since 1990 have continued privatization at a slower pace. Policy measures, such as the privatization of the national pension system, have encouraged domestic investment, which has contributed to an estimated total domestic savings of approximately 22% of GDP in 2000. Unemployment peaked well above Chile's traditional 4% to 6% range during the recession and was stubbornly remaining in the 10% to 11% range well into the economic recovery. Despite recent labor troubles, wages have, on average, risen faster than inflation during the past several years as a result of higher productivity and have boosted national living standards. The share of Chileans with income below the poverty line—roughly $4,000 per year for a family of four—fell to 23% of the population in 1998 from 46% in 1987. Maintaining a moderate inflation level has been primary Central Bank objective. The rate of inflation fell to only 2.3% during the 1999 recession. Most wage settlements and spending decisions were indexed, which reduced inflation volatility. The projected rate for 2000 was 3.6%. Such products as copper remained in strong demand; copper exports rose by an average of 25% in value compared with those during of 1999 owing to the lower prices that prevailed for much of 1999. The GDP growth in 2000 was about 5.4%; GDP amounted to about $69.9 billion at current (2000) prices, and the per capita GDP was about $4,600 (U.S. Embassy, Santiago, Chile, 2000).

[1]Where necessary, values have been converted from Chilean pesos (Ch$) to U.S. dollars at the rate of Ch$570=US$1.00, the average exchange rate in 2000.

Government Policies and Programs

The cross-border mine treaty between Argentina and Chile, which was ratified by the two presidents just before Christmas, lifts restrictions on property ownership and access rights for mining and exploration along most of the long border between the two nations and simplifies customs and taxation procedures, among other things. It was first signed in late 1997 but only ratified by Chile's Congress in August 1999. Argentina's parliament ratified the document in March 2000. Chilean parliamentarian and mining committee member supporters previously reported the agreement should result in $6 billion worth of new mining investment during the next 5 years.

At the treaty ratification ceremony, the Chilean president said that it would lead to 12,000 new jobs in the short to medium term. Construction of one of the first projects due to benefit from the treaty, the $950 million Pascua-Lama gold-silver mine of Barrick Gold Ltd. of Canada, however, was delayed by the company because of low gold prices. The future of another cross-border project that could benefit from the agreement, Cambior Inc. of Canada's El Pachón, which could produce 250,000 metric tons per year (t/yr) of copper, was also in doubt because of the company's attempt to offload the asset.

Environmental Issues

Proposals for new environmental legislation continued to be studied in close consultation with the mining industry. In 2000, La Comisión Chilena del Cobre (COCHILCO) was involved in drafting proposed legislation to govern mine closures and was in the phase of seeking the opinion of interested parties. In December 2000, the Ministry of Economics, Mines and Energy was expected to announce a project to establish norms for acid mine drainage (Knights, 2001). As of 2000, companies that wished to develop a mining project in Chile had to follow the legal regulations prescribed in law No. 19300, Environmental Basis (Bases del Medio Ambiente).

The most important element in this law was the presentation of an environmental impact study (EIS) or environmental impact statement. Such a study was evaluated by the corresponding Environmental Commission, which would approve it or reject it. Regardless of the approval of the EIS, the company developing the project should proceed before different public organizations

to obtain the necessary licenses or authorizations. These organizations include Sernageomin, the Health Service, the Superintendent of Sanitary Services (Superintendencia de Servicios Sanitarios), the Agricultural and Cattle Service (Servicio Agricola y Ganadero), the corresponding Council, and the Transportation Ministry (Comisión Chilena del Cobre, 2000b).

The primary environmental threats to Chile were air pollution from vehicle and industrial emissions, water pollution from untreated industrial sewage, deforestation, and soil erosion. Air pollution in the country's capital Santiago has been the most obvious and severe environmental problem in Chile. Because of Chile's position as the world's largest producer of copper, the impact of copper production on the country's environment has been growing. Toxic emissions from copper smelting has affected a broad population that includes the miners themselves, fishermen, farmers, and ordinary citizens. As a result of the industrial expansion of Chile's economy during the past 20 years, per capita energy use and carbon dioxide emissions in the country have increased significantly. In 1998, Chile's per capita carbon emissions registered 960,000 metric tons (t) of carbon, which was the country's highest per capita carbon emissions.

Environmental projects included a new gas treatment plant at El Teniente mine owned by the Corporación Nacional del Cobre de Chile (CODELCO); the plant was being built to reduce emissions of arsenic, sulfur, and particles from the EL Teniente's Caletones smelter. The plant will cost $230 million and should be completed and running by yearend 2000. The old plant treated only 37% of emissions, but when completed, the new plant will treat 92% of emissions. The Chuquicamata gas treatment program captured 95% of the sulfur and 97% of the arsenic from production gases. The Salvador Division of CODELCO started work on an acid plant, which should capture around 70% of fugitive gases for an investment of $139 million (Bawden, 2000).

Empresa Minera Escondida Ltda., which operated the giant La Escondida open pit copper mine in northern Chile, has submitted the EIS for its Escondida Norte project to regulators. The project, with investment put at $401.7 million, involved mining the Escondida Norte pit to the north of the 900,000-t/yr copper mine, which was the world's largest in terms of production in 2000. It does not involve building new plants or other processing facilities, although some of the ore at Escondida Norte could be bioleached at a new facility being developed at the mine. Minera Escondida was 57.5% owned by Australia's Broken Hill Proprietary Ltd. (BHP) 30% by London-based Rio Tinto Zinc Corp. plc. (RTZ) 10% by Japan Escondida Corp. (JECO), and 2.5% by International Finance Corporation (IFC) (Metals & Minerals Latin America, 2001b).

Production

In 2000, COCHILCO reported that Chilean copper production was 4.6 million metric tons (Mt), which was an increase of 4.8% compared with that of 1999; about 35% of the total, or 1.52 Mt, was contributed by the state-owned CODELCO, and about 67.1% by the private sector; Servicio Nacional de Geología y Minería de Chile (SERNAGEOMIN), which was an agency of the Ministry of Mines, reported that gold production for Chile in 2000 had increased by 12.63% to 54,143 kilograms (kg) and that silver production had decreased by about 10.03% to 1,242 t. The medium- and small-sized mines produced 73% of the gold and 53% of the silver in the country followed by the large-sized mines of CODELCO, with 27% of the gold and 47% of the silver produced primarily as byproducts of copper operations (Servicio Nacional de Geología y Minería de Chile, 2000, p. 34).

In 2000, CODELCO's production of 1.6 Mt of copper was about equal to that generated in 1999; this figure includes the 49% of El Abra's production that corresponds to CODELCO's share of that company. Ore processed in 2000 reached 176 Mt with an average ore grade of 1.02%; this was up from the 172 Mt with an average ore grade of 1.05% that was treated in 1999. With regard to the company's main byproduct molybdenum, production in 2000 was up by 1,157 t, or 4.9%, compared with that of 1999. In 2000, CODELCO's molybdenum production reached 24,944 t, or 75.2% of the total, which made Chile the world's third most important producer after the United States and China (Corporación Nacional del Cobre de Chile, 2000).

The increase in production of copper by the private sector in 2000 established a new benchmark in Chile's historical copper output chiefly because of the 7% increase in output and the startup of the country's newest copper mine Los Pelambres (Antofagasta Holdings P.L.C., 60%; Japanese interests, 40%), which came on-stream in November 1999. Production of industrial minerals increased significantly compared with that of 1999 (table 1).

Trade

Chile's economy remained highly dependent on international trade. In 2000, exports increased to $18.3 billion from $15.6 billion in 1999. Copper exports reached $7.3 billion, which was an increase from $5.9 billion in 1999. Total imports increased to $16.9 billion compared with $14 billion in 1999. Exports accounted for about 25% of the GDP; imports consisted of capital goods, food, fuel, and energy.

Chile has traditionally been dependent upon copper exports. Foreign private investment has developed many new mines, and the private sector produced more copper than CODELCO in 2000. Nontraditional exports have grown faster than those of copper and other minerals. Nonmineral exports accounted for about 60% of total exports. Chile's export markets were fairly balanced among Asia, Europe, Latin America, and North America. Although the United States, which was the largest single market, imported 17% of Chile's exports in 2000, Latin America has been the fastest growing export market in recent years.

Besides copper, Chile's other mineral exports were ferromolybdenum, gold, iodine, iron ore, iron pellets, lithium carbonate, molybdenum oxide, nitrate, potash, silver, sodium nitrate, and zinc. In 2000, CODELCO shipped 1.87 Mt of fine copper, which was 6% more than that of 1999. Revenues from copper sales by CODELCO were about $2.74 billion, or $450 million more than those of 1999; $361 million was from better prices, and $89 million was due to more copper shipped. Revenues from the sale of byproducts (molybdenum, metal doré, sulfuric acid, and others) reached $299 million; this was $29 million more than that of 1999. In the case of

molybdenum, which was the main byproduct, sales income reached $131 million, which was about equal to that of 1999; more shipments compensated for a drop of almost 3% in the price. Of the total sales of copper, 90% was copper-refined (cathodes and fire-refined) products (Corporación Nacional del Cobre de Chile, 2000, p. 22-23 c).

Structure of the Mineral Industry

The Chilean Government, through the Ministry of Mines, exercised control over the mineral industry through three large state-owned mining companies and four regulatory agencies. The mining companies were CODELCO, Empresa Nacional de Minería (ENAMI), and Corporación de Fomento de la Producción (CORFO); the subsidiaries of CORFO included Cía. de Acero del Pacífico S.A. de Inversiones, Empresa Nacional del Petróleo S.A., 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 Comisión Nacional del Medio Ambiente (CONAMA).

CODELCO comprised five divisions—Andina, Chuquicamata, El Teniente, El Salvador, and Radomiro Tomic. Sociedad Contractual Minera El Abra was formed in 1994 by CODELCO (49%) and Cyprus El Abra Corporation (51%) with Cyprus Amax Minerals Co. as its guarantor for the development and exploitation of El Abra deposit. Exploitation operations began at the end of 1996. The five CODELCO divisions accounted for about 32.9% of the 2000 Chilean copper production, which included the 49% output of copper from El Abra. The Radomiro Tomic operation generated 191,429 t of fine copper, and its work was focused on expanding the heap-leaching area and installing an additional storage area and a tertiary crushing plant. With startup scheduled for the first half of 2001, Radomiro Tomic will become the world's largest electrowinning cathode facility and one of its lowest cost copper operations. CODELCO was also a producer of gold (metal doré), molybdenum (trioxide and concentrate), silver, and sulfuric acid (Corporación Nacional del Cobre de Chile, 2000, p. 12-13).

ENAMI purchased concentrates of copper, gold, and silver; precipitates and minerals for direct smelting; and copper anodes and blister copper for its smelters and refineries. It served as a market-regulating force by determining the rates for the purchase of minerals and mining products 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-scale miners. ENAMI also produced, sold, and distributed sulfuric acid; participated with private investors in the development of small- and medium-sized mining projects; guarded against potential environmental harm from mining production; and bought ores for flotation and leaching at its own plants.

In 2000, the total labor force in Chile was about 5.8 million—services and Government, 36%; industry and commerce, 34%; agriculture, forestry, and fishing, 14%; construction, 7%; and mining, 2%. The mineral industry employed 46,150, which included staff and office personnel who worked directly for the minerals sector. The metal sector employed about 38,034 workers; the industrial minerals sector, 5,313 miners; and the mineral fuel sector, 2,803, which included 1,181 coal miners and 1,622 oil workers. Copper mining employed 31,849 workers, or about 69% of the mineral industry; this total included its own copper workers and contractors' personnel. The large-scale copper mining industry employed 26,653 miners; the medium-scale mining industry, 3,357; and the small-scale mining industry, 1,839 (Servicio Nacional de Geología y Minería, Chile, 2000, p. 114-115).

Commodity Review

Metals

Aluminum.—Project Alumysa Ltda. (an affiliate of Noranda Inc. of Toronto, Canada) announced that it had filed an EIS with the Environmental National Commission of Region XI (Southern Chile) for the construction of an aluminum reduction plant and its related hydroelectric facilities. The plant will have a capacity of approximately 440,000 t/yr of aluminum. "We hold excellent water and land assets in southern Chile, assets which we believe could support a world-class aluminum plant," said a Noranda official. "The filing of the EIS is only one of several requirements that must be satisfied before a final go-ahead can be given to the project" (Noranda Inc., August 29, 2001, Noranda files environmental impact study for potential aluminum project in southern Chile, Project Development—Alumysa, accessed on October 26, 2001, at URL http://noranda.com/Noranda/Corporate/Our+Businesses/Project+Development/Alumysa.htm). Before the project can proceed, the Chilean environmental authorities must first approve the EIS. Then, the participation of one or more investment partners must be secured, and, finally, Noranda's Board of Directors will need to approve a revised feasibility that incorporates the latest economic and operational data. The Chilean environmental agency was expected to take between 6 and 9 months to make a decision on the EIS.

Copper.—Production of copper in Chile increased by 4.8% in 2000 compared with that of 1999. In 2000, the price of copper experienced a significant recovery, a situation that coincided with a strong drop in metal stocks. Thus, for the year, the average copper price on the London Metal Exchange reached $0.823 per pound, which was up by 15% compared with the $0.714-per-pound average in 1999. Another outstanding event of the period was the agreement signed by CODELCO and Barrick Chile Ltda. to explore, operate, and possibly develop the Rio Hurtado property. This will be the first joint venture that involved property that belonged to third parties. It will explore for copper-gold porphyry ore. The increase of copper and molybdenum concentrate production was principally due to the first full year of operation of Cía. Minera Los Pelambres Ltda.'s (Antofagasta Holdings P.L.C., 65%), Los Pelambres Mine, which is located in Region IV. The mine's production of 310,200 t of fine copper was 8.6% in excess of its design capacity of 285,600 t; this increase is attributed to refinements in the concentrating plant and to changes in the configuration of the liner and lifters used in the SAG mills. In 2000, Los Pelambres was in the process of evaluating several

expansion alternatives, with no firm commitment expected until the latter part of 2001.

In 2000, CODELCO remained a world leader in copper production but slipped to second and positioned itself as one of the industry's lowest cost firms; it remained one of the state's most important sources of revenue. From 1994 to 1999, CODELCO paid $5.45 billion to the Treasury. CODELCO announced a strategic plan for 2001 to 2006 in which it would substantially increase its value and ability to generate income. It has set a goal of doubling the company's worth during the next 6-year period and bringing its net income gradually up to $1.8 billion toward the period's end, assuming a normal long-term copper price (Corporación Nacional del Cobre de Chile, 2000, p. 6-7).

During 2000, CODELCO's production was 1.6 Mt of fine copper; this amount was almost equal to that generated in 1999; of the total CODELCO production at its Divisions, the Chuquicamata produced 630,119 t; El Teniente, 355,664 t; Andina, 257,970 t; Radomiro Tomic, 191,429 t; and Salvador, 80,538 t. Chuquicamata output was 52 t higher than that of 1999. Of the total refined copper, 1.37 Mt was in the form of cathode from concentrate; 1.14 Mt, electrowon cathode; and 200,000 t, fire-refined copper (Corporación Nacional del Cobre de Chile, 2000, p. 22-23).

The Chuquicamata Division continued its modernization program in 2000 by embarking on a major asset replacement program for the Chuquicamata mine. The Division purchased two 56-cubic-meter cable shovels and a fleet of 17,300-t-capacity trucks. CODELCO has also announced that it will begin to study the feasibility of developing an underground panel-caving operation at the mine to access the sizable reserves remaining at depth. In August, CODELCO's board of directors approved an expansion of El Teniente Division to raise annual production from 356,000 t/yr of copper to 480,000 t/yr beginning in 2003. In 2000, El Teniente was the world's largest underground copper mine that used panel-caving mining methods. To date, $422 million in investment has been approved, of which $340 million will be used to increase concentrator capacity. According to a CODELCO official, $130 million will be spent at a later date to increase the Division's smelting capacity.

At yearend 2000, CODELCO presented an EIS to regional authorities for two projects at the Andina Division—one to expand the capacity of the mine to 135,000 metric tons per day (t/d) and the second to construct a treatment plant for mine waste water. The project will require an investment of approximately $600 million between 2001 and 2006. Most of the increased production will come from expanding the open pit operations at Andina. The Don Luis and the Sur-Sur la Union open pits will be expanded to 80,000 t/d of production with the underground panel-caving operation continuing to produce at its current level of 45,000 t/d (Knights, 2001). The Radomiro Tomic Division's expansion will increase this division's production capacity from 180,000 t/yr to 256,000 t/yr of copper cathode by 2006 and will require an investment of $171 million between 2001 and 2006. In 2000, work focused mainly on expanding the heap-leaching area and installing an additional storage area and a tertiary crushing plant. With startup, which was scheduled for the first half of 2000, Radomiro Tomic will become the world's largest electro-winning cathode facility and one of its lowest cost copper operations (Corporación Nacional del Cobre de Chile, 2000, p. 12-13).

The bioleaching joint venture finalized in August 2000 by Chile's CODELCO and London-based mining house Billiton Plc. (known as Alliance Copper Ltd.) was to acquire equity stakes in copper operations rather than simply licensing and selling technology. According to a Billiton spokesman, "After proving the technology, the idea is to gain participation and attributable copper production; the solvent extraction-electrowinning copper operations would be the most attractive targets as they have the facilities to produce cathodes, but often cannot make use of these once they have mined and processed high-grade copper oxide ore." CODELCO said that it will lend its experience in cathode-production to the venture, and Billiton will offer its extensive skills in leaching technology. Alliance Copper expected to invest around $200 million during the next 6 years in the venture to process low-grade sulfide ores and will start with a $40 million 20,000-t/yr project at Chuquicamata Division. CODELCO indicated that it has worked on the project since 1997 and has conducted pilot programs that have functioned "exactly as foreseen, with high recovery rates" at Chuquicamata and Billiton's research center in South Africa (Metals & Minerals Latin America, 2000c).

In November, the joint-venture partners in La Escondida copper mine (BHP, 57.5%; RTZ, 30%; JECO, 10%; and IFC, 2.5%) approved a $1.045 billion Phase 4 expansion that will increase the plant capacity by 85% and increase average copper production by 400,000 t/yr to 1.2 Mt/yr during the first 5 years of full operation. The approval was delayed by negotiations with the neighboring Zaldivar Mine (Placer Dome Inc. and Outokumpu Copper Resources, 50% each) to seek a stable water supply. Detailed engineering work has been completed, and construction will begging immediately with first production from the new concentrator expected in September 2002. In 2000, Escondida was the world's largest copper mine, and in the 12 months to June 30, 2000, output was 920,000 t, which represented more than more than 9% of the world copper market. Further ahead, the joint-venture partners were considering the development of Escondida Norte, which is located 5 kilometers (km) north of the existing open pit. Indicated resources amount to 676 Mt of sulfide that averages 1.03% copper plus 12 Mt of oxides that average 0.76% copper. Inferred resources amount to 796 Mt of sulfide that average 0.76% copper and 131 Mt of oxides that average 0.73% copper. The development concept for Escondida Norte involved mining, crushing, and conveying the highest grade ore to one of Escondida's concentrators and bioleaching the lower grade material. In addition, BHP said that the Phase 4 expansion of La Escondida, coupled with the Norte project, would enhance the potential of bioleaching of sulfide ore. Pilot leaching and commercial demonstration heaps were planned with a view to producing 100,000 to 150,000 t/yr of low-cost copper cathode (Knights, 2001).

Noranda Minerals Inc. of Canada's Altonorte copper smelter, which is located at La Negra, near Antofagasta, was being expanded to double its copper concentrate capacity and to decrease its operating costs by approximately 25%. The $170 million Phase 3 expansion project was delayed in May 1999 until 2003 owing to low copper prices. The company subsequently announced its intention to go ahead in February

2000, and the expanded operations were to begin in 2001. Once completed, the smelter will be capable of processing 820,000 t/yr of copper-in-concentrate to produce 290,000 t/yr of anode copper and 700,000 t/yr of sulfuric acid. During 2000, the smelter treated 387,327 t of material to produce 148,258 t of copper anodes/blister and 256,533 t of sulfuric acid. Throughput was comparable to 1999 level (Noranda Inc., 2000).

Los Pelambres copper mine was officially opened for production in April 1999. The giant $1.36 billion mine was originally designed to produce 250,000 t/yr of copper, all in concentrates, but throughput in 1999 was gradually raised to around 110,000 t/d from 85,000 t/d. Los Pelambres was undergoing an environmental investigation by the Comisión Regional del Medio Ambiente (COREMA), which is the regional environmental commission, following a spillage of contaminated water into the port area at Los Vilos. The spillage was caused by excessive rainfall in 2000 (Metals & Minerals Latin America, 2001c).

Los Pelambres' construction began in December 1997 to develop the mine and to build the concentrator, the120-km slurry pipeline to the port, and related facilities. It was completed on October 29, 1998, when the second crushing mill was installed. The ore grades were 0.78% copper and 0.21% molybdenum. The company was mining higher grade ore that would have a greater impact on cash flow during the first 10 to 15 years of operation. As mining extends into the pit, the gold and silver content in the ore will rise, as will the molybdenum grade. The mine can continue operating even if the snowfall is 2 to 2.5 m deep (Metals & Minerals Latin America, 2000f).

ENAMI was planning to sell its 10% stakes in the Carmen de Andacollo and the Quebrada Blanca copper mines, both of which were operated by Canada's Aur Resources Inc. The plan was aimed at alleviating the company's $470 million debt and included selling another 10% in the Altamira Mine (owned by Chile's Cruzat Group via Minera Pudahuel), which was not operating in 2000. ENAMI, whose main interests were in processing copper, held the noncapital contributing stakes because it had the original titles to the properties. Previous reports have suggested that Aur would be interested in buying ENAMI's stake in Quebrada Blanca; Aur already owed 76.5% of the mine, which produced 68,615 t of copper in 2000, all in cathodes, and Pudahuel, 13.5%. According to El Diario, a Chilean newspaper, Pudahuel also wanted to sell its share in Quebrada Blanca. Aur owned 63% of Carmen de Andacollo, which produced 22,029 t of copper in 2000, and Chile's Cía. Minera del Pacifico S.A. [part of Compañia de Acero del Pacifico (CAP) iron and steel group], 27%. According to El Diario, CAP also wanted to offload its stake in the mine (Metals & Minerals Latin America, 2001a).

In November, the Anglo-Norwegian engineering group Kvaerner Metals ASA was awarded a contract to conduct a feasibility study to increase the capacity of Cía. Minera Doña Inés de Collahuasi's copper mine from 60,000 t/d to 110,000 t/d. Collahuasi was 44% owned by Minorco Plc., 44% by Falconbridge Ltd., and 12% by Mitsui Consortium of Japan. The study was due to be completed by the end of 2001. Construction was also likely to begin in 2001 to develop the Fortuna de Cobre deposit, which is located 3 km from the Lomas Bayas Mine (owned by Boliden Mineral AB of Sweden). El Diario reported that the deposit contains an estimated 848 Mt of ore at 0.24% copper. Fortuna de Cobre has a favorable stripping ratio of 0.5 to 1, waste to ore, and was expected to produce about 90,000 t/yr of cathode copper; development will require an investment of $300 million. In March 2000, Falconbridge and Noranda signed a letter of intent to purchase Lomas Bayas and Fortuna de Cobre from Boliden for $175 million plus a cash balance of $2.1 million less third-party debt obligations of $112.7 million. An additional $15 million will be payable if the purchasers exercise their right to retain Fortuna de Cobre before the fifth anniversary of closing the agreement. The deal was subject to regulatory approval and approval of the board of directors of both companies (Knights, 2001).

Gold and Silver.—Production of gold in 2000 reached about 54,143 kg, which was 12.6% higher than that of 1999. The joint venture (CODELCO-Homestake Mining Co.) that was running the Agua de la Falda Mine in 2000 produced 1,397 kg (44,930 ounces) of gold in 2000. Exploration of Manto Jerónimo has increased reserves to 15,552 kg (500,000 ounces) of gold (Corporación Nacional del Cobre de Chile, 2000). The silver production derived from the gold and copper mining reached 1,242,194 kg, which was a 10% decrease compared with that of 1999 (Comisión Chilena del Cobre, 2000).

Barrick Gold Corp.'s El Indio copper/gold mine may continue operation after 2001, the year in which it was supposed to shut, according to the general manger at the mine and vice president of Barrick Gold Corp. Chile's operations. "The mine life may be extended a further two years depending on exploration work that we are carrying out at the moment. In 2000, we will spend $3 million on exploration at the mine. Indio's production in the first quarter of 2000 was 2,208 kg (71,000 ounces) of gold and 3,484 t of copper, generating operating profits of $ 6.3 million. Operations at the Tambo mine will end in May or June and closure operations will begin in September.

"Barrick will begin construction at the Pascua-lama gold-silver project in 6 months. The project will take Chile from its current number 14 ranking into the top 10 largest gold producers in the world. The project should be operational by 2003" (Metals & Minerals Latin America, 2000a).

In 1999, Cía. Minera Maricunga (a 50-50 joint venture between Kinross Gold Corp. and Bema Gold Corp. Ltd.) produced more than 5,599 kg of fine gold at its Refugio Mine, which is located 120 km east of Copiapo in the Salar de Maricunga zone, Atacama Region. Although the figure was higher than that of 1998, it was less than the earlier 1999 estimate of 7,154 kg (230,000 ounces). The company, however, did achieve a significant cash cost reduction to $9 per gram in 1999 from $12 per gram in 1998 owing to improvements at the operation (Metals & Minerals Latin America, 2000d).

Homestake Mining was awaiting the results of bioxidation tests on the Jerónimo ore at the Agua de la Falda gold mining operation in Chile, which it operated as a 50-50 joint venture with CODELCO. If these proved positive, then it was planning to invest some $50 million between now and 2001 to develop the ore body and to modify the processing plant. Production from Jerónimo was forecast to be 2,893 kilograms per year (Metals & Minerals Latin America, 2000d).

Iron Ore, Manganese, and Steel.—In 2000, Chilean iron ore production increased by 4.6% to 8.7 Mt. In 2000, Cia. Minera del Pacifico S.A. continued to develop the Colorado East open pit at its Los Colorados iron ore mine.

Manganesos Atacama, S.A. (MASA) (a Swiss-Chilean industrial group and subsidiary of Compañia Aceros del Pacífico S.A. de Inversiones), owned iron mines and Chile's largest steel plant, which produced ferromanganese and ferrosilicon, manganese, and steel cones for mills in the Coquimbo plant for the domestic market. The company produced manganese ore at El Corral Quemado and Los Loros Mines in Region IV. During 2000, production of manganese was 41,716 t, which was a 3% increase compared with that of 1999. Most of the manganese produced by MASA was bought by the Huachipato smelter. The production of steel in Chile amounted to 1.35 Mt, which was 4.7% higher than that of 1999.

Zinc and Lead.—The largest zinc and lead mine in Chile Minera El Toqui (a subsidiary of the Canadian zinc producer Breakwater Resources Ltd.) made an after-tax profit of $700,000 in the first half of 2000; this was a 75% increase compared with the $400,000 registered in the same period last year. The company operated El Toqui zinc mine, 120 km north of Coihaique in southern Chile. El Toqui processed 211,264 t of ore with an average grade of 8.3% zinc and 0.5 gram per metric ton (g/t) gold in its concentrate during the first half of 2000. El Toqui concentrator has the capacity to process 1,100 t/d of ore. In the first half of 2000, it processed 184,718 t of ore with an average grade of 9% zinc and 0.8 g/t gold. This larger amount of processed ore resulted in the production of 15,817 t of zinc contained in concentrates in the first half of 2000; this figure is a 6% increase compared with the 14,927 t produced in the same period in 1999. At the same time, El Toqui Mine produced 51 kg (1,633 ounces) of gold and 1,868 kg (60,050 ounces) of silver in the first half of 2000. Since Breakwater purchased El Toqui Mine from Barrick Gold in 1997, it has made several improvements and replaced some equipment to get better operational efficiencies. The most important improvements included new underground mine equipment to increase production capacity, a 23% reduction of workers, an increment in stockpile capacity of the ore already crushed, improvements in the control systems, a relocation of the stockpile warehouse for concentrates, and the construction of a new system to ship zinc concentrates to ocean-going vessels. With these improvements, the company expected to increase production by 25% to 40,000 t of zinc contained in concentrates in 2001 (Metals & Minerals Latin America, 2000b).

Industrial Minerals

Atacama Minerals Chile (a subsidiary of the Canadian company Atacama Minerals Corp.) expected to close an agreement with A.C.F. Minera S.A. by the end of 2000, which will result in the latter acquiring a 30% stake in Atacama's Aguas Blancas's iodine, nitrate, and sulfate project in Chile. The company was developing its Aguas Blancas project, which is located 95 km southeast of Antofagasta. At capacity, the project will initially produce nearly 1,200 t/yr of iodine. In its second stage, The project will also produce an average of 300,000 t/yr of sodium sulfate and 100,000 t/yr of potassium nitrates. The Aguas Blancas deposit has known and probable reserves of 44 Mt of ore with an average grade of 512 parts per million iodine, 22% sodium sulfate, and 2.87% nitrates. Under the terms of the agreement, A.C.F. had a 2-year deadline to obtain financing, construct, and start to operate the mine and related facilities to produce 720 t/yr of iodine. The company will also be in charge of sales. After A.C.F. acquires a 30% stake in the project, both companies will increase production at Aguas Blancas Mine to 1,200 t/yr of iodine (Metals & Minerals Latin America, 2000g).

Mineral Fuels

Coal.—In 2000, bituminous coal output was reported by SERNAGEOMIN to be 509,228 t, or 0.3% more than that in 1999. Chile's state-held coal company Empresa Nacional del Carbon was privatized in 1985. Several small, privately owned coal companies also operate in Chile. Domestic coal production is located in the Lota/Coronel area and in the extreme south on Tierra del Fuego. The country's largest coal mine closed in 1997, and only two small mines remained in operation. Chile's coal is low quality and has high production costs. Chile imported coal was primarily from Australia. The power sector was the largest coal consumer. Historically, consumption in the power sector has varied according to climate conditions because coal has functioned largely as a backup to hydropower. Coal use for power generation was anticipated to fall in coming years as natural gas fuels more of Chile's electricity (U.S. Energy Information Administration, May 2001, Chile—Energy, Country Analysis Brief, accessed on November 1, 2001, at URL http://www.eia.doe.gov/emeu/cabs/chile.html).

Natural Gas.—The principal natural gas reserves of the country are in the Magallanes Basin, Region XII (in the far south of Chile). In 2000, natural gas production decreased by 8.6% to 2.7 billion cubic meters, which continued the declining trend begun in 1990 (Comisión Chilena del Cobre, 2000b).

The Chilean market differs significantly from those of Argentina and Brazil. Chile does, however, share Brazil's lack of reserves (24 billion cubic meters), and the country has production of only 2 billion cubic meters per day in the south. As a consequence, an aggressive investment plan for the construction of gas pipelines has been implemented in collaboration with Argentina. This plan allows Argentine gas to be transported into and across Chile. In 2000, Chile had six gas pipelines that ran from north to south and had a maximum capacity as follows: Atacama, 8.5 million cubic meters per day; Normandin, 8 million cubic meters per day; Gas Andes, 11 million cubic meters per day; Gas del Pacifico, 4 million cubic meters per day; and the two methane pipelines, 2.9 million cubic meters per day and 2.0 million cubic meters per day. In 2000, Gas Andes and Methane had the highest capacity utilization rate. Atacama was constructed to satisfy the needs of two powerplants with a combined capacity of 740 megawatts (MW) (consuming 0.75 billion cubic meters in 2001), and Normandin's goal was to supply gas to three plants with a combined capacity of 870 MW (0.87 billion cubic meters per year beginning in 2004). In both cases, the total to be

consumed will be a third of the maximum available capacity. Gas del Pacifico had a similar problem (Oil & Gas Journal, 2001).

In 2000, Argentina was Chile's exclusive source of gas imports. In 1995, restrictions on imports to Chile of Argentine gas were eliminated completely, and significant imports began in 1997. Gas imports come from Argentina via four pipelines; in central Chile, the Gas Andes pipeline (majority owned and operated by TotalFina Elf S.A.), has been in operation since 1997. There are plans to extend this pipeline to the city of Rancagua, which would be completed by summer 2002 (U.S. Energy Information Administration, May 2001, Chile—Natural gas, Country Analysis Brief, accessed on November 01, 2001, at URL http://www.eia.doe.gov/emeu/cabs/chile.html).

Petroleum.—In 2000, Chile was a small oil producer with only 150 million barrels (Mbbl) of proven oil reserves; production was 5,616 barrels per day (bbl/d). In 2000, Chile consumed 185,000 bbl /d, with domestic production comprising only 3% of the total consumption. Oil and gas distribution has been liberalized in Chile, thus allowing free access for imported petroleum products (Comisión Chilena del Cobre, 2000b). Chile's main sources of oil imports were Gabon, Nigeria, and Venezuela. Chile's state-owned oil production and refining company Empresa Nacional del Petróleo (ENAP) planned to focus more on international exploration and production in 2001. The company also planned to target countries in Latin America and the Middle East in efforts to increase its production to satisfy 30% of Chilean demand. ENAP's international involvement increased in 2000 through agreements with Chile's Latin American neighbors. In November 2000, ENAP's international subsidiary Sipetrol S.A. and Ecuador's Petroecuador, which is the state-operated oil company, signed an agreement to cooperate in joint ventures in production, exploration, and refining in Ecuador for 2 years. In October 2000, Sipetrol S.A and Argentina's Repsol-YPF S.A. agreed to swap Sipetrol's Venezuelan assets for Repsol-YPF's Argentine assets, thus allowing Sipetrol to consolidate its Argentine holdings. This was the first development following a May 2000 decision between the two companies to collaborate in oil exploration and production in Argentina, Chile, Ecuador, and Peru.

In December 2000, ENAP and Chevron Corp.'s Argentine subsidiary Chevron San Jorge S.A. signed an agreement to explore the Caupolicán block in the Magellan Basin. ENAP will operate the block, and Chevron will provide technical assistance.

About 50% of Chilean crude oil supplies are transported via the 418-km (260-mile) TransAndino Pipeline, which connects Chile's Petrox refinery to the Neuquen Basin in Argentina. Construction of the pipeline was a joint effort between ENAP and Argentina's Repsol-YPF. There is one additional international oil pipeline into Chile, which connects northen Chile to Bolivian oil sources.

In the long term, plans to privatize ENAP have not yet been finalized. Although it was the state producer and refiner, it was not involved in retail activities. In 2000, ENAP was facing increased competition from Repsol-YPF, which was involved in the retail market. Sipetrol will likely be privatized in the nearer term despite delays. Privatization now was expected in late 2000 or earliest 2001 (U.S. Energy Information Administration, May 2001, Chile—Oil, Country Analysis Brief, URL accessed on November 1, 2001, at http://www.eia.doe.gov/emeu/cabs/chile.html). In 2000, Chilean production of crude oil decreased by 11.4% to 2.05 Mbbl (Comisión Chilena del Cobre, 2000b).

Infrastructure

In 2000, the Chilean railway system was a 6,782-km. The Empresa de Ferrocarriles del Estado was the largest government-owned railway. In the past 10 years, almost no investment has been made in the railways. The railway system served all the important agricultural, industrial, and mining areas from Region I (Iquique) to Region X (Puerto Montt).

The pattern of highways was similar to that of the railways. The road system totaled 79,800 km, of which 11,012 km was paved, and 68,788 km was unpaved. The country had 370 airports with paved runways more than 3,047 km long.

International trade of mineral commodities, chiefly copper and its byproducts, was handled through the ports of Antofagasta, Arica, Chañaral, Coquimbo, Iquique, Puerto Montt, Punta Arenas, San Antonio, San Vicente, Talcahuano, and Valparaíso; they handled almost 60% of the total tonnage.

Chile had 755 km of pipelines for crude petroleum; refined products, 785 km; and natural gas, 320 km. 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 Neuquén and Santiago was planned (World Oil, 1998).

Outlook

During 2000, Chilean universities were active in a number of research projects that related to the mining industry. In a major study funded by International Copper Association and the Chilean Government, researchers at the Catholic University of Chile and the Mining and Metallurgical Research Center continued to investigate the toxicity effects of copper in the environment. In the face of increasingly stringent environmental restrictions being considered by European countries, the results of the research were to influence the debate concerning the allowable copper content in potable water and, thus, ensure the marketing of copper water pipe.

At the end of 2000, a number of companies, industry bodies, and Government entities made public their price prediction for copper for 2001. The most conservative estimate was that of the Mining Council at $0.89 per pound. Minera Escondida, which was the most optimistic, predicted an average price of $0.95 per pound. Between these estimates were CODELCO's forecast of $0.93 per pound, COCHILCO's forecast of $0.91 per pound, the National Mining Society's forecast of $0.90 to 0.95 per pound, and Antofagasta Minerals' (Luksic Group's) prediction of $0.90 per pound. The general consensus was that the copper price will significantly increase from the $0.823 per pound average observed for 2000, and the industry attitude was bullish for year 2001. According to the President of the Mining Council, the Chilean mining industry "faces a scenario of growth and progress that should continue the positive trajectory

experienced by the Chilean mining industry over the past decade" (Knights, 2001).

COCHILCO's officials indicated that copper's national production for 2001 was expected to be 4,618 Mt, which can be explained by the absence of big new copper projects. With respect to foreign investment, COCHILCO expected $700 million to be invested in 2001, with a total of approximately $1,360 million for 2000, considering private and public investment.

Chilean mining activities were concentrated in the following mineral groups: coal, copper and its byproducts, industrial minerals, iron and steel, and precious metals. SQM emerged as a large integrated producer of natural nitrates and distributor of industrial chemicals, iodine and iodine derivatives, lithium carbonate, and specialty fertilizers. The production of bentonite, boric acid, diatomite, nitrates, potassium chloride, potassium sulfate, and sulfuric acid was also expected to increase by significant amounts in 2001.

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Major Sources of Information

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Major Publications

COCHILCO: 1999, Estadísticas del Cobre y otros Minerales.
CODELCO: 1999, Annual report.
SERNAGEOMIN: 1999, Anuario de la Minería de Chile

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

(Metric tons unless otherwise specified)

Commodity 3/		1996	1997	1998	1999	2000
METALS						
Arsenic trioxide e/		8,000	8,350 4/	8,400	8,000	8,000
Copper:						
Mine output, Cu content 5/	thousand tons	3,116	3,392	3,687	4,391 r/	4,602
Metal:						
Smelter, primary 6/	do.	1,356	1,390	1,403	1,474 r/	1,460
Refined: 7/						
Fire-refined, primary	do.	648	881	1,108	1,362 r/	1,373
Electrolytic	do.	1,113	1,236	1,227	1,304 r/	1,296
Total	do.	1,761	2,117	2,335	2,666 r/	2,669
Gold, mine output, Au content	kilograms	53,174	49,459	44,980	45,663 r/	54,143
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand tons	9,082	8,738	9,112	8,345 r/	8,729
Fe content	do.	5,676 r/	5,461 r/	5,694 r/	5,215 r/	5,455
Metal:						
Pig iron	do.	996	941	993	1,030 r/	1,035
Ferroalloys:						
Ferrochromium		2,079	2,000	2,000 e/	2,000 e/	2,000 e/
Ferromanganese		8,498	5,517	3,652	2,833 r/	2,800 e/
Ferromolybdenum		4,222	3,157	1,978	2,079 r/	2,000 e/
Ferrosilicomanganese		1,599	3,175	3,921	2,048 r/	2,050 e/
Ferrosilicon		4,650	1,294	1,159	1,000 r/	1,100 e/
Total		21,048	15,143	12,710	9,960 r/	9,950 e/
Steel, crude 8/	thousand tons	1,178	1,167	1,171	1,291 r/	1,352 e/
Semimanufactures	do.	1,095	1,062	1,060	1,303 r/	1,300 e/
Lead, mine output, Pb content		1,374	1,264	337	606 r/	784
Manganese ore and concentrate:						
Gross weight		62,887	63,673	48,931	40,505 r/	41,716
Fe content		18,277	18,147	14,345	11,915 r/	12,271
Molybdenum:						
Mine output, Mo content		17,415	21,339	25,298	27,307 r/	33,187
Oxides		9,416	11,537	13,678	10,000 r/	12,000
Rhenium, mine output, Re content e/ 9/	kilograms	2,600	2,500	2,500	2,400	2,200
Selenium e/ 9/	do.	50,000	49,500	49,000	49,000	40,000
Silver		1,147	1,091	1,340	1,780 r/	1,242
Zinc, mine output, Zn content		36,004	33,934	15,943	32,263 r/	31,402
INDUSTRIAL MINERALS						
Barite		2,559	2,654	1,430	823 r/	1,026
Borates, crude, natural (ulexite)		149,008	170,605	280,140	324,691 r/	337,966
Cement, hydraulic	thousand tons	3,634	3,735	3,888	3,036 r/	3,491
Clays:						
Bentonite		1,191	717	721	1,104 r/	1,314
Kaolin		13,452	14,238	11,530	4,361 r/	6,445
Other (unspecified)		18,462	14,537	5,040	53,721 r/	23,387
Diatomite		11,592	11,825	14,868	14,477 r/	13,384
Dolomite		2,569	11,840	16,473	20,016 r/	12,506
Feldspar		3,702	3,808	1,460	1,346 r/	2,311
Gypsum:						
Crude	thousand tons	520	398	781	886 r/	376
Calcined	do.	243	251	246	250 e/	120 e/
Iodine, elemental		5,514	7,154	9,722	9,317 r/	10,474
Lapis lazuli	kilograms	150	118 e/	58	100 e/	100 e/
Lime, hydraulic e/	thousand tons	1,050 4/	1,000	1,000	1,000	1,000
Lithium carbonate		14,180	24,246	28,377	30,231 r/	35,869
Nitrogen, natural, crude nitrates:						
Sodium ($NaNO_3$)	thousand tons	662	693	722	751 r/	800
Potassium (KNO_3)	do.	147	154	160	165 r/	188
Total	do.	809	847	882	916 r/	988
Phosphate rock (apatite)		17,356	12,605	15,065	12,074 r/	12,474
Pigments, mineral, natural, iron oxide		18,821	10,678 r/	10,449	9,992 r/	10,000 e/
Potash (K_2O equivalent)		20,552 r/	21,532 r/	22,414 r/	22,000 r/ e/	22,500 e/

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity 3/		1996	1997	1998	1999	2000
INDUSTRIAL MINERALS--Continued						
Potassium chloride (KCl) e/		80,000	80,000	80,000	60,000	55,000
Pumice, including pozzolan	thousand tons	500	491	912	958 r/	830 e/
Quartz, common	do.	583	555	641	491 r/	576
Salt, all types	do.	4,043	5,488	6,207	6,074 r/	5,083
Sodium compounds, n.e.s., sulfate 10/		44,345	64,335	51,928	58,026 r/	56,501
Sand and gravel (silica) e/	thousand tons	300	300	300	300	300
Stone:						
Limestone (calcium carbonate)	do.	6,009	5,618	5,999	5,618 r/	5,395
Marble		401	1,248	1,427	828 r/	812
Sulfur, byproduct, from smelters and oil refining		587,000	768,000	899,000	1,040,000 r/	1,100,000
Talc		4,276	3,986	3,772	2,231 r/	2,421
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous and lignite	thousand tons	1,446 r/	1,415 r/	230 r/	508 r/	509
Coke, coke oven e/	do.	350	350	350	350	300
Gas, natural:						
Gross	million cubic meters	3,632	3,211	3,218	2,957	2,702
Marketed e/	do.	1,911 4/	1,900	1,900	1,900	1,900
Natural gas liquids: e/						
Natural gasoline	thousand 42-gallon barrels	1,000	1,100	1,100	1,000	1,000
Liquefied petroleum gas	do.	2,800	2,900	2,880	2,000	2,500
Total	do.	3,800	4,000	3,980	3,000	3,500
Petroleum:						
Crude	do.	3,351 r/	3,076 r/	2,948 r/	2,314 r/	2,050
Refinery products: e/						
Liquefied petroleum gas	do.	3,585 4/	5,475 4/	5,350	5,200	5,200
Gasoline:						
Aviation	do.	83 4/	74 4/	75	80	80
Motor	do.	15,744 4/	16,716 4/	16,700 r/	16,700 r/	16,700
Jet fuel	do.	2,744 4/	4,380 4/	4,350	4,390	4,390
Kerosene	do.	2,443 4/	2,190 4/	2,150	2,250	2,250
Distillate fuel oil	do.	20,132 4/	21,900 4/	21,500	21,800	21,800
Residual fuel oil	do.	9,812 4/	12,045 4/	12,100	12,200	12,200
Unspecified	do.	4,715 4/	4,745 4/	4,650	4,750	4,750
Total	do.	59,258 4/	67,525 4/	66,900	67,400	67,400

e/ Estimated. r/ Revised.

1/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.

2/ Table includes data available through September 2001.

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

4/ Reported figure.

5/ 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 Commission Chilena del Cobre. Mine production reported by Servicio Nacional de Geologia y Mineria was as follows, in thousand metric tons: 1996--3,144; 1997--3,438; 1998--3,764; 1999--4,422; and 2000--4,450 (estimated).

6/ Detailed statistics on electrowinning are now available and reported by the International Copper Study Group, Copper Bulletin (January 1999) as follows, in thousand metric tons: 1996--635.7; 1997--881.0; 1998--1,108.0; 1999--1,362.0 (revised); and 2000--1,373.0.

7/ 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.

8/ Excludes castings.

9/ Rhenium and selenium are produced in Chile, but available information is inadequate to make reliable estimates of output levels.

10/ Includes production of natural sodium sulfate and anhydrous sodium sulfate, coproducts of the nitrate industry (salitre).

TABLE 2
CHILE: STRUCTURE OF THE MINERAL INDUSTRY IN 2000

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Coal, bituminous	Empresa Nacional del Carbón S.A. (ENACAR); (Government, 100%)	Three mines (Colico, La Chulita, and Trongol) and a Planta Lota in Lota, Curanilahue in Region VIII	82,000.
Do.	Carbonifera Schwagner S.A. [Agencias Universales S.A. (61%); private shareholders (39%)]	Regions X and XII (closed since 1994)	85,000.
Coal, subbituminous	Cía. de Carbones de Chile (COCAR) S.A. [Cía. de Petroleos de Chile S.A. (45.05%); International Finance Corp. (IFC) (9.9%); and Inversiones Ultraterra S.A. (45.05%)]	Pecket Coal mine, Region XII, open pit mine	340,000.
Copper	Corporación Nacional del Cobre de Chile (CODELCO), (Government, 100%)	Mines:	
		Andina	258,000.
		Chuquicamata	630,000.
		El Teniente	356,000.
		Rodomino Tomic	191,000.
		Salvador	81,000.
		Total	1,516,000.
Do.	CODELCO	Smelters:	
		Chuquicamata	460,000.
		El Teniente	360,000.
		Salvador	140,000.
		Total	960,000.
Do.	do.	Refineries:	
		Chuquicamata (oxide)	600,000.
		Chuquicamata (sulfide)	85,000.
		Salvador	130,000.
		Total	815,000.
Do.	do.	SX-EW plants: 1/	
		Chuquicamata (oxide)	130,000.
		El Teniente	2,000.
		Salvador (oxide 41 and sulfide 24)	65,000.
		Total	197,000.
Do.	do.	Sulfuric acid plants:	
		Chuquicamata (3 plants)	830,000.
		El Teniente	30,000.
		Total	860,000.
Do.	Cyprus Amax Minerals Co. (51%); CODELCO (49%)	El Abra mine	97,000.
Do.	Empresa Minera de Mantos Blancos S.A. [Anglo-American Corp. (88%); IFC (12%)]	Open pit, flotation/SX-EW plant, Mantos Blancos	80,000.
Do.	do.	Open pit, SX-EW plant, Mantoverde	42,000.
Copper, gold, silver kilograms	Empresa Minera Escondida Ltda. (Broken Hill Proprietary Ltd., 57.5%; RTZ Corp. plc, 30%; Japan Escondida Corp., 10%; International Finance Corporation, 2.5%)	La Escondida open pit, copper mine, and plant, Antofagasta, Region II	800,000 copper. 3,300 gold.
Do.	Empresa Nacional de Minería (ENAMI) (Government, 100%)	Plants: Taltal, Salado, Matta, Vellenor, Chancado	270,000.
Do.	do.	Smelters:	
		Las Ventanas	145,000.
		Paipote	80,000.
		Total	225,000.
Do.	do.	Refinery, LasVentanas	200,000.
Do.	do.	SX-EW plants, Chancado, Vallenar 1/	20,000.
Do.	do.	Sulfuric acid plant, Venetas	225,000.
Do. kilograms	Cía. Contractual Minera Candelaria-Phelps Dodge Corp. (80%); Sumitomo Metal Mining Co. Ltd. (15%); Sumitomo Corp. (5%)	Copiapó open pit and concentration plant, Mine Region III	137,000 copper. 2,500 gold. 30,000 silver.
Do. do.	do.	Mine, 22 kilometers southeast of Copiapó and 9 kilometers south of Tierra Amrilla	2,488 gold.
Do.	Cía. Minera Disputada de Las Condes S.A. [Exxon Minerals Chile (U.S.), 87%; ENAMI, 13%]	Mines:	225,000.
		El Cobre	18,000.
		El Soldado	60,000.
		Las Bronces	70,000.
		Total	148,000.

See footnotes at end of table.

TABLE 2--Continued
CHILE: STRUCTURE OF THE MINERAL INDUSTRY IN 2000

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper, gold, silver--Continued:		Cía. Minera Disputada de Las Condes S.A. [Exxon Minerals Chile (U.S.), 87%; ENAMI, 13%]	Smelter, Chagres	75,000.
Do.		do.	Sulfuric acid plant, Chagres	100,000.
Do.		do.	Tortolas SX-EW plant 1/	300,000.
Do.	kilograms	Cía. Minera El Indio (Barrick Chile Ltda., 82.9%), Canada	Region IV: El Indio mine and concentration plant, Tambo, Pascua (Nevada)	5,400 gold.
Do.	do.	Corporación Nacional del Cobre de Chile (CODELCO) (Government, 100%) (gold and silver byproducts from copper)	Andina, Chuquicamata, El Salvador, and El Teniente	1,227 copper, 1,300 gold, 248 silver.
Do.	do.	Cía. Minera El Bronce de Petorca (private, 100%)	Carmencita 240, Providencia, Santiago, Chile	2,700 gold.
Do.	do.	Cía. Minera Mantos de Oro (Placer Dome Inc., 50%; TVX Gold Inc., 50%)	Ladera Farellon, Farellon Bajo	18,600 gold, 358,000 silver.
	do.			
Iodine		Sociedad Química y Minera de Chile S.A., subsidiary of Corporación de Formento de la Producción (CORFO) (private, 65%; Government, 35%)	Miraflores 222, Santiago, Chile Maria Elena, Pedro de Valdivia	7,150 iodine.
Iron ore		Cía. Minera del Pacifico S.A.	Pedro Pablo Muñoz 675, La Serena Province, El Agarrobo, Colorados, Region III, and El Romeral, Region IV	8,400.
Iron ore pellets		do.	Mines: El Algarrobo, El Romeral, Los Colorados, Region III, and El Romeral, La Serena Province, Region IV	5,200,000.
Lead and zinc	kilograms	Soc. Contractual Minera El Toqui Ltda. (Breakwater Resources Ltd. of Canada)	Baquedeno 238, Coyahaique, Region XI	470 lead.
	metric tons		Doña Rosa	500 zinc.
Lithium carbonte		Soc. Chilena de Litio Ltda., subsidiary of Cyprus/ Amax Minerals Co. of the United States (private, 100%)	Salar de Atacama, Region II	20,000.
Do.		Soc. Minera Salar de Atacama (Minsal S.A.)	Toconao, Atacama, Chile	4,200.
Molybdenum		Corporación Nacional del Cobre de Chile (CODELCO) (Government, 100%) (byproduct from copper)	Huérfanos 1270, Santiago, Chile	25,000.
Natural gas	million cubic feet	Empresa Nacional del Petroleo (ENAP), subsidiary of CORFO (Government, 100%)	Ahmuda 341, Santiago, Chile	4.
Petroleum	thousand barrels	do.	do.	6,500.
Potassium nitrate		do.	Planta María Elena, Iquique Province	250,000.
Silver	kilograms	Corporación Nacional del Cobre de Chile (CODELCO) (Government, 100%) (byproduct from copper)	Huérfanos 1270, Santiago, Chile	604,100.
Do.	do.	Cía. Minera El Indio (Barrick Chile Ltda., 82.9%), Canada	Barrio Industrial, Alto Pa, Coquimbo	48,000.
Sodium nitrate		do.	Planta Pedro de Valdivia, Pedro de Valdivia Province	600,000.
Steel		Cía. Siderúrgica de Huachipato S.A., subsidiary of Corporación Acero del Pacifico (CAP) (private, 100%)	Huérfanos 669, Santiago, Chile	800,000.

1/ Solvent extraction-electrowinning.

TABLE 3
CHILE: MAJOR MINERAL INVESTMENTS FROM 1994 THROUGH 2001 e/

(Million dollars)

Region	Project	Commodity	Owner(s)	Investment	Startup date
I	Cerro Colorado	Copper	Rio Algom Ltd.	200	1998
I	Quebrada Blanca (expansion)	Copper cathodes	Cominco Ltd., 47.25%; Teck Corp. Ltd., 29.25%; Soc. Minera Pudahuel Ltda.; 13.50%; Empresa Nacional de Mineria (ENAMI), 10%	373	1998
I	Collahuasi	do.	Falconbrige Ltd., 44%; Minorco Ltd. 44%; Mitsui Consortium, 12%	2,185	1998
II	El Abra	Copper	Cyprus Amax Minerals Co., 51%; Corporación National del Cobre de Chile S.A., 49%	1,800	1997
II	Zaldivar	do.	Placer Dome Inc., 50%; Outokumpu Copper Resources., 50%	600	1995
II	Santa Barbara (expansion)	do.	Mantos Blancos S.A., 51%; Anglo American Corp., 49%	160	1996
II	Lomas Bayas	Copper cathodes	Westmin Resources Ltd.	244	1998
II	La Escondida (expansion)	Copper oxides	Empresa Minera Escondida Ltda. (Broken Hill Proprietary Ltd., 57.5%; RTZ Corp. plc, 30%; Japan Escondida Corp., 10%; International Finance Corporation, 2.5%)	2,342	1998
II	Spence	Copper	Rio Algom Ltd., 99%; Rio Algom Exploration Inc., 1%	500	2003-04
II	Yolanda	Iodine, nitrates (Na, K)	Kap Resources Ltd. (Canada)	140	1998
II	Minsal	Lithium	Sociedad Química y Minera de Chile S.A.	290	1994
II	Ivan-Zar	do.	Rayrock Yellowknife Resources Inc.	36	1996
II	Fundicion La Negra	Copper	American Barrick, Noranda Inc.	48	1997
II	Fundicion Refimet S.A.	do.	Inversiones Mineras del Pacifico, 50%; Barrick, 25.1%; Noranda Inc., 24.8%	100	1999
II	Fundicion Altonorte (expansion)	Blister copper	Noranda Inc. feasibility study	170	2003
II	La Negra	do.	Noranda Inc.	158	2000
II	Tuina	do.	Minera Mahogeny Ltd. Minera Northern	7	TBD
II	La Candelaria	Copper/gold/silver	Phelps Dodge Corp., 80%; Sumitomo Metal Mining, 15%	1500	1994
II	Sierra Gorda	Copper	Yuma Gold Mines Ltd.	85	TBD
II	Prucobre	do.	Punta del Cobre S.A.	50	2000
II	Aguas Blancas	Copper cathodes	Atacama Minerals/Canada	27	TBD
II	Santa Catalina	do.	Minera Santa Catalina S.A.; Outokumpu Oy of Finland	100	TBD
III	La Candelaria	Copper/gold/silver	Phelps Dodge Corp., 80%; Sumitomo Metal Mining, 15%; Sumitomo Corp., 5%	1500	1994
III	Manto Verde	do.	Anglo American Corp.; Minorco SA	180	1995
III	El Refugio	do.	Amax Gold Refugio Inc.; Bema Gold Corp.	130	1996
III	La Coipa	Gold/silver	Placer Dome Inc.; TVX Gold Inc.; Cia. Minera Mantos de Oro	400	1994
III	Nevada.	Gold	Cía. Minera San José Inc. (American Barrick Resources Corporation)	168	1997
III	Aldebarán	do.	Placer Dome Inc.	800	1997
III	Chimberos	Silver	Placer Dome Inc.; TVX Gold Inc.	30	1998
III	Pascua	Gold/silver	Barrick Gold Corp.	950	TBD
III	Cerro Casale	Copper/gold	Placer Dome Inc., Arizona Star Resources Bema Gold	1,330	TBD
III	Lobo Marte	do.	do.	300	TBD
III	Los Colorados	Iron ore	Mitsubishi Consortium (Japan)	100	1998
III	Radomiro Tomic	Copper	Division Radomiro Tomic (CODELCO, 100%)	171	2000
III	Atacama Kozan	do.	Grupo Errazuris/Chile, Nittetsu/Japan	130	2002-03
IV	Los Pelambres (expansion)	do.	Luksic Group; Mitsubishi Corp.; Mitsubishi Materials; Nippon Mining and Metals Co. Ltd.; Marubeni; and Mitsui Consortium	1,307	1999
IV	Tesoro	do.	Luksic Group, 69%; Equatorial Mining, 31%	300	2001
IV	Andacollo Oro	Gold	Andacollo Gold Inc.; La Serena Inc.	50	1996
IV	Tambo (expansion)	do.	Cía. Minera San José Inc. (American Barrick Resources Corporation)	105	1995
IV	Quebrada de Pascua	do.	Quebrada de Pascua	300	TBD
IV	Andacollo Cobre	Copper	ENAMI; Tungsten Intenational, Inc. (Canada); Cia. Minera del Pacifico S.A.	55	1997
XI	Fachinal	Gold/silver	Coeur d'Alene Mines Corp.	85	1996

e/ Estimated. TBD to be determined.