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THE MINERAL INDUSTRY OF CHILE

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The Republic of Chile is the leading copper producer and exporter in the world. In 2005, mine production of copper accounted for about 14% ($16 billion[1]) of the country's gross domestic product (GDP), and the total value of copper exports accounted for about 16% ($18 billion) of the GDP. Based on purchasing power parity, Chile's GDP was about $193.2 billion. The annual average price of copper on the London Metals Exchange (LME) rose to about $3.68 per kilogram ($1.67 per pound) compared with about $2.87 per kilogram ($1.30 per pound) in 2004. In 2005, the Government adopted policies to help control the potentially inflationary impacts of higher copper prices on the Chilean economy, but the country's rate of inflation nonetheless increased to 3.1% compared with 1.1% in 2004. In real[2] terms, the value of mine production of copper actually decreased by 0.8% and contributed 6.5% of Chile's real GDP compared with accounting for 7.0% of the real GDP in 2004 (Banco Central de Chile, 2006a, p. 28-29, 37; Comisión Chilena del Cobre, 2006, p. 64, 122; International Monetary Fund, 2006, p. 299; International Monetary Fund, 2006§[3]).

The prices of almost all mineral commodities produced by the mining sector of Chile were at record levels during the year. In 2005, the value of non-copper mine production ($2.4 million) represented an increase of about 61% compared with that of 2004. Most mining companies operating in the country responded to the higher prices by attempting to produce at or above listed capacities. The real value of non-copper mine production increased by 8.1% during the same timeframe, although it contributed about the same amount (0.9%) to the country's real GDP in both years. Total exports of production from all non-copper mining operations in the country accounted for 3.6% ($4.15 million) of the nominal GDP (Banco Central de Chile, 2006a, p. 28-29, 37; Comisión Chilena del Cobre, 2006, p. 64; International Monetary Fund, 2006§).

The most economically important mineral commodities that were lacking in Chile's otherwise diverse natural endowment of mineral resources were mineral fuels. Because of its limited resources of coal, petroleum, and natural gas, uncertain provision of hydropower, and increasing energy consumption (particularly of natural gas), the Chilean economy has become increasingly reliant on imports of mineral fuels. In 2005, Chile spent about $6.2 billion on imports of mineral fuels compared with $4.4 billion in 2004. About 40% of the amount spent in 2005 was spent on imports of mineral fuels from Argentina, although Argentina frequently restricted exports of natural gas to Chile to between 20% and 50% below contracted daily volumes (Banco Central de Chile, 2006b, p. 146; 2006c, p. 46; U.S. Energy Information Administration, 2006).

Chile contained the largest share of world reserves of rhenium and was the leading producer in 2005. Chile was ranked second only to the United States in mine production of molybdenum; its reserves of molybdenum were estimated to be the third largest in the world. Chile was also estimated to be the world's second-ranked producer of lithium-bearing compounds (lithium carbonate), while Australia was estimated to be the leading producer (of spodumene). Chile was the fourth-ranked producer of selenium in the world, and the country was estimated to contain the highest proportion of global reserves. During the year, a globally significant (5% or more of the world total) quantity of silver was mined in Chile, and 61% of this production was extracted as a byproduct from copper mines. The country also produced a regionally significant (about 5% of total mine production in the Western Hemisphere) quantity of gold, and 41% of this production was a byproduct of Chilean copper mines. The country was the leading producer and produced about 60% of the world's iodine; about 60% of global reserves of iodine were located in Chile. The country was the fourth-ranked producer of boron in the world and had boron reserves of global significance. Chile produced regionally significant quantities of nitrates and specialty fertilizers and was estimated to contain the largest natural reserves of nitrates in the world. About 40% ($14.6 million) of Chilean exports of sodium nitrate was sold to the United States during the year (Comisión Chilena del Cobre, 2006, p. 25-26; Servicio Nacional de Geología y Minería, 2006, p. 55, 59; Sociedad Química y Minera de Chile S.A., 2006, p. 11; George, 2007; Lyday, 2007a, b; Magyar, 2007a, c; Ober, 2007).

Operating costs for the mineral industry of Chile continued to increase rapidly. The average annual salary for employees in the production of metals, industrial minerals, and mineral fuels was $28,775 in 2005 compared with $24,991 in 2004 and $21,195 in 2003. In each of these years, the copper sector paid the highest annual salary per worker, on average, at $33,064 in 2005, $28,252 in 2004, and $24,092 in 2003. The annual average energy costs increased in 2005 compared with those of 2004, even relative to the price of copper. That is, the value of 1 metric ton (t) of copper was equal to the value of 75 barrels of crude petroleum in 2004 but was worth only about 68 barrels in 2005. The only mineral commodity of which Chile was a major producer that increased in price relative to the increased price of crude petroleum was molybdenum, and companies that produced this metal did not experience as great a downward pressure on profits from increasing energy prices as producers of the other mineral commodities in Chile. Because about 43% of electricity consumption in Chile was provided by hydropower, the mineral industry was somewhat sheltered from increased prices for mineral fuels but not from uncertainty (droughts) related to inconsistent electricity provision from hydropower (Comisión Chilena del Cobre, 2006, p. 125; Servicio Nacional

[1]Where necessary, nominal values have been converted from Chilean pesos (Ch$) to U.S. dollars (US$) at an annual average exchange rate of Ch$560=US$1.00 for 2005. All values are nominal, at current 2005 prices, unless otherwise stated.

[2]Real values are adjusted for inflation using constant 1996 prices.

[3]References that include a section mark (§) are found in the Internet References Cited section.

de Geología y Minería, 2006, p. 16-19; 2005, p. 118-121; U.S. Energy Information Administration, 2006).

Government Policies and Programs

In 2005, political uncertainty concerning passage of a new mining royalty bill was resolved. A new specific tax on the mine production of private companies in Chile was approved on June 16, 2005, and went into effect at the beginning of 2006. The tax, which is assessed on a per-company basis, takes effect only if the total value of mine production by a single company exceeds the average value of 12,000 t of copper during the year. Because copper prices in 2005 were already higher per metric ton than were those for most other minerals and increased more than for all other minerals besides molybdenum, the new mining tax was expected to apply mostly to companies that mined copper in Chile. The tax rate ranges between 0.5% and 5% depending on the value of the company's mine production for the year. Roughly, an estimate of the minimum value of a company's mine production necessary to incur the new tax would have had to have been 12,000 t x $3,680 per metric ton = $44.16 million in 2005, and the new tax imposed at this minimum level would have been approximately 0.5% x $44.16 million = $220,800 (if the mining royalty law had been in effect in 2005). The tax rate (percent royalty) on the annual production (sales) of a single mineral by a single mining company operating in Chile was set at 0.5% if the value of the company's annual production of that mineral is equivalent to the value of 12,000 t to 14,999 t of fine copper during the same year. The tax rate rises to 1% if the company's annual value of production for the mineral is equivalent to the value of 15,000 t to 19,999 t of fine copper; to 1.5% if equivalent to 20,000 t to 24,999 t of fine copper; 2% if equivalent to 25,000 t to 29,999 t of fine copper; 2.5% if equivalent to 30,000 t to 35,000 t of fine copper; 3% if equivalent to 35,000 t to 40,000 t of fine copper; and 3.5% if equivalent to 40,000 t to 45,000 t of fine copper. The tax rate then jumps to 4.5% if the value equivalent falls in the range of from 45,000 t to 49,999 t of fine copper and to 5% if the value equivalent exceeds 50,000 t of fine copper (Rojas and others, 2006, p. 360-362).

The annual average price of fine copper used in determining this tax is based on the average price of copper sold on the LME. Annual mine production of some other metals (such as lead and zinc) that are traded on the LME are also valued at LME prices. Annual mine output of gold, silver, and some other metals, such as molybdenum, are based on prices listed for those commodities on the New York Commodities Exchange (COMEX) or as published in such publications as Platts Metals Week and the Metal Bulletin. Prices used to value the mine production of industrial minerals are obtained from Government-accepted industrial publications, including the Chemical Market Reporter, Industrial Minerals, and Mineral Price Watch. The Government's Comisión Chilena del Cobre (COCHILCO) is primarily responsible for evaluating and publishing (both electronically and in hard copy) the annual average prices of mined minerals in Chile (in Chilean pesos) from averages of monthly data from the above sources (and some others, as necessary). During the first 15 days following every quarter of the calendar year, COCHILCO is required to publish the monthly data that will be used to calculate the annual averages and the source from which it was obtained (Rojas and others, 2006, p. 360-362).

Throughout the year, all foreign-owned mineral companies continued to pay taxes according to the terms of the country's 1974 foreign investment statute, known as Decree Law 600 (D.L. 600). Under D.L. 600, a foreign investor may sign a contract with the Chilean Government; the Comité de Inversiones Extranjeras (CIE) establishes the terms and conditions of the investment. Such contracts are not allowed to be modified unilaterally by the Government or by the enactment of any legal regulations after the contracts are signed; mining companies, therefore, are allowed to wait for their D.L. 600 contracts to expire before beginning to pay the new mining tax. Only Minera Escondida Ltd. (of which BHP Billiton Plc of London, United Kingdom, and Victoria, Australia, was the controlling owner), however, was expected to continue to operate under its D.L. 600 tax stability clause in 2006. All other mining companies in Chile were expected to opt out of this D.L. 600 clause in 2006. For Minera Escondida and any other mining companies that decide to wait until expiration of their existing D.L. 600 contracts, the new tax will be applied after these contracts expire, at which time their profits would be taxed at the current rates, which could be higher than those outlined above if rates are adjusted through passage of further mining royalty legislation in the meantime. Foreign mining companies were also allowed to apply to pay the mining-specific tax at a fixed rate of 4% for 12 years if they first choose to opt out of their D.L. 600 tax stability clause. The revenue expected by the Government from the first year (2006) of the mining-specific tax was about $270 million, and these funds were earmarked for development of an Innovation and Competitiveness Fund that would be used to invest in diversifying the Chilean economy away from extractive industries. This investment fund was designated to be administered by an independent agency, however, and the monies could still be used to reinvest in exploration for minerals, technological development in mineral extraction and processing, or other measures that might improve the competitiveness of the mining sector (table 2; Placer Dome Inc., 2005, p. 4; Rojas and others, 2006, p. 348-349, 363).

The Chilean Government, through the Ministerio de Minería, exercised control of the mineral industry through three large state-owned companies and four regulatory agencies. These state-run mining companies would not be subjected to the new mining tax and included Corporación Nacional del Cobre (CODELCO), some subsidiaries of Corporación de Fomento de la Producción (CORFO), and Empresa Nacional de Minería (ENAMI). The subsidiaries of CORFO that were important to the mineral industry included Cía. Chilena de Electricidad S.A., Cía. de Acero del Pacífico S.A. de Inversiones (CAP), Empresa Nacional del Carbón S.A. (ENACAR), and the state-owned oil company Empresa Nacional del Petróleo S.A. (ENAP). The four regulatory agencies were CIE, COCHILCO, the Comisión Nacional del Medio Ambiente (CONAMA), and the Servicio Nacional de Geología y Minería.

Structure of the Mineral Industry

In 2005, many of the world's leading private mining companies, which included Anglo American plc of the United Kingdom, Barrick Gold Corporation of Canada, BHP Billiton, Falconbridge Limited of Canada, Phelps Dodge Corporation of the United States, and Placer Dome Inc. of Canada, were deeply invested in the mineral industry of Chile. The effect of the new mining tax on investment was expected to be minimal as long as Chile maintains its global advantages in mineral reserves. Political uncertainty surrounding the Government debates over formulating and passing the mining royalty bill was often cited as at least a partial explanation of why foreign direct investment (FDI) by mining companies decreased to $350 million in 2004 from $392 million in 2003 and $2,003 million in 2002. FDI in the mining sector was estimated to have increased to $823 million in 2005; cost uncertainty, however, was of growing concern to both domestic and foreign investors in the mineral industry of Chile because of increasing energy costs and the shortages and of higher prices for mining equipment and machinery in 2005. In 2003, mining operational inputs, such as mining machinery, chemical reagents, and spare parts, accounted for about $1.24 billion of the approximate $5 billion in operating costs for the 17 leading copper mining companies in Chile. At that time, annual expenditures for these inputs alone by just those companies studied was expected to increase by $850 million by 2010. In 2005, however, total mining operational costs were already substantially higher than predicted just 2 years earlier. Shortages and higher-than-expected prices for equipment were expected to continue through at least 2007 because mining firms were expected to continue to produce as close to listed capacity as possible while mineral prices remain high (Valenzuela and Arias, 2005, p. 394-395; Minería Chilena, 2006a§, b§).

In 2005, COCHILCO estimated that total private investment in copper mining, smelting, and refining, which totaled $1,353 million, greatly exceeded state-sponsored investment through CODELCO, which totaled $727 million, but that CODELCO would increase its share of investment in the sector to about 78% by 2007. COCHILCO also projected that CODELCO would have to maintain this higher proportion of the total annual investment in the sector through at least 2010. In 2006, COCHILCO expected that private firms would invest a total of about $1,200 million in the copper sector, of which about $1,100 million would be invested by Antofagasta plc of the United Kingdom and BHP Billiton, and CODELCO would invest about $810 million. COCHILCO expected that CODELCO would increase investment in this sector of the mineral industry to about $1,750 million in 2007, and that private investors would invest only about $500 million (Vidal, 2006a, p. 15-16; 2006b, p. 14).

On October 31, 2005, Barrick announced its bid to acquire Placer Dome and completed the acquisition on March 8, 2006. Barrick acquired a 100% ownership interest in the Zaldivar copper mine as a result of this acquisition. The acquisition agreement was contingent on the subsequent sale of Placer Dome's interest (50%) in La Coipa gold and silver mine together with some other ownership interests of Placer Dome outside of Chile to Goldcorp Inc. Barrick named this the "Goldcorp Transaction" and planned to complete it by the end of the second quarter of 2006. Assuming completion of this ancillary transaction, Barrick was expected to enter the mineral industry of Chile as a relatively minor copper producer; Goldcorp, on the other hand, would enter the mineral industry with a noncontrolling 50% ownership interest in the leading producing gold mine in the country (table 2; Barrick Gold Corporation, 2006, p. 12-13).

The Chilean company Sociedad Química y Minera de Chile S.A. (SQM) was the world leader in the production of iodine, lithium carbonate (not contained in spodumene), and potassium nitrate. On December 23, 2004, the company acquired PCS Yumbes S.C.M. (a subsidiary of Potash Corporation of Saskatchewan Inc., of Saskatoon, Saskatchewan, Canada), but did not continue to operate the Yumbes Mine during 2005. Instead, the company expected to relocate at least some of the Yumbes facilities from about 90 miles south of Antofagasta in Region II to become part of the Coya Sur plant in the northern part of Region II and of the Nueva Victoria facilities in Region I. This restructuring was expected to help expand SQM's total production of nitrates by 25% in 2006. In 2005, PCS Yumbes S.C.M. changed its name to SQM Industrial S.A. SQM completed a project to increase the company's capacity to produce lithium carbonate at its facility located at Salar del Carmen to about 33,000 metric tons per year (t/yr) compared with approximately 28,000 t/yr at the end of 2004; another project which was started at the end of 2005, would increase the company's capacity to produce lithium carbonate to 40,000 t/yr by 2008. The company also neared completion of a project to increase annual production of iodine to about 3,500 t/yr compared with 2,200 t in 2005 at its Nueva Victoria facility; the expansion was expected to be completed during the first half of 2006. In 2005, SQM's project to expand and modernize its María Elena facilities included beginning replacement of the crushing circuit and development of a new mining area there; the company expected to complete this project by sometime in 2006 (tables 2, 3; Sociedad Química y Minera de Chile S.A., 2006, p. 13, 20, 37, 46, 51).

Exploration

Until at least 2009, BHP Billiton's Spence copper project appears to be the last significant new copper mine that will achieve production. The mine and solvent-extraction/electrowinning (SX-EW) plant is expected to produce about 200,000 t/yr of copper cathodes beginning at the end of 2006. The only other new mine expected to achieve production before 2010 was CODELCO's and Minmetals Non-Ferrous Metals Co. Ltd.'s Gaby project, which was expected to produce about 150,000 t/yr of copper cathodes if it is approved. Development of other copper deposits that had already been discovered by 2005 was still very uncertain owing to various difficulties associated with lower copper grades in the ores, increasing amounts of impurities and hazardous materials in the deposits, and the increasing depth necessary to exploit the deposits. Through 2005, such technical difficulties were expected to continue to become more problematic in Chile because exploration had not resulted in any new discoveries of higher-

grade copper deposits that were close to the surface, which had formed the basis of the development of the Chilean copper sector into the world's leading producer (table 3; Rojas and others, 2006, p. 349; Vidal, 2006b, p. 7-9, 13).

Although Barrick did not expect to have any share in gold mine production in Chile in 2006, it did obtain environmental approval for its Pascua-Lama gold project from the Chilean Government in the form of a resolution concerning the company's environmental impact assessment, which was issued to the company on February 17, 2006. The project straddles the Chilean border with Argentina, however, and Barrick had not yet received environmental approval from the Government of Argentina through the first quarter of 2006. Barrick still expected to be allowed to proceed with the project and projected that the proposed mine would produce about 2,400 kilograms per year (kg/yr) of gold, on average, during the first 10 years of production. The company expected to start production at Pascua-Lama sometime in 2010 after extensive preparation of the mine site is accomplished, including moving a portion of the glaciers that cover a portion of the mine site. On October 26, 2005, Placer Dome agreed to sell its 51% share in the Cerro Casale gold project to the company's partners in the joint venture, Bema Gold Corporation and Arizona Star Resource Corp. (both of Canada), but Barrick had not completed this sale by the end of 2005. Further exploration at the Cerro Casale project was expected to remain on hold until resolution of this issue between the companies involved (Barrick Gold Corporation, 2006, p. 13, 24, 47, 52-55; Bema Gold Corporation, 2006, p. 11)

Production

Although mine output of copper decreased in 2005 compared with that of 2004, the complexity of the copper ores increased, and more associated metals in the ores were extracted in proportion to the copper, including gold, molybdenum, rhenium, and silver. Mine production of gold did not change much during this timeframe, and about 41% of the total mine production of gold was extracted from copper concentrates in both 2004 and 2005. Mine production of silver, however, increased significantly, primarily because of greater extraction of silver from copper concentrates. In 2005, 61% (857 t) of the total silver content of mine production in Chile was extracted from copper concentrates compared with only 55% (747 t) of total silver production in 2004. A greater proportion of molybdenum relative to copper was also extracted per metric ton of ore mined by the three existing molybdenum producers during this same timeframe, and two new operations were started in 2005 to extract molybdenum from primarily copper ores at existing copper mines. These developments were mainly in response to the increase in the average annual price of molybdenum from $11.75 per kilogram in 2003 to $70.68 per kilogram in 2005. By 2005, some companies had also installed additional molybdenum roasting capacity to allow greater production of rhenium and other byproducts, such as ferromolybdenum and molybdenum oxide, compared with levels of production in 2004 (table 1; Servicio Nacional de Geología y Minería, 2005, p. 40, 56; 2006, p. 55, 59; Comisión Chilena del Cobre, 2007, p. 5, 21; Magyar, 2007a).

In 2005, mine production of manganese and zinc increased as mines operated near capacity to take advantage of higher prices compared with those of 2004, but mine production of lead contained in gold and zinc concentrates decreased substantially. All mine production of lead in Chile was through extraction of lead from gold and zinc concentrates that were produced in Region XI of the country. In 2005, the amount of lead extracted from gold concentrates was 579 t compared with 1,777 t in 2004, and from zinc concentrates, it was 299 t compared with 509 t. The precipitous decrease in the production of lead from gold concentrates was partially explained by the decrease in production of gold concentrates in Region XI to 12,654 t compared with 15,596 t in 2004 and also by the lower lead content per metric ton of gold concentrate. The production of zinc concentrates in Region XI increased to 56,552 t compared with 53,804 t, but the lead content of these concentrates also decreased during the same timeframe. In 2005, the annual average price of iron ore increased to about $44.50 compared with about $32.30 in 2003, but production of iron contained in the beneficiated (marketable) ore and concentrates continued to decrease as the average grade of iron in the mined ore continued to decrease (table 1; Servicio Nacional de Geología y Minería, 2005, p. 47, 66, 69; 2006, p. 57, 60-63; Compañía Minera del Pacífico S.A., 2006, p. 5-6, 14; Jorgenson, 2007).

In 2005, production of industrial minerals from caliche ore deposits in Regions I and II and from the brines and saline crusts of the Andean salars mostly decreased compared with that of 2004, including a 48.6% decrease in production of sodium sulfate, a 22.5% decrease in national production of ulexite (a boron compound), and an 8.5% decrease in total production of nitrates (both potassium and sodium nitrates). A slight increase of 2.8% in the production of iodine took place, however, mostly because SQM expanded the iodine production capacity at the company's Nueva Victoria facility. Total production of cement increased by 5.3% mostly owing to completion of capacity expansion projects in 2005 by the Chilean company Cementos Bío Bío S.A. in response to increasing domestic demand. National production of coal increased by more than 200% in 2005 compared with that of 2004 because production of coal (all types) increased to 594,309 t compared with 98,120 t in Region XII (Magallanes) (table 1; Cementos Bío Bío S.A., 2006, p. 5; Servicio Nacional de Geología y Minería, 2006, p. 80-88, 92, 108, 112, 115; Sociedad Química y Minera de Chile S.A., 2006, p. 13).

Trade

In 2005, the value of total copper exports was slightly less than $17.7 billion, which accounted for about 79% of total mining exports and 45% of total Chilean exports. Although the value of copper exports increased by about 22% compared with that of 2004, the annual quantity of copper exported decreased by 2.7% [to 5.3 million metric tons (Mt)] in 2005. The mineral trade balance as reported by the Central Bank of Chile (and excluding mineral fuels) was $21.5 billion. The value of Chilean imports of petroleum, natural gas, and their derivatives was $6.2 billion. Chile imported only $891 million of mine production (metals and industrial minerals), and exported almost no mineral fuels other than about $613 million of methanol. Also,

mining operations consumed about 32% of the total electricity provided in Chile during the year, including that generated by hydropower. Mining operations in Chile imported $5.5 billion in goods, which included mining machinery, chemical reagents, and spare parts; this total represented an increase of about 38% compared with that of 2004, which in turn was 43% higher than that of 2003. Most of these imported inputs into the mining sector were not included in the mineral trade balance given above except for some unknown proportion of the expenditures on imports of chemical reagents that were mined outside of the country (Banco Central de Chile, 2006a, p. 37; 2006b, p. 44, 46; Comisión Chilena del Cobre, 2006, p. 22-23, 101, International Monetary Fund, 2006§).

In 2005, China was the leading customer for Chilean copper and imported enough to account for 19.6% of the total value of the country's copper exports. The leading importer of ferromolybdenum was the Netherlands (53.3%); Chilean gold was the United States (55.1%); iron ore was Indonesia (22.6%); molybdenum concentrates was again the Netherlands (44.5%); molybdenum oxide was Japan (46.8%); silver was again the United States (41.7%); and zinc was North Korea (35.7%). The leading importers for Chile's main industrial mineral exports were Belgium for lithium carbonate (22.3% share of Chile's total exports, by value) and iodine (33.3%), Brazil for potassium nitrate (80.9%), and the United States for sodium nitrate (39.4%). By value, the countries of Asia purchased about 48.7% of Chile's total exports of metals; Europe, 28.4%; the Western Hemisphere, 21.8%; and other countries, including Australia and South Africa most prominently, the remainder. Combined, the countries of the Western Hemisphere were the leading purchasers of Chilean exports of industrial minerals, with a 51.8% share; Europe, 23.5%; Asia, 20.9%; and other countries, the remainder (Comisión Chilena del Cobre, 2006, p. 24-26).

In 2005, Chile signed a bilateral free trade agreement with China. As a result of this agreement, China was expected to increase exports of appliances and electronics to Chile, and Chile was expected to export even more copper concentrate to China, as well as more fish, fruit, and wood pulp. The value of total bilateral trade in goods between the two countries was expected to increase by about 30% in 2005 compared with that of 2004, after already increasing by about 42% in 2004 compared with that of 2003 (British Chilean Chamber of Commerce, 2005). Chile's total exports of copper to China increased in value by 28% in 2005 compared with that of 2004, after increasing by only 9.4% in 2004 compared with that of 2003. In terms of metric tons exported, however, Chile's exports of copper to China increased by only 10% in 2005 compared with that of 2004, and by about 19% in 2004 compared with that of 2003 (Comisión Chilena del Cobre, 2006, p. 35, 37).

Commodity Review

Metals

Copper.—On a national level, investment was increasingly directed more into research and development of technologies that might enable development of already discovered copper deposits to be less costly than those in other countries, despite higher labor costs, and proportionally less was directed into exploration for new copper deposits. After 2006, more Government funding for this type of research may come from revenues generated by the new mining-specific tax. In 2005, CODELCO invested in alternative technologies that included a solution-based method for extracting arsenic from the ores of the proposed Ministro Alejandro Hales Mine and still allow the ore to be smelted using its existing conventional smelting methods. Progress in such technological research was expected to become increasingly responsible for the pace of development of copper mine production capacity relative to investment in exploration and the rate of new discoveries of copper deposits in Chile (Corporación Nacional del Cobre, 2006, p. 7, 16, 38, 42, 44-47; Rojas and others, 2006, p. 349; Vidal, 2006b, p. 3-5, 7).

In 2005, CODELCO continued negotiations on a 15-year contract to sell 55,750 t/yr of fine copper to China for a payment of $550 million (up front) by Minmetals and price balances on each shipment to be determined according to the spot price of copper at the time of delivery. This agreement was expected to be ratified in early 2006, and Minmetals' option to buy into a minority share of CODELCO's Gaby copper project was ratified in 2005. Both of these agreements could help increase investment and speed up development of additional copper production capacity (at least partially targeted for the Chinese market), but CODELCO had still not approved the Gaby project for development through to production as of the end of the first quarter of 2006 (table 3; Corporación Nacional del Cobre, 2006, p. 21, 30, 43, 103).

In 2005, Chilean copper reserves were increasing in arsenic content and complexity of chemical makeup, and decreasing in copper content per ton of ore. According to SQM, Chilean environmental regulations have become increasingly stringent in recent years, both with respect to the approval of new mining projects and with respect to regulating the implementation and development of projects already approved. If this trend continues, then mining and processing costs are going to steadily increase in all Chilean mining sectors independent of other operating costs related to energy, labor, and the costs of purchasing and maintaining mining equipment. Although the sunk costs for investment in research and development of more modern methods to extract and process increasingly complex ores have been high and research was ongoing in 2005, more new copper mining development projects in Chile were being designed to better use such technologies as bioleaching. Prominent projects that were budgeted, ongoing, or completed in 2005 and that would rely on bioleaching to improve cost-effectiveness with low-grade and chemically complex ores were the new Escondida concentration plant, to process material from the Escondida and the Escondida Norte pits that was otherwise too costly to process; the Alliance concentration plant, to process low-grade ores from the Chuquicamata Mine; and the Ministro Alejandro Hales Mine and concentration plant, which was to be located so as to be essentially an extension of the Chuquicamata Mine but with higher arsenic content in the ores. In 2005, CODELCO was bioleaching some copper ore at pilot plants in its CODELCO Norte and Andina divisions, and Escondida was also employing bioleaching and bio-oxidation technology. In 2001, 13 mining companies were already using

some bioleaching in Chile, and about 10% of total copper production in the country used bioleaching (table 3; Corporación Nacional del Cobre, 2006, p. 7, 42, 44-45; Minera Escondida Limitada, 2006, p. 43; Sociedad Química y Minera de Chile S.A., 2006, p. 8-9; Vidal, 2006b, p. 9, 15; Dresher, 2004§).

Iron and Steel.—In 2005, the Chilean company Compañía Minera del Pacífico S.A. (CMP) accounted for about 90% of the total gross weight of iron ore mined in Chile, and production by the company decreased to 7,217 t of ore compared with 7,437 t in 2004. CMP continued to invest in exploration during the year and focused its efforts on exploring the property that immediately surrounded its active mines. As a result of this exploration and higher prices for iron ore, proven higher-grade reserves of iron ore at El Romeral Mine increased to about 45 Mt at an average grade of about 45% iron content compared with about 18 Mt at a grade of about 47% in 2004, but lower-grade reserves at the mine decreased to about 70 Mt at an average grade of 26% compared with 73 Mt at a grade of 26% during the same timeframe. The amount of ore extracted at El Romeral decreased in 2005, however, to 1,879 t compared with 2,172 t in 2004. The company extracted 5,338 t compared with 5,265 t of ore during the same timeframe at its El Algarrobo Mine, but this caused a depletion of proven reserves to 5.5 Mt compared with 7.7 Mt in 2004 despite exploration efforts at El Algarrobo and annual average price increases for iron ore in 2004 and 2005. Production of crude steel decreased only slightly during this timeframe compared with that of iron ore, but the country still imported $853 million worth of iron and steel manufactures in 2005 compared with $698 million in 2004 to help meet its consumption requirements (Compañía Minera del Pacífico S.A., 2005, p. 10, 14-16; 2006, p. 5-6, 8, 14, 18-20; Banco Central de Chile, 2006b, p. 77; Jorgenson, 2007).

Lead, Silver, and Zinc.—In 2005, Breakwater Resources Ltd. of Toronto, Ontario, Canada, accounted for about 94% of the total mine production of zinc in Chile through production at the company's El Toqui Mine. Total tonnage of ore milled during the year by the company at El Toqui increased by about 11% compared with that of 2004 partially owing to improvements in the mill's grinding circuit made in 2004, but production of zinc contained in concentrate at the mine increased by only about 4% during the same timeframe. Breakwater mined lower zinc grades in the parts of El Toqui that were already being mined, and the company experienced delays in further developing the Estatuas area of the mine. Because the Estatuas deposit is more highly faulted and difficult to mine than Breakwater expected and development of the new Concordia deposit at El Toqui was not expected to be completed until sometime in 2007, the company expected to produce only about 24,000 t of zinc in concentrate in 2006 compared with 28,347 t in 2005 (Breakwater Resources Ltd., 2006, p. 6-7, 18, 22).

Table 1 lists production of refined silver metal (granular) only from the Ventanas smelter and refinery in Puchuncavi, Region V, which was acquired by CODELCO from ENAMI in May 2005 and renamed the Ventanas Division of CODELCO. Production of refined silver at Ventanas increased substantially during the year compared with that of 2004. ENAMI retained the Hernán Videla Lira smelter and refinery in Paipote and continued to produce refined silver. Reliable data on total annual production in Chile was not publicly available at the time of this writing, but the country exported 511 t of refined silver metal in 2005. Annual Chilean exports of refined silver have decreased every year since 2001, when the country exported about 682 t (Comisión Chilena del Cobre, 2006, p. 23; Corporación Nacional del Cobre, 2006§).

Although the annual average price of lead increased by about 10% in 2005 compared with that of 2004, mine production of lead in Chile decreased substantially during the same timeframe. SERNAGEOMIN reported that Breakwater was the only producer of mined lead in the country; the company extracted the lead from the gold and zinc concentrates produced at El Toqui Mine. The company reported that the amount of gold in concentrates produced at the mine increased to about 1,300 kilograms (kg) in 2005 compared with about 870 kg in 2004 because of higher quantities of gold produced out of the Aserradero gold skarn deposit. During the last quarter of 2005, however, gold grades and total production of ore both decreased. The two deposits under development during 2005 by Breakwater at El Toqui (Estatuas and Concordia) were estimated to contain little or no gold. The company estimated an indicated and inferred mineral resource of 1.87 Mt at Concordia, at grades of 10.2% zinc, 5.1% lead, and 68 grams per metric ton of silver (table 1; Servicio Nacional de Geología y Minería, 2005, p. 67; 2006, p. 62; Breakwater Resources Ltd., 2006, p. 6-7, 18, 22).

Manganese.—The principal producer of manganese in Chile was Manganesos Atacama S.A.; this company was a subsidiary within the family of subsidiaries of CAP S.A. that also included CMP. Initiation of operations at Manganesos Atacama's Socavón Marquesa concentration plant in 2005 was primarily responsible for the substantial increase in the mine production of manganese compared with that of 2004 in Chile. This plant was constructed to process the ore from the Loma Negra Mine, which has a mean grade of 12% Mn content, and enabled the company to extract manganese at a greater rate from the ores mined at Loma Negra (CAP S.A., 2006, p. 27, 97-102).

Molybdenum and Rhenium.—In 2005, mine production of molybdenum in Chile was entirely as a byproduct of existing copper mines, but a new facility to extract molybdenum from copper ores for the first time was completed by Compañía Minera Doña Inés de Collahuasi SCM at the company's copper mine and another plant to extract molybdenum from tailings generated by CODELCO's El Teniente copper mine and concentration plant was completed by Mineral Valle Central S.A. In 2005, these new facilities accounted for only 349 t and 293 t of molybdenum production, respectively. The leading producer of molybdenum in Chile was CODELCO, which increased production to 36,566 t of Mo content compared with 32,324 t in 2004. The second-ranked producer was Los Pelambres Mine, which produced 8,710 t of molybdenum compared with 7,853 t in 2004, and the third-ranked producer was the Los Bronces Mine, which produced 2,123 t compared with 1,706 t in 2004. Molibdenos y Metales S.A. (Molymet) increased its molybdenum roasting capacity to an estimated 24,600 t/yr of fine molybdenum content in 2005 compared with about 21,300 t/yr in 2004, but Molymet did not control any mine production of molybdenum in Chile. Annually, some undisclosed proportion of Molymet's production of

molybdenum and rhenium products in Chile originates from imports of concentrate into the country, so it is unclear exactly how much of the increase in rhenium production in 2005 was a direct result of the increase in mine production of molybdenum in Chile. In 2005, both Antofagasta plc and CODELCO exported molybdenum concentrate directly and also supplied concentrate to Molymet to be processed in Chile (Comisión Chilena del Cobre, 2007, p. 19, 21-22).

The annual average price of molybdenum contained in oxide increased to $36.73 per kilogram in 2004 from $11.75 in 2003, and it increased again to $70.68 per kilogram in 2005. In response to an increase in the average annual molybdenum price relative to that of copper, Antofagasta increased production of molybdenum and lowered production of copper through a selective mining strategy at Los Pelambres Mine. Both molybdenum grades and recovery rates increased for the ores mined at Los Pelambres compared with those of 2004, and copper grades of the ores decreased during the same timeframe. In a similar manner, CODELCO increased production of molybdenum in all its wholly owned mining divisions during 2005; the CODELCO Norte Division accounted for 73.4% of CODELCO's total production of molybdenum in 2005. After construction of the molybdenum flotation plant at the Collahuasi Mine was completed in November 2005, Anglo American and Falconbridge expected it to be able to produce between 5,000 t/yr and 8,000 t/yr, depending on the grade of molybdenum in the ore being fed into the plant. Anglo American was also responsible for expanding the total production capacity (including of molybdenum) at its wholly owned Los Bronces Mine. This expansion was expected to be completed by 2007 (Anglo American plc, 2006, p. 9; Antofagasta plc, 2006, p. 4-7, 18, 40; Corporación Nacional del Cobre, 2006, p. 26; Comisión Chilena del Cobre, 2007, p. 21; Magyar, 2007b).

Industrial Minerals

Boron and Lithium.—Boron products, such as boric acid and ulexite, and lithium carbonate are produced mostly from brines extracted from underground deposits in a salt-encrusted depression called the Atacama Salar, which is located within the Atacama Desert in northern Chile. These brines contain reserves of boron, lithium, potassium, and sulfates, which were processed to produce various industrial mineral commodities that included boric acid, lithium carbonate, lithium hydroxide, potassium chloride, and potassium sulfate. Most of the boron was left in its natural form, as ulexite, and then used in the production of specialty fertilizers rather than processed to produce boric acid. Although Chile has other salars, most of the country's production of these minerals comes from the Atacama Salar, which is controlled by SQM. The company's production of most of these commodities decreased in 2005, especially production of ulexite. SQM increased production of natural boric acid from the brines of the Atacama Salar, but produced much less ulexite during the same timeframe. Boron that was left as ulexite was mined mostly from another salar called the Salar de Ascotan and then processed in a boron processing facility located at the Salar del Carmen, which was near the company's lithium processing facility and the city of Antofagasta. The Atacama Salar is located about 250 km east of Antofagasta. Considering only company reserves in the Atacama Salar brines, SQM increased its reserves of boron to 1.1 Mt in 2005 compared with 0.7 Mt in 2004; the company's reserves of lithium increased slightly to 2 Mt compared with 1.9 Mt during the same timeframe (table 1; Sociedad Química y Minera de Chile S.A., 2006, p. 14, 20-21, 43).

Clay and Shale.—Prior to 2005, SERNAGEOMIN reported clay production in only three major categories. The first category included only bentonite; the second included kaolin (approximately 40% alumina content) and bauxitic (alumina content above 65%) clays; and the third included plastic (and other ball-type) clays, common clays, and other unspecified clays. These broad categories have been maintained in table 1 for this chapter, but a breakdown of the broader categories for production of clays in 2005 was provided by SERNAGEOMIN to reorganize the Government agency's reporting of production levels in Chile compared with previous years. In 2005, Chile reportedly produced 54,301 t of plastic and other ball-type clays, 35,271 t of bauxitic clays, and 15,183 t of kaolin. SERNAGEOMIN did not list any reported production of bentonite or of any common clay during the year. All production of bentonite in the country was reportedly by a single producer in Region I of the country, but reliable information concerning the company's actual level of production of bentonite in 2005 was not available at the time of this writing (Servicio Nacional de Geología y Minería, 2006, p. 67-71).

Iodine, Nitrates, and Sodium Sulfate.—In Chile, iodine, nitrates, and sodium sulfate are produced mostly from open pit mining of the caliche ore deposits that are located in northern Chile. These deposits are typically only 0.5 to 1.5 meters below the surface. In 2005, production levels of iodine and nitrates in the country were significantly higher than those of 2004; the production of sodium sulfate decreased substantially during this timeframe, however. The relative changes in these production levels were caused primarily by SQM temporarily halting most of the company's extraction of sodium sulfate from the caliche ores mined at SQM's wholly owned Pedro de Valdivia and María Elena Mines, owing to a company decision to give the production of nitrates (and iodine) priority with respect to the production of sodium sulfate during the year. SQM produced sodium nitrate at plants located at both the Pedro de Valdivia and María Elena Mines, while most of the company's capacity to produce potassium nitrate and sodium sulfate were through different processes at the separate Coya Sur plant. SQM produced iodine at plants located at the company's Nueva Victoria and Pedro de Valdivia Mines from ores mined at these two mines and at SQM's two other caliche ore mines, María Elena and Pampa Blanca. The company's combined proven reserves of iodine and nitrates in the caliche ore at the Pedro de Valdivia Mine increased to 144 Mt in 2005 compared with about 142 Mt in 2004, but proven reserves decreased to about 147 Mt compared with 154 Mt at the María Elena Mine. In 2005, proven reserves of caliche ore also increased to about 95 Mt compared with about 37 Mt in 2004 at the Nueva Victoria Mine and to about 81 Mt compared with about 65 Mt at the Pampa Blanca Mine (table 1; Sociedad Química y Minera de Chile S.A., 2006, p. 17-19, 39).

Mineral Fuels

Coal.—In 2005, although ENACAR was beginning to make plans to close its Trongol Mine and total production of coal (all types) decreased slightly to 138,000 t compared with 140,000 t in 2004 in Region VIII of Chile, production of coal in the Magallanes region (Region XII) increased to about 594,000 t compared with about 98,000 t during this timeframe. This dramatic increase in production (although still small in scale relative to most other coal mining operations in Latin America) was primarily owing to increased production after expansion of infrastructure and coal mining activities by Ingenieria del Sur S.A. (Ingesur) in the area surrounding the company's Pecket Mine and reported development of an unnamed coal mine by Chabunco S.A. in the northern sector of Punta Arenas in Magallanes. Investment in exploration for coal in Magallanes also increased during the year. Ingesur continued its exploration and expansion efforts at the Pecket Mine and Chabunco S.A. continued to develop a mine in Punta Arenas. BHP Billiton acquired at least one exploration concession on the island of Isla Riesco and had entered bids in auctions for at least one other coal mining exploration concession on the island. Management of these auctions and all of the coal exploration and exploitation concessions in Magallanes was being conducted by CORFO (table 2; Servicio Nacional de Geología y Minería, 2006, p. 115; La Prensa Austral, 2006§; Compañía Carbonífera San Pedro de Catamutún, undated§).

Natural Gas.—The increasing interest in developing coal reserves in Chile was partly a reaction to continued restrictions on natural gas exports out of Argentina. By 2005, however, Chile had already converted much of its electricity generation capacity to be based on gas-fired plants and did not expect to make another large-scale conversion to coal-burning plants. During 2005, the Government instead promoted plans to develop cross-border pipelines that might provide the country with a secure supply of natural gas from other South American countries. The design of this natural gas pipeline network was most commonly proposed as a gigantic ring around Bolivia, which has not been willing to agree to a new natural gas supply arrangement with Chile. Such a design to circumvent Bolivia was also reportedly growing in popularity with the Governments of some other countries in South America as perceived uncertainty concerning Bolivian natural gas supplies grew during the year. Without the inclusion of Bolivia in the plans for an integrated South American gas network of pipelines, the surplus supply among other South American producers did not appear to be sufficient to satisfy projected Chilean consumption levels (Petroleum Economist, 2006; U.S. Energy Information Administration, 2006)

Outlook

Increasing operating costs combined with expected implementation of the new mining royalty in 2006 could deter investment in exploration and development of new copper deposits by private companies through at least 2010. Private companies are expected to invest in cost-effective technologies to process the more-complex ores during this same timeframe. State-run CODELCO, however, is expected to account for the bulk of both types of mining investment through 2012 in Chile. If high prices for copper are maintained and sufficient technological developments for more cost-effective mining of low-grade high-impurity copper deposits are forthcoming, then Chile's world leading reserves of copper are expected eventually to again attract substantial private and foreign direct investment to the country's copper sector. Although many copper deposits had already been discovered by 2005, these projects were still mostly in the conceptual stages and reliable timelines for their development have not been established.

On a macroeconomic level, the Government expects to continue to have large budget surpluses based mostly on revenues from the copper mining sector. The most pressing mineral industrial issue is considered to be the establishment of a secure supply of mineral fuels (especially natural gas) into Chile to help continue economic development in the country. The outlook for a substantial domestic discovery or development of mineral fuel production capacity or for establishing a network of pipelines to import sufficient quantities of natural gas from other countries in South America does not appear very likely for the next 5 years.

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TABLE 1
CHILE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2001	2002	2003	2004	2005
METALS						
Arsenic trioxide[e]		11,500	11,400	11,600	11,500 r	11,700
Copper:						
Mine output, Cu content[3]	thousand metric tons	4,739	4,581	4,904	5,413	5,321
Metal:						
Smelter, primary	do.	1,503	1,439	1,542	1,518 r	1,558
Refined:						
Electrowon	do.	1,538	1,602	1,653	1,636	1,585 p
Primary, other	do.	1,344	1,248	1,249	1,201 r	1,239 p
Total	do.	2,882	2,850	2,902	2,837 r	2,824 p
Gold, mine output, Au content	kilograms	42,673	38,688	38,954	39,986	40,447
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand metric tons	8,834	7,269	8,011	8,004 r	7,862
Fe content	do.	5,437	4,398	4,865	4,850	4,707
Metal:						
Pig iron	do.	897	934	988	1,137	1,099 p
Ferroalloys:						
Ferromanganese		2,213	--	--	--	--
Ferromolybdenum[e]		1,740	3,160	4,070	5,760	6,200
Total[e]		3,950	3,160	4,070	5,760	5,760
Steel, crude	thousand metric tons	1,247	1,280	1,377	1,579	1,534 p
Semimanufactures	do.	1,067	1,150	1,197	1,356 r	1,330 e
Lead, mine output, Pb content		1,193	2,895	1,697	2,286	878
Manganese ore and concentrate:						
Gross weight		31,320	12,195	19,641	25,801	39,786
Mn content		9,129 r	3,190	5,824	7,188	12,324
Molybdenum:						
Mine output, Mo content		33,492	29,466	33,375	41,883	47,748
Oxides		8,813	7,716	5,398	8,339	8,971
Rhenium, mine output, Re content[e, 4]	kilograms	16,000 r	15,400 [5]	16,000 r	18,900 r	21,500
Selenium[e]	do.	84,000	80,000	83,000	82,000	84,000
Silver:						
Mine output, Ag content		1,349	1,210	1,313	1,360	1,400
Metal, Ag content	kilograms	185,375 r	194,251 r	185,375 r	158,678 r	171,445
Zinc, mine output, Zn content		32,762	36,161	33,051	27,635	28,841
INDUSTRIAL MINERALS						
Barite		584	384	229	31	91
Boron compounds:						
Boric acid (H_3BO_3)		9,644	9,000	8,690	8,545	8,774
Ulexite, natural		327,743	431,293	400,603	594,191	460,683
Total		337,387	440,293	409,293	602,736	469,457
Cement, hydraulic	thousand metric tons	3,513	3,461	3,622	3,798	3,999
Clays:						
Bentonite		1,695	632	748	101	-- e
Kaolin		5,300	6,164	11,500	7,133 r	15,183
Other, including plastic and refractory clays		28,330	35,091	51,622	94,886 r	89,572
Total		35,325	41,887	63,870	102,120	105,000 e
Diatomite		22,705	30,274	25,594	30,015	27,091
Dolomite		29,940	31,439	17,308	27,436	24,903
Feldspar		2,867	3,069	6,690	4,838	5,820
Gypsum:						
Crude	thousand metric tons	517	610	662	630	661
Calcined	do.	175	229	190	304	310
Iodine, elemental		11,355	11,648	15,580 r	14,931	15,346
Lime, hydraulic	thousand metric tons	245 r	212 r	274 r	361 r	409

See footnotes at end of table.

TABLE 1--Continued
CHILE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2001	2002	2003	2004	2005
INDUSTRIAL MINERALS--Continued						
Lithium carbonate		31,320	35,242	41,667	43,971	43,595
Nitrates, crude, natural	thousand metric tons	1,072	1,174	1,134	1,402	1,283
Phosphate rock (apatite):						
Gross weight		11,511	11,066	9,389	11,695	10,311
P_2O_5 content		3,589	3,411	2,894	3,604	3,178
Phosphorite		7,466	8,475	11,911	9,770	10,052
Potash, natural:						
Potassium chloride, KCl		747,839	770,599	764,065	742,709	733,814
Of which, K_2O equivalent[6]		472,400	486,800	482,700	469,200	463,600
Potassium sulfate, K_2SO_4		170,418	173,209	157,174	177,325	162,102
Of which, K_2O equivalent[e,7]		87,000	88,000	80,000	90,000	83,000
Pozzolan, including pumice	thousand metric tons	785	826	1,242 [r]	1,535 [r]	1,620
Pyrophyllite[8]		3,385	2,974	3,534	2,271	3,315
Quartz, common	thousand metric tons	538	879	765	1,085	1,151
Salt (NaCl)	do.	5,989	3,503	6,213	4,939	6,068
Siliceous sand and gravel (silica):						
Quartz, common	do.	467	420	428	453	589
Silica sand	do.	71	459	487	632	562
Total	do.	538	879	916 [r]	1,085	1,151
Sodium compounds, n.e.s., sulfate[9]		67,760	70,776	44,011	30,622	15,730
Stone:						
Limestone, calcium carbonate	thousand metric tons	5,563	5,888	5,905 [r]	6,516 [r]	6,783
Lapis lazuli		-- [e]	-- [e]	129	43	130
Marble		782	633	828	845	31
Travertine[e]		--	--	--	--	4,680 [5]
Sulfur, byproduct, metallurgy	thousand metric tons	1,160	1,275	1,430	1,508 [r]	1,659
Talc		792 [r]	563 [r]	840 [r]	722 [r]	886
Zeolites		-- [e]	839 [r]	-- [e]	203 [r]	298
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous and lignite, marketable	thousand metric tons	568	452 [r]	347	238	732
Coke, coke oven[e]	do.	500 [5]	440 [5]	400	400	400
Methanol	do.	2,784	2,932	2,704	2,692	2,700 [e]
Natural gas liquids:[e]						
Natural gasoline	thousand 42-gallon barrels	1,000	1,000	1,000	1,000	1,000
Liquefied natural gas	do.	2,500	2,500	2,500	2,500	2,500
Total	do.	3,500	3,500	3,500	3,500	3,500
Natural gas, marketable	million cubic meters	2,684	2,543	2,181	2,106	2,294
Petroleum:						
Crude and condensate[10]	do.	2,425	2,116	1,319	1,292	1,208
Refinery products:[11]						
Liquefied petroleum gas	do.	7,768	7,914	7,534	7,793	7,101
Gasoline:						
Aviation	do.	5,381	68	97	52	47
Motor	do.	17,808	18,396	19,712	20,809	19,720
Jet fuel	do.	5,852	5,054	4,641	5,416	4,875
Kerosene	do.	1,281	1,185	681	626	689
Distillate fuel oil	do.	29,295	29,345	30,297	27,658	26,282
Residual fuel oil	do.	10,207	9,210	12,332	13,581	15,421
Solvents	do.	409	428	375	336	281
Other, including asphalt, ethilene, naphtha, and so forth	do.	1,489	1,696	1,744	1,719	1,463
Total	do.	79,490	73,296	77,413	77,990 [r]	75,879

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [p]Preliminary. [r]Revised. -- Zero.

[1]Table includes data available through November 2006.

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

TABLE 1--Continued
CHILE: PRODUCTION OF MINERAL COMMODITIES[1]

[3]Figures are the nonduplicate copper content of ore concentrates, blister and refined copper measured at the last stage of commercial production, as reported by Comisión Chilena del Cobre (COCHILCO). Mine production reported by Servicio Nacional de Geologia y Mineria (SERNAGEOMIN) for the same years was only slightly higher (0.01% to 0.95%).

[4]Rhenium content of mine output in Chile (whether processed in Chile or elsewhere) was estimated based on information from COCHILCO; the reported production figure for 2002 may include some rhenium content from Mexico processed at Molibdenos y Metales S.A. in Chile.

[5]Reported figure.

[6]Based on 63.17% potassium oxide equivalent for potassium chloride in Chile, as reported by SERNAGEOMIN, and rounded to four significant digits.

[7]Based on an assumed 51% potassium oxide equivalent for potassium sulfate, according to a minimum global average estimate (Kostick, D.S., 2006, Potash, in Metals and minerals: U.S. Geological Survey Minerals Yearbook 2005, v. I, p. 58.1) and rounded to two significant digits.

[8]Figures included as part of talc production in chapters prior to 2005.

[9]Includes production of natural sodium sulfate and anhydrous sodium sulfate, coproducts of the nitrate industry (salitre).

[10]Includes natural gasoline.

[11]Includes production from both imported and domestic petroleum, as reported by SERNAGEOMIN.

TABLE 2
CHILE: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	thousand metric tons	Cemento Melón S.A. (Lafarge S.A., 82%, and other private, 18%)	La Calera plant, Region V	1,600.[e]
Do.	do.	Cemento Polpaico S.A. (Holcim Ltd., 54.3%; Compañía de Consumidores de Gas de Santiago, 40.9%; other private, 4.8%)	Cerro Blanco plant, Metropolitan Santiago Region; Mejillones plant, Region II; Coronel plant, Region VIII	2,700.
Do.	do.	Cementos Bío Bío S.A. (CEMEX S.A. de C.V., 11.9%, and other private, 88.1%)	Talcahuano Plant, Region VIII	750.
Do.	do.	Industria Nacional de Cemento S.A. (Cementos Bío Bío S.A., 100%)	Plants in Antofagasta City, Region II; Copiapo City, Region III; Curico City, Region VII	1,500.
Coal, bituminous and lignite	do.	Empresa Nacional del Carbón S.A. (ENACAR)	La Chulita and Trongol Mines in Curanilahue, and plant in Lota, Region VIII	100.[e]
Do.	do.	Carbonífera Victoria de Lebu S.A. (Empresa Nacional del Carbón S.A., 99.99%, and other private 0.01%)	Victoria de Lebu Mine, Region VIII	85.[e]
Do.	do.	Ingenieria del Sur S.A. (Compañía Carbonífera San Pedro de Catamutún, 100%)	Pecket Mine (open pit), Magallanes, Region XII	1,100.
Copper		Corporación Nacional del Cobre de Chile (CODELCO) (Government, 100%)	Mining divisions and operating mines	1,740,000.
			Of which:	
			Andina Division, including Rio Blanco and Sur Sur Mines	240,000.
			CODELCO Norte Division, including Chuquicamata, Mina Sur, and Radomiro Tomic Mines	985,000.
			El Teniente Division and Mine	440,000.
			Salvador Division, including Inca, Campamento Antiguo, and Damiana Norte Mines	75,000.
Do.		do.	Smelters	960,000.
			Of which:	
			Chuquicamata (CODELCO Norte)	460,000.
			Las Ventanas (Ventanas Division)	400,000.
			Caletones (El Teniente)	360,000.
			Potrerillos (Salvador)	140,000.
Do.		do.	Refineries	815,000.
			Of which:	
			Chuquicamata (oxide)	600,000.
			Chuquicamata (sulfide)	85,000.
			Las Ventanas	365,000.
			Potrerillos	130,000.

See footnotes at end of table.

TABLE 2--Continued
CHILE: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper--Continued		Corporación Nacional del Cobre de Chile (CODELCO) (Government, 100%)	SX-EW plants[1] Of which: Chuquicamata (oxide) El Teniente Potrerillos (oxide and sulfide)	217,000. 130,000. 2,000. 85,000.
Do.		Sociedad Contractual Minera El Abra [Phelps Dodge Corporation, 51%, and Corporación Nacional del Cobre de Chile (CODELCO), 49%]	El Abra Mine and SX-EW[1] plant, near Calama	250,000.
Do.		Compañía Minera Doña Inés de Collahuasi SCM (Anglo American plc, 44%; Falconbridge Limited, 44%; companies led by Mitsui & Co. Ltd., 12%)	Open pit mine, concentration plant, SX-EW[1] plant, at Ujina, Region I	515,000.[e]
Do.		Minera Sur Andes Ltda. (Anglo American plc, 100%)	Los Bronces Mine and Tortolas SX-EW[1] plant	240,000.
Do.		do.	El Soldado Mine	70,000.
Do.		do.	Chagres smelter (blister and anodes)	162,000.
Do.		Empresa Minera de Mantos Blancos S.A. (Anglo American plc, 99.9%, and other private, 0.1%)	Mantos Blancos open pit mine, SX-EW[1] plant, Region II	95,000.
Do.		do.	Mantoverde open pit mine, SX-EW[1] plant, Region III	60,000.
Do.		Minera Los Pelambres S.A. (Antofagasta plc, 60%, and Japanese consortia, 40%)	Los Pelambres open pit mine, 200 kilometers northeast of Santiago	360,000.
Do.		Minera El Tesoro S.A. (Antofagasta plc, 61%, and Equatorial Mining Ltd., 39%)	El Tesoro open pit mine and SX-EW[1] plant, near Chuquicamata and Calama	100,000.
Do.		Minera Michilla S.A. (Antofagasta plc, 74.2%, and other private Chilean investor, 25.8%)	Michilla Mine and SX-EW[1]/sulfide leaching plant, 1,500 kilometers north of Santiago	55,000.
Do.		Compañía Minera Quebrada Blanca (Aur Resources Inc., 76.5%, and Inversiones Mineras S.A., 13.5%)	Quebrada Blanca open pit mine, Region I	80,000.
Do.		Compañía Minera Carmen de Andacollo (Aur Resources Inc., 63%; Compañía Minera del Pacífico, 27%; Empresa Nacional de Minería, 10%)	Andacollo Mine, Region IV	22,000.
Do.		Compañía Minera Zaldívar (Placer Dome Inc., 100%)	Zaldívar open pit heap-leach mine, Region II	150,000.
Do.		Compañía Minera Falconbridge Lomas Bayas (Falconbridge Limited, 100%)	Lomas Bayas Mine and SX-EW[1] plant, Region II	65,000.
Do.		Noranda Chile S.A., Fundición Altonorte (Noranda Inc., 100%)	Altonorte smelter, La Negra, Region II	290,000.
Do.		Empresa Nacional de Minería (Government, 100%)	Hernán Videla Lira smelter (anodes and blister), Paipote, Region III	300,000.
Do.		Compañía Minera Cerro Colorado (BHP Billiton Plc, 100%)	Cerro Colorado Mine and SX-EW[1] plant	125,000.
Do.		Alliance Copper Ltd. (BHP Billiton Plc, 50%, and Corporación Nacional del Cobre de Chile, 50%)	Bioleaching plant to process copper from CODELCO Norte concentrates in Chuquicamata	20,000.
Copper, gold, silver	kilograms	Minera Escondida Ltd. (BHP Billiton Plc, 57.5%; Rio Tinto plc, 30%; Japan Escondida Corporation, 10%; International Finance Corp., 2.5%)	Escondida open pit mine, two concentrator plants and an oxide plant, for cathode production (SX-EW[1])	1,250,000 copper; 5,600 gold; 135,000 silver.
Do.	do.	Empresa Nacional de Minería (Government, 100%)	Manuel Antonio Matta plant, Paipote; Osvaldo Martínez plant, El Salado; Vallenar plant, Region III; and José Antonio Moreno plant, Taltal, Region II	22,000 copper; 400 gold; 6,000 silver.
Do.	do.	Cía. Contractual Minera Candelaria (Phelps Dodge Corporation, 80%, and SMMA Candelaria, Inc., 20%)	Candelaria open pit mine, underground mine, and concentration plant; Ojos del Salado Mine and concentration plant, near Copiapo	232,000 copper; 2,500 gold; 30,000 silver.
Gold, silver	do.	Cerro Bayo Ltda. (Coeur d'Alene Mines Corp., 100%)	Cerro Bayo Mine and concentration plant, Laguna Verde, Region XI	1,870 gold;[e] 154,000 silver.[e]
Do.	do.	Corporación Nacional del Cobre de Chile (Government, 100%) (gold and silver byproducts from copper)	Andina, CODELCO Norte, El Teniente, Salvador and Ventanas Divisions	8,000 gold; 490,000 silver.

See footnotes at end of table.

TABLE 2--Continued
CHILE: STRUCTURE OF THE MINERAL INDUSTRY IN 2005

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Gold, silver--Continued	kilograms	Compañía Minera Mantos de Oro (Placer Dome Inc., 50%, and Kinross Gold Corporation, 50%)	La Coipa open pit mines, 140 kilometers north of Copiapo, Region III	5,700 gold; 230,000 silver.
Do.	do.	Compañía Minera Maricunga (Kinross Gold Corporation, 50%, and Bema Gold Corporation, 50%)	El Refugio open pit, heap-leach mine, 100 kilometers east of Copiapo, Region III	4,300 gold.
Iodine		SQM Químicos S.A. (Sociedad Química y Minera de Chile S.A., 100%)	Nueva Victoria mine and plant, Region I; María Elena, Pampa Blanca, and Pedro de Valdivia mines and plants, Region II	7,700.
Iron ore	thousand metric tons	Cía. Minera del Pacífico S.A. (subsidiary of CAP S.A.) (private, 100%)	El Algarrobo Mine, Region III; El Romeral Mine and El Tofo Mine, Region IV	10,500.
Do.	do.	do.	El Agarrobito, El Laco, El Romeral, Los Colorados, and Huasco concentration plants	14,000.
Do.	do.	Cía. Minera Huasco S.A. (Cía. Minera del Pacifico S.A., 50%, and MC Inversiones Ltda., 50%)	Huasco pellet plant, Region III	4,800.
Lime, hydraulic		Industria Nacional de Cemento S.A. (Cementos Bío Bío S.A., 100%)	Plants in Antofagasta City, Region II, and in Copiapo City, Region III	520,000.
Lithium carbonate		SQM Salar S.A. (subsidiary of Sociedad Química y Minera de Chile S.A.) (private, 100%)	Plant at Salar del Carmen, near the city of Antofagasta, Region II.	33,000.
Manganese		Manganesos Atacama S.A. (subsidiary of CAP S.A., 98.7%, and other private, 1.3%)	Plant in Coquimbo, Region IV	15,000.
Molybdenum		Corporación Nacional del Cobre de Chile (Government, 100%) (byproduct from copper)	Andina, CODELCO Norte, El Teniente, and Salvador Divisions	32,500.
Do.		Minera Los Pelambres S.A. (Antofagasta plc, 60%, and Japanese consortia, 40%)	Los Pelambres open pit mine, 200 kilometers northeast of Santiago	8,000.
Natural gas	million cubic meters	Empresa Nacional del Petróleo S.A. (subsidiary of Corporación de Fomento de la Producción) (Government, 100%)	Byproduct from 23 oilfields, including Costa Auera, in the Magallanes basin, Region XII	2,200.[e]
Petroleum	thousand 42-gallon barrels	do.	Magallanes Basin, Region XII	6,500.
Pig iron	thousand metric tons	Cía. Siderúrgica Huachipato S.A. (subsidiary of CAP S.A.) (private, 100%)	Plant in Bahía de San Vicente, 14 kilometers northeast of Concepcion, Region VIII	1,200.
Nitrates:				
Primarily sodium nitrate		SQM Nitratos S.A. (subsidiary of Sociedad Química y Minera de Chile S.A.) (private, 100%)	Maria Elena, Pampa Blanca, and Pedro de Valdivia mines and plants; Coya Sur concentration and blending plant, Region II	770,000.
Primarily potassium nitrate		do.	do.	650,000.
In fertilizer		Cosayach Nitratos S.A. (Errázuriz Group, 100%)	Plant in Maria Elena, Iquique, Region I	200,000.[e]
Do.		SQM Industrial S.A. (Sociedad Química y Minera de Chile S.A., 100%)	Mine and plant in Santiago, Region II	100,000.[e]
Rhenium, metal	kilograms	Molibdenos y Metales S.A. (private, 100%)	Nos plant, San Bernardo, 30 kilometers south of Santiago	22,000.[e]
Steel, crude	thousand metric tons	Cía. Siderúrgica Huachipato S.A. (subsidiary of CAP S.A.) (private, 100%)	Primary plant in Talcahuano and plant in Rengo, Region VIII	1,100.
Do.	do.	Gerdau AZA S.A. of Brazil	Rolling mills and steel plants in Renca and Colina	375.
Zinc, silver, gold	kilograms	Sociedad Contractual Minera El Toqui Ltda. (Breakwater Resources Ltd., 100%)	Doña Rosa zinc mine and a concentrating plant, 120 kilometers north of Coyhaique, Region XI	870 gold; 9,500 silver; 35,000 zinc.

[e]Estimated; estimated data are rounded to no more than three significant digits.

[1]Solvent-extraction/electrowinning.

TABLE 3
CHILE: ESTIMATED MAJOR MINERAL INVESTMENTS ONGOING OR BUDGETED IN 2005[1]

(Million dollars)

Region	Project name	Commodity	Ownership	Total investment	Planned startup date
I	Choquelimpie (restart)	Gold	Compañía Minera Can Can S.A., 100%	13 [2]	NA
I	Collahuasi Molybdenum Circuit	Molybdenum concentrate	Compañía Minera Doña Inés de Collahuasi SCM (Anglo-American plc, 44%; Falconbridge Limited, 44%; Companies led by Mitsui & Co. Ltd., 12%)	47	2005
I	Collahuasi (extension, Rosario Oeste)	Copper	do.	NA	NA
I	Nueva Victoria Plant (expansion)	Iodine	Sociedad Química y Minera de Chile S.A., 100%	29	2006
II	Alliance bioleaching plant	Copper (bioleach)	Alliance Copper Ltd. (BHP Billiton Plc, 50%, and Corporación Nacional del Cobre de Chile, 50%)	60 [2]	2006
II	Chuquicamata Smelter (expansion)	Copper anodes	Corporación Nacional del Cobre de Chile, 100%	250	2007-10
II	Gaby	Copper cathodes	Copper Partners Investment Company Ltd. (Corporación Nacional del Cobre de Chile, 50%, and Minmetals Non-ferrous Metals Co. Ltd., 50%)	874	end-2008
II	Esperanza	Copper	Antofagasta Minerals S.A. (Antofagasta plc., 60%; Nippon Mining and Metals, 15%; Mitsubishi Materials Corp., 10%; Marubeni Corporation, 8.75%; Mitsubishi Corp., 5%; Mitsui & Co. Ltd., 1.25%)	600	2010
II	Escondida Norte (extension)	Copper oxides	Minera Escondida Ltd. (BHP Billiton Plc, 57.5%; Rio Tinto plc, 30%; Japan Escondida Corporation 10%; International Finance Corp., 2.5%)	390	2006
II	Escondida concentration plant	Copper concentrates	do.	870	end-2006
II	Spence	Copper cathodes	do.	990	end-2006
II	Mantos de La Luna	do.	Compañía Minera Mantos de la Luna (Lipesed S.A., 100%)	42	2006
I	María Elena Plant (expansion)	Iodine, sodium nitrate	Sociedad Química y Minera de Chile S.A., 100%	100	2006
II	Ministro Alejandro Hales Mine	Copper (bioleach); copper cathodes	Corporación Nacional del Cobre de Chile (CODELCO), 100%	728	2011
II	Sierra Gorda	Copper	Quadra Mining Corp. has option agreements with four different owners of the properties being explored	3	NA
III	Candelaria	Copper-gold	Far West Mining Ltd., 100%	NA	NA
III	Cerro Casale	do.	Minera Estrella de Oro Ltda. (Placer Dome Ltd., 51%; Arizona Star Resources, 25%; Bema Gold Corporation, 24%)	1,650 [2]	NA
III	El Morro/La Fortuna	Copper-gold	Falconbridge Limited, 70%, and Metallica Resources Inc., 30%	16	2012 [3]
III	El Refugio (restart)	Gold (doré)	Compañía Minera Maricunga (Kinross Gold Corporation, 50%, and Bema Gold Corporation, 50%)	130	end-2005
III	Pascua-Lama	Gold-silver	Barrick Gold Corporation, 100%	1,750	2010
III	Purén (extension of La Coipa Mine)	do.	Compañía Minera Mantos de Oro (Placer Dome Inc., 50%, and Kinross Gold Corporation, 50%), 65%, and Corporación Nacional del Cobre de Chile, 35%	25	end-2006
III	Hernán Videla Lira Smelter (expansion)	Copper anodes	Empresa Nacional de Minería, 100%	28	2007
III	Volcan	Gold	Andina Minerals Inc., 100%	7	2009
IV	Andacollo (underground extension)	Copper	Compañía Minera Carmen de Andacollo (Aur Resources Inc., 63%; Compañía Minera del Pacifico, 27%; Empresa Nacional de Minería, 10%)	350 [2]	2009 [3]
IV	Delta concentration plant	Copper cathodes	Empresa Nacional de Minería, 100%	14	2008
IV	Los Pelambres (extension)	Copper	Antofagasta Minerals S.A. (Antofagasta plc., 60%; Nippon Mining and Metals, 15%; Mitsubishi Materials Corp., 10%; Marubeni Corporation, 8.75%; Mitsubishi Corp., 5%; Mitsui & Co. Ltd., 1.25%)	458	2009 [3]

See footnotes at end of table.

TABLE 3--Continued
CHILE: ESTIMATED MAJOR MINERAL INVESTMENTS ONGOING OR BUDGETED IN 2005[1]

(Million dollars)

Region	Project name	Commodity	Ownership	Total investment	Planned startup date
V	Andina (extension)	do.	Corporación Nacional del Cobre de Chile, 100%	259	2009
V	Chagres Smelter (expansion)	Blister copper, anodes	Minera Sur Andes Ltda. (Anglo American plc., 100%)	50	2006
V	El Soldado Mine (expansion)	Copper	do.	83	2007
V	Ventanas Smelter and Refinery (expansion)	Copper cathodes, gold ingots, silver grains	Corporación Nacional del Cobre de Chile, 100%	75 [2]	2012-14
VI	Caletones Smelter (expansion)	Blister copper, anodes	do.	249 [2]	2012 [3]
VI	El Teniente Plant (expansion)	Copper concentrate	Corporación Nacional del Cobre de Chile, 100%	846	2007
XI	Aserradero and Concordia (extensions of El Toqui Mine)	Copper, gold, lead, silver, zinc	Breakwater Resources Ltd., 100%	6	NA

NA Not available.

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

[2]If approved.

[3]Not before this date.