## ZINC

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In 2001, domestic zinc mine production, expressed in zinc content of ore, declined by about 1% compared with 2000. The decline was mainly due to the closure of seven mines and lower production at the Red Dog Mine in Alaska (table 1). On the basis of recoverable content of concentrate and annual average U.S. price, the value of zinc mine production was estimated to be about \$774 million, about 22% less than in 2000. The sharp decrease in total value was due to a decline in zinc prices, which reflected oversupply and excess production capacity worldwide. By the end of 2001, only 12 mines in 5 States were operating in the United States. ASARCO Incorporated and Zinc Corporation of America ceased ore production in 2001 leaving only seven companies still producing zinc ore at yearend. Alaska remained the leading zinc-mining State, followed by, in descending order of tonnage produced, Tennessee, Missouri, New York, and Montana. In 2001, as in every year since the opening of the Red Dog Mine in 1989, U.S. mine production greatly exceeded smelter capacity (table 6), necessitating exports of concentrate and imports of refined zinc metal. Most of the concentrate, supplied entirely by the Red Dog Mine, was exported to Belgium, followed by Japan, Republic of Korea, and Canada (table 14). Zinc metal production in the United States, provided by three primary and 12 large- and mediumsized smelters, declined by nearly 11% in 2001 (tables 4, 6). Nearly one-half of zinc metal imports was from Canada, followed by Mexico, Kazakhstan, Australia, and Peru.

Apparent domestic consumption of refined zinc metal in 2001 decreased about 14%, to 1.1 million metric tons (Mt), owing to a slowdown of the U.S. economy. Of the metal consumed in the United States, about one-half was used for galvanizing, followed by use in zinc-based alloys and in brass and bronze (table 11). Zinc compounds and dust were used primarily by the agricultural, chemical, paint, and rubber industries.

The average U.S. producer price for refined zinc in 2001, which is based on the London Metal Exchange (LME) daily cash price plus a premium, declined by about 21%, to \$0.89 per kilogram (40.16 cents per pound).

World production of zinc concentrate (by 41 countries) increased by less than 1%, to 8.9 Mt. The largest producers were, in decreasing order of magnitude, China, Australia, Peru, Canada, and the United States (table 17). World smelter production increased by less than 2%, to 9.3 Mt. The largest producers of zinc metal were, in decreasing order, China, Canada, Japan, Australia, and Republic of Korea (table 18).

#### **Legislation and Government Programs**

Hecla Mining Company reached an agreement in principle with the U.S. Government and the State of Idaho for damages

and cleanup costs from mining contamination of the Coeur d'Alene Basin in northern Idaho. Under terms of the agreement, Hecla will pay \$5 million for each of the first 2 years and \$6 million in each of the next 8 years for cleanup of the basin, along with other properties, including the Bunker Hill site, the Grouse Creek Mine, and the Stibnite site in central Idaho. In addition, during the following 20 years, Hecla has committed to payments and/or work valued at \$4 million annually (American Metal Market, 2001b).

#### **Production**

*Mine Production.*—Continued low zinc prices in 2001 began to take a toll on the U.S. zinc industry. The first two mines to reduce production and eventually close were Zinc Corporation of America's (ZCA) Balmat and Pierrepont mines in upstate New York. In April, when the zinc price fell to 43 cents per pound, production at the mines was curtailed and about 20 positions were eliminated. Because zinc prices did not rebound, an additional 141 workers were laid off in May (Watertown Daily Times, 2001). By August 2001, both mines closed—Pierrepont permanently and Balmat temporarily. ZCA retained a small complement of about 30 employees to keep the Balmat Mine ready to reopen when zinc prices improve. ZCA replaced lost domestic production for its Monaca, PA, smelter with zinc concentrate imports, mostly from Peru (Richard Knight, Zinc Corporation of America, oral commun., March 7, 2002).

Idaho-based Hecla Mining Co. was also adversely effected by a declining metal market. Because of low metal prices, the company decided in October 2001 to reduce operations at its Lucky Friday Mine in northern Idaho. Although mining continued at all developed areas, no new development was initiated. The company planned to save existing resources until metal prices rebounded and to make mining at Lucky Friday profitable again. By early 2002, the workforce was reduced to 42 employees from 189. The effect of this reduction on the U.S. zinc market, however, was minimal, because zinc production at Lucky Friday is small, a byproduct of precious metal production (Mining Journal, 2001h).

Sale of electric power from Teck Cominco Ltd.'s powerplant, which normally supplies Trail smelter with electric energy, lead to reduced zinc and lead production and less need for concentrate. Consequently, Teck Cominco delayed its plan to rebuild the Pend Oreille zinc mine in Washington State. The mine opening has been postponed until the first quarter of 2004, rather than September 2002 as originally planned (CRU, International Ltd., 2002c).

Asarco Inc. (subsidiary of Grupo Mexico S.A. de C.V.)

closed its Tennessee mines in November 2001. One-half the production of these mines went to Big River's Sauget smelter (IL), while the other one-half was used by Pasminco at its Clarksville smelter (TN). Both companies replaced lost domestic concentrate with imports, mostly from Peru.

Doe Run Resources Corp., the major lead producer in Missouri, also was effected by declining metal prices and low ore grades. The company put its Viburnum #29 Mine and the recently acquired West Fork Mine as well as its flotation mills at these locations on care and maintenance. The Viburnum #28 Mine was slated to close at the end of 2001, but remained open on a day-to-day basis. Because zinc production is only a byproduct of lead ore production, the status of these mines had a negligible effect on the zinc market.

The last domestic operation to be effected by low zinc prices, although indirectly, was the U.S. operation of the Australian zinc producer Pasminco Ltd.—Pasminco Zinc Corp. The company expects to sell its 105,000-metric-ton-per-year (t/yr) Clarksville, TN, smelter and two mines in 2002. According to an announcement by Pasminco, representatives of an unidentified company planned to visit the Tennessee operations during 2002. The announcement was the first official confirmation by the company that its Tennessee holdings are on the market to be sold. Industry sources believe that the sale will not be easy in the depressed zinc market (Platts Metals Week, 2002a).

Smelter Production.—All three zinc smelters in the United States had to deal with cuts in domestic zinc concentrate supplies during 2001. ZCA was the first company compelled to cope with concentrate shortage. All of its concentrate supply, which constituted about one-third of the feed for its Monaca smelter, had been supplied by the Balmat and Pierrepont Mines. Since both operations closed, and the stockpile at the smelter was depleted, ZCA was forced to purchase 5,000 metric tons (t) of zinc concentrate, in September and October, from the Iscaycruz Mine in Peru. In addition to ZCA, other U.S. smelters had to counter the decrease in the domestic supply of zinc concentrates (caused by mine closures) with increased imports, mostly from Peru (Mining Journal, 2001a). Consequently, imports from Peru in 2001 increased to 47,600 t from 15,400 t in 2000, or more than 200%.

Exploration.—The downturn in mineral exploration continued in 2001 as a result of a decline in the prices of other metals as well as zinc. Data on global exploration expenditures, compiled by Metals Economics Group of Halifax, Nova Scotia, showed a decrease of 15% from 2000 to \$2.2 billion. All regions of the world showed a decrease, but the largest was recorded by the United States and Southeast Asia. Latin America remained the most favored location for exploration with spending of \$576 million (29% of total), followed by Australia at \$349 million (18%) and Canada at \$332 million (17%). One of the few major explorations in North America was conducted by Teck Cominco in the vicinity of its Red Dog Mine (Moon, 2002).

Teck Cominco Ltd. announced the results of its latest drilling in the Red Dog Mine area. The Anarraaq deposit, 10 kilometers (km) north of the mine, was discovered in 1999. Further drilling in 2000 established an inferred resource of 17.2 Mt grading 15.8% zinc, 4.8% lead, and 17 grams per ton (g/t)

silver. One of the holes, drilled 5 km northwest of the Anarraaq deposit, intersected significant zinc mineralization. Four of the eight holes, drilled in 2001 on the north side of the Anarraaq deposit, intersected high-grade zinc mineralization, including a 24 meter (m) deposit at a depth of 992 m, containing 20.9% zinc and 3.2% lead. Within this mineralization, a 5 m intersection, averaging 45.8% zinc and 3.5% lead, was the highest ore grade ever intersected at Red Dog (Teck Cominco Ltd. 2001).

Atna Resources Ltd. of Canada announced it was planning to launch a drilling program at its 100%-owned Lone Pine property in Arizona. The initial 4 holes, totaling about 600 m, are to target the down-dip extension of high-grade polymetallic mineralization at the original underground Lone Pine Mine. This drilling is to follow the encouraging results from Atna's initial work, which included underground chip sampling and a transient electromagnetic geophysical survey. The Lone Pine Mine operated intermittently from the early 1900s into the 1950s. The deposit was mined to a depth of 60 m. Historic records indicate ore grades of 6% copper, 5% zinc, 1.5% lead, and small amounts of gold and silver. The geologic setting, rock alteration, and mineralization are typical of volcanogenic massive sulfide deposits, rich in precious metals, such as the nearby deposits supporting the Iron King and Jerome Mines (Atna Resources Ltd., 2001).

Due to financial problems, Pasminco Ltd. has elected to sell its 100% interest in the western Kentucky zinc exploration project and mill located in Crittenden, Livingston, and Caldwell Counties, which are part of the so-called Kentucky-Illinois "fluorspar district." Pasminco Zinc, together with previous owner Savage Zinc Inc., had spent about \$1.75 million on exploration and investment. The area hosts some historically defined and unexploited zinc reserves, including the Robinson-Lasher mine property with 500,000 t grading 14% zinc. The exploration potential is considered excellent for multiple midsize deposits that could produce high-quality, low-iron, zinc concentrate. The Babbs-Barnes mill is a 450-ton-per-day zinc and fluorite mill with a heavy-media plant, tailing ponds, and all the ancillary facilities needed for a zinc milling operation. The mill is situated about 18 km from the town of Marion and 160 km from Pasminco's Clarksville zinc smelter (InfoMine, undated§<sup>1</sup>).

#### Consumption

After 7 years of increasing world zinc consumption, global consumption declined in 2001 about 1% to 8.8 Mt. Despite its own declining consumption, the United States, with a 13% share, remained the second largest consumer of zinc metal after China, where consumption increased to 1.5 Mt in 2001. Although consumption differences between China and the United States have increased, the U.S. economy still plays an important role in world zinc markets, mainly because many countries depend on zinc exports to the United States.

According to the International Lead and Zinc Study Group (ILZSG), world production of zinc metal in 2001 exceeded consumption by 453,000 t, exerting downward pressure on zinc

<sup>&</sup>lt;sup>1</sup> References that include a section twist (§) are found in the Internet References section

prices. This imbalance will probably increase in 2002, because demand for zinc is to grow by only 1.4%, while production is expected to increase by about 3.6% (International Lead and Zinc Study Group, 2002).

#### **Prices**

According to some analysts, market oversupply, caused mainly by excessive Chinese exports and low demand, was the main factor behind the declining zinc prices. The low LME zinc price has encouraged a surge in Chinese imports of zinc concentrates, because the price of those imports is linked to the LME price of zinc metal. A relatively narrow premium of domestic over international prices prompted many Chinese smelters to export zinc metal and develop their international market, with an added advantage of quicker payment. Another reason for weak zinc prices was a 20% decline in automobile sales in the United States The decline in car sales effected the steel industry, where nearly 60% of zinc production is used for galvanized steel (Metal Bulletin, 2001m). Despite the pressure of low prices, the fragmented nature of the zinc industry deters many individual producers from reducing output because it may benefit their competitors. Instead, some of the producers are more likely to maintain or even expand output, hoping to reduce unit cost and drive competitors out of business (Mining Journal, 2001g). By lowering the unit cost, companies hope to absorb low zinc prices longer than their competition. Consequently, Asturiana de Zinc S.A. in Spain increased its smelter capacity by 120,000 t/yr to 460,000 t/yr by yearend 2001. Other notable producers that have either completed or are in the process of increasing processing capacities include Peñoles SA de CV of Mexico (80,000 t/yr), Ural Mining & Metallurgical Co. of Russia (60,000 t/yr), Cia Mineira de Metais of Brazil (44,000 t/yr), Outokumpu Oy of Finland (35,000 t/yr), and Hudson Bay Mining and Smelting Co. of Canada (15,000 t/yr) (Metal Bulletin, 2001d). The only significant reductions in zinc metal output in 2001 were related to shortages of electric power: Teck Cominco cut production of zinc (because it could profit more from direct sale of its electric power than from selling of zinc and lead metal) and cuts by Companhia Paraibuna de Metais of Brazil were mandated by the Brazilian Government in order to conserve energy.

#### **World Review**

The world zinc market is faced with an excess of smelter capacity, which in 2001 amounted to 240,000 t. In response, some companies reduced output in 2001, but many of the cuts were somewhat illusionary. Some of the cuts were implemented only to take advantage of high energy prices and were restored as soon as energy prices declined below potential profits from sale of zinc metal. Other zinc production cuts were from recently expanded capacities, resulting in higher production in 2001 than during the preceding years. Several companies reduced production at some plants while increasing it at others. The only sizeable and lasting cuts, in both mine and smelter production, were those made by the Chinese zinc industry (Metal Bulletin, 2002b).

Australia.—In an agreement with Consolidated Broken Hill

Ltd. (CBH), Normandy Mining Investment Ltd. acquired an area covering a central part of the Broken Hill mineral field in New South Wales in order to develop an underground mining operation for zinc, lead, and silver. The company (formerly Redfire Resources until a name change on January 1, 2001) believes that the site could be developed into a mine producing 500,000 t/yr of ore. CBH could replace Pasminco Ltd., as the only major mining company still operating at Broken Hill; Pasminco expects to close down its operations in the area. The new company would have the benefit of substantial infrastructure but would be without properly defined reserves.

Toho Zinc Co. Ltd. of Japan reportedly agreed to provide CBH with as much as \$6 million to help the latter's effort to acquire Pasminco Ltd.'s mining assets located in the Broken Hill area. Pasminco's assets surround CBH's mining lease, and a successful acquisition would bring together the entire 8-kmlong Broken Hill lode system under a single operation for the first time in its 120-year mining history. For its contribution, Toho Zinc will have the right to enter into an exclusive, life-ofmine marketing arrangement for the concentrate output at Broken Hill that is not already committed to Pasminco's smelters (Mining Journal, 2001e). Based on past drilling, it is known that the upper portion of the mineralization, located 250 m to 500 m below the surface, contains inferred and indicated resources of 1.26 Mt grading 7.7% zinc, 4.9% lead, and 53 g/t silver. CBH believes that total resources could be substantially larger, perhaps as much as 15 Mt grading 10% combined zinc and lead. The possibility of using dense-media separation to treat the ore is important to the project. It is a low cost preconcentration method not previously used on Broken Hill ore (Mining Journal, 2001j).

BHP Limited of Australia and United Kingdom's Billiton plc, two of the largest mining companies in the world, announced that they would merge to establish a premier diversified global resource group. The new company, BHP Billiton, has a combined value of more than \$28 billion, second to Alcoa, but more than rival miners Anglo American plc and Rio Tinto Ltd. plc. Headquartered in Melbourne, BHP Billiton maintains separate primary listings on the London and Sydney stock exchanges. BHP Billiton has operations on six continents and will become an industry leader or near-leader in aluminum, metallurgical coal, seaborne steaming coal, copper, ferroalloys, iron ore, and titanium minerals. It also has substantial interests in oil, liquified natural gas, nickel, diamonds, and silver (BHP Billiton Limited, 2001§).

Kagara Zinc Ltd. of Australia, after completing a feasibility study, decided to proceed with the development of its Mount Garnet project in Queensland, consisting of Dry River South, King Vol, Mt. Garnet, and Surveyor deposits. At 825,000 t of indicated and inferred resources, containing 20.3% zinc, plus copper, lead, and silver, King Vol is the largest zinc resource controlled by the company (Mining Journal, 2001f). Kagara intends to treat about 500,000 t/yr of high-grade ore to produce more than 70,000 t/yr of zinc concentrate, 15,000 t/yr of lead-zinc concentrate, and 5,000 t/yr of copper concentrate (Metal Bulletin, 2001e). Initially, ore will be produced for 6 months from the Mt. Garnet open pit, followed by the Surveyor pit, for the subsequent 28-month period. After that, ore will come from the remainder of the Mt. Garnet open pit and the underground

Surveyor and Mt. Garnet deposits, as well as from the Dry River South deposit, an underground deposit located about 500 m south of Surveyor (Mining Journal, 2001i).

In mid-2001, Pasminco Ltd. of Australia decided to divest all its mining and exploration activities in order to concentrate on its zinc and lead smelting in Australia, Netherlands, and the United States. By turning away from mining, Pasminco may emulate the success of Metaleurop SA and Union Minière SA, which have developed lucrative zinc smelting operations. By selling all mining and exploration operations, the company hoped to avoid much of the volatility in earnings arising from cyclical metal prices. This massive restructuring was induced by substantial losses incurred by the company, due to declining zinc prices, extensive debt, and costly currency hedging. Restructuring was to involve the sale of the world's largest zinc mine, Century, in north Queensland; the Broken Hill and Elura Mines in New South Wales; the Rosebery Mine in Tasmania; and the Gordonsville, Cumberland, and Clinch Valley Mines in Tennessee. Production at Broken Hill, which was scheduled to close in 4 years, is about 172,000 t of zinc in concentrate and 88,000 t of lead in concentrate. Elura's production was about 80,000 t of zinc and 43,000 t of lead in concentrate, while Rosebery's production amounted to about 79,000 t of zinc and 31,000 t of lead in 2000 (Metal Bulletin, 2001). In addition to the mines, Pasminco was planning to sell its Dugald River zinclead project in Queensland, which it acquired from Rio Tinto as part of the Century purchase. Dugald River is estimated to have resources of 38 Mt grading 13.2% zinc (Mining Journal, 20011). Pasminco secured a \$144 million loan and appointed two administrators to review each operation and restructure the company to secure the best outcome for shareholders. By yearend, the company's strategy had changed. Although there was considerable interest in the Century Mine, the offers received from prospective buyers were below what Pasminco hoped to receive and was not viewed as a benefit for the company or its creditors. According to a revised plan, Pasminco is to keep the Century Mine and the Budel zinc smelter in Netherlands, which are dependent on Century's lowiron concentrate feed (Platts Metals Week, 2002b). Furthermore, Pasminco has initiated proceedings to dispose of its Elura lead-zinc mine and Cockle Creek lead and zinc smelter in New South Wales, but is to retain the Port Pirie smelter in South Australia, plus the high-grade Rosebery zinc mine in Tasmania, which had previously been targeted for sale. The restructured Pasminco would ultimately own two mines (Century and Rosebery) and three smelting operations (Budel, Port Pirie, and Risdom) (Mining Journal, 2002).

Australia's MIM Ltd. has decided to investigate the possible sale of the inefficient zinc-smelting operations at Avonmouth in the United Kingdom and Duisburg in Germany. The main reason why MIM bought the Avonmouth and Duisburg smelters was to use them for processing concentrates from the inefficient operation at MIM's McArthur River Mine in Australia. Since then, the mining operation at McArthur improved to such an extent that it is now competitive and can sell concentrate on the world market. Avonmouth produced just over 78,400 t of zinc in 2000, and Duisburg produced about 90,000 t. To be competitive in today's tight market, both smelters would need upgrading that could cost up to \$100 million and take 4 to 5

years to complete (Metal Bulletin, 2001h).

Brazil.—Companhia Paraibuna de Metais, Brazil's second largest zinc producer, cut zinc production to a rate of 47,000 t/yr following the Government's introduction of electricity rationing in June. The production cut at its 90,000-t/yr refinery in Juiz De Fora was larger than required by the Government because the company decided to sell part of the energy it generates at its Sobragi 60-megawatt hydroelectric plant. During full production, the plant supplies about 75% of the company's energy requirements; the remaining 25% is supplied by Minas Gerais, the State electricity distributor. Paraibuna was able to make more money selling energy rather than zinc at the prevailing low prices. When energy prices started to decline, the company decided to return to full production by yearend. As the company was gradually increasing production, Teck Cominco Ltd. was negotiating, and eventually signed a memorandum of understanding with Paranapanema SA, giving Teck Cominco exclusive right to negotiate the purchase of Paraibuna, its wholly owned subsidiary. The reason behind the purchase offer was Teck Cominco's desire to expand without increasing world zinc smelting capacity, which is already larger than current global consumption (Metal Bulletin, 2002a).

Canada.—In December 2000, Cominco Ltd. decided to sell excess electric energy generated at its Waneta powerplant in British Columbia that also powers Cominco's Trail zinc smelter and Sullivan Mine. Cominco produces 2.5 million megawatthours of power per year and uses only about 1.9 million megawatt-hours to power its core business as a base-metal miner and producer. The sale of electric energy between December 11, 2000, and January 31, 2001, at a price of \$271 per megawatt-hour (Platts Metals Week, 2001k) led Cominco to initially curtail production and eventually completely discontinued zinc production from July to September. Production of zinc metal declined to 156,000 t or about 43% compared with production in 2000. The sale of electric energy helped offset the low production and depressed metal prices, especially of copper and zinc. Despite low zinc production, earnings from Trail amounted to \$222 million, or more than one-half of Teck Cominco's profits for 2001 (Teck Cominco Ltd., 2002).

At the beginning of 2001, the Boards of Directors of Teck Corporation and Cominco Ltd. announced that the two companies agreed to merge and by July, Teck Cominco Limited was created. The new company preserved the two most historic names in Canadian mining, with over 180 years of mining experience between them. Teck Cominco will be the world leader in the zinc business, with interests in two of the three largest zinc properties in the world, as well as an additional 10 operating mines producing gold, copper, zinc, and metallurgical coal, as well as zinc refining complexes in Canada and Peru. Ongoing projects at the time of merger included the expansion of capacity at the Red Dog Mine; the nearly completed Antamina copper and zinc mine in Peru; the planned expansion of the Cajamarquilla zinc refinery also in Peru; and the Pogo gold and San Nicolas copper and zinc projects (in Alaska and Mexico, respectively) currently at the feasibility study stage (Cominco Ltd., 2001). The merger became effective on July 20,

At a September 7 news conference, Teck Cominco Ltd.

accepted responsibility for the exposure of contract workers to excessive levels of thallium at its Trail smelter in British Columbia, Canada. The exposure in August 2001 occurred because the procedures for determining what hazard the workers might encounter relied on the testing of "boiler dust" rather than "boiler scale" that the workers actually were removing. The return of workers, on October 1, was contingent on strict adherence by all workers to health and safety procedures. The most important new protective measures included fully sealed clothing to prevent skin exposure, airsupplied welding hoods with a higher protection factor against inhalation exposure, a revised work schedule of staggered shifts that will have each welder in the boiler for only 6 hours in a 12hour shift, decontamination facilities to ensure that workers stay clean and do not take contamination from the workplace, and daily thallium and arsenic biological tests as well as weekly tests for lead and cadmium levels (Mining Journal, 2001p). The return to work was in stages as workers were oriented to new procedures and monitoring protocols.

Teck Cominco Ltd. closed its Sullivan lead-zinc mine in British Columbia. Mining officially ended on December 7, and the last ore was milled on December 21. The closure, due to ore depletion, had been expected and was hastened by low zinc prices. Zinc concentrate had been processed at Teck Cominco's Trail smelter. During production cutbacks at Trail, some of the concentrate was stockpiled at Sullivan (CRU International Ltd., 2002a).

Canadian Zinc Corp. is planning to develop the Prairie Creek zinc-lead-silver project, located in the southern part of the Mackenzie Mountains, about 43 km upstream from the Prairie Creek confluence with the South Nahanni River, in the Northwest Territories. Canadian Zinc owns 100% of the project, which comprises eight mining leases covering an area of about 3,500 hectares (ha) and five additional mineral claims covering 4,100 ha. The company also has a 60% interest in the plant and equipment located at the site and has an agreement with Titan Pacific Resources Ltd. that transfers the remaining 40% to it upon the payment of \$5.3 million from a 2% smelter royalty. Prairie Creek, formerly known as the Cadillac property, was discovered in 1928 and was acquired by Cadillac Explorations Ltd. in 1996. Based on previous drillings, the resource was estimated at 12 Mt grading 12.5% zinc and 10.1% lead, with small amounts of copper and silver. If environmental permits are granted, the company will be allowed to drill a further 50 to 60 drill holes and operate a 1-ton-per-hour pilot plant. Potential for a significant increase in stratiform mineralization exists throughout the property (Canadian Zinc Corporation, undated§).

Boliden Ltd. temporarily ceased production at its Myra Falls zinc-copper mine in British Columbia for 3 months, beginning on December 3, 2001. The suspension deprived the market of about 30,000 t of concentrate. Boliden retained a small workforce to conduct care and maintenance, but most employees were to be laid off during the suspension. During the hiatus, Boliden sought either a partnership or an outright sale of the Myra Falls Mine (Metal Bulletin, 2001n).

Hudson Bay Mining & Smelting Co. Ltd. (a subsidiary of Anglo American plc) also succumbed to the pressure of low zinc prices and decided to permanently close its Ruttan zinc-

copper mine in Manitoba, Canada, by May 2002. All of the concentrate production, amounting to about 30,000 t/yr, was processed at the Flin Flon smelter, which was recently expanded to a capacity of 114,000 t/yr (Metal Bulletin, 2001n).

Breakwater Resources Ltd. was the first Canadian company to announce closure, when on October 29th it made public its intention to cease operation of the Nanisivik zinc mine on Baffin Island in the Canadian Province of Nunavut, in September 2002 (Platts Metals Week, 2001o).

*China.*—The impact of low zinc prices was also felt in China. According to Antaike, the information center of the China National Nonferrous Metals Industry (CNMI) Association, more than 50% of the 500,000 t/yr of new zinc capacity built in 2000-01 has not been put into production or has been underutilized. For example, Liuzhou Zinc products Co. Ltd. in the Guangxi Autonomous Region has decided to hold monthly zinc production under 2,000 t as compared with up to 4,000 t monthly production during most of 2001. Huludao Zinc Plant's 130,000-t/yr electrolytic zinc line remained idle after maintenance in July, which made total zinc output by the plant for the year decline by 8% compared with 2000. The Chinese zinc industry is hoping that the prices will improve in 2002 and is planning to complete 90,000 t/yr of additional capacity, bringing the total zinc capacity in China to 2.5 Mt by the end of 2002. Most of this new capacity will be put into production as soon as the zinc price rebounds to at least \$900 per metric ton. Domestic concentrate production, however, will not only lag behind smelter capacity increases but will actually decline in 2002 compared with 2001. According to the statistics from the CNMI, Chinese zinc concentrate output declined by about 6% compared with 2000. The major reason for the decline was the suspension of 300,000 t of capacity in Guangxi and Shaanxi Provinces. Production in Guangxi Province normally accounts for nearly one-fourth of all Chinese zinc concentrate output (Platts Metals Week, 2001j).

Finland.—Inmet Mining Corp. of Canada is expected to acquire the mining assets offered for sale by Outokumpu Oy of Finland, which decided to reduce its focus on mining in order to concentrate on smelting, production of speciality materials, and development of processing technology. The acquisition, expected to be completed in 2002, includes an agreement to supply Outokumpu smelters with concentrate from Inmet's newly acquired Pyhäsalmi Mine and other company mines, and it provides for cooperation between the two firms on mining and mineral processing technology. In addition to the Pyhäsalmi Mine, Inmet will acquire a portfolio of exploration properties in Finland, measuring 3,000 ha, which have already yielded three high-grade satellite deposits as feed for the Pyhäsalmi beneficiation plant. The mine recently underwent a redevelopment and has proven and probable reserves totaling 17.2 Mt grading 2.8% zinc, 1.2% copper, 0.4 g/t gold, and 39% sulfur. Based on a production rate of 1.2 million metric tons per year (Mt/yr), the mine has a life span expected to reach at least 2015. Annual production is expected to average about 30,000 t of zinc in concentrate (Mining Journal, 2001c).

Outokumpu's main reason for leaving direct involvement in mining is that its European mines are at a cost disadvantage compared with other countries, due to high labor costs in an industry that is labor intensive. Another reason is the low return

that Outokumpu has achieved with relatively large amounts of capital (Mining Journal, 2001r). The company's first step in concentrating on processing was the expansion of its Kokkola plant to 260,000 t/yr, utilizing the Outokumpu-developed process for direct leaching of concentrate. The new process has less impact on the environment and utilizes raw materials more efficiently than traditional methods of processing (Mining Journal, 2001k). As the second step, Outokumpu purchased the 150,000-t/yr Norzink smelter in Norway. With a combined annual capacity of 410,000 t, Outokumpu became one of the largest zinc refiners in Europe. Increased need for concentrate would in part be provided by increased production from its Tara Mine in Ireland, following the signing of a contract to buy Bula Ltd.'s assets for \$24.5 million. If approved by Irish courts, Outokumpu would acquire territory adjacent to the Tara Mine covering the upper extension of the Navan ore body. Following approval, Outokumpu is planning to increase production to 250,000 t/yr of zinc in concentrate, which would make the Tara Mine the fourth largest zinc mine in the world. Tara produced 152,000 t of zinc in concentrate in 2000, which should increase to 200,000 t/yr as the southwest extension of the ore body comes onstream in 2002 (Platts Metals Week, 2001n).

*India.*— The Indian Government has been delayed in its attempt to privatize Hindustan Zinc Ltd. (HZL), the country's largest zinc producer. As late as November 2001, only five companies were interested in HZL, but only Bombay-based Sterlite Industries Ltd. proceeded to make an offer. That offer, for a 26% stake in the state-owned company (the Indian Government owns 76% of Hindustan Zinc), was rejected by the Government, because it failed to meet the reserve price, which remained unspecified. Other competing companies withdrew their offer after the Government imposed too many conditions on the sale. The Department of Disinvestment will now reconsider demands from some of the original bidders, which include an environmental audit and indemnity from the Government over any health risks. HZL owns six lead-zinc mines, with a combined capacity of 3.5 Mt/vr of ore, and four smelters, with a combined capacity of 169,000 t/vr of zinc. The HZL is the latest large company to be sold under the Indian Government's 10-year-old privatization plan (Mining Journal, 2001b).

Binani Zinc Ltd. is considering selling a 49% interest in the company to Korea Zinc Co. Ltd. because it may need a partner if it intends to proceed with plans to expand its zinc smelter capacity to 100,000 t/yr from 30,000 t/yr in 2001. Partnership with Korea Zinc appears logical, because Binani already shares technology with Korea Zinc, and a strategic alliance with an international producer would help raise necessary funds for expansion and help penetrate world markets. The expansion, however, may not be realized given current low zinc prices, recent cost increases in electric power, and Binani's dependence on imported concentrates, which also increased costs owing to the steep fall of the rupee against the dollar (Metal Bulletin, 2001c).

*Iran.*— A prefeasibility study of the Mehdiabad zinc project in central Iran confirmed that the future mine could produce between 175,000 t/yr and 225,000 t/yr of zinc metal at a cost of under 44 cents per kilogram (20 cents per pound). Also, about 120,000 t/yr of lead concentrate would be produced.

Development of Mehdiabad is expected to cost about \$250 million. Union Capital Ltd. of Australia, through its Union Zinc subsidiary, holds a 29% share of the project; the remaining shares were held by the Iranian Government (50%) and the Iranian company Itok (21%). According to the latest estimates, Mehdiabad resources amount to 218 Mt grading 7.2% zinc, 2.3% lead, and 51 g/t silver (Platts Metals Week, 2001h).

*Ireland.*—Ivernia West plc has released a detailed breakdown of production at its Lisheen Mine from the start of commercial production in 2000 to early 2001. The company reported that activity at the mine during the second half of 2000 was directed at improving the rate of underground production and metallurgical recoveries. This included building underground service bays to improve the availability of mobile equipment, installing additional pumping capacity, and starting a program for concentrator operations to improve zinc recoveries. Ore production and zinc recoveries were erratic, averaging 66% in the first quarter of 2000 and rising to 73% in the second quarter before falling to 58% in the third quarter. However, a steady improvement was made during the last quarter of 2000, reaching 90% recovery in December. The grade of zinc ore mined also fluctuated, but the quarterly averages were relatively steady, falling between 11.5% and 12.6% (Mining Journal, 2001d).

In response to low zinc prices, Outokumpu Oy of Finland put its 200,000-t/yr Tara zinc mine on care and maintenance at yearend 2001. Concentrate from the Tara Mine, which supplied up to 15% of feed for the Kokkola plant in Finland and the Norzink plant in Norway, will be replaced by concentrate purchased on the open market. Should the price for zinc metal improve, Outokumpu could possibly restart production at the Tara Mine (Platts Metals Week, 2001o). The possible reopening of the Tara Mine, however, may be done by a new company because, Outokumpu may form a joint venture with a minority ownership in the mine, or quit base-metal mining altogether, as noted above.

Korea, Republic of.—To meet the growing demand in Asia, Korea Zinc Co. Ltd. expanded the capacity of its zinc refinery in Sukpoo by 80,000 t/yr to 190,000 t/yr, and its Onsan refinery by 50,000 t/yr to 400,000 t/yr. Capacity at Onsan is to increase to 420,000 t/yr in 2002 and 500,000 t/yr by 2005 (Platts Metals Week, 2001i). Korea Zinc also contemplated expansion of its Townsville refinery in Queensland, Australia (Platts Metals Week, 2001f). Sun Metals Corp. (subsidiary of Korea Zinc) has reported that its Townsville zinc refinery is currently operating at a rate of 200,000 t/yr, or about 18% above capacity. Opened in 1999, the plant has a nominal capacity of 170,000 t/yr (Mining Journal, 2001n).

Macedonia.— Macedonia's privatization agency called for bids on the remaining government stakes in the country's Zletovo and Sasa zinc mines, which amount to 89% and 61%, respectively. Glencore International AG of Switzerland and Greek metals trader Mytilineos Holdings are among the companies that expressed interest in the mines. The Sasa Mine, in eastern Macedonia, is expected to produce 65,000 t of mixed zinc-lead in concentrate, while Zletovo, in the western part of the country, produces about 10,000 t/yr of zinc in concentrate. Glencore already has a foothold in Macedonia—it owns and operates the MHK Zletovo zinc and lead smelter that processes

concentrate from both mines. The smelter had been producing at near capacity of about 65,000 t/yr (Platts Metals Week, 2001g).

*Mexico*.—Expensive and unreliable energy was the biggest obstacle to increased production by the Mexican mineral industry in 2001. The State oil and natural gas company responded to pleas from industry by offering a 3-year natural gas supply contract at lower prices. Industrias Peñoles S.A. de C.V. decided to be independent of the State energy industry and decided to build its own powerplant in San Luis Potosi, in central Mexico. It should come onstream in 2003. In order to increase production of zinc concentrate, Peñoles invested in two new mines and implemented improvements in some of the existing operations (Metal Bulletin, 2001k). One of the new mines is the 51%-owned Rev de Plata Mine. The mine opened during the second half of 2000 and produced close to its design capacity of 26,000 t of zinc in concentrate in 2001. The remaining 49% interest in the Rey de Plata Mine is owned by two companies from Japan: Dowa Mining Co. Ltd. of Japan (39%) and Sumitomo Corp. (10%). A more significant contribution is expected from the Francisco I. Madero underground zinc mine, which opened in the third quarter of 2001 and should reach its design capacity of 110,000 t/yr of contained zinc in 2002. Peñoles invested \$127 million in the development of the mine, which is expected to significantly help the zinc concentrate needs of its Met-Mex zinc smelter at Torreon, Coahuila. Met-Mex was in year-long negotiations with Mexico's environmental protection agency; the impasse ended when Peñoles agreed to install costly emission controls and relocate some local inhabitants. Further mining projects started in 2001 include expansion of the Sabinas Mine to 23,300 t/vr of zinc in concentrate and starting a tailings re-treatment operation at the Fresnillo silver mine, which should contribute about 5,380 t of zinc this year (Mining Journal, 2001m).

Norway.—The sale of the Norzink zinc smelter by Rio Tinto Ltd. plc and Boliden Limited to Outokumpu Oy for \$180 million was signed on January 31, 2001. The smelter is located on Eitrheimsneset, a peninsula on the western side of Sørfjord, about 4 km north of Odda. The main products are zinc concentrate, aluminum fluoride, and sulfuric acid (Rio Tinto Ltd. plc, 2001§).

**Peru.**—Peru's once-promising zinc industry was struck by social protests and labor strikes, which flared up into a rash of production interruptions during the summer of 2001. At Cominco Ltd.'s Cajamaquilla zinc refinery, a labor strike disrupted operations for nearly 2 weeks because of labor contract delays. The previous contract expired at the end of 2000, and because company and union representatives could not reach an agreement, 380 workers walked out. The new contract, signed with the help of Peru's Ministry of Labor, will provide for salary increases in each of the next 3 years, better allowances, a bonus at the end of this year, and salary advances against the company's annual profit. Next, Antamina Mine and Ministry officials were held hostage for several hours in the port city of Huarmey by a rioting crowd protesting alleged environmental problems caused by the 302-km-long slurry pipeline that runs from the Antamina Mine to the port city. The \$2.3 billion project began producing concentrate in early June 2001 (Platts Metals Week, 2001b). Shipments by three major

zinc producers—Cia Minera Atacocha S.A., Cia Minera Milpo S.A., and Cia Minera Volcán S.A.—also were delayed by protesting townspeople who blocked roads in the central Andean town of Cerro de Pasco to protest upcoming privatization of powerplants run by the State mining company Centromin (Empresa Minera del Centro del Peru S.A.). These protests followed fires that destroyed Manhattan Mineral's installations at its Tambogrande copper-zinc project in the northern highlands (Platts Metals Week, 20011).

Compañía Minera Milpo S.A. has concluded the final feasibility study of its Cerro Lindo project at a cost of about \$90 million and began construction of the mine. Since reactivating the project in 1999, Milpo has carried out 24,000 m of drilling in 86 holes and 4,240 m of underground work. The exploratory work outlined a deposit 850 m long, 430 m wide, and up to 200 m thick. The mineable resource is estimated at 25 Mt grading 5.1% zinc, 0.7% copper, and 0.5% lead plus 33 g/t silver and 0.1 g/t gold. Metallurgical tests resulted in recoveries of 95% for zinc, 83% for copper, 77% for lead, and 62% for silver. At full production of 5,000 metric tons per day (t/d), the mine is expected to yield 140,000 t of zinc concentrate, 40,000 t of copper concentrate, and 11,000 t of lead concentrate, with most of the silver contained in the lead concentrate. Cerro Lindo is located 175 km southeast of Lima at an elevation of 1,850 m within the arid coastal range of Peru. A new gravel road from Chincha Alta provides access, and water will come from the Pucasaya and Topara Rivers. A 35-km powerline will be brought in from the national electric network (Northern Miner,

Milpo has also launched a bid worth up to \$45 million to take over Cía Minera Atacocha S.A. Milpo would like to increase its small 4.44% interest in Atacocha to 100% by offering \$0.3127 per share of Atacocha stock. If the takeover bid is successful, Milpo will become the second largest producer after Compañía Minera Antamina. The combined production of Milpo and Atacocha will be 407,000 t/yr of concentrate, compared with Antamina's projected production of 490,000 t of concentrate (Metal Bulletin, 2001g).

Compañía Minera Volcán S.A. has been searching for a partner that would provide operational experience and funds after a period of extraordinary growth that resulted from the firm's acquisition of three mines from the former state-owned Centromin. Volcán now owns the Andayshagua, Cungar, Mahr Tunel, Paragsha (formerly known as Cerro de Pasco), and San Cristobal mines. Further expansion will now come from increased production at the company's three operations in Peru to a planned total of 450,000 t of zinc in concentrate. For this expansion, Volcán is seeking a joint-venture partner with the funds and knowledge to introduce the newest technology to its existing operations. Some of the desired improvements include deepening of the pit at the Cerro de Pasco Mine, opening of a new leaching plant at the Mahr Tunel Mine, and expansion at the Chungar Mine. The company has not yet decided if it would be willing to give up majority ownership in its mines in order to attract a partner (Metal Bulletin, 20011).

Swiss-based Glencore International AG became a sole owner of Empresa Minera Iscaycruz S.A., when it purchased the Peruvian Government's 25% stake for \$18.6 million. The Iscaycruz Mine, located at an elevation of 4,900 m in the Andes

above Lima, contains reserves of 5.5 Mt, enough for 7 years of operation at the installed capacity of 1,700 t/d of ore. However, Glencore plans to invest \$10 million to upgrade treatment capacity to 2,500 t/d of ore that would increase concentrate production to 250,000 t. The reason for the planned increase is that Minera Iscaycruz operates on only 1,000 ha of the 52,000 ha in concessions it holds, giving it great potential for expansion. That also is why about 60% of the company's overall investment in 2001 was allocated for exploration (Platts Metals Week, 2001d).

Denver-based Solitario Resources Corp. announced that Cominco Ltd. and Pasminco Ltd. have terminated their option to acquire a 65% interest in Solitario's Bongará zinc-lead property in northern Peru. Both companies already have invested a total of \$17 million for exploration of the property during the past 4 years. Cominco alone completed about 10,000 m of drilling in 2000, mainly targeting the Florida Canyon area, where a total of 24,700 m of drilling already was completed. This zone of mineralization covers an area of 2.5 km by 1.3 km. Solitario will evaluate the data and eventually may decide to seek a new joint-venture partner or seek a loan for development (American Metal Market, 2001a).

Because of low zinc prices, Teck Cominco also delayed a decision to double the production capacity at its Cajamarquilla zinc refinery in Peru until 2002. The company is holding \$103 million in loans earmarked for the expansion in a trust that cannot be used for any other project. The refinery is 82% owned by Teck Cominco, 17% by Japan's Marubeni Corp., and 1% by workers at the refinery (Platts Metals Week, 2001m).

The Antamina Mine in Peru delivered its first shipment of zinc concentrate at the end of November, about 4 months ahead of schedule. An amount of 30,000 t of concentrate was shipped to Japan and the Republic of Korea, and an additional 50,000 t was ready to be shipped to Asia and Europe by yearend. The mine is owned by Billiton plc, 33.75%; Noranda Inc., 33.75%; Teck Cominco Ltd., 22.5%; and Mitsubishi Corp., 10% (Metal Bulletin, 2001a).

**Portugal.**—An agreement signed on December 20, 2001, by EuroZinc Mining Corp. of Canada and the Portugese Government, replaced a previous option agreement that called for EuroZinc to complete specific tasks by specific dates in order to qualify for purchase of the Aljustrel zinc project in southern Portugal. Measured and indicated reserves amount to 18.5 Mt grading 5.8% zinc, 1.9% lead, 0.3% copper, and 65 g/t silver. According to a feasibility study, zinc should be mined for the first 8 years, and then copper for the remaining 2 years. Total ore output is anticipated to be around 1.8 Mt/vr resulting in about 79,800 t/yr of zinc at a cost of 86 cents per kilogram (39 cents per pound) (Platts Metals Week, 2001c). A planned production rate of 1.8 Mt/yr of ore will cut estimated production costs to 39 cents per pound from the 42 cents per pound previously estimated (Bob Carmichael, 2001, EuroZinc Mining Corp., oral commun., May 22, 2001). The Aljustrel Mine is expected to produce about 80,000 t/vr of zinc over a mine life of 10 years. In addition to the mine, assets include a modern mill, offices, a machine shop, stocked warehouses, and a dedicated port facility. The operating company, Pirites Alentejanas S.A., in which EuroZinc expects to own nearly all shares, also holds all the required operating permits and has negotiated a grant, an

interest-free loan, and a tax incentive package valued at \$32 million for production financing. All additional payments required by the new agreement will come from future output, following at least 1 year of commercial production (EuroZinc Mining Corp., 2002).

Spain.—Boliden Apirsa S.L. (subsidiary of Boliden Limited of Canada) closed its Los Frailes lead-zinc mine, near the southern town of Aznalcollar, in October 2001. The closure ended a troubled 3 years that began with a tailings dam failure in 1998. Although Boliden was cleared of any negligence by the Regional Court in Seville, the company never recovered from the expense of cleanup, compensation cost, and low metal prices. Boliden has set aside \$65 million to clean up the damaged area and dismantle the mine. Before the closure, the mine was running at less than 85% of its capacity, equal to about 117,000 t/yr of zinc concentrate (Platts Metals Week, 2001a).

Asturiana de Zinc S.A. increased the capacity of its San Juan de Nieva smelter by 120,000 t/yr. With this expansion, the San Juan de Nieva smelter reached a nameplate capacity of 440,000 t/yr, making it one of the largest electrolytic zinc plants in the world. Waste generated during the production process is transformed into a solidified, inert, and non-contaminating material, which minimizes the environmental impact of smelter wastes. The Board of Directors of Asturiana also had recommended to its shareholders the takeover bid from the Swiss-based resources group Xstrata AG. The bid had already been approved by the Spanish Government. Glencore International AG is a 39.5% shareholder in Xstrata and also holds a 44.4% share in Asturiana (Metal Bulletin, 2001b).

Navan Mining plc suspended its Almagrera operations in the Spanish Province of Huelva at yearend 2001, as a result of low metal prices. The operations were placed under "suspension of payments," the Spanish equivalent of a U.S. Chapter 11 bankruptcy protection. Almagrera produced 13,600 t of zinc in concentrate during the first half of 2001 (CRU International Ltd., 2002b).

Yugoslavia. — Two companies from Ireland — GSA Group Ltd. and Knight Merz Ltd.—have been awarded a contract to provide management and advisory services to the Trepca basemetal complex in Kosovo by the United Nations Interim Administration and the Trepca Management and Advisory Team (TMAT). The complex consists of eight lead-zinc mines, three concentrators, a lead smelter, a zinc smelter-refinery, and numerous associated facilities, including a battery manufacturing plant. Although exploration and ore body delineation work have been halted for the past decade. technically sound data from the late 1980s indicate that there is a deposit of sufficient size and quality to attract outside investors (Mining Journal, 2001o). Unfortunately, a controversy about its ownership is impeding the restart and eventual sale of the complex. Trepca was privatized in 1992, after the ethnic Albanian staff was replaced with Serbs. According to the Albanians, Trepca was unlawfully privatized and should revert to public ownership. While disagreement about the ownership is unresolved, no private investor will risk funds to upgrade the facility. The zinc refinery is in a state of disrepair following years of neglect and an arson attack in 2000. The surrounding mines are unsafe by international standards

and need significant investment in equipment and training of personnel before they can reopen. Funds are also needed to upgrade concentrators, mechanical and electrical plants, and flotation operations (Metal Bulletin, 2001i).

#### Outlook

According to some analysts, the cost of zinc ore production over the next 5 years is expected to fall, mainly due to increased output by large open pit mines (which will have lower unit costs) and the closures of small, less efficient underground mines. The expanded Red Dog Mine in Alaska, together with the opening of the Century Mine in Australia, and the startup of the Antamina Mine in Peru will account for about one-quarter of all Western World zinc mine production by 2003. Other factors, including lower coproduct lead content and the trend to locate smelters near mine sites, are expected to further contribute to lower zinc production costs and prices (Metal Bulletin, 2001f).

In the more immediate future, the outlook for the zinc industry is not as optimistic. Despite production cuts, dramatic changes in China, and improved economic outlook, the zinc industry shows few signs of revival for 2002. The market is faced with an excess of both mine and smelter capacity.

The creation of large mining companies through mergers, coupled with the ascendancy of large mines, could help the zinc industry. It should be easier to achieve consensus about future production and treatment charges with less participants. This consolidation alone, however, may not be enough to improve the low profitability of the zinc industry (zinc companies represented a 0.7% return on equity in 1990-99 compared with a 10.3% return for copper producers). Some industry observers suggest that zinc producers should follow the example of other metal industries and emphasize development of new markets and applications rather than launch new projects based on unrealistic assumptions of rising metal prices (Platts Metals Week, 2001a).

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## TABLE 1 SALIENT ZINC STATISTICS 1/

(Metric tons, unless otherwise specified)

	1997	1998	1999	2000	2001
United States:					
Production:					
Domestic ores, contained zinc	632,000	755,000	852,000 r/	852,000 r/	842,000
Domestic ores, recoverable zinc	605,000 r/	722,000 r/	808,000 r/	805,000 r/	799,000
Value, recoverable zinc thousands	\$860,000 r/	\$819,000 r/	\$953,000 r/	\$987,000 r/	\$774,000
Refined zinc:					
From domestic ores	195,000	192,000	180,000	137,000	169,000
From foreign ores	31,700	41,900	61,100	90,800 r/	34,000
From scrap	141,000 r/	134,000	131,000	143,000	108,000
Total	367,000	368,000	371,000	371,000	311,000
Secondary zinc 2/	236,000 r/	300,000 r/	268,000 r/	297,000 r/	260,000
Exports:					
Ores and concentrates (zinc content)	461,000	552,000	531,000	523,000	696,000
Slab zinc	3,630	2,330	1,880	2,770	1,180
Rolled zinc	9,110	9,920	3,870	3,530	5,700
Imports for consumption:					
Ores and concentrates (zinc content)	49,600	46,300	74,600	52,800	84,000
Refined (slab) zinc	876,000	879,000	1,060,000 r/	915,000	813,000
Rolled zinc	19,200	16,900	22,600	9,380	7,240
Stocks of slab zinc, December 31:					
Producer	9,360	9,060	9,960	7,890	7,380
Consumer	60,400	45,400	64,400	58,300	57,100
Merchant	18,500	13,300	9,690	10,500	10,300
Total	88,200	67,700	84,100	76,600	74,700
Government stockpile	225,000	199,000	177,000	138,000	120,000
Consumption:					
Refined zinc:					
Reported	672,000	647,000	614,000	634,000 r/	543,000
Apparent 3/	1,260,000	1,290,000	1,430,000 r/	1,330,000	1,140,000
All classes 4/	1,500,000 r/	1,590,000 r/	1,700,000 r/	1,630,000 r/	1,400,000
Price, special high grade cents per pound	64.56	51.43	53.48	55.61	43.96
World:					
Production:					
Mine thousand metric tons	7,540 r/	7,660 r/	8,040	8,780 r/	8,850 e
Smelter do.	7,920	8,170 r/	8,600 r/	9,140 r/	9,290 e/
Price, London Metal Exchange cents per pound	59.7	46.45	48.8	51.15	40.16

e/ Estimated. r/ Revised.

TABLE 2 MINE PRODUCTION OF RECOVERABLE ZINC IN THE UNITED STATES, BY STATE 1/

State	2000 r/	2001
Alaska	580,000 2/	W
Missouri	50,500	43,600
Montana	16,400	22,600
New York	W	23,300
Other 3/	158,000	710,000
Total	805,000	799,000

r/ Revised. W Withheld to avoid disclosing company proprietary data; included with "Other."

<sup>1/</sup> Data are rounded to no more than three significant digits, except prices; may not add to totals shown.

<sup>2/</sup> Zinc in metal products and compounds derived directly from scrap; refined secondary zinc is listed separately in the table.

<sup>3/</sup> Domestic production plus net imports, plus or minus stock changes.

<sup>4/</sup> Apparent consumption of refined zinc plus reported consumption of zinc in metal products and compounds derived directly from ore, concentrate, or scrap.

<sup>1/</sup> Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2/</sup> Data based, in part, on publicly available information.

<sup>3/</sup> Includes production from Idaho and Tennessee.

 ${\it TABLE~3}$  Leading zinc producing mines in the united states in 2001, in order of output

Rank	Mine	County and State	Operator	Source of zinc
1	Red Dog	Northwest Arctic, AK	Teck Cominco Alaska Inc.	Lead-zinc ore.
2	Greens Creek	Juneau, AK	Kennecott Greens Creek Mining Co.	Zinc ore.
3	Gordonsville	Smith, TN	Pasminco Ltd.	Do.
4	Coy	Jefferson, TN	ASARCO Incorporated	Do.
5	Montana Tunnels	Jefferson, MT	Apollo Gold Co.	Do.
6	Cumberland	Smith, TN	Pasminco Ltd.	Do.
7	Young	Jefferson, TN	ASARCO Incorporated	Do.
8	Brushy Creek	Reynolds, MO	Doe Run Resources Corp.	Lead ore.
9	Immel	Knox, TN	ASARCO Incorporated	Zinc ore.
10	Pierrepont	St. Lawrence, NY	Zinc Corporation of America	Do.
11	Balmat	do.	do.	Do.
12	Clinch Valley	Grainger, TN	Pasminco Ltd.	Do.
13	Buick	Iron, MO	Doe Run Resources Corp.	Lead ore.
14	Fletcher	Reynolds, MO	do.	Do.
15	Sweetwater	do.	do.	Do.
16	Viburnum #29	Washington, MO	do.	Do.
17	Lucky Friday	Shoshone, ID	Hecla Mining Company	Silver ore.

 $\label{table 4} TABLE~4$  REFINED ZINC PRODUCED IN THE UNITED STATES 1/

#### (Metric tons)

	2000	2001
Primary:		
From domestic ores	137,000	169,000
From foreign ores	90,800 r/	34,000
Total	228,000	203,000
Secondary	143,000	108,000
Grand total (excludes zinc recovered by remelting)	371,000	311,000

r/ Revised.

#### TABLE 5 REFINED ZINC PRODUCED IN THE UNITED STATES, BY GRADE 1/

#### (Metric tons)

Grade	2000	2001
Special high	82,200	95,500
Continuous galvanizing	93,200	108,000
Other 2/	195,000	107,000
Total	371,000	311,000

<sup>1/</sup> Data are rounded to no more than three significant digits; may not add to totals shown.

# TABLE 6 SLAB ZINC CAPACITY OF PRIMARY ZINC PLANTS IN THE UNITED STATES, BY TYPE OF PLANT AND COMPANY

Type of plant and company	2000	2001
Electrolytic:		
Big River Zinc Corp., Sauget, IL	100,000	100,000
Pasminco Ltd., Clarksville, TN	115,000	115,000
Electrothermic:		
Zinc Corporation of America, Monaca, PA 1/	155,000	155,000
Total	370,000	370,000

<sup>1/</sup> Includes secondary capacity.

<sup>1/</sup> Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2/</sup> Includes controlled lead, high, and prime Western grades.

## TABLE 7 STOCKS AND CONSUMPTION OF NEW AND OLD ZINC SCRAP IN THE UNITED STATES IN 200 BY TYPE OF SCRAP 1/

#### (Metric tons of zinc content)

	Consumption					
	Stocks,		New	Old		Stocks,
Type of scrap	January 1	Receipts	scrap	scrap	Total	December 31
Diecastings	W	W		W	W	161
Flue dust	W	22,400	11,400	11,400	22,800	W
Galvanizer's dross	2,830	41,000	41,000		41,000	2,830
Old zinc 2/	69	252		249	249	72
Remelt die-cast slab	W	W		W	W	47
Remelt zinc 3/	W	W	W		W	W
Skimmings and ashes 4/	W	W	22,900		22,900	W
Other 5/	2,730 r/	133,000	76,100	33,600	110,000	2,280
Total	5,620 r/	196,000	151,000	45,200	197,000	5,380
/ D : 1 XXX XXX::11 11:	1.1.11.1				1 14 404	" 7

- r/ Revised. W Withheld to avoid disclosing company proprietary data; included with "Other." -- Zero.
- 1/ Data are rounded to no more than three significant digits; may not add to totals shown.
- 2/ Includes engraver's plates and rod and die scrap.
- 3/ Includes new clippings.
- 4/ Includes slab and die-cast skimmings.
- 5/ Includes chemical residues and solutions, electrogalvanizing anodes, fragmentized diecastings, and steelmaking dust.

TABLE 8
PRODUCTION OF ZINC PRODUCTS FROM ZINC-BASE SCRAP IN THE UNITED STATES 1/

#### (Metric tons)

Products	2000	2001
Redistilled slab zinc	143,000	108,000
Other zinc metal products 2/	6,040 r/	4,990
Zinc in chemical products	64,300 r/	47,600
Zinc dust	3,770	2,440

r/ Revised.

TABLE 9
ZINC RECOVERED FROM SCRAP PROCESSED
IN THE UNITED STATES BY TYPE OF SCRAP
AND FORM OF RECOVERY 1/

#### (Metric tons)

	2000	2001
Type of scrap:		
New scrap:		
Zinc-base	167,000	147,000
Copper-base	201,000	168,000
Magnesium-base	548 r/	548 e/
Total _	369,000	316,000
Old scrap:		
Zinc-base	56,100	43,400
Copper-base	13,200 r/	7,810
Aluminum-base	630	548
Magnesium-base	338 r/	338 e/
Total	70,300 r/	52,100
Grand total	439,000 r/	368,000
C f t t 1 - f t - 1 - 1 -		

See footnotes at end of table.

<sup>1/</sup> Data are rounded to no more than three significant digits.

<sup>2/</sup> Includes electrogal vanizing anodes, remelt die-cast slab, and other metal alloys.

# TABLE 9--Continued ZINC RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES BY TYPE OF SCRAP AND FORM OF RECOVERY 1/

#### (Metric tons)

	2000	2001
Form of recovery:		
Metal:		
Slab zinc	143,000	108,000
Zinc dust	3,770	2,440
Total	146,000	110,000
In brass and bronze	223,000 r/	205,000
In chemical products:		
Zinc oxide (lead free)	23,100	19,700
Zinc sulfate	32,800	23,100
Miscellaneous 2/	14,500 r/	9,820
Total	293,000 r/	258,000
Grand total	439,000 r/	368,000

e/ Estimated. r/ Revised.

TABLE 10 U.S. CONSUMPTION OF ZINC 1/

#### (Metric tons)

	2000	2001
Refined zinc, apparent	1,330,000	1,140,000
Ores and concentrates (zinc content)	225	727
Secondary (zinc content) 2/	297,000 r/	260,000
Total	1,630,000 r/	1,400,000

r/ Revised.

TABLE 11 U.S. REPORTED CONSUMPTION OF ZINC IN 2001, BY INDUSTRY USE AND GRADE 1/

	Special			Remelt	
	high	High	Prime	and other	
Industry use	grade	grade	Western	grades	Total
Galvanizing	115,000	37,200	98,600	30,200	281,000
Zinc-base alloys	91,100	W	W	W	91,200
Brass and bronze	40,700	W	18,400	W	74,400
Other	46,900	16,800	47,600	139	XX
Total	294,000	54,000	165,000	30,300	543,000

W Withheld to avoid disclosing company proprietary data; included with "Other" and in "Total." XX Not applicable.

<sup>1/</sup> Data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2/</sup> Includes chlorine, electrogalvanizing anodes, and zinc content of slab made from remelt die-cast slab.

 $<sup>1/\,\</sup>mathrm{Data}$  are rounded to no more than three significant digits; may not add to totals shown.

<sup>2/</sup> Excludes secondary slab zinc and remelt zinc.

 $<sup>1/\</sup>operatorname{Data}$  are rounded to no more than three significant digits; may not add to totals shown.

## TABLE 12 ZINC CONTAINED IN PIGMENTS AND COMPOUNDS PRODUCED AND SHIPPED IN THE UNITED STATES 1/2/

#### (Metric tons)

	2000		2001		
	Production	Shipments	Production	Shipments	
Zinc oxide	102,000	101,000	61,800	64,600	
Zinc sulfate	33,000	38,700	23,800	24,400	

<sup>1/</sup> Excludes leaded zinc oxide, lithopone, and zinc chloride.

TABLE 13
REPORTED SHIPMENTS OF ZINC CONTAINED
IN ZINC OXIDE, BY INDUSTRY 1/2/

#### (Metric tons)

	2000	2001
Ceramics	4,320	2,220
Chemicals	20,200	12,700
Paints	4,600	3,140
Rubber	67,500	43,200
Other 3/	4,790	3,340
Total	101,000	64,600

<sup>1/</sup> Data are rounded to no more than three significant digits; may not add to totals shown.

 ${\bf TABLE~14}$  U.S. EXPORTS OF ZINC ORES AND CONCENTRATES, BY COUNTRY 1/

	20	00	2001			
	Quantity		Quantity			
	(metric tons,	Value	(metric tons,	Value		
	zinc content)	(thousands)	zinc content)	(thousands)		
Australia	24,400	\$11,000	24,400	\$10,800		
Belgium	202,000	97,000	151,000	66,800		
Canada	49,900	65,700	85,100	42,700		
China			210	60		
Germany	28,100	14,700	33,000	14,900		
India	59	61	705	401		
Italy	6,840	2,990	16,500	4,110		
Japan	108,000	51,500	141,000	44,300		
Korea, Republic of	73,900	37,100	141,000	56,600		
Mexico	1,990	1,070	882	227		
Netherlands			51,800	22,900		
Saudi Arabia	68	139	328	547		
Singapore	40	67	580	559		
United Kingdom	28,400	16,400	13,700	3,360		
Other	56 r/	141 r/	36,300	16,300		
Total	523,000	298,000	696,000	285,000		

r/ Revised. -- Zero.

Source: U.S. Census Bureau.

<sup>2/</sup> Data are rounded to no more than three significant digits.

<sup>2/</sup> In addition, zinc contained in zinc oxide was imported as follows: 2000--71,103 and 2001-71,993; distribution cannot be distinguished by industry.

<sup>3/</sup> Includes agriculture and photocopying.

<sup>1/</sup> Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 15
U.S. EXPORTS OF ZINC COMPOUNDS 1/

20	00	2001		
Quantity		Quantity		
(metric tons of	Value	(metric tons of	Value	
gross weight)	(thousands)	gross weight)	(thousands)	
3,290	\$2,440	1,730	\$1,630	
5,240	9,110 r/	13,200	13,900	
7,080	12,400	11,300	17,600	
6,950	22,800	5,710	18,500	
	Quantity (metric tons of gross weight) 3,290 5,240 7,080	(metric tons of gross weight)         Value (thousands)           3,290         \$2,440           5,240         9,110 r/           7,080         12,400	Quantity (metric tons of gross weight)         Value (thousands)         Quantity (metric tons of gross weight)           3,290         \$2,440         1,730           5,240         9,110 r/         13,200           7,080         12,400         11,300	

r/ Revised.

Source: U.S. Census Bureau.

 $\label{table 16} TABLE~16\\ U.S.~IMPORTS~FOR~CONSUMPTION~OF~ZINC~COMPOUNDS~1/$ 

	200	00	2001		
	Quantity		Quantity		
	(metric tons,	Value	(metric tons,	Value	
	gross weight)	(thousands)	gross weight)	(thousands)	
Lithopone	1,380	\$1,150	1,290	\$1,140	
Zinc chloride	1,110	1,240	946	1,020	
Zinc compounds, n.s.p.f.	19	21	128	98	
Zinc hydrosulfite	174	361	306	569	
Zinc oxide	71,000	74,200	72,000	66,200	
Zinc sulfate	13,700	6,800	16,200	7,330	

<sup>1/</sup> Data are rounded to no more than three significant digits.

Source: U.S. Census Bureau.

 ${\bf TABLE~17} \\ {\bf WORLD~MINE~PRODUCTION~OF~ZINC~BY~COUNTRY~1/~2/}$ 

(Metric tons of zinc content of concentrate and direct shipping ore unless otherwise noted)

Country	1997	1998	1999	2000	2001 e/
Algeria	3,960	4,555 r/	9,808 r/	10,452 r/	12,000
Argentina	33,357	35,560	34,192 r/	34,858 r/	34,500 p/
Australia	1,036,000	1,059,000	1,163,000	1,420,000	1,519,000 3/
Bolivia	154,491	152,110	146,316	149,314 r/	150,000
Bosnia and Herzegovina e/	300	300	300	300	300
Brazil	152,634 r/	87,485 r/	96,590 r/	100,254 r/	100,254 3/
Bulgaria e/	20,000	17,000	11,000	11,000	11,000
Burma	467	474	279	437 r/	480
Canada	1,076,385	1,061,645	963,321	935,686	1,009,600 3/
Chile	33,934	15,943	32,263	31,402 r/	31,500
China	1,200,000	1,270,000 r/	1,480,000 r/	1,780,000 r/	1,600,000
Congo (Kinshasa)	1,660	1,147		215	1,014 3/
Ecuador e/	100	100	100	100	100
Finland	30,800	30,700 e/	20,000 e/	16,200	20,100 3/
Georgia e/	200	200	200	200	200
Greece	17,800 e/	29,100	19,619 r/	16,900	20,000
Honduras	39,500	36,639	31,095 r/	31,226 r/	32,565 3/
India	142,000	143,000	145,000 e/	144,000 e/	146,000
Iran e/	76,500 3/	80,000 r/	80,000	85,000 r/	85,000
Ireland	194,796	182,000	226,000	262,877 r/	225,135 3/
Italy e/	8,470 3/	2,500			
Japan	71,569	67,670	64,263	63,601 r/	44,519 3/
Kazakhstan	224,051	224,300	288,300	325,000	344,300 3/
Korea, North e/	210,000	200,000	190,000	190,000	190,000
Korea, Republic of	8,992	10,488	9,832	11,474 r/	11,000

See footnotes at end of table.

<sup>1/</sup> Data are rounded to no more than three significant digits.

#### TABLE 17--Continued WORLD MINE PRODUCTION OF ZINC BY COUNTRY 1/2/

(Metric tons of zinc content of concentrate and direct shipping ore unless otherwise noted)

Country	1997	1998	1999	2000	2001 e/
Macedonia	15,800	14,328	8,000 e/	12,200	12,000
Mexico	379,252	395,391	362,811 r/	392,791	400,000
Morocco	89,248	112,000	111,703 r/	105,107 r/	123,000
Namibia	39,658	42,274 r/	35,140 r/	40,266 r/	42,000
Norway	7,900			e/	
Peru	867,691 r/	868,757 r/	899,524 r/	910,303	1,056,629 3/
Poland	158,300	157,900	153,500 r/	155,000 e/	151,000
Romania	29,366	30,000 e/	26,536	27,455	25,000
Russia	121,000 e/	115,000 e/	132,000	136,000	124,000
Saudi Arabia	619	3,550	3,161	3,000 e/	3,000
Serbia and Montenegro	13,000	14,000	1,000 e/	2,500 e/	1,200
South Africa	71,062	69,630	69,733	62,703	61,221 3/
Spain	171,800	128,100	110,000	201,000 r/	183,900 3/
Sweden	155,400	164,711	174,400 r/	176,200	161,400 3/
Thailand	15,000	25,000	24,000	27,000 r/	24,000 3/
Tunisia	2,967	31,368	49,066	41,247	37,900
Turkey 4/	11,255 r/	6,000 r/e/	545 r/	r/	
United States	632,000	755,000	852,000 r/	852,000 r/	842,000 3/
Vietnam e/	16,000	18,000	18,000	16,000	16,000
Total	7,540,000 r/	7,660,000 r/	8,040,000	8,780,000 r/	8,850,000

TABLE 18 WORLD SMELTER PRODUCTION OF ZINC, BY COUNTRY 1/2/

#### (Metric tons)

Country 3/	1997	1998	1999	2000	2001 e/
Algeria, primary and secondary e/	29,300 4/	31,000	34,000	34,000	34,000
Argentina:					
Primary	38,672	38,677	40,224	36,359 r/	35,000
Secondary	3,100	3,100 e/	3,220	2,910 r/	3,000
Total	41,772	41,777	43,444	39,269 r/	38,000
Australia:					
Primary 5/	307,000	312,000	344,000 r/	490,000	554,000 4/
Secondary e/	10,000	10,000	10,000	10,000	10,000
Total e/	317,000	322,000	354,000 r/	500,000	564,000
Belgium, primary and secondary	243,600	205,000	232,400	251,700	259,300 4/
Brazil:					
Primary	185,701	176,806	187,010	191,777 r/	192,000
Secondary e/	7,000	7,000	7,000	7,000	7,000
Total e/	193,000	184,000	194,000	199,000 r/	199,000
Bulgaria, primary and secondary	70,420	72,755	84,000 e/	85,000 e/	85,000
Canada, primary	703,798	745,131	776,927	787,527	787,527 4/
China, primary and secondary e/	1,430,000	1,490,000	1,700,000	1,960,000 r/	2,080,000
Czech Republic, secondary e/	1,000	1,000	1,000	1,000	1,000
Finland, primary	175,300	199,000	225,200	223,000	248,800 4/
France, primary and secondary	346,100	321,000 e/	333,103 r/	350,000 r/	347,000
Germany, primary and secondary	251,700	334,000 e/	333,000 r/	356,000 r/	358,300 4/
India: e/					
Primary	159,000	171,900 4/	175,000	176,000 4/	205,000
Secondary	24,000	25,000	25,000	25,000	25,000
Total	183,000	196,900 4/	200,000	201,000	230,000
Italy, primary and secondary	227,700	231,600	152,800	170,300 r/	177,800 4/
Japan:					
Primary	500,603	513,916	524,979	541,704	541,277 4/
Secondary	149,605	138,771	158,637	158,806	142,660 4/
Total	650,208	652,687	683,616	700,510	683,937 4/

See footnotes at end of table.

e/ Estimated. p/ Preliminary. r/ Revised. -- Zero
1/ World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2/</sup> Table includes data available through July 1, 2002.

<sup>3/</sup> Reported figure.

<sup>4/</sup> Content in ore hoisted.

## TABLE 18--Continued WORLD SMELTER PRODUCTION OF ZINC, BY COUNTRY 1/2/

Country 3/	1997	1998	1999	2000	2001 e/
Kazakhstan, primary and secondary	188,996	240,728	249,327	262,200 r/	276,900 4/
Korea, North, primary e/	200,000	180,000	180,000	200,000 r/	180,000
Korea, Republic of, primary	335,488	390,260	430,108	473,897	480,000
Macedonia, primary and secondary e/	60,000 r/	64,200 r/	55,000 r/	69,800 r/	65,000
Mexico, primary	231,444	230,325	218,913	235,073 r/	250,000
Netherlands, primary 6/	201,100	218,700	220,000 e/	216,800 r/	204,800 4/
Norway, primary	137,400	128,000 e/	132,600	125,800	129,300 4/
Peru, primary	169,809 r/	174,655 r/	196,978	199,813	201,498 4/
Poland, primary and secondary	171,000	175,000 e/	179,000 r/	175,000 e/	175,000
Portugal, primary e/	3,600	3,600	3,600	3,600	3,600
Romania, primary and secondary	30,226	29,427	25,000 e/	25,000 e/	25,000
Russia, primary and secondary e/	189,000	192,000	221,000	230,000	237,000
Serbia and Montenegro, primary and secondary	29,454	14,000 e/	683	8,291	13,467 4/
Slovakia, secondary e/	1,000	1,000	1,000	1,000	1,000
South Africa, primary	108,500	107,400	108,000 r/	103,000 r/	110,000
Spain, primary and secondary	364,200	360,000 e/	393,000 r/	386,300 r/	340,000
Thailand, primary	72,035	75,904	75,639	77,525	74,129 4/
Turkey, primary	37,074	35,716	33,179 r/	r/	
Ukraine, secondary e/	2,000				
United Kingdom, primary and secondary	107,704	99,600	132,800	99,600	100,000
United States:					
Primary	226,000	234,000	241,000	228,000	203,000 4/
Secondary	141,000 r/	134,000	131,000	143,000	108,000 4/
Total	367,000	368,000	371,000	371,000	311,000 4/
Uzbekistan, primary e/	53,000	52,000	27,000	18,000	20,000
Grand total	7,920,000	8,170,000 r/	8,600,000 r/	9,140,000 r/	9,290,000
Of which:					
Primary	3,850,000	3,990,000	4,140,000 r/	4,330,000 r/	4,420,000
Secondary	338,000	320,000	337,000	348,000	297,000
Undifferentiated	3,740,000	3,860,000 r/	4,130,000 r/	4,460,000 r/	4,570,000
/E :: . 1 /B : 1 /Z					

e/ Estimated. r/ Revised. -- Zero.

<sup>1/</sup> World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

<sup>2/</sup> Wherever possible, detailed information on raw material source of output (primary-directly from ores, and secondary-from scrap) has been provided. In cases where raw material source is unreported and insufficient data are available to estimate the distribution of the total, that total has been left undifferentiated (primary and secondary). To the extent possible, this table reflects metal production at the first measurable stage of metal output. Table includes data available through July 1, 2002.

<sup>3/</sup> In addition to the countries listed, Israel also produces small amounts of secondary zinc, but available information is inadequate to make reliable estimates of output levels.

<sup>4/</sup> Reported figure.

<sup>5/</sup> Excludes zinc dust.

<sup>6/</sup> Sales.