

ZINC

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In 1999, domestic zinc mine production, expressed in zinc content of ore, increased by about 12% from that of 1998 mainly because of increased production at the Red Dog Mine in Alaska (table 1). On the basis of recoverable content and annual average U.S. price, the value of zinc mine production was estimated to be about \$953 million. Zinc was extracted from 20 mines in 7 States by 8 companies (tables 2, 3). For the ninth consecutive year, Alaska was the leading zinc mining State, followed by, in descending order, Tennessee, Missouri, and New York. In 1999, 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. More than one-third of all exports, which were supplied entirely by the Red Dog Mine, was trucked to the Trail smelter in Canada; the remaining two-thirds went mainly to Asian markets (table 14). In 1999, primary zinc metal production, which was mostly from domestic concentrate, by the three primary smelters increased by about 3% (tables 4, 6).

In 1999, apparent consumption of refined zinc increased by nearly 4%. Of the total refined zinc metal consumed in the United States, about one-half was used in galvanized products, followed by use in zinc-based alloys and in brass and bronze (table 11). Zinc compounds and dust were used principally by agricultural, chemical, paint, and rubber industries.

The average U.S. producer price for refined zinc in 1999, which was based on the London Metal Exchange (LME) daily cash price plus premium, increased by 5% to \$1.08 per kilogram (48.80 cents per pound).

World production of zinc concentrate by 42 countries increased by nearly 5% in 1999. The largest producers, were, in decreasing order of magnitude, China, Australia, Canada, Peru, and the United States (table 17). World smelter production increased by more than 3%. The largest producer of zinc metal was China, followed by Canada, Japan, the Republic of Korea, Spain, and the United States (table 18).

Legislation and Government Programs

Despite the beneficial health and nutritional qualities of zinc, the U.S. Environmental Protection Agency (EPA) included it on a list of 53 chemicals that the agency described as persistent, bioaccumulative, and toxic (PBT). Some States adopted the list and subsequently limited the use of some of the listed chemicals, which included zinc. Further limits on the use of zinc are not inconceivable; a partial ban has already been approved in some European countries. Even a limited restriction on zinc could have a momentous effect on the

economy and the everyday lives of people because zinc has many applications that range from cosmetic and dietary supplements to food packaging and corrosion-resistant coatings on innumerable consumer structures and consumer products. Zinc industry leaders and associations have urged the EPA to remove zinc from its PBT chemicals list (American Metal Market, 1999j).

Production

Mine Production.—The Red Dog zinc-lead mine in Alaska, which was owned by Cominco Ltd. of Canada and continued to be the largest zinc mine in the United States, contributed about 66% of the total domestic zinc production. In 1999, it produced a record 943,500 metric tons (t) of zinc concentrate that contained 521,000 t of zinc and shipped a record 942,000 t of zinc concentrate during a short shipping season (Doug Horswill, Cominco Ltd., written commun., February 1, 2000). The more-than 18% increase in production compared with that of 1998 was mainly due to the Production Rate Increase project, which began in early 1998, but did not reach its design capacity on a sustainable basis until the fourth quarter of 1998. Further production increases may be expected in the second half of 2001 when the Mill Optimization Project will be completed. This \$90 million project will enable Cominco to produce 1.1 million metric tons (Mt) of concentrate at a grade of 56% zinc (Doug Horswill, Cominco Ltd., written commun., February 7, 1999).

Red Dog's "resource base" in 1999 was 143 Mt grading 16.1% zinc, 4.3% lead, and 83 grams per ton (g/t) silver; it will increase with a discovery of a new zinc-lead mineralization 10 kilometers (km) north of the Red Dog Mine (Mining Engineering, 1999). Based on a preliminary drilling, Cominco estimates that the new deposit, named Anarraaq, will add a 12-Mt resource grading 18% zinc, 5% lead, and 90 g/t silver to the existing deposit (Northern Miner, 2000a).

Cominco signed an agreement with CalEnergy Minerals LLC to purchase up to 30,000 metric tons per year (t/yr) of zinc. The material will be produced at CalEnergy's Zinc Recovery Facility, now under construction in Calipatria, CA. CalEnergy will recover zinc metal from a brine residue generated at a geothermal powerplant (American Metal Market, 1999b).

Cominco's Pend Oreille zinc property in Metaline Falls, WA, which is 50 km south of Cominco's Trail smelter, should have its mining permits completed by early 2000. An additional 2 years after permitting could be needed to bring the abandoned mine back into production (Platt's Metals Week, 1999d).

Annual production is likely to be about 80,000 t of zinc concentrate grading 60% zinc. The ore reserve is 6 Mt grading 7.2% zinc and 1.3% lead (Cominco Ltd., 2000).

Production from the 200 South Zone began in the second half of 1999 at the Greens Creek Mine, which is located on Admiralty Island, near Juneau, AK. The new zone was discovered in 1998, and by the following year, it not only contributed 92,000 t of ore, but the additional reserves nearly offset reserves lost to mining. Surface exploration on the 3,000 hectares (ha) of surrounding area, which was acquired in exchange with the U.S. Forest Service in 1998, began in summer 1999. Greens Creek was a joint venture between Kennecott Greens Creek Mining Company (70.3%) and Hecla Mining Company (29.7%) (Hecla Mining Company, [no date], Greens Creek, Admiralty Island, AK, accessed June 1, 2000, at URL <http://www.hecla-mining.com/greencreek.html>).

Production in 1999 amounted to about 75,000 t of zinc and proven and probable reserves at yearend amounted to nearly 3 Mt grading 11.9% of zinc (Hecla Mining, March 23, 2000, Hecla reports year-end and fourth quarter 1999 financial results: accessed June 1, 2000, at URL <http://www.businesswire.com/webbox/bw.032300/200830057.htm>).

ASARCO Incorporated closed its Black Cloud lead-zinc mine in Leadville, CO, on January 31 because of the depletion of ore reserves. When last assessed at the end of 1997, proven and probable reserves totaled 400,000 t grading 9% zinc and 2.7% lead. Leadville has a rich history of mining, which includes the first Guggenheim Mine. After lead carbonates were discovered in 1876, many lead-zinc mines were established in Colorado; of those, Black Cloud was the last to close (Metal Bulletin, 1999a). On November 17, 1999, Grupo Mexico, S.A. de C.V., acquired Asarco for \$2.52 billion. In addition to being the leading producer of copper, speciality chemicals, and aggregates, Asarco owned three operating zinc mines in Tennessee (Coy, Immel, and Young) (Grupo Mexico, S.A. de C.V., 2000).

In February, Pasmaico Limited acquired Savage Resources Ltd., a fellow Australian mining company, in a hostile takeover bid that began in October 1998. The takeover bid was aimed mainly at acquiring control of Savage Zinc Inc., which was wholly owned subsidiary of Savage Resources, and its zinc operations in Tennessee, which consisted of a 105,000-t/yr zinc refinery in Clarksville and two mines. Before the takeover bid was concluded, however, the Clinch Valley Mine was put on standby status, thus leaving only the Gordonsville/Cumberland Mine operating. Lower local production will be augmented with concentrate from the new Century Mine in Australia (Platt's Metals Week, 1999c). The combined proven and probable reserves at the two mines in April 1999 amounted to 17.1 Mt grading 3.2% zinc (Pasmaico Limited., [no date], Welcome to Pasmaico, accessed June 1, 2000, at URL <http://www.pasmaico.com.au>).

For its future New Burgin silver-lead-zinc mine, Chief Consolidated Mining Co. wanted to appropriate water from the Great Salt Lake; after desalination, the treated water would be used by the new mine, and the salt would be sold on the open market. The move was aimed at preventing billions of gallons

of saline fluids from interfering with attempts to revive the former Burgin Mine. If the Utah Government approves the plan, then U.S. Filter will begin a feasibility study for the \$100 million water-treatment plant. The New Burgin Mine, which is 112 km southwest of Salt Lake City, UT, was owned by Tintic Utah Metal LLC, in which Chief Consolidated had a 75% interest and Korea Zinc Co. Ltd. held the remaining 25%. Ore reserves amount to 1 Mt grading 21% lead, 6.7% zinc, and 468 g/t silver (Northern Miner, 1999b).

Secondary Production.—In 1995, Metal Recovery Technologies Inc. (MRTI) set out to dezinc galvanized scrap by using an electrowinning process to generate pure zinc powder and steel scrap. In need of capital following repeated delays, MRTI reached an agreement with Meyado International Ltd. of Germany to provide \$4 million in financing and a guaranteed maximum timeframe to complete the plant. Within 3 months of its proposed completion in 2000, the plant could be at full capacity, processing about 150,000 t/yr of galvanized steel scrap (American Metal Market, 1999d).

Imco Recycling Inc., Houston, TX, acquired the assets of other companies in the past few years to become the largest zinc recycler in the United States. In February 1999, Imco acquired through Midwest Zinc Corp., its wholly owned subsidiary, all the assets of a zinc oxide production facility in Clarksville, TN, from North American Oxide, LLC, for about \$11 million. Because of this acquisition and a full year of processing from U.S. Zinc Corp., which was acquired in July 1998, Imco melted 116,884 t of zinc scrap, which was 82% more than in 1998 (Imco Recycling Inc., 1999).

Exploration.—Mineral exploration activities in the United States declined by 11% in 1999. Despite lower expenditures, Alaska remained one of the States with relatively high exploration activity, owing to a higher probability of undiscovered mineral resources and the cooperative relation that generally exists between industry and the State Government (Wilburn, D.R., 2000).

Exploration drilling at Rubicon Minerals Corp.'s Palmer polymetallic property in Alaska, which is 60 km from the deep-sea port of Haines, returned evidence of significant mineralization in the recently-discovered RW Zone. Two holes intersected zinc mineralization of up to 21.5% in addition to copper, gold, and silver. The new discovery remained open in all directions and depth (Mining Journal, 1999c).

A drilling program completed in September 1999 at the Cirque property by Camnor Resources Ltd. and Oromin Exploration Ltd., both of Canada, successfully intersected high-grade volcanogenic massive sulfide mineralization of up to 11.55% of combined copper-lead-zinc content in addition to gold and silver. The Cirque property is located in the Bonfield District, which is 130 km south of Fairbanks, AK (Mining Record, 1999b).

In August 1999, drilling by Atna Resources Ltd. and Grayd Resources Corp. began on the Dry Creek property, which is about 100 km south of Fairbanks, AK. To earn 51% in the property, Atna must spend \$3.3 million in exploration expenditures within 5 years. Prior to the August drilling, shallow, widely spaced drilling intersected mineralization that

averaged 7.9% zinc, and 3.5% lead, as well as small amounts of gold and silver (Mining Record, 1999a).

Consumption

To stimulate future zinc consumption, two new organizations were established in the United States in 1999—the GalvInfo Center and the Zinc Information Nutrition Center (ZINC). The GalvInfo Center in North Carolina was established by the International Lead and Zinc Research Organization, which is the cooperative research arm of the zinc industry. Financial backing for the center was provided by 14 companies with interests in galvanized steel. The primary goal of the organization is to answer technical inquiries about the use of metallic-coated steel sheet products in which zinc is a major component of the coating. This includes galvanized and galvanized products, Galvalume steel sheets, and Galfan steel sheets. The GalvInfo Center will also answer inquiries concerning the performance of surface treatments and paints (American Metal Market, 2000a).

American and international zinc associations are among a group of organizations behind the unveiling of the ZINC, which is a New York-based clearinghouse of information about the health benefits of zinc. Housed on the campus of the Rockefeller University since late September, ZINC also includes the New York Hospital-Cornell Medical College and the Memorial Sloan-Kettering Cancer Center among its backers. Researchers indicated that zinc has become a favorite subject of clinical investigation since a Tufts University study found it to be the number one nutritional deficiency in American children. Ultimately, the center planned to expand its efforts to benefit children in undeveloped countries (American Metal Market, 2000b).

Stocks

According to preliminary supply-and-demand balance reports, the zinc market was in deficit by about 38,000 t in 1999. Consequently, the stock levels in the Western countries continued to fall. The largest relative decline was registered by merchant stock, which fell by about 39%. The LME stock, which is represented much larger quantities, fell by 34,000 t, or about 11%, followed by producers' stocks, which declined by 10% (International Lead and Zinc Study Group, 2000a, p. 51).

Prices

A gradual but steady recovery in the daily zinc price from a low of \$900 per metric ton on January 5 reached \$1,239 per ton on December 30. The increase in the average monthly price was not as steep, but still was a respectable 20%. Despite the price increase, financial performance of zinc companies lagged behind other base-metal companies—pretax profit of zinc companies in 1999 was only about 1.5%, and return on capital investment during the past decade was below 3.5%. The main reason for this comparatively poor return reportedly was the inability of the companies to reduce their smelting and refining

cost (Metal Bulletin, 2000b).

Future zinc metal prices may increase even further, because of increased demand and increasing treatment charges. Smelters are predicting as much as a \$20-per-ton price increase over the 1999 benchmark of \$169 per ton of zinc concentrate (American Metal Market, 1999h). Recent developments—increased production of concentrates and unchanged smelter capacity—seemed to portend higher smelter prices. The recent start-up of such mines as Lisheen in Ireland and Century and Cannington in Australia and the expansion of Red Dog in Alaska have all contributed to this imbalance.

World Review

After a modest growth between 1995 and 1998, world zinc mine production increased by about 4.7% in 1999. Most of this increase came from, in descending order, Australia, China, the United States, Kazakhstan, and Ireland. Increased production at the Pillara Mine and several Pasmenco operations in 1999 more than offset the closure of the Woodcutters Mine in 1998. Production in the United States continued to increase, principally as a result of increases at the Red Dog Mine. Increase of European zinc mine production was mainly aided by the reopening of the Los Frailes Mine in Spain and by Irish mines.

World refined zinc production increased by about 3.5% in 1999. Lower production in Italy and Japan was more than offset by increased production in other countries, mainly in China, where refined zinc production increased by about 14%, to 1.7 Mt, thus making it the world's leading producer of refined zinc. Future Western refined zinc production will gain from the commissioning of the Townsville smelter at the end of 1999 and from large capacity increases at the Torreón smelter in Mexico and the Cajamarquilla smelter in Peru, where plans are approved, although the start of construction is not certain. Hindustan Zinc Limited, Norzink A/S, and Outokumpu Oy were also considering the addition of refining capacity (International Lead and Zinc Study Group, 2000b).

According to the International Lead and Zinc Study Group, the global demand for refined zinc exceeded 8 Mt for the first time in 1999. The nearly 6% increase in world zinc consumption was mainly driven by a particularly robust growth of zinc consumption in the U.S. market and in some Asian countries, namely Thailand (17%), Taiwan (14%), and the Republic of Korea (13%).

Australia.—With 1.1 Mt of contained zinc, Australia became the largest western producer of zinc concentrate in 1999. More than one-half of Australia's concentrate production was supplied by Pasmenco's three existing mines. Pasmenco's share will further increase when commercial production from the newly opened Century Mine in northern Queensland begins in 2000. The first shipment of zinc concentrate from the Century was shipped from the Gulf of Carpentaria on December 21, bound for the Budel smelter in the Netherlands. The concentrate was pumped as a slurry some 300 km to a dewatering port facility at Karumba. The 10,000-t cargo was loaded to a transatlantic ship from the Wunma, which was the

company's transfer vessel, 21 km offshore. Regular monthly shipments of zinc concentrate are expected to begin before the end of January 2000 and will build up to around 40,000 metric tons per month by the end of 2001 (Platt's Metals Week, 1999b). Pasmenco presold 90% of its anticipated production on a multiyear basis. In addition to the Budel smelter, which will take about 50% of production, concentrate will be also shipped to Pasmenco's smelters at Risdom, Tasmania, and Clarksville, TN, and to Korea Zinc Co. Ltd.'s new smelter at Townsville in Queensland. The Century deposit amounts to 100 Mt of proven and probable reserves grading 11.6% zinc, 1.7% lead, and 43 g/t silver (Mining Journal, 1999a).

Western Metals Ltd. rescinded its agreement to increase its equity in the Padaeng Industry Co. Ltd. of Thailand. Western Metals intended to expand the Pillara concentrator and associated facilities so that the aging plant at Cadjebut can be replaced. The decision to expand the recently commissioned the Pillara Mine and its facilities was based on a large increase in ore reserves to 17.6 Mt from the previous estimate of 13.2 Mt. During the March quarter, Pillara reached its design capacity, and by the end of the fiscal year, it produced 1.29 Mt of ore that contained 86,400 t of zinc; this helped Western Metals to increase its concentrate production by nearly 120% (Western Metals Ltd., [no date], Operations review, Annual report, 1999, accessed July 19, 2000, at URL <http://www.westernmetals.com.au/annual/annual99.pdf>). Western Metals was also investigating the possibility of using electrowinning technology to produce zinc cathode from the Hellyer Mine tailings when the mine ceases operation, probably in 2001. The tailings amounted to about 11 Mt grading 2.8% zinc and 3% lead, as well as copper, silver, and gold. The production could total 24,000 t/yr of zinc cathode, 500 t/yr of copper, 62 t/yr of silver, and 1.1 t/yr of gold (Metal Bulletin, 1999j).

MIM Holdings Limited was spending \$270 million for development of the George Fisher deposit and for upgrading the processing facilities at Mount Isa. The George Fisher Mine, which is located 22 km north of Mount Isa and 2 km north of the Hilton Mine, should begin production in the second half of 2000. Annual production was expected to be about 170,000 t of zinc in concentrate and 100,000 t lead in concentrate, and contain about 150 t of silver. The ore from George Fisher will be trucked to Mount Isa for processing, and the concentrate, together with concentrates from the Hilton and the Mount Isa Mines, will be railed to the new refinery at Townsville (MIM Holdings Limited, [no date], At a glance, accessed June 16, 2000, via URL <http://www.min.com.au/isa.html>).

The first stage of a zinc smelter in Townsville, north Queensland, was completed in October by Sun Metals Corp., which was a subsidiary of Korea Zinc Co. Ltd. By the end of 2000, the smelter should be operating at its design capacity of 170,000 t/yr of zinc metal, which was using concentrates from northwest Queensland (Metal Bulletin, 1999i). The first stage was designed in such a way that if needed, the second stage could be added in the future, thus doubling its present capacity.

Canada.—The total value of all mineral commodities produced in Canada during 1999 increased by almost 21%.

Because of the rising price, the value of zinc production rose by 2%, although production volumes declined by 5% to 1 Mt. The closure of Inmet Mining Corp.'s Winston Lake operations and lower production at other Canadian mines contributed to the lower output. The largest Canadian domestic zinc mine producers in 1999 were, in descending order, Noranda Inc., Cominco, Breakwater Resources Ltd., and Falconbridge Limited.

In 1999, Noranda's Canadian mines included the Brunswick and the Heath Steele Mines in New Brunswick and the Bell Allard Mine in Quebec. The Bell Allard Mine began production in the third quarter of 1999 and by yearend reached its design mill capacity of 2,000 metric tons per day, replacing Heath Steele, which ceased production in mid-October (Platt's Metals Week, 1999a). Additional output for Noranda, which in 1999 produced more than 300,000 t of zinc in concentrate, will come from the Caber zinc-copper deposit. Noranda can earn 70% interest in the property, which is located 35 km west of Matagami, Quebec, and was previously owned by Southern Africa Minerals Corp., by bringing the deposit to production. The feasibility study was based on the total resource estimate of 800,000 t grading 10.1% zinc and 0.6% copper, as well as gold and silver. This resource will probably be extended because new exploratory drillings in 1999 discovered additional mineralization (Northern Miner, 1999c). Ore will be trucked to the mill at Matagami and possibly mixed with the material from the Bell Allard Mine.

Cominco's Canadian mines included the Polaris Mine on Little Cornwallis Island (77.5% owned by Cominco), Nunavut, the Sullivan Mine, BC, and the newly acquired Faro Mine, Yukon Territory. Polaris, which was the world's most northerly mine, produced about 250,000 t of zinc and lead concentrate that was shipped to European smelters. The Sullivan Mine, which was expected to be depleted by 2001, produced about 231,000 t of zinc concentrate. In mid-1999, Cominco acquired Anvil Range Mining Corp.'s Faro lead and zinc mine. The Canadian Government not only has allowed Cominco to gain control of the inactive Faro Mine, but also exempted Cominco from paying environmental liabilities which were estimated to be as high as \$100 million. In addition, Cominco will receive 65% of the annual operating cost, which has been estimated to be between \$1 million and \$2 million, from the Department of Indian Affairs and \$200,000 per year from the Yukon Government for maintenance until the mine reopens (American Metal Market, 1999c).

In 1999, Breakwater's mines produced 173,700 t of zinc in concentrate, as well as gold, lead, and silver (Mining Record, 2000). Increased production of Breakwater was mainly due to inclusion of the Bougrine Mine in Tunisia for the whole year, versus 2 months in 1998. The Nanisivik Mine on Baffin Island, Northwest Territories, which was Breakwater's only Canadian mine, increased its production of zinc in concentrate by about 10% owing to higher ore grades and increased mill throughput. Further rise in zinc prices may enable Breakwater to bring the Caribou Mine, which closed in 1998, back on line (Metal Bulletin, 1999c).

Falconbridge operated the Kidd Creek Mine and smelter,

which are located 27 km southeast of Timmins, Ontario. Owing to the reduced grade of ore and a 26-day strike at the smelter that ended on August 3, zinc metal production declined by nearly 10% in 1999. The new contract with 720 workers, which will expire in September 2002, will provide a pay rise and improved health and dental care. Production at the Kidd Creek Mine was not affected by the strike. Because the concentrator is located at the smelter, it also closed, and ore was stockpiled at the Mine. In 1999, Kidd Creek produced about 144,000 t of zinc in concentrate, and smelter production was about 131,000 t (Metal Bulletin, 1999e).

Because of unsafe working conditions, Boliden Ltd. suspended operations at the Myra Falls Mine, British Columbia, for 3 months starting in mid-December 1998. During the suspension, 1,330 meters of drifts were rehabilitated by using a new tightly spaced rock-bolting pattern, as well as wire mesh and shotcrete. Total reserves at Myra Falls were reported to be 5.3 Mt grading 7.7% zinc, 1.6% copper, 0.7% lead, 56 g/t silver, and 2 g/t gold. In 1999, the mine produced 37,861 t of zinc in concentrate, as well as copper, gold, and silver in concentrate (Canada News Wire, February 1999, press release, accessed September 12, 2000, at URL <http://www.news.wire.ca/releases/February1999/08/c3952.html>).

China.—The Chinese Government updated its Mining Code in an attempt to lure more foreign investors. The changes will allow foreign mining companies to acquire a 100% equity interest in nondiamond exploration concessions, eliminate overlap in Government Departments, and streamline the permitting procedure. The new Mining Code states that mineral ownership belongs to the State, and royalty payments of 2% for base metals are mandatory. Exploration rights can be applied for and obtained through specific laws and regulations. Lease fees will be assessed according to the size of the area and the duration of exploration. The code also defines a minimum exploration investment and leasing fee for mining. Foreign companies exploring for diamond must form a joint venture with a Chinese company (Northern Miner, 1999a).

Billiton plc of United Kingdom may be the first foreign company to take advantage of this new Mining Code. It has reached an exclusive preliminary agreement with China's Yunnan Lanping Nonferrous Metals Co. Ltd. to develop the Lanping zinc project in western Yunnan Province. Under the terms of the agreement, a successful feasibility study would be followed by forming a joint venture that would build an integrated zinc-mining complex. In this joint venture, Billiton would hold majority ownership and operating rights. The deposit has the potential to be one of the largest lead-zinc mines in Asia; annual production could reach 200,000 t of refined zinc and 20,000 t of lead at a capital cost of \$500 million (Metal Bulletin, 1999b). Lanping was described as one of the world's last undeveloped zinc resources, and measured more than 200 Mt grading in excess of 10% zinc (Mining Journal, 2000a).

Chinese zinc producers were waiting expectantly for the news on the future of the country's zinc export licensing system. The Government has been restricting the issuance of zinc export licenses to avoid chaotic pricing and the possible decline of

zinc export prices owing to too many zinc suppliers wishing to earn foreign exchange. Also, according to domestic traders, many Chinese consumers often fail to pay on time, so suppliers would rather export at lower prices as long they are paid on time. In 1999, China exported 507,000 t of refined zinc, which was 153,000 t more than in 1998. In the longer term, Chinese zinc exports should decline gradually as a result of growing local consumption (Platt's Metals Week, 2000a).

India.—The state-owned Hindustan Zinc Ltd. (HZL), which was India's largest zinc producer, drafted a 5-year investment plan worth \$625 million shortly after the Government announced its desire to reduce its shareholding in the HZL from 76% to 51% by selling about 100 million shares worth about \$2.5 billion (American Metal Market, 1999f). The plan included expansion of the existing smelter at Dabri from 30,000 t to 50,000 t and adding 5,000 t to the annual capacity of the Vishakaptanam smelter. HZL also planned to build a new 100,000-t/yr-capacity greenfield smelter near Udaipur in Rajasthan and to modernize the mining operations at the Rampura-Agucha Mine, as well as explore the surrounding area for new deposits (American Metal Market, 1999i).

The Indian Government removed the restriction on imports of certain secondary zinc imposed in 1994 after the Basel Convention ban on international trade in hazardous wastes. The ban forced at least one-half of India's 40 secondary zinc processors to close down; as a result, primary zinc imports more than doubled (American Metal Market, 1999e). Lifting the ban on imports of secondary zinc will not greatly affect U.S. exports because India, with imports of 5,457 t, was a distant second to Taiwan, which imported 13,187 t of zinc scrap from the United States in 1999.

Ireland.—On January 15, Ireland's Supreme Court ruled in favor of Tara Mines Ltd., which was a wholly owned subsidiary of Finland's Outokumpu Oy, in its 13-year dispute with Bula Ltd., the Irish exploration group, over the ownership of the ore body associated with the Tara zinc mine at Navan in County Meath. About 15% of the reserves, which were discovered in 1970 by the Tara Exploration and Development Co., were located to the north of the Blackwater River where mineral rights had been acquired by Bula and a number of its shareholders. The Supreme Court dismissed claims filed by Bula that it had been prevented from independently developing its part of the Navan ore body and that it was pressured into selling its part of the ore body to Tara Mines at a price below market value (Mining Journal, 1999h).

In mid-July, the Tara Mine was on the verge of closure when a deal between Outokumpu and mine workers was made, which included a cut in the bonus payments of underground workers, increased shift flexibility, and voluntary elimination of a number of redundancies. The agreement will allow Tara to increase production by 20% to about 170,000 t/yr of zinc and 42,000 t/yr of lead and to proceed with the proposed deepening of the mine that could extend the life of the mine by 8 years (American Metal Market, 1999g). With a capacity of 175,000 t/yr, the Tara Mine was the largest zinc mine in Europe (Platt's Metals Week, 2000b).

On December 12, the Lisheen Mine in County Tipperary

shipped its first delivery of concentrate from the Port of Cork 3 months after commencement of operations. At full capacity, Minorco Lisheen Ltd., which was jointly owned by Ivernia West plc and Anglo American Corp., expected the mine to mill about 1.5 million metric tons per year of ore and to produce 190,000 t/yr of zinc in concentrate and 33,000 t/yr of lead in concentrate. The deposit, which has an estimated life of about 14 years, was discovered by Ivernia in 1990, and construction began in October 1997 (Mining Journal, 1999d). The deposit extends over 2 square kilometers with some 19 Mt of minable ore grading 13% zinc and 2.2% lead (Tony Roddam, January 27, 2000, Ireland zinc, accessed January 27, 2000, at URL <http://woza.co.za/reuters/jan00/zincireland27.html>).

Exploratory drilling at the Galmoy zinc-lead mine by Arcon Mines Ltd. of Ireland intersected mineralization grading in excess of 25% zinc. More than 10 holes were drilled without identifying the boundary of the new deposit. Since exploration started in 1995, Arcon has increased the resources and the reserve base at Galmoy by more than 60% to more than 10 Mt and expanded the mine's anticipated life from 10 years to 15 years (Mining Journal, 1999g).

Italy.—On March 15, Ente Nazionale Idrocarburi's Porto Vesme zinc smelter in Sardinia began operating at full capacity of 96,000 t/yr. The electrolytic zinc smelter had been closed since November 1998 for maintenance work, mainly for environmental reasons. Glencore International AG, which was the potential buyer, corrected the environmental deficiencies of the smelter, one of the prerequisites of the purchase. An estimated 36,000 t of production was lost during the temporary closure (Metal Bulletin, 1999h).

Cogefin, which was a consortium that acquired the 100,000-t/yr Pertusola Sud zinc smelter in Crotona, proposed a 3-year closure of the plant to undertake extensive modernization. The capacity of the smelter, which was owned by the former State oil and gas company giant Enirisorse SpA, would be increased to 180,000 t/yr (Platt's Metals Week, 1999e).

Kazakhstan.—Ennex International Ltd. of Ireland completed a feasibility study in July to construct a 100,000-t/yr zinc refinery in Kazakhstan. The project was based on the Shaimerden zinc deposit, and was 95% owned by Zinc Corp. of Kazakhstan, which was Ennex's subsidiary. The proven and probable resources available for open pit mining were estimated to be 43 Mt grading 20.9% zinc, and could allow from 4 to 10 years of mining. The entire project was expected to cost about \$285 million with a payback period of 4 to 5 years (Metal Bulletin, 1999d).

Mexico.—In 1999, Mexico's zinc mine production declined by about 9% to an estimated 360,000 t. The closure of the Real de Angeles Mine and lower production at the Charcas Mine was somewhat offset by increased production at San Martín and other operations.

Industrias Peñoles S.A. de C.V. of Mexico continued with the expansion of its Torreón smelter and refinery complex in the northern State of Coahuila with the construction of a third concentrate roaster. It will start up in the first quarter of 2000 and reach full capacity during the second quarter; this will increase the capacity of the zinc plant to 220,000 t/yr from

135,000 t/yr. In addition, Peñoles was developing and expanding several major zinc mines, several of which will start operating in time to feed concentrate to the enlarged plant. The Rey del Plata Mine in Guerrero was expected to open in 2000, and the Francisco I Madero Mine in Zacatecas will start producing the following year. The Madero deposit has ore reserves of 27.8 Mt that contain 1.4 Mt of zinc, 278,000 t of lead, and 1.2 t of silver (Metal Bulletin, 1999f). La Cienega, the Fresnillo, and the Tizapa Mines were being expanded, and together they will contribute 57,600 t/yr of zinc in concentrate for the Torreón smelter (Mining Bulletin Monthly, 1999).

Namibia.—Namibia's only zinc-producing mine, Rosh Pinah, is likely to expand in the near future. A 4-year ownership dispute has been resolved by establishing a new company called Rosh Pinah Zinc Corp. This new company was launched in May 1999 as an equal partnership between South Africa's Iscor Ltd., which was the mine operator, and PE (Private Enterprise) Minerals, which was awarded the mineral rights. The concentrate from Rosh Pinah had been sent to South Africa for processing. With a planned development of the nearby Skorpion zinc project, which is 20 km northwest of Rosh Pinah, current and possible additional output could be processed there, thus reducing transportation cost. Work on the Skorpion project, was expected to start in 2000 with the production start-up scheduled for 2002. Proven reserves of 17.5 Mt grading 10.4% zinc could support open pit mining of 1.5 Mt/yr of ore and refinery production of 150,000 t/yr. Calculated total mining life was estimated to be at least 14 years (Mining Journal, 1999e).

Peru.—The value of all Peruvian mine production and the value of mining products exported increased by 10% in 1999 (Mining Journal, 2000c). Production of zinc in concentrate increased to 899,457 t, and production of primary zinc reached 180,826 t. Because of inadequate refining capacity, only about 20% of domestic concentrate production was smelted and refined in Peru. This imbalance will further increase when production from the Antamina deposit begins near the end of 2001. According to domestic industry experts, Peruvian zinc mine production will almost double in the next 5 years. Because of this increasing imbalance, Peruvian experts were calling on the Government to take an active approach in attracting foreign investors or to encourage a local consortium to support the construction of a new refinery (Metal Bulletin, 1999g).

Comañía Minera Antamina, which was owned by Noranda (33.75%), Rio Algom Ltd. (33.75%), Teck Corp. (22.5%), and Mitsubishi Corp. (10%), was developing the \$2.26 billion Antamina deposit. Located 270 km north of Lima, the Antamina deposit was one of the largest copper-zinc ore bodies in the world. It contains estimated in-pit resources of 494 Mt grading 1.3% copper, 1% zinc, 0.3% molybdenum, and 12 g/t silver. The mine was expected to produce an average of 275,000 t/yr of copper and 165,000 t/yr of zinc during its 20 year life (Canada News Wire, March 1999, press release, accessed April 26, 1999, at URL <http://www.newswire.ca/releases/March 1999/26/c7543.html>). The waste-to-ore ratio will be 4 to 1 in the early years of mining and 2.4 to 1 for the

rest of the mine life (Northern Miner, 1999d).

The state-owned Empresa Minera del Centro del Peru S.A. (Centromin) approved a \$61.78 million bid by Peruvian polymetallic producer Compañía Minera Volcán S.A. for its Cerro de Pasco operation, which was Peru's largest zinc-lead-silver mine and Centromin's last major mining asset to be privatized. The acquisition will make Volcán the world's fifth-ranked zinc producer. Its combined annual production will total nearly 500,000 t of zinc concentrate, compared with 299,846 t in 1999 (Metal Bulletin, 2000a). Cerro de Pasco, which was renamed Paragsha after the purchase, included an open pit mine, which will be exhausted in 4 years; this will leave the mine functioning as an entirely underground operation with a 20-Mt reserve, two flotation plants, and a small copper cathode plant. The underground operation has a minimum mine life of 12 years and includes 30,000 ha of exploration properties above the highland city of Cerro de Pasco in the central Andes (Platt's Metals Week, 1999f).

Portugal.—The Aljustrel Mine, which is located in the Iberian Pyrite belt of southern Portugal, consisted of five deposits of which only the adjoining Feitais and Moinho deposits had been surveyed. On the basis of completed drilling results, the reserves at Feitais measured 12.2 Mt grading 5.67% zinc, as well as copper, lead, and silver. The Moinho zone, which has also been the source of previous zinc production, has remaining reserves of 1.6 Mt grading 4.48% zinc, as well as copper, lead, and silver (Northern Miner, 2000b). Once the feasibility study is completed, EuroZinc Mining Corp. will acquire a 75% interest from the state-owned Empresa de Desenvolvimento Mineiro, which was the owner of the properties. EuroZinc believed that it had the technology and know-how to make the mine profitable. The Aljustrel Mine closed in 1997 after two unprofitable years because of poor recoveries—about 40%.

Spain.—Plans to restart production at one mine, as well as expand and further develop two others, were expected to increase zinc output in Spain by nearly 300,000 t during the next 3 years compared with the beginning of 1999. Mining at the Boliden Ltd.'s Los Frailes Mine restarted in April 1999, a year after the collapse of the tailings dam that caused an estimated 6 million cubic meters of tailings to flow into surrounding rivers and fields, which caused one of the country's worst ecological disasters. It was expected to produce 124,000 t/yr of zinc in concentrate by using the exhausted Aznalcollar open pit as a new tailings storage (American Metal Market, 1999a).

Navan Resources plc began ore production at its Aguas Teñidas polymetallic mine in Andalucia. The mine has been under development since September 1997 at a cost of \$7.6 million. Aguas Teñidas was expected to produce 160,000 t of ore in 1999, and to rise to 400,000 t in 2000; full capacity of 650,000 t was expected by 2002 (Mining Journal, 1999b). This increase will come at the expense of Navan's older Sotiel Mine, where ore output will decline from 400,000 t in 2000 to 350,000 t the following year. By using a 5% zinc cut-off grade, the resource at Aguas Teñidas had been estimated at 9.65 Mt grading 8% zinc, 2.2% lead, 1.1% copper, and 75 g/t silver

(Mining Journal, 1999f).

Exploration.—According to the Metals Economics Group (MEG) of Halifax, Nova Scotia, worldwide expenditures in metal exploration declined during the past 2 years—31% in 1998 and an additional 23% in 1999—to a total of \$2.16 billion in 1999. MEG expected that exploration budgets will remain at a low level in the short term because of the lag between an upturn in commodity prices and increased investment in exploration. The 1999 base-metal exploration budgets of the 132 companies worldwide included in both the 1998 and 1999 exploration surveys by MEG totaled \$801 million, which was \$133 million less than that of 1998. A higher proportion of total exploration spending was, however, targeted toward base metals; spending rose to 37% in 1999 from 33% in 1998. Most of the base-metal exploration budget was directed toward copper exploration, followed by zinc and nickel. For the fifth consecutive year, Latin America was the most favored target for exploration. It accounted for 38% of total worldwide expenditures for base-metal exploration. Australia and Canada ranked second and third in the list of base-metal targets. MEG's breakdown by exploration site revealed that nearly 41% of exploration expenditures in the United States was used for seeking new resources within the vicinity of an existing mine. By contrast, grassroots exploration accounted for 33% of the total spent in the United States (Mining Journal, 2000b). The remaining 26% was for "late-stage and feasibility" expenditures, including drilling to quantify and define a known ore body (Metals Economics Group, 1999).

Outlook

The Western World is in the midst of a boom in the consumption and mining of zinc. A number of new mines, such as Antamina (Peru), Century, Queensland (Australia), George Fisher (Australia), and Lisheen (Ireland), are slated to come on stream. Because the zinc industry is reluctant to invest in new smelter capacity, concentrate surpluses as well as metal shortfalls are virtually certain. Owing to high demand, the deficit in the zinc market should last at least until 2001. Galvanizing will remain the main end-use driver behind the growth as the expansion of galvanized steel production grows, mainly in Asian countries; already in 1999, Thailand, Taiwan, and the Republic of Korea reported production gains of 17%, 14%, and 13%, respectively. Owing to economic recovery in former CIS (Commonwealth of Independent States) countries and continued growth of about 7% in China, exports from the former communist countries should decline, thus necessitating continued sale from stocks. With inventories remaining tight, the average price of zinc metal may reach \$1,390 per ton by 2001 (Standard Bank, 2000).

Although zinc demand may exceed supply during the next 2 years, the trend may be reversed after 2002. Already committed projects could increase smelter capacity by nearly 800,000 t/yr, which could reflect an annual rate of increase of 3% during the next 5 years. Concentrate surplus could change between 2002 and 2005, when a number of mines, such as Hellyer (Australia), Mt Isa (Australia), Polaris (Canada),

Suddles (Australia), Sullivan (Canada), and Reocin (Spain), are slated to close. In addition, a number of small mines may lose to larger mines in competition for markets (Platt's Metals Week, 2000c). The surplus of concentrate, coupled with the continuing struggle to determine treatment charges, may hasten corporate integration as companies with an excess of mine output acquire more smelter capacity.

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TABLE 1
SALIENT ZINC STATISTICS 1/

(Metric tons, unless otherwise specified)

	1995	1996	1997	1998	1999
United States:					
Production:					
Domestic ores, contained zinc	644,000	628,000	632,000	755,000	843,000
Domestic ores, recoverable zinc	603,000 r/	586,000 r/	592,000 r/	709,000 r/	808,000
Value, recoverable zinc	756,000	615,000	860,000	819,000	953,000
	thousands				
Refined zinc:					
From domestic ores	223,000	214,000	195,000	192,000	180,000
From foreign ores	8,840	11,400	31,700	41,900	61,100
From scrap	131,000	140,000	140,000 r/	134,000	131,000
Total	363,000	366,000	366,000 r/	368,000	371,000
Secondary zinc 2/	222,000	238,000	234,000	292,000 r/	267,000
Exports:					
Ores and concentrates (zinc content)	424,000	425,000	461,000	552,000	531,000
Slab zinc	3,080	1,970	3,630	2,330	1,880
Rolled zinc	5,180	5,020	9,110	9,920	3,870
Imports for consumption:					
Ores and concentrates (zinc content)	10,300	15,100	49,600	46,300	74,600
Refined (Slab) zinc	856,000	827,000	876,000	879,000	966,000
Rolled zinc	332	16,900	19,200	16,900	22,600
Stocks of slab zinc, December 31:					
Producer	7,120	11,100	9,360	9,060 r/	9,960
Consumer	64,400	59,700	60,400	45,400 r/	64,400
Merchant	6,440	4,800	18,500 r/	13,300	9,690
Total	78,000	75,600	88,200 r/	67,700 r/	84,100
Government stockpile	272,000	257,000	225,000	199,000	177,000
Consumption:					
Refined zinc:					
Reported	917,000	788,000	672,000	647,000	614,000
Apparent 3/	1,230,000	1,210,000	1,260,000 r/	1,290,000	1,340,000
All classes 4/	1,460,000	1,450,000	1,490,000 r/	1,580,000	1,610,000
Price: Special High Grade, cents per pound	56	51	65	51	53
World:					
Production:					
Mine	7,280	7,480	7,540 r/	7,680 r/	8,040 e/
Smelter	7,370 r/	7,560 r/	7,870 r/	8,120 r/	8,400 e/
Price: London Metal Exchange, cents per pound	47	47	60	46	49

e/ Estimated. r/ Revised.

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

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

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

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

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

(Metric tons)

State	1998	1999
Alaska 2/	473,000 r/	563,000
Missouri	49,200	48,700
Montana	24,900	22,200
Other 3/	162,000	173,000
Total	709,000 r/	808,000

r/ Revised.

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

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

3/ Includes production from Colorado, Idaho, New York, and Tennessee.

TABLE 3
LEADING ZINC-PRODUCING MINES IN THE UNITED STATES IN 1999, IN ORDER OF OUTPUT

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

1/ Includes Brushy Creek Mill

TABLE 4
REFINED ZINC PRODUCED IN THE UNITED STATES 1/

(Metric tons)

	1998	1999
Primary:		
From domestic ores	192,000	180,000
From foreign ores	41,900	61,100
Total	234,000	241,000
Secondary	134,000	131,000
Grand total (excludes zinc recovered by remelting)	368,000	371,000

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

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

(Metric tons)

Grade	1998	1999
Special High	91,900	93,400
Continuous Galvanizing	105,000	103,000
Other 2/	171,000	175,000
Total	368,000	371,000

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

2/ Includes Controlled Lead, High, and Prime Western grades.

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

(Metric tons)

Type of plant and company	1998	1999
Electrolytic:		
Big River Zinc Corp., Sauget, IL	85,000	95,000
Pasminco Limited, Clarksville, TN	105,000	115,000
Electrothermic:		
Zinc Corp. of America, Monaca, PA 1/	155,000	155,000
Total	345,000	365,000

1/ Includes secondary capacity.

TABLE 7
STOCKS AND CONSUMPTION OF NEW AND OLD ZINC SCRAP IN THE UNITED STATES IN 1999, BY TYPE OF SCRAP 1/

(Metric tons, zinc content)

Type of scrap	Stocks, January 1	Receipts	Consumption			Stocks, December 31
			New scrap	Old scrap	Total	
Diecastings	1,790	W	--	W	W	W
Flue dust	W	21,300	10,300	10,300	20,600	W
Galvanizer's dross	W	W	W	--	W	2,830
Old zinc 2/	179	294	--	296	296	W
Remelt die-cast slab	279	W	--	W	W	W
Remelt zinc 3/	571	W	W	--	W	177
Skimmings and ashes 4/	W	W	27,200	--	27,200	W
Other 5/	7,160	174,000	94,500	54,400	149,000	5,830
Total	9,990	196,000	132,000	65,000	197,000	8,840

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 sal skimmings and die-cast skimmings.

5/ Includes chemical residues and solutions, electrogalvanizing anodes, fragmented diecastings, and steelmaking dust.

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

(Metric tons)

Products	1998	1999
Redistilled slab zinc	134,000	131,000
Other zinc metal products 2/	5,820 r/	4,950
Zinc in chemical products	102,000	94,300
Zinc dust	19,600	3,010

r/ Revised.

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

2/ Includes electrogalvanizing anodes, remelt die-cast slab, and other metal alloys.

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

(Metric tons)

	1998	1999
Type of scrap:		
New scrap:		
Zinc-base	159,000	128,000
Copper-base	185,000 r/	192,000
Magnesium-base	83 r/	83 e/
Total	344,000	321,000
Old scrap:		
Zinc-base	65,800	62,300
Copper-base	16,000 r/	14,700
Aluminum-base	718	668
Magnesium-base	7,390 r/	7,400 e/
Total	89,900 r/	85,100
Grand total	434,000 r/	406,000
Form of recovery:		
Metal:		
Slab zinc	134,000	131,000
Zinc dust	19,600	3,010
Total	153,000 r/	134,000
In brass and bronze	172,000 r/	172,000
In chemical products:		
Zinc oxide (lead free)	64,200	35,900
Zinc sulfate	12,400	34,400
Zinc chloride	W	W
Miscellaneous 2/	32,200 r/	29,600
Total	281,000 r/	272,000
Grand total	434,000 r/	406,000

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

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

2/ Includes electrogalvanizing anodes and zinc content of slab made from remelt die-cast slab.

TABLE 10
U.S. CONSUMPTION OF ZINC 1/

(Metric tons)

	1998	1999
Refined zinc, apparent	1,290,000	1,340,000
Ores and concentrates (zinc content)	1,020	986
Secondary (zinc content) 2/	292,000 r/	267,000
Total	1,580,000	1,610,000

r/ Revised.

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

2/ Excludes secondary slab zinc and remelt zinc.

TABLE 11
U.S. REPORTED CONSUMPTION OF ZINC IN 1999, BY INDUSTRY USE AND GRADE 1/

(Metric tons)

Industry use	Special High Grade	High Grade	Prime Western	Remelt and other grades	Total
Galvanizing	111,000	40,500	101,000	55,100	308,000
Zinc-base alloys	105,000	--	W	W	105,000
Brass and bronze	40,500	W	21,200	W	78,200
Other	60,600	17,900	61,500	243	124,000
Total	317,000	58,400	184,000	55,400	614,000

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.

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

(Metric tons)

	1998		1999	
	Production	Shipments	Production	Shipments
Zinc oxide	138,000	138,000	114,000	116,000
Zinc sulfate	14,400	14,600	35,400	33,700

1/ Excludes leaded zinc oxide, lithopone, and zinc chloride.

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

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

(Metric tons)

	1998	1999
Ceramics	6,070	5,100
Chemicals	26,200	23,300
Paints	7,130	5,610
Rubber	93,500	76,600
Other 3/	5,360	5,020
Total	138,000	116,000

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

2/ In addition, zinc contained in zinc oxide was imported as follows: 1998-58,918 and 1999-65,203; distribution cannot be distinguished by industry.

3/ Includes agriculture and photocopying.

TABLE 14
U.S. EXPORTS OF ZINC ORES AND CONCENTRATES, BY COUNTRY 1/

	1998		1999	
	Quantity (metric tons, zinc content)	Value (thousands)	Quantity (metric tons, zinc content)	Value (thousands)
Australia	--	--	24,400	\$10,800
Belgium	117,000	\$56,000	219,000	96,100
Canada	179,000	71,400	61,000	83,400
Germany	33,000	14,600	32,700	14,600
Italy	1,130	1,240	1,300	1,250
Japan	60,400	31,500	123,000	69,300
Korea, Republic of	69,800	30,000	51,000	23,900
Mexico	2,140	1,540	5,080	2,160
Netherlands	33,400	14,800	--	--
Russia	10,000	3,890	--	--
Spain	24,900	10,800	76	43
United Kingdom	20,900	12,200	14,100	14,700
Other	36 r/	88 r/	81	194
Total	552,000	248,000	531,000	317,000

r/ Revised. -- Zero.

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

Source: U.S. Census Bureau.

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

	1998		1999	
	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)
Zinc chloride	1,940	\$1,290	3,200	\$2,140
Zinc compounds, n.s.p.f.	305	1,170	864	3,280
Zinc oxide	6,210	11,300	7,260	11,700
Zinc sulfate	4,380	2,780	4,750	2,940

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

Source: U.S. Census Bureau.

TABLE 16
U.S. IMPORTS FOR CONSUMPTION OF ZINC COMPOUNDS 1/

	1998		1999	
	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)
Lithopone	1,120	\$1,400	1,180	\$1,070
Zinc chloride	1,570	1,520	1,650	1,520
Zinc compounds, n.s.p.f.	4	7	34	32
Zinc hydrosulfite	101	371	100	239
Zinc oxide	58,900	60,100	65,200	66,600
Zinc sulfate	10,400	5,940	10,500	6,350

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

Source: U.S. Census Bureau.

TABLE 17

ZINC: WORLD MINE PRODUCTION (ZINC CONTENT OF CONCENTRATE AND DIRECT SHIPPING ORE UNLESS NOTED), BY COUNTRY 1/ 2/

(Metric tons)

Country	1995	1996	1997	1998	1999 e/
Algeria	7,174	5,912	3,960 r/	4,555 r/	5,000
Argentina	32,104	31,093	33,357	35,560	35,760 3/
Australia	937,000	1,071,000	1,036,000	1,059,000	1,163,000 3/
Bolivia	146,131	145,092	154,491	152,110	150,000
Bosnia and Herzegovina e/	300	300	300	300	300
Brazil	188,472	117,343	152,636	87,474 r/	96,500 3/
Bulgaria	26,000	19,800	20,000 e/	17,000 r/ e/	12,000
Burma	721	572	467	474 r/	279 3/
Canada	1,121,172	1,222,388	1,076,385	1,061,645 r/	1,008,955 p/
Chile	35,403	36,004	33,934	15,943	32,263 3/
China e/	1,010,000	1,120,000	1,200,000	1,273,000 r/ 3/	1,368,000 3/
Ecuador e/	100	100	100	100	100
Finland	16,385	26,294	30,800	30,000	30,000
Georgia e/	700	500	200 r/	200 r/	200
Greece	14,500 e/	13,602	17,800 e/	29,100 r/	18,900 3/
Honduras	27,100	37,000	39,500	36,639 r/	40,996 3/
India	154,500	148,200	142,000	143,000	145,000
Iran	145,100	76,300 r/	76,500 r/	82,000 r/	80,000
Ireland	184,118	164,168	194,796	182,000	226,000 3/
Italy	15,140	11,055	8,470	2,500 r/ e/	--
Japan	95,274	79,709	71,569	67,670	64,000
Kazakhstan	225,000	225,000	224,051 r/	224,300 r/	288,300
Korea, North e/	210,000	210,000	210,000	200,000	190,000
Korea, Republic of	7,747	8,384	8,992	20,977 r/	19,664 3/
Macedonia e/	15,000	15,017 3/	15,000	8,000	20,000
Mexico	363,658	377,599	379,252	395,391	360,000
Morocco	79,947	79,662	89,248	112,000 r/	115,000
Namibia	30,209	35,873	39,658 r/	42,142 r/	37,000
Norway	18,985	17,182	15,800 r/	14,100 r/	12,000
Peru	692,290	760,563	865,267	868,958	899,457 3/
Poland	154,500	159,000	158,300 r/	155,000 e/	153,000
Romania	34,730	32,082	29,366	30,000 e/	25,000
Russia	131,000	126,000	121,000 e/	115,000 e/	132,000
Saudi Arabia e/	500	500	619 3/	650 r/	650
Serbia and Montenegro	3,195	12,000 r/	13,000 r/	14,000 r/	3,000
Slovakia e/	2,800	-- r/	-- r/	-- r/	-- 3/
South Africa	70,241	76,853	71,062	69,630 r/	69,733 3/
Spain	172,469	140,100	171,800	128,100	110,000 3/
Sweden	167,090	160,325	155,400	164,711	175,000
Thailand	16,200	11,375 r/	8,894 r/	19,563 r/	27,048 3/
Tunisia	44,244	31,920	2,967	31,368	51,000
Turkey 5/	9,118	14,921	12,500 e/	13,000 e/	5,000
United States	644,000	628,000	632,000	755,000	843,000 3/
Uzbekistan e/	15,000	12,000	-- 6/	-- 6/	-- 6/
Vietnam e/	14,000	16,000	18,000	18,000	24,000
Total	7,280,000	7,480,000	7,540,000 r/	7,680,000 r/	8,040,000

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.

2/ Table includes data available through June 30, 2000.

3/ Reported figure.

4/ Formerly Zaire.

5/ Content in ore hoisted.

6/ Mining operations appear to have been sharply curtailed or to have ceased.

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

(Metric tons)

Country	1995	1996	1997	1998	1999 e/
Algeria, primary and secondary e/	30,000	30,000 r/	29,300 3/	31,000 r/	34,000
Argentina:					
Primary	35,767	36,392	38,672	38,677	36,000
Secondary e/	2,800	2,900	3,100	3,100 3/	2,500
Total	38,567	39,292	41,772	41,777	38,500
Australia:					
Primary 4/	320,000	326,000	307,000	312,000	338,000 3/
Secondary e/	4,500	4,500	10,000	10,000	10,000
Total e/	325,000	331,000	317,000	322,000	348,000
Belgium, primary and secondary	301,100	234,400	244,000 e/	205,000 r/	232,400 3/
Brazil:					
Primary	198,976	186,339	185,701	185,700	168,332 3/
Secondary e/	7,000	7,000	7,000	7,000	7,000
Total	205,976	193,339	192,701	192,700	175,332 3/
Bulgaria, primary and secondary	68,796	68,018	70,420	72,755 r/	84,000
Canada, primary	720,346	715,553	703,798	745,131 r/	784,767 p/
China, primary and secondary e/	1,080,000	1,180,000	1,430,000 r/	1,490,000 r/	1,700,000
Czech Republic, secondary e/	1,000	1,000	1,000	1,000	1,000
Finland, primary	176,600	176,300	175,300	199,000 r/	225,200 3/
France, primary and secondary e/	300,000	324,300 3/	346,000	321,000	340,000
Germany, primary and secondary	322,460	327,015	251,700	334,000 e/	330,000
India:					
Primary	146,500	143,600	159,000 e/	171,900	175,000
Secondary e/	24,000	24,000	24,000	25,000	25,000
Total e/	171,000	168,000	183,000	197,000	200,000
Italy, primary and secondary	180,400	269,000	227,700	231,600 r/	152,800 3/
Japan:					
Primary	573,912	500,674	500,603	513,916	433,490 3/
Secondary	137,139	141,593	149,605	138,771 r/	131,494 3/
Total	711,051	642,267	650,208	652,687 r/	564,984 3/
Kazakhstan, primary and secondary	169,200	190,000	188,996 r/	241,551 r/	247,000
Korea, North, primary e/	200,000	200,000	200,000	180,000 r/	180,000
Korea, Republic of, primary	279,335	286,526	335,488	390,260 r/	430,108 3/
Macedonia, primary and secondary	21,335	38,000 r/ e/	53,000 r/	57,000 r/ e/	48,000 3/
Mexico, primary	222,748	221,736	231,444	230,325 r/	220,000
Netherlands, primary 5/	206,300	207,100	201,100	218,700	220,000
Norway, primary	121,576	134,900	137,400	128,000 r/ e/	130,000
Peru, primary	158,987	173,139	171,691	174,654	180,826 3/
Poland, primary and secondary	162,700	163,100	171,000 r/	175,000 r/ e/	178,000 3/
Portugal, primary e/	4,000	3,600	3,600	3,600 r/	6,000
Romania, primary and secondary	29,300	28,162 r/	30,226 r/	29,427 r/	25,000
Russia, primary and secondary e/	166,000	172,000	189,000	192,000 r/	225,000
Serbia and Montenegro, primary and secondary	5,976	29,954	29,454	14,000 r/ e/	6,000
Slovakia, secondary e/	1,000	1,000	1,000	1,000	1,000
Slovenia, primary and secondary e/	2,500	2,000	--	--	--
South Africa, primary	98,782	101,100	108,500 r/	107,400 r/	114,000
Spain, primary and secondary	358,000	360,800	364,200	360,000 r/ e/	375,000
Thailand, primary	46,398	59,738	72,036	75,904 r/	75,639 3/
Turkey, primary	17,050	22,392	37,074 r/	36,716 r/	27,000
Ukraine, secondary e/	5,000	2,000	2,000	--	--
United Kingdom, primary and secondary	105,998	96,867	107,704	100,000 e/	130,000
United States:					
Primary	232,000	226,000	226,000	234,000	241,000 3/
Secondary	131,000	140,000	140,000	134,000	131,000 3/
Total	363,000	366,000	367,000	368,000	371,000 3/

See footnotes at end of table.

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

(Metric tons)

Country	1995	1996	1997	1998	1999 e/
Uzbekistan, primary e/	70,000	45,000 r/	53,000 r/	52,000 r/	27,000
Grand total	7,370,000 r/	7,560,000 r/	7,870,000 r/	8,120,000 r/	8,400,000
Of which:					
Primary	3,760,000 r/	3,720,000 r/	3,790,000 r/	3,950,000 r/	3,980,000
Secondary	313,000	324,000	338,000	320,000	309,000
Undifferentiated	3,300,000	3,520,000 r/	3,740,000 r/	3,850,000 r/	4,100,000

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.

2/ 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 June 30, 2000.

3/ Reported figure.

4/ Excludes zinc dust.

5/ Sales.