



2014 Minerals Yearbook

ZINC [ADVANCE RELEASE]

ZINC

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In 2014, U.S. mine production of recoverable zinc was 803,000 metric tons (t), 6% more than that of 2013 (table 1). The value of domestic mine production was approximately \$1.90 billion. Alaska continued to be the dominant zinc-producing State, followed by, in descending order of quantity, Tennessee, Missouri, Idaho, and Washington. The United States exported most of its zinc mine production (644,000 t) to foreign smelters for processing. Leading destinations for domestic exports of zinc contained in concentrates were Canada (35%), the Republic of Korea (14%), Spain (11%), Australia (10%), Japan (9%), and Belgium (8%) (table 6). Imports for consumption of zinc contained in concentrates were significantly less than exports and continued to decrease as the one remaining domestic primary zinc smelter increased its consumption of secondary materials and domestically sourced zinc concentrates (table 1). Estimated U.S. refined zinc production in 2014 decreased by 23% (53,200 t) to 180,000 t owing to a decrease in secondary production (table 1). Imports of refined zinc in 2014 increased by 13% to 805,000 t and were sourced primarily from Canada (55%), Australia (14%), and Mexico (13%) (table 1). Domestic exports of refined zinc increased by 8,280 t to 19,800 t in 2014 (table 1). Apparent consumption of refined zinc increased by 3% from that of the prior year to 965,000 t (table 1). Most reported refined zinc consumption was for galvanizing, and other major end uses were brass and bronze and zinc-base alloys (table 5). Global zinc mine production increased slightly to 13.3 million metric tons (Mt), and zinc metal production increased by 3% to 13.2 Mt (tables 9, 10). According to data from the International Lead and Zinc Study Group (ILZSG), global zinc metal consumption increased by 4% in 2014 to 13.7 Mt, exceeding ILZSG's tabulated metal production of 13.5 Mt by about 224,000 t (International Lead and Zinc Study Group, 2015c, p. 44, 47).

Legislation and Government Programs

A U.S. Government stockpile of refined zinc has been maintained since 1967 for national defense purposes. Public Law 102-484, signed in 1992, authorized the disposal of the entire inventory of zinc from the National Defense Stockpile (NDS). Sales of zinc from the NDS, however, were suspended in August 2008 owing to concerns regarding domestic availability and access to various raw materials. At yearend 2014, the reported inventory of zinc remained at 7,250 t.

Production

Mine.—In 2014, zinc was produced in five States; Alaska was the leading zinc-producing State, followed by Tennessee, Missouri, Idaho, and Washington. Domestic mine production of recoverable zinc in 2014 was 803,000 t, a 6% increase from that

of 2013 (table 1). Domestic mine production data were collected by the U.S. Geological Survey (USGS) from a voluntary survey of base-metal lode-mine production. Of the 15 mines surveyed, 15 reported, accounting for 100% of the USGS production total.

Alaska.—Teck Alaska Inc. (a subsidiary of Teck Resources Ltd., Canada) operated the open pit Red Dog zinc-lead mine in the Northwest Arctic Borough, the leading zinc-producing mine in the United States (table 3). The Red Dog property consists of several sedimentary-exhalative lead-zinc sulfide ore bodies. Zinc in concentrate production at Red Dog increased by 8% to 596,000 t in 2014 from 551,000 t in 2013 owing to an increase in the average annual mill recovery rate and a record-high mill throughput, which occurred as a result of processing softer ores from the recently developed Aqqaluk deposit. Approximately 30% of the zinc concentrates produced at Red Dog was refined at Teck's metallurgical complex at Trail, British Columbia, Canada. The remaining concentrates were exported to Asia and Europe. Most of Red Dog's concentrates were sold through long-term contracts, with the balance sold on the spot market. Reported reserves at yearend 2014 contained 7.10 Mt of zinc, and mine life was expected to extend for 17 years to 2031, with production declines beginning in 2020. Teck projected that zinc in concentrate production at Red Dog would decline in 2015 to between 540,000 and 565,000 t (Teck Resources Ltd., 2015a, p. 33, 34, 41; 2015b, p. 27).

Hecla Mining Co.'s (Coeur d'Alene, ID) underground Greens Creek Mine recovered metals from a polymetallic (gold-lead-silver-zinc) massive sulfide deposit on Admiralty Island in the Tongass National Forest near Juneau. The mine produced gold and silver dore, as well as bulk lead-zinc, lead, and zinc concentrates that were sold globally to smelters. Zinc in concentrate production rose by 4% from that of 2013 to 54,300 t owing to an increase in the average zinc ore grade and mill recovery rate. During the year, surface drilling work in the nearby Killer Creek area confirmed the existence of high-grade copper, silver, and zinc mineralization. According to Hecla, the new resource may extend Greens Creek's mine life for 3 to 5 years past its current expected mine life of 9 years. In 2015, Hecla planned to continue its drilling program at Greens Creek, focusing on the Killer Creek and High Sore areas, and continue to improve mill recovery rates. Yearend reserves at Greens Creek contained 581,000 t of zinc (Hecla Mining Co., 2015a, p. 4, 9; 2015b, p. 16, 30).

Idaho.—Hecla operated the Lucky Friday Mine, an underground silver-lead-zinc mine in the Coeur d'Alene mining district in northern Idaho, which produced silver-lead concentrate and zinc concentrate. In 2014, zinc production increased by 3,960 t to 7,400 t following a rampup to full production in September 2013. The mine reopened in February 2013 after production and exploration activities at

the mine had been suspended for 14 months as Hecla removed loose, built-up material in the primary shaft. All concentrates were sent to Teck's metallurgical facility in Trail for processing (Hecla Mining Co., 2015b, p. 30–31).

Missouri.—Doe Run Resources Corp. (St. Louis, MO) operated a series of production shafts that ran along the Viburnum Trend within the Mississippi Valley-type (MVT) lead-zinc-copper ore bodies in southeast Missouri. In 2014, Doe Run processed ore from the Brushy Creek, Buick, Fletcher, Sweetwater, and Viburnum (#29 and #35) Mines at four mills to produce primarily lead concentrates and, to a lesser extent, zinc and copper concentrates.

Tennessee.—Nyrstar NV (Belgium) owned and operated the East Tennessee and Middle Tennessee zinc mine complexes that recovered ore from MVT zinc deposits. The two mine complexes produced zinc concentrates, of which the Middle Tennessee concentrates contained a recoverable amount of gallium and germanium. Zinc in concentrate production at the two complexes decreased by 8% from that of 2013 to 111,000 t owing to equipment issues and changes to underground mine cycle times. Production at the East Tennessee mine complex (the Coy Mine, Immel Mine, and Young Mine and mill) decreased by 11% to 63,500 t, and production at the Middle Tennessee mine complex (the Cumberland Mine, Elmwood Mine, and Gordonsville Mine and mill) decreased by 6% to 47,400 t. Concentrates were sent to Nyrstar's Clarksville, TN, zinc refinery for processing. Total (proven and probable) zinc reserves at yearend were 184,000 t at East Tennessee and 89,300 t at Middle Tennessee (Nyrstar NV, 2015a, p. 49–50; 2015b).

Washington.—In December, Teck reopened the Pend Oreille Mine and began shipping lead and zinc concentrates to its nearby metallurgical facility in Trail for processing. Pend Oreille is a carbonate-hosted zinc-lead ore body near Metaline Falls in northeast Washington State. The mine opened in 2004 and was placed on care-and-maintenance status in February 2009 owing to low zinc prices at the time. In early 2014, Teck announced plans to restart the mine in anticipation of future market conditions, including a series of expected global zinc mine closures by yearend 2016 totaling about 1.5 million metric tons per year (Mt/yr) of zinc production. Pend Oreille's full production rate was 44,000 metric tons per year (t/yr) of zinc in concentrate, and Teck projected that the mine would produce 40,000 t of zinc in concentrate in 2015. Reported reserves at yearend 2014 contained 220,000 t of zinc, and the mine life was expected to be at least 5 years (Teck Resources Ltd., 2014; 2015a, p. 34, 41).

Smelter.—In 2014, refined zinc was mainly produced in three States: North Carolina (Horsehead Holding Corp.'s Mooresboro facility), Pennsylvania (Horsehead's Monaca zinc smelter) and Tennessee (Nyrstar's Clarksville zinc refinery). Zinc metal was also produced to a lesser extent by U.S. Zinc Corp.'s (owned by Votorantim Metais, Brazil) recycling operations in Coldwater, MI, and Houston, TX. Refined zinc production in 2014 decreased by 23% from that of 2013 to 180,000 t owing primarily to a decline in secondary production (table 1).

Primary.—Nyrstar's Clarksville electrolytic zinc refinery (122,000 t/yr capacity) was the only primary zinc smelter

in the United States. Clarksville's feed mix was mostly zinc concentrate from its Tennessee mines, and the balance was imported zinc concentrates and domestically sourced secondary crude zinc oxide. Refined zinc production at Clarksville in 2014 increased by 4% from that of 2013 to 110,000 t. Clarksville produced Special High Grade (SHG) and Continuous Galvanizing Grade (CGG) zinc. Byproducts included cadmium metal, copper cementate, copper sulfate, germanium leach product, synthetic gypsum, and sulfuric acid. In 2014, Nystar completed a feasibility study for a reclamation and dewatering plant at Clarksville that would treat the smelter's byproduct residues for the eventual recovery of minor metals. Project development was expected to begin in 2015 (Nyrstar NV, 2015a, p. 27, 52).

Secondary.—In April, Horsehead permanently shut down all operations at its electrothermic zinc smelter in Monaca, PA, and in May, began producing zinc at its new solvent extraction–electrowinning (SX–EW) facility in Mooresboro, NC. The plant generated SHG and CGG zinc in addition to Prime Western-grade (PW) zinc, which allowed Horsehead to sell to new customers, including continuous galvanizers and diecasters. The plant had a capacity of approximately 160,000 t/yr of zinc and was expected to produce about 140,000 t/yr of zinc. According to Horsehead, the new SX–EW technology would reduce manufacturing costs compared with the electrothermic technology employed at the Monaca facility owing to higher labor productivity and zinc recovery rates, and lower energy use and maintenance costs. Mooresboro produced 17,900 t of zinc metal in 2014; rampup was slower than anticipated owing to several technical issues (Horsehead Holding Corp., 2015, p. 2, 8).

Feedstock for Horsehead's metal production, which consisted entirely of secondary materials, was mostly sourced from the company's electric arc furnace (EAF) dust recycling operations. EAF dust is a waste product recovered from the air flow exiting EAFs during the steel recycling process and typically contains 10% to 20% zinc. Horsehead's four EAF dust recycling operations were in Barnwell, SC; Calumet, IL; Palmerton, PA; and Rockwood, TN. Horsehead also sourced secondary zinc oxides from ThirtyOx LLC (Forest City, NC), a joint venture formed between Horsehead and Imperial Zinc Corp. (Chicago, IL) in December 2013. ThirtyOx began production in August 2014 and processed zinc-bearing residues from zinc metal consumers into oxides (Horsehead Holding Corp., 2015, p. 8, 38).

U.S. Zinc produced PW zinc and CGG zinc, respectively, at its zinc recycling facilities in Houston, TX, and Coldwater, MI. Feed materials were mainly top dross from continuous galvanizers and bottom dross and skimmings from general galvanizers. U.S. Zinc also produced zinc dust in Houston and zinc oxide at two recycling facilities in Tennessee (U.S. Zinc Corp., undated).

Consumption

Changes in zinc consumption generally follow trends in industrial production or, more generally, economic growth. Domestic apparent consumption of zinc in 2014 was 965,000 t, a 3% increase from apparent consumption in 2013

(table 1), owing to continued growth in residential construction and an increase in automotive vehicle production.

According to reported data, most of the zinc consumed domestically in 2014 was for the production of galvanized (zinc-coated) steel (table 5). Reported zinc consumption data were collected by the USGS from a voluntary survey on consumption of zinc by grade and end use. Galvanized steel is used extensively in the automotive and construction industries. Most of the zinc consumed domestically for galvanizing was at continuous galvanizing plants, where steel sheet passes through a molten zinc bath at high speeds. There were an estimated 46 continuous galvanizing plants operated by 18 companies in the United States. The balance of zinc consumed for galvanizing was at general galvanizing plants, where fabricated steel shapes (for example, structural beams or fasteners) were immersed in a molten zinc bath individually or by batch. There were about 180 general galvanizing plants operated by 80 companies in the United States in 2014.

In July, OAO Severstal (Russia) announced that it had entered into agreements to sell its two U.S. steel production plants—both with approximately 1 Mt/yr of continuous galvanized sheet production capacity. Pending fulfilling closing conditions and regulatory approval, AK Steel Corp. (West Chester, OH) would acquire Severstal's Dearborn, MI, plant for \$700 million, and Steel Dynamics Inc. (SDI) (Fort Wayne, IN) would acquire the Columbus, MS, plant for \$1.63 billion. Both AK Steel and SDI stated that the plants would enhance their ability to supply steel products to the automotive market, and SDI's acquisition of the Columbus, MS, plant would allow the company to expand its market presence into the Southern United States and Mexico (AK Steel Corp., 2014; Steel Dynamics Inc., 2014). SDI operated six continuous galvanizing lines, three in Indiana and three near Pittsburgh, PA, and AK Steel produced galvanized sheet at its plants in Ashland, KY, Middletown, OH, and Rockport, IN.

Big River Steel LLC (Osceola, AR) began construction of a \$1.1 billion steel mill in Osceola, AR, in September. The steel mill would produce cold-rolled, cold-rolled motor lamination, galvanized, hot-rolled, and hot-rolled pickled and oiled steels for the automotive industry, electrical market, and pipe and tube industry. Initial production was expected to begin in the second quarter of 2016 (Cowden, 2014).

Other major end uses of zinc included brass and bronze, chemicals, semimanufactures, and zinc-base alloys. According to the Copper Development Association Inc. (2015), about 171,000 t of zinc was consumed for the production of brass (copper-zinc alloy) and bronze (copper-tin alloy with a small amount of zinc) in 2014, a 3% increase from that of 2013.

Leading zinc chemicals, by production volume, included zinc oxide, which is used extensively in the tire manufacturing industry as an activator in the vulcanization process, and zinc sulfate, which is used as a micronutrient additive in animal feed and fertilizers. Leading zinc oxide producers included U.S. Zinc and Zinc Oxide LLC (Dickson, TN). Zinc Oxide began production at a new 40,000-t/yr zinc oxide plant during the year. The plant used the French Process, producing zinc oxide from zinc metal and secondary zinc materials (Isenberg-O'Loughlin, 2013; Zinc Oxide LLC, 2014). In late

October, U.S. Zinc announced that it had completed the last phase of an expansion program with the installation of a new furnace at its Millington, TN, zinc oxide production plant, increasing the plant's zinc oxide production rate by 8,000 t/yr. The first phase, which increased the zinc oxide production rate at its Clarksville plant by 9,000 t/yr, was completed in early 2014 (U.S. Zinc Corp., 2014). Horsehead ceased production operations at its 82,000-t/yr zinc oxide plant at the Monaca smelter in December 2013.

Zinc semimanufactures included mainly zinc sheet, also known as rolled zinc, which is used in architectural applications and for the production of the U.S. 1-cent coin. Zinc-base alloys were predominantly used to make die-cast parts and components.

Stocks

Reported producer and consumer stocks of zinc in the United States increased by 22% to 90,000 t in 2014. Commodity exchange inventories [London Metal Exchange Ltd. (LME) and the Shanghai Futures Exchange (SHFE)] totaled 774,000 t of zinc at yearend 2014. Global LME warehouses held 690,825 t of zinc at the end of 2014, a 26% decrease (240,350 t) from the yearend 2013 stock level. LME warehouses in New Orleans, LA, held 89% of yearend stocks, and warehouses in Detroit, MI, held 4%. Month-end stocks of zinc in New Orleans warehouses fluctuated significantly throughout the year, increasing by more than 90,000 t in March and August and decreasing by around 50,000 t in February, April, and October. Stocks of zinc in Baltimore, MD, and Detroit warehouses steadily decreased in 2014, with the stock level declining from 109,025 t to 28,850 t in Detroit, and from 3,750 t to 0 t in Baltimore. At yearend 2014, the SHFE held 83,000 t of zinc, a 65% decrease (156,000 t) from that of 2013 (International Lead and Zinc Study Group, 2015c, p. 55).

Aside from the United States, China was the only other country known to hold a Government stockpile of zinc. China's State Reserve Bureau (SRB) manages its stockpile, which contained 254,000 t of zinc at yearend 2014, unchanged from the stock level at yearend 2013 (International Lead and Zinc Study Group, 2015c, p. 55).

Prices

The annual average LME cash price for SHG zinc in 2014 increased by 13% from that of 2013 to \$2,161.67 per metric ton (98.05 cents per pound). Prices decreased slightly in the first quarter, averaging \$2,038.11 per metric ton (92.45 cents per pound) in January and falling to an average of \$2,014.07 per metric ton (91.36 cents per pound) in March. Monthly average prices increased for the next 5 months, reaching a high of \$2,328.88 per metric ton (105.64 cents per pound) in August, before decreasing to an average of \$2,171.36 per metric ton (98.49 cents per pound) in December. According to CRU, with a significant reported and unreported inventory overhang in the market, supply fundamentals did not account for the price increase. Rather, they speculated that anticipated mine closures in 2015 encouraged investor interest and higher prices (CRU International Ltd., 2014, p. 37).

The annual average Platts North American price for SHG zinc in 2014, which was based on the LME cash price plus a regional North American premium, was 107.12 cents per pound, 12% more than that in 2013 (table 1). Monthly average North American SHG premiums generally decreased during the year, averaging about 9.3 cents per pound in January through April and decreasing to around 8.8 cents per pound in December. Decreasing premiums are generally indicative of a growing supply of zinc in a regional market.

World Review

Mine production.—Growth in global zinc mine production in 2014 continued to slow, increasing minimally from that of 2013 to 13.3 Mt, its slowest rate of increase in 6 years. China (37% share of global production), Australia (12%), and Peru (10%) continued to be the three leading producers of zinc in concentrate in 2014. China had the largest increase in zinc mine production in 2014, increasing by 200,000 t from that of the previous year; however, this was less than the year-on-year increases in the past 5 years. Outside of China, zinc mine production also increased significantly in the United States (47,200 t), Sweden (45,300 t), Bolivia (41,300 t), Australia (38,000 t), and Burkina Faso (32,800 t). Zinc mine production decreased notably in India (87,000 t), Canada (73,300 t), Ireland (43,700 t), Peru (32,600 t), and Namibia (29,900 t) (table 9).

Although mine production increased only minimally in 2014, three zinc-producing mines were opened, and six mine expansion projects were completed, totaling 454,000 t/yr of additional zinc mine capacity. Most of this capacity was added in Australia with the expansion of Glencore's George Fisher and McArthur River Mines. Other notable capacity additions included the opening of Zijin Mining Group Co. Ltd.'s (China) Kyzyl Tashty polymetallic mine in Russia, and the expansion of Boliden AB's (Sweden) Garpenberg Mine in Sweden. Partially offsetting these additions was the closure of TVI Pacific Inc.'s (Canada) Canatuan Mine in the Philippines owing to resource depletion (International Lead and Zinc Study Group, 2015b, p. 35).

Metal production.—Global zinc metal production increased by 3% in 2014 from that of the prior year to 13.2 Mt (table 10). China (42% share of global production), the Republic of Korea (7%), India (5%), Canada (5%), and Japan (4%) were the leading producers of refined zinc metal in 2014. Production increased most notably in China (510,000 t), Italy (30,000 t), Norway (22,200 t), France (19,000 t), and the Republic of Korea (15,100 t). Partially offsetting these increases were production decreases in India (82,000 t), the United States (53,200 t), and Namibia (22,700 t) (table 10).

Net zinc smelter capacity increased by 184,000 t/yr in 2014. Aside from the opening of Horsehead's Mooreboro, NC, plant, capacity increases included two new smelter openings in China—Yunnan Chihong Zinc and Germanium Co. Ltd.'s zinc smelter in Hulunbeier, Nei Mongol Autonomous Region, and Western Mining Group Co. Ltd.'s zinc smelter in Xining, Qinghai Province. Closures included Doe Run's La Oroya refinery in Peru and Horsehead's Monaca, PA, plant (International Lead and Zinc Study Group, 2015b, p. 39, 40).

Metal consumption.—According to the International Lead and Zinc Study Group (2015c), global zinc metal consumption

increased by 4% in 2014 to 13.7 Mt owing mostly to an 8% (474,000 t) increase in apparent consumption in China. Leading zinc-consuming countries included, in decreasing order of consumption, China, the United States, India, the Republic of Korea, and Japan. In the European Union member countries, which accounted for 15% of consumption, total consumption increased slightly in 2014 from that of 2013. ILZSG's data indicated that the zinc metal market was in a deficit for the second consecutive year with consumption exceeding production by 224,000 t in 2014, an increase from the 109,000-t deficit in 2013 (International Lead and Zinc Study Group, 2015c, p. 46–47).

Australia.—Glencore completed phase 3 of its expansion project at the McArthur River Mine in the second half of the year. The completed project was expected to extend mine life by 11 years to 2038 and included increasing ore production capacity to 5.5 Mt/yr from 2.5 Mt/yr. As a result of technological upgrades made in conjunction with the expansion, the mine would also produce zinc concentrates in addition to the bulk zinc-lead concentrates that have been historically produced at the mine (Glencore plc, undated).

In July, Nyrstar closed the zinc metal production plant at its lead smelter in Port Pirie, South Australia, amid the plant's decreasing production volumes and rising costs. The closure was part of a larger redevelopment program at Port Pirie to upgrade the facility's lead production technology, allowing the plant to treat a wider range of feed materials and reduce its airborne emissions. Port Pirie would continue to produce byproduct zinc oxide fume, which would be processed into metal at Nyrstar's zinc smelters in Auby, France, and Hobart, Tasmania, Australia (Outotec Oyj, 2014; Nystar NV, 2014, 2015a, p. 27).

MMG Ltd.'s (Hong Kong, China) Century Mine, Australia's leading zinc-producing mine, produced 466,000 t of zinc in concentrate in 2014, 5% less than in 2013. MMG expected to cease mining activity at Century in the third quarter of 2015 owing to reserve depletion. MMG projected that Century would produce between 350,000 and 370,000 t of zinc in concentrate in 2015 (MMG Ltd., 2014, p. 3; 2015, p. 13, 46).

Burkina Faso.—Increased zinc mine production in 2014 was due to the continued rampup of the Perkoa zinc-lead-silver mine [a joint venture among Blackthorn Resources Ltd. (Australia), Glencore plc (Switzerland), and the Government of Burkina Faso]. Perkoa produced 65,000 t of zinc in concentrate in 2014, about twice the amount produced in 2013 when the mine commenced production. At full production, Perkoa could produce 90,000 t/yr of zinc. During the year, Glencore acquired Blackthorn's 27.3% stake in Perkoa, increasing Glencore's ownership in the mine to 90% (Glencore plc, 2015a, p. 186; 2015b).

Canada.—Zinc mine production in Canada has decreased considerably to 353,000 t in 2014 from 641,000 t in 2012 (table 9), mostly owing to the closure of Glencore's Brunswick and Perseverance Mines in June 2013 owing to resource depletion. Shortly before the closures, Glencore commenced production at the Bracemac-McLeod copper-zinc mine in Quebec, which had the capacity to produce 90,000 t/yr of zinc. Ore production from the mine was sent to Glencore's Matagami mill for processing. At capacity, production would offset about one-half of the zinc production lost from the closure of the

Perseverance Mine, which was also part of the Matagami Mine and mill complex (Glencore plc, 2014, p. 8).

China.—Zinc mine production in China increased by 4% in 2014 to 4.93 Mt. According to Beijing Antaika Information Development Co., Ltd. (Antaika), significant production increases occurred in the Nei Mongol, Shaanxi, and Yunnan Provinces. Nei Mongol was the leading zinc-producing Province, accounting for 22% of the total. Antaika reported that production in Yunnan increased as a result of new mines producing at capacity in 2014, and in Shaanxi, production rose as a result of increased output by Shaanxi Non-ferrous Metals Holding Group Co. Ltd. in the first half of the year. Partially offsetting these increases were production declines in the Guangxi Zhuang Autonomous Region and Hunan and Sichuan Provinces. In Guangxi, zinc mines mostly sold to local smelters, and a reported oversupply of zinc concentrates in the Province resulted in mines reducing output. In Sichuan, decreased production was a result of lower ore grades as mines in the Province neared depletion of reserves. China's net imports of zinc in concentrate increased by 10% in 2014 to 932,000 t (International Lead and Zinc Study Group, 2015c, p. 61; Minor Metals Monthly, 2015b, p. 11–12).

Zinc metal production rose by 10% in 2014 from that of 2013 to 5.61 Mt (table 10). Yunnan Chihong Zinc & Germanium Co. Ltd.'s 140,000-t/yr zinc smelter in Huize, Yunnan, reached full production capacity in 2014 after opening in October 2013. The company also began producing zinc at its new 140,000-t/yr smelter in Hulunbeier, Nei Mongol, in early December. Notable production increases occurred at Hechi Nanfang Non-ferrous Metal Smelting Co. Ltd.'s zinc smelter in Guangxi and at Xichang Heli Zinc Industry Co. Ltd.'s and Hanyuan Jintai Mining Industry Co. Ltd.'s zinc smelters in Sichuan. Zinc metal production declined in the Guangdong Province mostly as a result of reduced production at Zhongjin Lingnan Nonfermet Co. Ltd.'s smelter in Shaoguan; the company operated only one production line in 2014 while it relocated to a new site (Minor Metals Monthly, 2015a, p. 22; 2015b, p. 12–13).

China's zinc consumption increased at a slower rate in 2014 from that of 2013 coinciding with a decreasing growth rate for the country's real estate sector throughout the year. ILZSG reported an 8% year-on-year increase in zinc consumption in 2014 compared to an 11% increase in 2013. In China, 55% of zinc consumption was for galvanizing, followed by zinc alloys for diecasting (26%), zinc oxide (9%), brass and bronze (6%), and batteries (4%) (International Lead and Zinc Study Group, 2015c, p. 61; Minor Metals Monthly, 2015a, p. 17; 2015b, p. 13–14).

France.—Zinc metal production at Nyrstar's smelter in Aubry increased by 13% in 2014 to 171,000 t. Nyrstar completed several modifications at Aubry in 2014 that would allow the smelter to treat byproduct zinc oxide fumes produced at the company's lead smelter in Port Pirie, Australia (Nyrstar NV, 2015a, p. 12, 52).

India.—Zinc mine and metal production decreased significantly in India in 2014 primarily as a result of decreased production at Hindustan Zinc Ltd.'s (HZL) (a subsidiary of Vedanta Resources plc) Rampura Agucha zinc-lead mine. From April through September 2014, HZL mined more waste rock than ore as it began transitioning the mine from an open pit to an

underground operation. In the fourth quarter, Rampura Agucha's total lead and zinc mine production recovered as excavation work concluded. As an open pit mine, Rampura Agucha's ore production capacity was 6.15 Mt/yr. HZL planned to operate both the open pit and underground mine until the fiscal year ending March 31, 2020, maintaining an average production rate of about 5.0 Mt/yr of ore. Once Rampura Agucha becomes solely an underground mine, ore production capacity would decrease to 3.75 Mt/yr. The company's total zinc metal output from its three smelting operations in India decreased as well owing primarily to the decrease in concentrate production at Rampura Agucha (Vedanta Resources plc, 2014b, 2015; Hindustan Zinc Ltd., 2015, p. 14, 28).

Ireland.—Decreased production at Ireland's two zinc-producing mines, Vedanta's Lisheen Mine and Boliden's Tara Mine, resulted in the country's total zinc mine production decreasing by 13% in 2014 from that of 2013. Vedanta reported that, in the fiscal year ending March 31, 2015, lead and zinc production at Lisheen decreased by 13% from that of the previous fiscal year owing to declining ore grades as the mine neared resource depletion. Zinc production at Tara fell by 10% as a result of equipment issues and a fire in the mine (Sesa Sterlite Ltd., 2014, 2015; Boliden AB, 2015a, p. 39).

Namibia.—Zinc mine and metal production decreased in Namibia owing mostly to a decline in production at Vedanta's Skorpion complex. Mined zinc oxide ore at Skorpion was treated onsite at an SX–EW refinery to produce SHG zinc. The zinc refinery produced 102,000 t of zinc metal in the fiscal year ending March 31, 2015, 18% less than that produced in the previous fiscal year as a result of lower ore grades at the mine. The company was evaluating resources at an increased depth in the deposit to potentially extend the life of the mine to fiscal year ending March 31, 2020. In November, Vedanta announced that it had approved an investment of \$782 million for the Gamsberg-Skorpion Integrated Zinc Project. The project included developing the Gamsberg zinc deposit in South Africa into an open pit mine and reconfiguring the Skorpion refinery to allow it to treat the high-manganese zinc sulfide concentrates that would be produced at Gamsberg. Once converted, the refinery would also be able to process sulfide concentrates from other zinc mines in Africa that have been exported from the continent for processing, including Glencore's Rosh Pinah Mine in Namibia and Vedanta's Black Mountain Mine in South Africa (Vedanta Resources plc, 2014c; Chamber of Mines of Namibia, 2015, p. 61, 89; Sesa Sterlite Ltd., 2015).

Norway.—Zinc metal production increased in Norway as a result of a 15% increase in zinc production at Boliden's smelter in Odda. The production increase was attributed to debottlenecking activities, long-term efforts to increase process efficiency and flexibility, and the replacement of a leaching tank that failed in the fourth quarter of 2012. The company planned to increase the smelter's zinc production capacity to 200,000 t/yr from 170,000 t/yr by the second half of 2017 (Boliden AB, 2015a, p. 42–43).

South Africa.—Vedanta approved capital expenditure of \$782 million for the Gamsberg-Skorpion Integrated Zinc Project, \$630 million of which was for the development of the Gamsberg deposit, which was, according to the company, one of the

largest undeveloped zinc-bearing ore bodies globally. Located near Vedanta's Black Mountain zinc mine, Gamsberg would be developed into an open pit operation that would produce an average of 250,000 t/yr of zinc in concentrate during a mine life of 13 years. Mill construction and pre-stripping activities were expected to take 2 years to complete, and mining was projected to begin in the fiscal year ending March 31, 2018 (Vedanta Resources plc, 2014a).

Sweden.—Zinc mine production increased in Sweden in 2014 from that of 2013 owing mostly to increased production at Boliden's Garpenberg zinc-silver mine. Zinc production at the mine rose by 41% to 99,400 t as a result of a significant increase in mill throughput. Boliden began operating a new concentrator at Garpenberg in May as part of an expansion project that increased ore processing capacity to 2.5 Mt/yr from 1.4 Mt/yr (Boliden AB, 2015a, p. 36, 39; 2015b, p. 25).

Outlook

ILZSG forecast global zinc consumption in 2015 to increase slightly from that in 2014 to 13.9 Mt, supported mostly by increases in Chinese consumption. Outside of China, consumption is expected to increase in India, the Republic of Korea, Taiwan, the United States, and Vietnam and remain essentially unchanged in Europe. On the supply side, ILZSG forecast global zinc mine production to remain flat at 13.6 Mt in 2015. Production increases in Australia, China, India, Peru, Russia, and Sweden would be offset by declines in Bolivia, Canada, Ireland, Mexico, Kazakhstan, Namibia, and Turkey. Metal production is forecast to increase by 4% to 14.0 Mt in 2015 owing to increased output in Canada, China, India, and the Republic of Korea. Overall, zinc metal production is expected to exceed consumption by about 90,000 t in 2015 (International Lead and Zinc Study Group, 2015a).

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TABLE 1
SALIENT ZINC STATISTICS¹

(Metric tons, unless otherwise specified)

	2010	2011	2012	2013	2014	
United States:						
Production:						
Domestic ores, contained zinc	748,000	769,000	738,000	784,000	832,000	
Domestic ores, recoverable zinc	723,000	743,000	713,000	758,000	803,000	
Value, recoverable zinc	thousands	\$1,620,000	\$1,740,000	\$1,510,000	\$1,600,000	\$1,900,000
Refined zinc:						
At primary smelters	120,000	110,000	114,000	106,000	110,000	
At secondary smelters ^e	129,000	138,000	147,000	127,000	70,000	
Total	249,000	248,000	261,000	233,000	180,000	
Exports:						
Ores and concentrates, zinc content	752,000	653,000	591,000	669,000	644,000	
Refined zinc	4,200	18,400	14,200	11,500	19,800	
Imports for consumption:						
Ores and concentrates, zinc content	32,200	26,600	6,140	2,550 ^r	2	
Refined zinc	671,000	716,000	655,000	713,000	805,000	
Reported stocks of refined zinc, December 31:						
Producer and consumer	50,400 ^r	71,900 ^r	74,200 ^r	73,900 ^r	90,000	
Government stockpile	7,490	7,250 ²	7,250	7,250	7,250	
Consumption, refined zinc:						
Reported	188,000	347,000	380,000	414,000	403,000	
Apparent ³	915,000 ^r	945,000 ^r	902,000 ^r	935,000 ^r	965,000	
Price:⁴						
North American	cents per pound	101.98	106.24	95.76	95.57	107.12
London Metal Exchange, cash	do.	97.99	99.47	88.35	86.64	98.05
World production:						
Mine	thousand metric tons	12,300	12,500	12,900 ^r	13,100 ^r	13,300 ^e
Smelter	do.	12,900 ^r	13,100	12,300 ^r	12,800 ^r	13,200 ^e

^eEstimated. do. Ditto. ^rRevised.

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

²Government stocks decreased from prior year owing to an inventory adjustment.

³Smelter production plus imports for consumption minus domestic imports.

⁴Special High Grade. Source: Platts Metals Week.

TABLE 2
MINE PRODUCTION OF RECOVERABLE ZINC
IN THE UNITED STATES, BY STATE¹

(Metric tons)

State	2013	2014
Alaska ²	609,000	659,000
Other ³	149,000	144,000
Total	758,000	803,000

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

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

³Includes production from Idaho (2014), Missouri, Tennessee, and Washington (2014).

TABLE 3
LEADING ZINC-PRODUCING MINES IN THE UNITED STATES IN 2014, IN ORDER OF OUTPUT¹

Rank	Mine	County and State ²	Operator	Source of zinc
1	Red Dog	Northern Region, AK	Teck Alaska Inc.	Zinc-lead ore.
2	East Tennessee Zinc Complex ³	Jefferson and Knox, TN	Nyrstar NV	Zinc ore.
3	Greens Creek	Southeastern Region, AK	Hecla Mining Co.	Zinc-silver ore.
4	Middle Tennessee Zinc Complex ⁴	Smith, TN	Nyrstar NV	Zinc ore.
5	Brushy Creek	Reynolds, MO	Doe Run Resources Corp.	Lead ore.
6	Lucky Friday	Shoshone, ID	Hecla Mining Co.	Silver ore.
7	Viburnum (#29 and #35)	Washington and Iron, MO	Doe Run Resources Corp.	Lead ore.
8	Buick	Iron, MO	do.	Do.
9	Fletcher	Reynolds, MO	do.	Do.
10	Sweetwater	do.	do.	Do.
11	Pend Oreille	Pend Oreille, WA	Teck American Inc.	Zinc-lead ore.

Do., do. Ditto.

¹The mines on this list accounted for 100% of recoverable U.S. zinc mine production in 2014.

²For Alaska, mines are located by geographic region, as delineated by the Alaska Division of Geological & Geophysical Surveys in its Special Report 67, Alaska's mineral industry 2013—Exploration activity.

³Includes the Coy, Immel, and Young Mines.

⁴Includes the Cumberland, Elmwood, and Gordonsville Mines.

TABLE 4
ZINC RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES, BY TYPE OF SCRAP¹

(Metric tons)

Type of scrap:	2013	2014
New scrap:		
Zinc-base	35,300	54,200
Copper-base	118,000	119,000
Magnesium-base	196	189
Total	153,000	173,000
Old scrap:		
Zinc-base	105,000	67,600
Copper-base	7,450	6,860
Aluminum-base	512	412
Magnesium-base	7	7
Total	113,000	74,800
Grand total	267,000	248,000

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

TABLE 5
U.S. REPORTED CONSUMPTION OF ZINC IN 2014, BY INDUSTRY USE AND GRADE¹

(Metric tons)

Industry use	Special	High Grade	Continuous	Controlled Lead Grade	Prime Western	Remelt	Total
	High Grade		Galvanizing Grade			and other grades	
Galvanizing	47,400	88,500	182,000	--	21,100	185	340,000
Zinc-base alloys	25,600	82	--	--	--	--	25,600
Brass and bronze	23,600	9,320	--	--	98	--	33,000
Other	4,460	--	--	--	--	--	4,460
Total	101,000	97,900	182,000	--	21,200	185	403,000

-- Zero.

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

TABLE 6
U.S. EXPORTS OF ZINC ORES AND CONCENTRATES, BY COUNTRY¹

	2013		2014	
	Quantity	Value	Quantity	Value
	(metric tons, zinc content)	(thousands)	(metric tons, zinc content)	(thousands)
Australia	48,800	\$58,800	61,800	\$104,000
Belgium	75,800	89,500	51,700	87,100
Canada	181,000	257,000	222,000	321,000
China	72	199	1,540	278
Costa Rica	29	98	24	59
El Salvador	31	90	41	136
Finland	34,400	41,000	27,400	61,500
Germany	32,900	39,200	25,800	59,700
India	51	102	17	44
Italy	--	--	28,900	64,100
Japan	72,000	114,000	59,300	104,000
Korea, Republic of	123,000	148,000	87,200	150,000
Mexico	--	--	5	4
Panama	6	20	6	23
Spain	101,000	120,000	71,500	157,000
Switzerland	--	--	6,570	11,100
Total	669,000	868,000	644,000	1,120,000

-- Zero.

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

Source: U.S. Census Bureau.

TABLE 7
U.S. EXPORTS OF ZINC COMPOUNDS¹

	2013		2014	
	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)
Chromates of zinc or of lead	7	\$366	12	\$490
Lithopone	588	3,810	623	4,580
Zinc chloride	776	1,070	681	1,000
Zinc oxide	17,500	32,000	6,160	20,800
Zinc sulfate	525	660	628	612
Zinc sulfide	6,150 ^r	16,900 ^r	1,570	19,200

^rRevised.

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

Source: U.S. Census Bureau.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF ZINC COMPOUNDS¹

	2013		2014	
	Quantity (metric tons, gross weight)	Value (thousands)	Quantity (metric tons, gross weight)	Value (thousands)
Chromates of zinc or of lead	83	\$389	112	\$744
Lithopone	1,030	2,740	1,770	2,750
Zinc chloride	278	1,900	149	1,270
Zinc oxide	97,400	192,000	125,000	272,000
Zinc sulfate	52,600	44,100	83,600	60,800
Zinc sulfide	2,200	8,640	2,290	8,700

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

Source: U.S. Census Bureau.

TABLE 9
ZINC: WORLD MINE PRODUCTION, BY COUNTRY¹

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

Country ²	2010	2011	2012	2013	2014 ^c
Argentina	32,566	33,975	39,602	39,424 ^r	41,000
Armenia ³	7,500 ^r	8,100	8,400 ^r	8,300 ^r	7,600
Australia	1,480,000 ^r	1,515,000	1,541,000	1,523,000	1,561,000 ⁴
Bolivia	411,409	427,129	389,911	407,332	448,653 ⁴
Bosnia and Herzegovina ^c	5,500	6,900	7,000	7,000	7,000
Brazil	211,203	197,840	164,258	152,147 ^r	160,000
Bulgaria	8,171 ^r	8,604 ^r	8,995 ^r	11,992 ^r	12,000
Burkina Faso	--	--	--	32,215	65,000 ⁴
Burma	8,600	9,300	10,000 ^e	10,000 ^e	10,000
Canada	649,065	622,600	641,134 ^r	426,089	352,745 ⁴
Chile	27,662	36,602	26,762	29,759	45,094 ⁴
China ^c	3,700,000	4,050,000	4,380,000 ^r	4,730,000 ^r	4,930,000
Congo (Kinshasa)	10,362 ^r	14,944 ^r	11,571 ^r	12,806 ^r	14,584 ⁴
Finland	55,562	64,115	52,303 ^r	40,956 ^r	44,000 ³
Greece	19,976	19,564	20,912	21,400 ^{r,3}	21,700 ³
Guatemala	--	--	--	1,221	13,394 ⁴
Honduras	33,839	26,000	26,000	25,000	30,000 ⁴
India	740,000 ^r	796,000 ^r	758,000 ^r	793,000	706,000
Iran ^c	130,000	140,000	140,000	130,000	140,000
Ireland	342,434	344,000	337,500	326,700	283,000
Kazakhstan	405,300	376,700	369,700	361,500	345,200 ⁴
Korea, North ^c	38,000	34,000	35,000	36,000	32,000
Korea, Republic of ³	360 ^r	740 ^r	1,430 ^r	1,750	1,800
Kosovo	4,000 ^{r,e}	3,000 ^{r,e}	3,818 ^r	4,983 ^r	5,514 ⁴
Laos ³	1,500 ^r	1,600 ^r	1,600 ^r	1,500 ^r	-- ⁴
Macedonia	29,000	28,000	29,000 ^e	29,000 ^e	30,000
Mexico	570,004	631,859	660,349	642,542	659,878 ⁴
Mongolia ³	56,300	52,400 ^r	59,600 ^r	52,100 ^r	46,600
Montenegro ^c	1,000	5,000	5,000	5,000	10,000
Morocco	43,700	45,050	45,800	40,000 ^{r,e}	40,000
Namibia ³	204,229	192,173	194,380	184,109	154,200 ⁴
Nigeria ^c	10,000	5,000	15,000	10,000	10,000
Pakistan	10,000	15,000	10,000 ^{r,e}	5,000 ^{r,e}	--
Peru	1,470,450	1,256,383	1,281,230	1,351,273	1,318,660 ⁴
Philippines	9,268	18,170	19,559	16,730	-- ⁴
Poland	72,500 ^r	65,200 ^r	57,700 ^r	58,200 ^r	58,000
Portugal	6,422 ^r	4,227	30,006 ^r	53,382	67,378 ⁴
Russia	186,900	176,300	179,800	177,200 ^r	175,000
Saudi Arabia	4,897	5,000 ^e	15,000 ^e	16,700 ^{r,3}	16,300 ³
South Africa	36,142	36,629	37,034	30,145	26,141 ⁴
Spain	17,358	33,199	28,634	30,428 ^r	30,000
Sweden	198,686	194,429	188,391 ^r	176,578 ^r	221,882 ⁴
Tajikistan ^c	--	10,000	20,000	20,000	30,000
Thailand	25,529	29,664 ^r	31,000	30,000	39,140 ⁴
Turkey ⁵	196,400	158,300	200,000 ^{r,e}	200,000 ^{r,e}	220,000
United States	748,000	769,000	738,000	784,000	832,000 ⁴
Uzbekistan ^c	--	15,000	25,000	35,000	45,000
Vietnam ^c	40,000	30,000	30,000	20,000	20,000
Total	12,300,000	12,500,000	12,900,000 ^r	13,100,000 ^r	13,300,000

^cEstimated. ^rRevised. -- Zero.

¹World totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown. Includes data available through November 5, 2015.

²Serbia may have produced zinc, but available information is inadequate to make reliable estimates of output levels.

³Data derived from reported production of zinc concentrates.

⁴Reported figure.

⁵Estimated based on reported exports of zinc ores and concentrates.

TABLE 9—Continued
ZINC: WORLD MINE PRODUCTION, BY COUNTRY¹

Sources: Bulgarian Association of the Metallurgical Industry; Chamber of Mines (Namibia); Chilean Copper Commission; China Nonferrous Metals Industry Association; Company reports; Department of Industry and Science (Australia); Department of Mineral Resources (South Africa); Department of Statistics of Kazakhstan; Geological Survey of Finland; International Lead and Zinc Study Group; Istanbul Minerals & Metals Exporters' Association; Korea Institute of Geoscience and Minerals Resources; Lao Department of Mines; Mines and Geosciences Bureau (Philippines); Ministry of Energy and Mines (Peru); Ministry of Industry, Energy, and Tourism (Spain); Ministry of Natural Resources and Ecology (Russia); National Department of Mineral Production (Brazil); National Institute of Statistics and Census (Argentina); National Institute of Statistics and Geography (Mexico); National Statistical Service of the Republic of Armenia; Natural Resources Canada; Polish Geological Institute; U.S. Geological Survey.

TABLE 10
ZINC: WORLD SMELTER PRODUCTION, BY COUNTRY^{1,2}

(Metric tons)

Country	2010	2011	2012	2013	2014 ^c
Algeria, primary ^c	30,000	30,000	20,000 ^r	20,000 ^r	20,000
Argentina, primary	39,539 ^r	42,067	37,797	36,712	29,122 ³
Australia, primary	499,000	507,316 ^r	498,259 ^r	498,291 ^r	481,573 ³
Belgium, primary	260,000	282,000	250,000	252,000	262,000 ³
Brazil, primary	288,107	284,770	246,526	242,000	242,000
Bulgaria, primary	91,372	90,083	73,558	75,830	75,000
Canada, primary	691,221	662,151	648,614	651,634	649,217 ³
China, primary and secondary ^c	5,210,000	5,210,000	4,630,000 ^r	5,100,000 ^r	5,610,000
Finland, primary	307,144	307,352	314,742	311,686	302,024 ³
France, primary	163,000	164,000	161,000	152,000	171,000 ³
Germany, primary and secondary	165,000	170,000	169,000	162,000	165,000 ³
India, primary and secondary	746,000 ^r	780,000 ^r	715,000	788,000	706,000
Iran ^c	120,040 ^{r,3}	130,000 ^r	150,000 ^r	140,000	150,000
Italy, primary	105,000	100,000	100,000	110,000	140,000
Japan, primary and secondary	574,008	544,674	571,312 ^r	587,291	583,021 ³
Kazakhstan, primary and secondary	318,858	319,847	319,900	320,150	324,946 ³
Korea, North, primary and secondary ^c	35,000 ^r	35,000 ^r	35,000 ^r	35,000	35,000
Korea, Republic of, primary	750,000 ^r	828,735	876,550 ^r	885,804 ^r	900,943 ³
Mexico, primary	327,742 ^r	322,116 ^r	323,569 ^r	322,781 ^r	321,000 ³
Namibia, primary	151,688	145,639	144,508 ^r	124,924	102,188 ³
Netherlands, primary	254,000	261,000	257,000	275,000 ^r	290,000 ³
Norway, primary	148,862	153,200	152,647	143,444	165,600 ³
Peru, primary	223,112	313,714	319,280	346,362	336,454 ³
Poland, primary	135,100	144,100	138,300 ^r	146,300 ^r	140,000
Russia, primary and secondary	248,606 ^r	255,600	250,000 ^r	216,260 ^r	223,312 ³
South Africa, primary	90,000	73,000	--	--	--
Spain, primary	480,069 ^r	489,104 ^r	489,455 ^r	490,488 ^r	490,000
Thailand, primary	103,620	103,366	97,000	78,000 ^r	65,500
United States:					
Primary	120,000	110,000	114,000	106,000	110,000
Secondary	129,000	138,000	147,000	127,000	70,000
Total	249,000	248,000	261,000	233,000	180,000
Uzbekistan, primary ^c	57,500 ^r	54,900	61,100	54,000 ^r	66,000
Vietnam, primary ^c	16,000	18,000 ^r	18,000	12,000 ^r	12,000
Grand total	12,900,000 ^r	13,100,000	12,300,000 ^r	12,800,000 ^r	13,200,000
Of which:					
Primary	5,330,000 ^r	5,490,000 ^r	5,340,000 ^r	5,340,000 ^r	5,370,000
Secondary	129,000 ^r	138,000 ^r	147,000 ^r	127,000 ^r	70,000
Undifferentiated	7,420,000 ^r	7,450,000 ^r	6,840,000 ^r	7,350,000 ^r	7,800,000

^cEstimated. ^rRevised. -- Zero.

¹Grand totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

²Wherever 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. Includes data available through November 12, 2015.

³Reported figure.

Sources: Bulgarian Association of the Metallurgical Industry; Chamber of Mines of Namibia; China Nonferrous Metals Industry Association; Company reports; Department of Statistics (Kazakhstan); International Lead and Zinc Study Group; Ministry of Economy, Trade, and Industry (Japan); Ministry of Energy and Mines (Namibia); Ministry of Energy and Mines (Peru); Ministry of Natural Resources and Ecology (Russia); National Department of Mineral Production (Brazil); National Institute of Statistics and Census (Argentina); Natural Resources Canada; Office of the Chief Economist (Australia); Polish Geological Institute; U.S. Geological Survey.