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Copper

By Daniel M. Flanagan

Domestic survey data and tables were prepared by Hodan A. Fatah, statistical assistant.

In 2017, mine production of recoverable copper in the United States decreased for the first time since 2010, by 12% to 1.26 million metric tons (Mt) from 1.43 Mt in 2016, and was the lowest quantity since 2013, when output was 1.25 Mt (tables 1, 3). Production declined in all copper-producing States and at all major U.S. copper mines because of lower ore grades and disruptions caused by poor weather conditions and technical complications. Globally, the United States remained the fourth-ranked mine producer of copper behind Chile, Peru, and China (in descending order of output) and accounted for 6% of global production. World mine output of copper decreased slightly to 20.0 Mt in 2017 from a record-high 20.4 Mt (revised) in 2016, primarily owing to declines in production in Australia, Canada, China, Indonesia, and the United States. These decreases were partially offset by increased output in Brazil, Congo (Kinshasa), Kazakhstan, and Peru (table 20).

Owing to planned maintenance at multiple domestic smelters and a 6-week shutdown of one U.S. smelter following a fatal accident, smelter production in the United States decreased by 16% to 470,000 metric tons (t) in 2017 from 563,000 t in 2016, and domestic production of refined copper declined by 12% to 1.08 Mt from 1.22 Mt (table 1). The United States remained the fourth-ranked producer of refined copper, following China, Chile, and Japan (in descending order of production), and accounted for 5% of global output. World refinery production of copper increased slightly to a record-high 23.9 Mt from 23.7 Mt (revised) in 2016. Significant increases in refinery production in China and Russia were mostly offset by decreases in Australia, Brazil, Chile, Japan, and the United States (table 22).

Reported U.S. consumption of refined copper in 2017 was 1.80 Mt, unchanged from the revised amount in 2016 (tables 1, 4, 5). Domestic consumption steadily decreased from a record high of 3.02 Mt in 2000 to 1.65 Mt in 2009 and has remained at roughly 1.8 Mt in each year since. In 2017, China accounted for 50% of world apparent consumption, which increased slightly to a record-high 23.8 Mt from 23.6 Mt (revised), according to data compiled by the International Copper Study Group (ICSG). Consumption in China and Vietnam collectively rose by 162,000 t from that in 2016, and consumption in all other countries and localities collectively fell by 8,200 t. The ICSG calculation of China's apparent consumption was based on reported production, trade, and Shanghai Futures Exchange (SHFE) stock data and did not include unreported Government or industry stocks, which can fluctuate significantly on an annual basis. The United States remained the second-ranked consumer of refined copper and accounted for 7% of global refined copper apparent consumption, followed by, in descending order of rank, Germany, Japan, and the Republic of Korea (International Copper Study Group, 2018a, p. 9, 19–20).

In 2017, the average annual Commodity Exchange Inc. (COMEX) spot copper price rose for the first time since 2011, by 28% to $2.80 per pound from $2.20 per pound in 2016 (table 1). Contributing factors to the increased price included continued copper consumption growth in China, depreciation of the United States dollar, and lower global mine production. The COMEX price reached a record-high $4.01 per pound in 2011 and decreased in each year from 2012 through 2016.

Production

Domestic production data were compiled from U.S. Geological Survey (USGS) monthly canvasses of the mines, smelters, and refineries operating in the United States. In 2017, responses to the surveys accounted for 96% of the mine production data, 100% of the smelter production data, and 95% of the refinery production data reported for these facilities in table 1. Production figures for companies that publicly reported operational data in 2017 can be found in the "Operating Property Reviews" section.

Mine production of recoverable copper in the United States decreased by 12% to 1.26 Mt in 2017 from 1.43 Mt in 2016, but the value of production increased by 12% to $7.92 billion from $7.09 billion. Copper recoverable in concentrates and precipitates accounted for 56% of mine output and declined by 14% to 702,000 t, and copper produced by solvent extraction and electrowinning (SX–EW) comprised 44% of mine production and fell by 9% to 557,000 t (tables 1, 3). Arizona was the leading copper-producing State and accounted for 69% of U.S. output, followed by, in descending order of production, Utah, New Mexico, Nevada, Montana, Michigan, and Missouri. Production decreased in all States and at all major mines, primarily owing to lower ore grades and disruptions caused by poor weather conditions and technical complications. Although copper was recovered at 23 mines in the United States (including 14 SX–EW facilities), 17 mines accounted for more than 99% of production in 2017 (table 2). The remaining mines were either small leach (solvent extraction) operations or byproduct producers of copper.

Smelter production in the United States was 470,000 t in 2017, 16% lower than 563,000 t in 2016, and refinery production declined by 12% to 1.08 Mt from 1.22 Mt, owing to decreased output of copper recoverable in concentrates, planned smelter maintenance shutdowns, and a 6-week suspension of operations at one domestic smelter following a fatal accident. Primary (from ore) refined copper produced by SX–EW accounted for 52% of refinery production in 2017, primary electrolytic copper accounted for 45%, and secondary (from scrap) electrolytic and fire-refined copper accounted for the remainder. Output of primary electrolytic copper decreased by 14% from that in 2016 to 482,000 t, and secondary refined production fell by 13% to 40,100 t (table 1). Three primary smelters in Arizona and Utah and three electrolytic refineries in Texas and Utah operated in the United States during 2017.

Operating Property Reviews.—In 2017, ASARCO LLC (Tucson, AZ), a subsidiary of Grupo México, S.A.B. de C.V. (Mexico), produced a total of 134,000 t of copper at its three mines in Arizona (a decrease of 13% from 155,000 t in 2016) and 124,000 t of electrolytic copper at its refinery in Amarillo, TX (a decrease of 6% from 132,000 t in 2016). At the Mission Mine, the company produced 61,900 t of copper in concentrates (68,200 t in 2016). Output from the Ray Mine was 38,200 t of copper in concentrates (46,500 t in 2016) and 15,000 t of copper by SX–EW (20,700 t in 2016). The Silver Bell Mine produced 18,600 t of electrowon copper (19,100 t in 2016). Production at the Mission and Ray Mines was lower than that in 2016 primarily as a result of lower ore grades. In November 2015, the U.S. Environmental Protection Agency and the U.S. Department of Justice announced a settlement with ASARCO that required the company to install new pollution control equipment at its smelter in Hayden, AZ, to reduce emissions of arsenic, lead, particulate matter, and sulfur dioxide. As of yearend 2017, the company expected that the upgrades would be completed in April 2018 and would result in an annual production increase of 15,000 t of copper anodes (U.S. Environmental Protection Agency, 2015; Grupo México, S.A.B. de C.V., 2018a, p. 112, 114, 118, 119; 2018b, p. 3).

Copper production at the Pinto Valley Mine in Arizona, owned by Capstone Mining Corp. (Canada), decreased by 17% to 57,300 t in 2017 from 68,900 t in 2016. Output was affected by electrical outages, a period of heavy rainfall, and a planned shutdown for repairs. Production at the mine primarily consisted of copper contained in concentrates with a small quantity of copper produced by SX–EW (Capstone Mining Corp., 2017a, b; 2018, p. 14–15).

Total output of recoverable copper at Freeport-McMoRan Inc.'s (Phoenix, AZ) U.S. operations in 2017 decreased by 13% to approximately 817,000 t from 943,000 t during the prior year, primarily owing to lower ore grades. Combined copper in concentrates and (or) electrowon production at each of the company's mines in Arizona was as follows: Bagdad—78,500 t (80,300 t in 2016), Miami—8,620 t (11,300 t in 2016), Morenci (the fourth-ranked global copper mine by production quantity in 2017)—464,000 t (500,000 t in 2016), Safford—68,000 t (104,000 t in 2016), and Sierrita—72,600 t (73,500 t in 2016). In New Mexico, copper output at the Chino Mine totaled 97,500 t (140,000 t in 2016), and SX–EW production at the Tyrone Mine was 27,700 t (34,500 t in 2016). Freeport also produced refined copper at its electrolytic facility in El Paso, TX, but did not publicly report copper cathode output. In 2017, the company started to develop significant copper resources at its Lone Star property near the Safford Mine. The project was expected to generate about 90,000 metric tons per year of copper over a mine life of 20 years, with first production anticipated in 2020 (Freeport-McMoRan Inc., 2018, p. 7, 26, 77–78).

KGHM International Ltd. (Canada), a subsidiary of KGHM Polska Miedź S.A. (Poland), produced 48,800 t of recoverable copper in concentrates at the Robinson Mine in Nevada. Output declined by 9% compared with 53,700 t in 2016 because of lower ore grades and reduced copper recovery rates. Extraction of ore at the company's Carlota Mine in Arizona ceased in 2014, but leaching of stockpiles continued through 2017. Production for the Carlota Mine was not publicly reported (KGHM Polska Miedź S.A., 2015, p. 2; 2018, p. 13, 56).

In 2017, Lundin Mining Corp. (Canada) produced 21,300 t of copper in concentrates at the Eagle nickel-copper mine in Michigan, 9% less than 23,400 t in 2016 as a result of planned mine sequencing, and published a feasibility study that demonstrated the economic viability of mining the Eagle East expansion of the Eagle Mine. As of yearend 2016, Eagle East contained 46,300 t of probable copper reserves, enough to extend the mine life to at least 2023. The company approved the full development of the expansion, pending the receipt of required permits, and continued work on the access ramp into the deposit (Lundin Mining Corp., 2017; 2018, p. 1, 18; Roscoe Postle Associates Inc., 2017, p. 15-2).

At the Bingham Canyon Mine in Utah, owned by Rio Tinto Kennecott [South Jordan, UT; a subsidiary of Rio Tinto Group (United Kingdom)], production of copper in concentrates decreased by 3% to 149,000 t from 153,000 t in 2016, with lower ore grades partially offset by increased mill throughput. Publicly reported production of refined copper at the company's refinery in Magna, UT, fell by 20% to 126,000 t from 157,000 t. Total refinery output reported to the USGS was higher than that stated in company reports because smelter and refinery production from toll third-party concentrates (which are refined and returned to the owner) were not included in the company's public figures. In 2017, Rio Tinto processed 161,000 t of third-party concentrates at its smelter in Utah. Following the death of a worker from fatal exposure to sulfur dioxide, the company halted operations at its smelter on October 8 and declared force majeure on shipments of refined copper on October 13. The smelting and refining facilities resumed normal operations by yearend 2017, after a 6-week pause. Rio Tinto continued a project to push back the south wall of the Bingham Canyon open pit to access an additional 510 Mt of ore reserves, which was anticipated to result in higher copper ore grades beginning in 2021 (Rio Tinto Group, 2016, p. 35; 2018, p. 42–43, 226; Mordant, 2017).

Consumption

In 2017, copper was consumed (used) as refined copper and scrap at about 30 brass mills; 15 wire-rod mills; and 500 chemical plants, foundries, and miscellaneous manufacturers in the United States. Reported U.S. consumption of refined copper was 1.80 Mt, unchanged from the revised amount in 2016; consumption by wire-rod mills was 1.32 Mt (73% of total refined use), and consumption by brass mills was 420,000 t (23%). Domestic consumption of copper scrap was 910,000 t (gross weight), slightly higher than 904,000 t in 2016. Brass and wire-rod mills consumed 742,000 t of copper scrap in 2017, equivalent to 82% of total use (tables 1, 4, 5, 10, 11).

Copper recovered from refined or remelted scrap in the United States increased slightly to 848,000 t (83% from new scrap and 17% from old scrap) and accounted for 33% of the total U.S. copper supply of 2.57 Mt (defined as primary refined production plus copper recovered from new and old scrap plus refined general imports minus refined exports, including adjustments for changes in refined copper stocks). The conversion of old (post-consumer) scrap to alloys and refined copper declined slightly to 146,000 t from 149,000 t (revised),

and copper production from new (manufacturing) scrap rose slightly to 702,000 t from 690,000 t. The larger overall quantity of copper recovered from scrap in 2017 was likely a consequence of decreased affordability of copper cathode owing to higher refined prices, as well as decreased cathode availability because of lower domestic production compared with that in 2016. Brass and wire-rod mills accounted for 83% of copper recovered from scrap in 2017 (tables 1, 6, 7).

According to preliminary data from the Copper Development Association Inc. (2018, p. 18), the copper content of copper and copper-alloy product shipments to the U.S. market by fabricators (brass mills, foundries, powder producers, and wire-rod mills), including domestic deliveries and net imports, increased slightly to 2.45 Mt in 2017 from 2.42 Mt (revised) in 2016. Since 2000, when shipments reached a record high of 4.34 Mt, deliveries to the domestic market have trended downward, and those in 2017 were 44% less than those in 2000. In 2017, wire-rod mill products accounted for about 56% of total deliveries to the U.S. market; brass mill products, 36%; net imports, 4%; foundry products, 3%; and powder products, 1%. The building construction sector remained the leading end-use market and accounted for about 44% of total shipments, followed by transportation equipment, 20%; electrical and electronic products, 19%; consumer and general products, 11%; and industrial machinery and equipment, 6%. Examples of product categories included in each sector are as follows: building construction—air conditioning, building wire, and plumbing and heating; electrical and electronic products—lighting and wiring devices, power utilities, and telecommunications; industrial machinery and equipment—industrial valves and fittings and plant equipment; transportation equipment—aircraft, automobiles, railroad, and ships; and consumer and general products—appliances, consumer electronics, and cords.

The increase in copper and copper-alloy product shipments to the domestic market corresponded with mostly positive economic trends in major industrial sectors that use copper. Housing starts in the United States rose slightly to 1.20 million units from 1.17 million units, and manufacture of appliances and electrical equipment (batteries, generators, lighting components, wiring devices, and so forth); equipment for heating, ventilation, and air-conditioning (HVAC); and power transmission products all increased slightly compared with output in 2016. In contrast, production of aircraft, automobiles, and ships was essentially unchanged, and fabrication of telecommunications equipment declined by 4% (Federal Reserve Board, 2018; U.S. Census Bureau, 2018).

Prices and Stocks

The average annual COMEX spot copper price rose by 28% to $2.80 per pound in 2017 from $2.20 per pound in 2016 (table 1). Contributing factors to the increased price included continued copper consumption growth in China, depreciation of the United States dollar, and lower global mine production. Prior to 2017, the COMEX price had declined for 5 consecutive years. The monthly average COMEX price ranged from a low of $2.55 per pound in May to a high of $3.10 per pound in October and December. Daily prices ranged from a low of $2.48 per pound on January 3 to a high of $3.29 per pound on December 28.

Copper scrap prices generally followed the trend in refined copper prices, and prices for various types of scrap increased by 13% to 25% in 2017 (table 13). The discount for refiners no. 2 scrap from the COMEX spot price averaged 34.7 cents per pound, up from 22.2 cents per pound in 2016. The refiners no. 2 scrap discount ranged between 27.9 cents per pound in June and 42.2 cents per pound in November, and the refiners no. 2 scrap price averaged $2.46 per pound, 24% greater than $1.98 cents per pound in 2016.

Total refined copper stocks in the United States increased by 42,100 t (19%) during the year to 265,000 t at the end of December from 223,000 t at the beginning of January. COMEX stocks rose by 111,000 t (more than twofold), and stocks at brass mills, refineries, and wire-rod mills increased by a combined 3,170 t (8%). These increases were partially offset by a drawdown in London Metal Exchange Ltd. stocks in U.S. warehouses, which were lower by 71,800 t (73%) at yearend. Changes in other industry stocks were negligible (table 1).

Foreign Trade

In 2017, net imports of refined copper into the United States were 719,000 t (813,000 t of imports and 94,200 t of exports), an increase of 25% from 574,000 t (708,000 t of imports and 134,000 t of exports) in 2016. The reduced supply of domestically produced refined copper (U.S. refinery output declined by 143,000 t in 2017) likely contributed to the increase in refined imports and decrease in refined exports. Refined copper accounted for 85% of unmanufactured copper imports (refined copper, unalloyed copper scrap, and the copper content of alloyed copper scrap; blister and anodes; matte, ash, and precipitates; and ore and concentrates) and 8% of unmanufactured copper exports. Chile, Canada, and Mexico were the leading foreign sources of refined copper in 2017 and accounted for 60%, 26%, and 9%, respectively, of the total refined import quantity. The leading destinations for refined copper exports were Mexico (66%), Canada (19%), and China (11%). Imports of copper ore and concentrates predominantly originated from Mexico (more than 99% of the total ore and concentrates import quantity) and increased to 14,000 t in 2017 from 67 t in 2016. Exports of copper ore and concentrates fell by 28% and were primarily shipped to Mexico (59%), China (30%), and Canada (10%) (tables 14, 16).

Copper scrap exports from the United States rose by 6% to a total gross weight of 1.00 Mt (494,000 t of unalloyed copper scrap and 510,000 t of copper-alloy scrap) in 2017 compared with 944,000 t (412,000 t of unalloyed scrap and 532,000 t of alloyed scrap) in 2016. China remained the leading destination for unalloyed and alloyed copper scrap exports, accounting for 69% of the total scrap quantity, 71% of the unalloyed quantity, and 66% of the alloyed quantity (table 18). Based on worldwide import data, China accounted for 52% of the 6.78 Mt (gross weight) of total global copper scrap imports (International Copper Study Group, 2018a, p. 40–41). The United States imported an estimated 129,000 t of copper contained in scrap during 2017, an increase of 31% from 98,400 t in 2016. Imports of copper in scrap primarily originated from Canada (60%) and Mexico (28%) (table 19).

World Review

World mine production of copper decreased slightly to 20.0 Mt in 2017 from a record-high 20.4 Mt (revised) in 2016. Copper in concentrates accounted for 80% of global mine output and declined slightly to 16.1 Mt from 16.4 Mt (revised) in 2016. Copper produced by SX–EW represented 20% of world mine production and fell slightly to 3.90 Mt from 3.99 Mt (revised). In 2017, 53 countries and localities were known to have mined copper. Chile was the leading producer of mined copper and accounted for 28% of total global production, followed by Peru (12%), China (9%), the United States (6%), and Congo (Kinshasa) (5%). The remaining countries among the 10 leading producers were, in descending order of output, Australia, Zambia, Mexico, Russia, and Indonesia. The 10 leading producers accounted for 79% of production, and the 20 leading producers accounted for 95%. Large decreases in production took place in China, where output fell by 190,000 t (10% less than country production in 2016); the United States, by 171,000 t (12%); Indonesia, by 106,000 t (15%); Canada, by 98,100 t (14%); and Australia, by 88,000 t (9%). These declines were partially offset by significant increases in Kazakhstan, where output rose by 94,700 t (20% greater than country production in 2016); Peru, by 91,700 t (4%); Congo (Kinshasa), by 69,000 t (7%); and Brazil, by 52,400 t (16%) (table 20). Explanatory comments regarding production changes are provided in the sections for individual countries below. According to data compiled by the International Copper Study Group (2018a, p. 9), global mine capacity increased slightly to 23.9 Mt in 2017 from 23.4 Mt in 2016, and global mine capacity utilization decreased to 83.8% from 86.9% (revised).

World production of refined copper increased slightly in 2017 to a record-high 23.9 Mt from 23.7 Mt (revised) in 2016. Production of primary copper represented 78% of global refined production and totaled 18.6 Mt, essentially unchanged from the revised quantity in 2016; electrowon copper output (16% of worldwide refined production) decreased slightly, and primary copper produced by electrolytic and fire refining (other primary, 62%) was essentially unchanged. Production of secondary copper accounted for 22% of global refined output and increased by 6% to 5.24 Mt from 4.94 Mt (revised) in 2016. In 2017, 45 countries and localities were known to have produced refined copper. China was the leading producer of refined copper and accounted for 37% of world refinery production, followed by Chile (10%), Japan (6%), and the United States (5%). The remaining countries among the 10 leading producers were, in descending order of output, Russia, Congo (Kinshasa), India, Germany, the Republic of Korea, and Poland. The 10 leading producers accounted for 77% of worldwide output, and the 20 leading producers accounted for 93% (table 22). Most of the increase in refined copper production was in China, owing to expansions and (or) equipment upgrades at multiple smelters and refineries. Refined output in China increased by 453,000 t in 2017 compared with output in 2016, and smelter and refinery capacities in the country rose by 330,000 t and 500,000 t, respectively (International Copper Study Group, 2018b, p. 143–145, 168–170). Production also increased significantly in Russia, by 94,700 t. These increases were partially offset by significant decreases in Chile, where output declined by 183,000 t (7% lower than country production in 2016); the United States, by 143,000 t (12%); Australia, by 89,000 t (19%); Japan, by 65,100 t (4%); and Brazil, by 63,000 t (28%) (table 22). Explanatory comments regarding production changes are provided in the sections for individual countries below. Global refinery capacity increased slightly in 2017 to 27.4 Mt from 26.9 Mt (revised) in the prior year, and global refinery capacity utilization decreased to 85.8% from 86.9% (revised) (International Copper Study Group, 2018a, p. 9).

In 2017, global apparent consumption of refined copper increased slightly to a record-high 23.8 Mt from 23.6 Mt (revised) in 2016, according to the ICSG. The leading consumers of refined copper were China (which accounted for 50% of worldwide consumption), the United States (7%), Germany (5%), Japan (4%), and the Republic of Korea (3%). The remaining countries and localities among the 10 leading consumers were, in descending order of quantity, Italy, Taiwan, India, Turkey, and the United Arab Emirates. The 10 leading countries and localities represented 80% of global consumption. The largest increases in consumption took place in China, where use of copper rose by 96,400 t (slightly higher than country consumption in 2016), and in Vietnam, where consumption increased by 66,000 t (31%). Consumption in all countries and localities excluding China and Vietnam collectively declined by 8,200 t. The ICSG calculation of China's apparent consumption was based on reported production, trade, and SHFE stock data and did not include unreported Government or industry stocks, which can fluctuate significantly on an annual basis. By region, use of refined copper in Asia accounted for 74% of the global total (24% excluding China) in 2017, followed by Europe (14%), North America (10%), South America (2%), and Africa (<1%). Consumption increased slightly in Asia (also slightly if China is excluded) and either declined or was essentially unchanged in all other regions (International Copper Study Group, 2018a, p. 9, 19–20).

Australia.—Refined copper production in Australia decreased by 19% to 386,000 t in 2017 from 475,000 t (revised) in 2016, owing primarily to major maintenance at the smelters associated with the country's two leading copper mines (table 22). BHP Group (Australia) produced 142,000 t of copper cathode at the Olympic Dam complex, 16% less than 169,000 t in 2016, and Glencore plc (Switzerland) produced 227,000 t (including from third-party materials) at the Mount Isa complex, down by 17% from 276,000 t (BHP Group, 2017, p. 11; 2018, p. 6, 10; Glencore plc, 2018, p. 70, 205).

Mined copper production in Australia declined by 9% in 2017, to 860,000 t from 948,000 t in 2016 (table 20). Output of mined copper was predominantly affected by smelter maintenance at Mount Isa and Olympic Dam, as well as an earthquake that disrupted operations at the Cadia Valley Mine, owned by Newcrest Mining Ltd. (Australia), from April 14 to September 13. Production of copper at Cadia Valley fell by 23% to 56,100 t in 2017 from 73,200 t during the prior year (Department of Industry, Innovation, and Science, 2018, p. 99; Newcrest Mining Ltd., 2018a, p. 21; 2018b).

Brazil.—In 2017, output of mined copper increased by 16% to an estimated 390,000 t from 338,000 t (revised) in 2016 (table 20). Production at the three leading copper mines in

Brazil was as follows: the Salobo Mine [owned by Vale S.A. (Brazil)]—193,000 t (176,000 t in 2016); the Sossego Mine (Vale)—99,700 t (92,600 t in 2016); and the Chapada Mine [Yamana Gold Inc. (Canada)]—57,700 t (52,400 t in 2016). The combined production from these three operations increased by 30,000 t in 2017 compared with output in 2016 and was equivalent to 90% of the country's estimated mined copper total. Yamana Gold attributed higher copper production at Chapada to increased copper recovery and ore-processing rates (Vale S.A., 2018, p. 16; Yamana Gold Inc., 2018, p. 18, 60).

Refined copper production in Brazil fell by 28% to 163,000 t in 2017 from 226,000 t (revised) in 2016 (table 22). Paranapanema S.A. (Brazil) reported primary refined copper output of 143,000 t, a decrease of 37% from that in 2016. The company cited limited availability of credit to finance operations and maintenance shutdowns as reasons for the decline (Paranapanema S.A., 2018, p. 4).

Canada.—Production of mined copper in Canada was 595,000 t in 2017, 14% lower than 693,000 t (revised) in 2016 (table 20). The combined output of the country's two leading copper mining operations, Vale's Sudbury complex and Teck Resources Ltd.'s (Canada) Highland Valley Mine, decreased by 49,800 t. At Sudbury, production declined because of unscheduled maintenance at the Coleman Mine and the termination of mining at the Stobie Mine. At Highland Valley, production fell as a result of temporary decreases in copper grades and recoveries, as anticipated in the mine plan. Output also declined significantly (by 15,100 t) at Capstone's Minto Mine, where ore grades were lower owing to mine sequencing changes implemented during 2017 to extend the mine life (Capstone Mining Corp., 2017a, b; 2018, p. 14; Teck Resources Ltd., 2018, p. 17–18; Vale S.A., 2018, p. 16–17).

Chile.—In 2017, 9 of the 20 leading copper mines in the world were located in Chile, which has been the leading global producer of mined copper since 1982. Output of mined copper declined slightly to 5.50 Mt from 5.55 Mt in 2016 (table 20). At the Escondida Mine (the first-ranked copper mine by production in 2017, majority-owned by BHP), production decreased by 8% to 903,000 t from 979,000 t in 2016 because of a 43-day labor strike in February and March (BHP Group, 2017, p. 15; 2018, p. 14; Rio Tinto Group, 2018, p. 42). At the Collahuasi Mine [second-ranked, majority-owned by Anglo American plc (United Kingdom) and Glencore], output was 524,000 t in 2017, up by 3% from 507,000 t, owing to higher ore grades and consistent mill throughput rates following planned maintenance in the second quarter. Majority-owner Anglo American increased production slightly to 308,000 t from 307,000 t at the Los Bronces Mine (14th-ranked), where higher ore grades were mostly offset by a mechanical failure at the processing plant in the third and fourth quarters (Anglo American plc, 2018, p. 50, 198). At the Los Pelambres Mine [11th-ranked, majority-owned by Antofagasta plc (United Kingdom)], copper production fell by 3% to 344,000 t from 355,000 t in 2016 as a result of lower ore grades (Antofagasta plc, 2018, p. 36–37). In 2017, the state-owned Corporación Nacional del Cobre de Chile (Codelco) operated 7 mines in the country, 5 of which were ranked among the 20 leading global copper mines, and produced 1.73 Mt of copper, slightly higher than 1.71 Mt in 2016. The company cited slightly higher copper recovery and processing rates as the reasons for the increase (Corporación Nacional del Cobre de Chile, 2018, p. 37).

Refined copper production in Chile was 2.43 Mt in 2017, a decline of 183,000 t (7%) from 2.61 Mt in 2016 (table 22). Production of copper cathodes was affected by disruptions at Codelco's Chuquicamata smelter (one of the leading global facilities by capacity), where planned maintenance lasted for 80 days instead of the expected 55 days because of technical issues, and at the state-owned Empresa Nacional de Minería's Paipote smelter, where operations were suspended for 26 days from December 12, 2017, through January 7, 2018, owing to a labor strike (Assalve, 2017; CRU International Ltd., 2017, p. 13; Kang, 2018). Codelco did not report refined copper production in 2017, but the company's refined sales fell by roughly 160,000 t (11%) to 1.33 Mt from 1.50 Mt in 2016 (Corporación Nacional del Cobre de Chile, 2017, p. 72; 2018, p. 46). Refined copper output at the Escondida electrowinning facility decreased by 74,100 t (24%) in 2017 compared with that in 2016 because of a 43-day worker strike (BHP Group, 2017, p. 15; 2018, p. 14; Rio Tinto Group, 2018, p. 42).

Indonesia.—Production of mined copper in Indonesia was 622,000 t in 2017, 106,000 t (15%) lower than 728,000 t (revised) in 2016 (table 20). At the Grasberg Mine (fifth-ranked, majority-owned by Freeport), copper production decreased by about 36,000 t (7%), to 446,000 t in 2017 from 482,000 t in 2016, owing to multiple disruptions. Freeport's license to export copper concentrates from Indonesia expired on January 11, and operations at Grasberg were halted on February 10 after the storage warehouse reached capacity. Mining resumed at a lower production rate on March 21, when the Gresik smelter restarted following a worker strike, and began to ramp up to full capacity on April 21, when the company received a permit for the resumption of copper concentrate exports. In August, Freeport reached a tentative agreement with the Government of Indonesia to construct a copper smelter in the country within 5 years and divest 51% of its ownership of Grasberg to local entities. In return, the company's license to operate the mine would be extended from 2021 to 2041. As of December, Freeport was permitted to export copper concentrates through June 2018, and negotiations on a final agreement were ongoing. Operations at the Grasberg Mine in 2017 also were affected by a prolonged strike, involving approximately 5,000 unionized employees, in protest of workforce layoffs during the export dispute (Hotter, 2017; Jennemann, 2017; Teo, 2017; Yang, 2017; Freeport-McMoRan Inc., 2018, p. 17–18, 26).

In 2017, PT Medco Energi Internasional Tbk (Indonesia) produced 131,000 t of copper at the Batu Hijau Mine, a decline of 86,000 t (40%) from 217,000 t in 2016. The company began development work on a new ore body, with first production expected in 2020 or early 2021. During the development project, PT Medco expected to focus operations on the processing of lower grade stockpiled ore (PT Medco Energi Internasional Tbk, 2017, p. 35; 2018, p. 52).

Kazakhstan.—Output of mined copper in Kazakhstan rose by 94,700 t (20%) in 2017, to 562,000 t from 468,000 t (revised) in 2016, as the Aktogay and Bozshakol Mines, owned by KAZ Minerals plc (United Kingdom), continued to ramp up to full production capacity (table 20). Commercial production of

copper at Aktogay and Bozshakol commenced in 2016 and 2017, respectively. In 2017, KAZ Minerals increased mine output from that in 2016 by 75,200 t at Aktogay and by 55,700 t at Bozshakol (KAZ Minerals plc, 2018, p. 28, 30).

Peru.—In 2017, 3 of the 20 leading copper mines in the world were located in Peru. Owing to significantly higher output at the Las Bambas Mine [sixth-ranked, majority-owned by MMG Ltd. (Australia)], production of mined copper in Peru rose by 4% to 2.45 Mt from 2.35 Mt in 2016 (table 20). Las Bambas operated for its first full year in 2017 following the start of commercial production in July 2016; output at the mine increased by 37% to 454,000 t in 2017 from 330,000 t in 2016 (MMG Ltd., 2018, p. 23). The increased production at Las Bambas was partially offset by decreases in production from other leading copper mines in Peru. At the Cerro Verde Mine (third-ranked, majority-owned by Freeport), copper production fell by 4% to 482,000 t from 503,000 t in 2016, primarily reflecting lower copper recovery rates (Freeport-McMoRan Inc., 2018, p. 15, 26, 81). At the Antamina Mine (ninth-ranked, majority-owned by BHP and Glencore), processing of higher volumes of polymetallic ore resulted in a slight production decline in 2017, to 423,000 t from 431,000 t. At Glencore's Antapaccay Mine, copper output decreased by 6% to 207,000 t from 220,000 t in 2016 because of lower ore grades (Glencore plc, 2018, p. 70, 204, 205, 209; Teck Resources Ltd., 2018, p. 18).

Russia.—Refined copper production rose by 11% in 2017, to 956,000 t from 861,000 t (revised) in 2016 (table 22). PJSC MMC Norilsk Nickel (Russia), which operates multiple refineries that account for roughly 40% of the refined copper capacity in Russia, reported salable metals output (predominantly consisting of refined copper with some copper contained in concentrates) of 388,000 t from its Russian operations, an increase of 37,000 t (11%) from that in 2016. The company attributed the higher production to processing of third-party concentrates. At the Kyshtym refinery, Russian Copper Company ZAO increased production of copper cathodes by 5% to 128,000 t (International Copper Study Group, 2018b, p. 185; PJSC MMC Norilsk Nickel, 2018a, p. 79, 82; 2018b; Russian Copper Company ZAO, 2018).

Outlook

Domestic mine output of copper in 2018 will likely be similar to that in 2017, based on production guidance published by companies that operate in the United States. Domestic refinery production will likely increase because output in 2017 was affected by planned smelter maintenance shutdowns and a 6-week suspension of operations at one U.S. smelter following a fatal accident. Global mine and refinery production capacities are expected to increase slightly. Global and domestic consumption will continue to depend on economic trends in sectors such as automobiles, housing and building construction, HVAC, power utilities, and telecommunications.

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TABLE 1
SALIENT COPPER STATISTICS[1]

(Metric tons, copper content, unless otherwise specified)

		2013	2014	2015	2016	2017
United States:						
Mine production:						
Copper ore concentrated, gross weight		172,000,000	175,000,000	164,000,000	155,000,000	151,000,000
Average yield of concentrated copper ore	percent	0.43	0.47	0.47	0.50 r	0.44
Recoverable copper:[2]						
Arizona		795,000	893,000	961,000	969,000	868,000
Other States		453,000	464,000	422,000	461,000	391,000
Total		1,250,000	1,360,000	1,380,000	1,430,000	1,260,000
Total value[3]	millions	$9,360	$9,510	$7,810	$7,090	$7,920
Smelter production:						
Primary (from ore)[4]		516,000	522,000	527,000	563,000	470,000
Byproduct sulfuric acid, sulfur content		574,000	545,000 r	605,000 r	636,000 r	489,000
Refinery production:						
Primary materials (ore):						
Electrolytic		518,000	535,000	503,000	561,000	482,000
Electrowon		475,000	514,000	588,000	615,000	557,000
Total		993,000	1,050,000	1,090,000	1,180,000	1,040,000
Secondary materials (scrap), electrolytic and fire-refined		46,900	46,000	48,800	46,300	40,100
Grand total, primary and secondary refinery		1,040,000	1,090,000	1,140,000	1,220,000	1,080,000
Secondary production:[5]						
Recovered from new (manufacturing) scrap		630,000	672,000	640,000	690,000	702,000
Recovered from old (post-consumer) scrap		166,000	173,000	166,000	149,000 r	146,000
Total		797,000	845,000	806,000	838,000 r	848,000
Copper sulfate production, gross weight		23,000	22,900	18,500	18,400	18,400
Exports, refined[6]		111,000	127,000	86,200	134,000	94,200
Imports for consumption, refined[6]		734,000	620,000	687,000 r	708,000	813,000
General imports, refined[6]		730,000	614,000	665,000	701,000	820,000
Stocks (closing), December 31:						
Blister and anodes		12,700	9,860	13,900	14,400	12,600
Refined copper:						
Refineries		15,000	9,540	12,000	4,190	5,840
Wire-rod mills		32,600	42,000	36,200	26,700	27,800
Brass mills		6,710	7,400	7,580	7,380	7,870
Other industry		4,360	5,090	5,730	5,420	5,350
Commodity Exchange Inc. (COMEX)[7]		14,900	23,900	63,200	80,700	191,000
London Metal Exchange Ltd. (LME), U.S. warehouses[7]		185,000	102,000	83,800	98,900	27,100
Total		259,000	190,000	209,000	223,000	265,000
Consumption:						
Reported, refined copper		1,830,000	1,760,000	1,810,000	1,800,000 r	1,800,000
Apparent, primary refined and copper from old scrap[8]		1,760,000	1,780,000	1,820,000	1,880,000	1,870,000
Price, annual average:[7]						
U.S. producer cathode[9]	cents per pound	339.94	318.05	256.15	224.87	285.39
COMEX, first position	do.	334.11	312.00	250.81	219.73	280.43
LME, Grade A cash	do.	332.29	311.13	249.53	220.57	279.52
World, production:						
Mine		18,400,000 r	18,600,000 r	19,200,000	20,400,000 r	20,000,000
Smelter		16,600,000	18,000,000	18,500,000	18,900,000	19,200,000
Refinery		21,300,000	22,800,000	23,200,000	23,700,000 r	23,900,000

rRevised. do. Ditto.

[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits, except prices; may not add to totals shown.

[2]Copper recoverable in concentrates (of copper and other metals) and precipitates plus copper produced by solvent extraction and electrowinning.

[3]Calculated with the U.S. producer cathode price.

[4]May contain small amounts of scrap.

[5]Copper converted to refined metal and alloys by refineries and manufacturers (brass mills, chemical plants, foundries, wire-rod mills, and so forth).

[6]Source: U.S. Census Bureau.

[7]Source: S&P Global Platts Metals Week.

[8]Primary refined production plus copper recovered from old scrap plus general refined imports minus refined exports, including adjustments for changes in refined stocks.

[9]Sum of the COMEX price and average New York dealer cathode premiums; reflects the delivered price of copper to domestic consumers by domestic producers.

TABLE 2
LEADING COPPER-PRODUCING MINES IN THE UNITED STATES IN 2017, IN ORDER OF OUTPUT[1, 2]

Rank	Mine	County and State	Operator	Source of copper	Capacity (thousand metric tons)
1	Morenci	Greenlee, AZ	Freeport-McMoRan Inc.	Copper-molybdenum ore, concentrated and leached	580
2	Bingham Canyon	Salt Lake, UT	Rio Tinto Kennecott[3]	Copper-molybdenum ore, concentrated	220
3	Chino	Grant, NM	Freeport-McMoRan Inc.	Copper ore, concentrated and leached	145
4	Bagdad	Yavapai, AZ	do.	Copper-molybdenum ore, concentrated and leached	110
5	Sierrita	Pima, AZ	do.	do.	110
6	Safford	Graham, AZ	do.	Copper ore, leached	110
7	Mission Complex	Pima, AZ	ASARCO LLC[4]	Copper ore, concentrated	75
8	Pinto Valley	Gila, AZ	Capstone Mining Corp.	Copper-molybdenum ore, concentrated and leached	65
9	Robinson	White Pine, NV	Robinson Nevada Mining Co.[5]	Copper-molybdenum ore, concentrated	65
10	Ray	Pinal, AZ	ASARCO LLC[4]	Copper ore, concentrated and leached	133
11	Continental Pit	Silver Bow, MT	Montana Resources LLP	Copper-molybdenum ore, concentrated	40
12	Tyrone	Grant, NM	Freeport-McMoRan Inc.	Copper ore, leached	45
13	Eagle	Marquette, MI	Lundin Mining Corp.	Nickel-copper ore, concentrated	25
14	Silver Bell	Pima, AZ	ASARCO LLC[4]	Copper ore, leached	21
15	Phoenix	Lander, NV	Newmont Mining Corp.	Gold-copper ore, concentrated and leached	30
16	Miami	Gila, AZ	Freeport-McMoRan Inc.	Copper ore, leached	90
17	Carlota	do.	Carlota Copper Co.[5]	do.	35

do. Ditto.
[1]Table includes data available through May 17, 2021.
[2]The mines listed accounted for more than 99% of U.S. mine production in 2017.
[3]Wholly owned subsidiary of Rio Tinto Group.
[4]Wholly owned subsidiary of Grupo México, S.A.B. de C.V.
[5]Wholly owned subsidiary of KGHM International Ltd.

TABLE 3
MINE PRODUCTION OF COPPER-BEARING ORES AND RECOVERABLE COPPER CONTENT OF ORES PRODUCED IN THE UNITED STATES, BY SOURCE AND TREATMENT PROCESS[1]

(Metric tons)

Source and treatment process	2016		2017	
	Gross weight	Recoverable copper	Gross weight	Recoverable copper
Mined copper ore:				
Concentrated	155,000,000	775,000 r	151,000,000	666,000
Leached	NA	615,000	NA	557,000
Total	NA	1,390,000 r	NA	1,220,000
Copper precipitates shipped, leached from tailings, dumps, and in-place material	NA	W	NA	W
Other copper-bearing ores[2]	4,590,000	40,700 r	4,500,000	35,700
Grand total	XX	1,430,000	XX	1,260,000

rRevised. NA Not available. W Withheld to avoid disclosing company proprietary data; included with "Other copper-bearing ores." XX Not applicable.
[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes gold ore, lead ore, and nickel ore.

TABLE 4
CONSUMPTION OF COPPER AND BRASS MATERIALS IN THE UNITED STATES, BY ITEM[1]

(Metric tons)

Item	Brass mills	Wire-rod mills	Foundries, chemical plants, miscellaneous users	Smelters, refiners, ingot makers	Total
2016:					
Copper scrap	718,000	W	55,400	131,000	904,000
Refined copper	421,000	1,320,000	56,200 r	4,580	1,800,000 r
Hardeners and master alloys	9,800	--	5,750	--	15,500
Brass ingots	--	--	52,800	--	52,800
Slab zinc	33,200	--	493	283	34,000
2017:					
Copper scrap	742,000	W	42,700	125,000	910,000
Refined copper	420,000	1,320,000	57,500	4,550	1,800,000
Hardeners and master alloys	9,800	--	3,710	--	13,500
Brass ingots	--	--	59,400	--	59,400
Slab zinc	33,200	--	358	309	33,900

rRevised. W Withheld to avoid disclosing company proprietary data; included with "Brass mills." -- Zero.
[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 5
CONSUMPTION OF REFINED COPPER SHAPES IN THE UNITED STATES, BY CLASS OF CONSUMER[1]

(Metric tons)

Class of consumer	Cathodes	Ingots and ingot bars	Cakes and slabs	Wirebar, billets, other	Total
2016:					
Wire-rod mills	1,320,000	--	--	(2)	1,320,000
Brass mills	325,000	W	43,700	51,600	421,000
Chemical plants	W	--	--	237 r	237 r
Ingot makers	W	W	--	4,580	4,580
Foundries	17,700	3,050	--	9,540	30,300
Miscellaneous[3]	W	W	--	25,700 r	25,700 r
Total	1,660,000	3,050	43,700	91,600 r	1,800,000 r
2017:					
Wire-rod mills	1,320,000	--	--	(2)	1,320,000
Brass mills	324,000	W	43,900	51,600	420,000
Chemical plants	W	--	--	242	242
Ingot makers	W	W	--	4,550	4,550
Foundries	17,300	4,340	--	9,430	31,100
Miscellaneous[3]	W	W	--	26,200	26,200
Total	1,660,000	4,340	43,900	92,000	1,800,000

rRevised. W Withheld to avoid disclosing company proprietary data; included with "Wirebar, billets, other." -- Zero.
[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Withheld to avoid disclosing company proprietary data; included with "Cathodes."
[3]Includes consumers of copper powder and copper shot, iron and steel plants, and other manufacturers.

TABLE 6
COPPER RECOVERED FROM SCRAP PROCESSED IN THE UNITED STATES,
BY KIND OF SCRAP AND FORM OF RECOVERY[1]

(Metric tons)

	2016	2017
Kind of scrap:		
New:		
Copper-base	652,000	663,000
Aluminum-base	37,400	38,300
Nickel-base	18	18
Total	690,000	702,000
Old:		
Copper-base	120,000	115,000
Aluminum-base	28,700 r	30,500
Nickel-base	254	254
Zinc-base	10	10
Total	149,000 r	146,000
Grand total, new and old scrap	838,000 r	848,000
Form of recovery:		
As unalloyed copper	46,400	40,200
In brass and bronze	723,000	739,000
In aluminum alloys	66,200 r	68,000
In alloy iron and steel and other alloys	839	692
In chemical compounds	1,800	--
Total	838,000 r	848,000

rRevised. -- Zero.
[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 7
COPPER RECOVERED AS REFINED COPPER AND IN ALLOYS AND OTHER FORMS
FROM COPPER-BASE SCRAP PROCESSED IN THE UNITED STATES, BY TYPE OF OPERATION[1]

(Metric tons)

	From new scrap		From old scrap		Total	
Type of operation	2016	2017	2016	2017	2016	2017
Ingot makers	9,630 r	8,540	48,000 r	48,300	57,600	56,800
Refineries[2]	19,900	20,100	26,400	20,000	46,300	40,100
Brass and wire-rod mills	586,000	608,000	35,200	36,900	621,000	645,000
Foundries and miscellaneous manufacturers	36,700	26,400	10,100	9,950	46,800	36,300
Total	652,000	663,000	120,000	115,000	772,000	779,000

rRevised.
[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Electrolytically refined and fire refined from scrap based on source of material at smelter or refinery level.

TABLE 8
PRODUCTION OF SECONDARY COPPER AND COPPER-ALLOY PRODUCTS
IN THE UNITED STATES, BY ITEM PRODUCED FROM SCRAP[1]

(Metric tons)

Item produced from scrap	2016	2017
Unalloyed copper products:[2]	46,400	40,200
Alloyed copper products:		
Brass and bronze ingots:		
Tin bronzes	5,940	5,820
Leaded red brass and semired brass	35,700	35,500
High leaded tin bronze	4,920	4,920
Yellow brass	1,580	1,280
Manganese bronze	6,170	6,170
Aluminum bronze	4,770	4,660
Nickel silver	1,020	1,020
Silicon bronze and brass	3,470	3,630
Copper-base hardeners and master alloys	4,990	4,480
Miscellaneous	6,090	6,090
Total	74,600	73,600
Brass mill and wire-rod mill products	705,000 r	729,000
Brass and bronze castings	45,300	29,400
Copper in chemical products	1,800	--
Grand total	873,000 r	872,000

rRevised. -- Zero.
[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes electrolytically refined copper, fire-refined copper, and copper castings.

TABLE 9
COMPOSITION OF SECONDARY COPPER-ALLOY PRODUCTION IN THE UNITED STATES[1]

(Metric tons)

	Copper	Tin	Lead	Zinc	Nickel	Aluminum	Total
Brass and bronze ingot production:							
2016	61,100 r	2,690 r	3,920 r	6,880 r	W	94 r	74,600
2017	60,200	2,650	3,870	6,780	W	93	73,600
Secondary metal content of brass mill products:							
2016	621,000 r	W	1,980	80,100	W	1,420 r	705,000 r
2017	645,000	W	W	80,100	W	3,250	729,000
Secondary metal content of brass and bronze castings:							
2016	42,700	W	417	966	68	1,140 r	45,300
2017	28,500	W	137	429	79	220	29,400

rRevised. W Withheld to avoid disclosing company proprietary data.
[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 10
CONSUMPTION AND YEAREND STOCKS OF COPPER-BASE SCRAP IN THE UNITED STATES[1]

(Metric tons, gross weight)

Scrap type and processor	2016		2017	
	Consumption	Stocks	Consumption	Stocks
Unalloyed scrap:				
No. 1 wire and heavy:				
Smelters, refiners, and ingot makers	14,700	W	13,200	W
Brass and wire-rod mills	387,000	(2)	391,000	(2)
Foundries and miscellaneous manufacturers	19,300	(2)	18,900	(2)
No. 2 mixed heavy and light:				
Smelters, refiners, and ingot makers	62,900	W	58,400	W
Brass and wire-rod mills	66,600	(2)	87,400	(2)
Foundries and miscellaneous manufacturers	12,500	(2)	12,500	(2)
Total unalloyed scrap:				
Smelters, refiners, and ingot makers	77,600	54,400	71,600	68,200
Brass and wire-rod mills	454,000	1,330	478,000	1,060
Foundries and miscellaneous manufacturers	31,800	3,430 r	31,400	3,460
Alloyed scrap:				
Red brass:[3]				
Smelters, refiners, and ingot makers	12,200	1,500	12,300	1,450
Brass mills	W	(2)	W	(2)
Foundries and miscellaneous manufacturers	3,470	(2)	W	(2)
Leaded yellow brass:				
Smelters, refiners, and ingot makers	8,800	758	8,800	774
Brass mills	101,000	(2)	W	(2)
Foundries and miscellaneous manufacturers	W	(2)	W	(2)
Yellow and low brass, all plants	50,200	792 r	65,700	766
Cartridge cases and brass, all plants	W	(2)	W	(2)
Auto radiators:				
Smelters, refiners, and ingot makers	14,900	655	15,100	663
Foundries and miscellaneous manufacturers	W	(2)	W	(2)
Bronzes:				
Smelters, refiners, and ingot makers	8,560	515	8,560	532
Brass mills and miscellaneous manufacturers	W	(2)	331	(2)
Nickel-copper alloys, all plants	9,500 r	191	9,690	159
Low grade and residues; smelters, refiners, miscellaneous manufacturers	8,890	606 r	8,890	620
Other alloy scrap:[4]				
Smelters, refiners, and ingot makers	W	W	W	209
Brass mills and miscellaneous manufacturers	5,390	(2)	5,440	(2)
Total alloyed scrap:				
Smelters, refiners, and ingot makers	53,300	5,570	53,700	5,200
Brass mills	264,000	356	264,000	323
Foundries and miscellaneous manufacturers	23,600	1,060	11,300	1,180
Grand total, scrap:				
Smelters, refiners, and ingot makers	131,000	60,000	125,000	73,400
Brass and wire-rod mills	718,000	1,690	742,000	1,380
Foundries and miscellaneous manufacturers	55,400	4,480 r	42,700	4,640

rRevised. W Withheld to avoid disclosing company proprietary data; included in totals.

[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Individual breakdown is not available; included in totals.

[3]Includes cocks and faucets, commercial bronze, composition turnings, gilding metal, railroad car boxes, and silicon bronze.

[4]Includes aluminum bronze, beryllium copper, and refinery brass.

TABLE 11
CONSUMPTION OF PURCHASED COPPER-BASE SCRAP IN THE UNITED STATES[1]

(Metric tons, gross weight)

Type of operation	New scrap		Old scrap		Total	
	2016	2017	2016	2017	2016	2017
Ingot makers	24,700	24,400	61,600	60,500	86,300 r	84,800
Smelters and refineries	21,300	21,000	23,300	19,500	44,600	40,500
Brass and wire-rod mills[2]	681,000	704,000	36,400	38,000	718,000	742,000
Foundries and miscellaneous manufacturers	43,900	31,500	11,500	11,200	55,400	42,700
Total	771,000	781,000	133,000	129,000	904,000	910,000

rRevised.
[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Consumption at brass and wire-rod mills assumed equal to receipts.

TABLE 12
FOUNDRIES AND MISCELLANEOUS MANUFACTURERS CONSUMPTION
OF BRASS INGOT, REFINED COPPER, AND COPPER SCRAP
IN THE UNITED STATES[1]

(Metric tons)

Ingot type or material consumed	2016	2017
Brass ingot:		
Tin bronzes	6,510	6,310
Leaded red brass and semired brass	21,800	24,900
Yellow, leaded, low brass[2]	11,400	14,500
Manganese bronze	2,500	2,420
Nickel silver[3]	3,700	4,270
Aluminum bronze	2,970	3,120
Hardeners and master alloys[4]	5,750	3,710
Lead free alloys[5]	3,950	3,890
Total	58,500	63,100
Refined copper	56,200 r	57,500
Copper scrap	55,400	42,700

rRevised.
[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes brass and silicon bronze.
[3]Includes brass, copper nickel, and nickel bronze.
[4]Includes special alloys.
[5]Includes copper-bismuth and copper-bismuth-selenium alloys.

TABLE 13
AVERAGE BUYING PRICES FOR COPPER SCRAP, BY TYPE[1]

(Cents per pound)

			Dealers buying (New York)	
Year	Brass mills no. 1 scrap	Refiners no. 2 scrap	No. 2 scrap	Red brass turnings and borings
2016	218.01	197.52	155.05	132.17
2017	271.69	245.68	189.25	149.55

[1]Table includes data available through May 17, 2021.

Source: American Metal Market.

TABLE 14

U.S. EXPORTS OF UNMANUFACTURED COPPER (COPPER CONTENT), BY COUNTRY OR LOCALITY[1]

	Ore and concentrates[2]		Matte, ash, and precipitates[3]		Blister and anodes		Refined		Unalloyed copper scrap		Total	
Country or locality	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)
2016	331,000	$2,210,000	30,800 r	$59,700 r	9,510	$41,000	134,000	$655,000 r	412,000 r	$1,310,000	916,000 r	$4,270,000 r
2017:												
Belgium	--	--	4,860	4,600	447	1,000	(5)	3	7,870	34,900	13,200	40,500
Canada	23,500	125,000	17,300	21,400	3,290	8,820	18,300	109,000	43,800	237,000	106,000	502,000
China	70,800	394,000	392	1,930	249	1,630	10,100	74,800	352,000	1,180,000	434,000	1,650,000
France	1	7	7	11	348	2,300	(5)	8	59	190	415	2,520
Germany	--	--	576	1,400	215	1,460	14	70	19,700	92,300	20,500	95,200
Hong Kong	--	--	--	--	1,110	7,360	1	6	5,580	16,600	6,690	23,900
India	1	7	(5)	4	730	4,020	15	100	4,810	17,500	5,560	21,700
Italy	--	--	73	119	325	1,950	14	85	5	24	417	2,180
Japan	1,540	7,960	189	159	80	553	16	260	11,800	59,400	13,700	68,300
Korea, Republic of	99	413	397	2,250	1,780	11,400	2,460	14,400	17,200	83,200	21,900	112,000
Malaysia	--	--	3	5	178	1,200	--	--	2,320	6,440	2,500	7,650
Mexico	141,000	1,050,000	99	308	102	594	62,600	392,000	3,500	20,600	207,000	1,470,000
Netherlands	--	--	168	223	--	--	(5)	18	7,260	35,700	7,430	35,900
Pakistan	--	--	--	--	1	5	--	--	3,790	15,400	3,790	15,400
Slovakia	--	--	347	1,330	--	--	--	--	2,980	13,800	3,330	15,100
Taiwan	--	--	146	879	122	799	19	715	5,750	29,000	6,040	31,400
Other	135	800	687	1,720	706	3,660	657	4,660	5,750	23,000	7,940	33,800
Total	237,000	1,580,000	25,200	36,400	9,690	46,700	94,200	596,000	494,000	1,860,000	860,000	4,130,000

rRevised. -- Zero.

[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Copper ore and concentrates only; excludes copper contained in ore and concentrates of other metals.

[3]Copper matte, ash, and precipitates only; excludes the copper content of mattes and ashes of other metals.

[4]Free alongside ship value.

[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 15

U.S. EXPORTS OF COPPER SEMIMANUFACTURES, BY COUNTRY OR LOCALITY[1, 2]

Country or locality	Pipes and tubing		Plates, sheets, foil, bars		Bare wire, including wire rod[3]		Wire and cable, stranded		Copper sulfate	
	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)
2016	14,000	$104,000	28,400	$239,000	170,000	$894,000 r	37,800	$291,000	5,840	$34,900
2017:										
Bahrain	85	663	1	11	2	19	9	203	2	8
Brazil	297	2,290	86	968	44	492	6	111	18	93
Canada	2,500	22,400	6,730	57,100	33,600	219,000	12,600	87,800	2,010	4,490
China	515	2,770	1,790	28,500	393	3,630	179	2,530	446	4,290
Dominican Republic	36	357	13	108	168	968	287	1,920	49	115
Germany	102	551	638	5,560	25	213	33	1,370	54	103
Hong Kong	12	416	789	17,200	14	276	34	2,020	5	181
Ireland	21	196	12	54	2	34	2	13	992	6,900
Japan	12	71	260	5,140	6	140	47	816	152	1,540
Jordan	228	2,190	53	443	--	--	--	--	--	--
Korea, Republic of	70	1,040	615	9,370	481	3,430	32	657	648	5,630
Malaysia	42	341	402	6,550	20	38	7	267	192	371
Mexico	6,640	52,800	16,300	133,000	128,000	813,000	26,900	202,000	3	12
Netherlands	70	485	11	152	1	41	11	295	--	--
Peru	1	16	20	160	1	19	221	5,420	--	--
Poland	104	550	(5)	5	3	74	2	25	1	7
Qatar	114	898	5	20	--	--	(5)	3	--	--
Saudi Arabia	3,240	24,400	21	472	(5)	5	270	1,110	--	--
Singapore	98	440	113	1,380	797	5,400	6	120	49	1,400
Taiwan	30	425	41	820	27	75	13	274	737	8,470
Thailand	5	68	672	6,120	11	98	14	150	--	--
United Arab Emirates	817	6,470	2	18	8	64	7	128	--	--
United Kingdom	44	505	160	1,040	119	649	95	1,750	--	--
Other	461	4,000	677	9,060	473	4,100	1,030	16,400	798	3,330
Total	15,500	124,000	29,400	283,000	164,000	1,050,000	41,800	326,000	6,160	36,900

rRevised. -- Zero.

[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]With the exception of copper sulfate, all categories include refined copper only; copper-alloy products are excluded.

[3]Exports of wire rod were 158,000 metric tons (t) valued at $821 million in 2016 and 156,000 t valued at $995 million in 2017.

[4]Free alongside ship value.

[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 16

U.S. IMPORTS FOR CONSUMPTION OF UNMANUFACTURED COPPER (COPPER CONTENT), BY COUNTRY OR LOCALITY[1]

	Ore and concentrates[2]		Matte, ash, and precipitates[3]		Blister and anodes		Refined		Unalloyed scrap		Total	
Country or locality	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)
2016	67	$178	807 r	$3,150	274	$3,060	708,000	$3,430,000	29,200	$117,000	738,000	$3,550,000
2017:												
Bolivia	--	--	--	--	--	--	1,560	9,480	17	65	1,580	9,550
Brazil	--	--	--	--	--	--	3,580	20,900	40	158	3,620	21,000
Canada	6	26	284	1,350	--	--	209,000	1,280,000	18,900	100,000	228,000	1,390,000
Chile	--	--	--	--	--	--	486,000	2,980,000	57	230	486,000	2,980,000
Colombia	--	--	--	--	--	--	--	--	598	2,480	598	2,480
Congo (Kinshasa)	--	--	--	--	--	--	9,190	47,800	--	--	9,190	47,800
Costa Rica	--	--	--	--	--	--	--	--	636	1,910	636	1,910
Finland	--	--	--	--	359	2,170	4	34	--	--	363	2,210
Germany	--	--	7	79	(5)	2	2,310	15,600	82	112	2,400	15,800
Japan	--	--	76	559	2	153	4,630	36,000	70	263	4,780	36,900
Malaysia	--	--	--	--	126	846	--	--	--	--	126	846
Mexico	14,000	25,700	588	851	--	--	75,200	453,000	10,400	43,600	100,000	523,000
Netherlands	--	--	166	767	3	77	3	63	8	16	180	923
Pakistan	--	--	--	--	--	--	--	--	694	2,580	694	2,580
Panama	--	--	--	--	--	--	--	--	1,440	7,580	1,440	7,580
Peru	--	--	--	--	--	--	18,000	113,000	54	189	18,100	113,000
Saudi Arabia	9	14	48	235	--	--	--	--	241	817	298	1,070
South Africa	--	--	--	--	--	--	1,510	8,710	--	--	1,510	8,710
Trinidad and Tobago	--	--	271	1,320	--	--	--	--	72	374	343	1,690
United Arab Emirates	--	--	--	--	--	--	--	--	208	762	208	762
Venezuela	--	--	--	--	--	--	5	10	958	4,390	963	4,400
Zambia	--	--	--	--	--	--	749	5,000	--	--	749	5,000
Other	--	--	180	1,500	14	273	750	6,230	1,060	4,810	2,000	12,800
Total	14,000	25,700	1,620	6,650	504	3,520	813,000	4,980,000	35,500	170,000	865,000	5,190,000

rRevised. -- Zero.

[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Copper ore and concentrates only; excludes copper contained in ore and concentrates of other metals.

[3]Copper matte, ash, and precipitates only; excludes the copper content of mattes and ashes of other metals.

[4]U.S. Customs value.

[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 17

U.S. IMPORTS FOR CONSUMPTION OF COPPER SEMIMANUFACTURES, BY COUNTRY OR LOCALITY[1, 2]

Country or locality	Pipes and tubing		Plates, sheets, foil, bars		Bare wire, including wire rod[3]		Wire and cable, stranded		Copper sulfate	
	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)	Quantity (metric tons)	Value[4] (thousands)
2016	61,100 r	$396,000 r	49,400 r	$349,000 r	152,000	$782,000	5,230	$34,600	45,200	$80,800
2017:										
Austria	4,620	38,100	196	1,290	57	421	(5)	13	--	--
Brazil	299	3,660	2,310	15,900	3	33	--	--	39	67
Bulgaria	--	--	1,460	10,400	--	--	--	--	--	--
Cabo Verde	2,690	19,500	--	--	--	--	--	--	--	--
Canada	270	2,490	959	8,590	124,000	775,000	892	5,880	5,490	10,900
Chile	--	--	56	311	983	6,310	--	--	2,880	5,340
China	826	6,380	1,730	14,800	601	5,800	63	767	92	214
Finland	4,200	28,700	4,860	42,600	624	5,340	--	--	--	--
France	783	7,690	2,320	18,700	245	5,720	85	1,640	--	--
Germany	(5)	5	23,900	187,000	1,080	10,100	106	1,940	12	63
Greece	15,900	134,000	--	--	--	--	--	--	--	--
India	1,880	16,800	284	1,780	2	120	51	837	654	1,140
Japan	38	278	2,820	50,400	524	7,030	1	30	234	391
Korea, Republic of	1,540	10,600	1,530	14,800	53	658	6	84	--	--
Luxembourg	--	--	1,050	13,200	--	--	--	--	--	--
Mexico	--	--	2,520	17,800	12,600	79,500	533	2,770	34,600	74,400
Peru	--	--	8,150	57,100	1,560	10,800	--	--	975	1,770
Russia	--	--	--	--	(5)	3	--	--	4,540	10,300
Taiwan	(5)	9	373	3,970	146	1,440	30	842	3,720	7,610
Turkey	--	--	1	7	208	1,540	1,380	9,520	88	171
Uzbekistan	15,600	109,000	--	--	--	--	--	--	--	--
Venezuela	11,500	81,500	--	--	--	--	--	--	--	--
Other	1,200	11,400	1,030	8,900	1,050	8,130	183	3,280	52	104
Total	61,400	471,000	55,600	467,000	144,000	918,000	3,330	27,600	53,300	112,000

rRevised. -- Zero.

[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]With the exception of copper sulfate, all categories include refined copper only; copper-alloy products are excluded.

[3]Imports of wire rod were 140,000 metric tons (t) valued at $706 million in 2016 and 133,000 t valued at $836 million in 2017.

[4]U.S. Customs value.

[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 18

U.S. EXPORTS OF COPPER SCRAP (GROSS WEIGHT), BY COUNTRY OR LOCALITY[1]

	Unalloyed copper scrap				Copper-alloy scrap			
	2016		2017		2016		2017	
Country or locality	Quantity (metric tons)	Value[2] (thousands)	Quantity (metric tons)	Value[2] (thousands)	Quantity (metric tons)	Value[2] (thousands)	Quantity (metric tons)	Value[2] (thousands)
Belgium	9,030	$33,100	7,870	$34,900	8,390	$23,400	8,560	$21,800
Canada	23,800 r	111,000 r	43,800	237,000	51,300 r	83,200 r	49,700	47,100
China	284,000	789,000 r	352,000	1,180,000	376,000	570,000	336,000	538,000
Germany	24,900	90,400	19,700	92,300	8,130	31,100	10,900	51,200
Hong Kong	6,530 r	17,900	5,580	16,600	17,200 r	19,300	30,800	32,700
India	1,670	6,390	4,810	17,500	23,000	60,000	20,100	54,700
Japan	6,460	28,700	11,800	59,400	8,730	36,400	9,300	30,800
Korea, Republic of	17,000	75,900	17,200	83,200	10,300	33,500	14,100	47,300
Malaysia	816	2,570	2,320	6,440	826	532	3,240	2,860
Netherlands	12,100	42,700	7,260	35,700	1,170	1,850	1,120	2,520
Pakistan	1,890	7,110	3,790	15,400	6,200	2,680	5,780	3,190
Slovakia	6,300	30,000	2,980	13,800	1,470	4,500	4,940	16,700
Spain	182	649	1,220	3,920	7,770	13,700	6,280	16,000
Taiwan	8,290	35,300	5,750	29,000	1,740	5,790	2,890	7,930
Other	8,880 r	40,800 r	8,090	39,900	10,400 r	28,100 r	6,410	18,300
Total	412,000 r	1,310,000	494,000	1,860,000	532,000	914,000	510,000	891,000

rRevised.

[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]Free alongside ship value.

Source: U.S. Census Bureau.

TABLE 19

U.S. IMPORTS FOR CONSUMPTION OF COPPER SCRAP, BY COUNTRY OR LOCALITY[1]

Country or locality	Unalloyed copper scrap		Copper-alloy scrap		
	Quantity (metric tons)	Value[2] (thousands)	Gross weight (metric tons)	Copper content[3] (metric tons)	Value[2] (thousands)
2016	29,200	$117,000	96,100	69,200	$342,000
2017:					
Bahamas, The	7	34	554	399	1,280
Canada	18,900	100,000	81,900	59,000	413,000
Chile	57	230	301	217	822
China	20	76	732	527	2,570
Colombia	598	2,480	1,360	976	5,040
Costa Rica	636	1,910	1,060	766	4,200
Dominican Republic	180	822	940	677	1,750
Ecuador	--	--	337	243	1,150
El Salvador	32	34	296	213	980
Guatemala	36	188	446	321	1,600
Honduras	61	311	352	253	1,330
Mexico	10,400	43,600	35,300	25,400	134,000
Nicaragua	38	160	321	231	1,650
Pakistan	694	2,580	--	--	--
Panama	1,440	7,580	790	569	1,970
Philippines	16	83	205	148	774
Russia	--	--	266	192	475
Saudi Arabia	241	817	--	--	--
Suriname	199	914	55	40	175
United Arab Emirates	208	762	42	30	139
United Kingdom	29	114	236	170	1,420
Venezuela	958	4,390	1,870	1,350	7,630
Vietnam	116	466	118	85	311
Other	666	2,790	2,410	1,730	7,730
Total	35,500	170,000	130,000	93,500	590,000

-- Zero.

[1]Table includes data available through May 17, 2021. Data are rounded to no more than three significant digits; may not add to totals shown.

[2]U.S. Customs value.

[3]Content is estimated by the U.S. Geological Survey to be 72% of gross weight.

Source: U.S. Census Bureau.

TABLE 20

COPPER: WORLD MINE PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Metric tons, copper content)

Country or locality	2013	2014	2015	2016	2017 [p]
Albania, concentrates	6,900 [e]	3,500 [e]	1,900 [e]	200 [e]	--
Argentina, concentrates	109,631	102,557	61,766	81,902 [r]	33,300
Armenia, concentrates	44,797 [r]	44,945 [r]	75,700 [r]	95,079 [r]	95,793
Australia:					
Concentrates	966,000 [r]	936,000 [r]	956,000	918,000	834,000
Leaching, electrowon	35,000 [r]	43,000 [r]	40,000	30,000	26,000
Total	1,001,000	979,000 [r]	996,000	948,000	860,000
Azerbaijan, concentrates	329	675	969	1,947 [r]	2,063
Bolivia:					
Concentrates	5,500	8,936 [r]	7,690 [r]	6,519 [r]	5,200 [e]
Leaching, electrowon	2,100	1,810 [r]	1,789 [r]	2,199 [r]	1,800 [e]
Total	7,600	10,746 [r]	9,479 [r]	8,718 [r]	7,000 [e]
Botswana, concentrates	48,500 [r]	38,000	9,126	12,415 [r]	1,239
Brazil:					
Concentrates	270,979	301,197	359,848	337,628 [r]	390,000 [e]
Leaching, electrowon	4,060	700	--	--	--
Total	275,039	301,897	359,848	337,628 [r]	390,000 [e]
Bulgaria, concentrates[3]	75,307	72,419	71,748	70,573	73,003
Burma, leaching, electrowon	25,000	33,200	46,900	75,000	115,100
Canada:					
Concentrates	652,595	672,729	714,647 [r]	693,059 [r]	594,994
Leaching, electrowon	--	900 [r]	500 [r]	--	--
Total	652,595	673,629 [r]	715,147 [r]	693,059 [r]	594,994
Chile:					
Concentrates	3,843,100	3,917,100	3,993,700	3,892,300	3,917,300
Leaching, electrowon	1,932,900	1,844,000	1,778,400	1,660,300	1,586,200
Total	5,776,000	5,761,100	5,772,100	5,552,600	5,503,500
China:					
Concentrates	1,680,000	1,740,000	1,670,000	1,850,700	1,660,000
Leaching, electrowon	33,900	35,500 [r]	44,900 [r]	49,500 [r]	50,000
Total	1,713,900	1,775,500 [r]	1,714,900 [r]	1,900,200 [r]	1,710,000
Colombia, concentrates	725	4,118	5,463	8,493 [r]	9,355
Congo (Kinshasa):					
Concentrates	229,978 [r]	163,204 [r]	109,497 [r]	180,512 [r]	220,000 [e]
Leaching, electrowon	684,653 [r]	866,595 [r]	886,308 [r]	840,524 [r]	870,000 [e]
Total	914,631 [r]	1,029,799 [r]	995,805 [r]	1,021,036 [r]	1,090,000 [e]
Cyprus, leaching, electrowon	3,631	3,088	2,121	1,754 [r]	1,293
Dominican Republic, concentrates	10,379	9,262	7,324	9,725 [r]	9,618
Ecuador, concentrates[e]	190,000	120,000	1,400	40,000	8,200
Eritrea, concentrates	21,800	88,900	61,600	25,300	7,900
Finland, concentrates	38,800	42,800	41,805 [r]	47,488 [r]	53,144
Georgia, concentrates[e]	5,000	5,000	6,500	7,700	8,000
India, concentrates	34,800	26,700	29,900	33,600 [r]	32,300
Indonesia:					
Concentrates	509,200	377,400 [r]	577,300	716,200 [r]	598,800
Leaching, electrowon	--	1,416 [r]	1,226 [r]	11,760 [r]	23,160
Total	509,200	378,816 [r]	578,526 [r]	727,960 [r]	621,960
Iran:					
Concentrates	209,200	203,900	233,400	275,900	289,000
Leaching, electrowon	13,700	12,700	13,000	13,400	13,100
Total	222,900	216,600	246,400	289,300	302,100
Kazakhstan:					
Concentrates	440,300	458,800	458,100	432,400 [r]	520,000 [e]
Leaching, electrowon	12,200	12,900	15,500	35,100 [r]	42,200
Total	452,500	471,700	473,600	467,500 [r]	562,200
Korea, North, concentrates[e]	17,000	19,300	20,000	20,000	20,000
Kyrgyzstan, concentrates	--	780 [r]	3,100	8,300	8,000

See footnotes at end of table.

TABLE 20—Continued
COPPER: WORLD MINE PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Metric tons, copper content)

Country or locality	2013	2014	2015	2016	2017 [p]
Laos:					
Concentrates	64,885	71,155	78,449	89,187 [r]	90,363
Leaching, electrowon	90,030	88,541	89,253	78,492 [r]	62,941
Total	154,915	159,696	167,702	167,679 [r]	153,304
Macedonia:					
Concentrates	9,300 [e]	7,800 [e]	8,834 [r]	9,032 [r]	8,008
Leaching, electrowon	1,900	1,700	2,268 [r]	1,396 [r]	958
Total	11,200	9,500	11,102 [r]	10,428 [r]	8,966
Mauritania, concentrates	37,970	33,079	45,001	32,818 [r]	28,791
Mexico:					
Concentrates	318,000	329,600 [r]	386,400 [r]	536,300 [r]	529,200
Leaching, electrowon	162,100	185,400 [r]	208,100 [r]	229,800 [r]	213,000
Total	480,100	515,000 [r]	594,500 [r]	766,100 [r]	742,200
Mongolia:					
Concentrates	186,655	249,200	311,745	332,000 [r, e]	303,000 [e]
Leaching, electrowon	2,344	6,993 [r]	14,990 [r]	15,010 [r]	14,644
Total	188,999	256,193 [r]	326,735 [r]	347,010 [r]	317,644
Morocco, concentrates[e]	12,000 [r]	17,000 [r]	18,000 [r]	30,000 [r]	30,000
Namibia:					
Concentrates	5,182 [r]	5,249	3,351 [r]	262 [r]	68
Leaching, electrowon	--	--	10,659	16,391 [r]	15,466
Total	5,182 [r]	5,249	14,010 [r]	16,653 [r]	15,534
Oman, concentrates	12,500 [r]	15,400 [r]	8,700 [r]	--	--
Pakistan, concentrates	13,500	13,122	13,056	14,136 [r]	10,052
Papua New Guinea, concentrates	105,523 [r]	75,901 [r]	45,185 [r]	80,022 [r]	105,000
Peru:					
Concentrates	1,285,983	1,293,842	1,627,727	2,280,005	2,383,163
Leaching, electrowon	89,658	83,800	73,091	73,854	62,421
Total	1,375,641	1,377,642	1,700,818	2,353,859	2,445,584
Philippines, concentrates	90,861	91,824	83,835	83,649 [r]	68,156
Poland, concentrates	429,275	421,695	426,196	424,704 [r]	419,603
Portugal, concentrates	77,236	75,433	83,081	74,453 [r]	63,812
Romania, concentrates	7,800 [r]	8,200 [r]	8,800	9,500	11,000
Russia:					
Concentrates	654,000	690,000	710,000 [r]	701,000 [r]	704,000
Leaching, electrowon	1,900 [r]	1,500 [r]	1,400 [r]	1,300 [r]	1,400
Total	655,900 [r]	691,500 [r]	711,400 [r]	702,300 [r]	705,400
Saudi Arabia, concentrates[e]	10,000 [r]	8,300 [r]	12,000 [r]	28,000 [r]	30,000
Serbia, concentrates	35,500	35,843	36,410	41,312 [r]	44,750
South Africa, concentrates	80,800 [r]	78,700 [r]	77,400	65,300	65,500
Spain:					
Concentrates	33,673 [r]	33,386 [r]	51,492 [r]	94,093 [r]	119,300
Leaching, electrowon	69,304 [r]	71,090 [r]	70,029 [r]	73,643 [r]	73,664
Total	102,977 [r]	104,476 [r]	121,521 [r]	167,736 [r]	192,964
Sweden, concentrates	82,904	79,681	75,113 [r]	79,247 [r]	104,594
Tanzania, concentrates	15,400	16,400	16,800	17,400	15,800
Turkey, concentrates	120,500	122,000	108,000	100,000 [r]	83,000
Uganda, concentrates	--	--	--	550 [e]	-- [e]
United States:					
Concentrates[4]	774,000	843,000	795,000	815,000	702,000
Leaching, electrowon	475,000	514,000	588,000	615,000	557,000
Total	1,250,000	1,360,000	1,380,000	1,430,000	1,260,000
Uzbekistan, concentrates[e]	98,000	99,500	101,000	100,000	100,000
Vietnam, concentrates[e]	12,300	12,100	12,300	12,100 [r]	12,200

See footnotes at end of table.

TABLE 20—Continued
COPPER: WORLD MINE PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Metric tons, copper content)

Country or locality	2013	2014	2015	2016	2017 [p]
Zambia:					
Concentrates	558,900	517,100	558,600	595,500	628,400
Leaching, electrowon	200,900	190,000	158,700	167,300	165,700
Total	759,800	707,100	717,300	762,800	794,100
Zimbabwe, concentrates	8,285	8,261	8,218	9,101 [r]	8,839
Grand total	18,400,000 [r]	18,600,000 [r]	19,200,000	20,400,000 [r]	20,000,000
Of which:					
Concentrates	14,600,000 [r]	14,600,000 [r]	15,200,000	16,400,000 [r]	16,100,000
Leaching, electrowon	3,840,000 [r]	4,000,000 [r]	4,050,000 [r]	3,990,000 [r]	3,900,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]Table includes data available through December 12, 2018. All data are reported unless otherwise noted. Grand totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]For some countries and (or) localities, the copper content of concentrates may also include copper precipitates. In some cases, total mine production is officially reported, but the distribution between concentrates and electrowon is estimated.

[3]Copper content of local concentrates processed to produce anodes and cathodes in Bulgaria. Total output is higher, as the copper content of exported local concentrates is not reported.

[4]Recoverable copper content.

TABLE 21

COPPER: WORLD SMELTER PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Metric tons, copper content)

Country or locality	2013	2014	2015	2016	2017 [p]
Armenia, primary	10,771	9,814	11,601	12,920 [r]	12,051
Australia, primary	446,000	468,000	433,000	445,000 [r]	360,000
Austria, secondary	61,000	56,000	60,000	60,000 [e]	60,000 [e]
Belgium, secondary	150,600	143,100	141,000	143,800	126,900
Botswana, primary[3]	21,300	14,628	13,888	11,348 [r]	--
Brazil:					
Primary	202,900	182,800	157,800	188,500	118,800
Secondary	54,000	50,500	42,400	27,000	24,800
Total	256,900	233,300	200,200	215,500	143,600
Bulgaria:					
Primary	294,000	318,700 [r]	292,200 [r]	245,000 [r]	322,700
Secondary	60,300	62,300 [r]	56,200 [r]	51,800 [r]	52,500
Total	354,300	381,000	348,400	296,800	375,200
Canada:					
Primary	254,509	288,699	281,416	304,349 [r]	289,400
Secondary	28,743	32,069	28,713	29,165 [r]	31,000
Total	283,252	320,768	310,129	333,514 [r]	320,400
Chile, primary	1,358,300	1,356,200	1,496,200	1,490,800	1,404,700
China:					
Primary	4,230,000	5,170,000	5,500,000	5,800,000	6,050,000
Secondary	1,300,000	1,350,000	1,380,000	1,410,000	1,510,000
Total	5,530,000	6,520,000	6,880,000	7,210,000	7,560,000
Finland:					
Primary	154,500	169,000	166,500	150,000	150,000 [e]
Secondary	3,700	4,000	4,000 [e]	4,000 [e]	4,000 [e]
Total	158,200	173,000	170,500	154,000	154,000 [e]
Germany:					
Primary	289,900	349,700	349,700	342,800	332,600
Secondary	169,000	179,000	170,000	159,100	198,300
Total	458,900	528,700	519,700	501,900	530,900
India:					
Primary	617,000	766,000	792,600	769,800	803,100
Secondary	--	--	--	3,500	20,000
Total	617,000	766,000	792,600	773,300	823,100
Indonesia, primary	215,000	236,900	199,700	255,700	245,800
Iran:					
Primary	154,600	156,500	153,500	153,400	114,200
Secondary	69,500	76,000	82,100	72,200	70,900
Total	224,100	232,500	235,600	225,600	185,100
Japan:					
Primary	1,249,332	1,290,640	1,175,101	1,137,864 [r]	1,118,626
Secondary	313,636	310,029	296,486	358,810 [r]	369,525
Total	1,562,968	1,600,669	1,471,587	1,496,674 [r]	1,488,151
Kazakhstan, primary	269,220	214,058	309,355	310,001	313,000 [e]
Korea, North:[e]					
Primary	10,000	10,000	10,000	10,000	10,000
Secondary	5,000	5,000	5,000	5,000	5,000
Total	15,000	15,000	15,000	15,000	15,000
Korea, Republic of:					
Primary	478,800	500,000	511,200	510,000 [e]	510,000 [e]
Secondary	125,100	120,000	125,000	125,000 [e]	125,000 [e]
Total	603,900	620,000	636,200	635,000 [e]	635,000 [e]
Mexico:					
Primary	220,800	258,000	256,300	267,800	270,000
Secondary[e]	5,000	5,000	5,000	5,000	5,000
Total	225,800	263,000	261,300	272,800	275,000
Namibia, primary	24,257 [r]	36,877 [r]	45,220 [r]	40,869 [r]	45,523

See footnotes at end of table.

TABLE 21—Continued
COPPER: WORLD SMELTER PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Metric tons, copper content)

Country or locality	2013	2014	2015	2016	2017 [p]
Oman, primary	20,100 [r]	21,000 [r]	26,500 [r]	11,300 [r]	20,400
Pakistan, primary[e]	13,000	13,000	13,000	14,000	10,000
Peru, primary	412,966	314,615	327,909	309,469	316,882
Philippines, primary	181,900	153,200	189,200	215,000	240,000
Poland:					
Primary	458,789	503,111	514,774	446,902	457,549
Secondary	78,009	72,585	67,624	60,369	53,024
Total	536,798	575,696	582,398	507,271	510,573
Russia:					
Primary	650,000 [r]	664,000 [r]	661,000 [r]	665,000	697,000
Secondary	215,000 [r]	220,400 [r]	218,900 [r]	202,000	200,000
Total	865,000 [r]	884,400 [r]	879,900 [r]	867,000	897,000
Serbia:					
Primary	33,300	30,700	43,000	61,000 [r]	75,000
Secondary	3,200	2,500	1,000	1,000 [e]	1,000 [e]
Total	36,500	33,200	44,000	62,000 [r]	76,000
Slovakia, secondary	18,458	11,400 [r]	11,400	42,691 [r]	48,152
South Africa, primary	69,700	71,700	71,800	68,700	70,000
Spain:					
Primary	212,000	285,400	286,300	292,300	272,000
Secondary	12,300	8,700	6,900	4,600	11,100
Total	224,300	294,100	293,200	296,900	283,100
Sweden:					
Primary	137,200	145,300	137,400	131,500	150,000
Secondary	61,900	65,200	61,800	62,200	60,000
Total	199,100	210,500	199,200	193,700	210,000
Turkey:					
Primary	35,800	40,600	45,400	46,200	46,000
Secondary[e]	5,000	5,000	5,000	5,000	5,000
Total	40,800	45,600	50,400	51,200	51,000
United States, primary	516,000	522,000	527,000	563,000	470,000
Uzbekistan, primary	98,000	99,500 [r]	101,000 [r, e]	101,000 [r, e]	101,000 [e]
Vietnam, primary	6,900 [r]	12,500 [r]	11,000 [r]	11,000 [r, e]	27,800
Zambia, primary	520,300	525,800	648,800	698,100	787,900
Grand total	16,600,000	18,000,000	18,500,000	18,900,000	19,200,000
Of which:					
Primary	13,900,000 [r]	15,200,000	15,800,000 [r]	16,100,000	16,200,000
Secondary	2,740,000 [r]	2,780,000 [r]	2,770,000	2,830,000	2,980,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]Table includes data available through December 12, 2018. All data are reported unless otherwise noted. Grand totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]To the extent possible, primary and secondary output of each country and (or) locality is shown separately. In some cases, total smelter production is officially reported, but the distribution between primary and secondary is estimated.

[3]Copper content of nickel-copper-cobalt matte.

TABLE 22

COPPER: WORLD REFINERY PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Metric tons)

Country or locality	2013	2014	2015	2016	2017 [p]
Argentina, secondary[e]	16,000 [r]	16,000 [r]	16,000 [r]	16,000 [r]	16,000
Australia, primary:					
Leaching, electrowon	35,000 [r]	43,000 [r]	40,000	30,000	26,000
Other	446,000 [r]	468,000 [r]	435,000	445,000 [r]	360,000
Total	481,000	511,000	475,000	475,000	386,000
Austria, secondary	82,842	83,190	102,859	103,215 [r]	100,000
Belgium:					
Primary	229,000	228,300	226,100	217,900	235,500
Secondary	158,000	159,000	152,500	148,800	163,400
Total	387,000	387,300	378,600	366,700	398,900
Bolivia, leaching, electrowon	2,100	1,810 [r]	1,789 [r]	2,199 [r]	1,800 [e]
Brazil:					
Primary:					
Leaching, electrowon	4,060	700	--	--	--
Other	231,990 [r]	212,385 [r]	199,000	199,000 [r]	143,000
Total, primary	236,050 [r]	213,085 [r]	199,000	199,000 [r]	143,000
Secondary	25,900	23,600	24,000 [r]	27,000	20,000 [e]
Total, primary and secondary	261,950 [r]	236,685 [r]	223,000 [r]	226,000 [r]	163,000
Bulgaria:					
Primary	204,600	208,300	204,700	197,200 [r]	203,500
Secondary	25,000	25,000	25,000	19,200 [r]	25,000
Total	229,600	233,300	229,700	216,400	228,500
Burma, leaching, electrowon	25,000	33,200	46,900	75,000	115,100
Canada:					
Primary:					
Leaching, electrowon	--	900 [r]	500 [r]	--	--
Other	292,200	292,900	301,300	284,400	290,600
Total, primary	292,200	293,800 [r]	301,800 [r]	284,400	290,600
Secondary	29,300	32,500	29,100	30,000	30,400
Total, primary and secondary	321,500	326,300 [r]	330,900 [r]	314,400	321,000
Chile, primary:					
Leaching, electrowon	1,932,900	1,844,000	1,778,400	1,660,300	1,586,200
Other	822,000	885,400	910,000	952,200 [r]	843,300
Total	2,754,900	2,729,400	2,688,400	2,612,500 [r]	2,429,500
China:					
Primary:					
Leaching, electrowon	33,900	35,500 [r]	44,900 [r]	49,500 [r]	50,000
Other	4,656,000	4,784,500 [r]	4,915,500 [r]	5,186,800 [r]	5,439,500
Total, primary	4,689,900	4,820,000	4,960,400	5,236,300 [r]	5,489,500
Secondary	1,980,000	2,830,000	3,000,000	3,200,000 [r]	3,400,000
Total, primary and secondary	6,669,900	7,650,000	7,960,400	8,436,300 [r]	8,889,500
Congo (Kinshasa), primary:					
Leaching, electrowon	684,653 [r]	866,595 [r]	886,308 [r]	840,524 [r]	870,000 [e]
Other[e]	35,000	35,000 [r]	35,000 [r]	35,000 [r]	35,000
Total	719,653 [r]	901,595 [r]	921,308 [r]	875,524 [r]	905,000
Cyprus, leaching, electrowon	3,631	3,088	2,121	1,754 [r]	1,293
Egypt, secondary	135,000	142,022 [r]	98,051 [r]	100,000 [r, e]	100,000 [e]
Finland:					
Primary	120,800	132,000	127,900	131,100 [r]	135,200
Secondary	3,700	4,000	4,000 [e]	4,000 [e]	4,000 [e]
Total	124,500	136,000	131,900	135,100 [r]	139,200
Germany:					
Primary	393,000 [r]	390,900 [r]	400,100 [r]	396,100 [r]	413,400
Secondary	284,600 [r]	283,100 [r]	278,000 [r]	275,300 [r]	281,000
Total	677,600	674,000	678,100 [r]	671,400	694,400
India, primary	617,000	766,000	791,900	769,800	803,500

See footnotes at end of table.

TABLE 22—Continued
COPPER: WORLD REFINERY PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Metric tons)

Country or locality	2013	2014	2015	2016	2017 [p]
Indonesia, primary:					
Leaching, electrowon	--	1,416 [r]	1,226 [r]	11,760 [r]	23,160
Other	215,000	232,000 [r]	197,100 [r]	249,000	245,000
Total	215,000	233,416 [r]	198,326 [r]	260,760 [r]	268,160
Iran:					
Primary:					
Leaching, electrowon	13,700	12,700	13,000	13,400	13,100
Other	123,100	124,000	113,900	125,700 [r]	90,000
Total, primary	136,800	136,700	126,900	139,100 [r]	103,100
Secondary	54,500	60,800	59,900	61,700 [r]	57,000
Total, primary and secondary	191,300	197,500	186,800	200,800	160,100
Italy, secondary	4,900	7,900	7,300	6,600	8,700
Japan:					
Primary	1,210,242	1,296,641	1,243,072	1,259,426	1,166,194
Secondary	257,881 [r]	257,583	240,059	293,707 [r]	321,886
Total	1,468,123 [r]	1,554,224	1,483,131	1,553,133 [r]	1,488,080
Kazakhstan, primary:					
Leaching, electrowon	12,200	12,900	15,500	35,100 [r]	42,200
Other	352,061	294,808	394,641	408,435 [r]	413,000 [e]
Total	364,261	307,708	410,141	443,535 [r]	455,200
Korea, North:[e]					
Primary	10,000	10,000	10,000	10,000	10,000
Secondary	5,000	5,000	5,000	5,000	5,000
Total	15,000	15,000	15,000	15,000	15,000
Korea, Republic of:					
Primary	495,400	491,200	515,300	522,400	501,300
Secondary	109,800	110,500	134,400	124,800	163,000
Total	605,200	601,700	649,700	647,200	664,300
Laos, leaching, electrowon	90,030	88,541	89,253	78,492 [r]	62,941
Macedonia, leaching, electrowon	1,900	1,700	2,268 [r]	1,396 [r]	958
Mexico:					
Primary:					
Leaching, electrowon	162,100	185,400 [r]	208,100 [r]	229,800 [r]	213,000
Other	242,100 [r]	262,000 [r]	272,400 [r]	256,200 [r]	228,000
Total, primary	404,200 [r]	447,400 [r]	480,500 [r]	486,000 [r]	441,000
Secondary[e]	5,000	5,000	5,000	5,000	5,000
Total, primary and secondary	409,200 [r]	452,400 [r]	485,500 [r]	491,000 [r]	446,000
Mongolia, leaching, electrowon	2,344	6,993 [r]	14,990 [r]	15,010 [r]	14,644
Namibia, leaching, electrowon	--	--	10,659	16,391 [r]	15,466
Norway, primary	37,461	35,800	35,500	28,100	22,700
Oman, primary	20,100 [r]	21,000 [r]	26,500 [r]	11,300 [r]	20,400
Peru, primary:					
Leaching, electrowon	89,658	83,800	73,091	73,854	62,421
Other	271,792	263,597	279,869	257,470	272,996
Total	361,450	347,397	352,960	331,324	335,417
Philippines, primary	153,000	130,000	153,000	185,100 [r]	205,000
Poland:					
Primary	450,600 [r]	469,100	470,900 [r]	429,000	429,600
Secondary	114,500	107,800	103,400 [r]	106,600	92,400
Total	565,100 [r]	576,900	574,300	535,600	522,000
Russia:					
Primary:					
Leaching, electrowon	1,900 [r]	1,500 [r]	1,400 [r]	1,300 [r]	1,400
Other	655,200 [r]	667,000 [r]	655,700 [r]	662,300 [r]	735,100
Total, primary	657,100 [r]	668,500 [r]	657,100 [r]	663,600 [r]	736,500
Secondary	218,400 [r]	222,300 [r]	218,600 [r]	197,800 [r]	219,600
Total, primary and secondary	875,500 [r]	890,800 [r]	875,700 [r]	861,400 [r]	956,100

See footnotes at end of table.

TABLE 22—Continued
COPPER: WORLD REFINERY PRODUCTION, BY COUNTRY OR LOCALITY[1, 2]

(Metric tons)

Country or locality	2013	2014	2015	2016	2017 [p]
Serbia:					
Primary	32,606	31,584	42,729	61,309 [r]	67,752
Secondary	3,234	1,591	1,917	1,000	1,469
Total	35,840	33,175	44,646	62,309 [r]	69,221
South Africa, primary	80,821	78,697	77,360	66,257	65,503
Spain:					
Primary:					
Leaching, electrowon	69,304 [r]	71,090 [r]	70,029 [r]	73,643 [r]	73,664
Other	213,500	274,300	278,300	281,600	260,700
Total, primary	282,804 [r]	345,390 [r]	348,329 [r]	355,243 [r]	334,364
Secondary	68,200	73,100	71,600	74,200	80,800
Total, primary and secondary	351,004 [r]	418,490 [r]	419,929 [r]	429,443 [r]	415,164
Sweden:					
Primary	144,300	152,100	144,200	145,100	153,600
Secondary	61,900	65,200	61,800	62,200	65,800
Total	206,200	217,300	206,000	207,300	219,400
Thailand, secondary	--	229	--	--	--
Turkey:					
Primary	64,000	61,300	74,000	47,400 [r]	88,000
Secondary	10,000 [e]	10,000 [e]	10,000 [e]	5,000 [r]	7,000
Total	74,000	71,300	84,000	52,400 [r]	95,000
Ukraine, secondary	16,500 [r]	15,200 [r]	18,500 [r]	27,100 [r]	30,600
United States:					
Primary:					
Leaching, electrowon	475,000	514,000	588,000	615,000	557,000
Other	518,000	535,000	503,000	561,000	482,000
Total, primary	993,000	1,050,000	1,090,000	1,180,000	1,040,000
Secondary	46,900	46,000	48,800	46,300	40,100
Total, primary and secondary	1,040,000	1,090,000	1,140,000	1,220,000	1,080,000
Uzbekistan, primary	98,000	99,500 [r]	101,000 [r, e]	101,000 [r, e]	101,000 [e]
Vietnam, primary	6,900 [r]	12,500 [r]	11,000 [r]	11,000 [r]	27,800
Zambia, primary:					
Leaching, electrowon	200,900	190,000	158,700	167,300	165,700
Other	327,200	288,800	312,800	230,600	264,800
Total	528,100	478,800	471,500	397,900	430,500
Zimbabwe, primary	3,360	1,500 [r, e]	--	--	--
Grand total	21,300,000	22,800,000	23,200,000	23,700,000 [r]	23,900,000
Of which:					
Primary:					
Leaching, electrowon	3,840,000 [r]	4,000,000 [r]	4,050,000 [r]	3,990,000 [r]	3,900,000
Other	13,800,000 [r]	14,200,000	14,500,000 [r]	14,700,000 [r]	14,800,000
Total	17,600,000	18,200,000	18,500,000 [r]	18,700,000 [r]	18,600,000
Secondary	3,720,000	4,590,000	4,720,000 [r]	4,940,000 [r]	5,240,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]Table includes data available through December 12, 2018. All data are reported unless otherwise noted. Grand totals, U.S. data, and estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]To the extent possible, primary and secondary output of each country and (or) locality is shown separately. The "primary," "primary, other," and "secondary" categories consist of electrolytic and fire-refined copper, and the "leaching, electrowon" category consists of refined copper produced by solvent extraction and electrowinning. In some cases, total refined production is officially reported, but the distribution between primary [electrowon and (or) other] and secondary is estimated.