

COPPER

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In 1999, mine production of recoverable copper in the United States continued its downward slide that began in 1998, falling by more than 250,000 metric tons (t) to the lowest level since 1990. In addition to mine closures announced in 1998 that carried forward into 1999, low refined copper prices led to additional mine cutbacks and closures. Following numerous acquisition offers and counter offers during the third quarter of the year, a consolidated copper industry emerged in October. Phelps Dodge Corp. acquired all of the assets of Cyprus Amax Minerals Company, and Mexico's Grupo Mexico, S.A. de C.V. acquired the assets of ASARCO Incorporated. The Broken Hill Proprietary Company Ltd. (BHP) closed its remaining U.S. mines at midyear. Although the United States maintained its position as the world's second largest mine producer of copper, accounting for about 13% of world production, its share of global production continued to decline from its 19% share in 1994. Chile, where mine production increased by 19% in 1999, was the largest mine producer, increasing its share to 35% of world production. About 50 countries reported production of copper, the top 10 of which accounted for 80% of production. The world reserves and reserve base for copper were estimated to be 340 million metric tons (Mt) and 650 Mt, respectively. The United States had about 13% each of reserves and reserve base.

U.S. copper smelter and refinery production also plummeted, falling by 25% and 15%, respectively, owing to the combined impact of mine cutbacks and low prices. By yearend, three of seven primary smelters had closed. Secondary output declined owing to capacity curtailments in 1998 and the impact of lower prices on scrap availability. Primary and secondary refined production declined owing to the resultant downstream shortage of anode for electrolytic refining and a shortage of scrap for fire refining. One primary and one secondary refinery closed during the year, while others experienced significant cutbacks. The U.S. share of world refined production fell to 15%, down from 18% in 1998, and it ceded its historical position as the leading global producer of refined copper to Chile (18%). Likewise, the United States, with less than 12% of global output, lost its position as the leading smelter producer, falling to third place behind Chile (13%) and Japan (12%).

Thirty-three mines operating in 9 States, down from 38 in 1998, reported recoverable quantities of copper in 1999. The top 10 and top 15 mines accounted for more than 92% and 99%, respectively, of production. The remaining 18 mines were either small leach operations or byproduct producers of copper. The principal mining States, in descending order, Arizona, Utah, New Mexico, Montana, and Nevada, accounted for 99.5% of production. Though capacity of 2.02 Mt at mines that

operated during the year was down by only about 50,000 t from that of 1998, capacity utilization fell from about 90% to 79%, the lowest level since 1986.

During the year, 7 primary and 2 secondary smelters, 7 electrolytic and 4 fire refineries, and 15 solvent-extraction electrowinning (SX-EW) facilities operated in the United States. By yearend, however, three of the primary smelters and one electrolytic refinery had closed. Capacity utilization at smelters and refiners fell from 90% and 92%, respectively, in 1998 to 74% and 80%, respectively, in 1999. Following 5 years of steady growth, mine cutbacks led to a slight decline in electrowon production. However, its proportional share of mine and refinery production rose to 37% and 27%, respectively. The conversion of old scrap to alloys and refined copper, declined by 85,000 t, or 18%, contributed 381,000 t of copper to the market, and accounted for 12% of apparent industrial demand. Lower copper prices in 1999 and closure of a secondary copper smelter during 1998 led to the sharp drop in recovery.

Copper was consumed as refined copper and as direct melt scrap at about 35 brass mills, 17 wire-rod mills, and 600 foundries, chemical plants, and miscellaneous operations. According to data compiled by the Copper Development Association Inc. (CDA) (2000, p. 18), mill and foundry product shipments to the U.S. market, including net imports of mill products, continued its 5-year upward trend, rising by 250,000 t (6%), to a record high level of 4.23 Mt. According to CDA data, 1999 shipments were 40% higher than in 1990.

The net import reliance for refined copper, as a percentage of apparent consumption, rose sharply to 27% (from 14% in 1998) following cutbacks in domestic production and growth in demand. Canada was the largest U.S. trading partner for unwrought copper, accounting for 31% and 30%, respectively, of refined copper imports and total imports of unwrought copper, and 55% and 50%, respectively, of refined exports and total unwrought copper exports.

Legislation and Government Programs

In October, the U.S. Mint (1999a) announced selection of the manganese bronze alloy it would use to clad the new Golden Dollar, a three-layer coin having a solid copper core, and in December, the Mint (1999b) began releasing the coin for testing by vendors and manufacturers. Authorized by the Coin Act of 1997, the new coin, though designed to have a golden color and a wide, smooth edge, was to match the electromagnetic signature and size and weight of the Susan B. Anthony Dollar (SBA) and therefore be accepted immediately by vending and

mass transit machines already accepting the SBA coins. On January 26, 2000, the U.S. Mint (2000b) began releasing its new Golden Dollar coin, and as of the end of February, the Mint had shipped 200 million Golden Dollars, four times the annual demand in recent years for the SBA coin it was replacing. In February, owing to the strong public demand for the new coins, the Mint (2000a) and the Federal Reserve developed a program to accelerate shipments of Golden Dollars and anticipated placing a total of 1 billion coins in circulation by yearend. At a coin weight of 8.1 grams and overall composition of 88.5% copper, 6% zinc, 3.5% manganese, and 2% nickel, 1 billion coins would contain about 7,200 t of copper.

As part of its Common Sense Initiative instituted in October 1994, the U.S. Environmental Protection Agency (EPA) proposed a rule change for the metal finishing industry that would allow facilities to accumulate sludges from the treatment of electroplating wastes for up to 180 days without obtaining a hazardous waste storage permit. The rule was intended to encourage recycling of the sludges by making it more economical to accumulate and ship these wastes in preference to land disposal. The proposed regulation would require the waste generators to implement practices that reduce the volume or toxicity of wastes generated, making them more amenable to recycling, and to accumulate no more than 16 t of waste at any one time. Current regulations only allow facilities that generate more than 1 metric ton per month (t/mo) of hazardous waste to accumulate wastes for 90 days without a waste storage permit. According to EPA, the metal finishing industry comprises more than 3,000 independent "job shops" and 8,000 "captive shops" (U.S. Environmental Protection Agency, 1999b).

In December, the EPA issued a proposed rule that would grant World Resources Company of Phoenix, according to a company petition, a variance from hazardous waste requirements for certain intermediary materials reclaimed from metal-bearing sludges. Currently these metal concentrates (copper, nickel, and tin), produced from electroplating sludges and sold to primary smelters, are classified as hazardous wastes and are subject to all the shipping, handling, and licensing requirements of hazardous materials. The EPA noted that in granting the variance it would be promoting recycling and, for the most part, accepted the company's assertion that the materials are analogous to virgin raw materials used by primary smelters (U.S. Environmental Protection Agency, 1999a).

On July 30, the Office of Trade Adjustment Assistance, Department of Labor, issued a ruling reversing its June 11 decision to deny assistance under section 223 of the Trade Adjustment Act of 1974 to workers at Cobre Mining Company who lost their jobs when the Continental Copper Mine, Hanover, NM, was closed. The reversal was based on new information submitted by the company indicating its intent to close the mine by mid-1999 and by its parent company, Phelps Dodge, indicating that it had increased its imports of copper concentrates during the relevant period. The initial finding had solely ascribed the closure to an environmental mishap during March 1999 (U.S. Department of Labor, 1999).

The National Electrical Manufacturers Association (NEMA) was petitioning the EPA to delist copper from its annual Toxic Release Inventory (TRI) because it felt that recycling prevents

most copper from entering the environment, there was growing evidence that copper was not as detrimental to the environment as previously thought, and public access to the TRI list could cause undue public concern and stigmatize some of its members. In 1997, the TRI report indicated that 34,500 t of copper had been released to the environment. A similar petition to delist copper in 1996 was rejected (American Metal Market, 1999).

Production

While mine production capacity was adjusted downward by about 35,000 t to reflect the long term expected closure of the Continental Mine in New Mexico in 1999, mine production declined by about 260,000 t in response to lower prices and numerous mine cutbacks. Capacity utilization fell to 79%, down from 90% in 1998. In addition to production cutbacks carried forward from 1998, BHP closed its Robinson Mine in Nevada and its San Manuel Mine in Arizona at midyear, and Phelps Dodge closed its Metcalf concentrator at its Morenci Mine in Arizona in August. Though these operations were retained as still viable capacity in 1999, it is anticipated that these cutbacks will be carried forward into 2000 when capacity will be adjusted downward to reflect anticipated long-term closure.

Primary smelter production declined by 27% owing to the closure of three of the seven primary domestic smelters during 1999. Asarco's El Paso Texas smelter was completely shuttered during the first months of the year and was expected to remain so for a period of at least 3 years (ASARCO Incorporated, 1998). BHP never reopened its San Manuel smelter in Arizona following a maintenance shutdown in May and the subsequent closure of its mines (Broken Hill Proprietary Company Ltd., 1999), and Phelps Dodge closed its Hidalgo New Mexico smelter during the third quarter of the year owing to reduced concentrate availability (Phelps Dodge Corp., 1999b). Secondary smelter production declined by about 11% owing to the impact of low prices on scrap availability and capacity curtailments during 1998.

Primary and secondary refinery production declined by 12% and 34%, respectively. The aforementioned mine and smelter closures led to downstream shortages of anode for refining and the closure of the BHP refinery in Arizona as well as cutbacks at Asarco's and Phelps Dodge's Texas refineries. Scrap shortages and reduced margins led to a cutback in fire refined production by Cerro Copper Corp. and the indefinite closure of Philip Service Corp.'s Warrenton refinery in March. At the time, Philip was negotiating with its lenders for debt restructuring under bankruptcy proceedings (Platt's Metals Week, 1999c). This followed closure of Cerro's secondary smelter/electrolytic refinery in 1998.

Industry Restructuring.—On July 15, Cyprus Amax and Asarco announced an agreement that would have combined the two companies in a merger-of-equals transaction. The new company was to be named Asarco Cyprus Incorporated. The merger would have created the world's second largest copper mining company with annual production of 900,000 t and cash operating costs for copper production of less than \$0.50 per

pound (Cyprus Amax Minerals Company, 1999). On August 20, the two companies announced that they were rejecting an unsolicited proposal from Phelps Dodge to negotiate acquisition of both companies in exchange for Phelps Dodge stock (ASARCO Incorporated, 1999e). Following a series of counter moves by Cyprus and Asarco, Phelps Dodge announced that it intended to take its acquisition offer directly to Asarco and Cyprus shareholders; that it had filed documents with the Securities and Exchange Commission outlining its plan to solicit proxies from Cyprus and Asarco shareholders; and that it would file suit against the board of directors of Cyprus and Asarco, alleging a breach of fiduciary duty (W.L. Watts, CBS Market Watch, August 31, 1999, Asarco, Cyprus urge rejection of hostile bid claim Phelps Dodge merely trying to break up merger, accessed September 2, 1999, at URL <http://cbs.marketwatch.com>). Asarco and Cyprus urged their shareholders to approve their merger of equals and reject Phelps Dodge's purchase offer as being inequitable on the basis of percentage ownership. They also filed a complaint in Federal Court that sought an injunction and damages against Phelps Dodge, alleging that Phelps Dodge's unsolicited takeover attempt violated U.S. antitrust laws (ASARCO Incorporated, 1999d).

On September 24, Mexico's Grupo Mexico, S.A. de C.V. entered the contest for control of Asarco when it tendered a cash offer of \$26 per share of Asarco stock (Grupo Mexico, S.A. de C.V., 1999b). Grupo Mexico, through its subsidiary Grupo Minero Mexico, owns the Cananea and La Caridad Mines, smelters, and refineries. Asarco had a long-term involvement in the Mexican copper mining sector that dated back to 1901, when Asarco first began mining in Mexico. Asarco still retained an 8% interest in Grupo Minero.

Cyprus Amax abandoned its merger with Asarco and on September 30 announced that it had signed a merger agreement under which Phelps Dodge would acquire Cyprus Amax for \$7.61 in cash plus 0.2203 Phelps Dodge shares for every Cyprus share. Phelps Dodge anticipated cash cost savings of at least \$100 million from the merger (Phelps Dodge Corp. and Cyprus Amax Minerals Company, 1999). On October 15, only 1 week after finally agreeing to be acquired by Phelps Dodge, Asarco notified Phelps Dodge that it would accept a newly increased cash purchase offer from Grupo Mexico of \$2.25 billion, \$29.75 per share, terminating its merger agreement with Phelps Dodge and paying Phelps Dodge a contractual termination fee of \$30 million (ASARCO Incorporated, 1999c).

By October 18, Phelps Dodge had accepted tenders for approximately 89.6% of the outstanding shares of Cyprus Amax, and on December 2, Phelps Dodge announced that it had acquired all the remaining outstanding shares of Cyprus Amax and that Cyprus Amax would cease trading on the New York Stock Exchange (Phelps Dodge Corp., 1999a).

On November 12, Grupo Mexico, announced that it had executed financing agreements with the Chase Manhattan Bank to provide funding for its purchase of all the outstanding shares of Asarco. By November 12, Grupo owned or had received tender offers for almost 90% of Asarco's common stock (Grupo Mexico, S.A. de C.V., 1999a). On December 14, Grupo announced that it had entered into a definite agreement to sell the specialty chemicals division of Asarco for \$503 million to

Cookson Group plc. The proceeds were to be committed to reducing the \$817 million debt incurred in the purchase of Asarco. Grupo Mexico further planned to reduce its acquisition debt through the sale of its aggregate division (Grupo Mexico, S.A. de C.V., 1999c).

Company Reviews.—On November 30, 1998, Asarco announced its intention to suspend operations at its El Paso smelter for a period of 3 years, beginning on about February 1, 1999. Asarco attributed the shutdown to a shortage of concentrates. The company expected that the same market conditions would allow it to sell surplus concentrates for a better overall return. The shutdown was expected to reduce refinery production at Amarillo by 63,000 t/mo and combined with other cutbacks from 1998, reduce production at Amarillo by 30% (ASARCO Incorporated, 1998). Accordingly, production at Amarillo fell to 319,000 t, down from 402,000 t in 1998 and 447,000 t in 1997 (Grupo Mexico, S.A. de C.V., 2000, p. 23). In July, Asarco announced cutbacks at its Mission and Ray Mines in Arizona that would reduce annual production by 25,000 t and reduce costs by about \$0.01 per pound. At Ray, unusually hard ore was reducing mill throughput, and annual production of copper in concentrate fell from 111,000 t in 1998 to 104,000 t in 1999. SX-EW production of cathode declined slightly to 40,000 t. An expansion of the electrowinning tankhouse was completed at midyear. At Mission, production of copper in concentrate fell from 116,000 t in 1998 to 91,000 t in 1999. Production of electrowon copper at the Silver Bell Mine in Arizona rose by about 8% to 20,700 t (ASARCO Incorporated, 1999b, p. 6; Grupo Mexico, S.A. de C.V., 2000, p. 23).

BHP scheduled a 45-day maintenance and upgrade shutdown of its San Manuel, AZ, smelter, beginning May 1, during which it anticipated spending \$54 million on improvements. On June 25, following months of industry speculation about sale or closure, BHP announced that it would cease operations at its North American properties by the end of August (Broken Hill Proprietary Company Ltd., 1999). BHP was widely viewed as having high mine production costs at both its underground San Manuel Mine and its relatively low-grade Robinson Mine in Nevada. Cash costs for San Manuel were estimated at \$0.70 per pound (Platt's Metals Week, 1999a). The San Manuel smelter, with a capacity of 340,000 metric tons per year (t/yr) of copper, had yet to reopen following its April renovation shutdown. In addition to the mines, which had a combined annual capacity of 150,000 t of copper, and the smelter, BHP operated an electrolytic refinery and wire-rod mill at San Manuel, and an electrolytic refinery in White Pine, MI. The White Pine refinery, which operates on imported anode from Canada, remained operational at yearend, as did BHP's small Arizona leach SX-EW operations at San Manuel, Pinto Valley, and Miami. The Pinto Valley sulfide operations had closed in 1998.

Summo Minerals Corp. reported that it expected continued delays in the startup of construction at the Lisbon Valley Mine in San Juan County, UT, because of a shortage of funds. In 1997, Summo had secured \$45 million in financing for the project. Delays caused by appeals of the U.S. Bureau of Land Management (BLM) Final Environmental Impact Statement and its Record of Decision approving development, however,

resulted in the withdrawal of the primary investor. Though final appeal of the BLM decision was rejected in April 1999, the drop in copper prices resulted in limited interest from other investment firms (Summo Minerals Corp., 1999b).

In November, Summo's board of directors approved a Phase 2 exploration drilling program to further explore the Centennial deposit, also in San Juan Co., UT, and approved commissioning of an updated feasibility study for the open pit SX-EW project that is expected to produce 18,000 t/yr of electrowon copper. Summo planned to use the updated study to secure financing once copper prices improved (Summo Minerals Corp., 1999c).

In June, Summo announced that it had transferred all of its proprietary data, rights, and obligations in the acquisition of the Johnson Camp Mine, Cochise County, AZ, to Nord Resources Corporation in exchange for 1.6 million shares of Nord common stock, and that Nord had then completed the purchase of Johnson Camp from Arimetco International Inc. Arimetco had continued to operate the Johnson Camp Mine in Arizona and the Yerington Mine in Nevada under the auspices of the Arizona Bankruptcy Court since filing for bankruptcy at the end of 1996. A full feasibility study commissioned by Summo had calculated that for \$15.3 million, including about \$2 million in acquisition costs, annual production at Johnson Camp could be raised to 8,600 t/yr at a cash cost of less than \$0.55 per pound, and that reserves were sufficient for 10 years of full production (Summo Minerals Corp., 1999a). Though mining at Johnson Camp was suspended in May 1997, production continued from inventory in the heap leach.

In Utah, copper mine production at Kennecott Utah Copper Corp.'s Bingham Canyon Mine fell by 6% to 279,000 t, despite an 8% increase in ore milled, owing to the processing of "lower than life of mine average copper grades." Mill-head ore grades, which fell from 0.62% copper in 1998 to 0.55% copper in 1999, were expected to recover in mid-2000. Gold grades did not drop as significantly and gold production of 11,415 kilograms was essentially unchanged. Copper refinery production rose 11% to a record high 265,000 t, despite a 23-day shutdown of the associated smelter in January to rebuild the flash converter following failure of the side wall (Rio Tinto, 2000, p. 18).

On October 21, 1998, Phelps Dodge announced that it would institute a series of cutbacks that would eventually curtail production by 91,000 t/yr of copper. At its Chino Mine in New Mexico, a production scaleback by 32,000 t/yr was phased in between October and the end of the first quarter of 1999. At its recently acquired Continental Mine, adjacent to Chino, underground mining was suspended immediately, and in March 1999, the remaining surface operations were suspended resulting in a total annual loss of production of 32,000 t. Production was suspended immediately at its 18,000-t/yr Ojos del Salvador Mine in Chile. On June 30, Phelps Dodge announced a plan to further reduce costs by closing the smaller of the two concentrators at its Morenci Mine in Arizona, and temporarily closing its Hidalgo, NM, smelter. The combined impact of the closures would be to reduce production at its El Paso refinery by 50%, 195,000 t (Phelps Dodge Corp., 2000, p. 22-24). In September, Phelps Dodge announced its intent to convert all production at its Morenci Mine to leaching by early 2001, investing \$220 million to expand its SX-EW facilities,

expand crushing and conveying systems, and install mobile stackers to disperse crushed ore. Phelps Dodge expected to realize a cash savings of \$0.09 per pound (\$0.07 per pound full cost) and production was expected to be maintained at about 360,000 t, the rate following closure of the Metcalf concentrator (Phelps Dodge Corp., 1999c).

With acquisition of the assets of Cyprus Amax during the fourth quarter, coupled with its decision to convert Morenci to an all-leach operation, Phelps Dodge announced the writedown of its shuttered Hidalgo smelter and intent to reconfigure it into a sulfuric acid plant. Production from Phelps Dodge's domestic operations, including minority share but exclusive of Cyprus Amax operations, fell from 715,000 t in 1998 to 633,000 t in 1999. At Morenci, electrowon production increased by about 8,000 t, while recoverable copper from concentrate fell by 47,000 t. At Chino, concentrate production of 67,400 t of copper and electrowon production of 50,600 t were down by 10,200 t and 15,100 t, respectively (Phelps Dodge Corp., 2000, p. 65).

Phelps Dodge continued its domestic exploration activities, expending about \$10 million, 25% of its exploration budget, on its domestic properties. At the Tyrone Mine in New Mexico, additional mine-for-leach material was delineated in the Niagara area where 500 Mt of leachable material grading 0.29% copper have been delineated. Additional reserves were delineated in the Western Copper Area at Morenci, and in the Dos Pobres and San Juan deposits in the Safford district, leach reserves were expanded by about 6% to 1.83 Mt of contained copper (Phelps Dodge Corp., 2000, p. 68).

In December 1998, Nicolet Minerals Company, in an effort to address public concerns, announced significant improvements to its design for its proposed underground mine near Crandon, WI, that would reduce the potential for acid and heavy metal runoff, reduce the drawdown of local ground water, and minimize water discharge from the site. In 1999, Nicolet completed a revised environmental impact statement and submitted it to the Wisconsin Department of Natural Resources for review. Nicolet also submitted documentation to satisfy Wisconsin's moratorium law that required documentation prior to issuance of permits of similar mines which had operated for 10 years without violations or significant pollution from heavy metals or acid mine drainage. It also required similar documentation from a mine that had been closed for 10 years. At full capacity, it is anticipated that the Crandon Mine will process about 2 million metric tons per year of ore and produce between 200,000 t and 300,000 t of zinc concentrate and 20,000 t of a copper-lead concentrate (Nicolet Minerals Company, 1998; 2000).

PolyMet Mining Corp. has reported high recoveries using a pressure-leach oxidation process to recover metals from a bulk concentrate at its NorthMet project adjacent to the Mesabi iron range in northeastern Minnesota. The company also reported completing about one-third of an in-fill drilling program for delineating reserves. According to estimates developed in 1991, the deposit contains 808 Mt of open pit minable resources grading 0.116 grams per ton (g/t) platinum, 0.437 g/t palladium, 0.432% copper, 0.109% nickel, 0.061 g/t gold, and 1.5 g/t silver, as well as minor recoverable amounts of cobalt. Polymet

hoped to complete a prefeasibility study during 2000 (Skillings Mining Review, 1999).

Trade

Net imports of refined copper rose sharply for the fourth consecutive year to 812,000 t, compared with 597,000 t in 1998. General imports of refined copper of 915,000 t were 78,000 t greater than imports for consumption and are more than accounted for by a 102,000 t rise in London Metal Exchange Ltd. (LME) inventories held in New Orleans warehouses. Prior to the beginning of the accumulation of LME inventories in New Haven and New Orleans warehouses in 1998, general imports and imports for consumption were essentially equal. Refined copper exports of only 25,000 t, down from 86,000 t in 1998 and 217,000 t in 1995, reflects both the decline in refined copper production and a continued rise in copper stocks held in California LME warehouses. Beginning in 1997, with the Asian economic crises that reduced copper demand in those countries, the traditional flow of refined copper from the Western United States to Asian markets was interrupted and LME warehouses became the destination for significant quantities of U.S. production. Though the United States remained a net importer of copper concentrates in 1999, essentially no concentrate imports were reported during the second half of the year. This corresponded to the rationalization of domestic smelting capacity.

Imports of wire rod, the semifabricate precursor to wire manufacturing, rose sharply during the latter half of 1999 following closure of two U.S. wire-rod mills. According to U.S. Census Bureau data, adjusted by the U.S. Geological Survey for imports from Mexico, wire rod imports rose from 108,000 t in 1998 to 188,000 t in 1999. Canada and Mexico accounted for 179,000 t. According to U.S. Census Bureau data compiled by the Copper and Brass Fabricators Council Inc. (2000, p. 1-9), U.S. net imports of all copper and copper-alloy semifabricated products, excluding wire-rod mill products, rose to 139,000 t, up from 86,000 t in 1998 and 100,000 t in 1997. Canada and Mexico accounted for 74% of semifabricated copper exports and 30% of imports.

While global trade in copper scrap declined in 1999, U.S. exports of copper scrap of 314,000 t (estimated copper content of 250,000 t) were essentially unchanged. The United States regained its position as the largest international source for copper scrap, having relinquished that distinction during 1998 to Russia, whose exports fell sharply in 1999 to about 200,000 t. Exports from Germany also declined sharply, falling by 55,000 t to 272,000 t (International Copper Study Group, 2000a, p. 40-43). China was the largest recipient of scrap, accounting for about 45% of global scrap imports. It was also the largest recipient of U.S. scrap, accounting for 27% of scrap exports. U.S. imports of copper scrap declined by 56,000 t to 211,000 t. Canada and Mexico were the leading sources for U.S. imports of copper and copper alloy scrap and accounted for 73% of imports in 1999.

Prices and Stocks

In response to a growing oversupply of copper and rising inventories, copper prices during the first half of the year continued their generally downward trend that began at midyear 1997. The average U.S. producer price fell to \$0.66 per pound in March, the lowest level since 1987, and in constant dollar terms, the lowest level since the Great Depression. Despite a continued rise in domestic and world refined copper inventories, copper prices staged a rally at the end of April, the U.S. producer price, as reported by Platt's Metals Week, rising to almost \$0.74 per pound by May 1. The rally was relatively short lived, and by the end of May the producer price had retreated to \$0.66 cents per pound. Industry offered several explanations for the rally, including speculative buying by commodity funds in anticipation of company cutbacks. The 45-day maintenance and upgrade shutdown of BHP's San Manuel smelter, beginning May 1, fueled industry speculation that the company would simply close the smelter and mines without making its announced investment (Platt's Metals Week, 1999a). According to data compiled by the International Copper Study Group (ICSG) (2000a, p. 6), world inventories of refined copper peaked in May at more than 1.5 Mt, and stocks held in COMEX and LME warehouses reached new record highs of almost 900,000 t. This compared with yearend 1998 inventories of 1.36 Mt and 680,000 t, respectively.

Copper prices began a sharp rise at the end of June. By the second week in July, the producer price had risen by more than 20% to \$0.81. The price premium of COMEX over LME widened with rising prices from about \$0.01 per pound to \$0.02 cents per pound, indicating the selective tightness in the U.S. market. The price rise was sparked by announcements of production cutbacks by BHP and Phelps Dodge followed closely by the announced shutdown of Falconbridge Ltd.'s Kidd Creek smelter in Canada on July 8, when unionized workers began a strike at that plant. North American production had already been reduced by previous U.S. mine cutbacks and a labor dispute that had closed the Highland Valley Mine in British Columbia and threatened to keep it closed through yearend (Platt's Metals Week, 1999b).

Copper inventories held in COMEX warehouses fell by 27%, 33,000 t during the third quarter, as inventories in San Manuel, AZ, were drawn down to feed BHP's wire-rod mill following closure of its smelter and refinery. Domestic commodity exchange inventories stabilized at about 500,000 t during the fourth quarter of the year. COMEX inventories at yearend of 83,000 t were at essentially the same level as yearend 1998, while U.S. LME inventories of 412,000 t were up from 340,000 t at yearend 1998. According to ICSG data (International Copper Study Group, 2000a, p. 7), yearend global inventories of 1.45 Mt were up by more than 90,000 t (6.8%) from yearend 1998, and, at the prevailing rate of consumption, represented more than a 5-week supply of copper. Combined yearend LME and COMEX stocks of 873,000 t were up by almost 200,000 t

from yearend 1998. Copper prices fluctuated significantly, but generally trended upward through the end of the year, the average U.S. monthly producer and COMEX prices in December rising to \$0.854 and \$0.814, respectively.

Consumption

Reported consumption of refined copper by domestic manufacturers continued its post-recession upward trend, rising by 3.4%, to almost 3.0 Mt. In addition to refined copper, domestic manufacturers directly consumed (melted or processed into chemicals) 1.3 Mt of copper-base scrap containing about 1 Mt of recoverable copper. An additional 80,000 t of copper was recovered in the consumption of aluminum-, nickel-, and zinc-base scrap. While the total quantity of copper recovered from the direct consumption of scrap rose about 3% in 1999, secondary refined copper production fell by 120,000 t, or 34%.

Despite closure of two wire-rod mills during the year, consumption of refined copper at wire-rod mills increased by about 2.8% and accounted for about 75% of domestic consumption of refined copper. For the second consecutive year, consumption growth at wire-rod mills was moderated by increased imports of wire rod, principally from Canada and Mexico, that rose by 80,000 t to 188,000 t in 1999. In October, following closure of its smelter and refinery, BHP ceased production at its 180,000-t/yr rod mill in San Manuel, AZ. In August, Superior Essex, a subsidiary of Superior TeleCom Inc., announced that it was rationalizing electrical wire manufacturing facilities and was closing plants at several locations, including its 65,000-t/yr wire-rod mill in Pauline, KS, by yearend. It was expected that some of the lost capacity would be recovered from increased production at its other wire-rod mills (Superior Essex, 1999). Wire mill capacity, including those closed by yearend 1999, rose by about 80,000 t in 1999 to 2.38 Mt, as several mills took steps to increase capacity incrementally, and the new Encore Wire Corp. mill in Texas experienced its first full year of production (Encore Wire Corp., About our company, accessed September 25, 1999, at URL <http://www.encorewire/index.html>).

At brass mills, which were the second largest consumers of refined copper, consumption of refined copper rose by about 10% owing to low copper prices that reduced the cost of using refined copper and reduced the availability of scrap for processing. Brass mills still remained the largest consumers of scrap, accounting for about 60% of the total copper recoverable from scrap. Copper recovery from scrap at brass mills (811,000 t) was essentially unchanged in 1999.

According to data compiled by the Copper Development Association Inc. (2000, p. 18), the supply of copper and copper-alloy products to the U.S. market by fabricators (wire mills, brass mills, foundries, and powder producers), including net imports, rose by about 2% to 3.92 Mt, up from the revised value of 3.84 Mt in 1998, and contained an estimated 3.5 Mt of copper. About 71% of these shipments was as pure (unalloyed) copper products. Wire mill products accounted for about 49% of total shipments to the domestic market; brass mill products, 46%; and foundry and powder products, 5%. In building construction, the largest end use sector, shipments rose by 5.3%

and accounted for about 41% of the market. Building construction included products used for building wire, plumbing and heating, air conditioning and commercial refrigeration, builders hardware, and architectural applications. Other use sectors included electric and electronic products, 27% of shipments; transportation equipment, 12%; industrial machinery, 10%; and consumer and general products, 10%.

World Review

Though more modest than in the preceding year, the global oversupply of copper that developed at midyear 1997, continued into 1999. According to data compiled by the ICSG, reported world inventories of refined copper rose by about 90,000 t to a total of 1,450,000 t. At the prevailing rate of consumption, yearend world inventories represented a 5.3 week supply of refined copper, essentially unchanged from yearend 1998, but nearly double that for 1996. Inventories held in LME warehouses rose by almost 200,000 t, overshadowing declines in producer, consumer, merchant, and other exchange stocks. The oversupply continued to reflect the failure of consumption to keep pace with large increases in global mine and refinery production outside the United States. Although world consumption of refined copper rose by 700,000 t, or 5.4%, it still failed to completely close the large gap that had existed between world refined production and consumption that had developed over the preceding years. Consumption in Asia grew by about 11%, or 550,000 t, and accounted for 38% of global consumption and most of the global demand growth. Consumption in Europe, 30% of global consumption, was essentially flat. North American demand rose by 5.4% and accounted for about 26% of global demand (International Copper Study Group, 2000a, p. 7, 18). In 1999, world mine capacity rose by 700,000 t, or 5%, to 13.95 Mt, extending the rapid growth trend that began in 1995. Australia and Chile accounted for most of the capacity expansion, their capacities having grown by 210,000 t and 630,000 t, respectively. Capacity also increased significantly in Argentina (55,000 t) and Kazakhstan (65,000 t). World smelter capacity rose by almost 300,000 t, despite the shutdown of three smelters in the United States. In Australia, smelter expansions at Mount Isa and Olympic Dam boosted capacity by about 125,000 t. In Japan, Nippon Mining and Metals Co. Ltd. completed a 1,000 t expansion, and in the Republic of Korea the L.G. Nikko Co.'s Onsan II smelter was fully commissioned (International Copper Study Group, 2000b). World smelter production however, rose only nominally owing to the large cutback in U.S. production. According to CRU International Ltd. (2000, p. 43-47), the supply and demand for copper concentrates for smelting was essentially balanced in 1999 and contract treatment (smelting) and refining charges assessed by smelters fell to an average of about \$0.17 per pound of recoverable copper, down from \$0.25 the previous year when a concentrate shortfall had intensified competition for concentrates. World refinery capacity rose by about 600,000 t owing to a 325,000 t expansion of electrowinning capacity, principally in Chile, and refinery expansions tied to the smelter expansions in Australia and Chile (International Copper Study Group, 2000b, p. 53-72).

Argentina.—The Bajo el Alumbreira Mine, owned by M.I.M. Holdings Ltd. (50%), North Ltd. (25%), and Rio Algom Ltd. (25%), and which began production in October 1997, reached full capacity in 1999 and produced 192,000 t of copper in concentrate, up from 154,000 t in 1998. Following additional drilling and a review of economic and mine planning factors, Alumbreira reserves were reduced by 27%, to 465 Mt of ore. The mine has an anticipated life of 14 years. Plans for a mill expansion to compensate for falling ore grades were scuttled (Rio Algom Ltd., 2000, p. 20).

Australia.—At the Mount Isa Mines Ltd.'s copper-lead-zinc silver operations, a major upgrade to the ISASMELT copper smelter was completed in mid-1999, enabling the company to produce a record 222,000 t of copper anode during fiscal year 1999-2000, 405 t higher than in 1998-1999. The \$243 million upgrade was to boost capacity to 250,000 t/yr of anode, sufficient to process concentrate from Mount Isa and the nearby Ernest Henry Mine. An additional \$96 million was spent to construct an "acid plant gas handling facility" to clean the waste gas before it is diverted to the fertilizer sulfuric acid plant. Development work on the Underground Enterprise Mine, located at depth beneath the existing Mount Isa Mine, continued in 1999 and commercial production began on July 1, 2000. Ore grades of 4% copper will offset the cost of mining at depths of between 1,200 meters (m) and 1,800 m below the surface. The Ernest Henry Mine, 160 km NE of Mount Isa, began commercial production in May 1998 and at capacity will produce about 95,000 t of copper in concentrate from reserves of 103 Mt grading 1.25% copper, contained in a plunging breccia system that is amenable to open pit extraction. In the year ending June 30, 2000, Ernest Henry produced 48,000 t of copper in concentrate (Mount Isa Mines Ltd., MIM at a glance, accessed September 11, 2000 at URL <http://www.MIM.com.au>; Mount Isa Mines, Ltd., 2000, p. 12-14).

Expansion of Western Mining Corp.'s Olympic Dam Project was completed in January, 3 months ahead of schedule, with startup of feed to the new Outokumpu smelter. Refined production at Olympic Dam rose to 138,000 t, up from 82,000 t in 1998, and was expected to reach design capacity of 200,000 t in 2000. The \$1.94 million expansion was expected to reduce fully allocated cash costs from \$1.01 per pound of copper in 1999 to less than \$0.55 per pound in 2000. A fire in the solvent extraction plant in late December was expected to have minimal impact on achieving design capacity in 2000 (Western Mining Corp., 2000, p. 14).

Canada.—Production and capacity declined in 1999 owing to the temporary closure of the Highland Valley Mine (British Columbia), the Myra Falls Mine (Vancouver Island), and the depletion of reserves and closure of the Gaspé Mine (Quebec) late in the year. On May 15, Highland Valley Copper Company suspended operations in response to mounting losses from low copper prices. The mine resumed operations in mid-October following negotiation of a 5-year labor agreement that linked worker compensation to the price of copper. A similar risk-sharing power supply agreement was also negotiated (Rio Algom Ltd., 2000, p. 20). In Ontario, Inco Limited reported a 5,000 t drop in production to 116,000 t, owing to extension of its annual vacation shutdown, closure of its Levack McCreedy

West Mine in July (3 months ahead of schedule), and the Stobie Mine in August (Inco Limited, 1999).

In October, Northgate Exploration Ltd., reached an agreement to purchase the Kemess copper-gold mine in British Columbia from Royal Oak Mines Inc., which had been placed in receivership in April. The mine began production in October 1998 and at full capacity is expected to produce 27,000 t/yr of copper. In April, production resumed at Boliden Ltd.'s Myra Falls zinc/copper mine on Vancouver Island following a 3-month shutdown for rehabilitation and development work. In Manitoba, Hudson Bay Mining and Smelting Company Ltd. began production in the second quarter of 1999 at its Konuto Lake copper/zinc mine, west of Flin Flon, and was projected to produce 10,000 t/yr of copper at capacity (Coulas, 2000).

Chile.—Mine production and capacity continued to escalate, rising by about 700,000 t and 600,000 t, respectively (International Copper Study Group, 2000b, p. 9). Production by State-owned Corporación Nacional del Cobre de Chile (CODELCO), the world's largest copper producer, rose from 1.50 Mt to 1.62 Mt, including its share of El Abra Mine. At the Andina Mine, an 80,000 t expansion, completed in November 1998, boosted production from 164,000 t in 1998 to 249,000 t in 1999. At CODELCO's newest division, Radomiro Tomic, which experienced its first full year of operation, the processing of 36 Mt of ore grading 0.69% copper yielded 190,000 t of electrowon copper, up from 162,000 t in 1998. Production at its largest division, Chuquibambilla, declined by 20,000 t to 630,000 t, while production at Salvador and el Teniente rose nominally to 92,000 t and 346,000 t, respectively. At the El Abra Mine, 49% owned by CODELCO and 51% by Phelps Dodge, SX-EW production rose by 20,000 t to 220,000 t (Corporación Nacional del Cobre de Chile, 2000, p. 55).

At the Escondida Mine, copper in concentrate production declined by 24,000 t to 827,000 t despite completion of a \$281 million mill expansion in late 1998 and a record mill throughput as mill head grades slipped from 2.46% copper in 1998 to 2.05% copper in 1999. Startup of a \$473 million processing facility to treat oxide ore that had been stockpiled from the main pit in November 1998 resulted in electrowon cathode production rising from 29,000 t in 1998 to 132,000 t in 1999. The Coloso leach plant was closed permanently in May 1999 (Rio Tinto, 2000, p. 20). At the Candelaria Mine, production of copper in concentrate rose by 13,000 t to 250,000 t, despite lower mill throughput as mill-head grade rose from 1.07% to 1.21% copper (Phelps Dodge Corp., 2000, p. 64-65).

Construction of the \$1.8 billion Collahuasi Mine (Falconbridge Ltd., 44%; Minorco S.A., 44%; Japanese consortium, 12%) and accompanying infrastructure was completed and commercial production begun in January 1999. Production in 1999 of 435,000 t of copper (385,000 t in concentrate and 50,000 t SX-EW) at a cash operating cost of \$0.38 per pound exceeded company expectations (Falconbridge Ltd., 2000).

Rio Algom announced that it had increased reserve estimates at its Spence deposit to 400 Mt averaging 1% copper and having a potential annual production output of 225,000 t of copper in concentrate. A new mine model using a hybrid approach of traditional sulfide concentrator and heap leach was developed

that allowed for processing a larger portion of the deposit with increased annual output. Rio Algom expected to complete a full feasibility study in 2000 and hoped to begin construction in 2002 (Rio Algom Ltd., 2000, p. 14-15).

Indonesia.—Following completion of its fourth concentrator expansion early in 1998, P.T. Freeport Indonesia Co.'s Grasberg Mine in Irian Jaya achieved record mill throughput of 220,000 metric tons per day (t/d) of ore in 1999, up from 196,400 t/d in 1998. However, owing to a drop in mill-head grade from 1.30% copper to 1.12% copper, production fell by 43,000 t to 767,000 t, and site production costs rose by more than \$0.04 per pound to \$0.365 per pound. Despite lower mill-head grades, gold recovery increased. Higher byproduct credits and lower treatment costs resulted in net operating costs and total production costs falling from \$0.11 per pound and \$0.28 per pound, respectively, in 1998, to \$0.09 per pound and \$0.27 per pound, respectively, in 1999. Freeport successfully concluded its "first-stage completion" testing of its new smelter and reported operating at 94% of its design capacity of 200,000 t/yr of copper during the fourth quarter (Freeport-McMoRan Copper & Gold Inc., 2000, p. 22-25).

Mexico.—Grupo Mexico acquired the assets of U.S. copper producer Asarco in December using a mixture of financial instruments that included \$546 million in equity in Grupo, \$817 million in new loan agreements, and assumption of \$1.2 million of Asarco debt. Grupo subsequently reduced its debt obligation by \$512 million through the sale of Asarco's specialty chemical division.

At Grupo's Mexicana de Cobre Division, a 2,000 t drop in copper in concentrate production (175,000 t of copper) at La Caridad Mine was offset by a 2,000 t increase in SX-EW production (22,000 t). Smelter production rose by 45,000 t to 341,000 t as a result of smelter upgrades including installation of an Asarco shaft furnace. The electrolytic refinery, commissioned in 1997, produced 275,000 t of refined copper, up from 227,000 t in 1998, and the wire-rod mill, which started in 1998, produced 99,000 t of wire rod, an almost 100% increase from 1998. La Caridad refined copper and wire-rod were a major source of U.S. imports. At the Mexicana de Cananea Complex, the smelter, which had operated since the beginning of the century, was permanently closed, and concentrates shipped to La Caridad for smelting. Concentrate production declined from 357,000 t in 1998 to 300,000 t in 1999, while SX-EW production was essentially unchanged at 28,700 t. Construction of a third SX-EW plant with a 22,000-t/yr capacity was begun (Grupo Mexico, S.A. de C.V., 2000, p. 16-22).

Peru.—Production from Southern Peru Copper Corp. mines rose by 10% to 338,000 t as the expanded mill, which started up late in 1997, was expected to boost production at Cuajone from 143,000 t in 1998 to 172,000 t in 1999. At Toquepala, the SX-EW expansion was completed and production rose to 49,500 t from 47,000 t in 1998. Modernization of the Ilo smelter, which will boost capacity by 10%, was proceeding and was expected to be completed in stages by 2003. The \$87 million project will include construction of a new acid plant, installation of a new smelting furnace, modernization of converters, and expansion of the refinery. Refined production at Ilo rose slightly in 1999 to

251,000 t (ASARCO Incorporated, 1999a, p. 6-9a; Grupo Mexico, S.A. de C.V., 2000, p. 26).

A mostly Canadian consortium consisting of Rio Algom (33.75%), Noranda Inc. (33.7%), Teck Corp. (22.5%), and Mitsubishi Corporation (10%), was proceeding with the development of the \$2.3 billion Antimina Project. Antimina is one of the world's largest undeveloped copper-zinc ore deposits, with estimated in-pit proven and probable reserves of 494 Mt averaging 1.7% copper, 1.0% zinc, 0.03% molybdenum, and 12 g/t of silver. By yearend, construction was well advanced with the first production scheduled for the third quarter of 2001, well in advance of initial estimates (Rio Algom Ltd., 2000, p. 13).

Cambior Inc.'s La Granja project in northern Peru is one of the largest copper deposits in the world with reserves placed at 2.3 billion metric tons grading 5.9% copper (13.6 Mt of contained copper), including 540 Mt grading 0.65% copper that could be leached. A feasibility study filed with Peruvian authorities was based on an open pit generating from 250,000 to 300,000 t/yr of copper at a development cost of \$1.3 billion. In 1999, development work focused on a hydrometallurgical test program for leaching the high-grade secondary mineralization (Cambior Inc., 2000, p. 16).

Zambia.—Early in 2000, Zambia Consolidated Copper Mines (ZCCM) announced that it had completed the sale of its state-run copper business after 3 years of delay. The privatization process was limited in 1998 when Phelps Dodge and Noranda withdrew from the Kafue consortium, a group that had been negotiating for a 94% interest in the Nkana and Nchanga Divisions. The finalized sale placed a significant portion of ZCCM's remaining copper production in the hands of Anglo American plc. Konkola Copper Mines plc. (65% owned by Anglo American, 20% by ZCCM, and 15% by other owners) would operate the Nchanga Division and the Konkola and Konkola deep mining project. It also held an option to purchase the Nkana smelter. Anglo projected output from these operations to reach 127,000 t of copper by 2004. Mopani Copper Mines Plc. (51% Glencore International AG of Switzerland and 49% First Quantum Minerals Ltd. of Canada) obtained a 90% stake in the Mufalira Mine, smelter, refinery, and the Nkana Mine, concentrator, and cobalt plant (Soloman, 2000).

Outlook

U.S. mine capacity and production are expected to decline by about 100,000 t and 150,000 t, respectively, in 2000 as the full impact of 1999 mine closures and cutbacks are felt. Production and capacity are expected to decline by an additional 30,000 t and 250,000 t in 2001 as mines are removed from active capacity following long-term closure. The Morenci Mine in Arizona is expected to close its remaining concentrator and convert to an all leach operation in 2001. Following mine cutbacks and the closure of three primary smelters in 1999, primary smelter and refined production are expected to plummet in 2000, with primary refined production falling by 280,000 t, 15%.

Secondary refined production is also expected to fall with the

closure of one of the two remaining secondary smelters. In May 2000, Southwire Company, an integrated producer of copper wire, closed its secondary smelter and associated refinery in Carrollton, GA, having failed to secure a buyer. As justification for the closure, the company cited the high cost of compliance with environmental regulations in the Atlanta area and its strong buying position as leverage for meeting its future refined copper needs in a global market (Southwire Company, 2000).

Domestic consumption of refined copper during the first 6 months of 2000 was unchanged from that of the same period in 1999. A 30,000-t decline in consumption at wire-rod mills was essentially offset by an increase in brass mill consumption. The decline in rod mill consumption reflects a decline in domestic rod mill capacity and an increase in wire rod imports. According to U.S. Census Bureau data, adjusted by the USGS, U.S. imports of wire rod for the first 6 months of 2000 were 128,000 t, up from 83,000 t for the first 6 months of 1999 and 108,000 t for all of 1998. In response to a growing shortage of North American wire rod, as well as expectations of a continued strong North American market, Alcatel, a French-owned communications company, announced plans to construct a 200,000-t/yr wire-rod mill in the Southeastern United States (Platt's Metals Week, 2000).

According to data compiled by the ICSG (International Copper Study Group, 2000a), global mine production remained relatively stagnant over the first 7 months of 2000, averaging 1.08 million metric tons per month (Mt/mo), yet was up by about 1% over the comparative period in 1999. This reflects a sharp departure from the 1997-99 period when world copper mine production growth averaged almost 4.7% per year. Similarly, though exhibiting greater monthly fluctuations, world refinery production has been relatively stagnant, averaging 1.22 Mt/mo during the first 7 months of 2000, an increase of 2.5% over the equivalent period in 1999. This compares with a 3-year average annual growth rate of 4.5%.

World consumption, though also exhibiting monthly fluctuations, trended sharply upward during the first 7 months of 2000 and was up by 9% over the comparative 1999 period. In the 1997-99 period, world consumption growth averaged only 3.8%. As a result of the disparity in refined production and consumption, the calculated cumulative production surplus (refined production minus consumption) over the 1997-99 period grew to 1.4 Mt, and reported world inventories rose by 780,000 t. This trend was reversed during the first 7 months of 2000, with a calculated production deficit of 390,000 t and a reported stock decline of 280,000 t.

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TABLE 1
SALIENT COPPER STATISTICS 1/

(Metric tons unless otherwise specified)

	1995	1996	1997	1998	1999	
United States:						
Mine production:						
Ore concentrated	thousand metric tons	267,000	274,000	284,000	268,000	236,000
Average yield of copper 2/	percent	0.46	0.46	0.46	0.46	0.43
Recoverable copper:						
Arizona		1,170,000	1,240,000	1,250,000	1,190,000	1,050,000
Michigan, Montana, Utah		384,000	339,000	337,000	337,000	313,000
New Mexico		250,000	256,000	259,000	252,000	197,000
Other States		47,400	85,600 r/	96,500	78,900	37,400
Total		1,850,000	1,920,000	1,940,000	1,860,000	1,600,000
Total value	millions	\$5,640	\$4,610	\$4,570	\$3,220 r/	\$2,680
Smelter production: 3/						
From domestic and foreign ores		1,250,000	1,300,000	1,440,000	1,490,000	1,090,000
From scrap (new and old)		354,000	339,000	285,000	232,000	205,000
Total		1,600,000	1,640,000	1,720,000	1,720,000	1,290,000
Byproduct sulfuric acid, sulfur content	thousand metric tons	1,210	1,240	1,430	1,420 r/	1,130
Refinery production:						
Primary materials:						
Electrolytic from domestic ores		1,300,000	1,290,000	1,370,000	1,290,000	1,110,000
Electrolytic from foreign materials		91,200	147,000	113,000	238,000	196,000
Electrowon		539,000	574,000	587,000	609,000	587,000
Total		1,930,000	2,010,000	2,070,000	2,140,000	1,890,000
Secondary materials (scrap):						
Electrolytic		215,000	193,000	233,000	202,000	156,000
Fire refined		137,000	152,000	163,000	147,000	73,700
Total		352,000	345,000	396,000	349,000	230,000
Grand total		2,280,000	2,350,000	2,470,000	2,490,000	2,120,000
Secondary copper produced:						
Recovered from new scrap		874,000	891,000	967,000	956,000 r/	950,000
Recovered from old scrap		443,000	428,000	498,000 r/	466,000 r/	381,000
Total		1,320,000	1,320,000	1,460,000	1,420,000	1,330,000
Copper sulfate:						
Production		52,000	43,400 r/	48,400	51,800 r/	52,700
Stocks, December 31		2,770	W	W	W	W
Exports:						
Refined		217,000	169,000	92,900	86,200	25,200
Unmanufactured 4/		894,000	748,000	628,000	412,000	395,000
Imports:						
Refined		429,000	543,000	632,000	683,000	837,000
Unmanufactured 4/		825,000	961,000	999,000	1,190,000	1,280,000
Copper stocks, December 31:						
Blister and in-process material		171,000	173,000	180,000	160,000	138,000
Refined copper:						
Refineries		38,000	32,200	59,700	44,200	9,830
Wire rod mills		24,800	32,100	24,600	37,300	33,500
Brass mills		7,110	14,000	14,300	20,800	23,600
Other industry		3,030	2,700	3,390	3,870	2,460
New York Commodity Exchange (COMEX)		21,500	26,600	83,000	85,200	83,100
London Metal Exchange (LME), U.S. warehouses		68,200	38,300	129,000	341,000	412,000
Total		163,000	146,000	314,000	532,000	564,000
Consumption:						
Refined copper, reported		2,530,000	2,610,000	2,790,000	2,890,000	2,990,000
Apparent consumption, primary refined and old scrap		2,540,000	2,830,000	2,950,000	3,020,000 r/	3,130,000
Price:						
Producer, weighted average	cents per pound	138.33	109.04	106.95	78.64	75.91
COMEX, first position	do.	134.72	105.87	103.58	75.08	72.11
LME, Grade A cash	do.	133.12	104.05	103.25	75.01	71.33
World production:						
Mine	thousand metric tons	10,000 r/	11,000	11,400	12,200	12,600
Smelter	do.	10,400	10,800 r/	11,300	11,400 r/	11,400
Refinery	do.	11,900	12,700	13,500 r/	14,100	14,400

r/ Revised. W Withheld to avoid disclosing company proprietary data.

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

2/ Yield calculations include precipitates but exclude copper recovered from leaching by solvent extraction-electrowinning.

3/ Includes primary copper produced from foreign ores, matte, etc., to avoid disclosing company proprietary data.

4/ Includes copper content of alloy scrap.

TABLE 2
LEADING COPPER-PRODUCING MINES IN THE UNITED STATES IN 1999, IN ORDER OF OUTPUT 1/

Rank	Mine	County and State	Operator	Source of copper	Capacity (thousand metric tons)
1	Morenci	Greenlee, AZ	Phelps Dodge Corp.	Copper-molybdenum ore, concentrated and leached.	490
2	Bingham Canyon	Salt Lake, UT	Kennecott Utah Copper Corp.	Copper-molybdenum ore, concentrated.	310
3	Ray	Pinal, AZ	ASARCO Incorporated	Copper ore, concentrated and leached.	150
4	Chino	Grant, NM	Phelps Dodge Corp.	do.	125
5	Bagdad	Yavapai, AZ	do.	do.	115
6	Sierrita	Pima, AZ	do.	do.	120
7	Mission Complex	do.	ASARCO Incorporated	Copper-molybdenum ore, concentrated.	110
8	Tyrone	Grant, NM	Phelps Dodge Corp.	Copper ore, leached.	75
9	Miami (Inspiration)	Gila, AZ	do.	do.	75
10	San Manuel	Pinal, AZ	BHP Copper Co.	Copper-molybdenum ore, concentrated and leached.	85
11	Continental	Silver Bow, MT	Montana Resources Inc.	Copper ore, concentrated.	50
12	Robinson	White Pine, NV	BHP Copper Co.	do.	35
13	Silver Bell	Pima, AZ	ASARCO Incorporated	Copper ore, leached.	21
14	Miami	Gila, AZ	BHP Copper Co.	do.	12
15	Pinto Valley	do.	do.	do.	10

1/ The mines in this list accounted for 99% of the U.S. mine production in 1999.

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	1998		1999	
	Gross weight	Recoverable copper	Gross weight	Recoverable copper
Mined copper ore:				
Concentrated	268,000,000	1,230,000	236,000,000 2/	1,000,000
Leached	NA	609,000	NA	586,000
Total	NA	1,840,000	NA	1,590,000
Copper precipitates shipped; leached from tailings, dumps, in-place material	8,790	8,160	7,750	6,230
Other copper-bearing ores 3/	11,700,000	8,230	6,550,000	7,220
Grand total	XX	1,860,000	XX	1,600,000

NA Not available. XX Not applicable.

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

2/ In 1999, 13,000 kilograms of gold and 342 metric tons of silver were recovered from concentrated ore. The average value of gold and silver per metric ton of ore concentrated was \$0.75.

3/ Includes gold ore, lead ore, silver ore, silver-copper ore, and zinc 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
1998:					
Copper scrap	1,020,000 2/	W	58,700 r/	645,000	1,720,000
Refined copper 3/	659,000	2,170,000	52,100 r/	5,360 r/	2,890,000
Hardeners and master alloys	588	--	2,480 r/	--	3,060 r/
Brass ingots	--	--	111,000 r/	--	111,000 r/
Slab zinc	53,200	--	W	W	75,000 4/
1999:					
Copper scrap	1,050,000 2/	W	79,900	501,000	1,630,000
Refined copper 3/	691,000	2,230,000	59,600	4,480	2,990,000
Hardeners and master alloys	703	--	2,100	--	2,800
Brass ingots	--	--	116,000	--	116,000
Slab zinc	55,800	--	W	W	78,300 4/

r/ Revised. W Withheld to avoid disclosing company proprietary data. -- Zero.

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

2/ Includes copper scrap at wire rod mills to avoid disclosing company proprietary data.

3/ Detailed information on consumption of refined copper can be found in table 5.

4/ Includes slab zinc items indicated by symbol W.

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
1998:					
Wire rod mills	2,160,000	--	--	13,800	2,170,000
Brass mills	439,000	27,100	76,200	117,000	659,000
Chemical plants	--	--	--	1,090	1,090
Ingot makers	W	W	W	5,360 2/	5,360
Foundries	1,180 r/	3,590 r/	W	14,500 2/	19,200 r/
Miscellaneous 3/	W	W	W	31,800 2/	31,800
Total	2,600,000	30,700 r/	76,200	184,000	2,890,000
1999:					
Wire rod mills	2,220,000	--	--	16,800	2,230,000
Brass mills	492,000	18,300	79,300	102,000	691,000
Chemical plants	--	--	--	1,220	1,220
Ingot makers	W	W	W	4,480 2/	4,480
Foundries	3,460	13,600	W	11,600 2/	28,600
Miscellaneous 3/	W	W	W	29,800 2/	29,800
Total	2,710,000	31,800	79,300	166,000	2,990,000

r/ Revised. W Withheld to avoid disclosing company proprietary data; included with "Wirebar, billets, other." -- Zero.

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

2/ Includes items indicated by symbol W.

3/ Includes consumers of copper powder and copper shot, iron and steel plants, primary smelters producing alloys other than copper, 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)

	1998	1999
Kind of scrap:		
New scrap:		
Copper-base	914,000 r/	903,000
Aluminum-base	42,400	47,600
Nickel-base	103 r/	94
Total	956,000 r/	950,000
Old scrap:		
Copper-base	432,000 r/	349,000
Aluminum-base	34,000	31,400
Nickel-base	47	44
Zinc-base	39	31
Total	466,000 r/	381,000
Grand total	1,420,000	1,330,000
Form of recovery:		
As unalloyed copper:		
At electrolytic plants	202,000	156,000
At other plants	156,000	81,800
Total	357,000	238,000
In brass and bronze	987,000 r/	1,000,000
In alloy iron and steel	664 r/	605
In aluminum alloys	76,600	80,500
In other alloys	132	126
In chemical compounds	83	11,800 2/
Total	1,060,000	1,090,000
Grand total	1,420,000	1,330,000

r/ Revised.

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

2/ 1999 data reflects expanded coverage to include copper sulfate and other copper chemical producers.

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)

Type of operation	From new scrap		From old scrap		Total	
	1998	1999	1998	1999	1998	1999
Ingot makers	35,800 r/	34,700	97,600 r/	94,700	133,000 r/	129,000
Refineries 2/	86,300	48,800	263,000	181,000	349,000	230,000
Brass and wire rod mills	781,000	804,000	30,400	25,900	811,000	830,000
Foundries and manufacturers	10,500	11,400	41,200 r/	40,000	51,700 r/	51,400
Chemical plants 3/	83	3,940	--	7,840	83	11,800
Total	914,000 r/	903,000	432,000 r/	349,000	1,350,000 r/	1,250,000

r/ Revised. -- Zero.

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

2/ Electrolytically refined and fire-refined scrap based on source of material at smelter level.

3/ 1999 data reflects expanded coverage to include copper sulfate and other copper chemical producers.

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	1998	1999
Unalloyed copper products:		
Electrolytically refined copper	202,000	156,000
Fire-refined copper	147,000	73,700
Copper powder	7,600	7,420
Copper castings	707 r/	647
Total	357,000	238,000
Alloyed copper products:		
Brass and bronze ingots:		
Tin bronzes	16,600 r/	15,400
Leaded red brass and semired brass	97,900 r/	90,100
High leaded tin bronze	12,700 r/	13,000
Yellow brass	6,240 r/	6,010
Manganese bronze	8,190 r/	6,720
Aluminum bronze	7,700 r/	6,870
Nickel silver	2,420 r/	2,050
Silicon bronze and brass	4,700 r/	4,530
Copper-base hardeners and master alloys	12,900	11,300
Miscellaneous	1,300	154
Total	171,000 r/	156,000
Brass mill and wire-rod mill products	1,000,000	1,030,000
Brass and bronze castings	44,400 r/	43,400
Brass powder	58 r/	214
Copper in chemical products	83	11,800 2/
Grand total	1,580,000 r/	1,480,000

r/ Revised.

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

2/ 1999 data reflects expanded coverage to include copper sulfate and other copper chemical producers.

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: 2/							
1998 r/	139,000	5,130	8,750	17,800	269	26	171,000
1999	128,000	4,750	7,690	15,100	256	18	156,000
Secondary metal content of brass mill products:							
1998	811,000	991	7,740	181,000	W	W	1,000,000
1999	830,000	950	7,840	188,000	W	W	1,030,000
Secondary metal content of brass and bronze castings:							
1998	39,800 r/	651 r/	1,060 r/	2,680 r/	120	148 r/	44,400 r/
1999	39,100	708	1,100	2,260	112	119	43,400

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total."

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

2/ Includes approximately 97% from scrap and 3% from other than scrap in 1998 (revised) and approximately 96% from scrap and 4% from other than scrap in 1999.

TABLE 10
CONSUMPTION AND YEAREND STOCKS OF COPPER-BASE SCRAP 1/

(Metric tons, gross weight)

Scrap type and processor	1998		1999	
	Consumption	Stocks	Consumption	Stocks
No. 1 wire and heavy:				
Smelters, refiners and ingot makers	139,000	2,500	106,000	2,260
Brass and wire-rod mills	411,000	NA	431,000	NA
Foundries and miscellaneous manufacturers	33,900	NA	41,200	NA
No. 2 mixed heavy and light:				
Smelters, refiners and ingot makers	205,000	5,790	137,000	6,090
Brass and wire-rod mills	32,600	NA	21,200	NA
Foundries and miscellaneous manufacturers	2,850 r/	NA	3,230	NA
Total unalloyed scrap:				
Smelters, refiners and ingot makers	344,000 r/	8,290	243,000	8,350
Brass and wire-rod mills	443,000	17,300	452,000	20,300
Foundries and miscellaneous manufacturers	36,700	2,500 r/	44,500	2,840
Red brass: 2/				
Smelters, refiners and ingot makers	55,000 r/	2,500 r/	50,200	2,230
Brass mills	9,920	NA	10,400	NA
Foundries and miscellaneous manufacturers	7,740 r/	NA	10,600	NA
Leaded yellow brass:				
Smelters, refiners and ingot makers	22,700 r/	1,170 r/	20,600	1,200
Brass mills	395,000	NA	400,000	NA
Foundries and miscellaneous manufacturers	1,520	NA	1,740	NA
Yellow and low brass, all plants				
Cartridge cases and brass, all plants	65,700 r/	854	76,600	713
Auto radiators:				
Smelters, refiners and ingot makers	58,200 r/	1,890	53,400	2,140
Foundries and miscellaneous manufacturers	4,710	NA	4,650	NA
Bronzes:				
Smelters, refiners and ingot makers	13,800 r/	917	16,100	940
Brass mills and miscellaneous manufacturers	14,500	NA	10,600	NA
Nickel-copper alloys, all plants				
Low grade and residues:	17,400	343	23,000	348
Smelters, refiners and miscellaneous manufacturers	122,000 r/	11,900 r/	111,000	12,800
Other alloy scrap: 3/				
Smelters, refiners and ingot makers	20,400 r/	1,540 r/	12,100	806
Brass mills and miscellaneous manufacturers	6,690 r/	NA	6,740	NA
Total alloyed scrap:				
Smelters, refiners and ingot makers	300,000 r/	21,100 r/	258,000	21,100
Brass mills	575,000	34,400	593,000	35,500
Foundries and miscellaneous manufacturers	22,000 r/	3,190 r/	35,500	3,100
Total scrap:				
Smelters, refiners and ingot makers	645,000 r/	29,400 r/	501,000	29,500
Brass and wire-rod mills	1,020,000	51,700	1,050,000	55,700
Foundries and miscellaneous manufacturers	58,700 r/	5,690 r/	79,900	5,930

r/ Revised. NA Not available.

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

2/ Includes cocks and faucets, commercial bronze, composition turnings, gilding metal, railroad car boxes, and silicon bronze.

3/ Includes aluminum bronze, beryllium copper, and refinery brass.

TABLE 11
CONSUMPTION OF PURCHASED COPPER-BASE SCRAP 1/ 2/

(Metric tons, gross weight)

Type of operation	From new scrap		From old scrap		Total	
	1998	1999	1998	1999	1998	1999
Ingot makers	47,800 r/	46,300	138,000 r/	132,000	186,000 r/	178,000
Smelters and refineries	100,000	71,100	358,000 r/	252,000	458,000 r/	323,000
Brass and wire rod mills	987,000	1,020,000	31,400	26,800	1,020,000	1,050,000
Foundries and miscellaneous manufacturers	12,700	27,200	46,000 r/	52,700	58,700 r/	79,900
Total	1,150,000	1,160,000	574,000	464,000	1,720,000	1,630,000

r/ Revised.

1/ 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	1998	1999
Tin bronzes	33,100 r/	33,200
Leaded red brass and semired brass	60,100 r/	63,000
Yellow, leaded, low brass 2/	6,890 r/	7,980
Manganese bronze	5,610 r/	4,720
Nickel silver 3/	648 r/	2,710
Aluminum bronze	3,920 r/	4,140
Hardeners and master alloys 4/	2,480 r/	2,100
Lead free alloys 5/	642	679
Total brass ingot	113,000 r/	118,000
Refined copper consumed	52,100 r/	59,600
Copper scrap consumed	58,700 r/	79,900

r/ Revised.

1/ 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 PRICES FOR COPPER SCRAP AND ALLOY-INGOT, BY TYPE

(Cents per pound)

Year	Brass mills No. 1 scrap	Refiners No. 2 scrap	Dealers' buying (New York)		Alloy-ingot (New York) 1/	
			No. 2 scrap	Red brass turnings and borings	No. 115 brass (85-5-5-5)	Yellow brass (405)
1998	73.55	60.19	49.46	40.33	138.50	135.25
1999	70.88	57.53	42.97	37.74	138.50	135.25

1/ List price quotes effective July 1996.

Source: American Metal Market.

TABLE 14
U.S. EXPORTS OF UNMANUFACTURED COPPER (COPPER CONTENT), BY COUNTRY 1/

Country	Ore and concentrate		Matte, ash, precipitates		Refined		Unalloyed copper scrap		Blister and anodes		Total	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1998	36,500	\$54,800	22,000	\$32,000	86,200	\$146,000	114,000	\$179,000	27,100	\$45,400	286,000	\$457,000
1999:												
Belgium	17	25	4	41	404	347	1,540	13,500	177	179	2,140	14,000
Canada	30,000	50,800	25,300	32,900	13,800	23,500	31,800	32,900	20,500	33,000	121,000	173,000
China	2,730	4,740	10	57	253	471	51,300	47,400	264	600	69,900	57,900
Germany	74	74	430	634	274	765	1,120	3,950	212	404	2,110	5,830
Hong Kong	33	43	--	--	215	323	9,390	10,700	3,410	6,970	13,000	18,000
India	--	--	2	3	41	77	2,580	2,430	6	17	2,630	2,520
Italy	--	--	--	--	16	32	70	480	541	1,110	627	1,620
Japan	98	224	660	181	84	150	10,500	28,300	1,350	2,900	12,700	31,700
Korea, Republic of	14	22	43	137	164	202	7,630	12,100	520	1,110	8,370	13,500
Mexico	13,500	8,010	123	204	1,430	2,140	1,610	2,310	107	196	16,800	12,900
Peru	1,040	3,600	--	--	--	--	2	46	20	38	1,060	3,690
Singapore	--	--	--	--	1	5	1,960	1,900	629	1,510	2,590	3,410
Spain	--	--	5	7	10	15	2,760	526	70	156	2,840	703
Taiwan	--	--	14	24	8,060	13,100	4,120	6,590	1,690	3,740	13,900	23,500
Other	294	356	119	448	439	949	1,930	2,700	1,240	2,520	4,030	6,980
Total	47,800	67,900	26,700	34,700	25,200	42,100	128,000	166,000	30,800	54,400	274,000	369,000

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

Source: U.S. Census Bureau.

TABLE 15
U.S. EXPORTS OF COPPER SEMIMANUFACTURES, BY COUNTRY 1/

Country	Pipes and tubing		Plates, sheets, foil, bars		Bare wire, including wire rod 2/		Wire and cable, stranded		Copper sulfate	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
1998	27,400	\$86,900	38,300	\$157,000	49,700	\$128,000	18,600	\$108,000	1,340 r/	\$1,280 r/
1999:										
Australia	83	418	17	76	2	27	76	618	32	51
Bahamas, The	8	25	4	10	84	269	344	2,360	--	--
Belgium	102	622	456	2,300	--	--	176	1,620	--	--
Brazil	137	677	35	213	37	920	403	3,380	--	--
Canada	9,660	27,500	20,300	71,700	14,100	33,100	4,430	10,100	546	477
China	321	1,780	735	2,520	8	176	185	633	119	95
Costa Rica	8	33	3,100	8,250	246	427	50	267	--	--
Denmark	--	--	8	37	24	226	17	196	--	--
Dominican Republic	8	31	7	26	1,570	3,010	65	269	--	--
Egypt	273	953	(3/)	4	59	269	65	272	8	7
El Salvador	--	--	307	1,190	549	1,030	314	1,920	--	--
Germany	48	187	4,590	17,100	16	424	291	4,290	--	--
Guatemala	8	49	21	157	17	55	76	385	80	65
Honduras	14	57	--	--	6	16	50	215	66	54
Hong Kong	124	145	866	5,210	181	1,240	105	1,200	--	--
Indonesia	--	--	(3/)	3	1	8	4	56	--	--
Italy	510	1,640	1,960	6,500	34	94	17	495	--	--
Japan	52	200	2,580	11,400	57	361	194	3,620	--	--
Korea, Republic of	126	605	1,300	6,060	92	686	158	1,370	22	18
Mexico	12,200	32,400	2,900	11,100	26,000	64,400	14,400	36,900	50	56
Netherlands	525	3,170	38	351	5	102	16	285	--	--
Saudi Arabia	212	721	31	125	216	566	321	1,310	--	--
Singapore	15	76	112	774	35	270	542	2,170	84	77
Sweden	1	3	6	164	64	429	6	308	--	--
Taiwan	27	171	1,660	7,150	171	914	13	290	--	--
Thailand	230	1,050	70	227	2	46	387	2,030	--	--
Trinidad and Tobago	--	--	2	6	1,280	2,340	107	288	--	--
United Kingdom	282	1,350	385	1,650	81	573	202	3,000	--	--
Venezuela	141	535	31	99	55	134	383	2,470	--	--
Other	1,010	4,460	635	4,970	1,260	5,940	1,600	12,200	73	75
Total	26,100	78,900	42,200	159,000	46,300	118,000	25,000	94,500	1,080	973

r/ Revised. -- Zero.

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

2/ Total exports of wire rod in 1998 were 31,000 tons valued at \$64,700,000 and in 1999 were 28,400 tons valued at \$58,800,000.

3/ Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 16
U.S. IMPORTS FOR CONSUMPTION OF UNMANUFACTURED COPPER (COPPER CONTENT), BY COUNTRY 1/

Country	Ore and concentrate		Matte, ash, precipitates		Blister and anode		Refined		Unalloyed scrap		Total	
	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)	Quantity (metric tons)	Value 2/ (thousands)
1998	217,000	\$219,000	2,230	\$2,360	150,000	\$367,000	683,000	\$1,240,000	54,400	\$91,700	1,110,000	\$1,920,000
1999:												
Brazil	--	--	--	--	--	--	13,600	21,200	--	--	13,600	21,200
Canada	3	5	4	4	79,400	234,000	258,000	420,000	6,760	10,100	344,000	664,000
Chile	110,000	36,800	--	--	87,000	163,000	145,000	235,000	5,520	8,120	348,000	443,000
Colombia	--	--	--	--	--	--	--	--	690	780	690	780
Congo	--	--	--	--	--	--	1,900	3,330	--	--	1,900	3,330
Costa Rica	--	--	--	--	--	--	--	--	726	810	726	810
Dominican Republic	--	--	--	--	--	--	--	--	1,200	1,370	1,200	1,370
Indonesia	31,900	45,800	--	--	--	--	--	--	--	--	31,900	45,800
Jamaica	--	--	--	--	--	--	--	--	347	478	347	478
Japan	--	--	49	43	(3/)	7	5,600	13,000	292	891	5,940	13,900
Kazakhstan	--	--	--	--	--	--	15,300	23,800	--	--	15,300	23,800
Malaysia	--	--	76	173	--	--	--	--	--	--	76	173
Mexico	500	1,030	987	562	19,700	51,900	107,000	164,000	16,300	19,100	144,000	237,000
Netherlands	--	--	369	209	--	--	3,660	5,940	--	--	4,030	6,150
Peru	--	--	--	--	5,380	9,900	211,000	337,000	--	--	216,000	347,000
Poland	--	--	--	--	--	--	4,500	7,980	--	--	4,500	7,980
Russia	--	--	--	--	--	--	49,300	72,300	15	6	49,300	72,300
South Africa	--	--	--	--	--	--	1,170	1,860	--	--	1,170	1,860
Spain	--	--	--	--	568	773	11,000	33,600	16	16	11,600	34,400
Taiwan	--	--	230	571	16	37	62	154	16	253	325	1,020
Venezuela	--	--	--	--	--	--	--	--	675	784	675	784
Other	13	14	9	14	530	1,170	10,100	18,000	1,820	2,870	12,500	22,100
Total	143,000	83,700	1,730	1,580	193,000	461,000	837,000	1,360,000	34,400	45,600	1,210,000	1,950,000

-- Zero.

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

2/ C.i.f. value at U.S. port.

3/ Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 17
U.S. IMPORTS FOR CONSUMPTION OF COPPER SEMIMANUFACTURES, BY COUNTRY 1/

Country	Pipes and tubing		Plates, sheets, foil, bars		Bare wire, including wire rod 2/		Wire and cable, stranded		Copper sulfate	
	Quantity (metric tons)	Value 3/ (thousands)	Quantity (metric tons)	Value 3/ (thousands)	Quantity (metric tons)	Value 3/ (thousands)	Quantity (metric tons)	Value 3/ (thousands)	Quantity (metric tons)	Value 3/ (thousands)
1998	845	\$4,120	65,300	\$230,000	118,000	\$225,000	5,740	\$26,600	27,600	\$22,300
1999:										
Belgium	2	22	1,190	7,160	157	402	1	16	1,070	789
Brazil	--	--	694	1,130	8,290	15,900	(4/)	3	--	--
Canada	276	1,610	14,800	42,200	101,000	175,000	1,120	3,500	5,970	5,400
Chile	95	234	3,600	7,490	93	233	725	1,440	427	319
China	--	--	508	1,970	40	161	571	1,520	818	594
Costa Rica	--	--	--	--	37	85	734	1,670	--	--
Finland	--	--	3,850	12,700	517	1,790	(4/)	4	--	--
France	(4/)	8	1,250	3,450	304	2,660	61	899	--	--
Germany	6	53	13,500	41,000	354	1,810	237	1,670	39	173
Hong Kong	--	--	2	25	13	58	--	--	--	--
Israel	--	--	(4/)	5	279	1,210	3,060	16,700	368	256
Italy	--	--	2,740	6,790	57	996	14	53	2	17
Japan	2	70	12,600	52,400	627	5,670	48	527	12	112
Korea, Republic of	(4/)	6	74	420	65	223	26	193	--	--
Luxembourg	--	--	957	7,480	--	--	--	--	--	--
Mexico	39	136	1,780	4,790	80,900	133,000	47	181	9,140	7,100
Netherlands	3	16	466	2,140	2	40	(4/)	3	--	--
Peru	--	--	448	958	401	816	273	598	1,890	1,240
Poland	--	--	--	--	--	--	1,380	3,480	20	13
Russia	--	--	21	69	--	--	--	--	768	542
Sweden	--	--	14,400	44,200	--	--	(4/)	7	--	--
Taiwan	2	44	127	982	454	1,810	225	747	6,120	4,510
Turkey	--	--	--	--	2,740	9,140	635	2,280	--	--
United Kingdom	8	84	1,110	7,140	10	289	206	1,360	--	--
Other	(4/)	4	1,500	6,650	48	362	60	916	85	146
Total	434	2,280	75,600	251,000	196,000	352,000	9,430	37,700	26,700	21,200

-- Zero.

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

2/ Total imports of wire rod in 1998 were 108,000 tons valued at \$194,000 and in 1999 were 193,000 tons valued at \$330,000. Imports data adjusted by USGS to correct misclassification of imports from Mexico.

3/ C.i.f. value at U.S. port.

4/ Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 18
U.S. EXPORTS OF COPPER SCRAP, BY COUNTRY 1/

Country	Unalloyed copper scrap				Copper-alloy scrap			
	1998		1999		1998		1999	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Belgium	2,730	\$22,000	1,540	\$13,500	434	\$1,230	361	\$1,160
Canada	39,600	36,000	31,800	32,900	68,200	77,100	35,700	42,300
China	28,600	39,700	51,300	47,400	20,700	20,100	34,800	26,400
Germany	7,800	18,000	1,120	3,950	5,920	11,700	2,120	3,520
Hong Kong	14,400	19,700	9,390	10,700	23,600	27,900	4,040	4,720
India	3,460	3,290	2,580	2,430	24,900	21,400	26,100	24,100
Japan	10,200	28,400	10,500	28,300	10,400	15,300	9,690	13,200
Korea, Republic of	2,720	3,810	7,630	12,100	11,600	15,100	34,800	41,100
Mexico	1,230	1,790	1,610	2,310	10,200	13,400	20,700	19,400
Singapore	266	244	1,960	1,900	173	286	213	219
Spain	60	30	2,760	526	1,860	379	2,670	1,610
Taiwan	2,110	3,810	4,120	6,590	6,210	7,870	7,510	10,100
United Kingdom	176	751	555	1,060	3,890	3,240	1,700	2,370
Other	781 r/	1,820 r/	1,450	2,160	5,270 r/	6,910 r/	6,440	9,920
Total	114,000	179,000	128,000	166,000	193,000	222,000	187,000	200,000

r/ Revised.

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

Source: U.S. Census Bureau.

TABLE 19
U.S. IMPORTS FOR CONSUMPTION OF COPPER SCRAP, BY COUNTRY 1/

Country or Territory	Unalloyed copper scrap		Copper-alloy scrap		
	Quantity (metric tons)	Value 2/ (thousands)	Gross weight (metric tons)	Copper content e/ 3/ (metric tons)	Value 2/ (thousands)
1998	54,400	\$91,700	111,000	80,100	\$142,000
1999:					
Canada	6,760	10,100	48,200	34,700	57,500
Chile	5,520	8,120	1,470	1,060	2,150
China	--	--	1,410	1,010	1,870
Colombia	690	780	2,780	2,000	3,660
Costa Rica	726	810	840	605	799
Dominican Republic	1,200	1,370	960	691	957
Guatemala	106	117	1,670	1,210	2,380
Jamaica	347	478	566	408	471
Mexico	16,300	19,100	29,400	21,200	32,100
Spain	16	16	1,290	927	2,840
United Kingdom	120	172	2,450	1,760	3,830
Venezuela	675	784	1,980	1,420	1,540
Other	1,920	3,730	8,800	6,330	10,700
Total	34,400	45,600	102,000	73,300	121,000

e/ Estimated. -- Zero.

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

2/ C.i.f. value at U.S. port.

3/ Content is estimated by USGS to be 72% of gross weight.

Source: U.S. Census Bureau.

TABLE 20
COPPER: WORLD MINE PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1995	1996	1997	1998	1999 e/
Albania e/	3,800 r/	2,500 r/	220 r/	3,200 r/	900
Argentina	-- e/	-- e/	30,421	170,273	210,000 p/
Armenia e/	7,000	9,100	9,000	9,200	9,600
Australia:					
By concentration or cementation	361,700 r/	503,100 r/	507,400 r/	552,000 r/	651,900 3/
Leaching (electrowon)	36,100 r/	44,200 r/	50,600 r/	55,000	83,100 3/
Total	397,800 r/	547,300 r/	558,000 r/	607,000 r/	735,000 3/
Bolivia	127	92	182	48 r/	100
Botswana 4/	21,029	25,275 r/	22,840 r/	25,043 r/	22,000
Brazil (concentrate)	48,933	46,203	39,952	34,483 r/	31,200
Bulgaria	76,000 r/	89,000 r/	93,000 r/	88,000 r/	75,000
Burma:					
By concentration or cementation	5,282	4,841	2,927	-- r/	--
Leaching (electrowon)	--	--	--	6,700 r/ e/	26,736 3/
Total	5,282	4,841	2,927	6,700 e/	26,736 3/
Canada:					
By concentration or cementation	723,700	685,900	656,800 r/	703,966 r/	614,200 3/
Leaching (electrowon)	2,600	2,500	2,700	1,800 r/	-- 3/
Total	726,300	688,400	659,500 r/	705,766 r/	614,200 3/
Chile: 5/					
By concentration or cementation	2,116,100	2,480,100	2,511,000	2,578,800 r/	3,021,200 p/
Leaching (electrowon)	372,500	635,700	881,000	1,108,000	1,361,400 p/
Total	2,488,600	3,115,800	3,392,000	3,686,800 r/	4,382,600 p/
China e/	445,000	439,000 r/	496,000 r/	486,000 r/	500,000
Colombia	2,747	2,222	1,800 e/	1,400 e/	1,400
Congo (Kinshasa): 6/ 7/					
By concentration or cementation	6,800	6,200 e/	--	--	--
Leaching (electrowon)	22,600	43,800	40,100	35,000 r/ e/	35,000
Total	29,400	50,000 e/	40,100	35,000 r/ e/	35,000
Cuba e/	2,000	2,000	1,000	1,000 r/	1,000
Cyprus	--	1,688	3,900 r/	7,800	6,000
Ecuador e/	100	100	100	100	100
Finland	9,790	9,261	8,500 e/	9,000 e/	10,000
France	172	--	-- e/	-- e/	--
Georgia	3,000 e/	5,100	4,100 r/	6,000 e/	8,000
Honduras	(8) r/	(8) r/	(8) r/	(8) r/	(8)
India	46,975	47,800	37,200 e/	39,900 r/	32,100
Indonesia 7/	443,618	507,484	529,121	780,780 r/	739,685 3/
Iran:					
By concentration or cementation	102,200	107,600	117,200	119,000 r/ e/	120,000
Leaching (electrowon)	--	--	1,500	9,500 e/	14,000
Total	102,200	107,600	118,700	128,000 r/ e/	134,000
Japan	2,376	1,145	932	1,070	1,038 3/
Kazakhstan	200,000	250,000 e/	316,166 r/	337,600 r/	374,000
Korea, North e/	16,000	16,000	16,000	14,000	14,000
Korea, Republic of	31	3	-- e/	41	-- 3/
Macedonia	8,560	8,484	13,000 r/	9,100 r/	9,000
Malaysia	20,751	20,219	18,821	13,907 r/	4,970
Mexico:					
By concentration or cementation	294,647	295,303	342,319	335,822	310,893 3/
Leaching (electrowon)	38,918	45,407	48,217	48,819	50,952 3/
Total	333,565	340,710	390,536	384,641	361,845 3/
Mongolia	121,901	123,039	124,400	125,400 r/	126,700 3/
Morocco	13,600 r/	15,100 r/	15,400 r/	10,700 r/	5,000
Namibia	22,530	14,845	17,879 r/	6,500 r/	--
Nepal e/	2	--	--	--	--
Norway	6,799	7,400	6,671	2,700 e/	--
Papua New Guinea	212,737	168,024 r/	86,790 r/	187,250 r/	182,590 3/
Peru:					
By concentration or cementation	376,301 r/	396,060 r/	406,760 r/	381,501 r/	421,403 3/
Leaching (electrowon)	33,392	88,171 r/	99,738 r/	101,837	114,917 3/
Total	409,693 r/	484,231 r/	506,498 r/	483,338 r/	536,320 3/

See footnotes at end of table.

TABLE 20--Continued
COPPER: WORLD MINE PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1995	1996	1997	1998	1999 e/
Philippines	108,063	61,600 r/	49,000 r/	46,500 r/	35,200
Poland	384,200	421,900	414,800 r/	436,200 r/	461,000 3/
Portugal	134,181	109,935	106,479	114,637 r/	99,500
Romania 7/	24,528	24,434	23,190	18,871 r/	20,000 3/
Russia	525,000	523,000 r/	505,000 e/	500,000 r/	530,000
Saudi Arabia	925 e/	834	703	800 r/	1,000
Serbia and Montenegro	74,600 r/	69,500 r/	73,600 r/	70,900 r/	51,700 3/
Slovakia e/	--	386	314 r/	670 r/	500
South Africa	161,600	152,595	153,058	166,000 r/	144,263 3/
Spain	22,614	37,510	37,883	37,000 r/	2,000
Sweden	83,603	71,660	86,640	73,700 r/	70,000
Turkey 9/	37,900 r/	50,000 r/	65,000 r/	74,000 r/ e/	80,000
United States: 7/					
By concentration or cementation	1,310,000	1,350,000 r/	1,350,000	1,250,000	1,020,000 3/
Leaching (electrowon)	539,000	574,000	586,000	609,000 r/	586,000 3/
Total	1,850,000	1,920,000	1,940,000	1,860,000	1,600,000 3/
Uzbekistan	40,000	65,000 e/	73,000	65,000 r/	60,000
Zambia: 10/					
By concentration or cementation (smelted)	254,000	276,000	288,900	258,000 r/	203,000
Leaching (electrowon)	62,000	58,000 e/	64,000	57,000 r/	57,000
Total	316,000	334,000	352,900	315,000 r/	260,000
Zimbabwe: e/					
By concentration	7,900	9,000	3,900 r/	3,600 r/	1,000
Leaching (electrowon)	200	3,200	2,900 r/	2,400 r/	3,000
Total	8,100	12,200	6,800 r/	6,000 r/	4,000
Grand total	10,000,000 r/	11,000,000	11,400,000	12,200,000	12,600,000

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

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

2/ Data represent copper content by analysis of concentrates produced except where otherwise noted. Table includes data available through July 7, 2000.

3/ Reported figure.

4/ Copper content of pelletized nickel-copper matte produced in smelter.

5/ Reported by Comision Chilena del Cobre. Includes recoverable copper content of nonduplicative mine and metal products produced from domestic ores and concentrates and leach production for electrowinning.

6/ Formerly Zaire.

7/ Recoverable content.

8/ Less than 1/2 unit.

9/ Excludes copper content of pyrite.

10/ Data are for fiscal years beginning April 1 of year stated. Zambian-mined copper reported recovered during smelting and electrowinning.

TABLE 21
COPPER: WORLD SMELTER PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1995	1996	1997	1998	1999 e/
Albania, primary	2,900 r/	1,424 r/	-- r/	800 r/	1,000
Australia:					
Primary	232,600 r/	261,300 r/	208,400	236,000 r/	334,000
Secondary	-- r/	-- r/	-- r/	-- r/	--
Total	232,600 r/	261,300 r/	208,400 r/	236,000 r/	334,000
Austria, secondary e/	53,400	65,400	73,000	54,800 r/	60,000
Belgium:					
Primary	31,000 r/	35,000 r/	38,000 r/	20,700 r/	25,000
Secondary	149,200 r/	153,800	139,000 r/	138,400	143,300 3/
Total	180,200 r/	188,800 r/	177,000 r/	159,100 r/	168,300 3/
Botswana 4/	21,029	25,275	22,840	25,043	22,000
Brazil, primary	164,966	172,075	177,060	167,205 r/	192,900 3/
Bulgaria:					
Primary	102,560	99,398	109,630	114,500 r/	95,000
Secondary e/	5,000	5,000	5,000	5,000	5,000
Total	107,560	104,398	114,630	119,500 r/	100,000
Canada:					
Primary	522,761	529,349	529,524	553,100	541,500 3/
Secondary	90,929	83,344	96,957	71,300	68,300 3/
Total	613,690	612,693	626,481	624,400	609,800 3/
Chile, primary	1,293,700	1,355,600	1,389,600 r/	1,403,100	1,474,000 3/
China: e/					
Primary	538,000	616,000	789,000	839,000 r/	830,000
Secondary	466,000	220,000 r/	180,000 r/	170,000 r/	190,000
Total	1,000,000	836,000 r/	969,000 r/	1,010,000 r/	1,020,000
Congo (Kinshasa), primary: e/ 5/					
Electrowon	22,600	43,800	40,100	40,000	10,000
Other	6,200	6,000	--	--	--
Total	28,800	49,800	40,100	40,000	10,000
Finland:					
Primary	120,577	135,400	156,000 r/	149,600 r/	150,000
Secondary e/	12,000	15,000	2,000 r/	2,000 r/	2,000
Total e/	132,577 r/ 3/	150,000	158,000 r/	152,000 r/	152,000
France, secondary e/	2,580	2,300	2,400	2,000 r/	2,000
Germany:					
Primary	242,100	296,800	273,000	258,600	266,400 3/
Secondary e/	66,000	88,600	76,000	80,000 3/	60,000
Total e/	308,000	385,000	349,000	338,600 3/	326,000
Hungary, secondary e/	100	100	100	--	--
India, primary	39,496	45,300	51,400 r/	107,600 r/	224,400 3/
Iran: e/ 6/					
Primary	113,700 3/	126,000	131,000	134,000	120,000
Secondary	8,000	6,000	6,100	6,000	5,000
Total	122,000	132,000	137,000	140,000	125,000
Japan:					
Primary	1,043,275	1,122,571	1,214,172	1,171,657	1,256,276 3/
Secondary	125,206	110,856	136,274	131,979	133,188 3/
Total	1,168,481	1,233,427	1,350,446	1,303,636	1,389,464 3/
Kazakhstan, undifferentiated	242,800	245,000	315,960 r/	335,000 r/ e/	384,234 3/
Korea, North: e/					
Primary	24,000	24,000	24,000	23,000	20,000
Secondary	5,000	5,000	5,000	4,500	5,000
Total	29,000	29,000	29,000	27,500	25,000
Korea, Republic of, undifferentiated e/	160,000	150,000	160,000	293,000 r/	370,000
Mexico:					
Primary	274,356	280,462	348,290	378,302	352,700 3/
Secondary e/	14,100	21,800	4,000	4,000	5,000
Total	288,456	302,262	352,290	382,302	357,700 3/
Namibia, primary	29,799	16,659	16,029	8,700 r/	--
Norway, primary	-- r/	-- r/	-- r/	-- r/	--
Oman, primary	34,200	24,663	22,800	22,800	25,000
Peru, primary	378,511	411,969	423,120	398,900	360,000 3/
Philippines, primary	242,171	201,661	206,160	198,088 r/	192,000

See footnotes at end of table.

TABLE 21--Continued
COPPER: WORLD SMELTER PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1995	1996	1997	1998	1999 e/
Poland:					
Primary	395,200 r/	399,800	415,500 r/	422,243 r/	459,000
Secondary e/	15,000	15,000	15,000	10,000	9,000
Total e/	410,000 r/	415,000	431,000 r/	432,000 r/	468,000
Romania:					
Primary	23,345	32,622	25,024	18,708 r/	18,000
Secondary e/	1,000	1,000	1,000	1,000	2,000
Total e/	24,300	33,600	26,000	19,700 r/	20,000
Russia: e/					
Primary	525,000	550,000	535,000 r/	510,000 r/	540,000
Secondary	20,000	20,000	35,000 r/	40,000 r/	158,000
Total	545,000	570,000	570,000 r/	550,000 r/	698,000 3/
Serbia and Montenegro:					
Primary	70,074	59,940	60,000 e/	50,000	54,000
Secondary	17,336	65,287	60,000 e/	65,000	4,000
Total	87,410	125,227	120,000 e/	115,000	58,000
Slovakia, primary e/	9,600 r/	14,000 r/	10,000 r/	10,000 r/	10,000
South Africa, primary	154,400	148,400	163,600 r/	152,300 r/	160,000
Spain:					
Primary	139,900	248,500	288,900	291,400	305,000
Secondary	19,100	22,400	23,800	23,800	25,000
Total	159,000	270,900	312,700	315,200	330,000
Sweden:					
Primary	85,000	100,000	100,000 e/	100,000 e/	100,000
Secondary	20,000	25,000	25,000 e/	25,000 e/	14,000
Total	105,000	125,000	125,000 e/	125,000 e/	114,000
Turkey, undifferentiated 7/	33,700 e/	38,600 e/	32,491	35,000	37,000
United States:					
Primary	1,250,000	1,300,000	1,440,000	1,490,000	1,090,000 3/
Secondary	354,000	339,000	285,000	232,000	205,000 3/
Total	1,600,000	1,640,000	1,720,000	1,720,000	1,290,000 3/
Uzbekistan: e/					
Primary	70,000	75,000	80,000	89,930 r/	72,000
Secondary	5,000	5,000	5,000	5,000	5,000
Total	75,000	80,000	85,000	94,930 r/	77,000
Zambia, primary: 8/					
Electrowon	65,400	73,900	61,140 r/	51,736 r/	25,000
Other	234,500	250,300	220,327 r/	206,871 r/	184,000
Total	299,900	324,200	281,467 r/	258,607 r/	209,000
Zimbabwe, primary e/ 9/	8,000	7,600	4,000 r/	3,000 r/	3,000
Grand total:	10,400,000	10,800,000 r/	11,300,000	11,400,000 r/	11,400,000
Of which:					
Primary:					
Electrowon	88,000	118,000	101,000 r/	91,700 r/	35,000
Other	8,400,000 r/	8,950,000 r/	9,450,000 r/	9,530,000 r/	9,450,000
Secondary	1,450,000	1,270,000 r/	1,180,000 r/	1,070,000 r/	1,100,000
Undifferentiated	458,000 r/	459,000 r/	531,000 r/	688,000 r/	813,000

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

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

2/ This table includes total production of copper metal at the refined stage, including low-grade cathode produced by electrowinning methods. The smelter feed maybe derived from ore, concentrates, copper precipitate or matte (primary), and/or scrap (secondary). To the extent possible, primary and secondary output of each country is shown separately. In some cases, total smelter production is officially reported, but the distribution between primary and secondary has been estimated. Table includes data available through July 7, 2000.

3/ Reported figure.

4/ Copper content of nickel-copper matte exported to Norway for refining.

5/ Formerly Zaire.

6/ Data are for year beginning March 21 of that stated. Secondary production is estimated to be about 5% of total.

7/ Secondary production is estimated to be about 5% to 10% of total.

8/ For fiscal year beginning April 1 of year stated. Electrowon is total electrowon production reported less the quantity reported as "finished production, leach cathodes."

9/ Includes impure cathodes produced by electrowinning in nickel processing.

TABLE 22
COPPER: WORLD REFINERY PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1995	1996	1997	1998	1999 e/
Albania, primary e/	1,000	1,000	1,000	500	500
Argentina, secondary e/	16,000	16,000 r/	16,000 r/	16,000 r/	16,000
Australia:					
Primary	248,000 r/	311,400 r/	270,100 r/	285,900 r/	418,000 3/
Secondary e/	18,000	--	--	--	--
Total	266,000 r/	311,400 r/	270,100 r/	285,900 r/	418,000 3/
Austria: e/					
Primary	530	1,000	2,000	2,000	2,000
Secondary	53,000	57,000	65,000	76,000	75,000
Total	53,500 r/	58,000	67,000	78,000	77,000
Belgium: 4/					
Primary	216,000	191,000	190,000	185,000	201,000
Secondary	160,000	163,000	183,000	183,000	187,000
Total	376,000	354,000	373,000	368,000	388,000
Brazil, primary	164,966	172,075	177,060	167,200 r/	193,000
Bulgaria:					
Primary	25,745 r/	17,301 r/	29,530 r/	31,800 r/	15,000
Secondary e/	3,332 3/	5,000	5,000	5,000	5,000
Total	29,077	22,301	34,530 r/	36,800 r/	20,000
Burma, electrowon	--	--	--	6,700 r/	26,736 3/
Canada:					
Electrowon	2,600	2,500	2,700	1,800	-- p/
Primary	479,100	475,000	458,400 r/	488,100 r/	468,300 3/
Secondary	90,900	81,700	99,300	72,600	71,300 3/
Total	572,600	559,200	560,400 r/	562,500 r/	539,600 3/
Chile:					
Electrowon	372,500	635,700	881,000	1,108,000	1,361,300 3/
Primary	1,119,000	1,112,500	1,235,600	1,226,900	1,304,300 3/
Total	1,491,500	1,748,200	2,116,600	2,334,900	2,665,600 3/
China: e/					
Primary	612,000	692,000	801,000	870,000 r/	880,000
Secondary	467,000	428,000	379,000	341,000 r/	330,000
Total	1,080,000	1,120,000	1,180,000	1,210,000 r/	1,210,000
Congo (Kinshasa), primary 5/ 6/	33,000	42,000	40,100	35,000 r/	10,000
Cyprus, electrowon	--	1,700	3,900	4,900 r/	6,000
Egypt, secondary e/	4,400 3/	4,600	4,400 r/	4,000 r/	4,000
Finland: e/					
Primary	63,700	106,000 r/	100,000	105,000 r/	105,000
Secondary	10,000	10,000	16,000	15,000 r/	15,000
Total	73,700	116,000 r/	116,000	120,000 r/	120,000
France: e/					
Primary	4,200	10,500	--	--	--
Secondary	38,300	28,600	35,600	22,400	1,800
Total	42,500	39,100	35,600	22,400	1,800
Germany:					
Primary	247,200	316,000 e/	297,900	322,800	271,000
Secondary	369,100	355,000 e/	375,800	373,000	425,000
Total	616,300	671,000 e/	673,700	695,800	696,000
Hungary, primary and secondary e/	11,000	11,000	11,000	11,000	10,000
India:					
Primary, electrolytic	33,900	29,100	30,200	100,000	200,000
Secondary e/	5,700	10,200	6,000	7,000	8,000
Total e/	39,600	39,300	36,200	107,000	208,000
Iran: 7/					
Electrowon	--	1,500	9,500 r/	14,000	14,000
Primary 8/	90,400	99,100	103,300 r/	108,000 r/	108,000
Total	90,400	100,600	112,800 r/	122,000 r/	122,000
Italy:					
Primary	14,300	25,000	5,600	-- e/	--
Secondary	83,700	60,800	80,100	29,100 e/	28,000
Total	98,000	85,800	85,700	29,100 e/	28,000

See footnotes at end of table.

TABLE 22--Continued
COPPER: WORLD REFINERY PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1995	1996	1997	1998	1999 e/
Japan:					
Primary	1,081,235	1,140,502	1,157,299	1,149,266	1,215,248 3/
Secondary	106,724	110,871	121,400	128,086	126,301 3/
Total	1,187,959	1,251,373	1,278,699	1,277,352	1,341,549 3/
Kazakhstan, primary					
	255,600	267,100	301,100	324,900	361,889 3/
Korea, North: e/					
Primary	22,000	23,000	23,000	23,000	20,000
Secondary	5,000	5,000	5,000	5,000	5,000
Total	27,000	28,000	28,000	28,000	25,000
Korea, Republic of:					
Primary	234,895	246,305	265,426	373,205 r/	450,444 3/
Secondary e/	2,000	2,000	2,000	2,000	4,000
Total e/	237,000	248,000	267,000	375,000 r/	454,000
Mexico:					
Primary:					
Electrowon	38,918	45,407	48,217	48,819	50,952 3/
Other	140,500	180,100	234,000 e/	383,181	309,000
Secondary	32,782	16,493	14,783 r/	15,000 e/	14,000
Total	212,200	242,000	297,000	447,000	374,000
Mongolia, electrowon					
	--	--	2,751	2,319	3,600 3/
Norway, primary 8/					
	34,322	28,526	32,600 e/	32,000 e/	33,000
Oman, primary					
	21,300 r/	23,300 r/	23,700 r/	24,400 r/	19,100
Peru:					
Electrowon					
Primary	261,751	249,890	296,993	305,507	318,914 3/
Total	295,143	338,062	395,073	407,344	433,831 3/
Philippines, primary					
	158,109	155,774	146,630	152,400 r/	148,200 3/
Poland:					
Primary	405,708	424,700	425,000 e/	426,500 r/	448,300 3/
Secondary e/	28,976 3/	20,000	20,000	20,300 r/	22,200 3/
Total	434,684	444,700	445,000 e/	446,800 r/	470,500 3/
Romania:					
Primary	22,013	29,305 r/	22,912 r/	21,208 r/	28,000
Secondary e/	5,000 r/	5,000 r/	4,000 r/	2,000 r/	4,000
Total	27,013 r/	34,305 r/	26,912 r/	23,208 r/	32,000
Russia:					
Primary	504,000	543,000 r/	535,000 r/	543,000 r/	600,000 3/
Secondary	56,000	57,000	65,000 r/	77,000 r/	150,000 3/
Total	560,000	600,000 r/	600,000 r/	620,000 r/	750,000 3/
Serbia and Montenegro:					
Primary	71,304	59,940	70,534 r/	50,000 r/	48,000
Secondary	7,147	44,060	43,000 r/	45,000 r/	2,000
Total	78,451	104,000	113,534 r/	95,000 r/	50,000
Slovakia, primary and secondary e/					
	21,500 r/	28,000 r/	31,300 r/	24,100 r/	21,000
South Africa, primary 8/					
	124,300	123,000	130,200 r/	125,600 r/	134,500 3/
Spain: e/					
Primary	117,000	210,000	229,000	247,000	250,000
Secondary	47,100	54,000	63,300	57,200	60,000
Total	164,000	264,000	292,000	304,000	310,000
Sweden:					
Primary e/	78,000	100,000	105,000 r/	100,000 r/	95,000
Secondary	27,100	25,000 e/	23,000 r/	25,000 r/ e/	20,000
Total	105,100	125,000	128,000 r/	125,000 r/ e/	115,000
Taiwan, secondary e/					
	8,000	6,000	4,000	4,000	4,000
Turkey:					
Primary	80,300	80,700	102,100 r/	82,800 r/	69,000
Secondary	20,000	20,000	9,300 r/	9,000 r/	9,000
Total	100,300	100,700	111,400 r/	91,800 r/	78,000
United Kingdom:					
Primary	28,000 e/	12,869	9,100	8,000	5,000
Secondary	50,500 e/	43,746	51,300	44,000	45,000
Total	78,500 e/	56,615	60,400	52,000	50,000

See footnotes at end of table.

TABLE 22--Continued
COPPER: WORLD REFINERY PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1995	1996	1997	1998	1999 e/
United States:					
Primary:					
Electrowon	539,000	574,000	586,000	609,000 r/	586,000 3/
Other	1,390,000	1,430,000	1,480,000 r/	1,530,000	1,300,000 3/
Secondary	352,000	345,000	396,000 r/	349,000 r/	243,000 3/
Total	2,280,000	2,350,000	2,470,000 r/	2,490,000 r/	2,130,000 3/
Uzbekistan: e/					
Primary	90,000	95,000	105,000	89,930 r/ 3/	72,000
Secondary	5,000	5,000	5,000	5,000	5,000
Total	95,000	100,000	110,000	94,900 r/	77,000
Zambia, primary: 9/					
Electrowon	62,000	58,000	63,736 r/	80,709 r/	57,000
Other	266,000	276,000	268,553 r/	248,820 r/	176,000
Total	328,000	334,000	332,289 r/	329,529 r/	233,000
Zimbabwe: e/					
Electrowon	200 3/	3,200	2,900 r/	2,400 r/	3,000
Primary	6,875 3/	10,900	4,990 r/	2,940 r/	10,000
Secondary	6,000	6,000	-- r/	-- r/	--
Total	13,100	20,100	7,890 r/	5,340 r/	13,000
Total, primary	9,790,000 r/	10,700,000 r/	11,400,000 r/	12,200,000 r/	12,500,000
Total, secondary	2,080,000 r/	1,980,000 r/	2,090,000 r/	1,930,000 r/	1,880,000
Total, primary and secondary, undifferentiated	32,500 r/	39,000 r/	42,300 r/	35,100 r/	31,000
Grand total	11,900,000	12,700,000	13,500,000 r/	14,100,000	14,400,000

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

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

2/ This table includes total production of refined copper, whether produced by pyrometallurgical or electrolytic refining methods and whether derived from primary unrefined copper or from scrap. Copper cathode derived from electrowinning processing is also included. Table includes data available through July 7, 2000.

3/ Reported figure.

4/ Includes leach cathode from Congo (Kinshasa), which is processed.

5/ Formerly Zaire.

6/ Excludes leach cathode exported for processing in Belgium.

7/ Data are for Iranian years beginning March 21 of that stated.

8/ May include secondary.

9/ Data are for fiscal year beginning April 1 of that stated. Electrowon covers only presumably high-grade electrowon cathodes reported as "finished production leach cathodes." Other, in addition to electrowon cathodes, includes a smaller amount of "finished product shapes" presumably cast from electro-refined cathodes, or any blister-anodes and low-anodes and low-grade electrowon cathodes that were furnace- or fire-refined.