

Copper

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After hitting an historical low of US62.5¢/lb in March 1999, copper prices started to recover during the third quarter of the year on expectations that strong demand would eventually have an impact on high inventory levels. By the end of 1999, prices had increased by 35% from the March level to US\$1851.88/t or US84.0¢/lb. However, inventories remained high with London Metal Exchange (LME) stocks ending the year at 790 000 t, a level just below all-time highs.

CANADIAN DEVELOPMENTS

In 1999, Canadian copper mine production (recoverable copper in concentrate plus solvent extraction-electrowinning [SX-EW] output) decreased to 614 210 t from 705 200 t in 1998. Mine output in 1999 was low due to the temporary closure of the Highland Valley and Myra Falls mines, as well as the permanent closure of the Gaspé mine in October 1999. Refined copper production totaled 540 500 t in 1999 compared to 562 500 t in 1998 (this includes refined copper from both primary and secondary material).

British Columbia

Operations at the Highland Valley Copper mine resumed in early September 1999 following completion of a new collective agreement with the United Steelworkers of America and an agreement with BC Hydro that ties power rates to copper prices. The collective agreement provides for wage adjustments linked to copper prices. Low copper prices and a failed attempt to agree on concessions with workers and suppliers to reduce operating costs had forced the owners of the mine to shut down operations for four months. Highland Valley Copper produced 110 000 t of copper in concentrate in 1999.

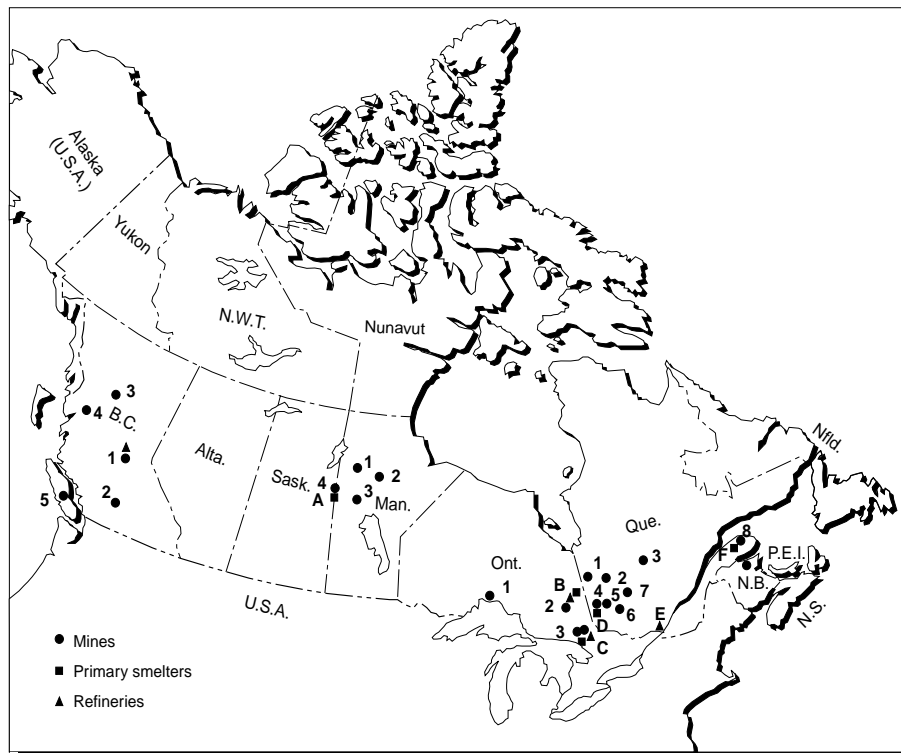
In October 1999, Northgate Exploration Ltd. reached an agreement with court-appointed interim receivers PricewaterhouseCoopers to purchase the Kemess copper-gold mine in north-central British Columbia. Royal Oak Mines Inc., the developer of the mine, was forced into receivership in April 1999 after a lengthy struggle against the combined effects of low metal prices and a high debt load. The mine reached commercial production levels in October 1998 and is expected to produce an average of approximately 27 000 t/y of copper and 7800 kg/y of gold over approximately 16 years.

In May 1999, Imperial Metals announced that it had negotiated a second financial restructuring package for the Huckleberry mine with the four Japan Group companies (Mitsubishi Materials Corp., Marubeni Corp., Dowa Mining, and Furukawa Co.) that held a 40% interest in the mine. Upon approval by the Japan Group, the arrangement specifies the deferral of all principal and interest payments during 1999, while in 2000 and 2001 the payment of principal and interest will be dependent on available cash. In addition, smelter charges and payment terms will be improved. In consideration of these and other elements of support, Imperial Metals agreed to sell an additional 10% interest in the Huckleberry mine to the Japan Group for a nominal amount.

Production at Boliden Limited's Myra Falls underground zinc-copper mine on Vancouver Island resumed at the end of March 1999 after a three-month shut-down to carry out rehabilitation and development work to address challenging ground conditions in the Battle zone. The mine produced 15 500 t of copper in concentrate in 1998.

In April, 1999, Taseko Mines Limited announced that it had reached agreement with Boliden Limited and certain affiliates to acquire the Gibraltar mine near Williams Lake in central British Columbia. Gibraltar is a large-scale, 35 000-t/d open-pit copper mine that had been placed on care and maintenance in December 1998 due to low copper prices. Under the terms of the agreement, Taseko will assume the costs of maintaining the mine on a standby care-and-maintenance basis until copper prices stabilize at a profitable level. Taseko will also assume responsibility for ultimate mine closure following the exhaustion

Figure 1
Copper Producers in Canada, 1999



Numbers refer to locations on map above.

MINES

BRITISH COLUMBIA

1. Boliden Limited (McLeese Lake)
2. Highland Valley Copper
3. Northgate Exploration Ltd. (Kemess)
4. Imperial Metals Corporation (Huckleberry)
5. Boliden Limited (Myra Falls)
6. Imperial Metals Corporation (Mount Polley)

SASKATCHEWAN

Hudson Bay Mining and Smelting Co., Limited
(Flin Flon)

MANITOBA

1. Hudson Bay Mining and Smelting Co., Limited (Ruttan mine)
2. Inco Limited (Thompson mine)
3. Hudson Bay Mining and Smelting Co., Limited (Photo Lake mine)
4. Hudson Bay Mining and Smelting Co., Limited (Flin Flon area mines including Konuto Lake)

ONTARIO

1. Inmet Mining Corporation (Pick Lake mine)
2. Falconbridge Limited (Timmins)
3. Falconbridge Limited (Sudbury area)
Inco Limited (Sudbury area)

QUEBEC

1. Les Mines Selbaie (Billiton Metals Canada Inc.)

MINES, Quebec (cont'd)

2. Noranda Inc. (Bell Allard mine)
3. Campbell Resources Inc. (Joe Mann mine)
4. Cambior inc. (Bouchard-Hébert mine)
5. Agnico-Eagle Mines Limited (La Ronde mine)
Barrick Gold Corporation (Bousquet mine)
6. Aur Resources, Inc., Novicourt Inc., Teck Corporation (Louvicourt mine)
7. Cambior inc. (Gonzague Langlois mine)
8. Noranda Inc., Division Mines Gaspé
9. Falconbridge Limited (Raglan)

NEW BRUNSWICK

Noranda Inc. (Heath Steele mine)
Noranda Inc. (Brunswick mine)

PRIMARY SMELTERS

- A. Hudson Bay Mining and Smelting Co., Limited (Flin Flon)
- B. Falconbridge Limited (Timmins)
- C. Inco Limited (Sudbury area)
Falconbridge Limited (Sudbury area)
- D. Noranda Inc. (Noranda)
- E. Noranda Inc. (Gaspé)

REFINERIES

- B. Falconbridge Limited (Timmins)
- C. Inco Limited (Sudbury area)
- E. Noranda Inc. (CCR Division)

1 Highland Valley Copper is a partnership of Cominco Ltd., Teck Corporation and Rio Algom Limited.

of copper reserves. The company estimates that the mine can sustain 12 years of profitable mine operations at historic average copper prices. In January 2000, Taseko announced that it would restart the mine once prices stabilized above the 85¢/lb level.

Manitoba/Saskatchewan

Hudson Bay Mining & Smelting Co. Limited (HBMS) reported that its Konuto Lake copper-zinc mine west of Flin Flon had achieved commercial production levels in the second quarter of 1999. The mine is expected to produce 10 000 t/y of copper plus zinc for six years.

In September 1999, Anglo American plc announced that it will invest US\$240 million at HBMS's zinc-copper complex in Flin Flon, Manitoba. The investment program includes sinking a new shaft to develop the 777 deposit near Flin Flon, with production expected to begin in 2003. Production from 777 will replace output from other mining operations in the area that are scheduled to close due to the exhaustion of ore reserves. The deposit is estimated to contain a resource of about 14.5 Mt grading 2.9% copper and 5.0% zinc, plus gold and silver. The program also includes a mill expansion project, a 15% expansion of the zinc plant, and a gas handling project at the copper smelter. The investment program is expected to extend the life of the Flin Flon operations to 2016.

Korea Resources Corp. (Kore), the South Korean government's mining arm, announced in November that it will invest \$5.2 million in a copper exploration program in the Knife Lake project in northeastern Saskatchewan. The project has geological reserves of 20 Mt with copper equivalent of 0.9%. A Calgary-based mining firm, Leader Mining International, will undertake exploration and development work while Kore will provide the financing and take a 50% stake in the project. Exploration is expected to last up to four years.

Ontario

Inco Limited produced 116 260 t of copper in 1999, a decrease of 4% from its 1998 total production of 121 107 t. The decrease in production is primarily due to the extended annual vacation shut-down at its Ontario Division operations. The shut-down was extended from three to five weeks in response to weak metal prices.

Inco announced in July 1999 that its Levack/McCreedy West mine was closing immediately, several months ahead of schedule, while the company's Little Stobie mine would close in August. Inco also confirmed that its Crean Hill mine would close in 2000 and its Coleman mine will close in 2001.

On July 8, 1999, production and maintenance workers, represented by the Canadian Auto Workers' Union, began a legal strike at Falconbridge Limited's Kidd Metallurgical Division in Timmins, Ontario, after the two parties failed to agree on the terms of settlement for their first collective agreement. During the strike, which continued until August 2, 1999, both the copper smelter and zinc plant were shut down, although the Kidd Creek mine continued to operate and stockpile its production.

In late December 1999, Falconbridge was forced to advance an extended maintenance shut-down scheduled for the spring of 2000 following a run-out in its smelter converting furnace at the Kidd Creek smelter. Production was disrupted for 46 days. Despite these setbacks, copper cathode production at the Kidd Creek Metallurgical Division increased by 6300 t to 121 300 t in 1999. The increase in production was attributable to successful efforts to debottleneck the production process in the smelter. According to the *Falconbridge 1999 Annual Report*, projected copper cathode production in 2000 is 136 000 t.

Of the total quantity of copper produced at the Kidd Creek Metallurgical Division in 1999, 43% was supplied from Kidd Creek mine concentrates and 26% was supplied from Falconbridge's Sudbury area mines. The balance was supplied from other third-party or "custom" copper concentrate mine production. Falconbridge's 1999 mine production totaled 113 358 t of copper metal in concentrate. Of this total, the Kidd Creek mine produced 67 400 t, the Sudbury Division mines (Craig, Fraser, Lindsley and Lockerby) produced 41 000 t, and the Raglan mine produced 4900 t. Falconbridge also produced 33 300 t of copper metal at its Nikkelverk nickel refinery in Norway. Details on Falconbridge's nickel and cobalt mining operations can be found in the Nickel chapter of the 1999 *Canadian Minerals Yearbook*.

Quebec

Commercial operations began in January at the new, \$119 million Bell Allard zinc-copper mine owned by Noranda Inc. and located in the Matagami region of Quebec. With an estimated mill throughput rate of 2000 t/d, the mine is expected to have a life of approximately five years.

In February 1999, Alcatel SA announced that it would close its Hochelaga cable manufacturing plant near Montréal in June 1999. The company stated that production at the plant would be transferred to a facility in Pennsylvania. The closure will result in the loss of 160 jobs.

In July 1999, Noranda Inc. reported that its \$124 million permanent copper cathode project at the CCR refinery in Montréal-Est was 90% complete and was expected to be fully operational during the first

quarter of 2000. The modernized refinery will have a capacity of 360 000 t/y and lower unit costs. The CCR refinery produced 311 000 t of copper, 1.2 million oz of gold and 41 million oz of silver in 1999.

In July 1999, employees of Noranda's Horne copper smelter in Rouyn-Noranda, Quebec, voted 79% in favour of accepting the terms of a new three-year collective agreement. The Horne smelter processed approximately 720 000 t of concentrate and 109 000 t of recyclable material in 1999, and produced 185 000 t of copper anode and 520 000 t of sulphuric acid.

Noranda's Gaspé mine ceased mining operations in early October after 46 years in operation. The Gaspé smelter will continue to operate as a stand-alone custom smelter with an annual production capacity of 135 000 t.

Newfoundland and Labrador

Inco Limited will not be proceeding with development of the Voisey's Bay project in the near term. The main reason for the delay is that Inco and the Government of Newfoundland and Labrador have not been able to reach agreement regarding processing requirements. At year-end, proved reserves at the site were 32 Mt grading 2.83% nickel and 1.68% copper. Please refer to the Nickel chapter of the 1999 *Canadian Minerals Yearbook* for a complete review of developments regarding the Voisey's Bay project during 1999.

WORLD DEVELOPMENTS

World mine production of copper was 12.68 Mt in 1999 compared to 12.19 Mt in 1998 (Table 3). During 1999, world production of refined copper (which includes refined copper from both primary and secondary material) increased to 14.37 Mt from 14.04 Mt in 1998 (Table 4). Low prices had a negative effect on copper scrap supplies during 1999, as was the case in 1998. Within the total world production of refined copper, the secondary component fell to 1.88 Mt in 1999 from 1.96 Mt in 1998. On the basis of statistics to May 2000, this downward trend appears to be reversing in response to an improved price outlook.

Chile

Total Chilean copper mine production in 1999 was 4.4 Mt, an 18.9% increase over 1998 production. Chile is the world's largest copper producer and its output accounted for 35% of total world copper mine production in 1999. Approximately two thirds of 1999 output came from private-sector producers with the remaining one third coming from The Corporación Nacional del Cobre de Chile (Codelco-Chile), the state-owned copper producer. Planned expansions

announced during 1999, anticipated new projects and further exploration should ensure that Chile maintains its dominant position in the world copper industry.

Codelco-Chile announced in June that its new Radomiro Tomic mine near Chuquicamata would be expanded from 180 000 t/y to 250 000 t/y of copper cathode at a cost of US\$220 million and the expansion would be at full capacity in the second half of 2001. The higher annual output is expected to reduce the mine life from 20 to 16 years. Current cash costs of production at Radomiro Tomic are US36¢/lb. The mine produces copper from oxide ore using SX-EW technology.

Codelco-Chile also announced a US\$600 million plan to expand production at its El Teniente Division by 140 000 t/y to 490 000 t/y of copper by 2006. The plan, known as the PDT or Teniente Development Project, includes the opening of the new Esmeralda mine, which contains 348 Mt of reserves, and a US\$73 million gas emissions recycling plant at the Caletones smelter.

The Escondida copper mine remains the world's largest; however, further expansion is required to offset forecast production declines due to falling ore grades. Copper in concentrate production of 830 000 t was 4.5% lower in 1999 than the 1998 total, while ore grades were expected to average 2.22% in 1999 and 1.84% in 2000, down from 2.75% in 1998. The Phase 3.5 expansion and the 125 000-t/y oxide project completed in late 1998 have stabilized output at around 955 000 t/y and cash costs at under US50¢/lb. A Phase 4 expansion of the operation is also being considered and final approval is expected in early 2001. This expansion would raise copper output to over 1 Mt/y by 2003 and include a new concentrate plant with a processing capacity of 110 000 t/d, a new tailings dam, and a new slurry pipeline to take concentrate to the port of Coloso. The total cost of the project is estimated at US\$1.2 billion. Escondida is owned by BHP of Australia (57.5%), Rio Tinto of the United Kingdom (30%), the Japanese consortium, Jeco, led by Mitsubishi (10%), and the International Finance Corp. (2.5%).

The first copper concentrate shipments from the new Los Pelambres mine, located 200 km north of Santiago, began in January 2000. Development of the mine took two years to complete at a cost of US\$1.36 billion. The mine is operated by Minera Los Pelambres, a joint venture between Antofagasta Holdings plc (Luksic Group) (60%) and a Japanese consortium comprising Nippon Mining & Metals Co. Ltd. (15%), Mitsubishi Materials Corporation (10%), Marubeni (8.75%), Mitsubishi Corp. (5%), and Mitsui and Co. (1.25%). During the first 10 years of operation, the Los Pelambres mine is expected to produce an average of 246 000 t/y of copper in concentrate at an average cash operating cost of 43¢/lb.

Equatorial Mining NL of Australia and Antofagasta Holdings plc announced in November that their joint-venture company, Compania Contractual Mienra El Tesoro, would begin development of the US\$300 million El Tesoro copper project in northern Chile. This SX-EW operation, which would produce about 75 000 t/y over 18 years, is expected to begin production in March 2001. Its cash operating costs are forecast at 39¢-41¢/lb over the first five years of operation.

The US\$1.76 billion Collahuasi copper mine in northern Chile was completed in the fourth quarter of 1998 and commercial production began in January 1999. The mine produced 435 000 t of copper during 1999 at an average cash cost of 38¢/lb. The Collahuasi project is owned by Falconbridge (44%), Minorco SA (44%), and a consortium of Japanese companies (12%) that includes Mitsui and Co., Ltd., Nippon Mining & Metals, and Mitsui Mining & Smelting Co. Ltd.

In April 1999, Noranda Inc. reported that engineering and design work was proceeding for the US\$170 million expansion of its Altonorte copper smelter in northern Chile. The company also announced that the original completion date had been deferred by 18 months to early in 2003 due to the poor outlook for metal prices. The planned expansion will increase annual production by 130 000 t to 290 000 t/y of copper cathode.

Although Boliden had initiated a feasibility study on its nearby Fortuna de Cobré deposit, the company decided to postpone the completion of this work given the current copper price and capital market environment. Fortuna de Cobre is estimated to contain a resource of 848 Mt grading 0.24% copper.

In July, Rio Algom announced that it had increased the in-pit resource at its wholly owned Spence deposit in northern Chile by 100 Mt, or 33%, to 400 Mt grading 1.0% copper. The company also announced that it had increased its potential annual production to 227 000 t of copper, including 186 000 t/y of copper in concentrate and 41 000 t/y of copper cathode. Average cash costs were estimated at about US55¢/lb.

Rio Algom stated that the increases were based on pre-feasibility work that indicated that a dual processing model, using both flotation and SX-EW, would allow the inclusion of an additional 100 Mt of sulphide ore at depth. Rio Algom estimates that total development costs would likely be in the range of US\$1.0 billion. The company expects to complete a full feasibility study in 2000. Construction could begin in 2002 with the first production being recorded in 2004.

In December Outokumpu completed the sale of its 50% stake in the Zaldivar copper mine to its joint-venture partner Placer Dome for \$251 million. Placer

Dome now owns 100% of the mine. Earlier in the year, Outokumpu had announced its intention to sell its stake in the mine to support the company's strategy of focusing on developing core assets such as its stainless steel business. The mine, located 175 km southeast of Antofagasta, produces 125 000 t/y of copper cathode using SX-EW technology.

Peru

Southern Peru Copper Corporation (SPCC) completed a US\$245 million expansion of its Cuacone mine in the first quarter of 1999, which increased its capacity from 64 000 t/d to 96 000 t/d. SPCC expects to complete a US\$875 million modernization and expansion of its Ilo smelter by 2003. This project includes the installation of a new single-line flash smelting furnace and a single-line converting furnace to process approximately 1.1 Mt/y of copper concentrate. The company expects that the new facility will have a sulphur capture rate in excess of 99%.

On June 30, 1999, Rio Algom Limited, Noranda Inc. and Teck Corporation announced that Compania Minera Antamina S.A. (CMA) had signed definitive documentation for US\$1.32 billion in financing for the Antamina project. The partners also announced that a definitive agreement has been reached with Mitsubishi Corporation whereby Mitsubishi would acquire 10% of CMA, subject to the satisfaction of certain conditions, including the closing of project financing.

Following completion of the Mitsubishi transaction, CMA will be owned 33.75% by each of Rio Algom Limited and Noranda Inc., 22.5% by Teck Corporation and 10% by Mitsubishi Corporation. Antamina is expected to begin production in early 2002. Located in the Andes mountains approximately 270 km north of Lima, Antamina is expected to be one of the largest copper-zinc projects in the world with annual production averaging 600 million lb of copper and 360 million lb of zinc for a period of approximately 20 years.

United States

As a result of mine cutbacks and closures announced in 1998 and 1999, copper mine production dropped by 260 000 short tons (236 000 tonnes) to 1.6 million short tons (1.45 million tonnes) in 1999, the lowest mined copper output in the United States in a decade. Closures at three of seven smelters resulted in a 25% decline in output and closures at three refineries reduced refined cathode output by 14% from 1998 levels. Major events are summarized below. A comprehensive review of the U.S. copper industry in 1999 is available from the U.S. Geological Survey (USGS) (<http://www.usgs.gov>).

In February 1999, operations at Asarco's El Paso smelter were suspended for a period of three years. Asarco, which had announced the closure in December 1998, attributed the shut-down to a shortage of concentrates. The company expected that the same market conditions would allow them to sell surplus concentrates for a better overall return. The shut-down was expected to reduce refinery production at Amarillo by 63 000 short tons per month and, combined with other cutbacks in 1998, to reduce production at Amarillo by 30%. In July, Asarco announced cutbacks at its Mission and Ray mines in Arizona that would reduce its annual production by 25 000 short tons and reduce costs by about US1¢/lb.

On June 25, 1999, Broken Hill Proprietary Co. (BHP) announced that it would close certain of its U.S. copper operations by the end of August, including about 190 000 t/y of sulphide mine capacity at its Robinson and San Manuel mine operations and the 340 000-t/y San Manuel smelter and refinery. In 1998, BHP closed its 70 000-t/y Pinto Valley sulphide operation.

On June 30, 1999, Phelps Dodge Corporation announced that, during the third quarter of 1999, the company would temporarily close its Hidalgo smelter and the smaller of two concentrators at its Morenci, Arizona, mining complex. The company expected that the production curtailment would result in an average reduction of approximately 68 000 t/y of total copper production. Phelps Dodge stated that it would retain its ability to smelt substantially all of its U.S. copper concentrates internally at its Chino smelter in New Mexico and continue to produce most of the acid consumed by its mining operations. The company also stated that production at the company's copper refinery in El Paso, Texas, would be curtailed by approximately 50%.

On July 15, 1999, Cyprus Amax Minerals Company and Asarco announced an agreement that would combine the two companies in a merger-of-equals transaction. The would-be merger was ultimately thwarted by the entry of two other major producers, Phelps Dodge Corporation and Grupo Mexico S.A. de C.V., into the contest for control. On August 20, Asarco and Cyprus announced that they were rejecting an unsolicited proposal from Phelps Dodge to negotiate acquisition of both companies in exchange for Phelps Dodge stock. On September 24, Grupo Mexico announced an offer to take over Asarco for US\$26 per share of Asarco stock. Cyprus Amax then abandoned its merger with Asarco and announced on September 30 that it had signed a merger agreement with Phelps Dodge under which Phelps Dodge would acquire Cyprus for US\$7.61 in cash and 0.2203 Phelps Dodge shares for every Cyprus share. On October 15, Asarco announced that it would abandon its merger agreement with Phelps Dodge and accept an increased cash purchase offer from Grupo Mexico of US\$2.25 billion, or US\$29.75 per share. As a

result of the mergers, Phelps Dodge becomes the world's second largest copper producer behind Codelco and Grupo Mexico becomes the world's third largest copper producer.

Mexico

In December 1999, Grupo Mexico announced that it was moving ahead with the second stage of a three-part program to increase SX-EW production at the Cananea copper mine from 32 000 t/y to 55 000 t/y. The final stage of the expansion program will raise production to 75 000 t/y.

Australia

Western Mining Corporation reported in October 1999 that work to expand copper production capacity at its Olympic Dam copper-uranium mine and copper smelter was complete and that production at the expanded rate of 200 000 t/y of refined copper would be reached during the fourth quarter of 1999.

In December, the Sydney-based copper producer, Straits Resources, announced that it will go ahead with an AS16 million expansion of its Nifty SX-EW copper mine in Western Australia, which will raise output from 18 000 t/y to 25 000 t/y by October 2000. The expansion will also result in a decrease in the total production cost from US55¢/lb to 50¢/lb. The expansion is part of the company's long-term plan to raise mine output to around 75 000 t/y of copper cathode through the exploitation of a large sulphide ore-body under the oxide cap.

Indonesia

P.T. Freeport Indonesia Company (PTFI), owned by Freeport-McMoRan Copper & Gold Inc. and Rio Tinto plc, reported that, at the end of 1998, PTFI's proven and probable reserves at its copper-gold Grasberg complex in Irian Jaya totaled 2.4 billion t grading 1.12% copper, 1.37 g/t gold and 2.78 g/t silver. The mine produced 1 630 700 t of copper in 1999 at an average unit production cost, including gold and silver credits, of US9¢/lb.

Production at the new 200 000-t/y copper smelter/refinery at Gresik in East Java commenced at the end of 1998 and is expected to reach full design capacity in the second half of 2000. The smelter produced 126 700 t of copper in 1999. This facility is owned by Mitsubishi Materials Corporation (70%), Freeport-McMoRan (25%) and Nippon Mining (5%).

In December 1999, Newmont Mining Corporation announced that its 45%-owned Batu Hijau project was undergoing the final stages of commissioning with commercial production projected to start by the first quarter of 2000. PTNNT is a joint venture

formed by U.S.-based Newmont Mining Corp., a Japanese consortium, and PT Pukuafu Indah of Indonesia. Newmont Indonesia Ltd. has a 45% stake in PTNNT while the Japanese consortium of Sumitomo Corp., Sumitomo Metal Mining Co. Ltd., Furukawa Co. Ltd. and Mitsubishi Materials Corp. owns 35%.

Batu Hijau is expected to produce an average of about 270 000 t/y of copper and 14 900 kg/y of gold over the first five years of the mine life. Anticipated total cash costs for the project are estimated at US\$48/lb of copper after gold credits.

Japan

On March 1, 1999, Nippon Mining & Metals Co. Ltd. (NMM) and South Korean copper producer LG Metals Corp. signed a Memorandum of Understanding to form a joint venture to take over LG's copper smelting and refining operations at a cost of US\$638 million. LG's smelting and refining assets comprise the 60 000-t/y Changhang refinery and 310 000-t/y Onsan smelter. Each company will hold a 50% stake in the planned joint venture, which is subject to due diligence by NMM, according to LG Metals' parent company, LG Group. NMM will form a consortium with Japanese partners Mitsui Mining & Smelting Co. Ltd. and trading house Marubeni Corp. in the venture. The same consortium also holds a 25% stake in the Los Pelambres copper project in Chile.

In November 1999, NMM, Mitsui Mining & Smelting Co. and Dowa Mining Co. signed a Memorandum of Understanding to study combining efforts in the copper business in order to "stay competitive internationally and rank with major American and European producers in a time of growing global competition." The two companies will explore cooperating in production, production technology, the procurement of raw materials, and sales in order to cut costs and operate more efficiently.

Thailand

Thai Copper Industries Public Company Limited announced in November 1999 that it had further delayed the start-up of its new 165 000-t/y smelter/refinery complex until April 2001 due to a delay in the finalization of agreements for additional financing. At the time of the announcement, the company was anticipating completion of the agreements by the end of December 1999, which would allow work to resume in April 2000 and to end 18 months later in September 2001.

Philippines

Climax Mining plans to begin developing its Didipio gold-copper project in early 2000.

Zambia

In February 1999, Zambia Consolidated Copper Mines Limited (ZCCM) announced that it would retrench over 7000 workers as part of a major restructuring initiative that resulted from an agreement reached between ZCCM, the Zambian government and the World Bank to create a manageable work force prior to the privatization of some of the company's major productive assets.

In early 1999, the Binani Group, through Roan Antelope Mining Company, announced that it had finalized investment plans for its Muliashi North project and for the refurbishment of a copper smelter and the construction of a new acid plant. Over the next two years the company expects to increase copper production from 45 000 t/y to 65 000 t/y.

Roan Antelope also announced that it was proceeding with development of the Muliashi North copper project. The operation, which will produce about 34 000 t/y of copper, is expected to start up in September 2000.

In August 1999, KGHM announced that it had signed a Memorandum of Understanding with the Zambian government giving it the opportunity to acquire an 80% interest in the Mufulira copper mining, smelting and refining complex. If, after due diligence, KGHM decides to proceed, the government will hold a 10% interest and the employees will hold the remaining 10%. The complex produced 103 000 t of copper in the fiscal year ending March 31, 1998.

In November 1999, Anglo American plc subsidiary, Zambia Copper Investments (ZCI), signed a deal with the Government of Zambia to acquire the Konkola and Nchanga copper mines and the Nampundwe pyrite mine from ZCCM. Under the agreement, which is due to be finalized by January 31, 2000, Anglo is committed to capital spending of US\$208 million in the first three years of the agreement and to begin the Konkola Deep Mining Project. ZCI also has the option to acquire the Nkana smelter and refinery, which will be managed by Anglo during the option period.

Anglo has reportedly stated that it expects to produce at least 250 000 t/y of copper from Konkola Deep and Nchanga. Production from Konkola Deep would commence in January 2002.

Democratic Republic of the Congo

In February 1999, Tenke Mining Corp. declared force majeure at its US\$475 million copper-cobalt Tenke Fungurume project. The company stated that it had taken this action after its plans to complete a feasibility study on its 55%-owned project had been undermined by six months of bloody fighting between

government troops and rebels. The Congo's state-owned mining firm, Gecamines, held the remaining 45% stake at Tenke Fungurume.

In April 1999, the shareholders of Tenke Mining approved an arrangement to grant BHP Copper Inc. an option to acquire a 45% ownership interest in the Tenke Fungurume concession.

The Tenke Fungurume deposit contains an estimated resource of 500 Mt grading 3.5% copper and 0.27% cobalt. The project is forecast to produce 100 000 t/y of copper for the first four years of operation, climbing to 200 000 t/y in the fifth year. Cobalt output is estimated at 6000 t/y, rising to 13 000 t/y. Capital costs for the project are estimated at US\$475 million.

Sweden

Boliden Limited expects to complete an expansion to its Rönnskär smelter and refinery by 100 000 t/y to 240 000 t/y of copper cathode by mid-2000. The US\$245 million project includes a new flash furnace, three new converters, a new anode casting plant, and an expansion to the tankhouse and sulphuric acid plant.

Germany

In September, Norddeutsche Affinerie (NA) announced its intention to purchase Huttenwerke Kayser (HK). NA is the world's fifth largest custom copper smelter with an annual production of around 360 000 t from concentrates and scrap. HK produces 180 000 t/y, all from scrap.

CONSUMPTION AND USES

World copper consumption increased to 14.1 Mt in 1999 from 13.4 Mt in 1998 (this includes refined copper from both primary and secondary material). Canadian refined copper consumption increased to 269 200 t in 1999 from 246 200 t in 1998.

In 1999 it was estimated that over 4.2 Mt of copper scrap was used directly by consumers worldwide. According to an annual survey conducted by Natural Resources Canada, 41 200 t of contained copper in scrap was consumed directly by Canadian manufacturers in 1999.

Table 8 presents preliminary end-use data for 1999 and 2000 for the United States, collected by the Copper Development Association Inc. (detailed copper consumption statistics are not officially collected in Canada).

MARKETS

In Canada, copper tube and fittings are now being used in houses and other buildings to carry natural gas. The growth of this market has been dramatic, with copper quickly becoming the preferred material, replacing steel pipe. This market is being heavily promoted by the Canadian Copper and Brass Development Association (CCBDA) with the financial support of the ICA. The CCBDA will make special promotional efforts in areas of eastern Canada that have recently gained, or will soon gain, access to natural gas distribution. The CCBDA and the Copper Development Association Inc. of the United States have also jointly undertaken major North American initiatives on the promotion of plumbing tube and fittings as well as architectural applications.

In addition, the CCBDA is actively involved in the promotion of electrical wire and cable, with particular emphasis on the use of larger conductors to improve energy efficiency and power quality, and on industrial and commercial power cable for building applications.

In recent years, copper has benefited from increasing consumer demand for large and small appliances, household convenience items, computers, and automotive options. In North America, there has been a noticeable increase in the intensity of copper use in residential applications. Part of this change is attributable to the construction of larger houses and the growth of home-based offices. In many homes there is a need for multiple phone lines to handle faxes, modems and security systems.

Although the use of fibre-optic cable in the communications and telecommunications sectors has increased in recent years, the development of new technologies has permitted copper wire to remain competitive, particularly in low-density applications, including communication connections to individual homes and for internal network links such as desk-to-desk telephone and computer connections. According to a recent press report, the market for short cables, which are used to interconnect telephones, computers and other electronic devices, has experienced double-digit growth rates for several years in the North American, European and Asian markets.

The use of additional electronics has also stimulated growth in demand for copper wire from the automotive industry in recent years. However, the introduction of multiplex electronic systems could limit copper demand in this application.

Aluminum has largely replaced copper in the original-equipment automotive radiator market,

particularly in the United States. However, the ICA has reported that copper still accounts for about two thirds of the global radiator market. According to the ICA, copper is particularly dominant in heavy-duty applications and in the after-market where the metal has an 80% market share. The ICA estimates that worldwide copper usage for radiators is about 190 000 t/y.

With technological advances and design innovations, new brazed copper-brass radiators have been developed that are 35-40% lower in weight than traditional copper-brass radiators. According to the ICA, these brazed radiators are produced more easily and at a lower cost than comparable aluminum radiators.

A number of other promising new markets for copper could also provide significant growth opportunities. These include the use of copper as an additive in roofing shingles to prevent the formation of algae and fungus, as well as use in fire suppression systems, natural gas systems, solar power generation equipment, and the storage of spent nuclear fuel.

HEALTH

Although copper toxicity is recognized at elevated intake/exposure levels, the element is an essential nutrient for human health. At a Task Group meeting of the International Programme on Chemical Safety (IPCS) held in Brisbane in June 1996, there was a recognition that copper is an essential trace element for human health and that there are greater risks, in Europe and the Americas in particular, of health effects from copper deficiency than from excess copper intake.

The U.S. National Academy of Sciences/National Research Council has recommended a daily intake of 0.4-0.6 mg for children up to six months of age, increasing progressively to 1-2 mg for children up to 10 years of age. For adolescents and adults, the recommended range is 1.5-2.5 and 1.5-3.0 mg, respectively. The World Health Organization (WHO) has suggested a recommended daily intake of copper of 80 micrograms (μg)/kg for infants and young children, and 40 $\mu\text{g}/\text{kg}$ and 30 $\mu\text{g}/\text{kg}$ for older children and adult males, respectively.

Acute copper poisoning is infrequent in humans, largely restricted to the voluntary or accidental ingestion of copper salts. According to the Copper Development Association Inc., the WHO and the U.S. Food and Agricultural Administration (FAA) are likely to suggest that the population's mean intake of copper should not exceed 12 mg/d for adult males and 10 mg/d for adult females. These levels are regarded as the lowest intakes likely to produce the slightest biochemical evidence of undesirable effects in all but a small number of the population.

Many regulatory agencies, including Health Canada, have chosen 1 part per million (ppm) as the maximum desirable concentration of copper in drinking water. It signifies more of an aesthetic limit than a health limit; water containing more than 1 ppm can stain laundry and persons with a keen sense of taste may perceive a metallic flavour in the water.

In 1993, the WHO included copper in a group of chemicals of health significance in drinking water and recommended a guideline value of 2 mg/L. The recommendation was deemed provisional due to uncertainties regarding copper toxicity in humans. As a result, scientific discussions were conducted internationally, and the WHO revised its recommendation in 1997 with the guideline value of 2 mg/L for copper now defined on the basis of the potential for acute gastrointestinal effects. The recommendation remains provisional in view of the remaining uncertainties regarding copper toxicity in humans.

STOCKS

Combined copper stocks on the London Metal Exchange (LME), the Commodities Exchange, Inc. (COMEX) and the Shanghai Metal Exchange increased throughout 1999 to reach 936 600 t at the end of December. At the end of December 1998, stocks stood at 760 000 t.

Total copper stocks, including those at producers, merchants, consumers and exchanges, totaled 1 457 300 t at the end of 1999, compared to 1 362 300 t at the end of 1998. Figure 2 shows both total copper stocks and prices for the period 1989-99.

PRICES

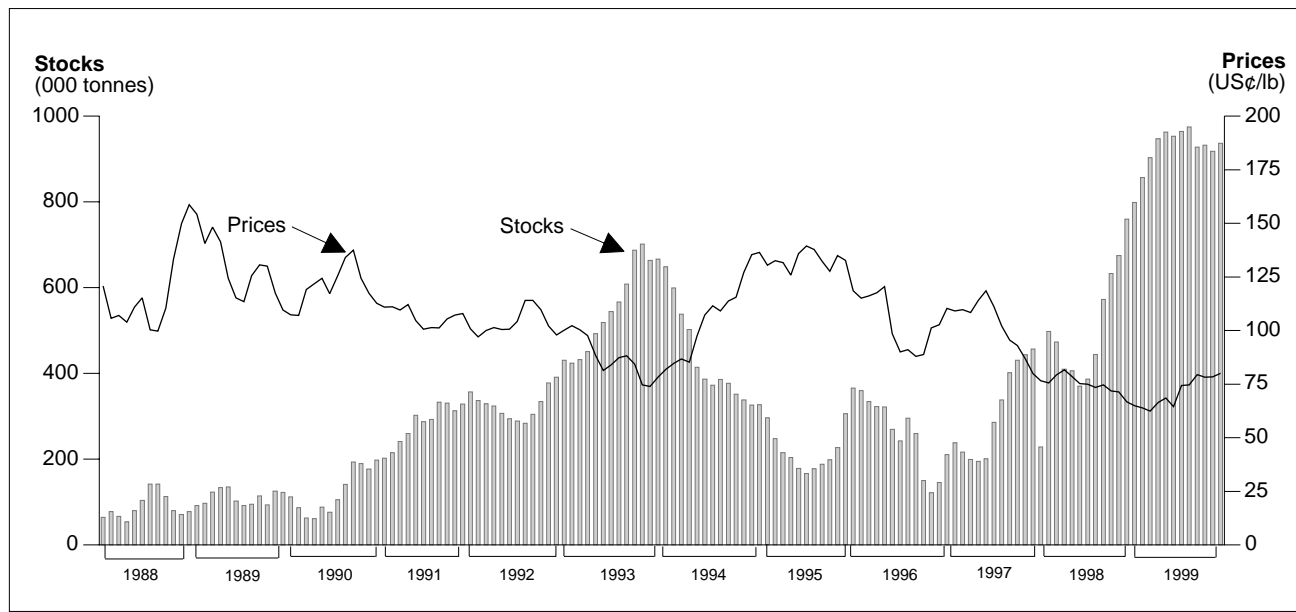
Copper prices on the LME averaged US\$1573/t (71¢/lb) in 1999 (Figure 2) compared to US\$1654/t (75.01¢/lb) in 1998.

In 1998 and the first half of 1999, Canadian producers sold refined copper in the United States at COMEX (high grade first position close) plus a premium of US\$3.3¢/lb, while in Canada prices were set at the Canadian dollar equivalent of COMEX plus 4.5¢-5.0¢/lb. For sales in Europe, Canadian producers established a price of LME (Grade A Settlement Price) plus an average premium of US\$30-\$35/t in 1998 and US\$38/t in 1999.

TREATMENT AND REFINING CHARGES

Benchmark smelting and refining charges for 1999 were established at US\$67/dry metric tonne (dmt) and US\$6.7¢/lb. Average spot smelting and refining charges were reported for the year at US\$35/dmt and 3.5¢/lb.

Figure 2
Copper Prices¹ and Exchange² Stocks, 1988-99



Source: Natural Resources Canada.

¹ Average monthly LME cash prices. ² Combined exchange stocks at end of the month.

Benchmark charges in 1998 were US\$99/dmt and 9.9¢/lb, while in 1997 the benchmark was roughly US\$105/dmt and 10.5¢/lb.

OUTLOOK

The combined effect of production cuts and growth in all of the major consuming regions should result in a more balanced metal market in 2000. A copper metal surplus of between 250 000 and 300 000 t is forecast in 1999, while in 2000 the metal balance is forecast to range from a surplus of up to 100 000 t to a deficit of up to 100 000 t.

The recovery in copper prices that began in mid-1999 is forecast to continue into 2000; however, any significant increases above the US\$1900/t level (US86¢/lb) could trigger mine re-openings and producer forward hedge selling, thereby limiting upside potential. In 2000, copper is expected to trade within a range of US\$1750-\$1850/t (US79¢-84¢/lb). For the period 2001-05, prices are expected to trade in a range between US\$1800 and US\$2200/t (US\$0.82 and US\$1.00/lb).

Higher-than-expected demand in Asia, particularly from South Korea and Taiwan, will offset continuing contraction in Europe. Demand growth in the United States of 3.4%, while still positive, has slowed. World consumption is forecast to rise 4.4% in 2000 to

14.4 Mt on the strength of a recovery in demand in Europe and continuing steady growth in Asia and the United States. For the period 2001-05, copper consumption is expected to grow at an average annual rate of about 3.3%.

Canadian copper mine production (recoverable copper in concentrate) is expected to total approximately 660 000 t in 2000 which, although it represents a substantial increase from the 1999 production total of 614 000 t, still falls below 1998 output of 692 000 t. Mine output in 1999 was low due to the temporary closure of the Highland Valley and Myra Falls mines, as well as the permanent closure of the Gaspé mine in October 1999. Estimated mine production in 2001 is currently forecast at slightly below the 2000 forecast level as net reductions in output from existing mines are anticipated and no new mines are scheduled to come on stream until 2002.

Refined copper production is forecast to grow by 6.4% to 582 000 t in 2000, and by a further 6.5% to 620 000 t in 2001. The rise in production is a result of increased capacity at Noranda's CCR refinery and Falconbridge's Kidd Creek refinery.

Canadian refined copper consumption is expected to increase by 8.3% to 288 000 t in 2000 and by a further 2.9% to 296 000 t in 2001. The expected rise in demand stems from several factors. There is growing demand for power cable and building wire coming

from the oil and gas and pulp and paper industries. Demand for use in new housing construction is also strong. In addition, Alcatel Canada Wire is set to complete the last stage of a planned expansion at its Montréal-Est rod plant by July 2000, which will lift capacity from 200 000 t/y to 250 000 t/y.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65. (2) Information in this review was current as of August 15, 2000. (3) This and other reviews, including previous editions, are available on the Internet at http://ww.nrcan.gc.ca/mms/cmty/index_e.html.

NOTE TO READERS

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TARIFFS

Item No.	Description	Canada			United States	EU	Japan ¹
		MFN	GPT	USA	Canada	MFN	WTO
2603.00 2603.00.00.10	Copper ores and concentrates Copper content	Free	Free	Free	Free	Free	Free
2825.50	Copper oxides and hydroxides	Free	Free	Free	Free	3.2%	4.8%
28.33	Sulphates; alums; peroxosulphates (persulphates) Other sulphates:						
2833.25	Of copper						
2833.25.10	Cupric sulphate	Free	Free	Free	Free	3.2%	3.9%
2833.25.90	Other copper sulphates	5.5%	Free	Free	Free	3.2%	3.9%
74.01	Copper mattes; cement copper (precipitated copper)						
7401.10	Copper mattes	Free	Free	Free	Free	Free	Free
7401.20	Cement copper (precipitated copper)	Free	Free	Free	Free	Free	Free
7402.00	Unrefined copper; copper anodes for electrolytic refining	Free	Free	Free	Free	Free	3%
74.03	Refined copper and copper alloys, unwrought						
	Refined copper:						
7403.11	Cathodes and sections of cathodes	Free	Free	Free	Free	Free	Free-3%
7403.12	Wire bars	Free	Free	Free	Free	Free	Free-3%
7403.13	Billets	Free	Free	Free	Free	Free	Free-3%
7403.19	Other	Free	Free	Free	Free	Free	Free-3%
	Copper alloys:						
7403.21	Copper-zinc base alloys (brass)	Free	Free	Free	Free	Free	Free
7403.22	Copper-tin base alloys (bronze)	Free	Free	Free	Free	Free	Free-3%
7403.23	Copper-nickel base alloys (cupro-nickel) or copper-nickel-zinc base alloys (nickel-silver)	Free	Free	Free	Free	Free	Free-3%
7403.29	Other copper alloys (other than master alloys of heading no. 74.05)	Free	Free	Free	Free	Free	Free-3%
7404.00	Copper waste and scrap	Free	Free	Free	Free	Free	Free
7405.00	Master alloys of copper	Free	Free	Free	Free	Free	3%
74.06	Copper powders and flakes	Free	Free	Free	Free	Free	3%
74.07	Copper bars, rods and profiles	Free-3%	Free	Free	Free	4.8%	3%
74.08	Copper wire, of refined copper	Free-3%	Free	Free	Free	4.8%	3%
74.09	Copper plates, sheets and strip, of a thickness exceeding 0.15 mm	Free	Free	Free	Free	5.2%	3%
74.10	Copper foil (whether or not printed or backed with paper, paperboard, plastics or similar backing materials) of a thickness (excluding any backing) not exceeding 0.15 mm	Free	Free	Free	Free	5.5%	3%
74.11	Copper tubes and pipes	2-2.5%	Free	Free	Free	4.8%	3%
74.12	Copper tube or pipe fittings (for example, couplings, elbows, sleeves)	3%	Free	Free	Free	5.2%	Free
7413.00	Stranded wire, cables, plaited bands and the like, of copper, not electrically insulated	3%	Free	Free	Free	Free-5.2%	3%

TARIFFS (cont'd)

Item No.	Description	Canada			United States	EU	Japan ¹
		MFN	GPT	USA	Canada	MFN	WTO
74.14	Cloth (including endless bands), grill and netting, of copper wire; expanded metal of copper	3%	Free	Free	Free	4.3%	Free
74.15	Nails, tacks, drawing pins, staples (other than those of heading no. 83.05) and similar articles, of copper or of iron or steel with heads of copper; screws, bolts, nuts, screw hooks, rivets, cotters, cotter-pins, washers (including spring washers) and similar articles, of copper	Free-3%	Free	Free	Free	3-4%	Free
7416.00	Copper springs	3%	Free	Free	Free	4%	Free
7417.00	Cooking or heating apparatus of a kind used for domestic purposes, non-electric and parts thereof, of copper	3%	Free	Free	Free	4%	Free
74.18	Table, kitchen or other household articles and parts thereof, of copper; pot scourers and scouring or polishing pads, gloves and the like, of copper; sanitary ware and parts thereof, of copper	3%	Free	Free	Free	3%	Free
74.19	Other articles of copper	Free-9.5%	Free-5%	Free	Free	3%	Free

Sources: Customs Tariff, effective January 2000, Canada Customs and Revenue Agency; Harmonized Tariff Schedule of the United States 2000; Worldtariff Guidebook on Customs Tariff Schedules of Import Duties for European Union (39th Annual Edition: 1999); Custom Tariff Schedules of Japan, 1999.
¹ WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, COPPER PRODUCTION AND TRADE, 1998 AND 1999

Item No.	1998		1999p	
	(tonnes)	(\$000)	(tonnes)	(\$000)
SHIPMENTS¹				
	–	–	–	–
Newfoundland	–	–	–	–
Prince Edward Island	–	–	–	–
Nova Scotia	–	–	–	–
New Brunswick	14 153	34 745	10 562	24 788
Quebec	121 778	298 965	125 163	293 758
Ontario	227 011	557 312	209 580	491 884
Manitoba	49 598	121 763	52 020	122 091
Saskatchewan	681	1 673	168	394
Alberta	–	–	–	–
British Columbia	277 541	681 363	182 543	428 429
Yukon	–	–	–	–
Northwest Territories	–	–	–	–
Total	690 762	1 695 820	580 036	1 361 344
Refinery output	562 261	..	540 446	..
EXPORTS				
2603.00.10	Copper ores and concentrates			
	Copper content			
	288 671r	244 608r	205 990	148 447
Japan	44 920r	31 460r	34 711	24 729
South Korea	40 784r	26 105r	21 323	12 058
Philippines	1 633r	3 934r	2	3
United States	38 172	34 519	–	–
Other countries	–	–	–	–
Total	414 180	320 626	262 026	185 237
2604.00.00.10, 2607.00.00.10, 2608.00.00.10, 2616.10.00.10	Other ores and concentrates			
	Copper content			
Italy	–	–	1 798	1 467
Total	–	–	1 798	1 467

TABLE 1 (cont'd)

Item No.	1998		1999p		
	(tonnes)	(\$000)	(tonnes)	(\$000)	
EXPORTS (cont'd)					
2620.30	Copper ash and residues				
	United States	104 ^r	164	4	6
	Total	104 ^r	164	4	6
2825.50	Copper oxides and hydroxides				
		–	–	–	–
2833.25	Copper sulphates				
	United States	5 491	7 919	5 966	8 023
	Total	5 491	7 919	5 966	8 023
7401.10	Copper mattes				
	Norway	18 246 ^r	41 472 ^r	18 852	36 809
	United Kingdom	1 260	3 230	1 185	2 965
	Total	19 506 ^r	44 702 ^r	20 037	39 774
7402.00	Copper anodes				
	United States	83 191	365 167	79 768	348 245
	Other countries	20	57	–	–
	Total	83 211	365 224	79 768	348 245
7403.11 to 7403.19	Refined copper and copper alloys, unwrought				
	United States	264 723	682 730 ^r	258 340	623 408
	United Kingdom	42 925	90 500	25 049	52 565
	France	9 552	24 253	3 286	8 138
	Sweden	5 384 ^r	13 700	2 882	7 245
	Taiwan	2 566	6 358	2 766	6 372
	Colombia	15 605 ^r	69 946 ^r	714	3 204
	Norway	20	93	562	1 925
	Netherlands	419	1 072	285	1 089
	Other countries	14 631	42 188	258	1 173
	Total	355 825 ^r	930 840 ^r	294 142	705 119
7403.21 to 7403.29	Other copper alloys				
	United States	842	2 483	2 826	7 645
	India	–	–	19	24
	Other countries	22	162	1	5
	Total	864	2 645	2 846	7 674
7404.00	Copper waste and scrap				
	United States	86 714	192 891	54 957	101 949
	China	3 724 ^r	3 729 ^r	3 509	3 346
	India	1 428	1 763 ^r	2 229	3 082
	Belgium	3 707	3 602	2 550	881
	Hong Kong	1 514	2 356	729	859
	South Korea	306	564	387	570
	Other countries	3 797	6 219	732	1 253
	Total	101 190 ^r	211 124 ^r	65 093	111 940
7405.00	Master alloys of copper				
	United States	61	62	37	55
	China	20	216	–	–
	Total	81	278	37	55
7406.10 to 7406.20	Copper powders and flakes				
	United States	132	863	39	483
	Taiwan	20	233	36	346
	Other countries	35 ^r	303 ^r	27	212
	Total	187 ^r	1 399 ^r	102	1 041
7407.11 to 7408.29	Copper and copper alloy wire				
	United States	72 532	203 303	101 381	261 804
	South Korea	3	53	15	291
	Other countries	86	357	68	307
	Total	72 621	203 713	101 464	262 402

TABLE 1 (cont'd)

Item No.	1998		1999p		
	(tonnes)	(\$000)	(tonnes)	(\$000)	
EXPORTS (cont'd)					
7409.11 to 7410.22	Copper and copper alloy plates, sheets, strip and foil				
	United States	15 613 ^r	69 787 ^r	13 320	61 925
	Saudi Arabia	1 178	5 025	658	2 720
	United Kingdom	609	2 121	765	2 519
	India	593	2 442	555	2 138
	Other countries	2 201	9 112	2 107	8 363
	Total	20 194 ^r	88 487 ^r	17 405	77 665
7411.10 to 7411.29	Copper and copper alloy tubes and pipes				
	United States	16 928	88 779 ^r	17 814	90 773
	Netherlands	243 ^r	1 674 ^r	144	914
	United Kingdom	68	462	84	752
	Other countries	547	2 446	359	1 762
	Total	17 786 ^r	93 361 ^r	18 401	94 201
7412.10 to 7412.20	Copper and copper alloy tube and pipe fittings				
	United States	..	18 429 ^r	..	22 743
	Germany	..	9 293	..	6 729
	Spain	..	5 892 ^r	..	2 500
	United Kingdom	..	2 122	..	2 186
	Other countries	..	4 872	..	4 087
	Total	..	40 608 ^r	..	38 245
7413.00	Stranded wire, cables, plaited bands and the like, of copper, not electrically insulated				
	United States	1 065 ^r	3 606 ^r	1 125	5 384
	Other countries	19	165	42	231
	Total	1 084 ^r	3 771 ^r	1 167	5 615
7414, 7415, 7416, 7419	Copper, other items of				
	United States	..	29 552 ^r	..	30 175
	Germany	..	44	..	219
	Other countries	..	2 059	..	724
	Total	..	31 655 ^r	..	31 118
	Total exports		2 395 552		1 959 286
IMPORTS²					
2603.00.00.10	Copper ores and concentrates				
	Copper content				
	Chile	45 121	60 025	52 846	95 601
	United States	33 755	71 905	37 868	72 352
	Argentina	7 007	15 150	20 152	34 892
	Indonesia	10 535	20 466	3 271	13 887
	Portugal	7 717	15 154	12 487	11 382
	Bulgaria	2 967	5 392	3 475	4 077
	Other countries	16 549	33 524	7 562	11 115
	Total	123 651	221 616	137 661	243 306
2604.00.00.10, 2607.00.00.10, 2608.00.00.10, 2616.10.00.10	Other ores and concentrates				
	Copper content				
	United States	628	987	372	880
	Mexico	108	236	60	141
	Russia	7	17	-	-
	Peru	1	3	-	-
	Total	744	1 243	432	1 021
2620.30	Copper ash and residues				
	United States	12 005	23 567	14 129	26 617
	Bulgaria	-	-	15 118	9 028
	Iran	732	5 159	4 118	5 658
	Zambia	57 717	47 720	1 600	5 095
	Other countries	9 659	5 678	3 076	6 528
	Total	80 113	82 124	38 041	52 926

TABLE 1 (cont'd)

Item No.	1998		1999p		
	(tonnes)	(\$000)	(tonnes)	(\$000)	
IMPORTS (cont'd)					
2825.50	Copper oxides and hydroxides	1 439	4 744	1 658	5 093
2833.25	Copper sulphates	15 249 ^r	13 334 ^r	13 350	11 315
2836.99.90.10	Copper carbonates	7	15	4	9
2837.19.00.10	Copper cyanides	42	257	40	245
3212.90.00.12	Pigments based on copper or copper alloy powders and flakes	–	–	–	–
3212.90.90.12	Pigments based on copper or copper alloy powders and flakes	3	54	8	131
7401.10	Copper mattes	2 596	9 008 ^r	12 287	22 429
7401.20	Copper mattes; cement copper (precipitated copper)	8 103	15 973	9 891	17 783
7402.00	Copper anodes	19 528	36 209	27 713	71 232
7403.11 to 7403.19	Refined copper and copper alloys, unwrought Refined copper				
	Total	18 685	47 994	16 474	38 887
7403.21 to 7403.29	Refined copper and copper alloys, unwrought Other copper alloys				
	Total	7 263 ^r	19 731 ^r	8 094	22 590
7404.00	Waste and scrap, copper or copper alloy				
	United States	109 799 ^r	161 811 ^r	67 340	109 432
	Finland	–	–	4 057	10 884
	Bulgaria	983	2 750	972	2 188
	Cuba	304	362	740	933
	United Kingdom	346	809	309	899
	Mexico	361	890	246	660
	Other countries	1 263	1 550	438	580
	Total	113 056 ^r	168 172 ^r	74 102	125 576
7405.00	Master alloys of copper	362 ^r	1 360 ^r	181	780
7406.10 to 7406.20	Copper powders and flakes				
	Total	2 121 ^r	10 993 ^r	2 510	12 831
7407.10 to 7407.29	Bars, rods and profiles of refined copper				
	United States	33 803 ^r	115 387 ^r	35 689	113 696
	Poland	2 274	4 956	2 945	5 035
	South Korea	507	1 225	1 643	3 646
	Turkey	3 710	5 805	1 122	2 455
	Other countries	1 742	7 183	1 904	6 659
	Total	42 036 ^r	134 556 ^r	43 303	131 491
7408.11 to 7408.29	Copper and copper alloy wire				
	Total	21 891	67 391 ^r	20 600	63 704
7409.11 to 7409.90, 7410.11 to 7410.22	Copper and copper alloy plates, sheets, strip and foil				
	Total	46 040	243 700 ^r	41 513	238 055
7411.10	Pipes and tubes, refined copper	9 064 ^r	37 508 ^r	8 755	37 289
7411.21	Pipes and tubes, copper-zinc base alloy	3 746 ^r	22 308 ^r	3 826	21 593
7411.22	Pipes and tubes, copper-nickel base alloy or copper-nickel-zinc base alloy	485 ^r	3 681 ^r	530	3 540

TABLE 1 (cont'd)

Item No.	1998		1999p		
	(tonnes)	(\$000)	(tonnes)	(\$000)	
IMPORTS (cont'd)					
7411.29	Plates and tubes, copper alloy, n.e.s.	1 100	5 614 ^r	1 068	5 104
7412.10	Fittings, pipe or tube, of refined copper	309	5 666 ^r	764	10 321
7412.20	Fittings, pipe or tube, copper alloy	4 570 ^r	63 095 ^r	5 095	64 941
7413.00	Stranded wire, cable, plaited bands and the like, of copper, not electrically insulated	4 006 ^r	13 522 ^r	4 953	16 407
7414.90	Cloth, grill and netting of copper wire and expanded metal of copper	273	1 417 ^r	293	1 264
7415.10	Nails, tacks, drawing pins, staples and similar articles of copper or of iron or steel with copper heads	128	844 ^r	190	1 135
7415.21	Washers, copper, including spring washers	386 ^r	2 383 ^r	292	1 799
7415.29	Articles of copper, not threaded, n.e.s., similar to those of headings 7415.10 and 7415.21	433	2 128 ^r	497	2 382
7415.31	Screws, copper, for wood	39	245	61	312
7415.32	Screws, bolts and nuts of copper, excluding wood screws	..	4 755 ^r	..	5 481
7415.39	Articles of copper, threaded, n.e.s., similar to bolts, nuts and screws	747 ^r	4 259 ^r	1 026	5 554
7416.00	Copper springs	..	179 ^r	..	452
7419.10	Chain and parts thereof of copper	82	537	61	412
7419.91	Articles of copper, not further worked than cast, moulded, stamped or forged	2 124 ^r	18 218 ^r	3 250	23 324
7419.99	Articles of copper, n.e.s.	..	46 055 ^r	..	51 619

Sources: Natural Resources Canada; Statistics Canada.

– Nil; .. Not available or not applicable; n.e.s. Not elsewhere specified; p Preliminary; r Revised.

1 Anode copper recovered in Canada from domestic concentrates plus exports of payable copper in concentrate and matte.

2 Imports from "other countries" may include re-imports from Canada.

Note: Numbers may not add to totals due to rounding.

TABLE 2. CANADA, COPPER PRODUCTION, TRADE¹ AND CONSUMPTION, 1975, 1980 AND 1985-99

	Production		Concentrates and Matte	Exports		Imports Refined	Consumption ³ Refined
	Shipments ²	Refinery Output		Refined	Total		
	(tonnes)						
1975	733 826	529 197	314 518	320 705	635 223	10 908	196 106
1980	716 363	505 238	286 076	335 022	621 098	13 466	208 590
1985	738 637	499 626	320 619	280 033	600 652	19 131	222 466
1986	698 527	493 445	341 390	306 822	648 212	20 901	225 586
1987	794 149	491 124	381 126	288 800	669 926	16 583	231 288
1988	758 478	528 723	348 404	268 680	617 084	4 659	236 280
1989	704 432	515 216	348 739	321 690	670 429	4 408	213 046
1990	771 433	515 835	374 875	335 941	710 816	2 611	180 605
1991	780 362	538 339	348 080	377 985	726 065	2 321	159 170
1992	761 694	539 302	346 842	385 761	732 603	8 916	156 132
1993	709 650	561 580	319 840	408 364	728 204	21 155	185 565
1994	590 784	549 869	237 554	388 568	626 122	19 594 ^r	199 350 ^r
1995	700 843	572 616	274 493 ^r	434 693 ^r	709 186 ^r	24 176 ^r	189 550 ^r
1996	652 499	559 200	409 577	384 338	793 915	28 700	218 280
1997	647 779	560 582	515 547	381 476	897 023	22 602	224 777
1998	690 762	562 261	450 867	355 825	806 692	18 685	246 212
1999p	580 036	540 446	283 861	294 142	578 003	16 474	265 789

Sources: Natural Resources Canada; Statistics Canada.

p Preliminary; r Revised.

¹ Beginning in 1988, exports and imports are based on the new Harmonized System and may not be in complete accordance with previous method of reporting. ² From 1975 to 1988, anode copper recovered in Canada from domestic concentrate plus exports of payable copper in concentrates and matte. Starting in 1989 to date, recoverable copper in concentrate shipped. ³ Producers' domestic shipments of refined copper plus imports of refined shapes.

TABLE 3. WORLD MINE PRODUCTION OF COPPER, 1997-99

	1997	1998	1999p
	(000 t)		
Chile	3 392	3 687	4 383
United States	1 979	1 886	1 622
Indonesia	548	809	786
Australia	558	607	719
Canada	658	706	614
Peru	503	483	536
China	496	480	520
Russia	505	500	510
Poland	415	436	463
Mexico	391	385	381
Kazakstan	316	339	374
Zambia	353	315	270
Papua New Guinea	112	152	188
South Africa	186	188	161
Other	1 143	1 255	1 185
Total	11 555	12 228	12 712

Source: International Copper Study Group.
p Preliminary.

TABLE 4. WORLD REFINERY PRODUCTION OF COPPER, 1997-99

	1997	1998	1999p
	(000 t)		
Chile	2 117	2 335	2 666
United States	2 450	2 489	2 132
Japan	1 279	1 277	1 342
China	1 184	1 211	1 174
Russia	600	640	750
Germany	674	696	696
Canada	560	563	547
Poland	447	447	470
South Korea	265	373	450
Peru	384	411	434
Australia	270	286	419
Belgium/Luxembourg	373	368	388
Mexico	297	447	374
Kazakstan	301	325	362
Spain	292	304	305
Scandinavia	277	280	264
Zambia	344	280	258
Brazil	177	167	193
Philippines	147	152	148
Other	1 085	1 017	1 080
Total	13 523	14 068	14 452

Source: International Copper Study Group.
p Preliminary.

TABLE 5. WORLD REFINED COPPER CONSUMPTION, 1997-99

	1997	1998	1999p
	(000 t)		
United States	2 790	2 889	2 995
China	1 285	1 397	1 530
Japan	1 440	1 254	1 294
Germany	1 039	1 147	1 133
South Korea	624	566	784
Taipei, China	588	584	655
Italy	521	590	635
Australia	171	286	419
Mexico	240	302	359
Belgium/Luxembourg	364	345	353
United Kingdom	384	363	300
Scandinavia	264	279	292
Brazil	256	298	291
Poland	239	263	268
Canada	225	246	266
India	186	253	262
Spain	203	235	255
Russia	160	150	197
Other	2 119	1 983	1 890
Total	13 098	13 430	14 178

Source: International Copper Study Group.
 p Preliminary.

TABLE 6. COPPER AND COPPER-NICKEL SMELTERS IN CANADA, 1999

Company and Location	Product	Rated Annual Capacity ¹	Feed Material	Remarks
(000 tonnes)				
Falconbridge Limited Falconbridge, Ontario	Copper-nickel matte	23	Nickel-copper concentrates	Copper-nickel concentrate processed in fluid bed roasters and an electric furnace; 1800-t/d sulphuric acid plant treats roaster gases. Matte from the smelter is refined in Norway.
Inco Limited Sudbury, Ontario	Molten "blister" copper, nickel sulphide and nickel sinter for the company's refineries; nickel oxide sinter for market, soluble nickel oxide for market	135	Bulk nickel-copper concentrates, scrap	Oxygen flash-smelting of copper sulphide concentrate. Copper converters produce blister copper. Oxygen flash furnace for smelting of nickel-copper concentrate; converters for production of nickel-copper Bessemer matte. Production of matte followed by matte treatment, flotation, separation of copper and nickel sulphides, then by roasting to make nickel oxides for refining and marketing. Oxygen flash conversion of copper sulphide to semi-blister followed by pyrorefining to blister copper.
Falconbridge Limited Timmins, Ontario	Molten "blister" copper	125	Copper concentrates, scrap	Mitsubishi-type smelting, separation and converting furnaces. Hazlett continuous cast anodes. Incremental expansion will increase capacity to 140 000 t/y in 1999.
Noranda Inc. Horne smelter Rouyn-Noranda, Quebec	Copper anodes	200	Copper concentrates, scrap	New continuous converter commissioned in 1997.
Noranda Inc. Gaspé smelter Murdochville, Quebec	Copper anodes	135	Copper concentrates	Green charge reverberatory furnace, three converters, one rotary anode furnace and an acid plant.
Hudson Bay Mining and Smelting Co., Limited (HBMS) Flin Flon, Manitoba	Copper anodes	90	Copper concentrates	Five roasting furnaces, one reverberatory furnace and two converters. Modernization planned but delayed indefinitely.

Source: Data were provided by the companies listed.
¹ Copper in matte, blister and anode.

TABLE 7. COPPER REFINERIES IN CANADA, 1999

Company and Location	Rated Annual Capacity (tonnes)	Remarks
Noranda Inc. CCR Refinery Montréal-Est, Quebec	350 000	Refines anodes from Noranda's Horne and Gaspé smelters, and also from purchased scrap and anode scrap. Precious metals, selenium and tellurium are recovered from slimes. Modernization program completed in July 1999 will raise capacity to 360 000 t/y by 2001.
Inco Limited Copper Cliff, Ontario	140 000	Casts and refines anodes from molten converter copper from the Copper Cliff smelter, and also refines purchased scrap. Gold, silver, selenium and tellurium cake are recovered from anode slimes. Recovers and electrowins copper from Copper Cliff nickel refinery residue. Annual capacity is a function of copper content in concentrates produced.
Inco Limited Copper Cliff, Ontario	9 000	Electrowinning plant processes copper-bearing fluids.
Falconbridge Limited Timmins, Ontario	120 000	Refines anodes from the Kidd Creek smelter. Incremental expansion will increase capacity to 147 000 t/y by 2000.
Boliden Limited McLeese Lake, British Columbia	2 000	Dissolved copper-in-solution from heap leaching operations is treated in a solvent extraction plant and then electrowinned to produce copper cathode. Production suspended in December 1998. Operation sold to Taseko Mines Limited in April 1999.

Source: Data were provided by the companies listed.

TABLE 8. U.S. SUPPLY OF WIRE MILL, BRASS MILL, FOUNDRY AND POWDER PRODUCTS, AND THEIR CONSUMPTION IN END-USE MARKETS, 1998 AND 1999P

United States	1998	1999P
	(000 t)	
SUPPLY		
Domestic mill products		
Building wire	656	669
Magnet wire	330	336
Telecommunications cable	317	322
Power cable	130	133
Automotive wire and cable	154	172
Electronic wire and cable	109	118
Other wire and cable	297	314
Strip, sheet, plate and foil	568	610
Rod and bar	540	561
Tube and pipe	564	583
Mechanical wire	44	43
Foundry products	182	181
Powder products	23	23
Total, domestic mill products	3 914	4 065
Imported mill products	67	167
Total supply	3 981	4 232
USES		
Building construction	1 634	1 720
Electrical/electronic products	1 069	1 134
Industrial machinery/equipment	442	447
Transportation equipment	450	494
Consumer and general products	388	437
Total	3 983	4 232

Source: Copper Development Association Inc.

P Preliminary.

Note: Numbers may not add to totals due to rounding.

**TABLE 9. YEARLY AVERAGE
COPPER PRICES,¹ 1980-99**

Year	LME
	(current US¢/lb)
1980	99.0
1981	79.0
1982	67.1
1983	72.1
1984	62.5
1985	64.3
1986	62.3
1987	80.9
1988	117.9
1989	128.9
1990	121.0
1991	106.2
1992	103.7
1993	86.8
1994	104.7
1995	132.9
1996	104.1
1997	103.2
1998	75.1
1999	71.3

Source: International Copper Study Group.

¹ Grade A, Cash.

TABLE 10. MONTHLY AVERAGE COPPER PRICES, 1998 AND 1999

	LME ¹		COMEX ²	
	1998	1999	1998	1999
	(current US¢/lb)			
January	76.6	64.9	108.3	65.1
February	75.5	64.0	110.2	63.9
March	79.3	62.5	114.8	62.5
April	81.7	66.5	110.0	67.0
May	78.6	68.6	115.3	69.1
June	75.3	64.5	117.6	65.2
July	74.9	74.4	109.9	76.0
August	73.5	74.7	102.1	75.9
September	74.7	79.4	95.1	80.9
October	71.9	78.2	93.1	79.3
November	71.4	78.4	87.6	79.1
December	66.8	80.1	79.3	81.3

Source: International Copper Study Group.

¹ LME cash price for Grade A copper. ² COMEX First Position High Grade price.