

Copper

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Copper prices weakened throughout 1998 and the first half of 1999 due principally to the combined effects of reduced demand in Southeast Asia and further increases in world copper production capacity. While cutbacks and closures in the industry, particularly in North America, and the prospect of improving Asian demand resulted in some improvement in prices in July 1999, the existence of elevated copper inventories combined with the addition of capacity from a number of large, low-cost mining projects continued to exert a negative influence on the market.

CANADIAN DEVELOPMENTS

In 1998, Canadian copper mine production (recoverable copper in concentrate plus SX-EW output) increased to 705 200 t from 657 900 t in 1997. Refined copper production totaled 562 500 t in 1998 compared to 560 400 t in 1997 (this includes refined copper from both primary and secondary material).

British Columbia

On May 15, 1999, Highland Valley Copper, owned jointly by Cominco Ltd., Teck Corp., Rio Algom Ltd. and Highmont Mining Co., suspended production for an indefinite period due to low copper prices. In the weeks prior to the closure, Highland Valley had attempted to obtain concessions on wage and power costs that would have reduced operating costs by US9¢/lb. Although Highland Valley Copper was reported to have reached an agreement with the provincial utility, B.C. Hydro, to tie electricity costs to the world price of copper, the company and the United Steelworkers of America (USW) were unable to agree on wage concessions. Highland Valley Copper and the USW were expected to resume discussions in mid-August 1999. At the time of the production suspension, Highland Valley Copper was involved

in contract negotiations with the USW to replace a contract that expired on September 30, 1998.

According to press reports, Highland Valley Copper was one of the highest-cost producers in North America with an estimated cash cost of about US68¢/lb. During 1998, Highland Valley Copper produced 172 000 t of copper in concentrate.

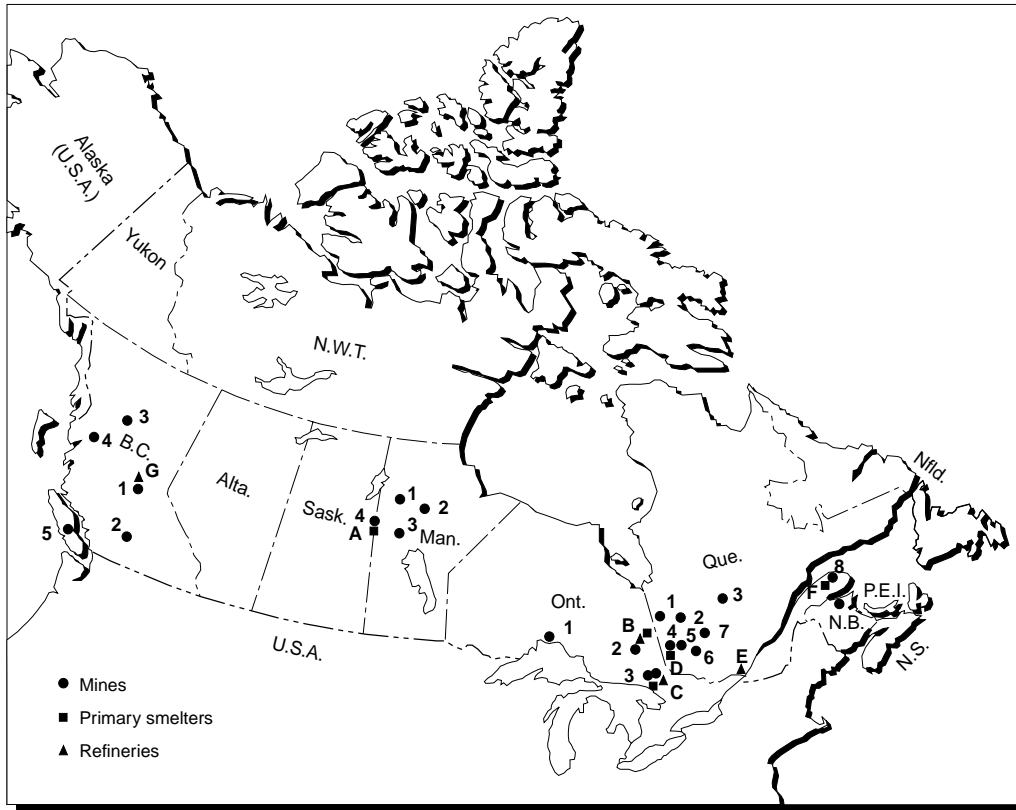
During the summer of 1998, British Columbia's Job Protection Commission was able to arrange certain hydro and other concessions to permit continued operation of Imperial Metals Corporation's Mount Polley gold-copper mine.

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.), which 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 agreed to sell an additional 10% interest in the Huckleberry mine to the Japan Group for a nominal amount.

In December 1998, Boliden Limited closed its Gibraltar mine citing low ore grades and low copper prices. In April 1999, Taseko Mines Limited announced that it had agreed to purchase the operation from Boliden. Taseko stated that it would maintain the mine on a standby care and maintenance basis until copper prices stabilized at a profitable level. In 1997, Gibraltar produced approximately 33 000 t of copper at a cash production cost of more than US\$2000/t (US90¢/lb).

In mid-December 1998, Boliden Limited temporarily suspended production at its Myra Falls underground polymetallic mine on Vancouver Island in order to implement the action plan to address challenging ground conditions in the Battle zone of the mine. Due to the success of the rehabilitation and development program, Boliden restarted operations at Myra

Figure 1
Copper Producers in Canada, 1998



MINES

British Columbia

1. Boliden Limited (McLeese Lake)
2. Highland Valley Copper¹
3. Royal Oak Mines Inc. (Kerness)
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 (Winston Lake mine)
2. Falconbridge Limited (Timmins)
3. Falconbridge Limited (Sudbury area)
Inco Limited (Sudbury area)

Quebec

1. Les Mines Selbaie
2. Noranda Inc. (Matagami Division)
3. Campbell Resources Inc.
4. Cambior inc. (Bouchard-Hébert mine)
5. Agnico-Eagle Mines Limited (La Ronde mine)
Barrick Gold Corporation (Bousquet mine)

Quebec (cont'd)

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 (Raglin)

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)
- F. Noranda Inc. (Gaspé)

REFINERIES

- B. Falconbridge Limited (Timmins)
- C. Inco Limited (Sudbury area)
- E. Noranda Inc. (CCR Division)
- G. Gibraltar Mines Limited (SX-EW)

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

Falls on March 24, 1999, eight days earlier than originally anticipated. In 1998, the Myra Falls mine produced 15 500 t of copper in concentrate.

In mid-April 1999, Royal Oak Mines Inc., the owner of the Kemess copper-gold mine, was forced into receivership after a lengthy struggle against the combined effects of low metal prices and a high debt load. At the time of writing, PricewaterhouseCoopers, the interim receiver for the company, was continuing to operate the mine. The Kemess mine reached commercial production levels in October 1998.

Manitoba/Saskatchewan

Hudson Bay Mining & Smelting Co. Limited (HBMS) reported that its Konoto Lake copper-zinc mine west of Flin Flon 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.

HBMS also announced plans to develop its new 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 13.3 Mt grading 3.3% copper, 5.8% zinc, 2.7 g/t gold and 37.7 g/t silver.

Ontario

In 1998, Inco completed a comprehensive review of mining operations at its Ontario Division to identify opportunities to maximize cash flow, ensure efficient mining operations and lower mining costs. After closing its Shebandowan and Whistle mines in 1998, Inco Limited 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 will close in 2000 while its Coleman mine will close in 2001.

As a result of weak metal markets, Inco announced in February 1999 that it would extend its annual vacation shut-down of the mines and concentrator at the Ontario Division by an additional two weeks to five weeks in order to align mine production with market requirements.

At the end of 1998, Inco reported that it had achieved permanent employment reductions of 1200 employees at the Ontario Division. The company reported that reductions were achieved, where possible, through retirement and attrition. Inco also announced that it expected to implement further employment reductions during 1999.

On November 25, 1998, Falconbridge Limited's Kidd Creek copper smelter in Timmins experienced a

runout at its converting furnace. The company reported that the failure caused the loss of 9000 t of copper cathode.

On July 8, 1999, production and maintenance workers, represented by the Canadian Auto Workers' Union, began a legal strike at Falconbridge's Kidd metallurgical site after the two parties failed to agree on the terms of settlement for their first collective agreement. During the strike, which lasted 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 December 1998, Inmet Mining Corporation announced that it was permanently closing its Winston Lake mine after studies concluded that the operation was uneconomic. Winston Lake produced 9900 t of zinc and 500 t of copper in concentrate in 1998.

Quebec

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 company expects that the project will increase productivity, reduce unit costs and improve the in-plant environment.

Also 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. In 1998, the smelter processed approximately 830 000 t of concentrate and recyclable material containing copper, and produced more than 500 000 t of sulphuric acid.

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.

Newfoundland and Labrador

On April 1, 1999, the Environmental Assessment Panel for the Voisey's Bay project in Labrador recommended that the development be authorized to proceed although it specified numerous conditions. These included the conclusion of an agreement between the Government of Newfoundland and Labrador and Voisey's Bay Nickel Company on the terms of a mining lease, the resolution of land claims with Aboriginal groups, and the negotiation of an impact and benefit agreement between the Aboriginal groups and the company.

In its August 3, 1999, response to the Environmental Assessment Panel Report, the Government of Canada concluded that the environmental effects of the mine/mill project would be acceptable as long as appropriate mitigative measures were put in place and appropriate monitoring and other follow-up programs are undertaken to ensure that these measures are being successfully implemented. In addition, the Government of Canada committed to negotiate consultation protocols with relevant Aboriginal groups, while the Government of Newfoundland and Labrador committed to develop a project-specific environmental management mechanism for involving affected Aboriginal groups.

On the basis of exploration and related work completed through to the end of June 30, 1999, Inco Limited reported that the total estimated resource for all zones or sections of the Voisey's Bay deposit had increased 10% to 136.7 Mt from the previously announced estimate of 124.4 Mt. The company also reported that the total resource, including proven and probable reserves of 32 Mt for the Ovoid section of Voisey's Bay, was still anticipated to be at least 150 Mt. It is expected that Voisey's Bay will produce up to 90 000 t/y of copper in concentrate.

WORLD DEVELOPMENTS

World mine production of copper was 12.17 Mt in 1998 compared to 11.54 Mt in 1997 (Table 3). During 1998, world production of refined copper (which includes refined copper from both primary and secondary material) increased to 13.96 Mt from 13.48 Mt in 1997 (Table 4). Due to low copper prices, which discouraged recovery and possibly encouraged hoarding, copper scrap supplies were extremely tight in 1998. Within the total world production of refined copper, the secondary component fell to 1.86 Mt in 1998 from 2.04 Mt in 1997. On the basis of statistics to May 1999, this downward trend continued into 1999.

Chile

According to Comisión Chilena del Cobre (Cochilco), Chilean copper mine production in 1999 was expected to increase by 16.2% to 4.3 Mt.

The Corporación Nacional del Cobre de Chile (Codelco-Chile), the state-owned copper producer, announced that its new Radomiro Tomic mine near Chuquibambilla would be expanded from 180 000 t/y to 250 000 t/y of copper cathode. Codelco-Chile expected that the US\$220 million expansion would be operating at full capacity in the second half of 2001.

Codelco-Chile also announced that it was proceeding with its PDT expansion at its El Teniente Division, which will increase output to 500 000 t/y from about

350 000 t/y of copper. While the original project, which had been named Teniente 2000, was scheduled to be completed in 2000, Codelco stated that PDT would be completed at a somewhat slower pace.

Minera Escondida Limitada closed its Coloso copper anode plant at the end of May 1998 due to poor market conditions. The plant, which utilized an ammonia-based solvent extraction process, had been hampered by technical problems that prevented it from reaching its 80 000-t/y design capacity. While total copper production at Escondida was slightly lower in 1998 due to lower ore grades, the Phase 3.5 expansion and 125 000-t/y oxide project were completed in December. A Phase 4 expansion of the operation is also being considered as a means of maintaining production at about 800 000 t/y of copper given that ore grades are expected to decline.

Minera Los Pelambres, a joint venture between Antofagasta Holdings plc (Luksic Group), Nippon Mining & Metals Co. Ltd. and Mitsubishi Materials Corporation, expects to begin copper production at the Los Pelambres project in the fourth quarter of 1999. During the first 10 years of operation, the US\$1.3 billion Los Pelambres mine is expected to produce an average of 246 000 t/y of copper in concentrate.

Equatorial Mining NL of Australia and Antofagasta Holdings plc plan to begin construction in late 1999 on the US\$300 million El Tesoro copper project in northern Chile. This solvent extraction-electrowinning (SX-EW) operation, which would produce about 75 000 t/y over 18 years, is expected to begin production in 2001.

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. Annual output at Collahuasi is expected to total 330 000 t of copper in concentrate and 50 000 t of copper cathode. 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 were proceeding for the expansion at the Altonorte copper smelter in northern Chile, although the completion date had been deferred by 18 months to early 2003. The planned expansion will increase production by 130 000 t to 290 000 t/y of copper cathode.

Boliden Limited reported that its Lomas Bayas copper project began commercial production on September 1, 1998. The company expects that the operation will reach its full production level of 60 000 t/y in 1999. Boliden has estimated that the cash operating

costs for Lomas Bayas over the life of the mine will be US\$54¢/lb of copper.

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

In the third quarter of 1998, Rio Algom Limited completed an expansion of its Cerro Colorado SX-EW operation that increased capacity from 60 000 t/y to 100 000 t/y.

In July 1999, 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 potential production to 227 000 t/y 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 US\$55¢/lb.

Rio Algom stated that the increases were based on prefeasibility work which 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.

Peru

Southern Peru Copper Corporation (SPCC) completed a US\$245 million expansion of its Cuajone mine in the first quarter of 1999 that increased 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%.

In July 1998, Rio Algom Limited, Noranda Inc. and Teck Corporation finalized arrangements to form a new ownership structure for the Antamina copper-zinc project in Peru that had been owned equally by Rio Algom and Inmet Mining Corporation. Antamina is estimated to contain an in-pit resource of 494 Mt grading 1.3% copper, 1.0% zinc, 12 g/t silver and 0.03% molybdenum.

As a result of the July transaction, Rio Algom retained 37.5% of Compania Minera Antamina

(CMA) while Noranda and Teck obtained 37.5% and 25% interests respectively in CMA. In exchange for its 50% interest in the project, Inmet received \$70 million and future payments from Noranda and Teck equivalent to 3.33% of free cash flow from the project.

In September 1998, Rio Algom, Noranda and Teck announced that they were proceeding with development of the project. At a planned milling rate of 70 000 t/d, Antamina will produce 272 000 t/y of copper and 160 000 t/y of zinc over a 20-year mine life. Development costs for the project are estimated at US\$2.2 billion. Projected average cash costs per pound of copper, net of by-product credits, are estimated at US\$40¢.

On June 30, 1999, Rio Algom, Noranda and Teck announced that 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 closure of the 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 2002.

In February 1998, Cambior announced that it was deferring its La Granja copper project due to low metal prices. The company expects that a 130 000-t/d operation would produce between 250 000 and 300 000 t/y of copper. Capital costs are estimated at \$1.3 billion for a mine or \$2.2 billion for a fully integrated mine and smelter/refinery. Mining reserves are estimated at 2.3 billion t grading 0.59% copper.

During 1998, the project was reengineered to allow development in phases, focusing first on open-pit mining and leaching/SX-EW operations on secondary mineralization of the deposit.

In 1999, Cambior planned to complete metallurgical studies on the alternative of copper production through leaching and SX-EW of the higher-grade portion of the secondary mineralization.

United States

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. This included 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%.

In July 1999, Asarco Inc. announced that it would reduce production at its Mission mine by about 25 000 t/y.

Also in July 1999, Cyprus Amax Minerals Company and Asarco Incorporated announced an agreement for the combination of the two companies in a merger-of-equals transaction. The two companies stated that the combined company, to be known as Asarco Cyprus Incorporated, would reduce the combined expenses of Cyprus Amax and Asarco by approximately US\$150 million annually. Cyprus Amax and Asarco also stated that when the expense reductions are fully implemented by 2001, the new company's cash cost of producing copper will be approximately US50¢/lb. The combined company will have an annual copper production of approximately 900 000 t.

Australia

The joint-venture company Port Kembla Copper, which is owned 52.5% by Furukawa Co. Ltd., 20% by Nittetsu Mining Co. Ltd., 17.5% by Nissho Iwai Corporation and 10% by Itochu Corp., was expected to complete a modernization and expansion of its Port Kembla copper smelter in the third quarter of 1999. The smelter was idled by its previous owners in January 1995.

Western Mining Corporation reported its expectation that the expansion of its Olympic Dam copper-uranium mine and copper smelter to 200 000 t/y of refined copper would be completed in the second half of 1999.

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, its proven and probable reserves at its copper-gold operations in Irian Jaya totaled 2.475 billion t grading 1.13% copper, 1.06 g/t gold and 3.8 g/t silver. For the second quarter of 1999, PTFI reported that its average unit

production costs, including gold and silver credits, were US11¢/lb.

Production at the new 200 000-t/y copper smelter/refinery at Gresik in East Java began at the end of 1998 and is expected to reach full design capacity in the second half of 2000. This facility is owned by Mitsubishi Materials Corporation (75%) and Freeport-McMoRan (25%).

In July 1999, Newmont Mining Corporation announced that its 45%-owned Batu Hijau project was more than 95% complete and was expected to begin production in the fourth quarter of 1999. Sumitomo Corporation holds 35% of the project while P.T. Pukuafu Indah holds the remaining 20% interest.

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 US48¢/lb of copper after gold credits.

Thailand

Thai Copper Industries Public Company Limited announced in March 1999 that it had delayed the start-up of its new 165 000-t/y smelter/refinery complex until the first quarter of 2001. The company reported that the project was about 70% completed.

Myanmar

Ivanhoe Mines Ltd. reported that its 50%-owned S&K SX-EW copper operation began production in November 1998. The company also announced that it will proceed with an expansion of the operation from 25 000 t/y to 35 000 t/y of copper cathode.

Sweden

Boliden Limited expects to complete a 100 000-t/y expansion to its Rönnskär smelter and refinery 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 expansion of the tankhouse and sulphuric acid plant.

France

In November 1998, Cie Générale d'Électrolyse du Palais announced that it would close its copper refinery in Haute Vienne by the end of February 1999.

Zambia

Under the terms of a Memorandum of Understanding signed by the Government of Zambia, Zambia Consolidated Copper Mines Limited (ZCCM) and Anglo American plc on January 21, 1999, Anglo agreed to

pay US\$90 million in cash and \$300 million in future capital investments for ZCCM's Nkana, Nchanga and Konkola divisions and the Nampundwe mine.

In March, Anglo reported that certain of the pre-conditions for the finalization of the transaction, notably the identification of a substantial mining partner for Anglo, had not yet been satisfied, due partially to depressed metal prices.

In February 1999, 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, the refurbishment of a copper smelter, and 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 begin production in September 2000.

Democratic Republic of the Congo

In February 1999, Tenke Mining Corp. declared force majeure at its \$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 fighting between government troops and rebels. The Congo's state-owned mining firm, Gecamines, held the remaining 45% stake in 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 in the fifth year. Cobalt output is estimated at 6000 t/y, rising to 13 000 t. Capital costs for the project are estimated at US\$475 million.

CONSUMPTION AND USES

World copper consumption increased to 13.4 Mt in 1998 from 13.1 Mt in 1997 (this includes refined cop-

per from both primary and secondary material). Canadian refined copper consumption increased to 246 200 t in 1998 from 224 600 t in 1997.

It is estimated that over 3.2 Mt of copper scrap was used directly by consumers worldwide in 1998. According to an annual survey conducted by Natural Resources Canada, 38 100 t of contained copper in scrap was consumed directly by Canadian manufacturers in 1997.

Table 8 presents preliminary end-use data for 1997 and 1998 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 copper plumbing tube and fittings as well as architectural applications.

The CCBDA is also 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 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 mg and 1.5-3.0 mg, respectively. The World Health Organization (WHO) has suggested a recommended daily intake of copper of 80 micrograms per kg for infants and young

children, and 40 and 30 micrograms per kg for older children and adult males, respectively.

Acute copper poisoning is infrequent in humans and is 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 intake levels 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 given the remaining uncertainties regarding copper toxicity in humans.

STOCKS

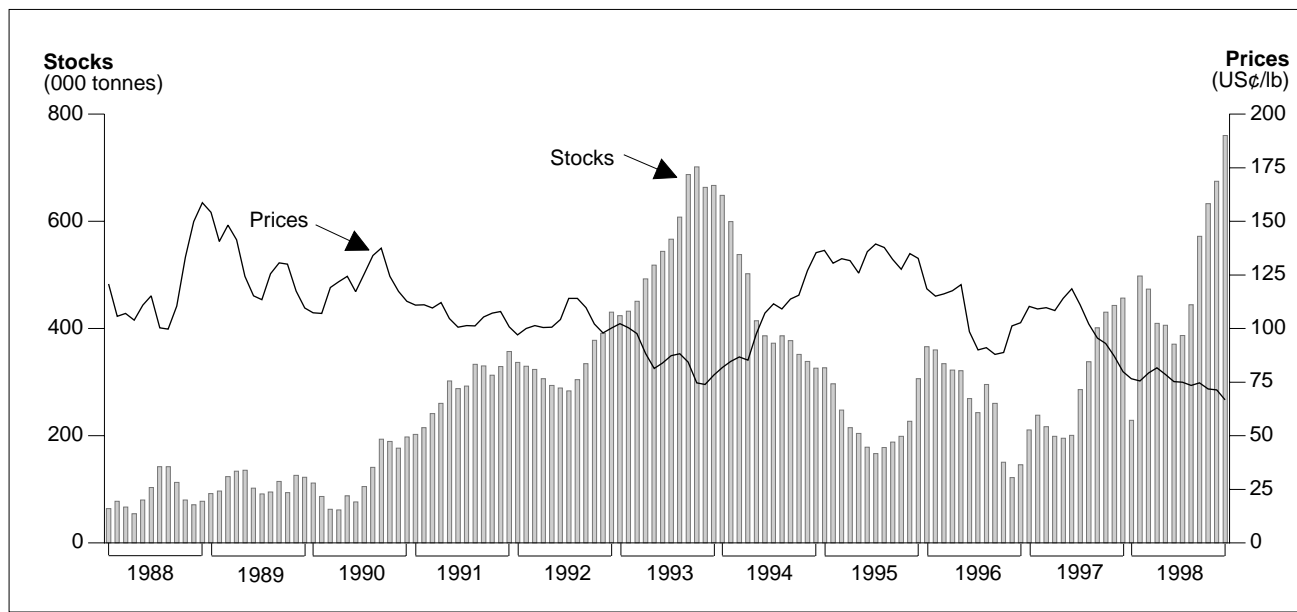
Combined copper stocks on the London Metal Exchange (LME), the Commodities Exchange, Inc. (COMEX) and the Shanghai Metal Exchange increased throughout 1998 to reach 760 000 t at the end of December. At the end of December 1997, stocks stood at 457 500 t.

At the end of 1998, total copper stocks, including those at producers, merchants, consumers and exchanges, totaled 1 349 800 t compared to 1 010 200 t at the end of 1997. Figure 2 shows both total copper stocks and prices for the period 1988-98.

PRICES

Copper prices on the London Metal Exchange (LME) averaged US\$1654/t (\$0.75/lb) in 1998 (Figure 2) compared to US\$2276/t (\$1.03/lb) in 1997. The average copper price in 1999 to the end of July was US\$1466/t (\$0.66/lb).

Figure 2
Copper Prices¹ and Exchange² Stocks, 1988-98



Source: Natural Resources Canada.

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

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 US3.3¢/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\$66/dry metric tonne (dmt) and US6.7¢/lb. In May 1999, spot smelting and refining charges were reported to be as low as US\$25/dmt and 2.5¢/lb.

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

With strengthening copper demand in Asian markets and some further cutbacks in copper production, copper prices are expected to strengthen in the second half of 1999 and to continue to improve in 2000.

With the improvement in copper prices in the second half of 1999, it is expected that the copper price for the year will average about US\$1550/t. In 2000, copper is expected to trade within a range of US\$1600 and \$1800/t while, in the longer term, copper prices are expected to trade in a range between \$1900 and \$2200/t (in constant 1997 dollars).

As a result of strong growth in copper demand in Asia, world consumption of refined copper in 1999 is expected to increase to about 13.8 Mt from 13.4 Mt in 1998. In 2000, it is expected to increase to about 14.2 Mt. It is expected that copper consumption in the longer term will grow at an annual average rate in excess of 3.5%. A significant proportion of this growth is expected to be in China. According to a press report, Simon Hunt (Strategic Services) Ltd. expects that refined copper consumption in China will grow at an annual average rate of 9% to 2005 and even faster during the three following years.

Canadian copper mine production (recoverable copper in concentrate) in 1999 had been expected to increase to over 700 000 t. However, the temporary closure of Highland Valley Copper will result in an overall reduction of mine production to about 600 000 t. In 2000, a further reduction is possible given that the incremental production from the new Minto mine in the Yukon and the Bell Allard mine in Quebec is likely to be exceeded by the loss of production associated with the permanent closure in the second half of

1999 of the Gaspé mine in Quebec and the Heath Steele mine in New Brunswick.

During 1999, Canadian refined copper production is forecast to be 585 000 t compared to 562 500 t in 1998 (includes refined copper from both primary and secondary material). Depending on feedstock availability, refined output in 2000 could increase to 625 000 t.

Canadian refined copper consumption is expected to increase by 4.2% to 255 000 t in 1999 and by a

further 1.2% to 258 000 t in 2000. These increases are expected to result from continued strong demand for data and telephone cables and from increased exports of copper wire (rod), particularly to the United States.

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, 1999.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan ¹
		MFN	GPT	USA	Canada	MFN	WTO
2603.00	Copper ores and concentrates						
2603.00.00.10	Copper content	Free	Free	Free	Free	Free	Free
2825.50	Copper oxides and hydroxides	Free	Free	Free	Free	3.2%	5%
28.33	Sulphates; alums; peroxosulphates (persulphates)						
	Other sulphates:						
2833.25	Of copper						
2833.25.10	Cupric sulphate	Free	Free	Free	Free	3.2%	4.2%
2833.25.90	Other copper sulphates	5.5%	Free	Free	Free	3.2%	4.2%
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	3.9%
74.03	Refined copper and copper alloys, unwrought						
	Refined copper:						
7403.11	Cathodes and sections of cathodes	Free	Free	Free	Free	Free	4.20-11.96 yen/kg
7403.12	Wire bars	Free	Free	Free	Free	Free	4.20-11.96 yen/kg
7403.13	Billets	Free	Free	Free	Free	Free	4.20-11.96 yen/kg
7403.19	Other	Free	Free	Free	Free	Free	4.20-11.96 yen/kg
	Copper alloys:						
7403.21	Copper-zinc base alloys (brass)	Free	Free	Free	Free	Free	4.20 yen/kg
7403.22	Copper-tin base alloys (bronze)	Free	Free	Free	Free	Free	4.20-11.96 yen/kg
7403.23	Copper-nickel base alloys (cupro-nickel) or copper-nickel-zinc base alloys (nickel-silver)	Free	Free	Free	Free	Free	4.20-11.96 yen/kg
7403.29	Other copper alloys (other than master alloys of heading no. 74.05)	Free	Free	Free	Free	Free	4.20-11.96 yen/kg
7404.00	Copper waste and scrap	Free	Free	Free	Free	Free	Free
7405.00	Master alloys of copper	Free	Free	Free	Free	Free	3.6%
74.06	Copper powders and flakes	Free	Free	Free	Free	0.3-1.2%	3.8%
74.07	Copper bars, rods and profiles	Free-3%	Free	Free	Free	5%	3.6-3.8%
74.08	Copper wire, of refined copper	Free-3%	Free	Free	Free	5%	3.6-3.8%
74.09	Copper plates, sheets and strip, of a thickness exceeding 0.15 mm	Free	Free	Free	Free	5%	3.6-3.7%
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%	3.6-3.7%
74.11	Copper tubes and pipes	2-2.5%	Free	Free	Free	5%	3.7-4%
74.12	Copper tube or pipe fittings (for example, couplings, elbows, sleeves)	3%	Free	Free	Free	5.5%	1.2%
7413.00	Stranded wire, cables, plaited bands and the like, of copper, not electrically insulated	3%	Free	Free	Free	5.5%	3.8%

TARIFFS (cont'd)

Item No.	Description	Canada			United States	EU	Japan ¹
		MFN	GPT	USA	Canada	MFN	WTO
7413.00	Stranded wire, cables, plaited bands and the like, of copper, not electrically insulated	3%	Free	Free	Free	5.5%	3.8%
74.14	Cloth (including endless bands), grill and netting, of copper wire; expanded metal of copper	3%	Free	Free	Free	4.7%	1-1.2%
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	3.4-4.5%	1.2%
7416.00	Copper springs	3%	Free	Free	Free	4%	1.2%
7417.00	Cooking or heating apparatus of a kind used for domestic purposes, non-electric and parts thereof, of copper	3%	Free	Free	Free	4.5%	1.2%
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	3.5%	1%
74.19	Other articles of copper	Free-9.5%	Free-5%	Free	Free	3.4%	1.2-2%

Sources: Customs Tariff, effective January 1999, Revenue Canada; Harmonized Tariff Schedule of the United States 1999; Worldtariff Guidebook on Customs Tariff Schedules of Import Duties of the European Union (38th Annual Edition: 1998); Custom Tariff Schedules of Japan, 1998.

¹ WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, COPPER PRODUCTION AND TRADE, 1997 AND 1998

Item No.	1997		1998p	
	(tonnes)	(\$000)	(tonnes)	(\$000)
SHIPMENTS¹				
	662	2 097	—	—
Newfoundland	—	—	—	—
Prince Edward Island	—	—	—	—
Nova Scotia	13 627	43 144	14 553	35 786
New Brunswick	125 396	397 0045	121 860	299 654
Quebec	235 750	746 385	224 883	552 987
Ontario	52 216	165 317	50 203	123 449
Manitoba	—	—	—	—
Saskatchewan	—	—	—	—
Alberta	—	—	—	—
British Columbia	220 127	696 922	277 078	681 334
Yukon	—	—	—	—
Northwest Territories	—	—	—	—
Total	647 779	2 050 869	688 576	1 693 209
Refinery output	560 582	..	565 081	..
EXPORTS				
2603.00.10	Copper ores and concentrates			
	Copper content			
	311 246	364 526	254 234	204 121
Japan	46 943	45 918	33 639	23 149
South Korea	55 296	50 963	30 561	19 557
Philippines	66 668	68 262	15 888	17 407
China	10 499	10 974	11 781	10 192
Mexico	..	8	1 533	3 898
United States	1 882	3 713	—	—
Other countries	—	—	—	—
Total	492 534	544 364	347 636	278 324
2604.00.00.10,	Other ores and concentrates			
2607.00.00.10,	Copper content			
2608.00.00.10,	3 507	4 129	—	—
2616.10.00.10	481	584	—	—
	1 842	2 346	—	—
South Korea	2	3	—	—
France	—	—	—	—
Belgium	—	—	—	—
United States	—	—	—	—
Total	5 832	7 062	—	—

TABLE 1 (cont'd)

Item No.		1997		1998P	
		(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)					
2620.30	Copper ash and residues				
	United States	227	396	140	164
	Total	227	396	140	164
2825.50	Copper oxides and hydroxides				
	United States	5	4	-	-
	Total	5	4	-	-
2833.25	Copper sulphates				
	United States	3 421	4 794	5 491	7 919
	China	20	27	-	-
	Total	3 441	4 821	5 491	7 919
7401.10	Copper mattes				
	Norway	16 073	48 619	17 104	38 954
	United Kingdom	1 108	3 553	1 260	3 230
	Total	17 181	52 172	18 364	42 184
7402.00	Copper anodes				
	United States	74 848	304 440	83 191	365 167
	Other countries	16	39	20	57
	Total	74 864	304 479	83 211	365 224
7403.11 to 7403.19	Refined copper and copper alloys, unwrought				
	United States	284 863	936 053	264 723	682 631
	United Kingdom	48 104	118 218	42 925	90 500
	Colombia	15 400	64 447	15 566	69 761
	France	12 731	40 607	9 552	24 253
	Italy	3 527	11 217	7 700	19 472
	Sweden	3 783	11 634	4 784	13 700
	Saudi Arabia	5 799	18 811	3 500	9 442
	Taiwan	4 752	13 307	2 566	6 358
	Other countries	2 517	9 481	3 650	13 447
	Total	381 476	1 223 775	354 966	929 564
7403.21 to 7403.29	Other copper alloys				
	United States	395	1 431	842	2 483
	China	-	-	22	162
	Total	395	1 431	864	2 645
7404.00	Copper waste and scrap				
	United States	111 191	263 597	86 714	192 891
	China	1 065	1 297	3 682	3 664
	Belgium	1 174	578	3 707	3 602
	Hong Kong	3 858	6 005	1 514	2 356
	Italy	376	675	1 197	1 999
	India	2 855	4 258	1 317	1 624
	Other countries	5 057	5 863	2 906	4 784
	Total	125 576	282 273	101 037	210 920
7405.00	Master alloys of copper				
	China	-	-	20	216
	United States	340	513	61	62
	Total	340	513	81	278
7406.10, 7406.20	Copper powders and flakes				
	United States	313	1 674	132	863
	Taiwan	62	588	20	233
	Other countries	44	385	34	290
	Total	419	2 647	186	1 386

TABLE 1 (cont'd)

Item No.		1997		1998P	
		(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)					
7408.11 to 7408.29	Copper and copper alloy wire				
	United States	51 621	177 381	72 532	203 303
	Chile	-	-	21	92
	Taiwan	-	-	20	83
	South Korea	-	-	3	53
	Hong Kong	1	23	5	47
	Other countries	54	215	40	135
	Total	51 676	177 619	72 621	203 713
7409.11 to 7410.22	Copper and copper alloy plates, sheets, strip and foil				
	United States	10 370	56 988	15 593	69 722
	Saudi Arabia	1 187	5 618	1 178	5 025
	India	283	1 314	593	2 442
	United Kingdom	568	2 269	609	2 121
	Algeria	118	590	332	1 302
	Other countries	1 172	6 261	1 869	7 810
	Total	13 698	73 040	20 174	88 422
7411.10 to 7411.29	Copper and copper alloy tubes and pipes				
	United States	17 196	101 065	16 928	88 780
	Netherlands	29	210	241	1 660
	Chile	86	501	279	1 129
	Israel	435	1 990	198	823
	United Kingdom	15	126	68	462
	Saudi Arabia	4	25	16	129
	Russia	..	3	15	96
	Other countries	137	626	31	185
	Total	17 902	104 546	17 776	93 264
7412.10, 7412.20	Copper and copper alloy tube and pipe fittings				
	United States	..	16 500	..	18 424
	Germany	..	5 610	..	9 293
	Spain	..	3 935	..	5 708
	United Kingdom	..	3 048	..	2 122
	Greece	..	585	..	1 228
	Sweden	..	1 425	..	1 204
	Poland	..	296	..	1 075
	France	..	1 463	..	858
	Other countries	..	2 300	..	507
	Total	..	35 162	..	40 419
7413.00	Stranded wire, cables, plaited bands and the like, of copper, not electrically insulated				
	United States	114	518	1 044	3 499
	Other countries	7	42	19	165
	Total	121	560	1 063	3 664
7414, 7415, 7416, 7419	Copper, other items of				
	United States	..	25 881	..	29 221
	United Kingdom	..	5	..	385
	Russia	..	88	..	297
	Other countries	..	4 362	..	1 418
	Total	..	30 336	..	31 321
	Total exports		2 892 199		2 348 447

TABLE 1 (cont'd)

Item No.		1997		1998P	
		(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS²					
2603.00.00.10	Copper ores and concentrates				
	Copper content				
	United States	81 567	136 258	33 755	71 905
	Chile	12 702	31 480	45 121	60 025
	Indonesia	3 273	14 708	10 535	20 466
	Portugal	10 886	24 606	7 717	15 154
	Argentina	7 007	15 150
	Spain	1 128	1 657	5 157	9 956
	Switzerland	6 183	13 570	4 557	8 280
	Other countries	19 114	27 201	9 802	20 680
	Total	134 853	249 480	123 651	221 616
2604.00.00.10,	Other ores and concentrates				
2607.00.00.10,	Copper content				
2608.00.00.10,	United States	910	1 401	628	987
2616.10.00.10	Mexico	132	347	108	236
	Russia	-	-	7	17
	Peru	4	11	1	3
	Total	1 046	1 759	744	1 243
2620.30	Copper ash and residues				
	United States	22 954	39 499	12 005	23 567
	Other countries	9 367	8 168	68 108	58 557
	Total	32 321	47 667	80 113	82 124
2825.50	Copper oxides and hydroxides	1 654	5 105	1 439	4 744
2833.25	Copper sulphates	12 605	13 139	15 247	13 332
2836.99.90.10	Copper carbonates	5	11	7	15
2837.19.00.10	Copper cyanides	37	233	42	257
3212.90.00.12	Pigments based on copper or copper alloy powders and flakes	15	126	n.a.	n.a.
3212.90.90.12	Pigments based on copper or copper alloy powders and flakes	n.a.	n.a.	3	54
7401.10	Copper mattes	8 802	22 039	2 596	9 0089
7401.20	Copper mattes; cement copper (precipitated copper)	409	1 706	8 103	15 973
7402.00	Copper anodes	27 341	83 436	19 528	36 209
7403.11 to 7403.19	Refined copper and copper alloys, unwrought				
	Refined copper				
	Total	22 602	71 166	18 685	47 994
7403.21 to 7403.29	Refined copper and copper alloys, unwrought				
	Other copper alloys				
	Total	6 738	21 549	7 190	19 545
7404.00	Waste and scrap, copper or copper alloy				
	United States	160 317	313 378	109 773	161 766
	Bulgaria	1 974	7 322	983	2 750
	Mexico	9	8	361	890
	United Kingdom	37	138	346	809
	Russia	5 542	5 132	657	656
	Other countries	5 826	17 408	910	1 256
	Total	173 705	343 386	113 030	168 127
7405.00	Master alloys of copper	104	444	361	1 359

TABLE 1 (cont'd)

Item No.		1997		1998 ^p	
		(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)					
7406.10, 7406.20	Copper powders and flakes				
	Total	1 554	8 513	1 704	9 113
7407.10 to 7407.29	Bars, rods and profiles of refined copper				
	United States	31 644	113 095	33 802	115 398
	Turkey	2 407	6 854	3 710	5 805
	Poland	3 292	7 575	2 274	4 956
	United Kingdom	198	987	378	1 499
	Germany	333	1 521	304	1 312
	France	278	990	370	1 285
	Other countries	937	3 701	1 179	4 210
	Total	39 089	134 723	42 017	134 465
7408.11 to 7408.29	Copper and copper alloy wire				
	Total	25 552	96 877	21 891	67 382
7409.11 to 7409.90, 7410.11 to 7410.22	Copper and copper alloy plates, sheets, strip and foil				
	Total	31 830	188 990	46 040	243 687
7411.10	Pipes and tubes, refined copper	8 725	39 193	9 066	37 518
7411.21	Pipes and tubes, copper-zinc base alloy	3 765	23 563	3 749	22 318
7411.22	Pipes and tubes, copper-nickel base alloy or copper-nickel-zinc base alloy	444	3 339	483	3 670
7411.29	Plates and tubes, copper alloy, n.e.s.	1 137	6 129	1 100	5 612
7412.10	Fittings, pipe or tube, of refined copper	386	6 490	309	5 665
7412.20	Fittings, pipe or tube, copper alloy	3 910	53 986	4 564	63 002
7413.00	Stranded wire, cable, plaited bands and the like, of copper, not electrically insulated	3 746	18 100	4 004	13 520
7414.90	Cloth, grill and netting of copper wire and expanded metal of copper	113	442	273	1 416
7415.10	Nails, tacks, drawing pins, staples and similar articles of copper or of iron or steel with copper heads	91	598	128	845
7415.21	Washers, copper, including spring washers	303	1 836	385	2 382
7415.29	Articles of copper, not threaded, n.e.s., similar to those of headings 7415.10 and 7415.21	299	1 637	433	2 127
7415.31	Screws, copper, for wood	155	302	39	245
7415.32	Screws, bolts and nuts of copper, excluding wood screws	963	4 434	..	4 738
7415.39	Articles of copper, threaded, n.e.s., similar to bolts, nuts and screws	798	4 234	746	4 255
7416.00	Copper springs	..	397	..	176
7419.10	Chain and parts thereof of copper	124	923	82	537
7419.91	Articles of copper, not further worked than cast, moulded, stamped or forged	1 761	14 950	2 118	18 203
7419.99	Articles of copper, n.e.s.	..	37 619	..	45 999

Sources: Natural Resources Canada; Statistics Canada.

– Nil; .. Not available or not applicable; . . . Amount too small to be expressed; n.a. Not applicable; n.e.s. Not elsewhere specified; ^p Preliminary.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 1985-98

	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	409 361	683 854 ^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 ^p	688 576	565 081	366 000	354 966	720 966	18 685	243 100

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, 1996, 1997 AND 1998

	1996	1997	1998 ^p
	(000 t)		
Australia	547	560	604
Canada	688	658	705
Chile	3 116	3 392	3 687
China	439	496	458
Indonesia	526	548	809
Kazakstan	250	316	338
Mexico	341	391	385
Papua New Guinea	186	112	152
Peru	484	503	483
Poland	422	415	427
Russia	523	505	500
South Africa	188	186	188
United States	1 953	1 979	1 900
Zambia	334	353	320
Other	1 105	1 128	1 224
Total	11 102	11 542	12 180

Source: International Copper Study Group.

^p Preliminary.

TABLE 4. WORLD REFINERY PRODUCTION OF COPPER, 1996, 1997 AND 1998

	1996	1997	1998p
		(000 t)	
Australia	311	271	285
Belgium/Luxembourg	354	373	368
Brazil	172	177	167
Canada	559	560	563
Chile	1 748	2 117	2 335
China	1 119	1 179	1 211
Germany	671	674	695
Japan	1 251	1 279	1 278
Kazakstan	267	301	325
South Korea	245	263	369
Mexico	242	297	447
Peru	338	384	407
Philippines	156	147	152
Poland	425	441	447
Russia	570	580	550
Scandinavia	271	277	280
Spain	264	292	305
United States	2 341	2 450	2 458
Zambia	334	336	304
Other	1 036	1 082	1 016
Total	12 674	13 480	13 962

Source: International Copper Study Group.
 p Preliminary.

TABLE 5. WORLD REFINED COPPER CONSUMPTION, 1996, 1997 AND 1998

	1996	1997	1998p
		(000 t)	
Australia	180	182	159
Belgium/Luxembourg	359	364	345
Brazil	235	255	302
Canada	218	225	246
China	1 293	1 285	1 397
France	518	558	580
Germany	960	1 039	1 138
India	202	186	253
Italy	504	521	590
Japan	1 481	1 441	1 254
South Korea	579	624	560
Poland	223	233	270
Russia	170	170	170
Scandinavia	251	265	277
Spain	191	203	230
Taipei, China	545	588	570
United Kingdom	397	384	374
United States	2 613	2 790	2 883
Other	1 701	1 779	1 783
Total	12 620	13 092	13 381

Source: International Copper Study Group.
 p Preliminary.

TABLE 6. COPPER AND COPPER-NICKEL SMELTERS IN CANADA, 1998

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. Hazelett 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	110	Copper concentrates	Green charge reverberatory furnace, two converters, one rotary anode furnace and an acid plant. Additional converter will increase capacity to 135 000 t/y in 1999.
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, 1998**

Company and Location	Rated Annual Capacity	Remarks
(tonnes)		
Noranda Inc. CCR Refinery Montréal-Est, Quebec	360 000	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 under way.
Inco Limited Copper Cliff, Ontario	175 000	Cast 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.
Inco Limited Copper Cliff, Ontario	15 000	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 140 000 t/y by year 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, 1997 AND 1998

United States	1997	1998 ^p
(000 t)		
SUPPLY		
Domestic mill products		
Building wire	630	643
Magnet wire	323	320
Telecommunications cable	268	272
Power cable	121	122
Automotive wire and cable	150	154
Electronic wire and cable	107	107
Other wire and cable	280	298
Strip, sheet, plate and foil	553	566
Rod and bar	541	540
Tube and pipe	537	564
Mechanical wire	44	44
Foundry products	180	183
Powder products	22	23
Total, domestic mill products	3 757	3 835
Imported mill products	82	81
Total supply	3 839	3 917
USES		
Building construction	1 577	1 620
Electrical/electronic products	980	1 019
Industrial machinery/equipment	446	439
Transportation equipment	476	484
Consumer and general products	360	354
Total	3 839	3 917

Source: Copper Development Association Inc.

^p Preliminary.

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

TABLE 9. YEARLY AVERAGE COPPER PRICES,¹ 1980-98

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

Source: International Copper Study Group.

¹ Grade A, Cash.

TABLE 10. MONTHLY AVERAGE COPPER PRICES, 1997 AND 1998

	LME ¹		COMEX ²	
	1997	1998	1997	1998
	(current US¢/lb)			
January	110.4	76.6	108.3	76.9
February	109.1	75.5	110.2	75.5
March	109.8	79.3	114.8	79.7
April	108.4	81.7	110.0	81.6
May	114.0	78.6	115.3	78.0
June	118.5	75.3	117.6	74.9
July	111.1	74.9	109.9	75.4
August	102.1	73.5	102.1	73.3
September	95.6	74.7	95.1	75.6
October	93.1	71.9	93.1	72.3
November	87.0	71.4	87.6	71.5
December	79.9	66.8	79.3	66.3

Source: International Copper Study Group.

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