

Copper

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Copper prices, which declined dramatically in June 1996 following revelations of major trading losses by Sumitomo Corporation, strengthened significantly in the fourth quarter of the year due to the combined influences of strong worldwide demand, lower-than-forecast world production, and extremely low metal exchange stock levels.

Despite the prospect of continued growth of worldwide copper demand in 1997, it is expected that the addition of significant new mine production capacity will exert some downward pressure on prices.

CANADIAN DEVELOPMENTS

In 1996, Canadian copper production (recoverable copper in concentrate) decreased to 688 000 t from 726 000 t in 1995. Refined copper production totalled 559 000 t in 1996, compared to 573 000 t in 1995 (includes refined copper from both primary and secondary material).

British Columbia

Royal Oak Mines Inc. began construction of its Kemess project in July. Production is expected to begin in April 1998. Kemess will produce about 6600 kg/y of gold and about 26 000 t/y of contained copper over an estimated mine life of 15 years.

At the end of 1996, there were press reports that a dispute had developed between Royal Oak and the Province of British Columbia over the interpretation of the \$166 million compensation and economic assistance package related to the cancellation of the Windy Craggy project. Discussions between the two sides were reported to be continuing.

In January 1997, Princeton Mining Corporation reported that work on its 60%-owned Huckleberry project was progressing on schedule and within budget. Start-up of the operation is expected in

September. The mine is expected to produce an average of 29 500 t/y of contained copper, 186 kg/y of gold, 8400 kg/y of silver and 450 t/y of molybdenum. The remaining 40% of the project is owned by a consortium of Japanese companies consisting of Mitsubishi Materials Corp., Marubeni Corp., Dowa Mining Co. Ltd., and Furukawa Co. Ltd.

As a result of lower copper prices, Princeton suspended mining and milling operations at its Similco mine on November 15, 1996. The company stated that the resumption of production would depend on an improvement in copper prices and positive results from a major exploration program at the site.

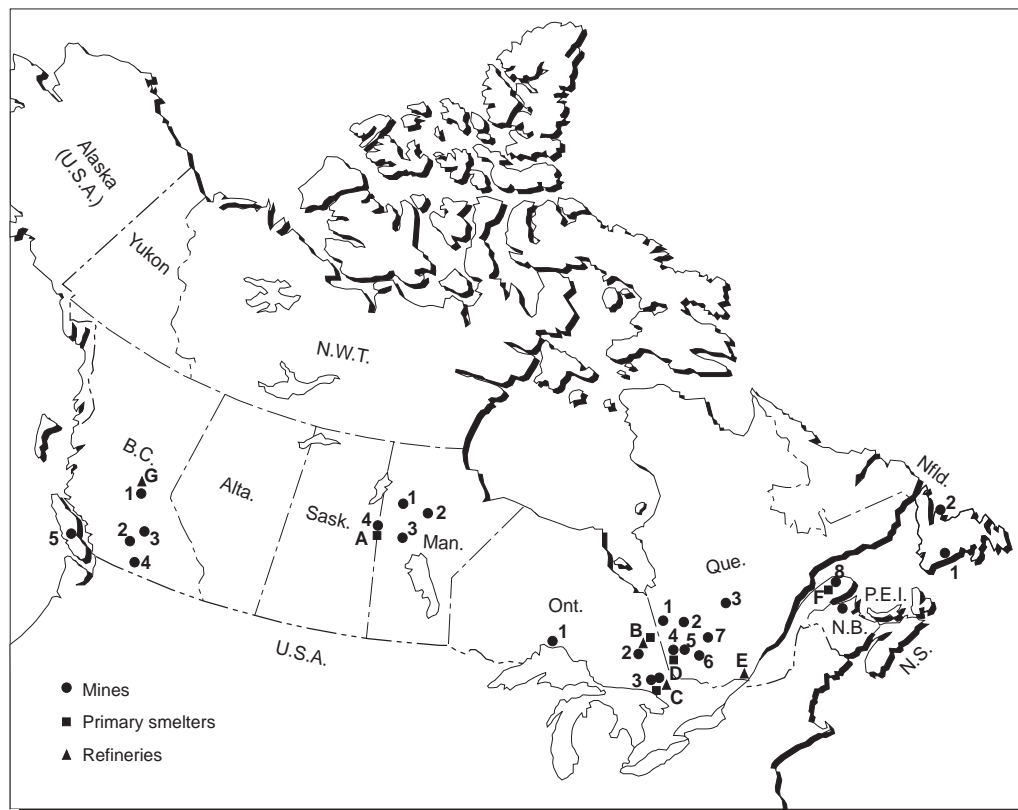
At the Mount Polley copper-gold project, Imperial Metals Corporation reported that mine construction in mid-November was approximately 60% complete. The company also reported that the project was within budget and on schedule for production start-up in the late summer of 1997. The Mount Polley mine is expected to produce about 3100 kg/y of gold during the first four years of operation and an average of 12 700 t/y of copper in concentrate during the entire mine life of at least 12 years. Imperial Metals holds a 55% interest in the project and the remaining 45% is owned by Sumitomo Corporation.

In December, Westmin Resources Limited announced that it had completed the purchase of 100% of the shares of Gibraltar Mines Limited. Prior to the \$37 million acquisition, Gibraltar's largest shareholder was Placer Dome Canada Limited with a 30.8% interest.

Taseko Mines Limited announced that it was undertaking a feasibility study on its Prosperity gold-copper property (formerly Fish Lake) located near Williams Lake. Reserve estimates for the deposit total 675 Mt grading 0.24% copper and 0.45 g/t gold. At an operating rate of 90 000 t/d, Prosperity would produce about 70 000 t/y of contained copper in concentrate and 11 700 kg/y of gold.

At the Red Chris project near Iskut, Teck Corporation decided not to complete a final feasibility study. American Bullion Minerals, which owns 80% of the deposit, was reported to be looking for another corporate participant for the project. Red Chris has measured and indicated reserves of 270 Mt grading 0.46% copper and 0.42 g/t gold.

Figure 1
Copper Producers in Canada, 1996



MINES

British Columbia

1. Westmin Resources Ltd. (McLeese Lake)
2. Highland Valley Copper
3. Afton Operating Corporation (Ajax mine)
4. Princeton Mining Corporation (Similco)
5. Westmin Resources Limited (Myra Falls)

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)

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 Mining and Exploration Inc. (Matagami Division)
3. MSV Resources Inc.
Campbell Resources Inc.
4. Cambior Inc., Bouchard-Hébert mine
5. Agnico-Eagle Mines Limited (La Ronde mine)
Barrick Gold Corporation (Bousquet mine)
6. Aur Resources, Novicourt, Teck Corp. (Louvicourt mine)
7. Cambior Inc., Gonzague Langlois mine
8. Noranda Mining and Exploration Inc., Division Mines Gaspé

New Brunswick

Noranda Mining and Exploration Inc. (Heath Steele mine)
Noranda Mining and Exploration Inc. (Brunswick mine)

Newfoundland

1. Royal Oak Mines Inc. (Hope Brook mine)
2. Ming Minerals Inc. (Ming mine)

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 Metallurgy Inc. (Noranda)
- F. Noranda Mining and Exploration Inc. (Gaspé)

REFINERIES

- B. Falconbridge Limited (Timmins)
- C. Inco Limited (Sudbury area)
- E. Noranda Metallurgy 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.

Note: For detailed production and ore grade information, refer to the nonferrous metal mine production table following the last commodity chapter.

Manitoba/Saskatchewan

Hudson Bay Mining & Smelting Co. Limited reported that it was undertaking significant new exploration work in order to increase copper reserves so that it can provide sufficient feed for its copper smelter in Flin Flon.

Consolidated Callinan Flin Flon Mines Ltd. announced that it had discovered high-grade copper mineralization at its War Baby property in Flin Flon. The company plans additional exploration work in 1997. The property is immediately adjacent to the Callinan mine of Hudson Bay Mining & Smelting.

Ontario

Inco Limited continued work in 1996 on its Victor advanced exploration project located east of Sudbury. Victor's upper zone of mineralization contains a reserve of 5.4 Mt grading 0.5% copper and 2.3% nickel, while its lower zone contains 6.3 Mt grading 5.1% copper and 1.9% nickel, plus gold and platinum group metals. The company expects to complete a feasibility study for the project in the third quarter of 1998, and production could begin by 2001.

Inco also continued development work on its McCreedy East mine, including engineering work on Phase II of the project. Production from Phase I, which began in 1996 at a rate of 3500 t/d, is expected to increase to 11 000 t/d in 1999. Phase I contains about 15 Mt of ore grading 4.3% copper and 1.4% nickel. Also during 1996, Inco conducted engineering work on Phase II of the Garson mine.

Quebec

At Cambior Inc.'s Gonzague Langlois (formerly Grevet) zinc-copper mine near Lebel-sur-Quévillon, the company suspended operations in late 1996 due to weak zinc markets and higher mining dilution. The company anticipates that the operation will re-open in the second half of 1997. In 1996 the mine produced 35 000 t of zinc and 1750 t of copper in concentrate. In 1997, Cambior expects that its Bouchard-Hébert (formerly Mobrún) mine will produce about 7400 t of copper and 31 600 t of zinc in concentrate.

MSV Resources Inc. reported that additional reserves at its Portage mine near Chibougamau would permit operations to continue until November 1997. At the Copper Rand mine, the company is evaluating promising mineralization that was discovered between the 4000 and 5000 levels.

In October, Noranda Metallurgy Inc. announced that it would invest \$124 million for the installation of permanent cathode technology at the company's CCR refinery in Montréal.

As part of a \$4.9 million feasibility study, Noranda Mining and Exploration Inc. inaugurated a pilot

plant to recover copper from stockpiled oxide ore at Mines Gaspé using a solvent extraction/electrowinning (SX/EW) process. A planned full-scale SX/EW plant at Mines Gaspé would produce about 8000 t/y of copper cathode over nine years.

Also at the Mines Gaspé operation, Noranda plans to begin production on the new E-34 orebody that is expected to extend the life of the underground mine to mid-1999. Mineable reserves in the E-34 deposit are estimated at 1.03 Mt grading 3.39% copper. The company will also spend \$10 million to develop the E-38 zone where proven reserves are estimated at 1.07 Mt grading 3.59% copper and 15.3 g/t silver.

At the Gaspé smelter, Noranda Mining and Exploration Inc. will invest \$18 million for the construction of a third converter to increase the smelter's treatment capacity by more than 15% to reach 350 000 t/y of copper in concentrate. The new converter will also increase copper anode production by about 16 000 t/y. In 1996, Noranda completed the installation of a new \$10.5 million concentrate drying and injection system that increased its smelting capacity from 85 000 t/y to 110 000 t/y of copper anode.

At Noranda Metallurgy Inc.'s Horne smelter, the company is proceeding with the installation of new converter technology that will allow the facility to achieve a minimum 70% sulphur fixation by 1998. A second stage of the project will bring the fixation rate up to 90% by 2002.

Falconbridge Limited is proceeding with the development of its Raglan nickel-copper project on the Ungava Peninsula. Construction of the project, which began in the third quarter of 1995, is expected to be completed by the end of 1997. The mine will produce about 5200 t/y of copper in concentrate. The Raglan deposit hosts geological reserves of 19.3 Mt grading 3.2% nickel and 0.9% copper.

During 1996, there were reports of promising showings of nickel-copper-cobalt mineralization in the North Shore region, including one made by the Government of Quebec grading 2.3% nickel and 2% copper. Further exploration work is planned in 1997.

Newfoundland

On August 21, 1996, Inco completed the \$4.3 million acquisition of Diamond Fields Resources Inc., giving it controlling interest of the Voisey's Bay nickel-copper-cobalt project in northern Labrador. Voisey's Bay Nickel Company Limited (VBNC), a 100%-owned subsidiary of Inco, will be responsible for development of the property and operation of the mining and processing facilities.

The total projected mineral resource of Voisey's Bay, as of October 1996, was estimated at 150 Mt of nickel, copper and cobalt mineralization. This includes 32 Mt of proven reserves grading 2.83%

nickel, 1.68% copper and 0.12% cobalt in the near-surface Ovoid deposit and 50 Mt of indicated resource in the Eastern Deeps section grading 1.36% nickel, 0.67% copper and 0.09% cobalt. In January 1997, Inco reported that it had discovered a new mineralized zone beneath the Western Extension deposit.

The Voisey's Bay operation will include both open-pit and underground mining operations, as well as a mill with a capacity of 15 000 t/d of ore and related facilities. While nickel concentrate will be shipped from Voisey's Bay to a proposed smelter and refinery complex in Argentina, Newfoundland, the company plans to market copper concentrate on world markets. It is expected that Voisey's Bay will produce up to 90 000 t/y of contained copper.

During 1996, VBNC initiated work to secure the applicable environmental permits. The company also reported that negotiations were continuing with the Labrador Inuit Association and the Innu Nation relating to impact and benefits agreements. Inco expects that production could begin in mid-1999.

Ming Minerals Inc., which began production at its Baie Verte area mine in the fourth quarter of 1995, suspended copper production in the second quarter of 1996.

Yukon

Cominco Ltd. continued exploration work on its Kudz Ze Kayah property in the Finlayson Lake area, 200 km northwest of Watson Lake. Reserve estimates for the deposit total 13 Mt grading 5.5% zinc, 1% copper, 1.3% lead, 125 g/t silver and 1.2 g/t gold.

At the Wolverine deposit located about 20 km east of Kudz Ze Kayah, Westmin Resources Limited and Atna Resources Ltd. announced an increase of the geological inventory to 5.3 Mt grading 1.8 g/t gold, 359.1 g/t silver, 1.4% copper, 1.5% lead and 13.0% zinc. In 1997, the companies plan additional exploration work in order to expand the size of the deposit.

NDU Resources reported an increase in reserves at its Marg property in central Yukon. On the basis of additional exploration work, a drill-indicated mineral reserve now stands at 5.5 Mt grading 1 g/t gold, 62.7 g/t silver, 4.6% zinc, 1.76% copper and 2.46% lead.

In July, ASARCO Inc. announced that it would fund development of the Minto copper-gold-silver project located 240 km northwest of Whitehorse. Under the terms of an agreement with Minto Explorations Ltd., ASARCO will acquire a 70% interest in the project while Minto will retain a 30% interest and be the operator. An actual production decision will be made once a water licence is secured from the Yukon Territory Water Board. The mine, which is expected to produce about 12 000 t/y of copper, 300 kg/y of gold and 5000 kg/y of silver in concentrate, could begin production in April 1998.

WORLD DEVELOPMENTS

World mine production of copper was estimated at about 10.6 Mt in 1996, compared to 10.0 Mt in 1995 (Table 3). During 1996, world production of refined copper increased to about 12.3 Mt from slightly less than 11.3 Mt in 1995 (Table 4).

According to a press report, Brook Hunt, a mining and metal industry consulting firm, reported that the average cash operating cost of copper mining in the Western World in 1996 was just over US\$60c/lb (US\$1330/t).

Argentina

The Bajo de la Alumbrera copper-gold project in northwestern Argentina is expected to begin production in July 1997, several months ahead of schedule. Capital costs for the development were reported to have increased to US\$903 million, compared to an earlier estimate of \$798 million, due partly to project enhancements. The project is owned by MIM Holdings Ltd. (50%), North Ltd. (25%) and Rio Algom (25%).

The Bajo de la Alumbrera mine is expected to produce 175 000 t/y of copper in concentrate and almost 17 000 kg/y of gold over a 19-year mine life. During 1996, it was reported that negotiations had been successfully concluded for the sale of concentrates to LG Metals Corp. of Korea and Outokumpu Harjavalta Metals of Finland for the period from 1998 to 2007. MIM also reported that some of the remainder of the planned output would be sold to Japanese, North American and Brazilian customers.

Elsewhere in Argentina, Broken Hill Proprietary Co. Ltd. (BHP) (70%) and Northern Orion Explorations Ltd. (30%) continued work on their Agua Rica property in Catamarca Province. Northern Orion estimates that the deposit contains a resource of 1.2 billion t grading 0.5% copper and 0.22 g/t gold, plus molybdenum and silver.

Cambior Inc. reported that mining reserves at its 50%-owned El Pachón project had increased to 882 Mt grading 0.62% copper. The company expects to complete a feasibility study for the project by the end of March 1997. The mine is expected to have a throughput of 100 000 t/d. To facilitate the exploitation of the El Pachón mining project, the governments of the Republic of Chile and the Republic of Argentina signed the El Pachón Cooperation Protocol at the beginning of January 1997. The agreement commits both governments to offer full border cooperation during the construction and operational phases of the mine.

Chile

Chile's mine production of copper in 1996 totalled 3.07 Mt, an increase of almost 24% over 1995. In

December, the Comision Chilena del Cobre (Cochilco) released a forecast suggesting that Chilean copper production will increase to 4.7 Mt/y in the year 2000.

In early 1997, Codelco announced that it was considering a possible expansion of the Radomiro Tomic mine near Chuquicamata to as much as 290 000 t/y of copper cathode. The first phase of the project, which will produce 150 000 t/y of copper, is expected to begin production in February 1998. At the Chuquicamata Division itself, workers staged a 10-day strike in early May to back contract demands.

At the Andina Division, Codelco reported that a US\$200 million expansion project that will increase copper output to about 220 000 t/y from 147 000 t/y would be completed in mid-1998.

At the El Teniente Division, Codelco reported that the Sub-Level 6 area of the operation was producing about 3000 t/d of copper. The company hopes to increase this production rate to 15 000 t/d, and eventually to as much as 30 000 t/d, using remote-controlled mining equipment. Mining activity at Sub-Level 6, which had once supplied a significant proportion of El Teniente's mine output, was suspended following a number of rockbursts in 1991. Codelco also reported that production from the Esmeralda section would begin in September, some nine months earlier than originally anticipated. By the year 2000, Codelco hopes to increase the El Teniente Division's copper output from 350 000 t/y to 500 000 t/y.

Codelco also began construction on the first of two acid plants at its Caletones smelter. This plant, which will reduce sulphur dioxide emissions by 40% and particulate emissions by 50%, is scheduled to begin operating in 1998.

With the completion of its Phase III expansion, Minera Escondida Limitada reported that its 1996 production of copper in concentrates and cathode had increased to 842 000 t from 467 000 t in 1995. The company expects to receive environmental approval by April 1997 for a 125 000-t/y SX/EW project that will cost US\$470 million. Production is likely to begin in September 1998. With further expansion being planned, the company anticipates that its overall output will increase to 1.4 Mt/y of contained copper by 2001.

Minera Disputada de Las Condes S.A. (Exxon Corporation) announced plans to increase production at its Los Bronces copper mine from the current 130 000 t/y to 240 000 t/y of copper in concentrate by the year 2000. The cost of the project is estimated at US\$570 million.

In January 1997, it was reported that a consortium of Japanese companies, including Nippon Mining and Metals Company, Mitsubishi Materials Corporation, Marubeni Corporation, Mitsubishi Corporation, and Mitsui & Company Limited, would acquire a 40%

interest in Minera Los Pelambres from Antofagasta Holdings plc (Luksic Group). It was also reported that the consortium had signed a long-term contract to purchase 400 000 t/y of copper in concentrate.

Minera Los Pelambres is proceeding with a US\$1.3 billion expansion at the Los Pelambres mine from 23 000 t/y to 260 000 t/y of copper in concentrate. Confirmed reserves at Los Pelambres total 2.4 billion t grading 0.63% copper. Commercial production related to the expansion is expected to begin in September 1999.

The Luksic Group and Equitorial Mining NL of Australia announced that they would undertake a feasibility study on their El Tesoro copper project in northern Chile. This SX/EW development, which would produce about 60 000 t/y, could begin production in late 1998.

The El Abra mine of Cyprus Amax Minerals (51%) and Codelco (49%) began copper production in August, some seven months ahead of schedule. While the collapse of a conveyor tunnel at the El Abra operation in October resulted in the death of four workers, copper output was not seriously affected. El Abra is expected to reach its full capacity of about 225 000 t/y of copper cathode in the first half of 1997. The operation is expected to have a cash operating cost of US\$35¢/lb of copper.

The Quebrada Blanca mine, in which Cominco and Teck hold a 76.5% interest, is expected to reach its design capacity of 75 000 t/y of copper cathode in 1997. Although production began in August 1994, the operation was hampered by problems associated with its bio heap-leach technology.

Phelps Dodge Corporation (80%) and Sumitomo Metal Mining Co. Ltd. (20%) confirmed that the capacity of their La Candelaria mine would be expanded from 115 000 t/y to 175 000 t/y by 1998. The cost of the project is estimated at US\$337 million.

Placer Dome Inc. and Outokumpu Copper Resources B.V. reported that production at their Zaldivar SX/EW project in northern Chile was below expectation in 1996 due to operational difficulties. The partners were reported to be considering certain equipment modifications in order to increase production. The mine was originally expected to reach a design capacity of 125 000 t/y of copper cathode in the second half of 1997.

Rio Algom announced that it was proceeding with a US\$198 million expansion at its Cerro Colorado SX/EW mine that will increase capacity there from 60 000 t/y to 100 000 t/y of copper cathode. The company anticipates that this new capacity will begin to come on stream in 1998. Rio Algom expects that the expansion will reduce the average cost of production at Cerro Colorado from US\$53¢/lb to 48¢/lb.

In January 1997, Rio Algom announced that it had discovered a major new copper deposit in Chile about 140 km northeast of Antofagasta. The discovery, which the company has called the Spence deposit, is estimated to host a resource of about 350 Mt grading 1% copper. The company expects that the deposit will be amenable to low-cost open-pit mining methods. Production at the site, which could begin by 2001, is expected to total about 135 000 t/y of copper in concentrate.

Development work on the US\$1.76 billion Collahuasi copper project was initiated during 1996 with commercial production expected to begin in January 1999. The Collahuasi project is owned by Falconbridge (44%), Minorco SA (44%) and a consortium of Japanese companies (12%), including Mitsui and Co. Ltd., Nippon Mining and Metals Co., and Mitsui Mining and Smelting Co. Ltd. During 1996, contracts were successfully negotiated for the sale of concentrate from the Collahuasi operation to the Japanese consortium, Norddeutsche Affinerie AG of Germany, and Falconbridge and Noranda Metallurgy in Canada.

Empresa Minera de Mantos Blancos S.A. reported that its new Mantoverde mine reached its full design capacity of about 40 000 t/y of copper cathode in May.

Minera Rayrock Inc. reported that it had discovered a new high-grade oxidized copper orebody on its Ivan copper property. In 1997, Minera Rayrock expects to produce about 11 000 t of copper cathode.

In December, Westmin Resources Limited and Gibraltar Mines Limited announced that their respective boards of directors had approved the US\$249 million Lomas Bayas copper oxide project. The operation, which will initially produce about 60 000 t/y of copper cathode, is expected to come on stream in mid-1998. A further expansion of this facility to 90 000 t/y of copper cathode is also under consideration.

Aur Resources Inc. (Canada Tungsten Inc.) and Compania Minera del Pacifico SA began production at their Andacollo copper operation in November 1996. Production at the mine will be about 20 000 t/y of copper cathode. Andacollo hosts a mineable reserve of 34.6 Mt grading 0.87% copper.

ENAMI reported in December that it was in the process of finalizing the start-up of new capacity at its Ventanas copper refinery. The US\$34 million project was expected to increase output at the plant by 100 000 t/y to about 320 000 t/y. ENAMI is also proceeding with a US\$43 million modernization of its Las Ventanas smelter to reduce sulphur dioxide and particulate emissions. The company also reported that a similar modernization program was under way at its Paipote smelter in northern Chile.

Fundicion Refimet SA, which is owned by Noranda Metallurgy Inc. (24.8%), Barrick Chile Limitada, a

subsidiary of Barrick Gold Corporation (25.1%), and Chilean investors (50.1%), is proceeding with an expansion of its smelter from 100 000 t/y to 170 000 t/y of copper. The expansion is expected to be completed by the end of 1997. Refimet was also reported to be considering an additional expansion that would increase its production to 300 000 t/y of copper.

Several new greenfield smelter projects are currently being studied in Chile. These include a possible project involving SONAMI (Sociedad nacional minera) and Hyundai Corporation that would process approximately 400 000 t/y of concentrate, and another project between Empresa Nacional de Electricidad SA (Endesa) and Outokumpu Oy that would produce 350 000 t/y of copper.

Peru

Empresa Minera Mantos Blancos reported that it expected to complete a feasibility study on its Quellaveco copper project in early 1997. The operation will produce about 200 000 t/y of copper in concentrate. Mining reserves at Quellaveco are estimated at 500 Mt grading 0.8% copper.

Southern Peru Copper Corporation (SPCC) announced that it was proceeding with an expansion of its Cuajone mine that will increase output by 64 000 t/y to 196 000 t/y of contained copper. The project is expected to cost US\$245 million. Construction is expected to begin in early 1997 and to be completed within two years. SPCC also announced that it would begin engineering studies to modernize its Ilo smelter to meet current international environmental guidelines and also to increase its capacity to handle approximately 1.1 Mt/y of copper concentrate. The cost of the smelter project is expected to be US\$787 million. During 1996, SPCC inaugurated its new US\$103 million SX/EW plant at Toquepala. The facility is expected to produce about 36 000 t/y of copper cathode.

In July, Rio Algom Ltd. and Inmet Mining Corp. won the bidding to develop the promising Antamina copper-zinc deposit. The deposit had been owned by state-owned Centromin Peru S.A. The Rio Algom/Inmet bid provides for a cash payment of US\$20 million and an investment commitment of US\$2.5 billion. In February 1997, the companies announced that exploration work had resulted in an increase in the size of the deposit's measured and indicated resources to 200 Mt grading 1.3% copper, 1.1% zinc and 15 g/t silver. Antamina's total resource is estimated at 400 Mt, and development costs are estimated at US\$1.5 billion.

Cambior expects to complete a feasibility study on its La Granja copper project by the spring of 1997. Estimated reserves at La Granja total 1.3 billion t grading 0.61% copper. Preliminary development plans envisage an open-pit operation that would produce in

excess of 110 000 t/y of copper in concentrate. Its development costs are estimated at US\$800 million.

Brazil

In early 1997, the state-owned mining company Cia Vale do Rio Doce (CVRD) confirmed the discovery of a world-class gold-copper deposit at its Carajas reserve in the eastern Amazon. Unconfirmed reports suggest that the deposit contains grades of 2% copper and 1.5 g/t gold. The Brazilian government plans to sell CVRD in 1997.

Panama

On the basis of a feasibility study on the Petaquilla copper property, Teck Corporation announced in December that the project did not meet the necessary requirements for the company to proceed with the acquisition of one half of Adrian Resources Ltd.'s 52% interest in the property. Inmet Mining holds the remaining 48% share of Petaquilla.

In January 1997, it was reported that the Petaquilla partners would undertake additional follow-up work to improve the economics of the project and develop a final bankable feasibility study by January 1998. The mineral resource at Petaquilla is estimated at about 1.5 billion t grading 0.11 g/t gold, 0.49% copper and 0.015% molybdenite.

Tiomin Resources Inc. continued exploration work on its Cerro Colorado copper project. The deposit contains an estimated sulphide reserve of 1.4 billion t grading 0.78% copper, plus significant supergene ore that would be amenable to processing using SX/EW technology. During 1996, the Ngobe-Bugle Indians in Panama voiced considerable opposition to the Cerro Colorado copper project. In early 1997, the government of Panama granted this group an autonomous homeland that includes the proposed development.

Mexico

Grupo Mexico SA reported that a capacity expansion at its La Caridad smelter from 180 000 t/y to 300 000 t/y would be completed by the end of 1996, at which time it planned to phase its Cananea smelter out of production. Grupo Mexico is also proceeding with the construction of a new 180 000-t/y copper refinery at its La Caridad complex where production is expected to begin in mid-1997. A further expansion to 300 000 t/y is expected to begin in the second half of 1997.

Phelps Dodge Corporation announced that construction had begun on a US\$42 million magnet wire plant near Monterrey. The facility, which is expected to begin production in January 1998, will have a capacity of about 30 000 t/y of copper magnet wire.

United States

Workers at Kennecott Corporation's Utah copper operations staged a two-day strike in October to back contract demands. The company was able to maintain production during the labour disruption by using non-union and management employees.

Kennecott experienced ongoing operational problems at its new 280 000-t/y Bingham Canyon smelter during 1996. The company announced that it planned a six-week shut-down of its flash converting furnace in the first half of 1997 for the replacement of refractory materials and the installation of new cooling blocks. In January 1997, the company reported that the flash smelting furnace was operating near its full design capacity of 1 Mt/y of copper concentrate grading 30% copper. Kennecott expected to have the entire facility operating at full capacity by June 1997.

Broken Hill Proprietary Co. (BHP) began production at its Robinson mine in Nevada (formerly owned by Magma Copper). In January 1996, BHP completed a US\$2.4 billion merger with Magma Copper Co. to form a new company, BHP Copper Group.

BHP Copper reported that it was proceeding with development plans for the Florence, Arizona, in-situ copper mine that will produce about 34 000 t/y of copper cathode. The company expects that permitting will be completed in early 1997 and that full production will be achieved in 1998.

ASARCO Incorporated announced that it would suspend operations at one of the two concentrators at its Ray Complex effective October 8, 1996, in order to reduce copper concentrate inventories. The company expected that the curtailment would remain in effect until March 1997.

ASARCO and Mitsui & Co. Ltd. expect to complete the construction of an SX/EW facility at ASARCO's Silver Bell mine in Arizona in mid-1997. The facility will produce about 16 000 t/y of copper cathode.

At the Chino mine of Phelps Dodge, operations continued in the second half of the year despite the fact that the existing labour contract expired on June 30. At year-end, there was no sign that an agreement would soon be reached. It was reported that the company was seeking significant concessions from its work force.

In Michigan, Inmet Mining announced in October that it would suspend pilot-scale solution mining at its White Pine mine due to what the company termed the uncertainty caused by the U.S. Environmental Protection Agency's decision to complete a comprehensive environmental analysis of the project. However, at the time of writing, the company reported that it was proceeding with the permitting process for the entire project.

Australia

The joint-venture company Port Kembla Copper, which is owned 50% by Furukawa Co. Ltd., 20% by Nittetsu Mining Co. Ltd., 17.5% by Nissho Iwai Corp., 10% by Itochu Corp. and 2.5% by an Australian company, purchased the Port Kembla copper smelter from RTZ-CRA in November. The smelter, with a capacity of 80 000 t/y of copper metal, had been idle since January 1995. The new owners expect to invest about A\$250 million in the plant in order to increase its capacity to 120 000 t/y and to bring the facility into environmental compliance. It is expected that the smelter will begin operations in the second half of 1998.

MIM Holdings Ltd. announced that it was proceeding with the construction of its new Enterprise copper mine at Mount Isa. Full production at the Enterprise operation is expected to be reached by the end of 1999. MIM is also proceeding with an expansion of its copper smelting capacity at Mount Isa from 190 000 t/y to 250 000 t/y, as well as an expansion of its Townsville copper refinery from 210 000 t/y to 255 000 t/y.

Western Mining Corporation and Outokumpu Oy entered into an agreement whereby the latter company will supply smelting technology for the expansion of the Olympic Dam flash smelter from 85 000 t/y to 150 000 t/y of copper by 1999, and eventually to 200 000 t/y.

Western Mining is also proceeding with an expansion of its Olympic Dam copper and uranium mine that will increase copper production from 85 000 t/y to as much as 200 000 t/y by the end of 1999. The cost of this expansion is estimated at A\$1.48 billion.

In December, Western Mining signed an agreement with Electrometals Mining to develop the latter company's patented EMEW cell technology for large-scale operations. The technology is applicable to the recovery of copper from very low-grade deposits, tailings and waste. The cell is capable of treating heap leach solutions with a copper content as low as 1 g/L. The conventional SX/EW process requires a concentration of about 35 g/L.

Intec Copper reported encouraging results from the operation of a pilot plant to test its copper leach process. These results included an average copper recovery of 97.2% using a variety of copper concentrates. The company estimates that the process can be installed at a capital cost of only US\$1400/t of copper capacity, while operating costs are estimated at US9.2¢/lb. The operating cost of an efficient copper smelter is estimated at about US15¢/lb. In December, it was reported that the Australian government would give Intec a grant of A\$6.4 million to construct a 1-t/d commercial-scale demonstration plant in Sydney.

Placer Pacific Limited was reported to be considering an expansion of its Osborne copper-gold mine in northwest Queensland that began commercial production in August 1995. A final decision was expected before the end of 1996. In 1997, the company expects to produce about 36 000 t of copper in concentrate plus significant amounts of gold.

MIM Holdings and Savage Resources Ltd. expect to begin production at their A\$350 million Ernest Henry copper-gold project in northwestern Queensland in the second half of 1997. The open-pit mine will produce about 95 000 t/y of copper in concentrate and 3700 kg/y of gold.

In September it was reported that the government of New South Wales had approved the development of the Cadia gold-copper mine development. The operation, which would likely start production in the second half of 1998, is expected to produce about 9000 kg/y of gold and 23 000 t/y of copper in concentrate over a 12-year mine life. Newcrest Mining holds a 100% interest in the project.

Indonesia

Freeport-McMoran Copper & Gold Inc. and RTZ-CRA are proceeding with a major mine and mill expansion at their copper-gold operations in Irian Jaya from 115 000 t/d to about 200 000 t/d by the second half of 1998. The expansion is expected to cost US\$960 million. In 1996, production at the operation totalled 507 000 t of copper in concentrate plus 57 725 kg of gold. In March, operations were suspended for several days as a result of civil unrest that was sparked by mounting grievances by indigenous people against PT Freeport Indonesia Company (PT-FI), the operating company. At the end of 1996, PT-FI's proven and probable reserves totalled 2.0 billion t grading 1.19% copper, 1.18 g/t gold and 3.8 g/t silver.

Mitsubishi Materials Corp. (75%) and Freeport-McMoran (25%) began construction of the new Gresik copper smelter/refinery project. The facility, which will have a capacity of 200 000 t/y of copper, is expected to begin production in 1999. The capital costs for the project are estimated at US\$700 million.

In March, Sumitomo Corporation and Newmont Gold Company signed an agreement in principle to develop and operate the Batu Hijau copper-gold deposit. Plans for the project envisage annual production of about 250 000 t of contained copper and 15 500 kg of gold beginning in 1999. Development costs are estimated at about US\$1.5 billion. Reserves at Batu Hijau total 830 Mt grading 0.5 g/t gold and 0.61% copper.

Papua New Guinea

Highlands Gold Limited reported promising gold-copper mineralization at its Frieda River property.

In early February 1997, Placer Dome Inc. announced that it had increased its holding in Highlands Gold Limited to more than 91% as part of a takeover bid for that company.

In early 1997, the government of Papua New Guinea announced that it wanted to buy the controlling interest in Bougainville Copper Ltd. from RTZ-CRA. Bougainville's Panguna copper mine was closed in 1989 as the result of a secessionist rebellion. Recoverable ore reserves at Panguna total 496 Mt grading 0.42% copper and 0.55 g/t gold.

Philippines

In March, the Marcopper copper mine was closed when some 4 Mt of tailings were released into the Boac River system after the failure of a concrete plug in a drainage tunnel. Placer Dome Inc., which had held a 40% interest in the operation at the time of the accident, announced that it would divest itself of its interest and management of Marcopper. However, the company stated that it was committed to rectifying the damage caused by the tailings escape. To this end, Placer Dome announced that it would take a US\$40 million financial charge against its second-quarter earnings to cover the financial obligations for Marcopper, including \$15 million for the cost of repairs and "environmental mitigation."

Atlas Consolidated Mining & Development Corporation was reported to have signed an agreement with a group of investors for the rehabilitation of its copper mine on the island of Cebu. The mine has been closed since January 1994.

Japan Energy Corporation announced that it would begin production at a new copper foil plant by early 1998. It is expected that the plant will produce about 360 t/m of copper foil.

Japan

During the Uruguay Round of trade negotiations, an agreement was reached whereby Japan agreed to reduce its copper tariff to 3% ad valorem by 1999. At present, Japan's tariff rate on imported copper is 15 000 yen/t. In order to keep the Japanese smelting industry competitive after the scheduled tariff reduction, a press report suggested that a number of companies plan to increase their smelting capacities by the year 2000. In this regard, Nippon Mining & Metals Co. plans to increase the capacity of its Saganoseki smelter from 350 000 t/y to 420 000 t/y, while Mitsubishi Materials plans to increase capacity at its Naoshima smelter by as much as 20%. Meanwhile, Sumitomo Metal Mining Co., Ltd. is considering plans to increase the capacity of its Toyo smelter from 210 000 t/y to 250 000 t/y.

Korea

LG Metals Corporation is proceeding with an expansion of smelting capacity at its Onsan facility to

about 350 000 t/y, while its refining capacity will be increased to 330 000 t/y.

Mongolia

In early 1997, it was reported that the new Erdmin SX/EW facility (a Mongolian-U.S. joint venture) had begun operating. This operation is expected to produce about 3000 t/y of copper cathode. It was also reported that the government of Mongolia wanted to build a smelter to process at least half of the country's output of copper concentrate from the Erdenet copper mine.

People's Republic of China

Production of refined copper in China during 1996 was estimated at 850 000 t compared to 1 080 000 t in 1995. Meanwhile, China's consumption of refined copper was estimated at 975 000 t in 1996 compared to 1 150 000 t in 1995.

China expects that its copper consumption will increase to as much as 1.3 Mt/y by the year 2000. This consumption level will require the importation of about 300 000 t of copper concentrate plus a substantial but unspecified amount of copper scrap. China National Non-Ferrous Metals Industry Corporation reported that a number of mining projects were under way that will boost Canada's domestic copper production by 100 000 t/y. These include the Yinshan mine of the Jiangxi Copper Company, the second phase of the Tonglushan mine of the Daye Non-ferrous Metals Company, the first and second phases of the Dongguashan mine of the Tongling Non-ferrous Company, and the first phase of the Yulong mine in Tibet.

The Jinglong copper smelter project, which is owned by Tongling Copper (52%), Sumitomo Metal Mining Company (20%), Sumitomo Corporation (7.5%), Itochu Corporation (7.5%) and CNNC (13%), is expected to begin operations in June 1997. The ¥20 billion facility is expected to produce about 100 000 t/y of copper.

In November, Outokumpu Copper Products inaugurated a new copper tube plant in Zhongshan City in Guangdong Province. The plant is expected to have a capacity of 10 000 t/y of copper piping for air conditioners.

At the end of 1996, it was reported that a major copper porphyry deposit had been discovered in Yunnan Province. The report suggested that the deposit could support an operation that would produce 100 000 t/y of copper.

Thailand

In December, Union Minière SA reported that it had sold its 10% stake in Thai Copper Industries Public

Company Limited, which is in the process of building a 165 000-t/y smelter/refinery complex in Rayong Province. The operation is expected to begin production by the end of 1998. During 1996, it was reported that Codelco would supply an El Teniente converter for the facility.

Malaysia

Outokumpu Copper Products Oy plans to build a US\$25 million plant that will produce drawn copper shapes, sections and strip, plating anodes and tubes. The plant will have a production capacity of 12 000 t/y, which is to eventually increase to 20 000 t/y.

India

In January 1997, it was reported that Hindustan Copper Limited had received government clearance to proceed with a project to increase the capacity of its Khetri copper smelter from 31 000 t/y to 100 000 t/y.

Metdist Ltd. expects to complete its US\$543 million smelter/refinery project in the state of Gujarat by the end of 1998 or early 1999. The operation will have a capacity of 150 000 t/y of copper cathode. Mitsubishi Materials Corporation will hold a 30% interest in the project. The smelter will use the Mitsubishi continuous copper smelting process and the Kidd refinery process.

In October, Sterlite Industries (India) Limited was reported to have started production at its new 100 000-t/y smelter at Tuticorin in the state of Tamil Nadu.

According to a press report, Swil Ltd. expects to complete its 50 000-t/y secondary smelter and refinery at Jhagadia in Gujarat in the fourth quarter of 1997.

Pakistan

The Saindak mine of Pakistan's Resource Development Corporation was forced to suspend operations in July due to a shortage of operating capital. The company was reported to be seeking financing to restart the operation in 1997.

Iran

National Iranian Copper Industries Co. (Nicico) was reportedly proceeding with an expansion at its Sar Cheshmeh operation that will increase its smelting and refining capacity from 100 000 t/y to 200 000 t/y.

Uzbekistan

The Almalyk integrated copper mining and smelting complex announced plans in 1996 to modernize and upgrade its facilities. This enterprise includes the Kalmakyr and Sary-Cheku mines as well as associated concentrating and smelting facilities.

Kazakstan

In September, it was reported that a consortium of companies, including Glencore AG, Phelps Dodge Corporation, and Kazkommerzbank, had won a tender for an 85% interest in the Balkhashmet (formerly Balkhashmet) Metallurgical Complex. The consortium agreed to invest US\$650 million in the complex by 2005, to increase copper output to 180 000 t/y in 1997, and to assume an outstanding debt of \$90 million.

In February 1997, it was reported that Samsung Co. Ltd. had won a tender to buy Balkhashmys. The report suggested that the previous winning tender (described above) had been withdrawn. The Samsung tender provides for an investment of US\$700 million for the period 1997 to 2000 in order to modernize facilities and expand output to 200 000 t/y of copper.

Poland

In 1996, the Polish government announced that it was proceeding with plans to privatize a part of KGHM Polska Miedz S.A. As part of the government's proposal, the State would retain a 49% interest and 15% would be reserved for employees.

Sweden

Boliden Metall AB announced plans to undertake a US\$200 million expansion of its Ronnskar copper refinery from 130 000 t/y to 210 000 t/y by 2000.

Belgium

Union Minière plans to increase the capacity of its new Olen copper refinery by 130 000 t/y to 330 000 t/y. The project, which will cost between 1.2 billion and 1.3 billion Belgian francs, is expected to be completed in early 1998.

Zambia

A consortium comprised of Falconbridge Ltd., Zambia Copper Investments Limited, an associate of Anglo American Corporation of South Africa Limited, and Gencor Limited signed a Memorandum of Understanding with the Government of Zambia and Zambia Consolidated Copper Mines Limited (ZCCM) in February 1997 for the exclusive right to undertake a feasibility study on the Konkola project, which includes the Konkola mine and the Konkola Deep mining project, as well as the Mufulira smelter and refinery. The Konkola Deep deposit hosts ore reserves of 340 Mt grading 3.8% copper. Konkola Deep, which will cost between US\$700 million and \$800 million to develop, is expected to produce about 180 000 t/y of copper and 600 t/y of cobalt.

Also in February 1997, an international consortium consisting of Noranda Mining and Exploration Inc., Avmin Limited (the mining division of Anglovaal

Group), Phelps Dodge Mining Company and the Commonwealth Development Corporation submitted a bid to the Government of Zambia for the acquisition of certain mining and metallurgical assets of ZCCM. The bid includes the Nkana and Nchanga divisions, the Chambishi cobalt refinery and the Chingola refractory ore piles (known as packages "A," "G" and "L"). The Nkana and Nchanga divisions, which produced about 220 000 t of copper in 1996, represent about two thirds of ZCCM's total copper production. In addition to its participation in this consortium, Avmin signed an agreement with the Zambian government covering the development of the Konkola North copper deposit.

In January 1997, Cyprus Amax Minerals Company announced an agreement with ZCCM to acquire 80% of the Kansanshi copper mine and deposit. The property contains a delineated copper resource of approximately 24.4 Mt grading 2.9% copper. ZCCM will retain a 20% carried interest. The development costs for the project are estimated at US\$300 million.

ZCCM announced plans to re-open its Luanshya copper smelter to provide standby smelting capacity. The smelter was closed in February 1994.

In December, it was reported that First Quantum Minerals Ltd. had begun work on a project to recover copper from tailings at the former Bwana Mkubwa mine. The company expects to produce about 10 000 t/y of copper over a five-year period.

Zaire

In December it was reported that the Government of Zaire had granted Consolidated Eurocan Ventures Ltd. a 55% stake in the Tenke Fungurume copper deposit in return for US\$250 million. Under the terms of the agreement, Gecamines, the state-owned mining corporation, will retain a 45% interest in the deposit. The first phase of the project would produce 100 000 t/y of copper and 8000 t/y of cobalt by the year 2002. The deposit contains a geological resource of 220 Mt grading 4.42% copper and 0.33% cobalt.

During 1996, International Panorama Resource Corp. secured the rights to the Kambove and Kakanda tailings project in the southern part of the country. The company will control 51% of the project and Gecamines will retain a 49% interest. These tailings deposits contain an estimated 61 Mt of material grading 0.98% copper and 0.19% cobalt.

Namibia

Operations at Tsumeb Corporation Ltd.'s mines and smelter were affected by a six-week strike that began in August. During the strike, the company estimated that it lost about 80 t/d of copper production.

Namibian Copper Mines Inc. reported that a feasibility study on the Haib copper deposit confirmed the

viability of the project. The operation, which would produce 100 000 t/y of copper cathode, is expected to cost US\$490 million. Cash costs are projected at US51 c/lb.

International Copper Study Group

The International Copper Study Group (ICSG) held a seminar during its June 1996 meetings to discuss problem areas for international copper statistics. The principal recommendations from this seminar were as follows: to develop and utilize consistent definitions to avoid the possible mismatch between the production of refined copper and trade items used for the calculation of apparent consumption; to improve copper scrap consumption data; to increase the transparency and coverage of stock data; to urge governments to improve the accuracy of trade data, particularly some European Union members; and to improve the coverage of detailed refined copper consumption data.

The ICSG will hold two meetings in Lisbon during 1997. The first will be held June 2-5, 1997.

CONSUMPTION AND USES

World copper consumption in 1996 was estimated at about 12.23 Mt, the same level that was recorded in 1995 (this includes refined copper from both primary and secondary material). Canadian refined copper consumption was estimated to have increased to 218 000 t in 1996 from 190 000 t in 1995.

In 1996, it was estimated that over 3 Mt of copper scrap was used directly by consumers worldwide. According to a new survey conducted by Natural Resources Canada, about 39 000 t of contained copper in scrap was consumed directly by Canadian manufacturers in 1995.

In July it was announced that Alltrista Corporation had won a multi-year contract to supply copper-electroplated zinc one-cent blanks to the Royal Canadian Mint. In 1995 the Mint announced that it planned to replace the copper alloy one-cent coin with either a copper-plated steel or copper-plated zinc coin in order to reduce costs.

Table 8 presents preliminary end-use data for 1994 and 1995 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 International Copper Association, Ltd. (ICA).

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. Another electrical campaign is being undertaken on industrial and commercial power cable for building applications. Other areas receiving attention include brass forgings for engineered components. The CCBDA and the Copper Development Association 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 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.

While 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. Asymmetrical digital subscriber line (ADSL) is a technology that monitors the quality of a signal passing down a copper line and makes necessary adjustments to keep it clean. In addition, improved compression technologies permit the use of copper wire to transmit a significantly increased number of video images.

In February 1997, Lucent Technologies Inc. announced that it had introduced a new copper cable that delivers reliable high-speed performance at up to one gigabit per second, or six times the speed of standard copper cable.

In the automotive industry, the use of additional electronics offers significant growth potential for copper wire. Despite the significant penetration of aluminum into the original-equipment automotive radiator market, particularly in the United States, 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 aftermarket where the metal has an 80% market share. The ICA estimates that worldwide copper usage for radiators is about 190 000 t/y.

With the development of new solders and new processing methods for coating and core baking, as well

as a new brazed structure, it is possible that copper can regain a large share of the original-equipment market in view of its superior heat exchange efficiency.

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 AND THE ENVIRONMENT

Copper is an essential element for normal healthy growth and reproduction of all higher plants and animals. While copper may be toxic at elevated levels, copper deficiency in soils can have a serious impact on crop yields and animal health.

In plants, copper is an essential element of several proteins, mostly enzymes, that have varied but important metabolic functions. In certain regions, copper may have to be applied to soils to achieve minimum copper requirements.

In animal health, copper is an essential element in a number of critical enzymes. For humans, it is estimated that the daily minimum copper intake requirement for adults is between 1.6 and 2.0 mg. The World Health Organization (WHO) has established a recommended dietary allowance of 2.0-3.0 mg of copper per day.

Many regulatory agencies 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.

The European Commission, in its proposed Directive on Drinking Water Quality (80/778/EEC), is considering reclassifying copper as a "chemical parameter of health significance." This revision is based on a 1993 WHO recommendation that uses studies that have now been refuted by recognized experts and institutions. Under the existing EC Drinking Water Directive, copper is classified as an indicator parameter (limits for copper based principally on aesthetic criteria). Should the Commission's proposal be adopted, there could be significant adverse implications for the use of copper plumbing tube in Europe.

The proposed new Directive of the European Commission establishes a copper limit of 2 mg/L. The existing limit of 3 mg/L was established principally on the basis of aesthetic criteria.

The WHO is itself expected to begin a review of its 1993 provisional Guideline Value for copper in drinking water in April 1997.

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. This group also concluded that while a lower limit for copper intake could be established, it would be very difficult to set an upper limit.

RECYCLING

Philip Environmental Inc. announced that it was purchasing Conversion Resources Inc., which operates a secondary copper refinery in Warrenton, Missouri. The plant has a capacity of about 32 000 t/y.

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal is an environmental agreement designed to restrict the transboundary movement of hazardous wastes to protect countries (particularly developing countries) that may not have the capability and technology to properly manage the waste.

The Basel Convention came into force in May 1992 and, as of October 1996, more than 100 countries had ratified the Convention with the United States being the most notable exception.

The Basel Convention controls the transboundary movement of hazardous wastes via a movement control regime of "prior informed written consent." Exporting countries are required to formally notify the importing State of their intention to export a particular hazardous waste. Exportation can only occur following written acknowledgement and consent by the importing competent authority of the proposed movement.

A principal difficulty identified within the Convention has been the ambiguity of exactly which materials would be subject to the Convention. The term "waste" is defined by means of generic waste stream sources and specific waste constituents in Annex I of the Convention. Wastes are considered to be hazardous if they exhibit any of the hazard characteristics contained in Annex III of the Convention. In addition, the Convention recognizes that countries have the sovereign right to define any material to be "hazardous waste" within their national jurisdiction and to have these domestically defined hazardous wastes become subject to the Convention.

While "final disposal" operations (Annex IV.A) are identified separately from resource recovery, recycling, reclamation, direct re-use or alternative use

operations (Annex IV.B), both are considered equivalent for transboundary movement control purposes under the Convention.

Many non-OECD countries maintain that they do not possess the required infrastructure or technologies to allow the environmentally sound management of hazardous wastes whether destined for final disposal or for recycling operations. Accordingly, many non-OECD countries insist that the only means of controlling the movement of hazardous wastes is via a movement "ban" from developed to developing countries.

In March 1994 at the second Conference of Parties (COP), the Parties unanimously adopted a "ban" Decision (Decision II/12). Decision II/12 banned the movement of hazardous wastes arising from OECD countries and destined for final disposal operations located in non-OECD countries. The Decision also banned the movement of hazardous recyclables arising from OECD countries and destined for recycling operations located in non-OECD countries as of December 31, 1997.

In September 1995 at the third COP, the Parties adopted an amendment decision to the Convention which, upon receiving sufficient ratifications to enter into force, would give legal force to the "ban" Decision II/12 of March 1994 for those ratifying countries. Recognizing the perceptual and legal difficulties related to enacting a trade measure differentiating between countries who are members of a trade organization and those who are not members (e.g., the OECD), the COP adopted language referring instead to "Parties listed in Annex VII" and to "States not listed in Annex VII."

The amendment immediately bans, for ratifying countries, all movements of hazardous wastes arising from the Parties listed in Annex VII and destined for final disposal in States not listed in Annex VII, and bans, for ratifying countries, by December 31, 1997, movements of hazardous wastes arising from the Parties listed in Annex VII and destined for recovery operations in States not listed in Annex VII. Annex VII countries include Parties and other States that are members of the OECD, the EC and Liechtenstein. Monaco has recently applied to be part of Annex VII.

It is important to note that trade in hazardous wastes and hazardous recyclables is not prohibited among Parties listed in Annex VII, nor is trade prohibited among States not listed in Annex VII or exports from States not listed in Annex VII to Parties listed in Annex VII.

Since the third COP, the Technical Working Group (TWG) of the Basel Convention has provisionally compiled two lists of recyclable materials: List A recyclables that will be considered as being subject to Decision III/I, and List B recyclables that will be considered to be beyond the scope of the Basel Convention. These lists will be presented to Parties at the

fourth COP, scheduled for October 1997, for adoption into the Convention.

As of February 1997, the TWG had provisionally agreed upon the placement of a large number of specific wastes on List A and List B. List A comprises wastes that will normally be considered as hazardous and, accordingly, will be subject to the "ban" amendment. List B comprises materials that will not normally be considered to be subject to the Basel Convention.

It has provisionally been agreed that the following copper compounds will be listed in List A and, upon the coming into force of the "ban" amendment, will be subject to the movement ban.

List A provisional entries related to copper compounds include:

- ashes from the incineration of insulated copper wire;
- dusts and residues from gas cleaning systems of copper smelters;
- spent electrolytic solutions from copper electrorefining and electrowinning operations;
- waste sludges, excluding anode slimes, from electrolytic purification systems in copper electrorefining and electrowinning operations;
- spent etching solutions containing dissolved copper; and
- waste cupric chloride cyanide catalysts.

It has provisionally been agreed that the following copper scrap and copper compounds will be listed in List B and will not normally be subject to the Basel Convention.

List B provisional entries related to copper scrap and copper compounds include:

- copper mill scale;
- slags from copper processing for further processing or refining not containing arsenic, lead or cadmium to an extent that they exhibit Annex III hazard characteristics;
- wastes of refractory linings, including crucibles, originating from copper smelting;
- wastes of copper and copper alloys in dispersible form, unless they contain Annex I constituents to an extent that they exhibit Annex III characteristics;
- copper scrap and copper alloy scrap in metallic, non-dispersible form; and

- slag from copper production, chemically stabilized, having a high iron content (above 20%) and processed to industrial specifications (e.g., DIN 4301 and DIN 8201) mainly for construction and abrasive applications.

As part of its September 1995 Amendment Decision, the COP also instructed the TWG to develop technical guidelines to assist any Party or State that has the sovereign right to conclude agreements or arrangements, including those under Article 11 of the Convention, concerning the transboundary movement of hazardous wastes. There has been little progress on these guidelines to date and it remains unclear whether bilateral agreements would be considered to be consistent with the Convention following the coming into force of the "ban" amendment.

The work program for the Ad Hoc Working Group of Legal and Technical Experts continues its efforts to negotiate a protocol on liability and compensation resulting from damage caused by the transboundary movement of hazardous wastes. There remain significant challenges to the achievement of an agreed-upon legal text and it is unlikely that any adoption recommendations will be forwarded for consideration to the COP. Outstanding issues relate to the scope of application, the channelling of liability, defining illegal traffic, the financial limits of liability, the need for an international fund, state liability, and the relationship with other bilateral, multilateral and regional agreements.

The fourth COP is scheduled for October 1997, when the provisional lists will be presented for adoption by Parties. Issues likely to be discussed include the mechanism for incorporating these lists into the Convention, the status of bilateral agreements in relation to the "ban" amendment, any potential amendments that could broaden the scope of the Convention, and the future work programs for both the Technical Working Group and the Working Group of Legal and Technical Experts.

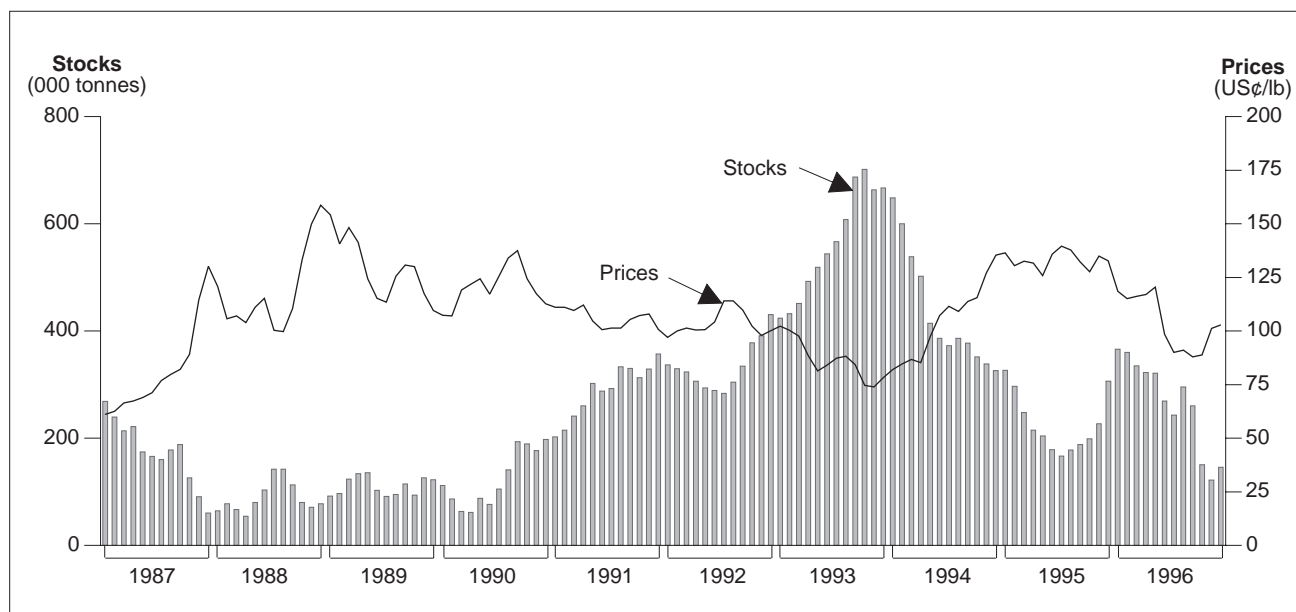
STOCKS

Combined copper stocks on the London Metal Exchange (LME) and the Commodities Exchange, Inc. (COMEX) declined throughout 1996 to reach 122 100 t at the end of November. However, there was a slight rebound during December to 148 200 t.

At the end of December, total copper stocks, including those at producers, merchants, consumers and exchanges, totalled 466 900 t compared to 684 900 t at the end of 1995 and 720 000 t at the end of 1994. Figure 2 shows both total copper stocks and prices for the period 1987-96.

In November, the World Bureau of Metal Statistics (WBMS) reported that its analysis indicated an apparent build-up of copper stocks at bonded warehouses in

Figure 2
Copper Prices¹ and Exchange² Stocks, 1987-96



Source: Natural Resources Canada.

¹ Average monthly LME cash prices.

² Combined LME and COMEX stocks at end of the month.

the Netherlands that totalled 588 000 t for the period 1990-95. In December, the Central Bureau of Statistics in the Netherlands admitted that the data that had been provided to the WBMS had been flawed. According to this agency, there had been a failure to distinguish between copper imported into the Netherlands for domestic use and copper in transit.

In February 1997, the American Bureau of Metal Statistics (ABMS) revised its number for refined copper stocks outside the United States for October 1996 to 145 000 t from 764 000 t. The ABMS reported that it had changed the way data were gathered after it had discovered errors.

PRICES

Copper prices on the LME averaged about US\$2294/t (\$1.04/lb) in 1996 (Figure 2) compared to US\$2930/t (\$1.33/lb) in 1995.

In the fourth quarter of 1996 and first quarter of 1997, 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¢/lb. For sales in Europe in 1997, Canadian producers have established a price of LME (Grade A Settlement Price) plus an average premium of US\$27-\$30/t. The base premium in 1996 was US\$30/t.

As a result of reports of trading losses by Sumitomo Corp. of at least US\$2.6 billion, which that company attributed to unauthorized trading by its chief non-ferrous metal trader, Yasuo Hamanaka, copper prices fell to US\$700/t in mid-June. Despite buoyant demand and low copper inventory levels, uncertainty with regard to the size of Sumitomo's positions and how it would be released onto the market delayed any significant recovery of prices until the fourth quarter of the year.

In the wake of the Sumitomo affair, regulatory investigations were undertaken by the U.K. Securities and Investments Board (SIB) and the U.S. Commodity Futures Trading Commission.

The SIB, which completed its investigation in December, recommended that the LME review its rules concerning historic price carries, member/customer relationships and non-regulated customers. The SIB also recommended that the LME examine warehousing, the price transparency of futures, options and stocks, inter-office trading, and also consider the composition of its Board, the various committees, and the role and structure of the LME Executive.

On February 3, 1997, the LME introduced a new copper contract, the Traded Average Price Options (TAPOs), for Grade A copper. Unlike LME Traded Options, TAPOs are priced off the average futures price of an entire month, rather than off a specific

Figure 3
Daily London Metal Exchange Copper Prices, 1996
 Grade A



Source: Reuters.

day. According to the LME, the introduction of TAPOs as official exchange contracts will benefit both granters and takers of options in terms of greater liquidity, greater price transparency, greater efficiency, and the protection afforded to Exchange Cleared Contracts by the London Clearing House. More importantly, the LME will have regulatory jurisdiction over average price options traded on the Exchange.

The LME announced in 1996 that it was considering the expansion of its warehouse facilities in the Asia-Pacific region. The New York Mercantile Exchange (NYMEX) announced in early 1997 that it was considering the establishment of a copper warehouse in Chile as well as in the Far East.

The Tokyo Commodity Exchange announced that it plans to introduce copper futures contracts within four or five years.

TREATMENT AND REFINING CHARGES

At the time of writing, the continued availability of significant copper concentrate stocks resulted in continued high spot smelting and refining charges (TC/RC) (US\$120/dmt and US12¢/lb). While there are indications that the smelter bottleneck situation that persisted through 1996 will begin to ease in 1997, press reports at the time of writing indicated that benchmark charges for 1997 had been estab-

lished at about US\$105/dmt and 10.5¢/lb. It was reported that Japanese term contracts for 1996 were roughly US\$95/dmt and 9.5¢/lb.

OUTLOOK

World consumption of refined copper in 1997 is forecast to increase to 12.8 Mt. For the period 1997 to 2005, copper consumption is expected to grow at an annual average rate in excess of 3.0%.

It is expected that a large share of the forecast growth in demand will occur in the Asian markets, particularly in China and India. In India, per capita consumption is less than 0.2 kg/y, while average consumption in China is estimated at 0.8 kg/y. This compares to between 10 and 13 kg/y in leading industrialized countries and a worldwide average of about 2.6 kg/y.

While copper consumption is forecast to remain strong into 1997, it is expected that prices in the second half of the year will be adversely affected by major increases in copper mine production capacity, particularly in South America. However, at the time of writing, there was some speculation that increased demand in China during 1997 could support copper prices in the short term.

Although forecast production will likely outpace consumption for the remainder of the decade, it is possible

that not all of the capacity expansion projects under consideration will proceed as currently envisaged.

From an average range of between US\$2050 and \$2250/t in 1997, copper prices are expected to decline below US\$2000/t in 1998. In the longer term, copper prices are expected to trade in a range between \$2050 and \$2350/t (constant 1996 dollars).

Despite the suspension of operations at the end of 1996 at the Similco operation of Princeton Mining Corporation due to depressed copper prices and the closure of Teck Afton Corporation's mine in June 1997 due to the depletion of reserves, the start-up of several new mines in 1997 and 1998 should increase Canadian mine production of copper to about 780 000 t. The additions to capacity include the following pro-

jects: Minto in the Yukon, and Huckleberry, Kemess South and Mt. Polley in British Columbia. In the longer term, a number of other Canadian projects offer significant potential for additional production capacity. These include the Casino, Kudz Ze Kayh and Wolverine prospects in the Yukon; Red Chris, Prosperity (Fish Lake) and Tulsequah Chief in British Columbia; and the Voisey's Bay property in Newfoundland/Labrador. It is expected that Canada's mine production of copper during the first half of the next decade will average about 900 000 t/y.

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 70. (2) Information in this review was current as of March 15, 1997.

TARIFFS

Item No.	Description	Canada			United States	EU	Japan ¹
		MFN	GPT	USA	Canada	MFN	GATT
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%	5.4%
28.33	Sulphates; alums; peroxosulphates (persulphates)						
	Other sulphates:						
2833.25	Of copper						
2833.25.10	Cupric sulphate	6%	Free	Free	Free	3.2%	4.3%
2833.25.90	Other copper sulphates	7%	4%	Free	Free	3.2%	4.3%
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	4.4-5.6%
74.03	Refined copper and copper alloys, unwrought						
	Refined copper:						
7403.11	Cathodes and sections of cathodes	Free	Free	Free	Free	Free	12.6-16.48 yen/kg
7403.12	Wire-bars	1%	Free	Free	Free	Free	12.6-16.48 yen/kg
7403.13	Billets	Free	Free	Free	Free	Free	12.6-16.48 yen/kg
7403.19	Other:						
7403.19.10	Ingots, ingot-bars and slabs	Free	Free	Free	Free	Free	12.6-16.48 yen/kg
7403.19.90	Other	1%	Free	Free	Free	Free	12.6-16.48 yen/kg
	Copper alloys:						
7403.21	Copper-zinc base alloys (brass)						
7403.21.10	Ingots, ingot-bars, slabs and billets	1%	Free	Free	Free	Free	12.6 yen/kg
7403.21.90	Other	1%	Free	Free	Free	Free	12.6 yen/kg
7403.22	Copper-tin base alloys (bronze)	1%	Free	Free	Free	Free	12.6-16.48 yen/kg
7403.23	Copper-nickel base alloys (cupro-nickel) or copper-nickel-zinc base alloys (nickel silver)						
7403.23.10	Ingots, ingot-bars, slabs and billets	Free	Free	Free	Free	Free	12.6-16.48 yen/kg
7403.23.90	Other	1%	Free	Free	Free	Free	12.6-16.48 yen/kg
7403.29	Other copper alloys (other than master alloys of heading no. 74.05)						
7403.29.10	Copper beryllium or copper phosphor alloys	1%	Free	Free	Free	Free	12.6-16.48 yen/kg
7403.29.90	Other	1%	Free	Free	Free	Free	12.6-16.48 yen/kg
7404.00	Copper waste and scrap						
	Not alloyed:						
7404.00.11	Spent anodes; waste and scrap with a copper content of less than 94% by weight	Free	Free	Free	Free	Free	Free
7404.00.19	Other	Free	Free	Free	Free	Free	Free
	Copper-zinc base alloys (brass):						

TARIFFS (cont'd)

Item No.	Description	Canada			United States	EU	Japan ¹
		MFN	GPT	USA	Canada	MFN	GATT
7404.00.21	With a copper content of less than 94% by weight	Free	Free	Free	Free	Free	Free
7404.00.29	Other	Free	Free	Free	Free	Free	Free
7404.00.91	With a copper content of less than 94% by weight	5.9%	3%	Free	Free	Free	Free
7404.00.99	Other	5.9%	3%	Free	Free	Free	Free
7405.00	Master alloys of copper	1.4%	Free	Free	Free	Free	4.8%
74.06	Copper powders and flakes	Free-1.2%	Free	0.4-1%	0.3-0.5%	0.6-2.5%	5.5%
74.07	Copper bars, rods and profiles	2-4.5%	Free-2%	Free-1%	Free-0.6%	5.3%	4.7-5.5%
74.08	Copper wire	1.4-5.9%	Free-3%	Free-1%	Free-0.4%	5.3%	4.7-5.5%
74.09	Copper plates, sheets and strip, of a thickness exceeding 0.15 mm	Free-5.9%	Free-3%	Free-1%	Free-0.6% ^a	5.3%	4.7-5.1%
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-1%	Free	Free-1%	Free-0.1% ^a	5.7%	4.8-5.1%
74.11	Copper tubes and pipes	Free-5.9%	Free-3%	Free-1%	Free-0.5% ^a	5.3%	5.1-6.1%
74.12	Copper tube or pipe fittings (for example, couplings, elbows, sleeves)	5.9%	3%	1%	0.3-1.1% ^a	5.7%	3.5%
7413.00	Stranded wire, cables, plaited bands and the like, of copper, not electrically insulated	3.6%	1%	1%	0.4-0.5% ^a	Free-5.7%	5.5%
74.14	Cloth (including endless bands), grill and netting, of copper wire; expanded metal of copper	3.6-4.2%	1-2%	1%	0.4-1%	5.2%	2.9-3.5%
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	3.5-4.2%	1-2%	1%	0.1-0.6% ^a	3.8-5%	3.5%
7416.00	Copper springs	4%	2%	Free	Free	5%	3.5%
7417.00	Cooking or heating apparatus of a kind used for domestic purposes, non-electric and parts thereof, of copper	6.8%	4%	1.2%	0.4%	5%	3.5%
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	5.9%	3%	1%	0.3-0.4%	3.8%	3.1%
74.19	Other articles of copper	Free-11.8%	Free-7%	Free-1.5%	0.5-0.8% ^a	3.8%	3.5-6%

Sources: Customs Tariff, effective January 1997, Revenue Canada; Harmonized Tariff Schedule of the United States 1997; The Bulletin International des Douanes, "Journal Number 14 (18th edition), European Union, 1995-1996, "Conventional" column; Custom Tariff Schedules of Japan, 1996.

^a Lower tariff rates may apply circumstantially.

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

TABLE 1. CANADA, COPPER PRODUCTION AND TRADE, 1995 AND 1996

Item No.	1995		1996P		
	(tonnes)	(\$000)	(tonnes)	(\$000)	
SHIPMENTS¹					
Newfoundland	1 247	5 015	5 175	16 073	
New Brunswick	13 510	54 323	13 243	41 133	
Quebec	114 090	458 757	127 536	396 127	
Ontario	251 266	1 010 339	221 722	688 669	
Manitoba	42 401	170 494	56 094	174 228	
British Columbia	278 330	1 119 163	232 121	720 968	
Total	700 843	2 818 090	655 891	2 037 198	
Refinery output	572 616	..	559 902	..	
EXPORTS					
2603.00.10	Copper ores and concentrates				
	Copper content				
	Japan	167 095	526 003	265 284	379 991
	South Korea	30 239	93 152	38 635	49 884
	China	20 036	69 000	31 101	43 753
	Philippines	16 181	50 734	34 402	31 333
	Peru	—	—	3 899	13 924
	Spain	19 975	62 974	—	—
	Brazil	4 227	15 571	—	—
	Other countries	3 224	10 723	12 879	15 850
	Total	260 977	828 157	386 200	534 735
2620.30	Copper ash and residues				
	United States	574	1 137	274	675
	India	971	921	—	—
	Other countries	306	291	—	—
	Total	1 851	2 349	274	675
2825.50	Copper oxides and hydroxides				
	United States	—	—	2	10
	Total	—	—	2	10
2833.25	Copper sulphates				
	United States	1 960	2 060	4 239	5 253
	Total	1 960	2 060	4 239	5 253
7401.10	Copper mattes				
	Norway	12 282	43 159	15 988	48 966
	United Kingdom	1 198	3 979	2 326	8 685
	Peru	—	—	...	5
	Total	13 480	47 138	18 314	57 656
7402.00	Copper anodes				
	United States	58 372	233 357	78872	318 317
	Other countries	37	176	—	—
	Total	58 409	233 533	78 872	318 317
7403.11 to 7403.19	Refined copper and copper alloys, unwrought				
	United States	265 300	1 091 789	279 582	956 517
	United Kingdom	61 533	253 786	53 056	174 805
	Colombia	9 442	38 330	13 613	56 014
	France	15 402	63 924	11 559	39 564
	Saudi Arabia	8 023	33 864	6 300	20 976
	Taiwan	9 735	39 268	6 432	20 642
	Italy	24 002	99 750	5 445	18 270
	Sweden	9 847	40 588	3 713	12 135
	Other countries	6 077	23 578	5 517	18 958
	Total	409 361	1 684 877	385 217	1 317 881

TABLE 1 (cont'd)

Item No.		1995		1996P	
		(tonnes)	(\$000)	(tonnes)	(\$000)
EXPORTS (cont'd)					
7403.21 to 7403.29	Other copper alloys				
	United States	295	1 222	449	1 726
	Indonesia	139	398	89	114
	Singapore	190	616	—	—
	Thailand	201	369	—	—
	Taiwan	80	239	—	—
	Other countries	90	329	28	85
	Total	995	3 173	566	1 925
7404.00	Copper waste and scrap				
	United States	101 196	279 990	98 159	241 119
	Hong Kong	4 355	7 254	4 673	9 712
	India	3 828	4 858	2 856	3 907
	Japan	1 221	3 382	1 234	2 856
	China	4 094	5 735	1 124	2 056
	Italy	1 790	3 427	734	1 466
	Other countries	3 974	6 364	3 359	3 452
	Total	120 458	311 010	112 139	264 568
7405.00	Master alloys of copper				
	United States	937	1 476	1 083	1 646
	Other countries	—	—	2	27
	Total	937	1 476	1 085	1 673
7406.10, 7406.20	Copper powders and flakes				
	United States	69	654	58	635
	Taiwan	44	488	60	620
	Thailand	13	128	45	153
	Hong Kong	6	71	9	104
	Germany	—	—	9	97
	Venezuela	—	—	13	73
	Other countries	33	323	33	328
	Total	165	1 664	227	2 010
7407.10 to 7407.29	Copper and copper alloy rods and profiles				
	United States	7 025	38 396	9 281	43 471
	Ireland	459	1 743	848	3 234
	Colombia	—	—	519	2 134
	Spain	—	—	8	102
	Other countries	5	36	36	206
	Total	7 489	40 175	10 692	49 147
7408.11 to 7408.29	Copper and copper alloy wire				
	United States	39 246	169 035	54 621	186 020
	South Korea	26	29	36	306
	Kuwait	—	—	30	227
	Belgium	—	—	12	41
	Cuba	50	406	4	38
	Other countries	152	435	46	124
	Total	39 474	169 905	54 749	186 756
7409.11 to 7410.22	Copper and copper alloy plates, sheets, strip and foil				
	United States	10 920	63 266	10 180	56 192
	Saudi Arabia	484	2 802	1 069	5 848
	United Kingdom	776	3 821	561	2 326
	Taiwan	339	1 836	300	1 481
	Thailand	240	1 288	242	1 281
	Other countries	690	3 867	874	5 281
	Total	13 449	76 880	13 226	72 409

TABLE 1 (cont'd)

Item No.	1995		1996P		
	(tonnes)	(\$000)	(tonnes)	(\$000)	
EXPORTS (cont'd)					
7411.10 to 7411.29	Copper and copper alloy tubes and pipes				
	United States	14 580	93 027	16 834	97 176
	Israel	357	1 860	758	3 554
	Netherlands	—	—	37	195
	Saudi Arabia	58	432	17	148
	Sweden	12	124	15	142
	Indonesia	—	—	22	130
	Other countries	98	511	38	203
	Total	15 105	95 954	17 721	101 548
7412.10, 7412.20	Copper and copper alloy tube and pipe fittings				
	United States	..	19 174	..	16 119
	Germany	..	7 595	..	3 584
	United Kingdom	..	2 584	..	3 363
	Spain	..	8 215	..	2 829
	Belgium	..	304	..	2 040
	Greece	..	1 857	..	1 921
	Other countries	..	2 069	..	3 119
	Total	..	41 798	..	32 975
7413.00	Stranded wire, cables, plaited bands and the like, of copper, not electrically insulated				
	Indonesia	1 287	4 731	7	388
	Tunisia	37	205	53	351
	United States	74	393	52	226
	Egypt	234	737	—	—
	Other countries	42	183	3	16
	Total	1 674	6 249	115	981
7414.10, 7414.90, 7415.10 to 7415.39, 7419.10 to 7419.99	Copper, other items of				
	United States	..	21 512	..	27 164
	Saudi Arabia	..	548	..	810
	China	..	80	..	574
	Indonesia	..	3	..	346
	Nicaragua	..	—	..	150
	Dominican Republic	..	16	..	124
	Kuwait	..	273	..	18
	Other countries	..	2 327	..	860
	Total	..	24 759	..	30 046
IMPORTS²					
2603.00.00.10	Copper ores and concentrates				
	Copper content				
	United States	116 518	312 398	83 105	158 885
	Chile	4 761	12 315	32 854	77 800
	Indonesia	6 348	21 178	5 656	14 500
	Portugal	14 063	44 769	3 957	13 096
	Bulgaria	1 745	4 881	3 753	9 272
	Australia	4 730	17 178	—	—
	Other countries	473	1 170	5 501	11 140
	Total	148 638	413 889	134 826	284 693
2604.00.00.10, 2607.00.00.10, 2608.00.00.10, 2616.10.00.10	Other ores and concentrates				
	Copper content				
	United States	1 013	2 200	443	911
	Mexico	236	746	225	642
	Peru	25	38	66	140
	Other countries	—	—	1	2
	Total	1 274	2 984	735	1 695

TABLE 1 (cont'd)

Item No.		1995		1996P	
		(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)					
2620.30	Copper ash and residues				
	United States	21 180	28 800	15 583	22 887
	Australia	—	—	19 640	19 998
	United Kingdom	—	—	408	2 366
	Finland	430	191	2 507	1 063
	Romania	10 237	5 375	—	—
	Other countries	182	134	1 044	998
	Total	32 029	34 500	39 182	47 312
2825.50	Copper oxides and hydroxides	1 354	4 570	1 187	4 079
2833.25	Copper sulphates	9 842	10 732	9 574	10 552
7401.10	Copper mattes	4 973	10 775	10 964	30 747
7402.00	Copper anodes	35 089	134 498	17 506	55 757
7403.11 to 7403.19	Refined copper and copper alloys, unwrought Refined copper				
	Total	24 312	91 762	28 700	94 138
7403.21 to 7403.29	Refined copper and copper alloys, unwrought Other copper alloys				
	Total	8 527	28 297	5 284	17 348
7404.00	Waste and scrap, copper or copper alloy				
	United States	159 372	349 793	146 517	295 437
	Canada	114	47	2 567	3 773
	Mexico	2 380	7 979	780	2 385
	Russia	1 956	2 349	2 325	1 952
	Finland	498	375	507	1 151
	Sweden	882	2 423	—	—
	Other countries	2 122	2 921	627	1 156
	Total	167 324	365 887	153 323	305 854
7405.00	Master alloys of copper	28	127	79	364
7406.10, 7406.20	Copper powders and flakes				
	Total	1 833	11 081	1 764	10 215
7407.10 to 7407.29	Bars, rods and profiles of refined copper				
	United States	31 797	124 542	26 217	96 718
	Poland	1 511	4 836	2 494	6 957
	Turkey	648	2 130	1 313	3 532
	Germany	521	2 624	274	1 340
	New Zealand	322	1 447	217	951
	United Kingdom	243	1 172	146	929
	South Korea	631	1 897	270	845
	Other countries	1 010	4 070	720	3 091
	Total	36 683	142 718	31 651	114 363
7408.11 to 7408.29	Copper and copper alloy wire				
	Total	16 386	73 782	17 631	70 354
7409.11 to 7409.90, 7410.11 to 7410.22	Copper and copper alloy plates, sheets, strip and foil				
	Total	27 202	169 049	24 869	142 899

TABLE 1 (cont'd)

Item No.		1995		1996P	
		(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)					
7411.10	Pipes and tubes, refined copper	7 988	40 811	7 886	36 652
7411.21	Pipes and tubes, copper-zinc base alloy	3 901	25 473	3 545	23 495
7411.22	Pipes and tubes, copper-nickel base alloy or copper-nickel-zinc base alloy	342	2 450	324	2 297
7411.29	Plates and tubes, copper alloy, n.e.s.	826	4 787	910	4 977
7412.10	Fittings, pipe or tube, of refined copper	454	5 361	310	4 456
7412.20	Fittings, pipe or tube, copper alloy	3 722	46 420	3 494	44 572
7413.00	Stranded wire, cable, plaited bands and the like, of copper, not electrically insulated	2 946	16 154	3 248	15 649
7414.10	Copper wire for machinery, endless bands	..	4	-	-
7414.90	Cloth, grill and netting of copper wire and expanded metal of copper	107	665	134	691
7415.10	Nails, tacks, drawing pins, staples and similar articles of copper or of iron or steel with copper heads	102	684	83	536
7415.21	Washers, copper, including spring washers	211	1 363	207	1 334
7415.29	Articles of copper, not threaded, n.e.s., similar to those of headings 7415.10 and 7415.21	301	1 728	292	1 829
7415.31	Screws, copper, for wood	67	386	22	106
7415.32	Screws, bolts and nuts of copper, excluding wood screws	781	4 966	718	4 648
7415.39	Articles of copper, threaded, n.e.s., similar to bolts, nuts and screws	448	2 862	440	2 730
7416.00	Copper springs	..	227	..	331
7419.10	Chain and parts thereof of copper	78	566	90	655
7419.91	Articles of copper, not further worked than cast, moulded, stamped or forged	775	6 029	998	7 382
7419.99	Articles of copper, n.e.s.	..	44 641	..	35 550

Sources: Natural Resources Canada; Statistics Canada.

- Nil; .. Not available or not applicable; ... Amount too small to be expressed; 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 1985-96

	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 ^r	385 761	732 603 ^r	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	19 593	199 349
1995	700 843	572 616	274 457	409 361	709 150	24 312	189 686
1996 ^p	655 891	559 202	404 514	385 217	864 783	28 700	218 263

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, 1995 AND 1996

	1995	1996 ^p
	(000 t)	
Australia	379	459
Canada	726	688
Chile	2 488	3 092
China	445	400
Indonesia	444	508
Kazakstan	232	163
Mexico	339	339
Papua New Guinea	213	187
Peru	354	427
Poland	384	384
Russia	526	523
South Africa	189	188
United States	1 850	1 911
Zambia	324	334
Other	1 119	1 073
Total	10 012	10 676

Source: International Copper Study Group.

^p Preliminary.

TABLE 4. WORLD REFINERY PRODUCTION OF COPPER, 1995 AND 1996

	1995	1996 ^p
	(000 t)	
Australia	271	303
Belgium/Luxembourg	401	393
Brazil	165	179
Canada	573	559
Chile	1 491	1 743
China	1 080	906
Germany	616	666
Japan	1 188	1 247
Kazakstan	257	273
Mexico	202	204
Peru	295	338
Philippines	158	156
Poland	406	413
Republic of Korea	233	246
Russia	560	567
Scandinavia	219	274
Spain	164	264
United States	2 280	2 341
Zambia	321	325
Other	977	1 041
Total	11 857	12 438

Source: International Copper Study Group.
^p Preliminary.

TABLE 5. WORLD REFINED COPPER CONSUMPTION, 1995 AND 1996

	1995	1996 ^p
	(000 t)	
Belgium/Luxembourg	361	355
Brazil	200	234
Canada	190	218
China	1 148	1 010
France	549	492
Germany	1 062	993
Italy	491	508
Japan	1 414	1 470
Poland	212	223
Republic of Korea	540	592
Russia	180	160
Spain	178	194
Taipei, China	573	550
United Kingdom	398	406
United States	2 534	2 627
Other	2 185	2 181
Total	12 215	12 213

Source: International Copper Study Group.
^p Preliminary.

TABLE 6. COPPER AND COPPER-NICKEL SMELTERS IN CANADA, 1996

Company and Location	Product	Rated Annual Capacity ¹	Feed Material	Remarks
		(thousand tonnes)		
Falconbridge Limited Falconbridge, Ontario	Copper-nickel matte	22.5	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	124	Copper concentrates, scrap	Mitsubishi-type smelting, separation and converting furnaces, acid plant and oxygen plant to treat continuous copper concentrate feed stream to yield molten 99%-pure copper. Hazelett continuous cast anodes.
Noranda Metallurgy Inc. Horne smelter Noranda, Quebec	Copper anodes	205	Copper concentrates, scrap	One continuous Noranda process reactor, five converters and an acid plant.
Noranda Mining and Exploration Inc. Gaspé smelter Murdochville, Quebec	Copper anodes	110	Copper concentrates	Green charge reverberatory furnace, two converters, one rotary anode furnace and an acid plant.
Hudson Bay Mining and Smelting Co., Limited (HBMS) Flin Flon, Manitoba	Copper anodes	85	Copper concentrates	Five roasting furnaces, one reverberatory furnace and two converters. Project to replace concentrate roasting and calcine smelting with Noranda continuous converter technology has been postponed.

Source: Data provided by each company.

¹ Copper in matte, blister and anode.**TABLE 7. COPPER REFINERIES IN CANADA, 1996**

Company and Location	Rated Annual Capacity	Remarks
	(tonnes)	
Noranda Metallurgy Inc. CCR Division East Montréal, Quebec	365 000	Refines anodes from Noranda's Horne and Gaspé smelters, from the Flin Flon smelter, and also from purchased scrap and blister. Precious metals, selenium and tellurium are recovered from slimes.
Inco Limited Copper Cliff, Ontario	175 000	Casts and refines anodes from molten converter copper from the Copper Cliff smelter; 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	104 000	Refines anodes from the Kidd Creek smelter.
Gibraltar Mines 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.

Source: All data 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, 1994 AND 1995

United States	1994		1995 ^P	
	(000 t)	(% of total)	(000 t)	(% of total)
SUPPLY				
Domestic mill products				
Building wire	517	15.1	562	16.2
Magnet wire	304	8.9	311	9.0
Telecommunications cable	210	6.2	215	6.2
Power cable	137	4.0	141	4.1
Automotive wire and cable	117	3.4	122	3.5
Other wire and cable	354	10.4	385	11.1
Strip, sheet, plate and foil	526	15.4	506	14.6
Rod and bar	485	14.2	470	13.5
Tube and pipe	496	14.5	495	14.3
Mechanical wire	31	0.9	30	0.9
Foundry products	194	5.7	179	5.2
Powder products	21	0.6	21	0.6
Total, domestic mill products	3 391	99.3	3 437	99.0
Imported mill products	23	0.7	33	1.0
Total supply	3 414	100.0	3 470	100.0
USES				
Building construction	1 359	39.8	1 383	40.0
Electrical/electronic products	860	25.2	886	25.5
Industrial machinery/equipment	409	12.0	412	11.9
Transportation equipment	434	12.7	434	12.5
Consumer and general products	352	10.3	355	10.2
Total	3 414	100.0	3 470	100.0

Source: Copper Development Association Inc.

^P Preliminary.

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

TABLE 9. YEARLY AVERAGE COPPER PRICES,¹ 1980-96

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

Source: International Copper Study Group.

¹ Settlement price for highest grade of copper sold.

TABLE 10. MONTHLY AVERAGE COPPER PRICES, 1995 AND 1996

	LME ¹		COMEX ²	
	1995	1996	1995	1996
	(current US¢/lb)			
January	136.5	118.6	139.9	118.1
February	130.5	115.1	133.8	116.7
March	132.6	116.1	139.0	118.2
April	131.7	117.7	134.0	119.3
May	125.8	120.5	127.9	123.3
June	132.8	98.5	137.8	104.5
July	139.5	90.0	138.0	90.7
August	137.8	91.1	137.8	92.1
September	132.3	88.0	132.1	90.5
October	127.6	88.9	128.0	93.5
November	135.0	101.2	136.5	100.8
December	132.7	102.8	131.8	102.8

Source: International Copper Study Group.

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