

Nickel

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(Author notes: [1] This review concentrates on production facilities. The format of the production data has been changed to make it more readable and more comparable between operations. The extensive coverage of Canadian operations in 2000 precludes similar coverage for foreign operations of non-Canadian companies in 2000. [2] Only material relating to events in 2000 is covered in this review. [3] This chapter includes some information about cobalt as it relates to nickel; it does not provide a comprehensive review of cobalt.)

Abbreviations used in this review include:

Ag Silver; Au Gold; Co Cobalt; Fe Iron; FeNi Ferro-nickel; H₂SO₄ Sulphuric acid; HPAL High pressure acid leach; Ir Iridium; Ni Nickel; PAL Pressure acid leach; Pd Palladium; PGMs Platinum group metals; Pt Platinum; Rh Rhodium; Ru Ruthenium; Se Selenium; SO₂ Sulphur dioxide; Te Tellurium.

OVERVIEW

World nickel mine production increased by 11.8%. World production of refined and finished nickel increased by 5.7%. Nickel use (formerly called "consumption") increased by 4.2%.

Cobalt data are less well documented than nickel data. A principal source of world information is The Cobalt Development Institute (CDI) <<http://thecdi.com>>. The data from the CDI are shown in Table 9, which shows cobalt production in 2000. Figures 3 and 4 show mine production and metal production of cobalt, respectively, from data of the International Consultative Group on Nonferrous Metals Statistics, 2000.

WORLD NICKEL DATA

	1999	2000
	(000 t)	
Mine production	1 058	1 183
Finished production	1 024	1 082
Usage (consumption)	1 082	1 127

Source: International Nickel Study Group (INSG) data, rounded to nearest 1000 tonnes.

Note: Refer to Tables 4-6 at the end of this review for data from 1996 to 2000.

LME ASK PRICES

Cash	3 15 27 month			
	(US\$/t)			
Average	8 641	8 453	7 354	6 614
Maximum	10 660	10 380	8 655	7 540
Minimum	7 030	6 730	6 260	5 765

Sources: INSG; London Metal Exchange (LME).

Notes: Cash ask price = settlement price. Refer to Figure 2 for a graph of nickel prices in 2000 and for the period 1990-2000.

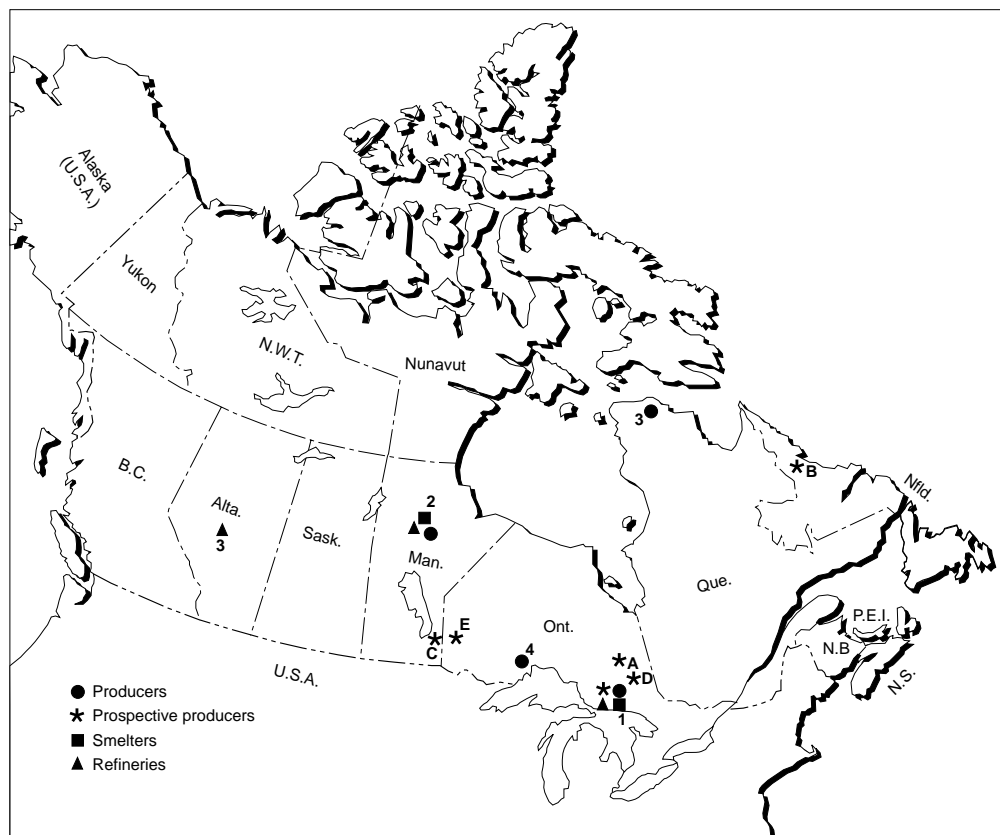
CANADIAN DATA

	1999	2000
	(t)	
Ni mine production ¹	186 236	190 727
Ni in concentrates shipped ²	176 749	181 074
Ni refined production ³	124 269	134 225
Ni usage ⁴	22 527	24 932
Co mineral production ²	2 014	2 013
Co metal production ³	4 901	6 307
Co usage ⁴	130	127

Ni = nickel; Co = cobalt.

¹ Metal in concentrates produced from Canadian mines. ² Recoverable metal in concentrates shipped from Canadian mines. ³ Metal produced, whether from domestic or foreign origin. ⁴ Use includes metal in scrap and other recycled forms.

Figure 1
Nickel and Cobalt in Canada, 2000



Numbers and letters refer to locations on map above

PRODUCERS

1. Falconbridge Limited (Fraser, Lindsley, Onaping-Craig, Lockerby)
1. Inco Limited (Coleman, Copper Cliff North, Copper Cliff South, Crean Hill, Creighton, Froid, Garson, Gertrude, McCreedy East, Stobie)
2. Inco Limited (Thompson, Birchtree)
3. Falconbridge Limited (Raglan)
4. North American Palladium Ltd. (Lac des Iles)

SMELTERS

1. Falconbridge Limited (Falconbridge)
1. Inco Limited (Copper Cliff)
2. Inco Limited (Thompson)

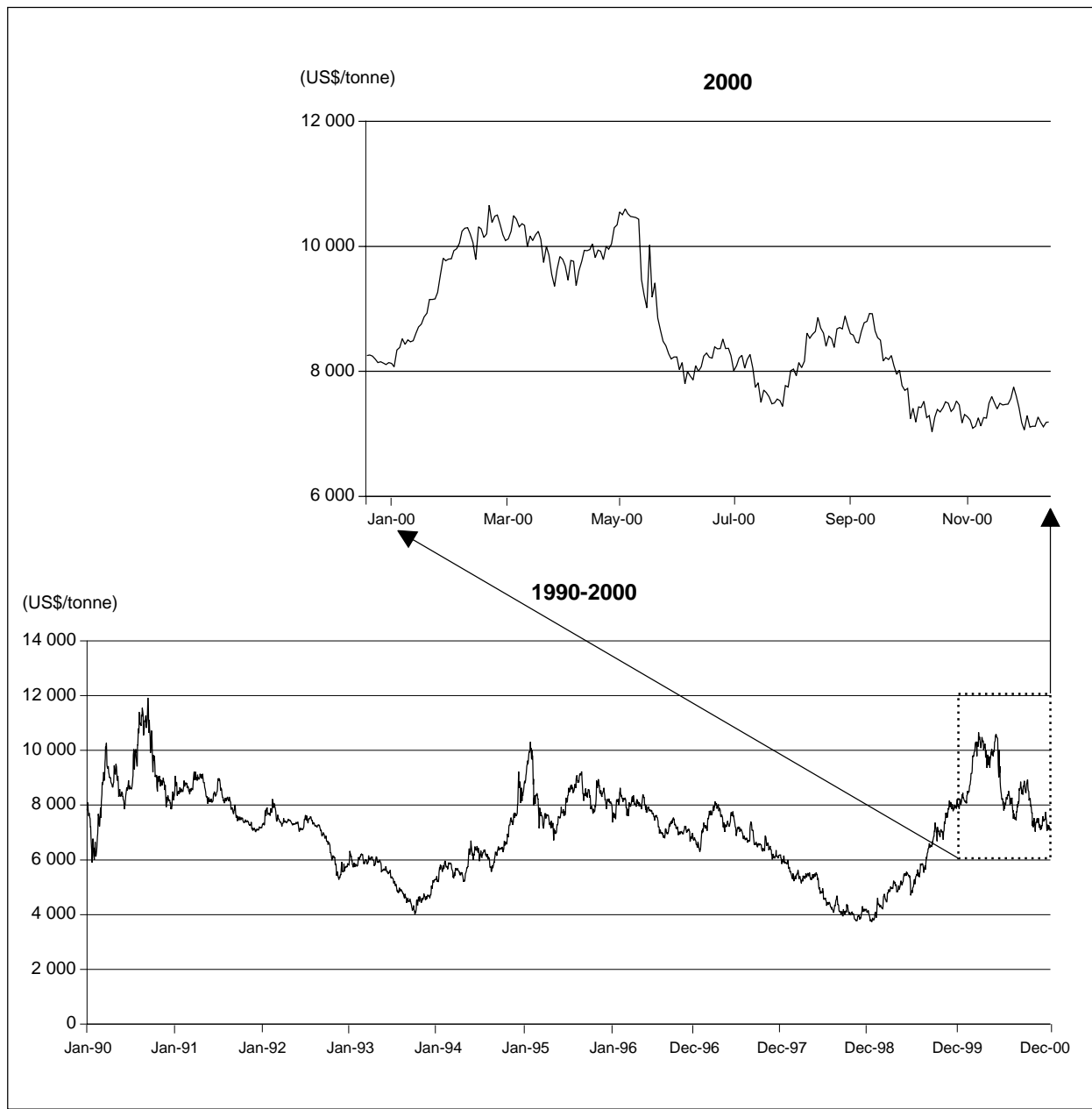
REFINERIES

1. Inco Limited (Sudbury)
2. Inco Limited (Thompson)
3. Sherritt International Corporation (Fort Saskatchewan)

PROSPECTIVE PRODUCERS

- A. Outokumpu Mines Ltd. (Moncalm Township) (mine)
- B. Inco Limited (Voisey's Bay mine)
- C. Canmine Resources Corporation (Maskwa) (mine)
- D. Canmine Resources Corporation (Cobalt, Ontario) (refinery)
- E. Canmine Resources Corporation (Werner Lake) (mine)

Figure 2
LME Cash Settlement Nickel Prices, 1990-2000



Sources: International Nickel Study Group, Reuters; World Bureau of Metal Statistics.

The significant changes in Canadian nickel production in 1999 and 2000 were due to the lower mine production in Ontario resulting from a labour action at Falconbridge Limited's mines and smelter; these were offset by higher production at Falconbridge's Raglan mine in Quebec in 2000 and higher production at Inco Limited's Manitoba operation in 2000 (in

1999, a labour action in Manitoba's facilities reduced nickel output).

Canadian mine production of nickel (nickel contained in concentrates produced) was 181 027 t in 2000, up from 176 749 t in 1999. Primary nickel production in Canada was 134 225 t, up from 124 260 t in 1999 (Table 1).

Canadian exports and imports of various forms of nickel are shown in Table 1a; some data refer to contained nickel and other data refer to gross weights, according to the definitions of the *Harmonized Commodity Description and Coding System* (Harmonized System) for trade classification. Additional detail has been presented in Table 1a to clarify whether the tonnage is nickel content or the weight of material shipped. The most significant nickel exports from Canada are nickel oxide sinter exports to the United Kingdom,¹ nickel in matte exports to Norway, and unwrought nickel exports (of which over half went to the United States). The most significant nickel import was mixed nickel-cobalt feed for Sherritt International Corporation's refinery in Alberta. About 10 000 t of nickel intermediates were also imported.

Additional trade information is also presented in Table 1b, which shows the total trade of cupro-nickel, nickel-silver, stainless steel, and nickel-containing batteries. These data do not show the weight of the contained nickel but, rather, the entire weight of the material; thus, stainless steel data show the weight of nickel plus iron plus chromium plus other alloying elements.

Table 1c provides an historical summary of nickel production and use from 1970 to date for selected years.

Canadian shipments of recoverable cobalt in concentrate from Canadian mines totaled 2013 t in 2000, almost equal to the 2014 t produced in 1999. The lower output from Falconbridge's Sudbury mines was offset by increased production in 2000 relative to 1999 from the Raglan mine and from Inco's Thompson/Birchtree operations. Refined cobalt production was 4091 t in 2000, up from 3972 t in 1999. Table 2a shows the production and trade data for 1999 and 2000. Note that the unit of measurement for the data in Table 2a is kilograms.

Table 2b provides an historical summary of cobalt production and use from 1970 to date for selected years.

FALCONBRIDGE LIMITED

<<http://www.falconbridge.com>>

Falconbridge is the third largest producer of finished nickel in the world.

Its operations include: the Raglan mine/mill in Quebec, the Sudbury operations (four mines, a mill,

a smelter and an acid plant) in Ontario, a refinery in Norway, and a mine and smelter in the Dominican Republic (see separate sections below).

Falconbridge's other projects include the Koniombo ferro-nickel (FeNi) smelter and mine project in New Caledonia, the Montcalm deposit and Bucko project in Canada, the Touba-Biankouma project in Ivory Coast, and the potential purchase of 25% of a nickel laterite project at Gag Island in Indonesia (see separate sections below).

Falconbridge is the world's largest cobalt recycler; it also toll refines cobalt material from other sources. A force majeure on cobalt shipments was declared in September and lifted in November (refer to the company web site for details).

Falconbridge produces and sells nickel in the following shapes: full plate cathode, cut cathode, SUPERELECTRO™ crowns, D crowns, microcrowns, D-microcrowns, and FeNi cone.

Securities documents are available on the Internet at <http://www.sedar.com/command_servlet?cmd=DisplayCompanyDocuments&issuerNo=00000376&lang=EN>.

Noranda Inc. <<http://www.noranda.com>> increased its ownership of Falconbridge to 50.1% in July and, by year-end, held 54.9% of common shares.

Sudbury Operations

Four underground mines operate in the Sudbury basin: the Craig, Fraser, Lindsley and Lockerby mines.

All mine ore is sent to the 10 000-t/d Strathcona mill for processing to concentrate; nickel-copper concentrate is sent to the company's smelter.

FALCONBRIDGE MINE PRODUCTION

Mine	2000
Craig	811 000 t @ 1.88% Ni, 0.69% Cu
Fraser	555 000 t @ 1.22% Ni, 2.45 % Cu
Lindsley	236 000 t @ 1.17% Ni, 1.11% Cu
Lockerby	189 000 t @ 1.75% Ni, 0.97% Cu
Total	1 791 000 t @ 1.57% Ni, 1.32% Cu

Smelter

- Has an electric furnace and Pierce Smith converters with a capacity of 70 000 t/y of nickel in about 130 000 t of nickel-copper matte; roaster gas is sent to the adjacent 300 000-t/y sulphuric acid plant.

¹ Trade data for 1999 and 2000 show exports of nickel in matte to the United Kingdom but no nickel oxide sinter; an investigation began in 2001 about the classification of some of these exports in 2000 to the United Kingdom.

- Matte is exported to the company's Nikkelverk refinery in Norway.
- Concentrate is sourced from Falconbridge's own Sudbury mines and its Raglan mine, as well as from recycled materials.
- Has received permission from the Ontario government to export nickel-copper matte containing up to 45 360 t of recoverable nickel from mines in Ontario until the end of 2009.
- Recycles significant amounts of nickel and cobalt; in 2000, 2950 t of nickel were recovered from recyclable feed material (included in data totals below).

FALCONBRIDGE SMELTER PRODUCTION BY SOURCE

	1999	2000
	(t)	
Ni in matte from Sudbury mines	33 041	22 221
Ni in matte from Raglan mine	18 912	22 266
Ni in matte from custom feed	3 814	2 952
Total Ni in matte	55 767	47 439
Co in matte from Sudbury mines	732	556
Co in matte from Raglan mine	307	330
Co in matte from custom feed	1 375	906
Total Co in matte	2 414	1 792

Mineral Inventory to Year-End 2000

- Proven + probable reserves = 20.2 Mt @ 1.49% Ni, 1.34% Cu.
- Measured + indicated resources = 16.3 Mt @ 2.47% Ni, 1.22% Cu.
- Inferred resources = 15.6 Mt @ 1.75% Ni, 2.04% Cu.

2000 Notes

- A strike by the Sudbury Mine, Mill & Smelter Workers' Union Local 598/C.A.W. <<http://www.minemill598.com>> began on August 1 and continued through the remainder of 2000; there was limited mine production by management after August 1.
- The smelter operated during the labour strike using concentrate from the Raglan mine plus concentrate from limited mine production from the Sudbury mines.
- Onaping Depth project:
 - reserves at depth of 2300-2600 m;
 - feasibility study delayed by strike;
 - completion of study is scheduled for mid-2001;
 - has indicated resources of 14.6 Mt @ 2.5% Ni, 1.15% Cu;
 - has an additional 1.2 Mt/y of inferred resources @ 3.61% Ni and 1.21% Cu.

Falconbridge's Canadian Properties

Montcalm Property

- Falconbridge signed a letter of intent with Outokumpu Mines Inc.; Falconbridge can earn a 50% interest in the Montcalm deposit near Timmins, Ontario.
- A decision on whether to finalize the agreement was expected in 2001; Falconbridge would fund an exploration and feasibility study.
- Deposit has an indicated + inferred resource of 7.75 Mt @ 1.48% Ni, 0.7% Cu.
- An operating rate of 6000 t/y of nickel in concentrate is being considered.
- Concentrate would be processed at Falconbridge's Sudbury smelter.

Bucko Project

- Nuinsco Resources Limited <<http://www.nuinsco.ca>> signed an option with Falconbridge to acquire 100% of the Bucko deposit and a 49% interest in the Strong Lake/Moak claims, subject to a number of conditions.
- \$1.5 million was spent during 2000 on diamond drilling and equipment purchases, including surface buildings, pumps and a mine hoist.
- Shaft dewatering and bulk sampling are planned during 2001.
- A 5000 to 7000-t bulk sample is to be processed at Inco's Thompson facility.
- Approvals were received for site construction, underground development and a road/power line corridor.
- Calculated mineral inventory:
 - indicated = 1.5 Mt @ 2.36% Ni (diluted);
 - inferred = 0.5 Mt @ 1.99% Ni (diluted).
- Will use an existing Falconbridge shaft to 800-m depth.

New Quebec Raglan Mines Limited

<<http://www.falconbridge.com>>

Raglan Mine

- Located north of 60° N latitude, at Katinniq, Nunavik Territory, Quebec.
- New Quebec Raglan owns 100% of Société minière Raglan du Québec ltée, which in turn owns 100% of the Raglan operation.
- There is significant participation by local Aboriginal groups in the labour force and as contractors.
- The operation is 100% owned by Falconbridge Limited.

Mineral Inventory to Year-End 2000

- Proven + probable reserves = 19.5 Mt @ 2.85% Ni, 0.78% Cu.
- Indicated + inferred resources = 5.7 Mt @ 2.19% Ni, 0.77% Cu.
- Ore also contains cobalt and platinum group metals.

RAGLAN MINE PRODUCTION

	1999	2000
	(t)	
Ni in concentrate	19 524	23 089
Co in concentrate	238	289

2000 Notes

- The Raglan mine was not affected by the strike in Sudbury.
- The mill production rate increased from 0.8 Mt/y to 1 Mt/y of ore in the second half of the year.
- A \$12 million exploration program was conducted in 2000:
 - the operation is seeking additional ore reserves that would permit a production increase to 30 000 t/y of nickel;
 - 2001 exploration expenditures are targeted at \$10 million;
 - 853 000 t of ore grading 2.45% Ni and 0.81% Cu in Lens D (located 15 km east of the concentrator) was added to the mineral inventory in 2000.
- A mill optimization plan is scheduled for completion in 2001; this should raise capacity to 3000 t/d from its current rate of 2400 t/d.

Falconbridge Nikkelverk Aktieselskap

<<http://www.falconbridge.com>>

Nikkelverk Refinery

- This chlorine leach/electrowinning refinery, located in Kristiansand in southern Norway, has a capacity of 85 000 t/y Ni, 40 000 t/y Cu and 4500 t/y Co; its acid plant capacity is 100 000 t/y of sulphuric acid.
- Can be expanded to 100 000 t/y Ni, 60 000 t/y Cu and 5000 t/y Co.
- Feed sources:
 - nickel-copper matte from Falconbridge's Sudbury smelter and the Bamangwato Concessions Limited's (BCL) smelter in Botswana accounted for the majority of feed to the refinery;
 - the refinery toll refines cobalt from WMC Limited's Australian operations;
 - Falconbridge has a contract to the end of 2010 with Centametal AG, which purchases matte from BCL, to process between 13 000 and 16 000 t/y of nickel in matte.
- The operation is owned 100% by Falconbridge Limited.

NIKKELVERK PRODUCTION

	1999	2000
	(t)	
Ni	74 137	58 679
Co	4 041	3 431

2000 Notes

- The refinery had a five-day work stoppage in November in support of the labour action at Falconbridge's Sudbury operations.
- Feed to the refinery was reduced due to the strike at Sudbury.
- Custom feed amounted to 28% of nickel output and 75% of cobalt output at the refinery.
- Refinery recovered 6.8 t of PGMs, up about 10% from 1999.

Falconbridge Dominicana, C. por A. (Falcondo) <<http://www.falconbridge.com>>**Falcondo**

- The nickel laterite mine and FeNi smelter are located at Bona, Dominican Republic; the mine/smelter has a capacity of about 30 000-32 000 t/y Ni in FeNi.
- Mining is by loaders and trucks; the FeNi plant is powered by a 200-MW, oil-fired power plant; production costs are highly dependent upon the oil price.
- The mine is owned by: Falconbridge, 85.26%; the Dominican Republic, about 10%; and Redstone Resources Inc., a subsidiary of Franco-Nevada Mining Corporation <<http://www.franco-nevada.com>>, about 4.1%.

Mineral Inventory to Year-End 2000

- Proven + probable reserves = 65.1 Mt @ 1.16% Ni.
- Indicated resources = 13.8 Mt @ 1.53% Ni.
- Inferred resource = 6.4 Mt @ 1.44% Ni.
- Stockpiled material added to probable reserves in 2000 is to be fed to the plant starting in 2002.

FALCONDO PRODUCTION

	1999	2000
	(t)	
Ni in FeNi production	24 500	27 800

2000 Notes

- Higher fuel costs had an impact on the economics of the operation; power plant and electric furnace problems reduced production by 1000 t from target.
- A labour contract was concluded in January, running until December 1, 2002.

Koniambo Project

<<http://www.falconbridge.com>>

Falconbridge can earn 49% of a joint venture with La Société Minière du Sud Pacifique S.A. (SMSP) and Société de Financement et d'Investissement de la Province Nord (SOFINOR), SMSP's controlling shareholder.

A laterite nickel mine and a FeNi smelter to produce 60 000 t/y Ni in FeNi, as well as a power plant and port, are being studied; a US\$85 million bankable feasibility study that started in the fourth quarter of 1998 is scheduled for completion in the fourth quarter of 2002.

Mineral Inventory

- Inferred resource = 151 Mt @ 2.58% Ni, 0.07% Co.

2000 Notes

- Diamond drilling, an environmental baseline study and scoping studies were completed.
- US\$21 million was spent in 2000.
- Requests for proposals to build a 300-MW power plant were sent out to qualified bidders.
- US\$40 million is budgeted for expenditure in 2001/02.

Gag Island Project - PT Gag Nickel

- Gas Island hosts a nickel-cobalt laterite deposit; Gag Island is located 150 km west of Irian Java in Indonesia.
- A 1997 prefeasibility study considered 40 000 t/y of nickel output.
- Ownership of PT Gag Nickel: BHP Limited, through BHP Asia Pacific Nickel Pty Ltd, 75%; PT Aneka Tambang (Persero) Tbk, 25%.

Mineral Inventory to Mid-2000

- Measured + indicated resources = 105 Mt @ 1.45% Ni, 0.07% Co.
- Inferred resource = 135 Mt @ 1.33% Ni, 0.09% Co.

2000 Notes

- A tentative agreement was reached in 2000 between Falconbridge and BHP Limited whereby Falconbridge could earn half of BHP's interest in PT Gag Nickel.

- Subject to final agreement, Falconbridge could fund a feasibility study costing US\$75 million to earn 37.5% of ownership by mid-2002.
- Regulatory issues to be resolved with the Indonesian Department of Forestry involve seeking recognition of PT Gag Nickel's prior right to use surface mining techniques in an area later decreed to be a protected forest.
- Agreement had not been finalized as of year-end.

La Société pour le Développement Minier de la Côte d'Ivoire

<<http://www.falconbridge.com>>

The Touba-Biankouma nickel-cobalt laterite resource, located in Ivory Coast 500 km inland, consists of four significant deposits: Sipilou North, Fougouesso, Moyango and Viala.

Other ore deposits include Sipilou South, Yamatoulo and Touba.

Development of infrastructure, including a railway to the coast and a developed energy supply, is needed to permit profitable development of the mine/hydrometallurgical processing facilities.

The project is owned by Falconbridge and the Ivory Coast government.

Mineral Inventory to Year-End 2000

- Indicated resource = 126 Mt @ 1.57% Ni, 0.11% Co.
- Inferred resource = 138 Mt @ 1.39% Ni, 0.12 % Co.

2000 Notes

- Test work on laterite ore processing options continued.
- In October, Consolidated Trillion Resources Ltd. sold its 15% interest in the Touba-Biankouma nickel-cobalt laterite deposit in Ivory Coast to Falconbridge International (Investments) Limited for US\$2.5 million.

INCO LIMITED

<<http://www.inco.com>>

Inco is the largest nickel producer in Canada (second largest in the world), producing nickel in various forms, including specialty products (e.g., powders and foams); by-products include Cu, Co, Au, Ag, PGMs, Se, Te, H₂SO₄ and liquid SO₂.

Inco's mines, smelters and refineries, associated plants, and projects in Ontario and Manitoba consist of:

- 12 mines;
- two concentrators;

- a nickel-copper smelting complex (including dryers and Pierce Smith converters) and a nickel smelter;
- two nickel refineries;
- one nickel oxide sinter plant;
- a copper refinery;
- a precious metals refinery;
- a cobalt refinery;
- an H₂SO₄ plant and a liquid SO₂ plant; and
- the Voisey's Bay project in Newfoundland and Labrador.

Inco has overseas facilities that it operates and owns varying percentages of:

- The International Metals Reclamation Company, Inc.'s (INMETCO) nickel-cadmium recycling plant in the United States, 100%;
- a nickel refinery in Wales, United Kingdom, 100%;
- a laterite nickel mining/smelting operation in Indonesia called PT International Nickel Indonesia Tbk (PT Inco), 59%; and
- a PGMs refinery at Acton, in London, United Kingdom, 100%.

Inco has a number of operations and a project in which it has varying degrees of ownership, including:

- a nickel refinery, Inco TNC Limited, in Japan, 67%;
- a nickel refinery, Korea Nickel Corporation (KNC), in South Korea, 25%;
- a nickel refinery, Taiwan Nickel Refining Corporation (TNRC), in Taiwan, China, 49.9%;
- a nickel salts plant, Jinco Nonferrous Metals Co., Ltd, in China, 65%; and
- a nickel laterite mine/hydrometallurgical project, Goro Nickel S.A., in New Caledonia, 85%.

Inco's nickel products include: cathode, high-purity pellets and powder, UTILITY™ nickel (about 97% Ni), nickel oxide sinter 75™ (75% Ni), various specialty products (e.g., INCOFOAM™, nickel disks), electrolytic cobalt (99.9% Co), and black cobalt oxide (about 71.5% Co as Co₃O₄).

Securities information is available on the Internet at <http://www.sedar.com/command_servlet?cmd=DisplayCompanyDocuments&issuerNo=00001084&lang=EN>.

Inco is owned 45% by Canadian residents, 54% by U.S. residents and 1% by others.

Nickel and By-Product Production in 2000

Cobalt sales, not production, is reported. The Cobalt Development Institute (CDI) shows production infor-

mation reported to it, indicating total Inco cobalt production as 1470 t in 2000 and 1420 t in 1999; 80% of Inco's cobalt production is sold as metal while the balance is sold as cobalt oxide.

Inco's PGMs production, principally from its mines in Sudbury, plus purchased material derived from spent automotive catalysts and other materials, totaled 10.7 t in 2000.

Inco also produced 114 397 t of copper in 2000. Gold deliveries were 2 t, silver deliveries were 42.4 t, and H₂SO₄ (sulphuric acid) plus liquid SO₂ deliveries totaled 578 000 t.

See tables below for nickel production.

INCO CORPORATE PRODUCTION

Region ¹	1999	2000	2001 ^f
(t)			
Ni from Ontario Division ^{2,3}	99 800	98 000	97 500
Ni from Manitoba Division ³	33 600	45 800	47 600
Ni from Indonesia (counting all PT Inco output)	43 500	59 000	63 500
Total counting all PT Inco output	176 900	202 700	208 600

^f Forecast released in third quarter of 2001.

¹ Data may not add due to rounding to nearest 100 t. ² Ontario Division includes nickel refinery in Clydach, Wales, where Inco operates a carbonyl nickel refinery, the U.K.'s only nickel refinery; U.K. refined nickel production was 38 100 t in 1999 and 38 000 t in 2000. ³ Data include material purchased and tolled from other locations, including concentrate from Australia and an undetermined amount of recycled nickel. ⁴ PT International Nickel Tbk's total production is shown by Inco as its total production; if only 59% of PT's output is assigned to Inco (Inco owns 59% of the equity), then the above table would become as restated in the table below.

INCO CORPORATE PRODUCTION RESTATED

Region ¹	1999	2000	2001 ^f
(t)			
Ni from Ontario ^{2,3}	99 800	98 000	97 500
Ni from Manitoba ³	33 600	45 800	47 600
Ni from Indonesia (counting 59% of PT Inco output)	25 700	34 800	37 500
Total counting 59% of PT Inco output	159 000	178 600	182 600

(Refer to the previous table for explanation of footnotes.)

2000 Corporate Notes

The buy-back of 26 million Class VBN shares was completed at a cost of \$7.50 per share plus 0.45 of an Inco Common Share purchase warrant with an exercise price of US\$30 per share.

Contracts were negotiated to import nickel concentrates from Australia for the Thompson/Sudbury smelters; the contracts are expected to supply 80 000 t of nickel in concentrates between 2000 and 2005 from the Cosmos mine and future Emily Ann mine in Australia.

The 1997 objective to cut costs by US\$250 million per year was met in 2000.

Negotiations with the Government of Newfoundland and Labrador about the Voisey's Bay project were halted in January and did not restart in 2000 (see Voisey's Bay below).

Sudbury, Ontario Operations

Inco has permission from the Province of Ontario to export the following intermediate products from ores mined in Ontario until year-end 2005:

- nickel oxide sinter and nickel sulphate residue to Inco's Clydach, Wales, in the United Kingdom; and
- semi-refined PGMs concentrate to Inco's PGMs refinery in Acton, U.K.

Production in 2000 was 98 000 t of finished nickel (this includes production refined at the Clydach refinery in the U.K.).

Mines operating at the end of 2000 (all underground except Gertrude) were Coleman, Copper Cliff North, Copper Cliff South, Crean Hill, Creighton, Frood, Garson, Gertrude, McCreedy East, and Stobie. (The Coleman, Crean Hill and Frood mines will close in 2001.)

Mill

- The Clarabelle mill is located between Inco's Copper Cliff North mine and the Copper Cliff smelter.
- Processes employed are crushing, grinding, flotation and magnetic separation.
- Mill capacity is 36 000 t/y.
- The mill head grade in 2000 was 1.57% Ni and 1.67% Cu, compared to 1.41% Ni and 1.40% Cu in 1999.

Smelting and Refining

- Nickel smelter smelts bulk Ni-Cu concentrate; after subsequent separation by slow cooling and milling, Ni is sent to matte plant and refinery;

capacity is 100 000 t/y Ni, subject to SO₂ emission limits.

- Matte processing plant produces nickel oxide sinter; capacity is 18 000 t/y.
- Nickel refinery uses the carbonyl process to produce high-purity nickel; capacity is 59 000 t/y.
- SO₂ emissions in 2000 were 13% below the provincial regulatory limit.

Mineral Inventory to Year-End 2000

- Proven + probable reserves = 225 Mt @ 1.30% Ni, 1.23% Cu.
- Ore grade mined in 2000 = 1.57% Ni, 1.67% Cu (1.41% Ni, 1.4% Cu in 1999).
- Inco's Sudbury by-product metals account for 70% of the company's cobalt production, 92% of its precious metal production, and 92% of its copper production. Only nickel is recovered from PT Inco in Indonesia.

2000 Notes

- A labour agreement in Sudbury and Port Colborne was signed in May; it runs from June 2000 to May 2003.
- Creighton Deep project: Ongoing work on US\$125 million development project at Creighton mine to produce 10 900 t/y Ni, 9500 t/y Cu and 0.88 t/y PGMs beginning in 2002:
 - Phase 1: 2.8 Mt proven ore @ 3.34% Ni, 2.8% Cu to start in 2001; reserves to 2013;
 - Phase 2: 3.4 Mt probable ore @ 3.77% Ni 3.5% Cu; to produce over the 2005-19 period.
- Stobie mine: Decision was made to develop the low-grade section of the mine, raising total mine production to over 20 000 t/y Ni for the period 2001-16.
- McCreedy East mine: US\$33 million mine expansion announced in July:
 - 7.6 Mt @ 1.88% Ni, 0.84% Cu, 0.91 g/t PGMs to be developed;
 - full production expected by late 2004 will raise output of McCreedy East mine from 13 150 t/y to 21 800 t/y Ni;
 - exploration continued on high-grade PGMs deposit and will extend into 2001.
- Totten discovery:
 - exploration continued on 7.6 Mt @ 1.28% Ni, 1.73% Cu, 4.3 g/t PGMs probable ore discovered in 1999;
 - ore accessible from Totten shaft (maintained on standby basis);
 - environmental permitting to commence in 2001;
 - initial production targeted by 2005.
- Copper Cliff North mine:
 - in addition to Ni and Cu production, a high-grade PGMs orebody went into production in the fourth quarter producing from reserves of 0.3 Mt @ 0.9% Ni, 4.5% Cu, 16.4 g/t PGMs;
 - more drilling of the PGMs orebody is planned in 2001.

- Pump Lake deposit:
 - exploration continued on precious-metal-rich zone located 2.5 km north of Copper Cliff South shaft; more exploration planned in 2001.
- Kelly Lake deposit:
 - exploration continued of 5.9 Mt of probable ore @ 2.07% Ni, 1.38% Cu, 4.2 g/t PGMs plus Au;
 - ore discovered in 1997, located 2 km south of Copper Cliff South shaft;
 - announcement in March that development decision is expected in 2000, but no decision was announced in 2000.
- Victor Deep project: additional engineering studies were completed; further exploration from surface was undertaken in 2000 and is to continue in 2001.
- Clarabelle mill:
 - handles all mine ore production from Inco's Sudbury operations;
 - increased recovery by 2.5% during 1999-2000 with plans to increase by a further 2% in 2001.
- Ongoing work to develop additional means to reduce SO₂ emissions from Sudbury operations.

Thompson, Manitoba Operations

Production in 2000 was 46 000 t finished Ni. Underground mines operating at the end of 2000 were Thompson and Birchtree.

Mineral Inventory to Year-End 2000

- Proven + probable reserves = 42 Mt @ 2.26% Ni, 0.14% Cu.
- Ore grade mined in 2000 = 2.38% Ni (2.47% Ni in 1999).

Mill

- Thompson mill is located on the same site as the Thompson mine.
- Processes employed are crushing, grinding and flotation.
- Mill capacity is 16 000 t/d.
- The mill head grade in 2000 was 2.38% Ni (no Cu grade disclosed) compared to 2.47% in 1999.

Smelting and Refining

- Nickel smelter smelts partially roasted nickel concentrate in electric furnaces for feed to electrolytic refinery; copper concentrate from Manitoba ores is sent to the company's Sudbury smelter for processing.
- Nickel refinery produces both cathode and plating-grade nickel rounds¹ by electrolytic process; total capacity is 55 000 t/y.
- SO₂ emissions limit nickel output; emissions were 2% below the provincial regulatory limit in 2000.

2000 Notes

- Full production resumed in January (the Thompson operations restarted in December 1999 when a labour contract was signed after a strike in 1999).
- US\$48 million Birchtree mine deepening project was announced in January to develop 13.6 Mt @ 1.79% Ni:
 - project is sufficient to extend the mine life for at least 15 years, permitting mine production to increase to 3175 t/d of ore from the existing 1635 t/d;
 - project completion target is 2002.
- Exploration work in the Thompson area included drilling and geophysical work; further drilling is planned in 2001.
- Phasing out of copper smelting at Thompson was completed.
- Imported and processed 1300 t of nickel in concentrate from Jubilee Mines NL's Cosmos pit during 2000; Jubilee shipped further additional material from Australia in October and December.
- Various nickel properties/exploration projects in Manitoba could provide the Thompson smelter with opportunities for future concentrate feed, including the Mel project and the Minago deposit.
 - Mel project:
 - Inco agreement with Nuinsco Resources Limited <<http://www.nuinsco.ca>> in 1999 in which Nuinsco has option to acquire up to 100% of the Mel property, subject to a number of conditions;
 - deposit discovered by Inco in 1961; indicated resource of 0.29 Mt @ 1.69% Ni plus 0.26 Mt @ 1.69% Ni, based upon 1.25% Ni cut-off, to depth of 230 m;
 - Nuinsco's target is to outline at least a 0.8-Mt resource grading at least 1.6% Ni accessible by ramp, to a depth of 250 m, with milling to be done at the Thompson mill, 40 km away;
 - drilling started in early 2000; more work is scheduled in 2001.
 - Minago deposit:
 - purchased by Nuinsco in 1999 from Black Hawk Mining Inc. <www.bhmining.com>;
 - probable reserves of 5.4 Mt @ 1.17% Ni plus possible resource of 5.2 Mt @ 1.21% Ni; Pd and Pt are also present.

Port Colborne Refinery

<<http://www.inco.com>>

- Produces cobalt by electrolytic refining.
- Recovery of nickel from material in process.
- Precious metals upgrading.
- Cobalt production data not released; The Cobalt Development Institute reports Inco total cobalt production at 1470 t.

¹ "S" rounds and "R" rounds.

Clydach Refinery<http://www.inco.com>

- Carbonyl nickel refinery located near Swansea, United Kingdom.
- Production capacity of 40 000 t/y high-purity nickel as pellets, powder and specialty products such as INCOFOAM™.
- Refinery takes nickel oxide sinter, nickel sulphate matte, and nickel sulphate residue from Sudbury, with permission of the Ontario government for export, for feed to the carbonyl process.
- Nickel oxide residues are returned to Sudbury for subsequent processing to remove by-product metals.
- Ownership: Inco Limited, 100% (plant output considered to be part of the "Ontario Division" production).

CLYDACH PRODUCTION

	1999	2000
	(t)	
Ni	38 100	38 000
Co	n.a.	n.a.

Source: INSG data for U.K. production of refined nickel.
n.a. Not applicable.

2000 Notes

- First INCOFOAM™ line reached full production rate.
- Second INCOFOAM™ line was commissioned to produce nickel foam material for batteries in vehicles using electric drive and in cordless consumer products.

PT International Nickel Indonesia Tbk (PT Inco) <http://www.inco.com>

- Nickel laterite mine and four electric furnaces located in Sorowako, Sulawesi, Indonesia.
- Produces nickel in matte grading 77-80% Ni; capacity is 68 000 t/y Ni in matte.
- Owns 165-MW and 93-MW hydro-electric generating facilities to produce low cost of power, but still requires 2.6 million barrels per year of oil.

- Matte production is exported to Japan: 80% to Inco TNC and 20% to Sumitomo.
- The company ownership is: 59%, Inco Limited; 20%, Sumitomo Metal Mining Co., Ltd.; and 20%, public holdings.

PT INCO PRODUCTION

	1999	2000
	(t)	
Ni in matte	45 000	59 200

Mineral Inventory to Year-End 2000

- Proven reserves = 91 Mt @ 1.82% Ni.
- Probable reserves = 10 Mt @ 1.79% Ni.
- Indicated + inferred resources = 301 Mt @ 1.81% Ni.

2000 Notes

- Ongoing ramp-up of US\$633 million expansion (completed in 1999) from 45 000 t/y to 68 000 t/y Ni in matte; design capacity is expected to be reached by year-end 2001.
- A two-year labour agreement, negotiated in December, extends to November 2002.

Inco TNC Limited<http://www.inco.com>

- Nickel refinery located at Matsuzuka, Japan.
- Capacity expansion to 60 000 t/y from 40 000 t/y was completed in 1998.
- Imports nickel matte from PT Inco in Indonesia to produce nickel oxide sinter (75% Ni) plus a low-grade refined nickel brand (Tonimet, about 96% Ni).
- The company ownership is: Inco Limited, 67%, and Sumitomo Metal Mining Co., Ltd., about 13%.

INCO TNC PRODUCTION

	1999	2000
	(t)	
Contained Ni	30 000	48 000

Jinco Nonferrous Metals Co., Ltd.<http://www.inco.com><http://www.jnmc.com/cn/engjnm>

- Produces nickel salts for plating (nickel chloride and nickel sulphate).
- Located near Shanghai.
- Ownership: Inco Limited, 65%, and Jinchuan Nonferrous Metals Corporation, 35%.
- Nickel sulphate production increased in 2000 (no production data were released).

Korea Nickel Corporation (KNC)

- 32 000-t/y refinery located in Onsan, South Korea.
- Imports nickel oxide sinter to make UTILITY™ nickel (97% Ni content).
- New refinery was officially inaugurated in August 1999; old 16 500-t/y plant was placed on standby.
- Ownership: Inco Limited, 25%, and Korea Zinc Co., 19%.

KNC PRODUCTION¹

	1999	2000
		(t)
Contained Ni	19 000	29 000

¹ This production is considered to be reprocessing, not primary, production as KNC takes a finished product (nickel oxide sinter grading about 75% Ni, which can be used directly by the stainless steel industry) and transforms it into another finished product as noted above.

2000 Notes

- Production was limited by a lack of feed during 2000.
- Imports of nickel oxide sinter during 2000 were 37 700 t (gross weight, containing about 29 000 t Ni, assuming material graded 77% Ni), sourced principally from Japan.

Taiwan Nickel Refining Corporation

- Refinery was completed in 1983 by a partnership of Inco Limited and Talent Metal Company at Kaohsiung Hsien, Taiwan; it is the only nickel refinery in Taiwan, China.

- Imports nickel oxide sinter to make UTILITY™ nickel (97% Ni content).
- Capacity: 14 000 t/y (1993).
- Taiwanese imports of nickel oxide sinter were 10 767 t in 1999 and 11 586 t in 2000.
- Assuming that all these imports were refined at Taiwan Nickel, that the nickel oxide sinter averaged 77% Ni content, and that the nickel recovery rate in the plant was above 99%, then the implied throughput of the plant averaged in the order of 8300-8600 t/y over the period 1999-2000.
- Ownership: joint venture with Inco Limited owning a 49.9% interest.
- This production is considered to be reprocessing, not primary, production because Taiwan Nickel takes a finished product (nickel oxide sinter grading about 75% Ni, which can be used directly by the stainless steel industry) and transforms it into another finished product, as noted above.

Voisey's Bay Project, Newfoundland and Labrador <http://www.inco.com>

- Large sulphide nickel-copper-cobalt deposit located in Newfoundland and Labrador, close to the Atlantic Ocean near the town of Nain.
- The federal and provincial government responses to the Environmental Assessment Panel report released in mid-1999 allow Voisey's Bay Nickel Company Limited to apply for the licences required for the project to proceed.
- The federal government response of 1999 was challenged by the Labrador Inuit Association and Innu Nation in 1999. The challenge was subsequently stayed a number of times until mid-2001.
- Separate negotiations by Inco with the Labrador Inuit Association and Innu Nation were halted after the Inco-province impasse over further processing in the province (see below).
- Ownership: 100% Inco Limited through its subsidiary, Voisey's Bay Nickel Company Limited.

Mineral Inventory to Year-End 2000

- Ovoid, Eastern Deeps, Western Extension and other smaller zones contain:
 - proven open-pit reserves at the Ovoid Zone = 32 Mt @ 2.83% Ni, 1.68% Cu, 0.14% Co;
 - indicated open-pit resources = 10 Mt @ 0.92% Ni, 0.72% Cu;
 - indicated + inferred underground resources = 99 Mt @ 1.27% Ni, 0.59% Cu.

2000 Notes

- Negotiations with the Government of Newfoundland and Labrador broke off in early January over processing conditions, namely, the provincial government wanted a guarantee that processing would take place in the province whereas Inco wanted the ability to send nickel concentrate to existing facilities in Ontario and Manitoba for some period of time.
- In early January, Inco announced that it had been considering a project consisting of:
 - a US\$500 million, 6000-t/d mine/mill;
 - a US\$95 million underground exploration project, including shaft sinking; and
 - a US\$125 million research and development program, including a pilot plant for a hydrometallurgical process to treat nickel sulphide concentrates.
- Share redemption was approved by shareholders in November giving Inco 100% ownership in Class VBN shares.
- NM Rothchild & Sons' valuation of Class VBN shares included Rothchild's two scenarios for possible development at Voisey's Bay:
 - Scenario one: 25-year life, 50 000-t/y project with 50 000-t/y hydrometallurgical plant; and
 - Scenario two: 25-year life, 81 500-t/y project with 50 000-t/y hydrometallurgical plant.
- Further details can be found in Schedule A of Inco's prospectus dated September 15, 2001, available on the Internet at <<http://www.sedar.com/csfsprod%2Fdata21%2Ffilings%2F00298207%2F00000001%2FC%3A%5CMyFiles%5CInco%5CBanjo%5Ccircuar.pdf>>.
- Process R&D work for hydrometallurgical recovery of Voisey's Bay nickel-cobalt concentrate continued; integrated mini-pilot plant testing was expected to commence in 2001.
- Cost of exploration activities in 2002 was US\$6 million for:
 - 9600 m of Eastern Deeps definition drilling;
 - grass-roots exploration targets tested at Ryan's Pond, Red Dog and Sarah targets;
 - drilling at Ryan's Pond;
 - geophysical work and limited drilling at Nain Bay South; and
 - 16 000 m of drilling planned in 2001 for further definition drilling at Eastern Deeps and continued drilling at Ryan's Pond.

Goro Nickel S.A. Project

<<http://www.inco.com>>

- Inco Limited's subsidiary, Inco S.A., owns 85% of Société Minière de Xéré with Bureau de Recherches Géologiques et Minières de France (BRGM) owning the remaining 15%.
- Société Minière de Xéré owns 100% of Goro Nickel S.A., the company that will operate the Goro project.

- A US\$50 million pilot plant operating since late 1999 is testing a proprietary pressure acid leach/solvent extraction process (PAL-SX).
- The plant is designed to operate at high temperatures and high pressures to allow increased throughput relative to lower-pressure PAL plants.
- A US\$1.3 billion-\$1.4 billion mine and hydrometallurgical plant are planned with a capacity of 54 000 t/y Ni in nickel oxide and 5400 t/y Co in the form of intermediates or metal.

Mineral Inventory to Year-End 2000

- Proven + probable reserves = 47 Mt @ 1.59% Ni, 0.17% Co.
- Measured + indicated + inferred resources = 219 Mt @ 1.57% Ni, 0.18% Co.

2000 Notes

- The hydrometallurgical pilot plant continued operations through 2000.
- Detailed design for a bankable feasibility study is under way; negotiations with the government about the tax regime continued, as did the search for potential partners and financing.
- There was an announcement in December of a further US\$100 million commitment to continue work in 2001 to prepare for the construction phase.
- Work planned for 2001 includes:
 - completing the bankable feasibility study in the first quarter of 2001;
 - finishing basic engineering;
 - obtaining environmental permitting;
 - finalizing the tax regime;
 - negotiating financing;
 - bringing a partner into the project; and
 - a final project decision is expected by mid-2001.

SHERRITT INTERNATIONAL CORPORATION <<http://www.sherritt.com>>

Sherritt International Corporation owns a 50% stake in Metals Enterprise, which in turn owns a laterite nickel-cobalt operation in Cuba and a hydrometallurgical nickel-cobalt plant at Fort Saskatchewan, Alberta. The other owner of Metals Enterprise is Compañía General de Niquel S.A. (GNC).

Metals Enterprise runs its operations in Cuba through Moa Nickel S.A., which operates the mine and the acid leach plant; the facility produces a high-grade nickel-cobalt sulphide material that is exported to Canada. Metals Enterprise owns The Cobalt Refinery Company Inc. (CRC), which operates the hydrometallurgical refinery in Canada. The feed from Cuba enters Canada classified under the Harmonized System classification of HS 2620.90, which records only gross tonnage and gross value.

Securities information is available on the Internet at <http://www.sedar.com/command_servlet?cmd=DisplayCompanyDocuments&issuerNo=00002460&lang=EN>.

Ownership: The Chairman of the Board of Sherritt International Corporation holds all of the multiple voting shares, giving him sufficient votes to elect a majority of the directors to the Board, subject to the limitations contained in its articles of incorporation. These limitations include provisions that the multiple voting shares are non-transferable, are not entitled to any dividends or distributions of assets, and are automatically converted into restricted voting shares on a share-per-share basis upon the occurrence of certain events.

2000 Corporate Notes

Sherritt increased its holdings in Anaconda Nickel Limited from 8.9% to 9.4%.

Sherritt purchased \$75 million of its convertible debentures during the year; Deutsche Bank Canada contested the purchases in court and the case was unresolved at year-end.

Metals Enterprise

Metals Enterprise was formed in November 1995; it is a joint venture of Sherritt International Corporation and Compañía General de Niquel S.A. (GNC), which owns:

- Moa Nickel S.A., which operates a laterite nickel-cobalt laterite open-pit/pressure acid leach facility in Cuba yielding a high-grade nickel-cobalt sulphide;
- The Cobalt Refinery Company Inc. (CRC), which operates a nickel-cobalt refinery at Fort Saskatchewan, Alberta, that uses the nickel-cobalt material from Moa as its principal feed source (imported as HS2620.90, reported as gross tonnage); and
- International Cobalt Company Inc. (ICCI), which sources feed and markets nickel and cobalt output.

Sales arrangements for Metals Enterprise are:

- ICCI sells cobalt briquettes and powder through Sherritt International; and
- ICCI sells nickel powder and briquettes through its exclusive sales agent, Empresa Cubana Exportadora de Minerales y Metales (Cubaniquel).

Moa Nickel S.A. - Pedro Soto Alba Mine/Leach Plant <<http://www.sherritt.com>>

- A nickel-cobalt laterite mine plus pressure acid leach plant, located in Holguin Province, Cuba, about 5 km from the town of Moa.
- Mined ore is dissolved in sulphuric acid, then precipitated by H₂S gas under pressure to form a mixed nickel-cobalt sulphide material.
- Two orebodies are mined, Moa Occidental and Moa Oriental, with a cut-off grade of about 1% Ni.
- A mining concession was awarded to Moa Nickel S.A. in 1994 by the Cuban government.
- In the mid-1990s, consideration had been given to increasing the mine and leach plant throughput to produce 40 000 t/y of nickel plus cobalt in mixed sulphides.
- Ownership: Metals Enterprise, 100% (which in turn is owned 50% by Sherritt International Corporation and 50% by Compañía General de Niquel S.A.).

MOA BAY PRODUCTION

	1999	2000
	(t)	
Ni + Co in mixed sulphide output	27 020	29 520

Mineral Inventory

- Proven ore = 35.5 Mt @ 1.25% Ni, 0.14% Co.
- Probable ore = 2.4 Mt @ 1.16% Ni, 0.13% Co.
- An ore reserve re-evaluation in 2000 resulted in a downward revision by 6.1 Mt (which has been incorporated into the data above).

2000 Notes

- Mining began in the higher-grade Moa Oriental deposit in the fourth quarter of 2000; Moa Occidental had previously been the only source of ore.
- A new record was established for the production of nickel and cobalt in mixed sulphides due to higher-grade ore feed and debottlenecking, including a new thickener.
- Moa's production rate at the end of the last quarter of 2000 was equivalent to an annualized rate of 31 000 t/y of nickel plus cobalt in mixed sulphides.

The Cobalt Refinery Company Inc.

<<http://www.sherritt.com>>

- An ammonia leach, hydrogen reduction refining process with associated fertilizer production (original "Sherritt leach process"), located at Fort Saskatchewan, Alberta.
- Produces nickel powder and nickel briquettes, and cobalt powder and cobalt briquettes.
- Plant capacity = 30 000 t/y Ni, 3000 t/y Co, plus 165 000 t/y of ammonium sulphate fertilizer.
- Plant obtains feed from Moa Bay as mixed nickel-cobalt sulphides sent by ship to Nova Scotia, which is then railed to the refinery; feed from other sources is also obtained.
- Yearly output has increased progressively through debottlenecking.
- Ownership: Metals Enterprise, 100% (which in turn is owned 50% by Sherritt International Corporation and 50% by Compañía General de Niquel S.A.).

COBALT REFINERY COMPANY PRODUCTION

	1999	2000
	(t)	
Ni metal	28 643	28 070
Co metal	2 770	2 855

Note: Sherritt and GNC each get 50% of the above tonnages.

2000 Notes

- Record cobalt production.
- Plant debottlenecking continued, raising capacity by 1000 t/y.
- Production in 2001 is likely to increase as Metals Enterprise's Moa Bay mine is expected to increase production to 31 000 t of nickel plus cobalt in mixed sulphides.

CANMINE RESOURCES CORPORATION

<<http://www.canmine.com>>

Canmine owns a refinery and three mining projects. The refinery and Werner Lake cobalt mine project are in Ontario. The Maskwa mine project and the BINCO nickel exploration project are in Manitoba.

Canmine is modernizing and expanding its hydrometallurgical cobalt-nickel refinery to process future feed from existing stockpiled material and from future Canmine mining in Canada. Canmine will also be able to process custom feed materials at the refinery once refurbishment is completed.

Securities filings are available on the Internet at <http://www.sedar.com/command_servlet?cmd=DisplayCompanyDocuments&issuerNo=00012293&lang=EN>.

Canmine Refinery

- The hydrometallurgical cobalt-nickel refinery at Cobalt, Ontario, was purchased in late 1999 after the bankruptcy of Cobatec Inc.; the recovery of other metals such as copper, silver, gold or PGMs is possible.
- A \$5.3 million refurbishment project is under way by AGRA Simons Ltd. to produce cobalt and nickel chemicals; initial capacity of 300 t/y of Co in chemicals; no production took place in 2000.
- Cobalt carbonate output supply contract with Sheppard Chemical Company of the United States is in place.
- Future feed sources: cobalt feed from the Werner Lake mine project (see below) and nickel-cobalt feed from the Maskwa mine project (see below).
- Subsequent refinery expansions to 1000 t/y Co and then to 2000 t/y Co are envisaged.
- Nickel recovery is to commence when refinery feed is sourced from the future Maskwa mine project (see below) or from purchased material.

2000 Notes

- Purchase of 13 100 t of stockpiled material from Agnico-Eagle Mines Limited, located 45 km from the refinery.
- Stockpile grade = 1.76-3.12% Co, 1275 g/t Ag (an estimated 225-400 t Co and 6.7 t Ag contained).
- Sufficient stockpile for two to three years of operation.
- An Ag recovery circuit to be installed to process initial feed.
- Commenced drilling on nearby Temagami Cobalt Property at Emerald Lake, located 40 km from the company's refinery; the goal is to define ore zones that could supplement stockpile material feed.

BINCO Nickel Exploration Project

- 165 000 ha of claims northeast of Thompson, Manitoba, held by BINCO Resources Corporation, which is wholly owned by Canmine.

- \$2 million drilling program announced in late 2000 to drill 25 holes.
- BINCO Resources is to become a public company; regulatory approval is pending.

Maskwa Mine Project

- Nickel-copper-cobalt project in Manitoba with reserve plus resource consisting of 2.65 Mt @ 1.27% Ni, 0.04% Co, 0.21% Cu, 2.8 g/t Pt, and 0.96 g/t Pd (previous articles in the *Canadian Minerals Yearbook* showed tonnage incorrectly because short tons were not converted to tonnes).
- The capital cost for mine/mill development is estimated at \$20 million-\$60 million.
- Environmental permits from the province are required prior to construction.

Werner Lake Cobalt Mine Project

- Deposit is located in western Ontario, close to the Manitoba border; access is by road from Manitoba.
- 300-t/d underground mine operation is planned; ore is to be trucked to the Maskwa site (see above) for milling; concentrate is to be sent to Canmine's refinery in Cobalt, Ontario, for processing into cobalt carbonate.
- West Cobalt Zone reserve plus resource is estimated at 1.1 Mt @ 0.31% Co, 0.29% Cu, 0.34 g/t Au.

NORTH AMERICAN PALLADIUM LTD.

<<http://www.napalladium.ca>>

The company owns the Lac des Iles open-pit palladium mine/mill, located 85 km north of Thunder Bay, Ontario. Concentrate is shipped to Inco and Falconbridge in Sudbury under agreements to March 2006. Nickel is produced as a by-product of palladium mining (the ore also contains recoverable Pt, Au and Cu).

Securities filings are available on the Internet at <http://www.sedar.com/command_servlet?cmd=DisplayCompanyDocuments&issuerNo=00003026&lang=EN>.

A Labour agreement with United Steelworkers of America-Canada, Local 9422, expires in 2006.

Ownership: The operating company, Lac des Iles Mines Ltd., is owned 100% by North American Palladium.

NORTH AMERICAN PALLADIUM

	1999	2000
	(t)	
Ni in concentrate	442	470

Mineral Inventory to Year-End 2000

- Proven + probable reserves = 96 Mt @ 1.55 g/t Pd, 0.055% Ni.
- Measured + indicated resources = 49 Mt @ 1.62 g/t Pd, 0.05% Ni.
- The mineral inventory also includes Pt, Au and Cu.

2000 Notes

- \$200 million mine/mill expansion from 2400 t/d to 15 000 t/d continued.
- New 15 000-t/d mill is being built for expansion; once completed and commissioned in 2001, the 2400-t/d mill will close.
- Expansion project was 70% completed by year-end.
- The expansion is scheduled for completion in 2001 and is expected to operate at capacity in 2002.
- Long-term average production is expected to be 900 t/y Ni plus 7.78 t/y Pd, 0.7 t/y Pt, 0.65 t/y Au and 2700 t/y Cu.
- Exploration drilling continues in 15 000 ha of claims and leases within 25 km of the mine.

WORLD COBALT PRODUCTION

World cobalt mine and metal production data by country from the International Consultative Group on Nonferrous Metals Statistics for the period 1991 to 2000 are presented in Figures 3 and 4. Table 9 presents CDI information about refined cobalt availability by company for the period 1996 to 2000.

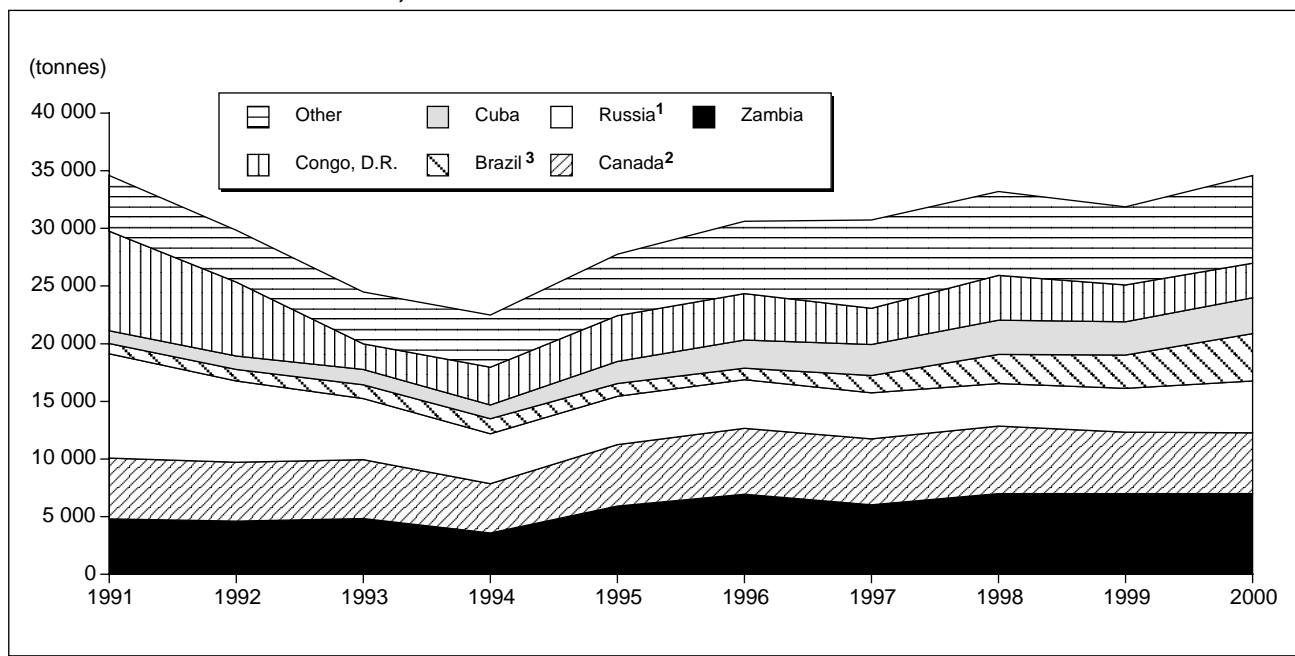
NICKEL USE

Canadian data on nickel use, including nickel in scrap, are presented in Figure 5.

The important world markets for primary nickel are shown in Figure 6. In addition to the 1.1 Mt of primary nickel used in 2000, there were approximately 600 000 t of nickel contained in stainless steel scrap used by stainless steel mills in 2000 (see "Recycling" below).

The stainless steel industry is the largest user of nickel, both in the primary and recycled forms; stainless steel production reached an estimated 18.5 Mt in 2000, up from 17 Mt in 1999.

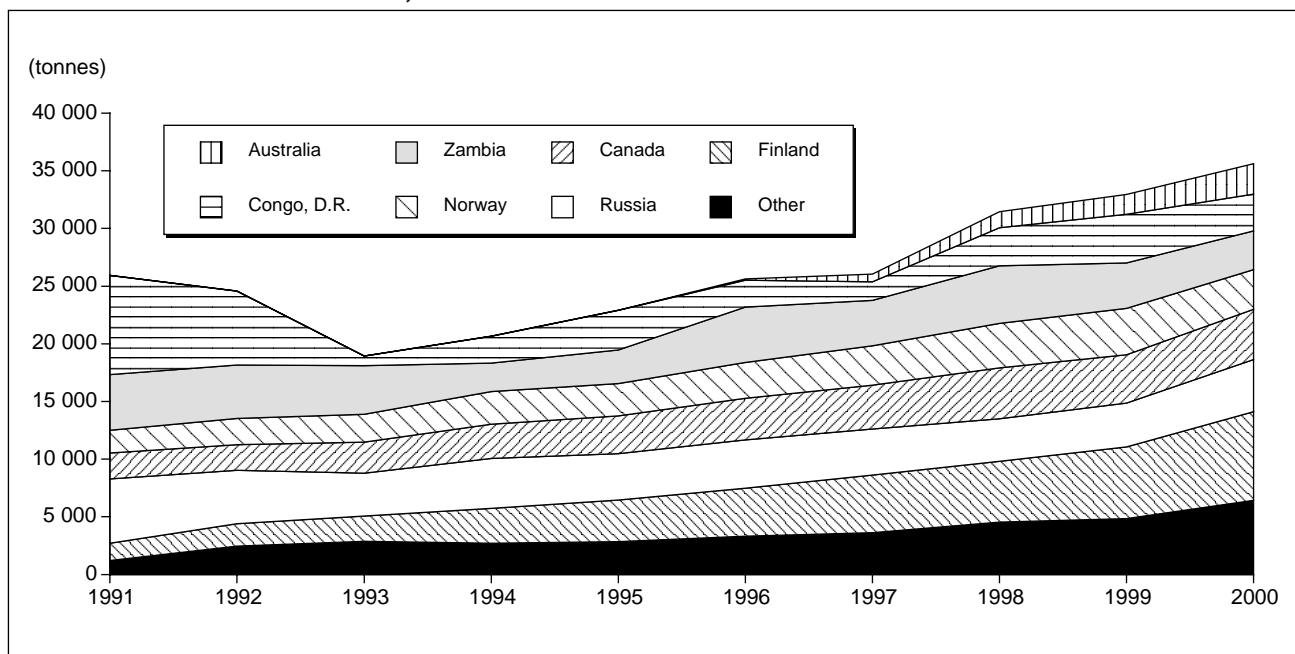
Figure 3
World Mine Cobalt Production, 1991-2000



Source: International Consultative Group on Nonferrous Metals Statistics.

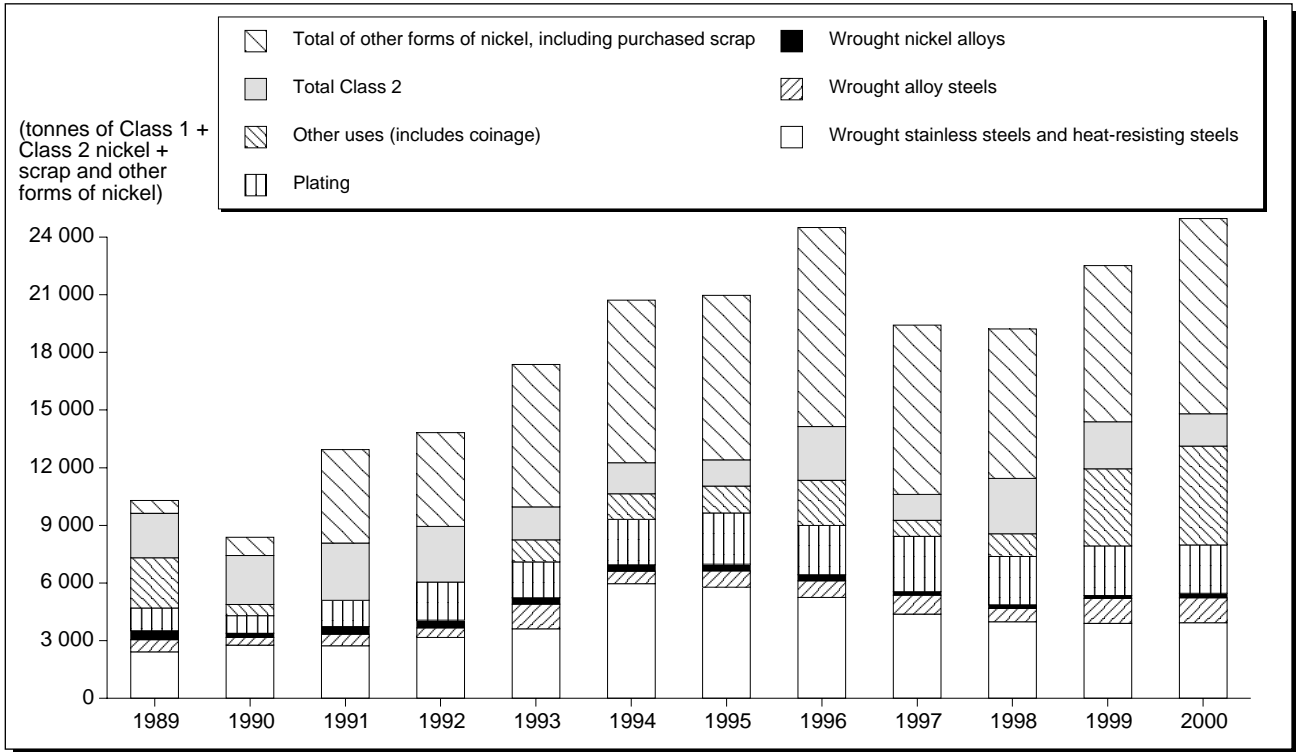
¹ Cobalt metal. ² Cobalt content in concentrates produced. ³ Cobalt content in ores.

Figure 4
World Cobalt Metal Production, 1991-2000



Source: International Consultative Group on Nonferrous Metals Statistics.

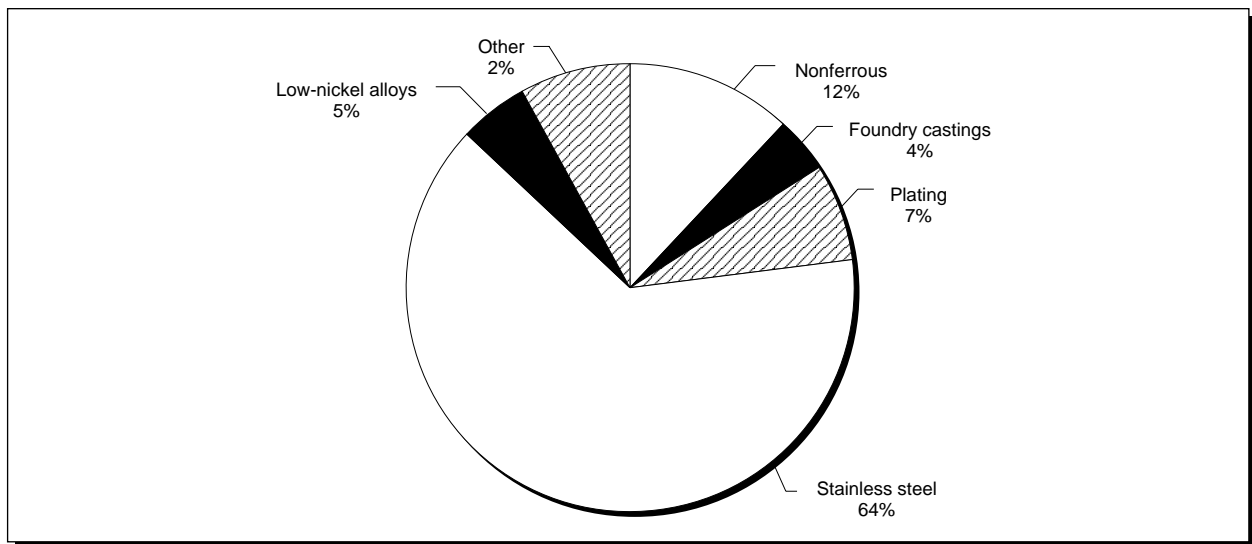
Figure 5
Canadian Use of Nickel, Including Nickel in Recycled Forms (Scrap, Etc.), 1989-2000



Source: Natural Resources Canada.

Notes: Class 1 nickel has a nickel content of more than 99% nickel. Class 2 nickel has a nickel content of less than 99% nickel.

Figure 6
Western World Nickel Use, 2000



Source: Inco Limited's 10K report, 2000.

Note: Western World excludes the Russian Federation, China, Cuba, the former Eastern Europe and the C.I.S.

Stainless steel producers can use either nickel in stainless steel scrap (which also contains needed iron and chromium) or nickel from primary producers in various forms such as nickel oxide sinter, ferro-nickel (FeNi), or high-grade finished nickel forms such as cut cathodes or briquettes.

Stainless steel producers can vary the proportion of the nickel that they use in primary or recycled forms, depending upon prices and availability of each material. Usually stainless producers can obtain a tonne of nickel in recycled material cheaper than a tonne of nickel in primary form. According to Inco Limited's 10K report for 2000, about 48% of the nickel used to make stainless steel in the Western World in 2000 was obtained from scrap, compared to 44% in 1999. Thus, the Western World stainless steel industry sourced a minimum of about 500 000 t of nickel in scrap during 2000; this compares with approximately 535 000 t of primary nickel used in the Western World to make stainless steels.

A steel is "stainless" or corrosion-resistant when it contains a minimum of 10.5% chromium by weight. A thin film of chromium oxide adheres to the surface of stainless steel; when damaged, this film is self-healing if sufficient oxygen is present. The presence of nickel gives stainless steel superb resistance to corrosion, even in harsh operating environments. The common form of stainless steel that contains nickel is called "austenitic." Its weldability characteristics are very good, making it a good choice for construction. Austenitic stainless steel has exceptional resistance to extreme temperatures. In addition, austenitic stainless steel is very easily cleaned and therefore has excellent hygienic characteristics.

Stainless steel comes in a variety of grades and types. The most common grade is A 304, composed of 18-20% chromium and 8-10.5% nickel, with almost all of the remainder as iron. While austenitic stainless steel contains nickel, ferritic stainless steel need not. A guide to these two types of stainless steel and others can be found at The Specialty Steel Industry of North America's Internet sites at <<http://www.ssina.com/stainless.html>> and <<http://www.ssina.com/student.html>>.

General information on stainless steels can be found on Outokumpu Oyj's Internet site at <<http://www.outokumpu.com/steel/pprod4.htm>>. Additional information is available from the International Iron and Steel Association's Internet site at <http://www.worldsteel.org/issf/issf_about/index.html>. A list of stainless steel producers and organizations can be found at <<http://www.mlc.lib.mi.us/~stewarca/stainless.html>>.

Stainless steel and high-nickel alloys are used in many applications, including:

- gas turbines,
- petroleum refining,
- the chemical industry,
- the food industry,
- flue gas desulphurization plants,
- liquified petroleum gas tank liners,
- cryogenic applications,
- coinage,
- electronics,
- surgical equipment and implants,
- batteries (nickel-cadmium, nickel-iron, and nickel-metal hydride cells), and
- household goods (such as cutlery, appliances, sinks, building facings and building trim).

Various car manufacturers continued their work on the development of nickel-metal hydride batteries to power electric and hybrid cars.

The term "use" replaces the term "consumption" in this publication. "Use" reflects the fact that nickel, like most metals, is not "used up" in the same manner that fuel oil, natural gas or food are "used up" when consumed. Nickel, when used, is largely available for re-use at the end of the service life of the product containing that nickel.

Stainless steel production grew at a high rate during the first half of the year and then slowed during the third quarter. By the fourth quarter, producers had cut back and the stainless industry was destocking (sales exceeded production as the stainless industry reduced inventories). With stainless steel being such a large sector for primary demand, nickel prices fell. By year-end, the outlook was negative for stainless steel growth and little chance of recovery was foreseen until the second half of the year. For example, Macquarie Research Equities calculated changes in "apparent consumption" in the United States for each quarter in 2000 compared to a year earlier; the data show the decline compared to the same periods in 1999.

Year 2000 Quarter	% Change in Apparent Use compared to Same Period in 1999	Apparent Use
	(%)	(000 t)
First	24.2	836
Second	14.1	833
Third	-7.4	703
Fourth	-25.3	620

COBALT USE

Information about cobalt uses can be obtained from: Canmine's internet site at <<http://www.canmine.com/me/index.html>> (click on "cobalt market"), The Cobalt Development Institute's Internet site at <<http://thecdi.com>>, the U.S. Geological Survey's Internet site at <<http://minerals.usgs.gov/minerals/pubs/commodity/cobalt>>, and the OM Group's Internet site at <<http://www.omgi.com>>.

At the OM Group site, click on the button marked "Select a Category"; this leads the viewer to a series of application titles (see table below). Each title can be clicked on for more information about the specific application.

Canadian cobalt use is reported in Table 2B.

HEALTH AND THE ENVIRONMENT

Nickel is a naturally occurring element that exists in bedrock, soil, groundwater, rivers and the ocean. Nickel is also believed to make up a large percentage of the earth's core and is considered to be an essential element for plants and most animals. It has been proven to be an absolute growth requirement for certain types of bacteria and algae, and nickel deficiencies in animals have been linked to growth retardation. Besides being an essential element for plants and many animals, it is the view of many experts that nickel is likely an essential element for humans as well.

The average human body contains an estimated 7-10 mg of nickel, and nickel is present in human fetal tissue. Food is the major route for nickel intake by humans. Ingestion of nickel has not been shown to be either a cause of cancer in humans or a cause of nickel sensitivity. The principal health risks associated with oxidic, sulphidic and soluble nickel compounds include lung or nasal cancer and contact dermatitis.

Nickel dermatitis is caused through long-term direct or indirect contact of the skin with certain nickel-containing items that can dissolve in sweat and penetrate the skin. It is estimated that 10-20% of women and 1-2% of men are "sensitive" to nickel, with nickel dermatitis being one of the principal adverse health effects. However, many nickel alloys, including stainless steel, do not react with sweat and therefore do not cause a nickel allergy.

In the past, increased rates of lung and nasal cancers were experienced by personnel employed in certain dusty nickel-processing facilities where most of the workers involved were also exposed to many other substances in the dust (in some cases, arsenic, and where tobacco smoking was a compounding factor).

More information about nickel-specific health issues can be found at the Nickel Producers Environmental Research Association (NiPERA) Internet site at <<http://nipera.org>>.

In April, in the United States, the National Toxicology Program announced its intention to review certain materials for possible listing in its *Report on Carcinogens, Tenth Edition*. Nickel and nickel compounds, including metallic nickel and nickel alloys, were named in a list that also contained lead and lead compounds, broad spectrum UV radiation, and wood dust. Public comments were received during the year. More information is available on the Internet at <<http://ntp-server.niehs.nih.gov>>.

RECYCLING

Nickel is an element that is intensively recycled. This recycling is driven by economic incentives, not government subsidies. The major competitor for primary nickel's biggest market, stainless steel-making, is nickel in scrap. In the Western World, Inco estimated that about 48% of the nickel needed by the austenitic stainless steel industry is obtained in the form of stainless steel scrap. Stainless steel scrap not only contains nickel, but also chrome and iron, which are needed to produce austenitic stainless steel.

COBALT APPLICATIONS

Batteries/Rechargeable Cells	Copper Powders	Petrochemical Refining
Bushings & Bearings	Diamond Tools	Polyester Catalysts
Ceramics & Glassware	Driers	Pressed Metal Parts
Chemicals for Electronics and Engineered Applications	Fuel Additives	Printed Circuit Boards
Chemicals for Heat Stabilizers	Heat Stabilizers	Printing Inks
Coatings	Lubricant Additives	Solder Pastes
Cobalt & Tungsten Powders	Metal Finishing	Synthetic Fibres
Construction Equipment	Metal Spraying & Welding	Tires
	Metal Surfacing	

Source: Applications listed above are from <http://www.omgi.com>, where more information is available.

About three quarters of the stainless steel produced is austenitic, with the remaining one quarter called "ferritic stainless," which does not contain nickel.

Approximately 65% of the primary nickel used in the Western World in 2000, or about 670 000 t, goes to make austenitic stainless steels. Using a 52%:48% ratio of primary to recycled nickel used in austenitic stainless steels implies that the Western World used just over 615 000 t of nickel contained in scrap to make austenitic stainless steels. It is difficult to estimate the scrap usage in other parts of the world. If one can conservatively assume that world scrap usage were only 615 000 t, total world nickel usage for 2000 would be 1 127 000 t of nickel from primary sources and 615 000 t of nickel from recycled sources, or a total of 1 742 000 t of nickel from primary plus recycled sources. Thus, about 35% of total (primary plus recycled) nickel used in 2000 was sourced from recycled materials, but this does not mean that the recycling rate of nickel was only 35%; in fact, it was higher.

To calculate a recycling rate, one needs to know the product life for the materials used in goods. Then the production from decades earlier could be related to the recycled nickel in a current year. Stainless steel is used in relatively long-life applications due to its higher initial cost and lower maintenance costs over its years in service. So this means that there is a long period of time between the production of the nickel-containing stainless steel and its recycling. But, during that time, demand has grown (and thus production). At a 6% growth rate, stainless steel demand more than quadruples in 25 years. If all the nickel in stainless steels produced in one year were to be recycled after 25 years, the recycling of 100% of that material would only represent 25% of the nickel being used to make stainless steel. So in this case, 100% recycling would translate into a feed ratio of only 25% recycled material if all scrap were sourced only from used consumer and industrial goods (i.e., no new scrap from fabrication being used in this example) to the extent that new scrap or "blended scraps" (using primary nickel mixed with scrap iron) are being used. Thus, one can conclude that recycling rates are higher than the ratio of recycled feed to total feed, but calculating the true recycling rate is difficult.

PRICES AND STOCKS

Cash settlement prices for nickel on the London Metal Exchange (LME) averaged US\$8641/t (US\$3.92/lb), continuing the rise from the low of December 1998 to peak at US\$10 660/t (US\$4.84/lb) on March 7. Prices then declined to as far as US\$9360/t, before running up to US\$10 600/t in May prior to the announcement of a labour agreement between Inco and the union locals representing work-

ers in Sudbury and Port Colborne. Thereafter, prices trended downward through the year as the stainless steel industry could not maintain its momentum of 1999. Figure 2 shows prices in 2000 and for the period 1990 to 2000.

LME inventories declined from 46 908 t at the start of the year to 9678 t at year-end.

Current and historical nickel prices and stocks are available on the LME's Internet site at <<http://www.lme.co.uk>>. Another site for nickel prices is <<http://www.metalalloys.com>>.

Cobalt

Cobalt prices on a monthly basis are shown in Figure 7. No terminal markets such as the LME exist for cobalt, although WMC Limited reports trading on its Internet site at <<http://www.wmc.com>> (click on the tab "Nickel," then from the new screen choose "WMC COSS," and then choose "Market News & Commentary").

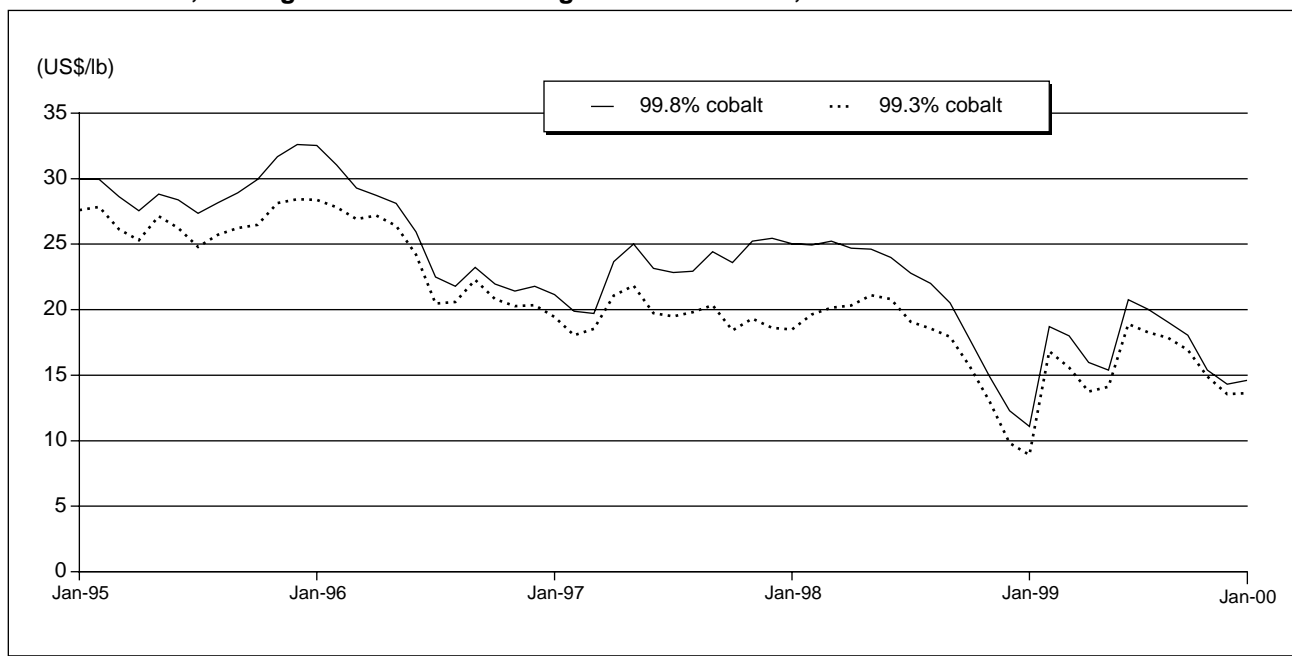
OUTLOOK

The outlook for nickel demand is a function of the industrial activity of the major countries in the world. The largest user of nickel, both primary and recycled, is the stainless steel industry, whose use is strongly correlated with indices of industrial production (see the Nickel chapter of the 1999 *Canadian Minerals Yearbook*, Figure 5, for a graph illustrating the relationship).

The demand for primary nickel is expected to grow at an average trend rate of 3%/y or less during the next decade. The actual demand in any year will vary about the trend, due primarily to changes in world industrial activity, which cause changes in stainless steel demand. It is suggested that a sustained period of prices in the US\$8500/t range would decrease the competitiveness of a significant portion of austenitic stainless steel production, which in turn would lead to decreased demand growth for nickel.

The performance of the Australian operations continues to be disappointing to date (from the viewpoint of those who operated, financed and owned the facilities). These problems, the long and slow ramp-up of Murrin Murrin, and the financial woes of the Bulong and Cawse projects have slowed plans to start up new laterite operations elsewhere, with the exception of Inco's Goro project. A success at Anaconda Nickel's Murrin Murrin, for example, or a successful start-up of the Goro project is expected to re-invigorate the appetite for financing and constructing new laterite nickel projects.

Figure 7
Cobalt Prices, Average of Metal Bulletin High and Low Prices, 1995-2000



Source: Metal Bulletin monthly averages.

Nickel price volatility is also expected to continue, with price levels dependent upon world economic activity. For that reason, a series of annual prices by year is not forecasted here, but it is suggested the probable average annual prices will fall over the next 15 years and will be within a range of US\$8800-\$4400/t (US\$4-\$2/lb) with the caveat that successes of new technologies and building new laterite capacity should result in the lower price boundary of the forecast range declining over time, to perhaps US\$3310/t (US\$1.50/lb).

The prices noted above are current prices, not inflation-adjusted prices (assuming that the U.S. currency maintains its current strength relative to other major currencies). Nickel prices are not expected to vary with inflation; technological advances are expected to more than overcome inflationary pressures. In fact, if stainless steels and other nickel-containing products are to grow at high compound rates, then nickel prices will need to continue to drop faster than the rate of inflation to allow stainless steel and other nickel-containing products to penetrate new markets.

Cobalt

Cobalt prices (Figure 7) are trending lower, due in part to increasing nickel production from nickel-cobalt deposits. The expectation is that decisions to proceed with a number of new hydrometallurgical

nickel-cobalt laterite plants would further depress cobalt prices in the medium term. However, a lower price would allow cobalt to be used economically in other applications for which it is presently too expensive. The high prices of the mid-1990s would be very difficult to sustain in the future, given present conditions and expectations.

ADDITIONAL SOURCES OF INFORMATION

Readers may access various additional sources of information on the Internet to obtain more details about nickel in general. A search engine, such as Google <www.google.com> is a good way to start to find such information. A few sites for additional information include:

Natural Resources Canada

Yearbook articles:

http://www.nrcan.gc.ca/mms/cmy/CMY_E3.html

Metal and mineral statistics:

<http://www.nrcan.gc.ca/mms/efab/mmsd/>

Nickel production by month:

<http://www.nrcan.gc.ca/ms/efab/data/default.html>

Production by province:

<http://www.nrcan.gc.ca/mms/efab/mmsd/production/production.htm>

Physical/Chemical Properties of Nickel

<http://www.webelements.com/webelements/elements/text/Ni/key.html>

Physical/Chemical Properties of Cobalt

<http://www.webelements.com/webelements/elements/text/Co/key.html>

WMC Market News and Commentary

<http://www.wmc.com>
(Click on "Nickel" tab below globe, choose "WMC NIMS," then "Market News.") Provides market information and industry developments (hundreds of items of market information for 1999 onward).

International Nickel Study Group

<http://www.insg.org/>

U.S. Geological Survey

Comprehensive commodity reviews:
<http://minerals.usgs.gov/minerals/pubs/commodity/>

Yahoo Search of Mining News

<http://biz.yahoo.com/news/mining.html>
(Scroll to the bottom of the page and put the word "nickel" into "Search News".)

Notes: (1) For definitions and valuation of mineral production, shipments and trade, please refer to Chapter 65 of the Canadian Minerals Yearbook. (2) Information in this review was current as of November 30, 2001. (3) Various Internet sites have been identified in this article. Please note that Natural Resources Canada has no control over the content of the web sites of other organizations, which may be modified, updated or deleted at any time. (4) This and other reviews, including previous editions, are available on the Internet at http://www.nrcan.gc.ca/mms/cmty/index_e.html.

NOTE TO READERS

The intent of this document is to provide general information and to elicit discussion. It is not intended as a reference, guide or suggestion to be used in trading, investment, or other commercial activities. The author and Natural Resources Canada make no warranty of any kind with respect to the content and accept no liability, either incidental, consequential, financial or otherwise, arising from the use of this document.

TARIFFS

Item No.	Description	Canada		USA	United States Canada	EU MFN	Japan ¹ WTO	Brazil MFN	India MFN	Taiwan MFN	Korea ² MFN
		MFN	GPT								
2604.00	Nickel ores and concentrates	Free	Free	Free	Free	Free	Free	5%	5%	Free	1%
2825.40	Nickel oxides and hydroxides	Free	Free	Free	Free	Free	4.8%	5-13%	35%	2.5%	8%
7202.60	Ferronickel	6.5%	Free	Free	Free	Free	3.3%	9%	25%	Free	3%
7501.10	Nickel mattes	Free	Free	Free	Free	Free	Free	9%	15%	Free	1%
7501.20	Nickel oxide sinters and other intermediate products of nickel metallurgy	Free	Free	Free	Free	Free	Free-44 yen/kg ³	9%	15%	Free	1-2%
7502.10	Unwrought nickel, not alloyed	Free	Free	Free	Free	Free	44 yen/kg	9%	15%	1.25%	3%
7502.20	Unwrought nickel alloys	Free	Free	Free	Free	Free	Free-3% ⁴	9%	15%	1.25%	3%
7503.00	Nickel waste and scrap	Free	Free	Free	Free	Free	Free	5%	15%	Free	1%
7504.00	Nickel powders and flakes	Free	Free	Free	Free	Free	Free-41 yen/kg-3% ³	9%	15%	Free	5%
7505.11	Bars, rods and profiles of nickel, not alloyed	Free	Free	Free	Free	Free	Free	15%	15%	2.5%	5%
7505.12	Bars, rods and profiles of nickel alloys	Free	Free	Free	Free	2.9%	3%	15%	15%	2.5%	5%
7505.21	Nickel wire, not alloyed	Free	Free	Free	Free	Free	3%	15%	15%	1.25%	5%
7505.22	Wire of nickel alloys	Free	Free	Free	Free	2.9%	3%	15%	15%	1.25%	5%
7506.00	Nickel plates, sheets, strip and foil	Free	Free	Free	Free	Free-3.3%	Free-3%	15%	15%	2.5%	5%
7507.00	Nickel tubes, pipes, and tube or pipe fittings	Free	Free	Free	Free	Free-2.5%	Free-3%	17%	15%	2.5%	8%
7508.00	Other articles of nickel	Free-3%	Free	Free	Free	Free	3%	19%	15%	1.25-5%	8%

Sources: *Customs Tariff*, effective January 2001, Canada Customs and Revenue Agency; *Harmonized Tariff Schedule of the United States*, 2001; *Worldtariff Guidebook on Customs Tariff Schedules of Import Duties for European Union* (40th Annual Edition: 2000); *Worldtariff Guidebook on Customs Tariff Schedules of Import Duties of Brazil* (7th Annual Edition: 2000); *Worldtariff Guidebook on Customs Tariff Schedules of Import Duties of India* (7th Annual Edition: 2000); *Worldtariff Guidebook on Customs Tariff Schedules of Import Duties of Korea* (7th Annual Edition: 2000); *Worldtariff Guidebook on Customs Tariff Schedules of Import Duties of Taiwan* (5th Annual Edition: 2000); *Customs Tariff Schedules of Japan*, 2000.

¹ WTO rate is shown; lower tariff rates may apply circumstantially. ² South Korea. ³ Free except for nickel oxide sinters containing by weight not less than 88% nickel, for which the tariff rate is 44 yen/kg, and nickel oxide containing by weight not more than 1.5% copper, for which the tariff rate is 3%. ⁴ The tariff rate of 3% applies to nickel alloys other than those containing by weight less than 50% nickel and not less than 10% cobalt.

TARIFFS

Item No.	Description	Canada			United States
		MFN	GPT	USA	Canada
2605.00	Cobalt ores and concentrates	Free	Free	Free	Free
2822.00	Cobalt oxides and hydroxides, commercial cobalt oxides	Free	Free	Free	Free
2827.34	Cobalt chloride	4%	3%	Free	Free
2833.29.00.40	Cobalt sulphate	Free	Free	Free	Free
2836.99.10.30	Cobalt carbonates for use in the manufacture of animal or poultry feeds, glues or adhesives, optical fibres or optical fibre bundles or cables, typewriter or similar ribbons, polymers in primary forms or profile shapes or sheets of plastics; cobalt carbonates to be employed as drilling mud or additives in drilling for minerals, natural gas, oil or water	Free	Free	Free	Free
2836.99.90.20	Other cobalt carbonates	3.5%	3%	Free	Free
2915.23.10	Cobalt acetates for use as petroleum refining catalysts, or for use in the manufacture of animal or poultry feeds, glues or adhesives, optical fibres or optical fibre bundles or cables, typewriter or similar ribbons, polymers in primary forms or profile shapes or sheets of plastics	Free	Free	Free	Free
2915.23.90	Other cobalt acetates	8%	3%	Free	Free
8105.10	Cobalt mattes and other intermediate products of cobalt metallurgy; unwrought cobalt; waste and scrap; powders				
8105.10.10	Cobalt waste and scrap fit only for remelting and recovery of the metal content; powders; unwrought cobalt, not alloyed	Free	Free	Free	Free
8105.10.90	Other	3%	Free	Free	Free
8105.90.10	Cobalt bars and rods, not alloyed	3%	Free	Free	Free
8105.90.90	Cobalt and articles thereof, n.e.s.	3%	Free	Free	Free

Sources: *Customs Tariff*, effective January 2001, Canada Customs and Revenue Agency; *Harmonized Tariff Schedule of the United States*, 2001.

n.e.s. Not elsewhere specified.

TABLE 1a. CANADA, NICKEL PRODUCTION AND TRADE, 1999 AND 2000

Item No.	1999		2000P	
	(tonnes)	(\$000)	(tonnes)	(\$000)
MINE OUTPUT (Nickel content of ore milled in 2000)	186 236	..	190 727	..
PRODUCTION¹ (Recoverable nickel content in concentrates shipped in 2000)				
All forms				
Quebec	19 402	174 737	22 898	298 205
Ontario	126 575	1 139 931	114 350	1 489 186
Manitoba	30 773	277 137	43 778	570 127
Total Canada	176 749	1 591 805	181 027	2 357 518
Finished nickel output (refined nickel in various shapes in Class I, plus Class II nickel [as defined by the International Nickel Study Group], which includes nickel oxide sinter)	124 260	..	134 225	..
EXPORTS				
2604.00.40 Nickel ores and concentrates, nickel content	-	-	-	-
2620.90 Ash and residue which is known to contain nickel ²				
United States	213 791	123 797	127 571	85 794
United Kingdom	-	-	..	3 841
Other countries	92	5 892	21	25
Total	213 883	129 689	127 592	89 660
2825.40 Nickel oxides and hydroxides (weight of material, not nickel content)				
Hong Kong	479	5 999	954	10 622
Malaysia	9	114	85	1 054
United States	21	248	75	1 052
Singapore	95	1 043	71	968
Other countries	49	423	33	293
Total	653	7 827	1 218	13 989
2827.35 Nickel chlorides (weight of material, not nickel content)	-	-	-	-
2833.24 Nickel sulphates (weight of material, not nickel content)				
United Kingdom	304	2 906	332	1 752
Other countries	36	120	95	299
Total	340	3 026	427	2 051
3815.11 Catalysts and other reaction initiators, reaction accelerators and catalytic preparations with nickel or nickel compounds as the substance (weight of material, not nickel content)				
United States	126	1 074	28	157
Other countries	1	114	-	-
Total	127	1 188	28	157
7202.60 Ferronickel	-	-	-	-
7204.21 Stainless steel waste and scrap (weight of material, not nickel content)				
United States	44 762	24 293	31 267	27 019
Spain	7 618	5 992	5 593	6 498
India	396	455	1 363	1 308
Other countries	3 271	2 562	1 777	2 482
Total	56 047	33 302	40 000	37 307
7501.10 Nickel mattes (nickel content)				
Norway	51 799	434 836	41 031	572 078
United Kingdom ³	39 467	268 339	30 218	384 899
Other countries	247	1 636	21	105
Total	91 513	704 811	71 270	957 082

TABLE 1a (cont'd)

Item No.	1999		2000P		
	(tonnes)	(\$000)	(tonnes)	(\$000)	
EXPORTS (cont'd)					
7501.20	Nickel oxide sinters and other intermediate products of nickel metallurgy (weight of material, not nickel content)				
	United States	4 189	30 044	3 225	39 714
	Taiwan	1 135	9 085	1 434	11 530
	South Korea	5 764	43 869	1 105	9 217
	Belgium	649	4 947	936	8 913
	Total	11 737	87 945	6 700	69 374
7502.10	Nickel unwrought, not alloyed (nickel content)				
	United States	45 342	362 735	52 132	662 659
	Belgium	7 354	54 467	10 295	135 500
	Hong Kong	3 400	28 579	6 511	88 106
	Italy	7 570	66 038	6 382	82 225
	Taiwan	3 609	25 914	3 761	51 800
	Netherlands	6 345	58 306	3 844	48 167
	Japan	2 684	19 235	2 973	39 457
	Singapore	1 072	8 106	2 287	30 795
	United Kingdom	1 620	13 587	2 340	29 384
	Other countries	7 848	61 398	4 591	60 123
	Total	86 844	698 365	95 116	1 228 216
7502.20	Nickel unwrought, alloyed (weight of material, not nickel content)				
	Hong Kong	—	—	1 891	25 871
	United States	203	1 502	217	3 034
	Other countries	—	—	1 784	22 989
	Total	203	1 502	3 892	51 894
7503.00	Nickel waste and scrap (weight of material, not nickel content)				
	United States	3 010	9 329	5 100	34 103
	Japan	137	817	521	3 675
	Other countries	21	32	36	97
	Total	3 168	10 178	5 657	37 875
7504.00	Nickel powders and flakes, alloyed and unalloyed (weight of material, not nickel content)				
	United States	5 744	85 128	6 470	109 649
	Japan	5 156	46 382	2 276	30 857
	Netherlands	417	3 648	250	3 519
	United Kingdom	168	4 032	24	2 873
	Other countries	1 951	26 383	386	6 446
	Total	13 436	165 573	9 406	153 344
7505.11	Bars, rods and profiles of nickel, not alloyed (nickel content)				
		—	—	—	—
7505.12	Bars, rods and profiles of nickel alloy (weight of material, not nickel content)				
	Poland	1	13	1	13
	United Kingdom	1	22	1	10
	Other countries	2	151	2	42
	Total	4	186	4	65
7505.21	Nickel wire, not alloyed (weight of material including coating, if any, not nickel content)				
	United States	11	294	11	289
	Total	11	294	11	289
7505.22	Wire, nickel alloy (weight of material, not nickel content)				
	United States	13	303	30	662
	Taiwan	—	—	20	148
	United Kingdom	4	138	3	42
	Germany	—	—	2	40
	Total	17	441	55	892

TABLE 1a (cont'd)

Item No.	1999		2000P		
	(tonnes)	(\$000)	(tonnes)	(\$000)	
EXPORTS (cont'd)					
7506.00 ^a	Nickel plates, sheets, strip and foil (weight of material, not nickel content)				
	United States	27	278	3	44
	Poland	1	19	1	17
	Libyan Arab Jamahiriya	10	100	1	2
	Other countries	4	30	–	5
	Total	42	427	5	68
7507.00 ^b	Nickel tubes, pipes, and tube or pipe fittings, alloyed and unalloyed (weight of material, not nickel content)				
	United States	..	2 909	..	3 294
	Germany	..	136	..	159
	Netherlands	–	–	..	78
	Other countries	..	227	..	257
	Total	..	3 272	..	3 788
7508.00	Other articles of nickel (weight of material, not nickel content)				
	United States	..	10 464	..	10 236
	China	..	16	..	337
	Germany	..	51	..	100
	Other countries	..	489	..	301
	Total	..	11 020	..	10 974
	Total exports		1 729 357		2 567 365
IMPORTS⁴					
2604.00.00.20	Nickel ores and concentrates, nickel content				
	United States	929	5 834	1 146	7 207
	Germany	2	15	5	46
	Other countries	3	17	..	1
	Total ⁵	934	5 866	1 151	7 254
2620.90	Ash and residue that is known to contain nickel ² Cuba ⁶ (weight of material, not nickel content; material also includes significant cobalt value; hence the value of imported nickel calculated below is too high)				
	Total	55 576	242 456	54 865	361 717
2825.40	Nickel oxides and hydroxides (weight of material, not nickel content)				
	Finland	392	5 173	365	5 409
	United States	1 723	394	3 119	1 174
	Other countries	1	9	238	139
	Total	2 116	5 576	3 722	6 722
2827.35	Nickel chlorides (weight of material, not nickel content)				
	United States	32	221	116	736
	France	44	262	146	626
	Other countries	16	105	..	1
	Total	92	588	262	1 363
2833.24	Nickel sulphates (weight of material not nickel content)				
	United States	83	591	544	4 173
	Other countries	359	848	627	3 274
	Total	442	1 439	1 171	7 447

TABLE 1a (cont'd)

Item No.		1999		2000P	
		(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)					
3815.11	Catalysts and other reaction initiators, reaction accelerators and catalytic preparations with nickel or nickel compounds as the substance (weight of material, not nickel content)				
	United States	1 851	17 251	1 062	14 645
	Other countries	333	5 422	420	7 494
	Total	2 184	22 673	1 482	22 139
7202.60	Ferronickel (weight of material, not nickel content)				
	United States	30	158	54	289
	Total	30	158	54	289
7204.21	Stainless steel scrap (weight of material, not nickel content)				
	United States	28 000	26 260	46 699	44 105
	China	423	556	395	405
	Other countries	45	27	77	80
	Total	28 468	26 843	47 171	44 590
7501.00 ^c	Nickel mattes, nickel oxide sinters and other intermediate products of nickel metallurgy (weight of material, except for matte, which is nickel content)				
	Australia ⁷	3 125	16 566	5 234	30 529
	United States	1 913	3 680	2 363	6 791
	Germany	—	—	1 198	1 697
	Other countries	499	1 614	1 260	5 365
	Total	5 537	21 860	10 055	44 382
7502.10	Nickel unwrought, not alloyed (nickel content)				
	Norway	952	8 044	1 159	13 689
	United States	102	781	351	4 373
	Finland	271	2 327	243	3 424
	United Kingdom	248	2 036	124	1 258
	Other countries	788	5 388	251	2 735
	Total	2 361	18 576	2 128	25 479
7502.20	Nickel unwrought, alloyed (weight of material, not nickel content)				
	United States	189	1 260	339	2 395
	Bermuda	547	3 077	258	1 418
	United Kingdom	207	1 021	102	1 008
	Germany	2	21	406	662
	Other countries	73	422	22	159
	Total	1 018	5 801	1 127	5 642
7503.00	Nickel waste and scrap (weight of material, not nickel content)				
	United States	18 385	40 415	17 926	48 612
	Russia	—	—	1 014	5 617
	Germany	171	680	601	1 871
	United Kingdom	704	2 621	354	1 413
	Venezuela	—	—	156	991
	Other countries	1 289	6 904	473	2 670
	Total	20 549	50 620	20 524	61 174
7504.00	Nickel powder and flakes alloyed and unalloyed (weight of material, not nickel content)				
	Australia	912	8 356	1 074	13 558
	United States	260	3 886	460	5 138
	Belgium	9	160	159	1 894
	Germany	10	205	296	1 779
	Other countries	394	4 220	126	1 634
	Total	1 585	16 827	2 115	24 003

TABLE 1a (cont'd)

Item No.		1999		2000 ^p	
		(tonnes)	(\$000)	(tonnes)	(\$000)
IMPORTS (cont'd)					
7505.11	Bars, rods and profiles of nickel, not alloyed (nickel content)				
	United States	26	399	10	166
	Other countries	1	36	. . .	9
	Total	27	435	10	175
7505.12	Bars, rods and profiles of nickel alloys (weight of material, not nickel content)				
	United States	406	9 186	981	20 343
	Germany	33	634	84	1 462
	Other countries	11	203	9	173
	Total	450	10 023	1 074	21 978
7505.21	Nickel wire, not alloyed (weight of nickel wire plus coating, if any)				
	United States	95	1 051	79	859
	Germany	6	75	19	240
	Other countries	59	546	20	171
	Total	160	1 672	118	1 270
7505.22	Wire, nickel alloy (weight of alloy plus coating, if any, not nickel content)				
	United States	302	5 859	350	6 770
	Germany	70	1 176	115	2 027
	Other countries	91	1 275	138	1 882
	Total	463	8 310	603	10 679
7506.00	Nickel plates, sheets, strip and foil, alloyed and unalloyed (if alloyed, weight of material and not nickel content)				
	Germany	1 099	5 849	1 103	22 066
	United States	651	13 340	624	12 949
	Other countries	130	1 431	50	968
	Total	1 880	20 620	1 777	35 983
7507.00	Nickel tubes, pipes, and tube or pipe fittings, alloyed and unalloyed (weight of material and not nickel content)				
	Japan	259	9 108	633	21 452
	United States	429	9 344	577	12 681
	United Kingdom	69	1 775	200	3 832
	Norway	218	2 313	200	2 797
	Other countries	198	5 624	54	1 115
	Total	1 173	28 164	1 664	41 877
7508.00	Other articles of nickel (weight of material, not content)				
	United States	463	8 930	858	12 431
	France	114	1 275	311	1 813
	United Kingdom	39	649	42	701
	Other countries	131	1 271	105	1 352
	Total	747	12 125	1 316	16 297
	Total Imports		500 632		740 460
	Net Imports of nickel		1 228 725		1 826 905

Sources: Natural Resources Canada; Statistics Canada.

- Nil; . . Not available or not applicable; . . . Amount too small to be expressed; ^p Preliminary; ^r Revised.^a Included in the data are HS codes 7506.10 and 7506.20. ^b Included in the data are HS codes 7507.11, 7507.12 and 7507.20.^c Included in the data are HS codes 7501.10 and 7501.20.

¹ Recoverable nickel in concentrates shipped. ² Nickel and cobalt are in the mixture, which is an artificial nickel-cobalt sulphide made from nickel-cobalt oxides mined in Cuba. ³ Shipments to the United Kingdom are under investigation to determine if HS 7501.20 would be a more appropriate classification. ⁴ Imports from "Other countries" may include re-imports from Canada. ⁵ No imports of nickel concentrate recorded for 2000; Jubilee Mines NL in Australia lists three shipments to Canada during 2000 of which two may have arrived during the calendar year; trade data are under investigation. ⁶ The International Nickel Study Group reported Canadian imports of nickel-cobalt sulphides from Cuba of 55 576 t in 1999 and 54 865 t in 2000. ⁷ Imports of nickel ores and concentrates occurred in 2000 according to Jubilee Mines NL and an investigation of matte imports and ores and concentrate imports from Australia in 2000 is under way.

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

TABLE 1b. CANADA, NICKEL PRODUCTION AND USE, 1970, 1975, 1980 AND 1985-2000

	Production ¹ (Mine Output)	Use ²
	(tonnes)	
1970	277 490	10 699
1975	242 180	11 308
1980	184 802	9 676
1985	169 971	7 206
1986	163 640	8 865
1987	193 391	9 732
1988	216 589	9 250
1989	200 899	10 421
1990	196 225	8 410
1991	192 259	13 322 ^{a,r}
1992	186 384	15 528 ^r
1993	188 080	17 384 ^{a,r}
1994	149 886	20 746 ^r
1995	181 820	20 973 ^r
1996	192 649 ^r	24 504 ^r
1997	180 624 ^r	19 447
1998	197 947 ^r	19 787 ^r
1999	176 749	22 527 ^r
2000 ^p	181 027	24 976 ^r

Source: Natural Resources Canada.

. . Not available; ^p Preliminary; ^r Revised.

^a Increase in number of companies being surveyed.

¹ Refined nickel and nickel in oxides and salts produced, plus recoverable nickel in matte and concentrates exported. Data for 1987-2000 are nickel contained in concentrates produced.

² Use of metallic nickel, all forms (refined metal, nickel in ferronickel oxides and salts, and other forms of nickel including nickel in purchased scrap) as reported by users on the Natural Resources Canada survey "Consumption of Nickel."

Note: Metals are used in industrial and consumer applications; unlike fuel oil or agricultural commodities, metals are not "used up" or "consumed"; instead, they are recycled. Discussions taking place in international fora indicate that the term "consumption" should be changed to more appropriately reflect actual practice. For this reason, the word "use" has replaced "consumption" in this chapter, where appropriate.

TABLE 1c. CUPRONICKEL, NICKEL-SILVER, STAINLESS STEELS, AND NICKEL-CADMIUM AND NICKEL-IRON BATTERIES, 1999 AND 2000

	1999		2000P	
	(tonnes)	(\$000)	(tonnes)	(\$000)
STAINLESS STEEL SEMI-FABRICATED ITEMS (excludes scrap)				
Exports – Total for Each HS Class				
7204.29	111 738	18 500	162 737	33 113
7210.9	759	1 181	2 591	3 977
7220.2	2 568	9 498	3 004	11 652
7222.11	3 373	7 939	6 052	12 855
7222.19	18	116	79	270
7222.2	8 624	36 136	12 627	56 023
7222.3	1 503	7 134	139	526
Total exports	128 583	80 504	187 229	118 416
Imports – Total for Each HS Class				
7204.29	225 961	54 213	203 380	59 288
7210.9	8 622	19 711	6 925	15 485
7212.50.90.13	3 811	9 222	3 078	7 192
7222.11	28 468	26 843	47 171	44 590
7222.19	2 520	10 344	3 106	13 191
7222.20.10	59	367	39	212
7222.20.90	7 344	30 240	11 623	45 323
7222.30.00.11	220	1 441	282	1 815
7222.30.00.19	4	22	12	44
Total imports	277 009	152 403	275 616	187 140
Net exports of stainless steels	-148 426	-71 899	-88 387	-68 724
CUPRO-NICKEL AND NICKEL-SILVER SEMIFABRICATED GOODS (nickel-silver is a copper-nickel-zinc alloy)				
Exports – Total for Each HS Class				
7403.23	–	–	81	346
7407.22	77	450	82	580
7408.22	21	499	24	320
7409.40	948	5 749	5 237	70 661
7411.22	2 764	18 907	2 809	21 570
Total exports	3 810	25 605	8 233	93 477
Imports – Total for Each HS Class				
7403.23.00.10 to 7403.23.00.40	13	50	218	736
7407.22.11 to 7407.22.29.10	64	298	51	250
7408.22.10 to 7408.22.90.30	455	1 168	372	939
7409.40.00.11 to 7409.40.00.40	5 018	24 059	2 477	10 052
7411.22.00.10 to 7411.22.00.30	530	3 542	391	2 508
Total imports	6 080	29 117	3 509	14 485
Net exports of cupro-nickel and nickel-silver	-2 270	-3 512	4 724	78 992
ELECTRIC ACCUMULATORS (nickel-cadmium and nickel iron batteries)				
	1999	2000		
	(\$000)	(\$000)		
Exports – Total for Each HS Class				
Ni-Cd batteries 8507.30	1 527	5 188		
Ni-Fe batteries 8507.40	7 181	10 159		
Total exports	8 708	15 347		
Imports – Total for Each HS Class				
Ni-Cd batteries 8507.30	70 333	61 950		
Ni-Fe batteries 8507.40	4 481	3 026		
Total imports	74 814	64 976		
Net exports of Ni-Cd and Ni-Fe batteries	-66 106	-49 629		

Source: Natural Resources Canada.

– Nil.

TABLE 2a. CANADA, COBALT PRODUCTION AND TRADE, 1999 AND 2000, AND USE, 1998-2000

Item No.	1999		2000P	
	(kilograms)	(\$000)	(kilograms)	(\$000)
MINE OUTPUT (Cobalt content of ore milled in 2000)	5 322 562		5 281 125	
PRODUCTION¹ (Recoverable cobalt in concentrates shipped)				
Quebec	189 104	10 543	220 000	11 047
Ontario	1 522 247	84 873	1 359 539	68 269
Manitoba	302 546	16 868	433 408	21 764
Total	2 013 897	112 285	2 012 947	101 080
Refined ²	3 972 051	..	4 090 989	..
EXPORTS				
2605.00 Cobalt ores and concentrates (cobalt content)	9 553	21	-	-
Total	9 553	21	-	-
2822.00 Cobalt oxides and hydroxides; commercial cobalt oxides (weight of material, not cobalt content)				
United Kingdom	223 916	8 599	327 651	10 457
South Africa	-	-	5 480	115
United States	101	7	1 364	83
Taiwan	-	-	6	..
Total	224 017	8 606	334 501	10 655
2915.23 Cobalt acetates	-	-	-	-
8105.10 Cobalt, mattes and other intermediate products of cobalt metallurgy, unwrought cobalt, waste, scrap and powders (cobalt content of unwrought and mattes, and powders; weight of material for intermediates, alloys and waste and scrap)				
Norway	2 256 812	86 533	1 487 194	59 047
Japan	1 142 871	56 871	1 193 306	58 712
United States	839 008	38 116	864 884	37 638
Netherlands	794 800	41 259	464 600	23 175
Singapore	483 300	26 464	304 000	14 879
Other countries	764 420	32 380	558 355	24 176
Total	6 281 211	281 623	4 872 339	217 627
8105.90 Cobalt and articles thereof, n.e.s.				
United States	14 999	2 967	12 220	3 238
Germany	10 443	1 903	12 950	2 290
Brazil	-	-	401	78
United Kingdom	370	99	385	68
Other countries	380	65	2 842	145
Total	26 192	5 034	28 798	5 819
Total exports	6 540 973	295 284	5 235 638	234 101
IMPORTS				
2605.00 Cobalt ores and concentrates (cobalt content)				
Switzerland	-	-	376 950	3 494
Germany	71 964	825	40 697	576
Other countries ³	11 374	526	88 724	3 282
Total	83 338	1 351	506 371	7 352
2822.00.00.10 Cobalt hydroxides (weight of material, not cobalt content)				
United States	10 434	500	25 133	1 323
Other countries	109	6	4 726	273
Total	10 543	506	29 859	1 596
2822.00.00.20 Cobalt oxides (weight of material, not cobalt content)				
Belgium	30 625	1 599	35 750	1 401
Finland	54 976	2 173	14 790	486
South Korea	-	-	5 111	225
United States	16 064	692	3 319	143
Other countries	29	1	2	..
Total	101 694	4 465	58 972	2 255

TABLE 2a (cont'd)

Item No.		1999		2000P	
		(kilograms)	(\$000)	(kilograms)	(\$000)
IMPORTS (cont'd)					
2822.00.00.30	Commercial cobalt oxides (weight of material, not cobalt content)				
	Belgium	—	—	10 650	437
	United Kingdom	748	14	2 811	57
	United States	1 486	30	335	6
	Total	2 234	44	13 796	500
2827.34	Cobalt chlorides (weight of material, not cobalt content)				
	United States	16 878	305	45 287	668
	Other countries	21	..	89	2
	Total	16 899	305	45 376	670
2833.29.00.40	Cobalt sulphate (weight of material, not cobalt content)				
	United States	24 576	485	21 670	396
	Finland	14 648	249	14 557	141
	France	540	5	500	2
	Other countries	4 721	66	26	..
	Total	44 485	805	36 753	539
2836.99.10.30	Cobalt carbonates (weight of material, not cobalt content)				
	Finland	..	24	..	60
	Belgium	..	85	..	49
	United States	..	205	..	23
	Total	..	314	..	132
2836.99.90.20	Other cobalt carbonates				
	United States	10 228	282	19 397	504
	Finland	11 144	293	7 878	188
	Other countries	5 831	190	—	—
	Total	27 203	765	27 275	692
2915.23	Cobalt acetates (weight of material, not cobalt content)				
	United States	45 919	517	37 120	405
	Other countries	16	..	10	..
	Total	45 935	517	37 130	405
8105.10.10.10	Cobalt waste and scrap fit only for remelting and recovery of the metal content (weight of material, not cobalt content)				
	United States	180 025	676	32 517	645
	Germany	2 544	113	4 869	78
	United Kingdom	55 720	257	—	—
	Other countries	52 566	110	497	17
	Total	290 855	1 156	37 883	740
8105.10.10.20	Cobalt powders (cobalt content)				
	Australia	194 467	7 402	250 072	8 393
	Belgium	3 520	142	119 154	4 838
	Japan	38 081	1 872	95 764	4 580
	South Africa	120 814	5 588	84 098	3 770
	United States	44 007	2 374	58 598	3 072
	Other countries	8 856	371	60 003	1 229
	Total	409 745	17 749	667 689	25 882
8105.10.10.30	Unwrought cobalt, not alloyed (cobalt content)				
	Congo	54 400	1 499	25 614	902
	United States	27 560	1 357	9 566	429
	Other countries	23 677	1 138	17 242	731
	Total	105 637	3 994	52 422	2 062

TABLE 2a (cont'd)

Item No.	1999		2000P		
	(kilograms)	(\$000)	(kilograms)	(\$000)	
IMPORTS (cont'd)					
8105.10.90	Unwrought cobalt, alloyed, mattes and other intermediate products of cobalt metallurgy (cobalt content of unwrought and mattes; weight of material for intermediates and alloys)				
	United States	9 820	408	7 296	355
	Switzerland	-	-	3	...
	Russia	-	-	-	-
	Total	9 820	408	7 299	355
8105.90.00.10	Cobalt bars and rods, not alloyed (cobalt content)				
	United States	2 479	204	2 218	171
	Other countries	2	...	150	10
	Total	2 481	204	2 368	181
8105.90.00.90	Cobalt and articles thereof, n.e.s. (cobalt content)				
	United States	41 468	5 140	53 453	6 398
	Other countries	2 048	141	4 021	281
	Total	43 516	5 281	57 474	6 679
	Total imports	1 194 385	37 864	1 580 667	50 040
	Net exports	5 346 588	257 420	3 654 971	184 061
USE⁴	1998	1999	2000P		
	(kilograms)				
Cobalt contained in:					
	Cobalt metal and metallic compounds	48 381	49 340	46 698	
	Cobalt pigments, feed and ground coat frit	6 901	8 378	8 487	
	Cobalt salts and driers and other uses ⁵	90 701	72 270	71 780	
	Total	145 983	129 988	126 965	

Sources: Natural Resources Canada.

- Nil; . . Not available or not applicable; . . . Amount too small to be expressed; n.e.s. Not elsewhere specified; P Preliminary; r Revised.

1 Production includes recoverable cobalt in concentrates shipped. 2 Nickel and cobalt are in the mixture, which is an artificial nickel-cobalt sulphide made from nickel-cobalt oxides mined in Cuba. 3 Nickel cobalt sulphides as reported by the International Nickel Study Group (imported into Canada under classification HS 2620.90 Ash and Residue). This material shown in Table 1a includes both the weight and value of imported nickel and cobalt from Cuba and is not included in this table. 4 Available data as reported by consumers. 5 Other uses include glass and chemicals.

Notes: Numbers may not add to totals due to rounding. The absence of a tonnage and value for the cobalt being imported from Cuba (total value shown in nickel Table 1a, entry 2620.90) in the mixed nickel-cobalt sulphides from Cuba means that the total imports shown are less than the actual imports.

TABLE 2b. CANADA, COBALT PRODUCTION, TRADE AND USE, 1975 AND 1980-2000

	Production ¹	Exports			Imports	Use ⁴
		Cobalt Metal	Cobalt Oxides and Hydroxides	Cobalt Ores and Concentrates ²	Cobalt Oxides and Hydroxides ³	
	(tonnes)					
1975	1 354	431	561	123
1980	2 118	325	1 091	2	26	105
1981	2 080	677	601	24	20	101
1982	1 274	585	212	2	30	81
1983	1 410	885	192	45	30	101
1984	2 123	1 487	373	14	27	113
1985	2 067	1 551	268	36	192	101
1986	2 297	1 805	374	20	31	96
1987	2 490	1 875	440	45	38	120
1988	2 398	3 062	953	98	37	159
1989	2 344	3 262	371	22	33	147
1990	2 184	3 039	391	–	73	194
1991	2 171	3 456	459	–	42	166
1992	2 223	2 963	489	–	64	205
1993	2 150	3 581	394	–	52	187
1994	1 846	3 922	204	–	81	193
1995	2 016	4 227	–	–	41	148
1996	2 150	4 488 ^r	632	–	33	147
1997	2 168	5 829	526	–	39	136
1998	2 262	6 592	457	–	45	146
1999	2 014	6 307	224	10	114	130
2000 ^P	2 013	4 901	335	–	103	127

Sources: Natural Resources Canada; Statistics Canada.

– Nil; . . Not available; ^P Preliminary; ^r Revised.

¹ Production includes recoverable cobalt in concentrates shipped. 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 Cobalt content. From 1975 to 1988, cobalt recovered in Canada from domestic concentrate plus exports of payable cobalt in concentrate plus exports of matte. Starting in 1989 to date, recoverable cobalt in concentrates shipped.

³ Gross weight. Producers' domestic shipments of refined cobalt plus imports of refined shapes. ⁴ Use of cobalt in metal, oxides and salts; available data as reported by user.

TABLE 3. CANADA, NICKEL PROCESSING CAPACITY, 2000

	Inco Limited		Falconbridge Limited	Sherritt International Corporation	Canmine Resources Corporation ¹
	Sudbury	Thompson	Sudbury	Fort Saskatchewan	Cobalt
	(t/y of contained nickel)				
Smelter	100 000	63 000	70 000	n.a.	n.a.
Refinery	59 000	55 000	n.a.	30 000	n.a.

Source: Natural Resources Canada.

n.a. Not applicable.

¹ Plant being rehabilitated; initial production to be cobalt in salts with minor nickel by-product production. Plans call for subsequent increase in throughput of cobalt and nickel.

TABLE 4. WORLD MINE PRODUCTION OF NICKEL, 1 1996-2000

	1996	1997	1998	1999	2000
	(000 tonnes)				
Russia	232	235	235	235	235
Canada	193	191	208	186	191
Australia	113	123	144	124	166
New Caledonia	125	137	125	110	128
Indonesia	88	71	74	89	98
Cuba	54	62	68	67	71
Colombia	28	31	29	39	59
China	44	47	48	50	51
Brazil	21	21	33	33	36
South Africa	34	35	36	36	37
Other (13 countries)	121	121	117	88	113
Total	1 051	1 073	1 117	1 058	1 183

Sources: Natural Resources Canada (NRCan), for Canada; *World Nickel Statistics*, International Nickel Study Group (INSG), October 2001.

¹ Nickel content of sulphide concentrates or nickel content of lateritic ore mined.

Notes: NRCan data used for 1999 for Canada and for total. Numbers may not add to totals due to rounding. Australian data include PAL production since 1999 as estimated by the INSG. Dominican Republic production is the nickel content of ferro-nickel produced.

TABLE 5. WORLD PRODUCTION OF PRIMARY NICKEL, 1996-2000

	1996	1997	1998	1999	2000
	(000 tonnes)				
Russia	190	230	227	228	221
Japan	131	128	127	134	161
Canada	130	132	147	124	134
Australia	74	74	80	79	111
Norway	62	63	70	74	59
China	44	40	40	45	51
New Caledonia	42	44	45	45	44
Cuba	27	34	39	39	40
United Kingdom	39	36	39	38	38
South Africa	34	35	36	36	37
Dominican Republic	30	33	25	25	28
Other (13 countries)	151	164	161	157	160
Total	953	1 012	1 035	1 024	1 083

Sources: Natural Resources Canada, for Canada; *World Nickel Statistics*, International Nickel Study Group, October 2001.

TABLE 6. WORLD USE¹ OF PRIMARY NICKEL, 1996-2000

Country	1996	1997	1998	1999	2000
	(000 tonnes)				
Japan	190	202	169	183	200
United States	153	156	150	152	150
Germany	75	91	97	101	107
Taiwan	50	68	70	89	90
South Korea	50	66	68	81	78
China	42	43	42	47	62
Italy	44	50	53	55	53
France	46	50	55	52	50
Other (more than 27 countries)	292	291	305	322	481
Total	943	1 016	1 009	1 082	1 270

Source: *World Nickel Statistics*, International Nickel Study Group, October 2001.

¹ The term "use" replaces "consumption" and reflects the fact that nickel is not being "used up" in its applications; over 500 000 t of nickel are recycled annually in addition to the material shown above.

**TABLE 7. AVERAGE ANNUAL NICKEL PRICES,
1981-2000**

	Settlement Price	
	(US\$/t)	(converted to US\$/lb)
1981	5 985	2.71
1982	4 808	2.18
1983	4 695	2.13
1984	4 783	2.17
1985	4 987	2.26
1986	3 887	1.76
1987	4 849	2.20
1988	14 206	6.44
1989	11 955	5.42
1990	8 880	4.03
1991	8 158	3.70
1992	7 000	3.18
1993	5 283	2.40
1994	6 344	2.88
1995	8 237	3.74
1996	7 500	3.40
1997	6 916	3.14
1998	4 617	2.09
1999	6 015	2.73
2000	8 641	3.92

Source: International Nickel Study Group, *World Nickel Statistics*, October 2001.

**TABLE 8. AVERAGE MONTHLY NICKEL PRICES,
1997-2000**

	1997	1998	1999	2000
	(US\$/t)			
January	7 047	5 495	4 272	8 314
February	7 737	5 390	4 630	9 658
March	7 899	5 399	5 015	10 284
April	7 318	5 397	5 106	9 731
May	7 485	5 023	5 403	10 134
June	7 065	4 479	5 198	8 415
July	6 838	4 329	5 704	8 168
August	6 763	4 084	6 452	8 010
September	6 507	4 106	7 031	8 642
October	6 383	3 875	7 325	7 683
November	6 142	4 135	7 953	7 344
December	5 949	3 881	8 087	7 319
	(converted to US\$/lb)			
January	3.20	2.49	1.94	3.77
February	3.51	2.44	2.10	4.38
March	3.58	2.45	2.27	4.66
April	3.32	2.45	2.32	4.41
May	3.40	2.28	2.45	4.60
June	3.20	2.03	2.36	3.82
July	3.10	1.96	2.59	3.70
August	3.07	1.85	2.93	3.63
September	2.95	1.86	3.19	3.92
October	2.90	1.76	3.32	3.48
November	2.79	1.88	3.61	3.33
December	2.70	1.76	3.67	3.32

Source: International Nickel Study Group, various issues of *World Nickel Statistics*.

TABLE 9. REFINED COBALT¹ AVAILABILITY, 1996-2000

Company	1996	1997	1998	1999	2000
(tonnes)					
PRODUCTION OF COMPANIES BELONGING TO THE COBALT DEVELOPMENT INSTITUTE					
Falconbridge	3 099	3 417	3 851	4 009	3 433
Gécamines	3 540	2 808	4 490	5 180 ^b	4 320
ICCI	2 070	2 250	2 640	2 770	2 855
Inco	1 544	1 500	1 740	1 420	1 470
OMG	4 160	5 000	5 250	6 200	7 700
QNI	–	617	1 395	1 539	1 520
Sumitomo	228	263	329	221	311
Zambia ²	4 799	3 949	5 011	3 946	2 316 ^c
CTT	80	220	241	470	1 200
Eramet	174	159	172	180	204
Union Minière	1 200	1 200	1 200	950	1 110
Murrin Murrin	–	–	–	83	925
Kasese	–	–	–	77	420
Subtotal	20 894	21 383	26 319	27 045	27 785
PRODUCTION OF OTHERS					
South Africa	292	294	320	320 ^e	320
Brazil	193	266	364	630	792
India	–	110 ^e	120 ^e	120 ^e	206
China	1 200	1 200	1 200	1 200	1 200
Mopani Copper	–	–	–	–	1 026
Bulong	–	–	–	79	192
Subtotal	1 685	1 870	2 004	2 349	3 736
EXPORTS AND SALES FROM STOCKPILES					
DLA sales	2 052	1 621	2 310	1 679	3 083
Sales from other stocks	500	–	–	–	–
C.I.S. exports	1 654	3 200	2 800	2 678	4 700 ^d
Subtotal	4 206	4 821	5 110	4 357	7 783
Total availability ³	26 785	28 074	33 433	33 751	39 303

Source: *Cobalt News*, April 2001, The Cobalt Development Institute.

ICCI = International Cobalt Corporation Ltd. (marketed by Sherritt International Corporation)

OMG = OM Group ZCCM = Zambia Consolidated Copper Mines

CTT = La Compagnie de Tifnout Tiranimine RAMZ = Roan Antelope Mining Corporation

DLA = Defense Logistics Agency Gécamines = La Générale des Carrières et des Mines

– Nil; ^e Estimated.

^a Excludes the Central Mining Group production. ^b Includes correction for CTT. ^c Chambishi Metals production only. ^d Figure under investigation; 3200 t is believed by some to be more accurate.

¹ "Refined cobalt" means all cobalt units whether in metal or chemicals derived from feed requiring further refining. The following materials are not counted as feed: DLA or other stockpile releases, Russian output, Lisaki output, and lower grade Moroccan output. ² Zambian production includes ZCCM, RAMZ and Avmin. ³ Numbers may not add to totals due to rounding.