Nickel

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(Author notes: [1] For more detailed information about Canadian facilities, refer to the Nickel chapter of the "2000 Canadian Minerals Yearbook." [2] Only material related to events in 2001 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:

Co Cobalt; Fe Iron; FeNi Ferronickel; PAL Pressure acid leach; Ni Nickel; PGMs Platinum group metals.

OVERVIEW

World nickel mine production increased by 3.2%. World production of refined and finished nickel increased by 6.1%. Nickel use (formerly called "consumption") decreased by 2.2%. Prices peaked in mid-May, bottomed out in early October and then recovered to US$5680/t by year-end.

Cobalt data are less well documented than nickel data. A principal source of world information is The Cobalt Development Institute (CDI) <www.thecdi.com>. Data from the CDI are shown in Table 9, which shows cobalt production for the period 1996 to 2001.

A list of Canadian nickel producers, their web sites, and the locations from which Canadian securities filing information can be obtained are provided in Table 3.

WORLD NICKEL DATA

	2000	2001
	(000 t)	
Mine production	1 183	1 221
Finished production	1 082	1 148
Usage (consumption)	(r) 1 123	1 098

Source: International Nickel Study Group (INSG), *World Nickel Statistics - April 2002* (data rounded to nearest 1000 tonnes).
(r) Revised.
Note: Refer to Tables 8, 9 and 10 in this article for data from 1996 to 2000.

LME ASK PRICES, 2001

	Cash	3 month	15 month	27 month
	(US$/t)			
Average	5 948	5 877	5 799	5 789
Maximum	10 660	10 380	8 655	7 540
Minimum	7 030	6 730	6 260	5 765

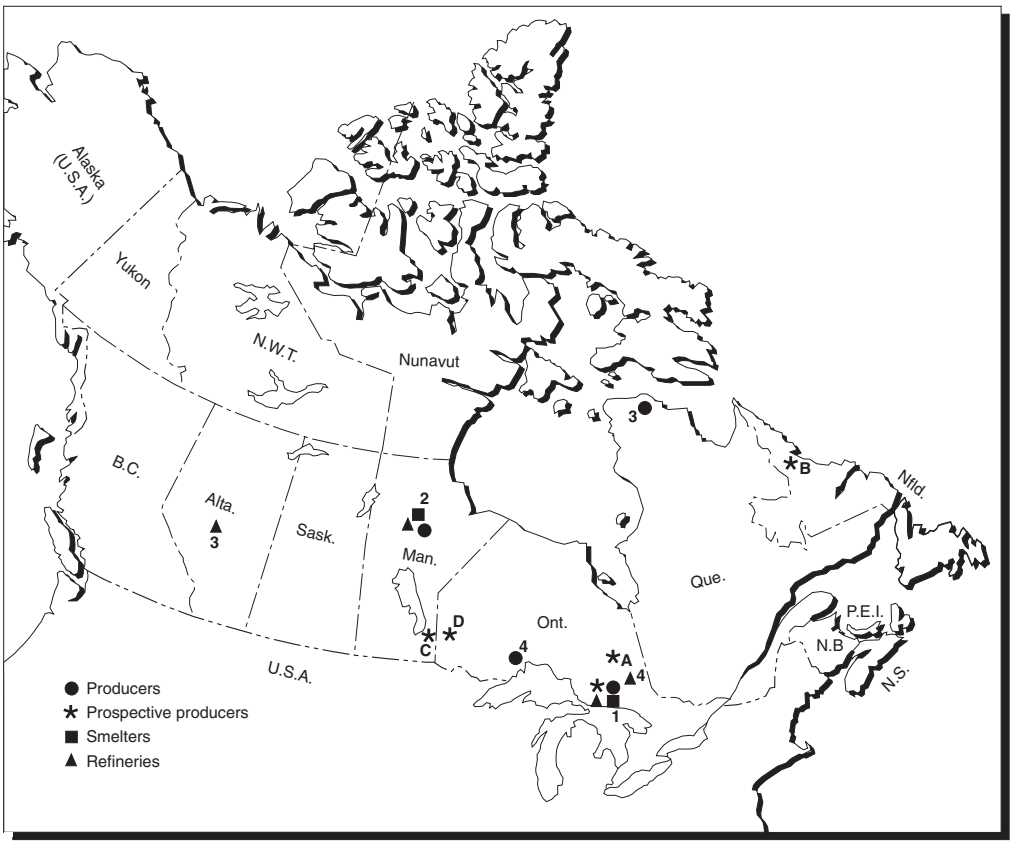
Sources: INSG; London Metal Exchange (LME).
Notes: Cash ask price = settlement price. Refer to Figure 2 for a graph of nickel prices in 2001 and for the period 1986-2001.

CANADIAN DATA

	2000	2001
	(t)	
Ni mine production (1)	(r) 190 793	193 361
Ni in concentrates shipped (2)	(r) 181 139	183 643
Ni refined production (3)	134 225	140 591
Ni usage (4)	(r) 24 976	..
Co mineral production (2)	(r) 2 022	2 048
Co metal production (3)	6 307	5 008
Co usage (4)	127	..

.. Not available; (r) Revised.
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, 2001



Numbers and letters refer to locations on map above.

PRODUCERS

1. Falconbridge Limited (Fraser, Lindsley, Onaping-Craig, Lockerby)
1. Inco Limited (Lower Coleman, Copper Cliff North, Copper Cliff South, Crean Hill, Creighton, Garson, 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)

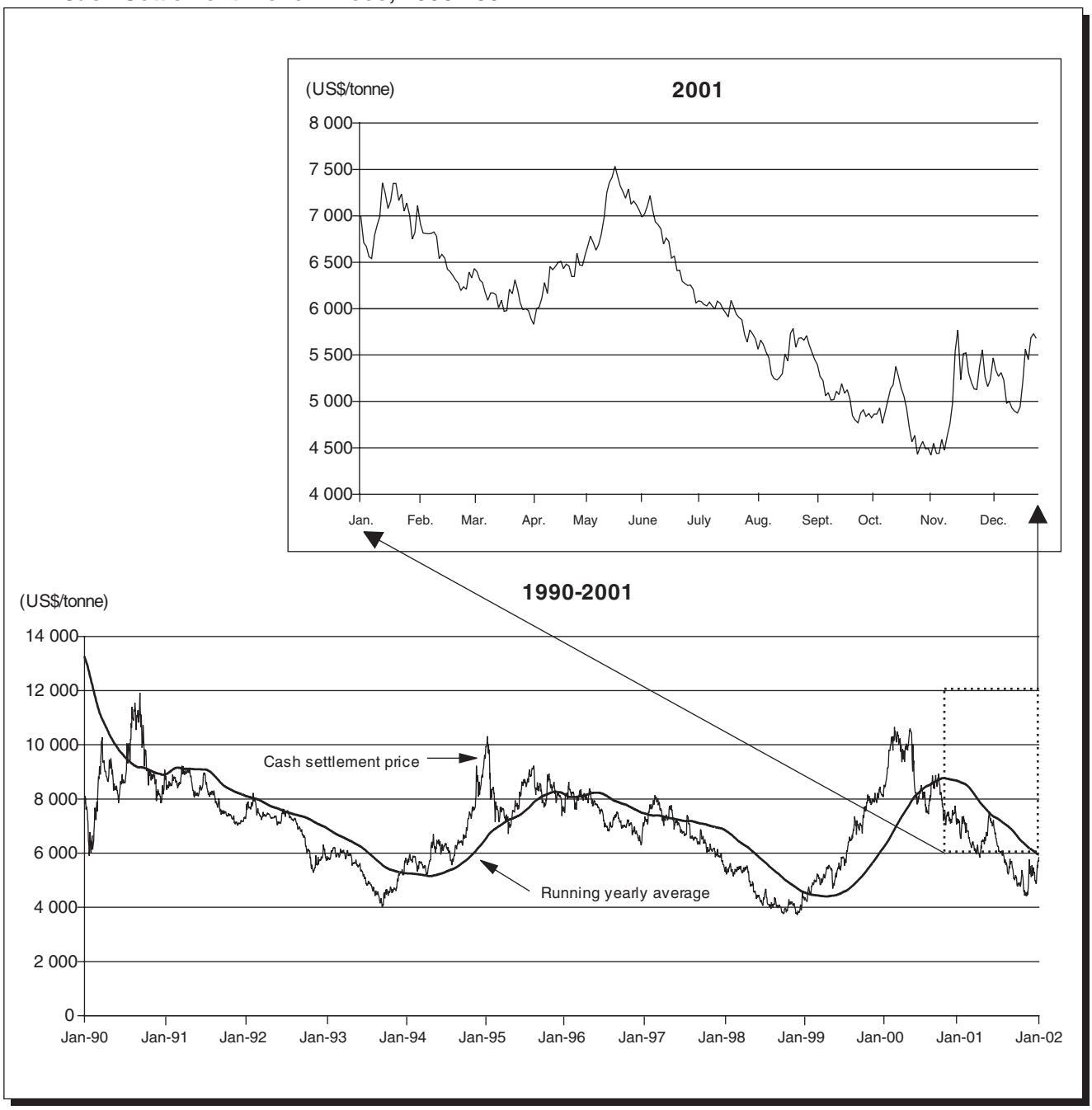
REFINERIES

1. Inco Limited (Sudbury)
2. Inco Limited (Thompson)
3. Sherritt International Corporation (Fort Saskatchewan)
4. Canmine Resources Corporation (Cobalt, Ontario)

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 (Werner Lake) (mine)

Figure 2
LME Cash Settlement Nickel Prices, 1990-2001



Sources: International Nickel Study Group, Reuters; World Bureau of Metal Statistics.
Conversions: $2.50/lb = $5512/t; $3.00/lb = $6614/t; $3.50/lb = $7716/t; $4.00/lb = $8818/t.

Canadian mine production of nickel (nickel contained in concentrates produced) was 193 361 t in 2001, up from 190 793 t in 2000. Primary nickel production in Canada was 140 591 t, up from 134 225 t in 2000 (Table 1). The locations of Canadian nickel production facilities are shown in Figure 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, 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 in 2001. The data for nickel in concentrates exported from Australia to Canada in 2000 do not appear in the trade data and may have been misclassified under the tariff system as 7501.10 (nickel intermediates).

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

Additional trade information is also presented in Table 1c, 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.

The increase in Canadian nickel production in 2001 was due to increased mine production in Ontario as production recovered in 2001 from the effects of the labour action at Falconbridge Limited's mines and smelter, which lasted from August 2000 to February 2001.

Canadian shipments of recoverable cobalt in concentrate from Canadian mines totaled 2047 t in 2001, almost equal to the 2022 t produced in 2000. Refined cobalt production was 4063 t in 2001, compared to 4091 t in 2000. Table 2a provides cobalt 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 Canadian cobalt production and use from 1970 to 2000 for selected years.

CANADIAN DEVELOPMENTS

There were four nickel and cobalt producers in Canada in 2001, and there will be five such producers in 2002 as Canmine Resources Corporation started commissioning its hydrometallurgical refinery at the end of 2001. As noted earlier, Table 3 provides data on where to get additional information from the Internet for Canadian nickel-producing companies.

Table 4 provides summary details about Canadian nickel and cobalt production facilities in 2001. This table shows the type of output at each facility (e.g., nickel in concentrate is processed to nickel in matte, which is then processed to refined nickel, so counting all tonnages would triple-count production); therefore, the "production" data are not additive. For additional information about these facilities, readers can refer to the corporate web sites listed in Table 3, to the securities information available from the sources listed in Table 3, and to the "Nickel" chapter of the 2000 *Canadian Minerals Yearbook* <www.nrcan.gc.ca/mms/cmy/content/2000/42.pdf>, which presents a detailed review of Canada's nickel and cobalt production facilities in 2000.

Table 7 presents the capacities of nickel production facilities in Canada.

For more information about events during 2001, the reader may examine the 2001 *Nonferrous Metals Outlook*, prepared in October 2001, available at <www.nrcan.gc.ca/mms/pubs/nfo-e.htm>.

In addition, monthly Canadian nickel data are posted monthly at <http://mmsd1.mms.nrcan.gc.ca/mmsd/data/default_e.asp>. At this site, data are available in three file formats. Table 7 in all the files listed at the web site shows data by month for:

- mine output (nickel content in concentrates produced);
- primary production (recoverable nickel in concentrates shipped);
- refined production (includes nickel in chemicals and in Class II forms); and
- domestic shipments of refined production.

WORLD NICKEL PRODUCTION

Table 5 shows a list of world nickel producers and their web sites, where available. Table 6 provides information about world nickel producers for 2001.

Tables 8 and 9 show, respectively, selected mine production and primary production data for nickel.

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 were presented in Figures 3 and 4 of the Nickel chapter in the 2000 *Canadian Minerals Yearbook* <www.nrcan.gc.ca/mms/cmy/content/42.pdf>. Table 9 presents CDI information about cobalt availability by company for the period 1996 to 2001.

NICKEL USE

The important world markets for primary nickel are shown in Figure 3. In addition to the 1.1 Mt of primary nickel used in 2001, there were approximately 600 000 t of nickel contained in stainless steel scrap used by stainless steel mills in 2001.

The stainless steel industry is the largest user of nickel, both in the primary and recycled forms. According to Macquarie Equities Limited, stainless steel production declined by almost 4% to 17.9 Mt from 18.6 Mt in 2000.

COBALT USE

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

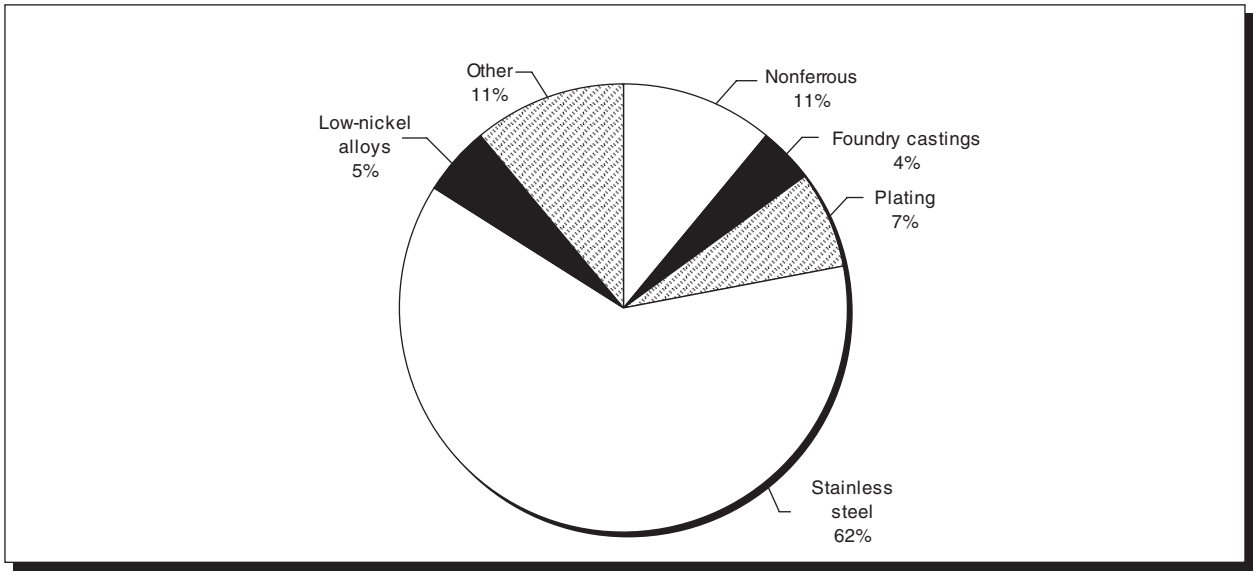
Canadian cobalt use is reported in Table 2B.

RECYCLING, HEALTH AND THE ENVIRONMENT

Health and environmental issues relating to nickel are examined briefly in a general fact sheet on nickel (<www.nrcan.gc.ca/mms/cmy/mfs_e.htm>).

To calculate a recycling rate, one needs to know the product life for the materials used in goods. 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 and production

Figure 3
Western World Plus China Nickel Use, 2001



Source: Inco Limited's 10K report, 2001.
Notes: Western World excludes the Russian Federation, Cuba, the former Eastern Europe and the C.I.S. About 78% of stainless steel is estimated to be nickel-containing.

grow. 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. Therefore, 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., "old" scrap). Thus, one can conclude that recycling rates are higher than the ratio of recycled feed to total feed; calculating the true recycling rate is difficult because of the varying product lives that contain nickel.

PRICES AND INVENTORIES

Figure 2 shows prices in 2001 and for the period 1986 to 2001. Inventories on the London Metal Exchange (LME) rose from 9624 t at the start of the year to 19 188 t at year-end. This rise took inventories to only 40% of the level at the start of 2000, which was 46 908 t.

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

Cobalt

Cobalt prices on a monthly basis are shown in Figure 4. No terminal markets such as the LME exist for cobalt, although WMC Limited reports trading on its Internet site at <www.wmc.com> and, more recently, OMG on its site at <www.omgcobalt.com> .

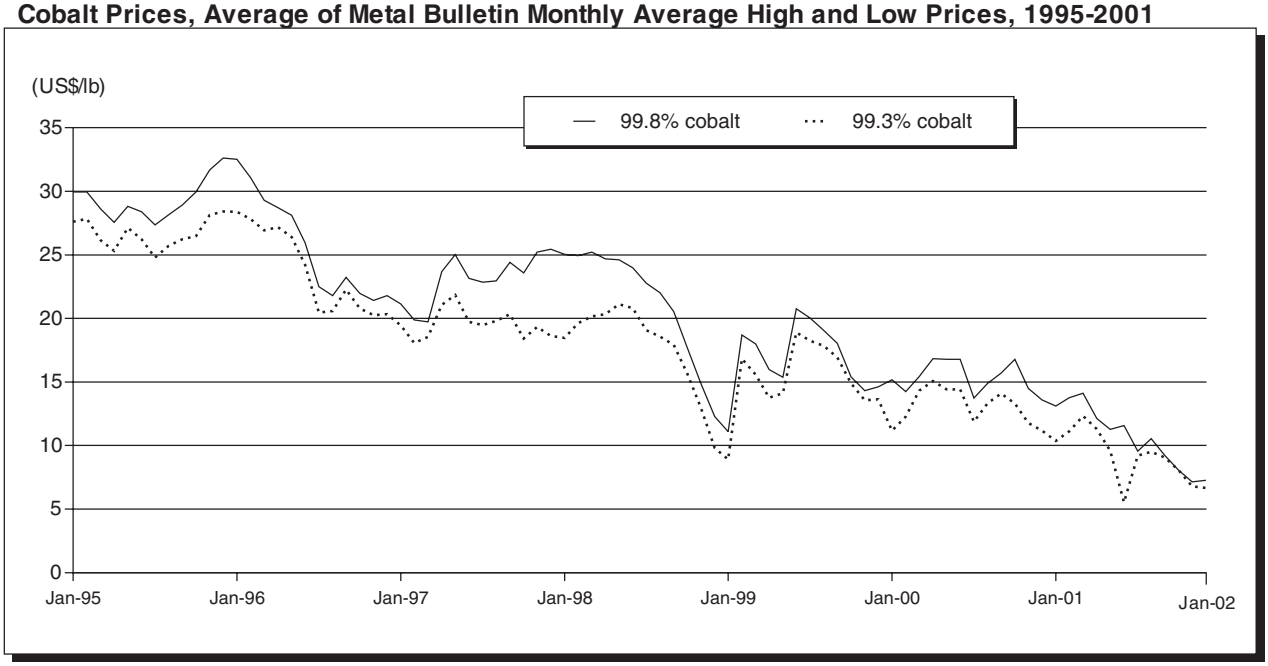
OUTLOOK

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 high growth rates for austenitic[1] stainless steel would increase nickel

[1] Type of stainless steel containing nickel; ferritic stainless steels do not contain nickel.

Figure 4
Cobalt Prices, Average of Metal Bulletin Monthly Average High and Low Prices, 1995-2001



Source: *Metal Bulletin*.

prices; a sustained period of prices in the US$8500/t range would decrease the competitiveness of a significant portion of austenitic stainless steel production. Unless new lower-cost production came on stream, the higher nickel prices would lead to decreased demand growth for nickel.

The December 1998-November 2001 price cycle that peaked in March 2000 at US$10 660/t did not result in new nickel production capacity building following this peak as had occurred when prices improved in earlier price cycles. Part of the reason for the lack of enthusiasm by potential new entrants to the nickel industry in times of high prices was due to the legacy of the laterite debts. Lenders and bond holders for two Australian projects, Cawse and Bulong, were disappointed at the inabilty of these projects to service debt. At the end of 2001, Anaconda Nickel Limited, operator of the third Australian project, reported a loss of A$458 million, largely due to writeoffs.

The traditional producers continued with incremental capacity increases at existing operations (e.g., Sherritt at Moa Bay and Fort Saskatchewan) to reduce operating costs. Some new production capacity came on stream in 2001, such as BHP Billiton's doubling of the capacity of its FeNi plant in Colombia and Anglo American plc's Loma de Niquel new 20 000-t/y operation in Venezuela. In contrast, there was no announcement of a decision on whether to expand Nkomati, as had been expected, and BHP Billiton's Ravensthorpe investment was delayed while studies continued. Inco Limited announced its commitment to the 54 000-t/y Goro project in New Caledonia; the US$1.4 billion operation is scheduled to start producing in 2004. In part, the go-ahead was attributable to the favourable tax concessions that Inco secured in New Caledonia, giving Inco's Goro project a 100% tax holiday for 15 years followed by a 50% tax holiday for 5 years. In addition, Inco will also benefit from financing assistance from the French government.

In general, the amount of new production capacity scheduled to come on stream in the next five years is regarded as insufficient to meet the expected growth rate in stainless steel production. This implies that the growth in stainless steel production will not be as high as expected with higher nickel prices retarding stainless demand. Higher stainless steel prices due to higher nickel prices will act to moderate the stainless steel demand growth rate.

Nickel price volatility is 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). But, in the next three to five years, annual nickel prices are expected to remain in the upper portion of the forecast range. For shorter intervals, nickel prices may be much higher.

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. However, it seems increasingly likely that the U.S. currency value will decline relative to other major currencies, so the nominal price in U.S. dollars may increase more than the price in Euros, as an example. If the Canadian dollar appreciates relative to the U.S. dollar, this will pose a challenge to Canadian producers who have many of their costs denominated in Canadian currency. Nickel prices are not expected to vary with the rates of inflation expected; 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 4) continued their downward trend, due less to increasing nickel production from nickel-cobalt deposits in 2001 than to the downturn in aerospace demand following the terrorist attack in the United States. 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/advanced_search> is a good way to start to find such information. A few sites for additional information include:

Natural Resources Canada
Canadian Minerals Yearbook:
<www.nrcan.gc.ca/mms/cmy/pref_e.html>
Metal and mineral statistics:
<http://mmsd1.mms.nrcan.gc.ca/mmsd/minstatistics_e.asp>

Nickel production by month:
<http://mmsd1.mms.nrcan.gc.ca/mmsd/data/default_e.asp>
Production by province and territory:
<http://mmsd1.mms.nrcan.gc.ca/mmsd/production/production_e.asp>

Physical/Chemical Properties of Nickel
<www.webelements.com/webelements/elements/text/Ni/key.html>

Physical/Chemical Properties of Cobalt
<www.webelements.com/webelements/elements/text/Co/key.html>

WMC Market News and Commentary
<www.wmc-nickel.com/news.asp>
The site provides market information and industry developments (hundreds of items of market information for 1999 onward).

International Nickel Study Group
<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 64. (2) Information in this review was current as of June 30, 2002. (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 www.nrcan.gc.ca/mms/cmy/index_e.html.

NOTE TO READERS

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TARIFFS

Item No.	Description	Canada			United States	EU	Japan (1)	Brazil	India	Taiwan	Korea (2)
		MFN	GPT	USA	Canada	MFN	WTO	MFN	MFN	MFN	MFN
2604.00	Nickel ores and concentrates	Free	Free	Free	Free	Free	Free	4.50%	5%	Free	1%
2825.40	Nickel oxides and hydroxides	Free	Free	Free	Free	Free	4.80%	4.5-12.5%	35%	2.50%	8%
7202.60	Ferro-nickel	6.50%	Free	Free	Free	Free	3.30%	8.50%	25%	Free	3%
7501.10	Nickel mattes	Free	Free	Free	Free	Free	Free	8.50%	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)	8.50%	15%	Free	1-2%
7502.10	Unwrought nickel, not alloyed	Free	Free	Free	Free	Free	44 yen/kg	8.50%	15%	1.25%	3%
7502.20	Unwrought nickel alloys	Free	Free	Free	Free	Free	Free-3% (4)	8.50%	15%	1.25%	3%
7503.00	Nickel waste and scrap	Free	Free	Free	Free	Free	Free	4.50%	15%	Free	1%
7504.00	Nickel powders and flakes	Free	Free	Free	Free	Free	Free-41 yen/kg-3%	8.50%	15%	Free	5%
7505.11	Bars, rods and profiles of nickel, not alloyed	Free	Free	Free	Free	Free	3%	14.50%	15%	2.50%	5%
7505.12	Bars, rods and profiles of nickel alloys	Free	Free	Free	Free	2.90%	3%	14.50%	15%	2.50%	5%
7505.21	Nickel wire, not alloyed	Free	Free	Free	Free	Free	3%	14.50%	15%	1.25%	5%
7505.22	Wire of nickel alloys	Free	Free	Free	Free	2.90%	3%	14.50%	15%	1.25%	5%
7506.00	Nickel plates, sheets, strip and foil	Free	Free	Free	Free	Free-3.3%	Free-3%	14.50%	15%	2.50%	5%
7507.00	Nickel tubes, pipes, and tube or pipe fittings	Free	Free	Free	Free	Free-2.5%	Free-3%	16.50%	15%	2.50%	8%
7508.00	Other articles of nickel	Free-3%	Free	Free	Free	Free	3%	18.50%	15%	1.25-5%	8%

Sources: *Customs Tariff* , effective January 2002, Canada Customs and Revenue Agency; *Harmonized Tariff Schedule of the United States* , 2002; *Worldtariff Guidebook on Customs Tariff Schedules of Import Duties of the European Union* (41st Annual Edition: 2001); *Worldtariff Guidebook on Customs Tariff Schedules of Import Duties of Brazil* (8th Annual Edition: 2001); *Worldtariff Guidebook on Customs Tariff Schedules of Import Duties of India* (8th Annual Edition: 2001); *Worldtariff Guidebook on Customs Tariff Schedules of Import Duties of Korea* (8th Annual Edition: 2001); *Worldtariff Guidebook on Customs Tariff Schedules of Import Duties of Taiwan* (6th Annual Edition: 2001); *Customs Tariff Schedules of Import Duties for Japan* (35th Annual Edition: 2001).

(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	3.50%	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	6.50%	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 2002, Canada Customs and Revenue Agency; *Harmonized Tariff Schedule of the United States* , 2002.
n.e.s. Not elsewhere specified.

TABLE 1a. CANADA, NICKEL PRODUCTION AND TRADE, 2000 -2001

Item No.		2000		2001 (p)	
		(tonnes)	($000)	(tonnes)	($000)
MINE OUTPUT	Nickel content of concentrate	190 793	..	193 361	..
PRODUCTION	Recoverable nickel content in concentrates shipped in 2001				
	All forms				
	Quebec	22 946	294 369	24 199	232 359
	Ontario	114 415	1 467 824	116 418	1 117 849
	Manitoba	43 778	561 634	43 026	413 132
	Total Canada	181 139	2 323 827	183 643	1 763 340
	Finished nickel output (refined nickel in various shapes in Class 1, plus Class II nickel (as defined by the International Nickel Study Group), which includes nickel oxide sinter	134 225	..	140 591	..
EXPORTS					
2604.00.40	Nickel ores and concentrates (nickel content)				
	United States	–	–	6	39
2825.40	Nickel oxides and hydroxides (weight of material, not nickel content)				
	Hong Kong	954	10 622	409	4 573
	United States	75	1 052	120	1 134
	China	9	125	91	969
	Singapore	71	968	60	615
	Sweden	–	–	149	527
	Japan	–	–	11	128
	Malaysia	85	1 054	8	77
	Brazil	6	117	2	43
	Germany	–	–	2	25
	France	–	–	1	10
	United Kingdom	18	51	–	–
	Total	1 218	13 989	853	8 101
2827.35	Nickel chlorides (weight of material, not nickel content)	–	–	–	–
2833.24	Nickel sulphates (weight of material, not nickel content)				
	United Kingdom	332	1 752	284	1 839
	United States	4	6	–	–
	South Africa	91	293	–	–
	Total	427	2 051	284	1 839
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)				
	Belgium	–	–	19	100
	United States	28	157	138	62
	Argentina	–	–	–	–
	Total	28	157	157	162
7202.60	Ferronickel	–	–	–	–
7204.21	Stainless steel waste and scrap (weight of material, not nickel content)				
	Netherlands	–	–	–	–
	Spain	5 593	6 498	–	–
	United Arab Emirates	–	–	–	–
	Brazil	37	50	–	–
	Italy	46	56	–	–
	Switzerland	3	14	–	–
	United States	31 267	27 019	27 350	24 074
	China	189	185	1 372	1 400
	India	1 363	1 308	858	827
	Japan	182	258	392	404
	Taiwan	483	670	294	141
	South Korea	812	1 215	159	153
	United Kingdom	–	–	39	229
	Hong Kong	25	34	25	31
	Total	40 000	37 307	30 489	27 259
7501.10	Nickel mattes (nickel content)				
	Norway	41 031	572 078	45 199	632 275
	Netherlands	–	–	3 182	31 336
	India	21	105	–	–
	Total	41 052	572 183	48 381	663 611

TABLE 1a (cont'd)

Item No.		2000		2001 (p)	
		(tonnes)	($000)	(tonnes)	($000)
EXPORTS (cont'd)					
7501.20	Nickel oxide sinters and other intermediate products of nickel metallury (weight of material, not nickel content)				
	United Kingdom	40 290	387 512	38 061	284 775
	South Korea	1 105	9 217	2 649	17 325
	United States	3 225	39 714	1 621	15 556
	Taiwan	1 434	11 530	1 292	8 447
	Belgium	936	8 913	500	3 757
	Total	46 990	456 886	44 123	329 860
7502.10	Nickel unwrought, not allowyed (nickel content)				
	United States	52 132	662 659	50 716	528 980
	Belgium	10 295	135 500	10 482	99 989
	Hong Kong	6 511	88 106	8 410	89 666
	Netherlands	3 844	48 167	7 954	72 285
	Taiwan	3 761	51 800	5 806	57 032
	Italy	6 382	82 225	5 038	49 049
	United Kingdom	2 340	29 384	3 909	36 581
	Singapore	2 287	30 795	3 816	33 125
	Japan	2 973	39 457	2 158	21 057
	China	525	6 652	1 614	14 714
	Thailand	853	11 389	1 231	11 183
	France	1 386	17 617	1 104	9 928
	Australia	731	9 421	750	7 661
	South Korea	221	3 119	844	7 552
	Indonesia	120	1 825	150	1 649
	Switzerland	–	–	145	1 412
	Spain	546	7 082	120	998
	Chile	96	1 420	72	830
	Philippines	79	1 172	72	800
	Turkey	–	–	36	409
	Brazil	17	176	23	240
	Luxembourg	–	–	24	195
	Venezuela	10	156	10	126
	Germany	–	–	...	25
	Argentina	7	94	–	–
	Total	95 116	1 228 216	104 484	1 045 486
7502.20	Nickel unwrought, alloyed (weight of material, not nickel content)				
	Hong Kong	1 891	25 871	3 692	38 075
	Belgium	679	7 993	1 332	13 163
	South Korea	700	9 422	807	8 561
	China	284	3 623	747	7 834
	United States	217	3 034	39	460
	United Kingdom	–	–	4	28
	Netherlands	121	1 951	–	–
	Total	3 892	51 894	6 621	68 121
7503.00	Nickel waste and scrap (weight of material, not nickel content)				
	United States	5 100	34 103	2 628	10 787
	United Kingdom	11	55	69	277
	Netherlands	–	–	120	130
	Japan	521	3 675	19	62
	Germany	2	13	...	2
	Italy	23	29	–	–
	Total	5 657	37 875	2 836	11 258
7504.00	Nickel powders and flakes, alloyed and unalloyed (weight of material, not nickel content)				
	United States	6 470	109 649	4 515	75 419
	Japan	2 276	30 857	771	9 576
	United Kingdom	24	2 873	23	3 214
	Luxembourg	96	1 191	264	2 326
	South Korea	87	1 265	139	1 408
	Taiwan	111	1 982	126	1 238
	Germany	4	103	46	810
	Netherlands	250	3 519	60	551
	Sweden	–	–	42	467
	Belgium	30	609	18	248
	China	–	–	20	161
	France	24	353	12	138
	Thailand	1	121	5	128
	Austria	...	30	10	101
	Mexico	–	–	11	73
	South Africa	12	373	2	64
	Brazil	4	96	3	58
	Switzerland	2	46	2	26
	Ireland	1	18	1	19
	Hong Kong	...	20	...	18

TABLE 1a (cont'd)

Item No.		2000		2001	
		(tonnes)	($000)	(tonnes)	($000)
EXPORTS (cont'd)					
	Turkey	–	–	1	14
	Indonesia	...	21	1	12
	Czech Republic	–	–	1	11
	Argentina	5	10	...	3
	Spain	6	110	–	–
	Singapore	...	13	–	–
	Philippines	3	39	–	–
	New Zealand	...	28	–	–
	Cuba	...	14	–	–
	India	...	4	–	–
	Total	9 406	153 344	6 073	96 083
7505.11	Bars, rods and profiles of nickel, not alloyed (nickel content)				
	United States	–	–	11	181
7505.12	Bars, rods and profiles of nickel alloy (weight of material, not nickel content)				
	Brazil	–	–	17	105
	United States	...	9	1	44
	Poland	1	13	1	6
	China	...	6	...	1
	United Kingdom	1	10	–	–
	Italy	1	8	–	–
	Russia	1	9	–	–
	Japan	...	3	–	–
	Cuba	...	7	–	–
	Total	4	65	19	156
7505.21	Nickel wire, not alloyed (weight of nickel wire plus coating if any, not nickel content)				
	United States	11	289	8	207
7505.22	Wire, nickel alloy (weight of alloy plus coating, if any; not nickel content)				
	United States	30	662	22	493
	Sweden	–	–	19	137
	United Kingdom	3	42	–	–
	Germany	2	40	–	–
	Taiwan	20	148	–	–
	Total	55	892	41	630
7506.00 (a)	Nickel plates, sheets, strip and foil (weight of material, not nickel content)				
	United States	3	44	16	676
	Poland	1	17	12	147
	China	...	2	1	15
	South Korea	–	–	...	3
	Libyan Arab Jamahiriya	1	2	–	–
	Italy	...	1	–	–
	Russia	...	2	–	–
	Total	5	68	29	841
7507.00 (b)	Tubes, pipes and tube or pipe fittings alloyed and unalloyed (weight of material, not nickel content)				
	United States	..	3 294	..	2 864
	Brazil	–	–	..	647
	United Arab Emirates	..	21	..	344
	Japan	..	70	..	267
	Singapore	..	23	..	91
	Australia	..	15	..	18
	Germany	..	159	..	7
	Malaysia	–	–	..	7
	New Zealand	–	–	..	3
	Poland	..	36	–	–
	Netherlands	..	78	–	–
	Russia	..	40	–	–
	China	..	45	–	–
	Mexico	..	7	–	–
	Total	..	3 788	..	4 248

TABLE 1a (cont'd)

Item No.		2000		2001 (p)	
		(tonnes)	($000)	(tonnes)	($000)
EXPORTS (cont'd)					
7508.00	Other articles of nickel (weight of material, not nickel content)				
	United States	..	10 236	..	11 933
	Poland	..	96	..	179
	United Kingdom	..	30	..	152
	China	..	337	..	147
	Germany	..	100	..	104
	France	..	39	..	62
	New Zealand	–	–	..	60
	Italy	..	10	..	38
	Singapore	..	7	..	32
	Australia	..	12	..	22
	Hong Kong	–	–	..	14
	South Korea	–	–	..	9
	Cuba	–	–	..	7
	Sweden	..	54	..	6
	Netherlands	..	5	..	5
	Switzerland	–	–	..	2
	Finland	..	...	..	...
	Czech Republic	..	6	..	...
	Japan	..	34	–	–
	Brazil	..	...	–	–
	Norway	..	...	–	–
	Russia	..	6	–	–
	Ethiopia	..	1	–	–
	French Polynesia	..	1	–	–
	Mexico	..	...	–	–
	Total	..	10 974	..	12 772
	Total exports	..	2 569 978	..	2 270 855
IMPORTS					
2604.00.00.20	Nickel ores and concentrates (nickel content)				
	Australia (1)	–	–	1 003	9 216
	United States	1 146	7 207	938	5 929
	Finland	–	–	–	–
	Germany	5	46	–	–
	Tanzania, United Republic of	...	...	–	–
	Dominican Republic	...	1	–	–
	Total	1 151	7 254	1 941	15 145
2620.90	Ash and residue that is known to contain nickel (weight of material, not nickel content; material also includes significant cobalt)				
	Cuba (2,3)	54 865	361 717	62 418	303 997
2825.40	Nickel oxides and hydroxides (weight of material, not nickel content)				
	Finland	365	5 409	498	7 036
	United States	3 119	1 174	3 126	1 254
	Germany	236	137	–	–
	United Kingdom	...	...	–	–
	Belgium	2	2	–	–
	Total	3 722	6 722	3 624	8 290
2827.35	Nickel chlorides (weight of material, not nickel content				
	United States	116	736	77	502
	France	146	626	63	350
	United Kingdom	...	1	...	...
	Germany	...	...	...	...
	Switzerland	–	–	...	...
	Norway	...	...	–	–
	Total	262	1 363	140	852
2833.24	Nickel sulphates (weight of material, not nickel content)				
	United States	544	4 173	1 610	5 228
	Finland	256	735	204	555
	Belgium	203	697	102	294
	Austria	10	38	6	18
	France	7	24	3	9
	Australia	120	1 661	2	6
	South Africa	31	117	...	1
	Japan	...	1	–	–
	Taiwan	...	1	–	–
	Total	1 171	7 447	1 927	6 111

TABLE 1a (cont'd)

Item No.		2000		2001 (p)	
		(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	1 062	14 645	488	5 507
	Germany	176	2 182	237	2 799
	United Kingdom	173	3 467	191	2 562
	Denmark	3	60	61	1 878
	Belgium	16	369	8	186
	India	1	6	14	116
	Netherlands	8	121	6	90
	France	...	1	...	7
	Switzerland	–	–	...	...
	Japan	2	28	–	–
	Netherlands Antilles	10	148	–	–
	South Africa	31	1 112	–	–
	Total	1 482	22 139	1 005	13 145
7202.60	Ferronickel (weight of material, not nickel content)				
	United States	54	289	65	339
7204.21	Stainless steel scrap (weight of material, not nickel content)				
	United States	46 701	44 108	35 717	29 404
	China	395	405	238	259
	Canada	39	42	1	1
	Belgium	7	9	–	–
	Greece	..	...	–	–
	Liberia	16	14	–	–
	India	1	1	–	–
	Brazil	15	14	–	–
	Total	47 174	44 593	35 956	29 664
7501.00 (c)	Nickel mattes (nickel content), nickel oxide sinters and other intermediate products of nickel metallurgy (weight of material, not nickel content)				
	Australia	5 234	30 529	4 634	26 187
	Belgium	515	1 265	353	453
	Chile	–	–	32	79
	China	60	404	–	–
	Cuba	–	–	...	...
	Germany	1 198	1 697	982	1 041
	Japan	...	...	1	7
	Netherlands	36	361	–	–
	New Caledonia	–	–	...	...
	Russia	82	475	34	40
	South Africa	186	1 116	1 564	5 997
	Switzerland	112	424	–	–
	Taiwan	–	–	...	1
	United Kingdom	269	1 320	2	16
	United States	2 363	6 791	2 297	6 112
	Total	10 055	44 382	9 899	39 933
7502.10	Nickel unwrought, not alloyed (nickel content)				
	Norway	1 159	13 689	1 029	9 846
	Finland	243	3 424	171	1 913
	United States	351	4 373	56	655
	Russia	87	782	65	618
	China	–	–	25	271
	United Kingdom	124	1 258	45	266
	Canada	81	1 054	22	220
	France	7	116	11	123
	South Africa	1	7	4	32
	Zimbabwe	9	157	1	5
	Germany	–	–	...	4
	Bermuda	38	210	–	–
	Netherlands	9	141	–	–
	Spain	19	265	–	–
	Taiwan	...	...	–	–
	Australia	...	3	–	–
	Total	...	25 479	1 429	13 953

TABLE 1a (cont'd)

Item No.		2000		2001 (p)	
		(tonnes)	($000)	(tonnes)	($000)
IMPORTS (cont'd)					
7502.20	Nickel unwrought, alloyed (weight of material, not nickel content)				
	Russia	–	–	900	5 235
	United States	339	2 395	170	1 701
	Germany	406	662	331	1 375
	United Kingdom	102	1 008	25	340
	Malaysia	–	–	104	198
	Belgium	–	–	...	5
	Italy	–	–	...	...
	Israel	–	–	...	...
	Bermuda	258	1 418	–	–
	Canada	...	5	–	–
	Norway	22	154	–	–
	Switzerland	...	...	–	–
	Japan	...	...	–	–
	Total	1 127	5 642	1 530	8 854
7503.00	Nickel waste and scrap (weight of material, not nickel content)				
	United States	17 926	48 612	21 246	46 487
	United Kingdom	354	1 413	626	4 605
	Russia	1 014	5 617	89	502
	South Africa	–	–	60	495
	Norway	58	682	38	374
	Germany	601	1 871	110	224
	Canada	113	426	25	70
	Argentina	87	545	14	60
	Netherlands	42	346	–	–
	Bermuda	80	455	–	–
	Belgium	...	...	–	–
	Spain	9	18	–	–
	Switzerland	60	173	–	–
	Brazil	2	12	–	–
	Venezuela	156	991	–	–
	Mexico	22	13	–	–
	Total	20 524	61 174	22 208	52 817
7504.00	Nickel powders and flakes, alloyed and unalloyed (weight of material, not nickel content)				
	Australia	1 074	13 558	1 323	12 831
	United States	460	5 138	261	4 203
	Germany	296	1 779	227	2 787
	Belgium	159	1 894	104	1 222
	Ireland	–	–	18	394
	United Kingdom	23	222	20	291
	Switzerland	44	704	8	184
	Russia	22	257	11	125
	Japan	...	2	3	75
	South Korea	–	–	7	75
	Sweden	1	19	...	12
	Austria	1	7	1	9
	Canada	1	13	1	7
	Denmark	–	–	1	6
	Italy	–	–	...	1
	Finland	25	283	–	–
	South Africa	4	53	–	–
	China	2	52	–	–
	Hong Kong	3	22	–	–
	Total	2 115	24 003	1 985	22 222
7505.11	Bars, rods and profiles of nickel, not alloyed (nickel content)				
	United States	10	166	11	194
	Germany	...	8	...	8
	Canada	–	–	...	1
	United Kingdom	–	–	...	1
	Taiwan	–	–	...	...
	Italy	...	1	–	–
	Total	10	175	11	204

TABLE 1a (cont'd)

Item No.		2000		2001(p)	
		(tonnes)	($000)	(tonnes)	($000)
IMPORTS (cont'd)					
7505.12	Bars, rods and profiles of nickel alloy (weight of material, not nickel content)				
	United States	977	20 220	936	19 971
	Italy	4	73	17	363
	Germany	84	1 462	19	286
	United Kingdom	4	79	6	110
	Canada	–	–	3	46
	Cayman Islands	–	–	1	29
	France	...	9	...	9
	Netherlands	...	2	...	6
	Argentina	...	2	1	6
	Austria	...	2	...	1
	Japan	...	1	...	1
	Taiwan	...	...	...	1
	Brazil	...	2	...	...
	Mexico	...	...	–	–
	Slovenia	1	3	–	–
	Total	1 070	21 855	983	20 829
7505.21	Nickel wire, not alloyed (weight of nickel wire plus coating if any, not nickel content)				
	United States	79	859	41	483
	Germany	19	240	10	178
	Japan	15	121	11	93
	Sweden	2	17	4	48
	Switzerland	...	...	...	5
	China	–	–	...	4
	Canada	–	–	...	3
	United Kingdom	–	–	...	...
	South Korea	3	33	–	–
	Total	118	1 270	66	814
7505.22	Wire, nickel alloy (weight of alloy plus coating, if any; not nickel content)				
	United States	350	6 770	314	6 708
	Germany	115	2 027	70	1 195
	Sweden	6	128	32	623
	United Kingdom	38	387	70	525
	France	89	1 272	36	495
	Austria	–	–	26	373
	Belgium	–	–	15	211
	Australia	–	–	4	52
	Italy	4	74	3	50
	South Korea	–	–	4	26
	Mexico	...	2	...	4
	Swaziland	–	–	...	2
	Taiwan	...	...	...	1
	Switzerland	...	3	...	...
	Japan	...	2	...	...
	Hong Kong	–	–	...	...
	Canada	...	...	–	–
	China	...	...	–	–
	Netherlands	...	...	–	–
	South Africa	1	14	–	–
	Total	603	10 679	574	10 265
7506.00	Nickel plates, sheets, strip and foil (weight of material, not nickel content)				
	United States	624	12 951	434	10 493
	Germany	1 111	22 148	150	2 632
	Japan	15	333	8	160
	United Kingdom	28	521	4	88
	France	1	12	1	42
	Sweden	2	33	1	21
	Italy	...	1	...	13
	Belgium	1	19	...	7
	Israel	–	–	...	4
	Finland	...	1	...	3
	Canada	...	9	...	1
	India	1	14	–	–
	Spain	...	...	–	–
	Poland	...	5	–	–
	South Korea	2	15	–	–
	Taiwan	...	5	–	–
	Total	1 785	36 067	598	13 464

TABLE 1a (cont'd)

Item No.		2000		2001 (p)	
		(tonnes)	($000)	(tonnes)	($000)
IMPORTS (cont'd)					
7507.00	Tubes, pipes and tube or pipe fittings alloyed and unalloyed (weight of material, not nickel content)				
	Japan	633	21 452	781	37 546
	United States	593	12 934	770	15 931
	France	10	232	53	1 996
	Germany	26	555	57	1 349
	Norway	200	2 797	121	1 123
	United Kingdom	200	3 832	56	1 119
	Russia	–	–	38	300
	Brazil	–	–	17	293
	Italy	11	200	8	218
	Mexico	–	–	9	85
	Sweden	4	73	3	55
	Spain	...	3	1	22
	Taiwan	...	...	1	11
	China	...	...	2	10
	Austria	...	4	...	4
	Hong Kong	...	2	...	4
	Canada	...	5	...	3
	India	1	10	–	–
	Thailand	...	3	–	–
	Australia	...	1	–	–
	Total	1 678	42 103	1 917	60 069
7508.00	Other articles of nickel (weight of material, not nickel content)				
	United States	859	12 437	736	12 869
	France	311	1 813	353	1 372
	United Kingdom	42	701	37	703
	China	37	265	65	484
	Taiwan	12	123	32	384
	Canada	7	88	32	311
	Switzerland	5	34	39	254
	Israel	15	422	9	196
	Italy	4	79	7	129
	Germany	4	50	4	45
	India	3	47	2	41
	Japan	...	3	4	23
	Hong Kong	2	11	2	21
	Norway	–	–	2	19
	Korea, South	1	16	2	14
	Australia	–	–	1	10
	Poland	...	5	1	10
	Netherlands	1	10	1	9
	Indonesia	–	–	3	6
	Malaysia	...	...	...	6
	Mexico	...	4	...	5
	Greece	...	...	...	4
	Austria	1	4	1	3
	Thailand	...	...	...	2
	Spain	1	25	...	...
	Pakistan	–	–	...	...
	Russia	...	4	–	–
	Belgium	...	...	–	–
	Total	1 305	16 141	1 333	16 920
	Total imports		740 494		637 887
	Total exports	...	2 569 978	...	2 270 855
	Net exports of nickel		1 829 484		1 632 968

Sources: Natural Resources Canada; Statistics Canada.
– Nil; . . Not available or not applicable; . . . Amount too small to be expresssed; (p) Preliminary.
(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) While no imports from Australia were recorded in 2000, Jubilee Mines NL recorded at least two shipments of nickel in concentrates to Canada in 2000; an investigation into these shipments has not been completed. (2) Nickel and cobalt are in the artificial nickel-cobalt sulphide made at an acid leach plant in Cuba using nickel-cobalt oxides as feed. The values reflect both the nickel and the cobalt contents. (3) The tonnage and value of nickel in residue returned to Canada after processing nickel oxides in the United Kingdom cannot be separated out from tonnages of other residues imported from the United Kingdom and so is not included in this total.
Note: Numbers may not add to totals due to rounding.

TABLE 1b. CANADA, NICKEL PRODUCTION AND USE, 1970, 1975, 1980 AND 1985-2001

	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	(a) 13 322
1992	186 384	15 528
1993	188 080	(a) 17 384
1994	149 886	20 746
1995	181 820	20 973
1996	192 649	24 504
1997	(r) 190 502	19 447
1998	(r) 208 301	19 787
1999	(r) 186 236	22 527
2000	190 793	24 976
2001 (p)	193 361	..

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 1987-2001 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 "Nickel Used."
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 "comsumption" in this chapter, where appropriate.

TABLE 1c. CUPRONICKEL, NICKEL-SILVER, STAINLESS STEELS, AND NICKEL-CADMIUM AND NICKEL-IRON BATTERIES, 2000 AND 2001

	2000		2001	
	(tonnes)	($000)	(tonnes)	($000)
STAINLESS STEEL SEMI-FABRICATED ITEMS (excludes scrap)				
Exports – Total For Each HS Class				
7204.29	163 052	33 192	104 207	20 582
7210.90	2 629	4 291	4 988	7 392
7220.20	3 067	11 852	3 871	12 694
7222.11	6 077	12 996	6 686	15 595
7222.19	440	1 802	238	1 032
7222.20	13 207	59 466	11 502	57 483
7222.30	269	1 298	1 568	6 844
Total exports	188 741	124 897	133 060	121 622
Imports – Total For Each HS Class				
7204.29	203 385	59 293	163 929	53 307
7210.90	6 660	14 410	5 018	11 224
7212.50.90.13	3 078	7 187	3 336	8 038
7222.11	2 168	8 701	2 504	10 160
7222.19	3 090	13 068	3 002	14 686
7222.20.10	40	213	154	890
7222.20.90	11 636	45 381	9 086	36 752
7222.30.00.11	282	1 815	202	1 324
7222.30.00.19	12	44	5	22
Total imports	230 351	150 112	187 236	136 403
Net exports of stainless steels	-41 610	-25 215	-54 176	-14 781
CUPRO-NICKEL AND NICKEL-SILVER SEMIFABRICATED GOODS (nickel-silver is a copper-nickel-zinc alloy)				
Exports – Total For Each HS Class				
7403.23	88	370	95	330
7407.22	140	1 301	150	1 067
7408.22	24	323	22	341
7409.40	5 257	70 802	1 899	9 823
7411.22	2 816	21 667	4 805	37 911
Total exports	8 325	94 463	6 971	49 472
Imports – Total For Each HS Class				
7403.23.00.10 to 7403.23.00.40	218	736	84	300
7407.22.11 to 7407.22.29.10	51	252	89	426
7408.22.10 to 7408.22.90.30	373	940	346	961
7409.40.00.11 to 7409.40.00.40	2 447	10 052	108	522
7411.22.00.10 to 7411.22.00.30	392	2 509	415	2 718
Total imports	3 481	14 489	1 042	4 927
Net exports of cupro-nickel and nickel-silver	4 844	79 974	5 929	44 545
ELECTRIC ACCUMULATORS (nickel-cadmium and nickel iron batteries)				
Exports – Total For Each HS Class				
Ni-Cd batteries 8507.30	..	8 945	..	7 916
Ni-Fe batteries 8507.40	..	42	..	158
Total exports	..	8 987	..	8 074
Imports – Total For Each HS Class				
Ni-Cd batteries 8507.30	..	59 222	..	44 304
Ni-Fe batteries 8507.40	..	3 025	..	840
Total imports	..	62 247	..	45 144
Net exports of Ni-Cd and Ni-Fe batteries	..	-53 260	..	-37 070

Source: Natural Resources Canada.
.. Not available.

TABLE 2a. CANADA, COBALT PRODUCTION AND TRADE, 2000 AND 2001, AND USE, 1999-2001

Item No.		2000		2001 (p)	
		(kilograms)	($000)	(kilograms)	($000)
MINE OUTPUT	Cobalt content of concentrates milled	5 298 164		5 333 691	
PRODUCTION	Recoverable cobalt in concentrates shipped				
	Quebec	229 371	11 384 141	251 000	9 580 912
	Ontario	1 359 539	67 476 640	1 401 355	53 491 122
	Manitoba	433 408	21 510 906	395 533	15 097 890
	Total	2 022 318	100 371 687	2 047 888	78 169 933
	Refined (1)	4 078 955		4 062 613	
EXPORTS					
2605.00	Cobalt ores and concentrates (cobalt content)	–	–	–	–
2822.00	Cobalt oxides and hydroxides; commercial cobalt oxides (weight of material, not cobalt content)				
	United Kingdom	327 651	10 457	355 512	10 305
	United States	1 364	83	–	–
	South Korea	5 480	115	–	–
	Taiwan	6	...	–	–
	Total	334 501	10 655	355 512	10 305
2915.23	Cobalt acetates (weight of material, not cobalt content)	–	–	–	–
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 intermediate, alloys and waste and scrap)				
	Norway	1 569 862	62 380	1 437 154	49 377
	United States	864 884	37 638	839 747	34 220
	Japan	1 195 843	58 870	1 003 191	31 922
	Netherlands	464 600	23 175	693 836	22 938
	Belgium	289 978	13 676	410 038	20 104
	Singapore	304 000	14 879	302 400	8 973
	United Kingdom	114 809	3 850	95 562	3 880
	Australia	44 000	1 242	73 000	2 275
	Hong Kong	50 000	2 369	85 174	2 219
	South Korea	15 241	877	21 950	1 137
	China	20 000	1 035	20 000	643
	Germany	–	–	1 724	185
	India	21 716	967	857	47
	Portugal	–	–	500	22
	Argentina	1 100	50	500	14
	Taiwan	–	–	250	12
	Switzerland	–	–	32	2
	France	45	3	–	–
	Indonesia	1 949	125	–	–
	Mexico	311	20	–	–
	Total	4 958 238	221 156	4 976 915	177 970
8105.90	Cobalt and articles thereof, n.e.s.				
	United States	12 220	3 238	17 617	4 437
	Germany	12 950	2 290	11 184	3 092
	United Kingdom	385	68	1 116	227
	Austria	56	7	856	223
	Sweden	142	40	396	87
	Mexico	232	42	188	56
	Brazil	401	78	106	21
	China	–	–	73	19
	Dominican Republic	–	–	8	2
	Korea, South	–	–	1	...
	Netherlands	64	14	–	–
	Argentina	2 221	19	–	–
	France	61	9	–	–
	Japan	39	6	–	–
	Australia	27	8	–	–
	Total	28 798	5 819	31 545	8 164
	Total exports		237 630		196 439

TABLE 2a (cont'd)

Item No.		2000		2001 (p)	
		(kilograms)	($000)	(kilograms)	($000)
IMPORTS (2)					
2805.00	Cobalt ores and concentrates (cobalt content)				
	Finland	32 275	1 471	39 453	1 316
	United States	3 063	134	16 661	626
	Germany	40 697	576	60 541	589
	Belgium	36 001	878	1 744	115
	Poland	17 385	799	–	–
	Switzerland	376 950	3 494	–	–
	Total	506 371	7 352	118 399	2 646
2822.00.00.10	Cobalt hydroxides (weight of material, not cobalt content)				
	United States	25 133	1 323	31 367	1 270
	Finland	3 717	212	2 553	168
	Belgium	–	–	32	2
	United Kingdom	9	...	20	1
	Russia	–	–	–	–
	Netherlands	1 000	61	–	–
	Total	29 859	1 596	33 972	1 441
2822.00.00.20	Cobalt oxides (weight of material, not cobalt content)				
	Belgium	35 750	1 401	55 804	1 968
	Japan	2	...	10 005	661
	United States	3 319	143	2 774	140
	Australia	–	–	324	27
	Finland	14 790	486	75	5
	South Korea	5 111	225	–	–
	Total	58 972	2 255	68 982	2 801
2822.00.00.30	Commercial cobalt oxides (weight of material, not cobalt content)				
	South Korea	–	–	22 002	704
	United Kingdom	2 811	57	492	9
	United States	335	6	364	8
	Belgium	10 650	437	–	–
	Total	13 796	500	22 858	721
2827.34	Cobalt chlorides (weight of material, not cobalt content)				
	United States	45 287	668	45 409	703
	Germany	–	–	50	1
	United Kingdom	89	2	23	...
	Total	45 376	670	45 482	704
2833.29.00.40	Cobalt sulphate (weight of material, not cobalt content)				
	United States	21 670	396	24 367	399
	Finland	14 557	141	5 946	67
	Brazil	–	–	1 816	25
	Philippines	–	–	1 814	25
	France	500	2	1 000	5
	Russia	–	–	100	1
	United Kingdom	26	...	–	–
	Total	36 753	539	35 043	522
2836.99.10.30	Cobalt carbonates (weight of material, not cobalt content)				
	United States	..	23	..	89
	Belgium	..	49	..	37
	Brazil	–	–	..	33
	Philippines	–	–	..	28
	Finland	..	60	..	9
	Total	..	132	..	196
2836.99.90.20	Other cobalt carbonates (weight of material, not cobalt content)				
	Finland	7 878	188	16 783	367
	United States	19 397	504	12 472	324
	Japan	–	–	–	–
	Total	27 275	692	29 255	691

TABLE 2a (cont'd)

Item No.		2000		2001 (p)	
		(kilograms)	($000)	(kilograms)	($000)
IMPORTS (cont'd)					
2915.23	Cobalt acetates (weight of material, not cobalt content)				
	United States	37 120	405	26 645	301
	Japan	...	–	13	...
	United Kingdom	8	...	–	–
	Canada	2	...	–	–
	Total	37 130	405	26 658	301
8105.10.10.10	Cobalt waste and scrap fit only for remelting and recovery of the metal content (weight of material, not cobalt content)				
	Congo	–	–	199 616	1 109
	United States	32 517	645	24 553	568
	Germany	4 869	78	481 787	471
	Netherlands	–	–	37 106	151
	Japan	–	–	30 329	71
	United Kingdom	–	–	105	5
	Trinidad and Tobago	443	16	87	5
	Canada	54	1	–	–
	Total	37 883	740	773 583	2 380
8105.10.10.20	Cobalt powders (cobalt content)				
	Australia	250 072	8 393	367 580	9 224
	United States	58 598	3 072	77 744	3 355
	Belgium	119 154	4 838	90 202	2 935
	Finland	–	–	59 403	2 144
	South Africa	84 098	3 770	55 502	1 963
	Switzerland	–	–	13 008	383
	United Kingdom	1 255	82	5 709	324
	Ireland	–	–	6 000	205
	France	297	22	1 469	151
	Japan	95 764	4 580	5 010	57
	Germany	142	10	422	32
	Sweden	14 140	465	136	7
	Russia	–	–	82	6
	Netherlands	44 048	647	–	–
	Hong Kong	121	3	–	–
	Total	667 689	25 882	682 267	20 786
8105.10.10.30	Unwrought cobalt, not alloyed (cobalt content)				
	Congo	25 614	902	26 907	921
	Zambia	–	–	4 000	152
	United States	9 604	431	1 502	81
	Ireland	–	–	83	3
	Belgium	–	–	15	1
	Switzerland	540	14	–	–
	Russia	3 026	132	–	–
	Japan	7 140	292	–	–
	Bahamas	6 536	293	–	–
	Total	52 460	2 064	32 507	1 158
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	7 296	355	14 706	473
	Japan	–	–	284	4
	Switzerland	3	...	–	–
	Total	7 299	355	14 990	477
8105.90.00.10	Cobalt bars and rods, not alloyed (cobalt content)				
	United States	2 180	169	4 550	422
	Canada	2	...	97	6
	Japan	18	2	55	3
	Switzerland	–	–	26	2
	United Kingdom	130	8	–	–
	Total	2 330	179	4 728	433

TABLE 2a (cont'd)

Item No.		2000		2001 (p)	
		(kilograms)	($000)	(kilograms)	($000)
IMPORTS (cont'd)					
8105.90.00.90	Cobalt and articles thereof, n.e.s. (cobalt content)				
	United States	53 388	6 391	51 051	6 558
	Canada	785	60	999	75
	Belgium	611	48	997	69
	United Kingdom	947	52	459	25
	China	50	2	8	1
	Japan	36	3	10	1
	Germany	798	74	1	. . .
	Switzerland	69	6	–	–
	Mexico	20	2	–	–
	Total	56 704	6 638	53 525	6 729
	Total imports		49 999		41 986
	Total exports		237 630		196 439
	Net exports		187 631		154 453

USE (3)	**1999**	**2000**	**2001**
		(kilograms)	
Cobalt contained in:			
Cobalt metal and metallic compounds	49 340	46 698	. .
Cobalt pigments, feed and ground coat frit	8 378	8 487	. .
Cobalt salts and driers and other uses (4)	72 270	71 530	. .
Total	129 988	126 715	. .

Sources: Natural Resources Canada; Statistics Canada.
– Nil; . . Not available or not applicable; . . . Amount too small to be expresssed; (p) Preliminary.
(1) This total includes cobalt refined production sourced from both domestic and imported feed materials, including mixed Ni-Co sulphides from Cuba. (2) 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. (3) Available data as reported by users. (4) 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 1980-2001

	Concentrate Shipments (1)	Processed Cobalt Exports (2)	Cobalt Oxide and Hydroxide Exports	Cobalt Ore and Concentrate Exports (3)	Cobalt Oxide and Hydroxide Imports (4)	Use (5)
			(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	(r) 4 488	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	2 022	4 987	335	–	103	127
2001 (p)	2 048	5 008	355	–	126	..

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) Processed cobalt includes all forms classified in HS code 8105.10 (intermediate forms such as cobalt in matte, unwrought cobalt, alloyed cobalt, waste or scrap of cobalt, cobalt powders) plus all forms classified in HS code 8105.90 (cobalt and articles thereof, not elsewhere specified). (3) Cobalt content. From 1975 to 1988, cobalt recovered in Canada from domestic concentrate plus exports of payable cobalt in concentrate. Starting in 1989 to date, recoverable cobalt in concentrates shipped. (4) Gross weight. Producers' domestic shipments of refined cobalt plus imports of refined shapes. (5) Use of cobalt in metal, oxides and salts; available data as reported by user.

TABLE 3. CANADIAN NICKEL PRODUCERS - SOURCES FOR ADDITIONAL CORPORATE INFORMATION ON THE INTERNET

Full Corporate Name	Web Site	SEDAR Site (English)
Canmine Resources Corporation	www.canmine.com	<www.sedar.com/command_servlet?cmd=DisplayCompanyDocuments&issuerNo=00012293&lang=EN>
Falconbridge Limited	www.falconbridge.com	<www.sedar.com/command_servlet?cmd=DisplayCompanyDocuments&issuerNo=00000376&lang=EN>
Inco Limited	www.inco.com	<www.sedar.com/command_servlet?cmd=DisplayCompanyDocuments&issuerNo=00001084&lang=EN>
North American Palladium Ltd.	www.napalladium.com	<www.sedar.com/command_servlet?cmd=DisplayCompanyDocuments&issuerNo=00003026&lang=EN>
Sherritt International Corporation	www.sherritt.com	<www.sedar.com/command_servlet?cmd=DisplayCompanyDocuments&issuerNo=00002460&lang=EN>

TABLE 4. CANADIAN NICKEL PRODUCERS

Company	Location	Operation	Production Data: Nickel 2000 (t)	Nickel 2001 (t)	Nickel 2002 (pf) (t)	Cobalt 2001 (t)	Type of Ni Output	Remarks
Canmine Resources Corporation	Cobalt, Ont.	Hydrometallurgical refinery	–	–			Ch	Refinery commissioning started in Dec. 2001; scheduled to be completed in late Q1 2002; initial capacity of 300 t/y Co in chemicals plus by-product Ni in chemicals.
Falconbridge Limited	Katinniq, in Nunavik territory, Que.	Raglan mine/mill (a)	23 089	24 570	26 000	318	S	Mill optimization completed, mill operated at capacity in Q4; forecast production for 2002 of 26 000 t Ni in concentrate (Jan. 2002 forecast).
Falconbridge Limited (1)	Sudbury, Ont.	**Sudbury Operations** (a)						
		Craig mine, u/g	15 300	17 300			SO	Ni in ore mined, rounded to nearest 100 t; production in 2000 and 2001 was affected by a labour strike.
		Fraser mine, u/g	6 800	7 300			SO	Ni in ore mined, rounded to nearest 100 t; production in 2000 and 2001 was affected by a labour strike.
		Lindsley mine, u/g	2 800	3 600			SO	Ni in ore mined, rounded to nearest 100 t; production in 2000 and 2001 was affected by a labour strike.
		Lockerby, u/g	3 300	3 100			SO	Ni in ore mined, rounded to nearest 100 t; production in 2000 and 2001 was affected by a labour strike.
		Total	28 100	31 300				
		Strathcona mill	23 234	25 226	27 000	680	S	10 000-t/d capacity; mill produces bulk concentrate for shipment by truck to company smelter at Falconbridge, Ontario; production in 2000 and 2001 was affected by a labour strike.
		Smelter	47 439	54 892		1 788	M	Processes concentrate from Falconbridge's Sudbury and Raglan operations plus recyclable Ni, Co, Cu; SO_2 is captured to make sulphuric acid; matte is exported to Falconbridge's Nikkelverk refinery in Norway; provincial permission to export up to 45 360 t/y of recoverable Ni in matte until end of 2009; new draft SO_2 regulations issued in September cutting emission limit by 33% by 2007 and ground level concentration to 0.34 ppm by April 2002; production in 2000 and 2001 was affected by a labour strike.
Inco Limited	Sudbury, Ont.	**Sudbury Operations** (2) (b,e)						
		Copper Cliff North mine, u/g					SO	Nominal ore production rate = 900 000 t/y; capacity = 2800 t/d.
		Copper Cliff South mine, u/g					SO	Nominal ore production rate = 1 000 000 t/y; capacity = 3000 t/d.
		Crean Hill mine, u/g					SO	Nominal ore production rate = 1 000 000 t/y; capacity = 3000 t/d.
		Creighton mine, u/g					SO	Nominal ore production rate = 1 100 000 t/y; capacity = 4000 t/d.
		Garson mine, u/g					SO	Nominal ore production rate = 700 000 t/y; capacity = 2000 t/d.
		Lower Coleman mine, u/g					SO	Mine closed in 2001 except for lower portion; previous capacity was 1400 t/d of ore.

TABLE 4 (cont'd)

Company	Location	Operation	Production Data Nickel 2000	Nickel 2001	Nickel 2002 (pf)	Cobalt 2001	Type of Ni Output	Remarks
				(t)				
Inco Limited (cont'd)		McCreedy East mine, u/g					SO	Nominal ore production rate = 1 200 000 t/y including Lower Coleman production; capacity of McCreedy East = 2800 t/d of ore.
		Stobie mine, u/g					SO	Includes remaining operations at Frood mine; nominal ore production rate = 3 500 000 t/y; capacity = 8300 t/d of ore.
		Clarabelle mill					S	36 000-t/d mill takes output of all Inco's Sudbury area mines; improved recovery of Ni by 3.4% since 1999; head grade of 1.57% Ni, 1.68% Cu in 2001.
		Nickel smelter					M	Twin flash smelters; slow cooling of matte, then milling to separate to Ni and Cu streams; matte is sent to matte plant, refinery in Sudbury basin, or refinery in United Kingdom; capacity 100 000 t/y Ni in matte.
		Matte processing plant					II	Produces Ni oxide sinter for export to refineries in Korea and Taiwan or for use in stainless steel industry.
		Nickel refinery					I	59 000-t/y carbonyl refinery producing high-purity Ni pellets, powders and foams.
	Clydach, United Kingdom	Nickel refinery (c)	38 000	33 800			I	Carbonyl refinery producing high-purity Ni pellets, powders and foams from Sudbury feed; returns residue to Canada for reprocessing; Co oxide produced from feed exported from Thompson, about 20% of Inco's Co production in 2001 was in the form of Co oxide; Ontario government permission to export Ni sulphide matte, Ni sulphate residues, Ni oxide sinter, and PGMs concentrates until year-end
		Total of Sudbury plus U.K. finished Ni production (d)	98 000	95 000	104 300			Clydach is part of the Ontario and U.K. division of Inco.
		Cobalt originating from Sudbury ores						61% of Inco's Co production is sourced from Inco's Ontario ores; Inco produced 1450 t of Co in 2001 according to The Cobalt Development Institute.
	Port Colborne, Ont.	Co refinery (b)						Produces refined Co from Ni-Co carbonate feed from Sudbury; Au, Ag, PGMs separated for further treatment at other sites; PGMs are sent to Inco's Acton, U.K. plant for final recovery; capacity 1360 t/y refined Co; about 80% of Inco's Co production is metal; Inco produced 1450 t Co in 2001 according to The Cobalt Development Institute.
	Thompson, Man.	**Manitoba Operations** (b)						
		Thompson mine, u/g					SO	1-D orebody production increased 20% in 2001; ongoing and future exploration for additional ore reserves underground and in area; investigation of bio-assisted heap leaching.
		Birchtree mine,u/g					SO	Upper part of mine producing at 1635 t/d of ore; US$48 million shaft deepened and mine extension approved in 2000 to access 13.6 Mt grading 1.79% Ni to extend mine life by 15 years and increase production by 90%; shaft deepened in 2001, new skips installed in Q1 of 2002, ore hoisting from new ore zones commenced; ramp up to full production targeted at late 2003.
		Manitoba finished Ni production (d)	45 800	49 000	49 900			

		Cobalt originating from Thompson ores (d)					25% of Inco's Co production is sourced from Manitoba production; some is sent to Clydach and some is sent to Port Colborne; about 20% of Inco's production is in form of Co oxide; Inco produced 1450 t of Co in 2001 according to The Cobalt Development Institute.
		Thompson mill (b,d)				S	13 000-t/d mill; head grade in 2001 was 2.46% Ni.
		Thompson smelter				M	Electric furnace smelts partially roasted Ni concentrates from Thompson; Cu concentrate is sent to Sudbury for smelting; smelts Ni concentrates from Cosmos mine in Australia.
		Thompson refinery				I	55 000-t/y electrolytic Ni refinery produces rondelles and cathodes, majority of which is used for electroplating applications; Co hydrate is sent to Port Colborne for recovery; Co oxide is sent to the U.K. for processing.
The Cobalt Refinery Company Inc.	Fort Saskatchewan, Alta.	Hydrometallurgical nickel and cobalt refinery (f)	28 070	29 225	2 943	I	Sherritt International Corporation and General Nickel Company S.A. (owned by the Cuban Ministry of Basic Industries) together own a 50:50 joint venture called Metals Enterprise, which owns The Cobalt Refinery Company Inc.; refinery output progressively increased over past years by de-bottlenecking; produces by-product fertilizer.
North American Palladium Ltd.	85 km from Thunder Bay, Ont.	Open-pit mine and mill (g)	470	728		S	Open-pit palladium mine with by-product nickel production; expansion to 15 000 t/d from 2400 t/d, new mill commissioned in June; throughput lower than expected; additional modifications expected in 2002 to bring operation to capacity; concentrates sent to Inco and Falconbridge Sudbury smelters.

Sources: Various annual reports, web sites, industry publications and press releases. Some specific sources are noted below:

(a) Falconbridge Annual Report and Annual Information Form.
(b) *Canadian Mining Journal*, April-May 2002.
(c) Refined Ni production of U.K. according to INSG; Clydach is the sole primary Ni refinery in the U.K.
(d) Inco Annual Report and 10K report.
(e) *Mining and Mineral Processing Operations in Canada*, 2000-2001, Natural Resources Canada.
(f) Sherritt International Corporation Annual Report 2001.
(g) North American Palladium Annual Report 2001.

(pf) Preliminary forecast; ppm Parts per million.
Ch = Ni in chemicals.
I = Class I Ni (e.g., cathodes, briquettes, pellets, powders, etc., which have a Ni content of 99% ore more).
II = Class II Ni (e.g., products with a Ni content of less than 99% such as FeNi, NiO, UTILITY^{TM} Ni).
M = matte.
S = sulphide concentrates.
SO = sulphide ore mined.
(1) Falconbridge Limited's production in 2000 and 2001 was affected by a labour strike.
(2) Nominal production as reported in the *Canadian Mining Journal*, April/May 2002; capacity as reported in 2000-01 *Mining and Mineral Processing Operations in Canada*, MR 251, Natural Resources Canada; data are for different periods and may not agree.

TABLE 5. LIST OF WORLD NICKEL PRODUCERS

Country	Full Corporate Name or Identifier	Web Site
Albania	Bitincka mine	www.larco.gr
Australia	Anaconda Nickel Limited	www.anaconda.com.au
	Goldfields Mine Management Pty Ltd.	(unknown)
	Jubilee Gold Mines NL	www.jubileemines.com
	LionOre Australia (Nickel) Ltd.	www.lionore.com
	Miitel JV	www.mincor.com.au
	OM Group, Inc. (OMG)	www.omgi.com
	Outokumpu Mining Australia Pty. Ltd.	www.outokumpu.com
	Preston Resources Limited	www.prestonres.com.au
	QNI Ltd.	www.qni.com.au; www.bhpbilliton.com
	Tectonic Resources NL	www.tectonicres.com.au
	Titan Resources NL	www.titanresources.com.au
	WMC Limited	www.wmc.com
Austria	Treibacher Industrie AG	www.treibacher.at/en/index.html
Botswana	BCL Limited	(unknown)
	Tati Nickel Mining Company (Proprietary) Limited	www.lionore.com; www.angloamerican.co.uk
Brazil	Barro Alto Mineração Limitada project	www.angloamerican.co.uk
	Codemin SA	www.angloamerican.co.uk
	Companhia Níquel Tocantins	www.vmetais.com.br/homecnt.htm
	Mineração Serra da Fortaleza Limitada	www.riotinto.com
Canada	Canmine Resources Corporation	www.canmine.com
	Falconbridge Limited	www.falconbridge.com
	Inco Limited	www.inco.com
	North American Palladium Ltd.	www.napalladium.com
	Sherritt International Corporation; The Cobalt Refinery Company Inc.; Metals Enterprise	www.sherritt.com
China	Jilin Nickel Co.	www.jlnickel.com.cn/edefault.htm
	Jinchuan Nonferrous Metals Corporation	www.jnmc.com
	Jinco Nonferrous Metals Co., Ltd.	www.inco.com; www.jnmc.com
	Sichuan Copper-Nickel Co.	(unknown)
	Simsen Metals (Holdings) Ltd.	(unknown)
	Tonghua Ni Cu mine (corporate name unknown)	(unknown)
	Huili Ni mine (corporate name unknown)	(unknown)
	Xinjiang Nonferrous Metals Industry Corporation	(unknown)
Colombia	Cerro Matoso S.A.	www.bhpbilliton.com
Cuba	Moa Nickel S.A.	www.sherritt.com
	Union del Niquel	(unknown)
Dominican Rep.	Falconbridge Dominicana, C. por A.	www.falconbridge.com
Finland	Kokkola Chemicals Oy	www.omgi.com
	OM Group, Inc.	www.omgi.com
	OMG Harjavalta Nickel Oy	www.omgi.com
	Outokumpu Oyj	www.outokumpu.com
France	Eramet Group, The	www.eramet.fr
Former Yugoslav Republic of Macedonia	Feni-Rudnici i Industrija za Nikel, Celik i Antimon (FENI)	www.baryte.com
Greece	General Mining and Metallurgical Co. S.A.	www.larco.gr
Indonesia	PT Antam Tbk	www.antam.com
	PT International Nickel Indonesia Tbk	www.inco.com
Japan	Hyuga Smelting Co., Ltd.	www.smm.co.jp
	Inco TNC Limited	www.inco.com
	Nippon Yakin Kogyo Co., Ltd.	www.nyk.co.jp
	Pacific Metals Co., Ltd.	(unknown)
	Sumitomo Metal Mining Co., Ltd.	www.smm.co.jp
Kazakhstan	Kempirsai Mining Directorate	(unknown)

TABLE 5 (cont'd)

Country	Full Corporate Name or Identifier	Web Site
Korea, Rep. of	Korea Nickel Corporation	www.inco.com
New Caledonia	Goro Nickel S.A.	www.inco.com
	Le Nickel-SLN	www.eramet.fr
	Société Minière du Sud Pacifique S.A., La	(unknown)
	Société Minière Georges Montagnat S.A.	(unknown)
	Sociètè des Mines de la Tontouta	(unknown)
Norway	Falconbridge Nikkelverk Aktieselskap	www.falconbridge.com
	Nikkel og Olivin A/S	www.outokumpu.com
	Titania A/S	(unknown)
Philippines	Cagdianao Mining Corporation	(unknown)
	Hinatuan Mining Corporation	(unknown)
	Rio Tuba Mining Corporation	(unknown)
	Taganito Mining Corporation	(unknown)
Russia	MMC Norilsk Nickel	www.nornik.ru/index.jsp?lang=E
	Rezh Nickel Plant Joint Stock Company	(unknown)
	Ufaleynikel Joint Stock Co.	(unknown)
	Yuzhuralnikel Kombinat Joint Stock Co.	(unknown)
Serbia	Ferro-Nickel D.D. Glogovac	(unknown)
South Africa	Anglo American Platinum Corporation Limited	www.angloplatinum.com
	Impala Platinum Holdings Limited	www.implats.co.za
	Lonmin plc	www.lonmin.com
	Nkomati JV	www.avmin.co.za
Taiwan, China	Taiwan Nickel Refining Corporation	(unknown)
Ukraine	Nikomed Limited	(unknown)
United Kingdom	Inco Limited	www.inco.com
Venezuela	Minera Loma de Niquel C.A.	www.angloamerican.co.uk
Zimbabwe	Bindura Nickel Corporation Limited	www.angloamerican.co.uk
	Rio Tinto Zimbabwe Limited	www.riotinto.com
	Makwiro Platinum Mines (Private) Limited	www.zimplats.com

Source: Natural Resources Canada.

TABLE 6. WORLD NICKEL PRODUCERS, 2001

Country	Company	Operation	Nickel Output 2000	Nickel Output 2001	Cobalt in 2001	Type of Ni output	Remarks
				(t)			
Australia	Anaconda Nickel Limited	Murrin Murrin mine, PAL, refinery	12 988	24 991	1 452	I	Ni briquettes produced, listed on LME in Sept.; continued problems in attaining rated capacity; major write-offs in Dec.; arbitration hearing against contractor expected to be heard in early 2002.
	Goldfields Mine Management Pty Ltd	Otter Juan and Cornet mines	–	(e) 2 300		SO	Purchased in May from WMC, ore delivered to WMC for toll milling, concentrate purchased by WMC under long-term contract; ore deliveries in 2001 started in May; production estimated for 2001.
	Jubilee Gold Mines NL	Cosmos mine, mill	5 600	11 000		S	Ni in concentrate sent to Inco smelters in Canada (2001 production rounded to nearest 1000 t); underground extension; Jubilee announced in Nov. it will proceed with underground development after securing A$40 million debt facility from bank.
	LionOre Australia (Nickel) Ltd.	Emily Ann mine, mill	–	110		S	Ni in conc.; contracted to Inco (to be smelted by WMC in Australia); mill construction finished in Oct., reached planned throughput in Q4; resource of 2.1 Mt @ 3.98% Ni.
	Miitel JV	Miitel and Wannaway mines	–	7 227	132	SO	JV of Mincor, Clough, and Donegal mining former WMC mines; WMC mills ore and buys conc., Wannaway mine purchased in Sept.; reserves at Miitel, Wannaway and Redross mines expected to last at least five years.
	OM Group, Inc. (OMG)	Cawse mine, PAL, refinery	6 639	?	?	I	Refinery closed in early 2002 after OMG purchase; Ni-Co intermediate to be shipped to OMG refinery in Finland; no production data released.
	Outokumpu Mining Australia Pty. Ltd.	Black Swan mine, mill	16 600	21 800		S	Ni in concentrate sent to Outokumpu refinery in Finland; Outokumpu considering selling property; ore production about 0.5 Mt/y.
	Preston Resources Limited	Bulong mine, PAL, SXEW	5 216	6 977	379	I	Produces Ni cathode, Cu metal, Co in sulphide; lower throughput and operating problems during year; tentative agreement with major creditors to surrender 95% of equity for release from debt agreements; R&D testing program started for atmospheric laterite leaching; tested Ni-Co residues from WMC's refinery.
	QNI Ltd.	Yabulu refinery; ammonia leach	26 713	28 500	1 800	I	Imports limonitic laterite ore from New Caledonia (70% feed), Philippines (7%), Indonesia (23%); expansion to 65 000 t/y being studied to handle expected output of Ravensthorpe project, Western Australia, under consideration.
	Tectonic Resources NL	RAV 8 mine, mill	2 730	4 008		S	Shipped Ni in concentrate to WMC's Kalgoorlie smelter; milling closed end of 2001 and mill will ship to WMC mill; underground exploration of two orebodies at site ongoing at year-end.
	Titan Resources NL	Radio Hill mine, mill		4 755	264	S	Ni in concentrate shipped to WMC smelter at Kalgoorlie; conc. contains Cu, Co and Pd as well.
	WMC Limited	Kambalda mines, mill	19 202	18 653		S	Ni in concentrate is sent to WMC smelter at Kalgoorlie; mill takes ore from various WMC properties sold in 2000 and 2001; in 2002, Tectonic mine ore will be shipped to WMC's Kambalda mill.
	WMC Limited	Leinster mines, mill	40 724	38 008		S	Ni in concentrate is sent to WMC smelter at Kalgoorlie.
	WMC Limited	Mt. Keith pit, mill	47 532	47 930		S	Record output in 2001. Yakabindie orebody purchased from Rio Tinto; prefeasibility study under way to expand Mt Keith using Yakabindie and North Six Mile deposits.
	WMC Limited	Kalgoorlie smelter	103 019	96 650	1 000	M	700 000 t of concentrate smelted, including 19 717 t from third parties such as Miitel JV; matte surplus to needs of Kwinana exported to Japan (Sumitomo) and Finland, totaling 35 000 t; production forecast for 2002 is 92 000 t; Co in mixed sulphide residue is sent to Europe for recovery.
	WMC Limited	Kwinana refinery	60 532	61 324		I	Refinery upgraded to 67 000-t/y capacity; record output in 2001; debottlenecking could take capacity to 70 000 t/y; conceptual plans to increase capacity to 80 000 t/y and beyond.
	Treibacher Industrie AG	FeNi smelter	1 300	1 300	–	II	Takes scrap to produce FeNi.

Botswana	BCL Limited	Mines, mill and smelter at Selebi Phikwe	21 446	22 454	325	M	Own mines supply concentrate to smelter, supplemented by Tati feed; matte is sent to Nikkelverk in Finland and to Bindura in Zimbabwe.
	Tati Nickel Mining Company (Proprietary) Limited	Selkirk u/g and Phoenix pit, dry magnetic mill	8 547	8 177	26	S	Selkirk u/g mine direct ships ore, to close in first half of 2002; Phoenix open-pit expansion and wet mill expansion to be completed in 2002 and production to nearly double; mine paid for about 77% of Ni shipped to BCL; Centametall buys mine output; BCL management of mine to end in 2002; payable production in 2001 was 6305 t Ni.
Brazil	Codemin SA	Niquelandia mine, smelter	6 300	5 800	–	II	Mandatory power rationing in second half of 2001 caused 25% reduction in throughput, partially offset by higher-grade feed; reserves only until about 2007; produces FeNi.
	Mineração Serra da Fortaleza Limitada	Fortaleza mine, mill, smelter	8 738	10 170		M	Ni matte is sent to OMG refinery in Finland.
	Companhia Níquel Tocantins	Tocantins mine, ammonia leach plant at Niquelandia; refinery at Sao Paulo	16 906	16 700	890	I	Announced plan to increase capacity from 17 000 t/y Ni to 21 000 t/y in 2002 and Co capacity from 780 t/y to 1100 t/y; thereafter to increase to 21 000 t/y Ni in 2004; built power generation facilities due to power rationing instituted in mid-year.
Canada	Canmine Resources Corporation	Cobalt hydrometallurgical refinery	–	–	–	Ch	Refinery plans to produce Ni by-product in 2002 in order of 100 t.
	Falconbridge Limited	Raglan mine, mill	23 089	24 570	318	S	Record production in 2001; output forecast at 26 000 t of Ni in concentrate in 2002.
	Falconbridge Limited	Sudbury - 4 u/g mines, mill, smelter	54 900	47 400	630	M	Ni-Cu-Co matte exported to Nikkelverk refinery in Norway; operation returned to normal output in June after 6½-month strike that ended in late Feb.; mining of Onaping Deep orebody being studied; produced about 3000 t of Ni in matte from recyclables in 2001; encouraging drill results near Nickel Rim deposit to be further explored in 2002; production forecast for 2000 = 27 000 t Ni in concentrate.
	Falconbridge Limited	Montcalm deposit	–	–	–	SO	Purchased in Q2; potential to produce 8000 t/y Ni in concentrates; ore to be milled at Falconbridge's Kidd Creek operation, then concentrate sent to Sudbury for smelting; plans call for initial production in 2004, subject to decision to proceed.
	Inco Limited	Port Colborne refinery and processing facilities	–	–	n/a		Produces electrolytic cobalt metal, about 80% of Inco's Co production is produced as metal; capacity reported as 1360 t/y Co; upgrading of PGMs, Au and Ag; class action suit filed for C$750 million for past emissions being opposed by Inco.
	Inco Limited	Sudbury - 8 u/g mines, mill, smelter, matte processing, carbonyl refinery	98 000	95 000	n/a	I,II	Pellets, powder, NiO sinter; Crean Hill mine to close in 2002; cobalt recovered at Port Colborne; PGMs are sent to Inco facility at Acton in U.K. Production data include 38 000 t Ni in 2000 and 33 800 t in 2001 produced at Clydach.
	Inco Limited	Thompson - 2 u/g mines, mill, smelter, electro-refinery	45 800	49 000	n/a	I	Cathode, rondelles; 470-t/y capacity to produce Co oxide.
	The Cobalt Refinery Company Inc.	Fort Saskatchewan - hydromet refinery using ammonia	28 070	29 225	2 943	I	(Sherritt/Cubaniquel JV) record output at 32 000 t/y Ni and 3200 t/y Co plant; takes 93% of Ni feed from Moa Nickel S.A.
	North American Palladium Ltd.	Lac des Iles - open-pit mine, mill	470	728		S	Ni contained in PGM concentrate sent to Inco and Falcobridge in Sudbury; mine/mill expansion from 2700 t/d to 15 000 t/d with mill commissioned in June; mill throughput problems being addressed.
China	Cu-Ni mine (company name unknown)	Tonghua Cu-Ni mine	?	?		S	Cu-Ni mine; capacity and output unknown.
	Ni mine (company name unknown)	Huili Nickel mine and smelter	?	?		M	Reportedly a mine and smelter with capacity of about 1400 t/y Ni.
	Jilin Nickel Co.	3 mines, smelter, refineries	?	?		M,I	Capacity 9500 t/y Ni in matte and 1000 t/y Ni cathodes plus 3500 t/y Ni hydroxide; recent production data not available; production in 1998 said to be about 5000 t Ni; smelts Ni concentrate from other producers.
	Jinchuan Nonferrous Metals Corporation	Mines, mill, smelter, refinery	40 000	(e) 50 000	(e) 750	I, Ch	Various estimates for production in 2001 estimated Co production in 2001 between 750 and 1000 t.
	Sichuan Copper-Nickel Co.	Chengdu refinery	?	?		I	Refinery; capacity and output unknown.
	Simsen Metals (Holdings) Ltd.	Mine	?	?		S	Started up in 1999; ships concentrate to Jinchuan; forecast from 1999 that production would be 1500 t contained Ni in 2000.
	Xinjiang Nonferrous Metals Industry Corporation	Kalatongke	?	?		M,I	Ni-Cu mine, smelter, refinery; capacity and output unknown.

TABLE 6 (cont'd)

Country	Company	Operation	Nickel Output 2000	Nickel Output 2001	Cobalt in 2001	Type of Ni output	Remarks
				(t)			
Colombia	Cerro Matoso S.A.	Cerro Matoso mine, FeNi smelter	27 800	38 500	–	II	FeNi produced; US$500 million expansion started up Jan. 2001; capacity will reach 55 000 t/y after ramp-up; mining rate increased to 2.5 Mt of ore in 2001 compared to 1.2 Mt in 1999.
Cuba	Union del Niquel	Commandante Ernesto Che Guevara Mining and Metallurgical Combine (Punta Gorda) mine and refinery	(e) 30 500	(e) 32 200	(e) 975	II,S	NiO sinter produced for export plus Ni-Co in mixed sulphide produced and exported to Canada and China; production said to be "over 31 000 t" in 2001; *production in 2001 estimated by author after site visit (production in 2000 estimated by taking INSG Cuban production of 39 994 t of Ni in NiO less reported Nicaro production plus an estimated 1950 t of Ni in sulphides)* .
	Union del Niquel	Commandante Rene Ramos Latour Mining and Metallurgical Combine (Nicaro) mine and refinery	10 780	(e) 11 000		II	NiO sinter produced for export; *2001 production estimated by author* .
	Moa Nickel S.A.	Pedro Sotto Alba mine, PAL (e)	26 800	(e) 29 400	(e) 2 950	T	New mining area commenced in 2001; produces mixed Ni-Co sulphide for export to Fort Saskatchewan, Canada; production data released as Ni+Co contained *(ratio of Ni:Co output for Fort Saskatchewan refinery used to estimate Ni and Co tonnage, data rounded and approximate)* .
Dominican Republic	Falconbridge Dominicana, C. por A.	Falcondo mine, FeNi smelter	21 662	27 800	–	II	FeNi produced; mine was shut from October to year-end due to low Ni prices.
Finland	Outokumpu Oyj	Hituri mine, mill	2 000	2 600	?	S	Conc. is sent to Harjavalta smelter; mine was to have closed in 2001 but averted by agreement with OMG, which needs feed for its refinery at Harjavalta.
	Outokumpu Oyj	Harjavalta smelter (e)	(e) 35 600	(e) 36 500		M	Matte is sent to OMG refinery on site; *(production in 2001 and 2000 estimated by author using reported refined Ni production in Finland less imported matte reported for each year; estimate rounded)* .
	OMG Harjavalta Nickel Oy	Harjavalta refinery	50 600	54 600	?	I	Data are INSG production of refined nickel for Finland.
France	The Eramet Group	Sandouville refinery	12 276	13 033	199	I,Ch	Takes matte from Doniambo as feed for Ni cathodes and Ni chloride; cobalt chloride is also produced; 10% cost reductions achieved through debottlenecking under "Sandouville Demain" program initiated in 1998.
Former Yugoslav Republic of Macedonia	Feni-Mak	Feni-Mak mines, FeNi smelter	–	3 000		II	June start-up reported, ramp-up to 500 t per month Ni in FeNi by Sept.; 2001 production per INSG stats; plant purchased in 2000 by Feni-Rudnici i Industrija za Nikel, Celik i Antimon (FENI) of France.
Greece	General Mining and Metallurgical Co. S.A.	Larco mines, FeNi smelter	18 000	19 600	–	II	US$30 million investment announced in 2001; imports some ore from Albanian mine; production data per INSG; government to privatize operation; produces FeNi.
Indonesia	PT Antam Tbk	Gebe, Pomalla, Gee, Buli mines	(e) 41 000	(e) 49 000	–	L	Gebe, Pomalaa, Gee and Buili mines; produced 2.5 Mt (wet) high-grade saprolite ore + 1.1 Mt wet limonitic ore in 2001 (2.1 Mt and 0.93 Mt in 2000); high-grade ore shipped to Japan and limonitic ore shipped to QNI; mines supply own FeNi plant at Pomalaa; Buili mine started up in Q3; export contracts with Japanese FeNi smelters increased to 2.1 Mt (wet) for period June 2001 to May 2002 from 1.32 Mt (wet) one year earlier to compensate for Japanese smelters' loss of feed due to SMSP cessation of exports of garnieritic (high-grade) laterite ore to Pamco. *(Production estimated by author using reported shipments and reserve grades, as well as moisture contents for ore reserves.)*
	PT Antam Tbk	Pomalaa FeNi I and FeNi II plants, smelter lines	10 111	10 302	–	II	One furnace shut in July due to water leak, restarted in August causing loss of about 1150 t Ni in FeNi production; PT Antam sent 65 000 wet t ore to Pamco for toll smelting; FeNi III project to increase capacity from 11 000 t/y to 24 000 t/y Ni in FeNi being reviewed by German Credit Agency; estimated cost of expansion is US$228 million.
	PT International Nickel Indonesia Tbk (PT Inco)	Soroako mine, smelter	59 200	62 600	–	M	Smelter expansion to 150 million lb/y (68 000 t/y) completed in 2000; talks with PT Antam about joint development of Inco's orebodies at East Pomalaa; forecast production for 2002 of 60 000 t Ni in Ni matte (production below capacity due to furnace rebuild).

Japan	Hyuga Smelting Co., Ltd.	FeNi smelter at Hyuga, Miyazaki Prefecture	19 618	19 130	–	II	Owned 60% by Sumitomo; intention to expand production to 25 000 t/y Ni in FeNi from current 19 000 t/y announced in 2000, no construction begun in 2001; obtains feed from New Caledonia and Indonesia.
	Inco TNC Limited	Nickel refinery located at Matsauzka, Mie Prefecture	(e) 48 000	(e) 48 000	–	II	Estimated production from Tex Report; imports matte from PT Inco to produce NiO for use in other refineries in which Inco has interests (16 600 t of Ni in NiO to Korea in 2001 and 7400 t to Taiwan) and to produce Class II brands (Tonimet and UTILITY™ Ni).
	Nippon Yakin Kogyo Co., Ltd.	FeNi smelter at Oheyama, Kyoto Prefecture	11 609	12 445	–	II	Announcement in November that contracted imports from PT Antam would be 400 000 t for period June 2001-May 2002; also takes feed from New Caledonia; produces FeNi.
	Pacific Metals Co., Ltd. (Pamco)	FeNi smelter at Hachinohe, Aomori Prefecture	36 538	42 000	–	II	SMSP suspended ore exports to Pamco in Jan.; Pamco toll smelted small amount of ore for PT Antam; will import 900 000 t (wet) of ore from PT Antam in period June 2001 to May 2002 (up from 180 000 t in 2000); imported 1.3 Mt (wet) from Philippine mines; produces FeNi.
	Sumitomo Metal Mining Co., Ltd.	Electroytic refinery at Niihama, Ehime Prefecture	30 500	32 526	350	I	Production using matte imported from Australia and matte from PT Inco in which Sumitomo has a 20% share; mid-2001 announcement that Sumitomo would proceed with PAL plant at Rio Tuba to produce 10 000 t/y Ni and 700 t/y Co in intermediates to be processed at Niihama plant starting in 2004.
Kazhakstan	Kempirsai Mining Directorate	Laterite mines	2 000	?	–	L	Estimated Ni content of ore exported to FeNi plants in Russian Federation in 2000.
Korea	Korea Nickel Corporation	Onsan refinery	26 500	28 000		II	Produces Class II Ni (UTILITY™ grade at 97%); feed includes NiO feed from Inco Sudbury operation and Inco TNC in Korea.
New Caledonia	Sociète des Mines de la Tontouta (SMT)	Nakety, Moneo and Karenbe mines and Nakety/Bogata project with Argosy/Norilsk			–	L	Exports ore to Japan (saprolite) to Hyuga; 284 000 t (wet) in 2001 and 282 000 t (wet) in 2000; MMC Norilsk Nickel is buying into an Argosy Minerals Inc.-SMT project to develop a 6-Mt/y mine and plant to produce NiCo sulphide intermediates, Norilsk will fund a bankable feasibility study.
	Le Nickel-SLN	Doniambo FeNi smelter	57 463	58 973	–	II, M	Produces FeNi and Ni in matte in ratio of about 4:1; matte is sent to Eramet refinery in France at Sandouville and FeNi sold to end users.
	Le Nickel-SLN	Kouaoua, Nepoui Kopeto, Tiebaghi, Thio, and Poro mines	?	?		L	Mined 3.6 Mt (wet) compared to 3.7 Mt (wet) in 2000, of which 92% was garnieritic, almost all shipped to the company's FeNi smelter in New Caledonia; SLN exported garnieritic ore to Japan in 2001: 167 000 t (wet) exported to Nippon Yakin and 18 000 t (wet) to Hyuga; limonitic production was exported in 2001 to QNI in Australia.
	La Société Minière du Sud Pacifique S.A.	Various mines on both coasts and Koniambo project with Falconbridge	?	?	?	L	Owned by investment agency of the Northern Province; ceased shipments of 1 Mt/y (wet) garnieritic ore to Pamco in Jan., reducing total exports to Japan from 1.2 Mt in 2000 to 439 000 t in 2001; also shipped 2 Mt (wet) of limonitic ore to QNI in Australia; to hold 51% of Koniambo project being studied by Falconbridge (60 000 t/y of Ni in FeNi planned).
	Société Minière Georges Montagnat S.A.	Tontouta open pit	?	?	–	L	Leases Tontouta pit from SLN; exported 224 000 t (wet) garnieritic ore to Pamco in 2001, up from 74 000 t in 2000; also ships limonitic ore to QNI in Australia.
Norway	Nikkel og Olivin A/S	Mine, mill	2 300	2 500	(e) 90	S	Mine to close in July 2002 when ore reserves exhausted; owned by Outukumpu; contained estimated 90 t Co in concentrate in 2001.
	Falconbridge Nikkelverk Aktieselskap	Nikkelverk refinery	58 679	68 221	3 314	I	Takes matte from Falconbridge's Sudbury smelter, from BCL and from other sources; production in 2000 and 2001 affected by feed shortages due to strike at Falconbridge Sudbury operations; forecast production 76 000 t Ni in 2002 and 86 000 t in 2003; new feed supply will be matte originating from Tati mine and smelted at BCL.
	Titania A/S	TiO, magnetite mine	400	400	?	S	By-product low-grade Ni concentrate is sent to Outokumpu's smelter at Harjavalta, Finland.
Philippines	Cagdianao Mining Corporation	Mine	5 050	3 000		L	Ships ore to Pamco.
	Hinatuan Mining Corporation	Mine	5 500	–		L	Hinatuan mine reserves exhausted, company refused permission to ship stockpiled ore from former Manikani mine.
	Rio Tuba Mining Corporation	Rio Tuba mine	9 500	4 350	–	L	Ships ore to Pamco.
	Taganito Mining Corporation	Mine located in Suriago del Norte	6 050	13 000		L	Entire output sold to Pamco.

TABLE 6 (cont'd)

Country	Company	Operation	Nickel Output 2000	Nickel Output 2001	Cobalt in 2001	Type of Ni output	Remarks
				(t)			
Russia	MMC Norilsk Nickel	Norilsk - 7 mines, 2 mills, 2 smelter/refineries	?	?	?	I,M	Oktaybrsky mine is source of over 50% of Ni and 55% of PGMs produced in Polar Division (Taimyrsky is 33% and 16% respectively); mine grades are declining.
	MMC Norilsk Nickel	Pechanganickel - 3 mines, mill, agglomeration plant, smelter	?	?	?	M	Open-pit mines at Zapolyarny and smelter at Nikel; US$91 million program to reduce SO_2 emissions announced (including US$30 million grant from Norwegian government and US$30 million low-rate loan from Nordic Bank).
	MMC Norilsk Nickel	Severonickel refineries	?	?	?	I	Increasing amount of scrap recycled; also produces small amount of nickel carbonyl.
	MMC Norilsk Nickel, all divisions		217 000	223 000	4 600	I	Production data for company released Sept. 24, 2002.
	Rezh Nickel Plant Joint Stock Company	Talovsk mine, smelter	?	4 400	?	M	Production reported as 2945 t in first half 2001, then shut on Oct. 1 until year-end due to low Ni prices and high costs; plant produces 13% Ni matte for refining at Ufaleynikel; plant also had some FeNi capacity.
	Ufaleynikel Joint Stock Co.	Ufaley and Serovskoye mines, refinery	11 000	(e) 9 500	tolls	II, I	Produces FeNi; tolls Ni matte from Rezh plant as well as Co concentrate from MMC Norilsk Nickel; production cut in July and reportedly was shut in October *(author's estimate of production in 2001 based upon 1000 t/month for 9.5 months; Interfax reported 12 000 t of production in 2001); Co tolling rate of 450 t/month reported.*
	Yuzhuralnikel Kombinat Joint Stock Co.	Buruktalskoye mine (Orenburg region) and Sakharinskoye mine (Chelyabinsk region)	7 400	?		L	Yuzhpolymetall, subsidiary of Yuzhuralnikel, leases Ni metal production facilities; *author's estimate for 2000 production based upon 11 months reported data; no information for 2001 production but reportedly in production in early 2002.*
Serbia-Kosovo	Ferro-Nickel D.D. Glogovac	Cikotava and Gllavica laterite mines	–	–	–	II	INSG does not show FeNi production since 1998.
South Africa	Anglo American Platinum Corporation Limited	Underground and open-pit mines, smelters, base-metal and precious-metal refineries	19 200	19 500	–	I	Ni is by-product of PGM operations; major expansion of PGM operations likely to result in expanded Ni production capacity by 2006 when Pt production to increase by 70%; smelter convertor program scheduled for completion in Q2 2002 (handles 33 000 t/y Ni in convertor matte); plans to increase platinum production by 70% by 2006 were announced in 2000, implying substantial increase in future by-product nickel production can be expected.
	Anglovaal Mining Limited, Anglo American plc	Nkomati JV mine/mill	4 700	4 400	57	S	US$100 million expansion to about 17 500 t/y Ni output being studied; considering Activox™ low pressure process plus SXEW to produce Ni cathodes, Cu cathodes, Co in carbonate; Pd also recovered; mine sends bulk of concentrate to BCL for smelting.
	Impala Platinum Holdings Limited	Various mines, smelter and base-metals refinery in Bushveld complex	13 800	14 000		I	Ni is by-product of PGM operations; Impala supplements own feed with tolled and purchased concentrates; plan to study expansion of Ni refinery to handle 40 000 t/y Ni and 4000 t/y Co in intermediate from potential revival of Nonoc operation on hold.
	Lonmin plc	Eastern Platinum Limited, Western Platinum Limited mines, smelter and refinery	?	?		Ch	Ongoing US$500 million expansion, Ni is by-product of PGM operation, INSG put capacity at 3000 t/y Ni as Ni sulphate; production data not released; Lonmin plans expansion of platinum production by about 50% from 2001 levels, implying some increase in Ni by-product production can be expected.
	Northern Platinum Limited	Mines, mills, smelter, base-metal removal plant	1 500	1 400		Ch	Ni is by-product of PGM operation; produces approximately 1400 t/y Ni in concentrate, which is sold in form of Ni sulphate to Anglo American Platinum Corporation Limited.
Taiwan	Taiwan Nickel Refining Corporation	Transforms NiO to make UTILITY™ Ni (97% Ni) at Kaohsiung Hsien	(e) 9 000	(e) 10 000		II	Transforms NiO UTILITY™ Ni; plant output estimated assuming 76% Ni in feed and 99% recovery in process with no changes in inventory; data are not released.
Ukraine	Nikomed Limited	Pobuzhsky FeNi smelter	?	1 500		II	Plant purchased by Nikomed Limited, which spent US$10.5 million to refurbish plant and restart it in Q1 2001; SMSP sent two trial shipments of garnerite; one of two furnaces shut in December for repairs to refractory bricks; produces FeNi.
United Kingdom	Inco Limited	Clyadach carbonyl refinery	38 000	33 800		I	Takes NiO from Sudbury to produce Ni pellets, foams and powders; residue from refining is returned to Sudbury for reprocessing; data shown is INSG production reported for U.K. These data are counted in Sudbury production totals.

Venezuela	Minera Loma de Niquel, C.A.	Loma de Niquel mine, FeNi smelter	–	9 700		II	US$500 million twin line FeNi plant operation started up in January; first shipment of FeNi in March; ramp up to design capacity of 20 000 t/y forecast for second half of 2002.
Zimbabwe	Bindura Nickel Corporation Limited	Trojan and Shangani mines, smelter, refinery	12 700	12 900		I	Mine reserves at Trojan are 10 years; at Shangani, 5 years; 1.9 Mt mined in 2001; Madziwa mine closed at end of 2000.
	Rio Tinto Zimbabwe Limited	Empress refinery	6 935	6 635	?	I	Toll treats BCL matte plus other material using leach/electrowin process.
	Makwiro Platinum Mines (Private) Limited	Ngezi mine and Selous metallurgical complex mill and smelter	–	–	–	M	Crusher commissioned in Dec.; Ngezi mine to produce at capacity by mid-2002; Phase I production calls for 1300 t/y Ni content in PGM; matte is sent to South Africa for refining.

Sources: Various web sites and press releases as well as commercial publications.
(e) Author estimate.
Ch = Ni content in Ni chemicals; Co = cobalt; FeNi = ferronickel; I = Class I Ni (e.g., cathodes, briquettes, pellets, powders, etc., which have a Ni content of 99% or more); II = Class II Ni (e.g., products with a Ni content of less than 99% such as FeNi, NiO, UTILITY™ Ni); L = laterite ore; M = matte; NiO = nickel oxide; S = sulphide concentrates; SO = sulphide ore mined; T = Ni intermediates such as Ni carbonates, Ni sulphides or Ni hydroxides.

TABLE 7. CANADIAN NICKEL PROCESSING CAPACITY, 2001

	Smelter	Refinery
	(t/y of contained nickel)	
Falconbridge Limited		
Sudbury, Ontario	70 000	n.a.
Inco Limited		
Sudbury, Ontario	100 000	59 000
Sudbury, Ontario (1)	18 000	n.a.
Thompson, Manitoba	63 000	55 000
Sherritt International Corporation		
Fort Saskatchewan, Alberta	n.a.	32 000
Canmine Resources Corporation (2)		
Cobalt, Ontario	n.a.	300

Source: Natural Resources Canada.
n.a. Not applicable.
(1) Produces nickel oxides sinter. (2) Commissioning started in December 2001; production will be cobalt in salts plus by-product nickel in salts.

TABLE 8. WORLD MINE PRODUCTION OF NICKEL, (1) 1997-2001

	1997	1998	1999	2000	2001
	(000 tonnes)				
Russia	235	235	235	235	235
Canada	191	208	186	191	194
Australia	123	144	119	166	198
New Caledonia	137	125	110	128	118
Indonesia	71	74	89	98	102
Cuba	62	68	67	71	76
Colombia	31	29	39	59	53
China	47	48	50	51	52
Brazil	21	33	33	36	36
South Africa	35	36	36	37	36
Other (13 countries)	121	117	94	113	121
Total	1 073	1 117	1 058	1 183	1 221

Source: INSG *World Nickel Statistics* (April 2002).
(1) Ni content of sulphide concentrates or Ni content of lateritic ore mined.

TABLE 9. WORLD PRODUCTION OF PRIMARY NICKEL, 1997-2001

	1997	1998	1999	2000	2001
	(000 tonnes)				
Russia	230	227	228	221	245
Japan	128	127	134	161	154
Canada	132	147	124	134	141
Australia	74	80	79	110	126
Norway	63	70	74	59	68
China	40	40	45	51	50
New Caledonia	44	45	45	44	46
Cuba	34	39	38	40	41
United Kingdom	36	39	38	38	34
South Africa	35	36	36	37	36
Dominican Republic	33	25	24	28	22
Other (13 countries)	164	160	158	161	185
Total	1 012	1 034	1 024	1 083	1 148

Source: INSG *World Nickel Statistics* (April 2002).

TABLE 10. WORLD USE[(1)] OF PRIMARY NICKEL, 1997-2001

	1997	1998	1999	2000	2001
			(000 tonnes)		
Japan	202	169	182	200	162
United States	156	150	152	150	130
Germany	91	97	101	104	111
Taiwan	68	70	89	90	85
South Korea	66	68	81	78	75
China	43	42	47	62	82
Italy	50	53	55	53	55
France	50	55	52	50	49
Other (more than 27 other countries)	291	305	322	337	349
Total	1 016	1 009	1 081	1 123	1 098

Source: INSG *World Nickel Statistics* (April 2002).
(1) The term "use" replaces "consumption" to reflect the fact that nickel is not being "used up" in its applications; over 500 000 t/y of nickel is recycled yearly, which is not included in the above data.

TABLE 11. AVERAGE ANNUAL NICKEL PRICES, 1981-2001

	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
2001	5 948	2.70

Sources: INSG *World Nickel Statistics* (various issues); London Metal Exchange, *Metal Bulletin*.

TABLE 12. AVERAGE MONTHLY NICKEL PRICES, 1996-2001
(Settlement Price)

	1996	1997	1998	1999	2000	2001
			(US $/t)			
January	7 866	7 047	5 495	4 272	8 314	6 999
February	8 219	7 737	5 390	4 630	9 658	6 528
March	8 024	7 899	5 399	5 015	10 284	6 138
April	8 047	7 318	5 397	5 106	9 731	6 334
May	8 030	7 485	5 023	5 403	10 134	7 064
June	7 712	7 065	4 479	5 198	8 415	6 645
July	7 207	6 838	4 329	5 704	8 168	5 940
August	7 057	6 763	4 084	6 452	8 010	5 525
September	7 321	6 507	4 106	7 031	8 642	5 030
October	7 034	6 383	3 875	7 325	7 683	4 828
November	6 946	6 142	4 135	7 953	7 344	5 082
December	6 584	5 949	3 881	8 087	7 319	5 268
			(converted to US$/lb)			
January	3.57	3.20	2.49	1.94	3.77	3.17
February	3.73	3.51	2.44	2.10	4.38	2.96
March	3.64	3.58	2.45	2.27	4.66	2.78
April	3.65	3.32	2.45	2.32	4.41	2.87
May	3.64	3.40	2.28	2.45	4.60	3.20
June	3.50	3.20	2.03	2.36	3.82	3.01
July	3.27	3.10	1.96	2.59	3.70	2.69
August	3.20	3.07	1.85	2.93	3.63	2.51
September	3.32	2.95	1.86	3.19	3.92	2.28
October	3.19	2.90	1.76	3.32	3.48	2.19
November	3.15	2.79	1.88	3.61	3.33	2.31
December	2.99	2.70	1.76	3.67	3.32	2.39

Source: INSG, various issues of *World Nickel Statistics* to April 2002.

TABLE 13. REFINED COBALT PRODUCTION, 1996-2001

Company	1996	1997	1998	1999	2000	2001
			(tonnes)			
PRODUCTION OF COMPANIES BELONGING TO THE COBALT DEVELOPMENT INSTITUTE						
OMG	4 160	5 000	5 250	6 200	7 700	8 100
Falconbridge	3 099	3 417	3 851	4 009	3 433	3 314
Gécamines	3 540	2 808	4 490	(b) 5 180	4 320	3 199
ICCI	2 070	2 250	2 640	2 770	2 855	2 943
Zambia (a)	4 799	3 949	5 011	3 946	(c) 2 316	(c) 2789
QNI		617	1 395	1 539	1 520	1 818
Murrin Murrin				83	925	1 452
Inco	1 544	1 500	1 740	1 420	1 470	1 450
CTT	80	220	241	470	1 200	1 200
Umicore (1)	1 200	1 200	1 200	950	1 110	1 090
Kasese				77	420	634
Sumitomo	228	263	329	221	311	350
Eramet	174	159	172	180	204	199
Subtotal	20 894	21 383	26 319	27 045	27 785	28 538
PRODUCTION OF OTHERS						
Mopani Copper					1 026	1 876
China	1 200	1 200	1 200	1 200	1 200	1 470
Brazil	193	266	364	630	792	889
South Africa	292	294	320	(e) 320	320	252
India		(e) 110	(e) 120	(e) 120	206	(e) 250
Bulong				79	192	203
Subtotal	1 685	1 870	2 004	2 349	3 736	4 940
EXPORTS AND SALES FROM STOCKPILES						
DLA sales	2 052	1 621	2 310	1 679	3082.6	1 893
Sales from other stocks	500					
C.I.S. exports	1 654	3 200	2 800	2 678	4 700	(e) 3 900
Subtotal	4 206	4 821	5 110	4 357	7 782.6	5 793
Total	26 785	28 074	33 433	33 751	39 303	39 271

Source: *Cobalt News,* 02/2, April 2002, The Cobalt Development Institute. Table re-arranged in order of descending production for 2001; data reproduced with permission of The Cobalt Development Institute.

"Refined cobalt" includes:
All cobalt units whether in metal or chemicals that are derived from feed requiring further refining.
The following materials are NOT counted as feed: DLA or other stockpile releases, Russian output, production from Likasi, and lower-grade production from Moroccan mines.

(a) Zambian production includes ZCCM, RAMZ, and Avmin.
(b) Revised to include Central Mining Group.
(c) Chambishi Metals plc production only.
(e) Estimate.
(1) Union Minière SA changed its name to Umicore.

ICCI = International Cobalt Company Inc. (marketed by Sherritt International Corporation)
OMG = OM Group, Inc.
CTT = Cie. de Tifnout-Tiranimine
DLA = Defense Logistics Agency
ZCCM = Zambia Consolidated Copper Limited
RAMZ = Roan Antelope Mining Corporation
Gécamines = La Générale des Carrières et des Mines
Mopani Copper = Mopani Copper Mines plc (a JV comprising the Mufilira mine/smelter/refinery plus the Nkana mine and cobalt plant)