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# Canadian Overview

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The total value of all mineral commodities produced in Canada, including metals, nonmetals and mineral fuels, declined fractionally from \$83.9 billion in 2000 to an estimated \$83.8 billion in 2001.<sup>1</sup> This second consecutive high level in the value of mineral production was again primarily due to another strong performance by the fuels sector, especially natural gas shipments. Non-fuels (metals and nonmetals) declined in value, with a decrease in the metals sector more than offsetting a slight increase in the value of nonmetals. (Note that Canadian mineral production reflects the production and value of domestically mined minerals and does not include the value of primary aluminum production because it is produced from imported bauxite ore, nor does it include the value of recycled material.)

The overall value of fuel production rose very slightly to \$66.0 billion in 2001 from \$65.4 billion in 2000. Overall increases in the output of most fuels combined with lower energy prices contributed to the stable value of mineral fuels production. Increases in the value of production for natural gas, by 21.5%, and coal, by 8.4%, were offset by declines in the value of crude oil, by 15.0%, and natural gas by-products, by 17.3%.

The value of metal production produced from Canadian mines fell by 6.8% in 2001 to \$10.2 billion. Significant declines in the value for nickel, copper, zinc, iron ore and cobalt contributed to the 2001 decrease. Substantially lower nickel prices led to a 24.1% fall in the value of nickel to \$1.8 billion. Copper production declined slightly, but lower prices resulted in a 9.7% decline in the value produced, to \$1.5 billion. The value of zinc production was down by 9.6% to \$1.4 billion despite a rise in the volume produced. Iron ore production fell by 23.5%, reflecting lower steel demand in North America and resulting in an 18.9% decline in the value of production to \$1.2 billion. Lower prices for cobalt led to a total value of \$78 million, a drop of 22.1% even though production was up slightly.

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<sup>1</sup>The non-fuel production data presented in this OVERVIEW are based on Natural Resources Canada's Annual Census of Mines, Quarries and Sand Pits' shipments data and may differ from production figures cited elsewhere in this Canada paper. The 2001 data are preliminary annual figures released in January 2002.

### **Mineral Industry Value of Production (\$ million)**

	2000 (r)	2001 (p)	Change (%)
Metallic minerals	10 988.9	10 245.4	-6.77
Non-metallic minerals	7 425.7	7 552.3	1.70
<b>Total, non-fuels</b>	<b>18 414.7</b>	<b>17 797.7</b>	<b>-3.35</b>
Fuels	65 439.3	65 984.7	0.83
<b>Total minerals</b>	<b>83 854.0</b>	<b>83 782.4</b>	<b>-0.09</b>

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary; (r) Revised.

Note: Totals may not add due to rounding.

Gold was Canada's leading metal in 2001 with an output value of \$2.1 billion. Among the value of other metals, uranium was up significantly to more than \$600 million, platinum group metals were up 18.9% to \$569 million, silver declined by 4.0% to \$268 million, lead increased by 12.2% to \$108 million, and molybdenum rose by 22.8% to \$77 million.

The value of nonmetal mining production (which includes structural materials such as cement and sand and gravel) realized an overall increase of 1.7%, reaching \$7.6 billion. An impressive increase in the value of diamonds, along with increases in the values of salt, clay products and cement, offset declining values for other nonmetal commodities. Cement increased to \$1.3 billion, an increase of 4.3%. The value of diamond production was up by 35.5% to \$847 million, with output from Canada's only (so far) diamond mine increasing by 51.3%. Salt increased by 27.9% to \$450 million and the value of clay products rose by 11.3% to \$195 million.

Decreases in the price of sulphur in 2001 resulted in sharply lower values for elemental sulphur and sulphur in smelter gas. Outputs and the corresponding values also declined for lime (\$212 million), peat (\$168 million), gypsum (\$96 million), asbestos (\$132 million), sand and gravel (\$953 million), and potash (\$1.6 billion). Nevertheless, potash remained the leading nonmetal produced in Canada.

The Canadian non-fuel mineral industry is defined to include mining (including coal), smelting and refining, and the mineral manufacturing industries, but excludes the crude petroleum and natural gas industries. This industry accounted for \$35.1 billion, or 3.7%, of Canada's Gross Domestic Product (GDP), measured at basic prices in 1997 constant dollars, a decrease of 0.7% over 2000 levels. Mining contributed 25.0% of the industry's GDP while nonferrous smelting and refining and primary iron and steel production added

a further 21.1% to the total. Metal and nonmetal mineral manufacturing accounted for the remainder.

According to data released by Statistics Canada, employment in the Canadian mining industry recorded a 9.7% decline in 2001, falling to 51 200 from 56 700 in 2000. All of the major components of the industry (metal mining, nonmetal mining and coal mining) experienced declines, most notably the metal mining sector where employment declined by nearly 4000 from 29 500 in 2000 to 25 600 in 2001. These decreases are not surprising. In 2001, seven mines closed and seven mining operations were suspended while only two new mines opened.

Exports of crude minerals (excluding petroleum and natural gas), coal, smelted and refined outputs, and mineral products contributed \$47.4 billion to the value of Canada's domestic exports in 2001, a 4.4% decline compared with 2000. This represented 12.7% of Canada's total domestic exports of \$373.6 billion. Metallic mineral and mineral product domestic exports accounted for 76.2% (\$36.1 billion) of the total non-fuel (including coal) value, nonmetal domestic exports (including structural materials) accounted for 19.6% (\$9.3 billion), and coal accounted for 4.2% (\$2.0 billion). The United States remains Canada's principal trading partner with domestic exports of non-fuel minerals and mineral products, including coal, to that country valued at \$36.2 billion. Exports to the European Union totalled \$4.6 billion, to Japan, \$1.7 billion, and to Mexico, \$0.2 billion. Canadian imports of non-fuel minerals and mineral products, including coal, decreased by 9.0% to \$46.6 billion, resulting in a merchandise trade surplus (total mineral exports minus total mineral imports) of \$2.1 billion in 2001, compared with a 2000 deficit of \$0.3 billion. The value of both total exports and total imports declined in 2001 compared with 2000, although the drop in imports was greater.

The value of total exports of natural gas, natural gas by-products, petroleum and other fuels (excluding coal) rose to \$53.2 billion in 2001 from \$50.4 billion in 2000. The value of imports of those commodities, however, declined from \$18.2 billion in 2000 to \$17.7 billion in 2001. When the values for fuels are combined with the non-fuels, total exports for the mineral, mineral product and fuel sector reached \$101.9 billion in 2001, up very slightly from \$101.2 billion in 2000. As a result, in 2001, the mineral industry (fuels and non-fuels) contributed \$37.7 billion to Canada's overall trade surplus of \$59.6 billion.

## Minerals and Metals Production (Shipments)

	Unit	1997	1998	1999	2000 (r)	2001 (p)
	(000)					
Aluminum	t	2 327	23 74	2 390	2 373	2 583
Antimony	kg	529	359	357	364	234
Asbestos	t	420	321	337	310	294
Bismuth	kg	196	186	217	202	258
Cadmium	kg	1 272	1 179	1 115	934	1 058
Coal	t	78 670	75 360	72 497	69 163	70 361
Cobalt	kg	2 168	2 262	2 014	2 022	2 048
Copper	t	648	691	582	622	611
Gold	g	171 479	164 773	157 617	154 384	157 854
Gypsum	t	8 628	8 307	9 345	8 572	8 119
Iron ore	t	38 928	36 586	(r) 33 789	35 247	26 981
Lead	t	171	150	155	143	149
Molybdenum	kg	7 594	8 099	6 250	6 980	8 540
Natural gas	000 m <sup>3</sup>	156 171	160 515	162 219	167 790	171 966
Nepheline syenite	t	648	636	676	717	734
Nickel	t	181	198	177	181	184
Peat	t	1 054	1 125	(r) 1 253	1 277	1 187
Petroleum	000 m <sup>3</sup>	124	128	122	128	131
Platinum group	g	11 836	14 033	13 872	15 304	18 154
Potash (K <sub>2</sub> O)	t	9 235	8 884	8 475	9 033	8 184
Salt	t	13 497	13 034	12 686	12 164	13 548
Sand and gravel	t	225 495	225 338	(r) 243 251	238 901	225 991
Selenium	kg	592	398	359	335	261
Silver	kg	1 194	1 140	1 174	1 169	1 224
Stone	t	99 265	108 924	109 184	118 222	119 805
Sulphur, elemental	t	8 272	8 404	8 656	8 621	8 080
Sulphur in smelter gas	t	800	836	843	831	832
Tellurium	kg	59	62	64	53	60
Uranium (U)	kg	11 127	9 992	10 157	9 921	12 992
Zinc	t	1 027	992	963	936	1 010

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary; (r) Revised.

# Exploration

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In 2000, exploration and deposit appraisal expenditures in Canada totalled \$497 million. Preliminary estimates for 2001 show a slight decline to \$491 million (refer to the table for provincial/territorial totals).

The decline in exploration and deposit appraisal expenditures that has been experienced since 1997 moderated considerably in 1999 and again in 2000. A 23% decline between 1998 and 1999 was followed by a decline of only 1.5% from 1999 to 2000, and 1.1% from 2000 to 2001.

In 2000, diamonds again were the second most sought commodity after gold. Diamond exploration and deposit appraisal expenditures declined to \$92 million in 2000 from \$109 million in 1999. Diamond activity normally contributes about 20% of exploration and deposit appraisal expenditures in Canada; they reached a high of 25% in 2001 with expenditures of \$123 million. In 2000 and 2001, Ontario ranked second, after the Northwest Territories, with diamonds receiving 21% and 16% respectively in those years of total diamond exploration and deposit appraisal expenditures in Canada.

Expenditures on exploration and deposit appraisal for the platinum group metals (PGM) increased by about \$8 million to \$29 million in 2000 in response to sharply higher prices. Expenditures of about \$33 million were reported for PGM in 2001.

In the years 2000 and 2001, exploration expenditures in Canada accounted for 69% of total exploration and deposit appraisal expenditures. Off-mine-site exploration alone accounted for \$312 million in 2000 and \$300 million in 2001, both of these amounts being higher than the \$270 million recorded in 1999.

Ontario, Quebec, Nunavut and the Northwest Territories, the top four jurisdictions in terms of exploration and deposit appraisal expenditures in 2000 and 2001, jointly accounted respectively for a combined 66% and 73% of total expenditures in Canada for those two years.

Diamond exploration continues at various Canadian localities, chiefly on, but not limited to, the Canadian Shield. Exploration continues on the properties surrounding the Ekati mine, the Diavik project of Diavik Diamond Mines Inc. (60%) and Aber Diamond Corp.

(40%), which is scheduled to commence production in 2003, and the Snap Lake Project of De Beers Canada Mining Inc. (production expected to begin in 2005). Reserves at Snap Lake are sufficient for 22 years of production with an annual production value for diamonds of US\$170 million. Inferred resources could almost double these reserves.

De Beers Consolidated Mines Ltd. continues to explore for diamonds in various other Canadian localities with in excess of \$80 million, more than half of that company's global exploration budget, to be spent in Canada in 2002. De Beers Canada Exploration Inc. is taking additional bulk samples at a cost of \$10 million at its Gahcho Kué (former Kennady Lake) project in the Northwest Territories, where the intention is to recover another 2000 ct of diamonds from each of the 5034 and Hearne kimberlites. The decision to take these bulk samples is based in part on the recovery of a 9.9-ct diamond valued at US\$60 000.

At the Victor kimberlite in Ontario, west of James Bay, the 9650-t bulk sample taken by De Beers Canada Exploration has indicated a diamond content of about \$100/t for the inferred resource of some 36 Mt. Pre-feasibility studies are in progress. At Fort à la Corne, Saskatchewan, De Beers Canada Exploration (42.3%) and joint-venture partners Kensington Resources Ltd. (42.3%), UEM Inc. (10%) and Cameco Inc. (5.5%) spent US\$4.8 million on large-diameter drilling and are continuing to take additional large-diameter drill samples. The 122 kimberlite, estimated to contain 540 Mt, has a grade, modelled by De Beers, of US\$11/t. The 141 kimberlite, with a size of 932 Mt, yielded a modelled grade of US\$28/t.

In Alberta, a 22.8-t mini-bulk sample taken by Ashton Mining Canada Inc. from the K252 kimberlite yielded 12.54 ct of diamonds for an estimated diamond content of 55 ct/100 t.

In the Otish Mountains of north-central Quebec, late in 2001, Ashton Mining of Canada Inc. and its joint-venture partner Soquem INC. discovered the Renard 1 and Renard 2 diamondiferous kimberlites. Renard 2 yielded the most encouraging results, and a small mini-bulk sample is being taken. These two discoveries have led to an extensive staking rush in the region.

In Ontario, Pacific Northwest Capital Corp. discovered the Dana platinum group metals zone on its River Valley property where exploration is being funded by Anglo American Platinum Corp. Ltd. Current measured and indicated resources for the zone are 7.74 Mt containing 0.371 g/t Pt, 1.162 g/t Pd and 0.073 g/t Au, with Rh, Ni and Cu values, for a total of 399 452 oz of contained Pt + Pd + Au. The nearby Lismer Ridge zone has a measured and indicated and inferred resource of 4.97 Mt averaging 1.24 g/t Pt + Pd + Au.

At Sudbury, Ontario, Falconbridge Ltd. discovered the Nickel Rim South Ni-Cu-Co-Pt-Pd-Au deposit, 2.7 km north of the Sudbury airport, in November. Drilling continues using four drills. Inco Ltd. announced the discovery of the Pump Lake deposit, about 2500 m north of the Copper Cliff North mine shaft. In January 2001, the indicated resource stood at 3.5 Mt grading 1.4% Ni, 1.0% Cu, and 1.5 g/t combined Pt, Pd and Au. Further drilling was expected to increase this resource. Inco also announced the discovery of additional PGM-rich ore at the Totten deposit, the McCreedy East mine, and the Copper Cliff North mine.

In British Columbia in 2000 and 2001, further drilling of the Kemess North deposit of Northgate Exploration Ltd. has increased the inferred mineral resource to 442 Mt grading 0.4 g/t Au and 0.23% Cu. The deposit could be mined using the infrastructure of the present Kemess mine.

In Nunavut, Cumberland Resources Ltd.'s recently discovered Vault deposit, the fifth deposit discovered at the company's Meadowbank gold project, contains 422 000 oz of gold within 120 m of the surface and is open in all directions.

Also in Nunavut, at the Hope Bay project, joint-venture partners Hope Bay Gold Corp. Inc. and Miramar Mining Corp. discovered the Naartok and Suluk zones. In 2001, largely because of these discoveries, there was a 30% increase in total contained ounces of gold at Hope Bay relative to year-end 2000 resources. Measured and indicated resources now stand at 3.36 Mt averaging 15.4 g/t Au, and additional inferred resources of 6.71 Mt averaging 12.3 g/t Au.

### **Mineral Exploration and Deposit Appraisal Expenditures**

Province/Territory	2000	2001 (p)
	(\$ million)	
Newfoundland and Labrador	27.3	18.1
Nova Scotia	3.6	3.5
New Brunswick	12.1	8.4
Quebec	94.1	111.8
Ontario	117.9	108.9
Manitoba	28.1	28.3
Saskatchewan	45.6	36.1
Alberta	7.2	4.3
British Columbia	35.9	29.1
Yukon	11.2	7.2
Northwest Territories	51.4	75.3
Nunavut	62.1	60.4
Total	496.7	491.3
Exploration	342.5	337.3
Deposit appraisal	154.1	153.9

Notes: Exploration covers activities up to and including the discovery and first delineation of a new mineral deposit of potential economic interest; deposit appraisal includes activities needed to bring a delineated deposit to the stage of detailed knowledge required for a feasibility study to support a production decision. Numbers may not add to totals due to rounding.



# Aluminum

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The production of primary aluminum increased 8.8% to 2.58 Mt in 2001 from 2.37 Mt in 2000, ranking Canada fourth after China, Russia and the United States in terms of world production. The increase reflects the ramp-up of Alcan Inc.'s new 400 000-t/y smelter in Alma, Quebec, which reached full operating capacity in September 2001.

The value of Canadian primary aluminum production in 2001 is estimated at \$5.8 billion, up from \$5.5 billion in 2000, reflecting the increased production level. Canada, the second largest aluminum-exporting country in the world after Russia, exported 2.05 Mt of unwrought aluminum valued at \$4.9 billion in 2001.

In January 2002, the Aluminum Association of Canada and the Government of Quebec signed a Covenant on voluntary reduction goals of an additional 200 000 t of greenhouse gas emissions by the end of 2007. The Covenant proposes gradual, permanent reductions, allows for growth in the industry, and acknowledges the importance of aluminum's life cycle and contribution to the collective effort to reduce greenhouse gas emissions.

Over the past year, aluminum producers have continued work on the expansion of existing smelters and studied greenfield smelters in several locations.

During the past year, changes in Alcan Inc.'s Canadian operations have included:

- Production at the 400 000-t/y smelter at Alma, Quebec, reached full capacity in September 2001. Alcan expects the purchase of a 20% share of the 244 000-t/y Alouette smelter from Société Générale de Financement du Québec to be completed in May 2002.
- Alcan's 275 000-t/y Kitimat smelter in British Columbia suffered from low water levels in the Nechako Reservoir. In June 2001, the company announced a slowdown of up to 50% of the plant's capacity; however, it has also been reported that this winter's snowfall may alleviate the situation. Studies into an expansion and pilot work on converting the smelter to pre-bake technology will be undertaken during the slowdown.

- Alcan signed a Memorandum of Understanding with Hydro-Québec in February 2002 to explore optimizing hydro-electric resources in the Saguenay–Lac-St-Jean region to support the eventual expansion of the Alma smelter.
- Alcan also owns the 248 000-t/y Arvida smelter in Jonquière, Quebec; the 196 000-t/y Grande-Baie smelter in La Baie, Quebec; the 219 000-t/y Laterrière smelter in Chicoutimi, Quebec; the 91 000-t/y Shawinigan smelter in Shawinigan, Quebec; and the 50 000-t/y Beauharnois smelter in Melocheville, Quebec. The total of Alcan's capacity in Canada is now 1.49 Mt/y, or approximately 55% of total Canadian capacity.

In 2001, Alcoa Inc. also studied expanding its operations in Canada. Work has included:

- Alcoa Inc. signed a letter of intent with Newfoundland and Labrador Hydro and the Province of Newfoundland and Labrador on a joint review for a possible hydro-electric power expansion and a possible aluminum smelter located in that province. The review was completed in late 2001 and discussions are continuing.
- Alcoa has had discussions with the Government of Quebec to obtain additional power supplies to upgrade the 418 000-t/y Baie Comeau smelter and has done preliminary work on other expansions, including a doubling of the 240 000-t/y Lauralco smelter.
- Alcoa Inc. also has a 74.95% interest in the 390 000-t/y Aluminerie de Bécancour Inc. (ABI) smelter. Alcoa's partner in ABI is Pechiney Corp. of France (25.05%). In total, Alcoa controls approximately 35% of Canada's total primary aluminum smelting capacity.

After a discussion with Quebec smelters on the use of a block of 500 MW of power at standard commercial rates, the Government of Quebec chose a joint proposal by Aluminerie Alouette Inc. and Alcan. Alouette plans to more than double the capacity of the 244 000-t/y smelter at Sept-Îles, Quebec, to 550 000-t/y and will invest more than \$1.3 billion in the project. Construction will start in the summer of 2002 and the first metal is expected to be produced in 2005. In addition to 2000 construction jobs, the expansion will create 340 new jobs at the smelter and 1500 jobs in other areas of the province. As part of the proposal, Alcan has proposed downstream processing projects in the Saguenay area.

As a result of Norsk Hydro ASA's purchase of VAW AG from E.ON, the new Hydro Aluminum now owns 20% of the Alouette smelter. The other equity partners in Aluminerie Alouette are: Alcan Inc. (which has announced the purchase of a 20% interest in the smelter from Société Générale de Financement du Québec), Austria Metall AG (20%), Kobe Steel of Japan (13.33%), Marubeni of Japan (6.67%), and Corus Group plc (20%), which has announced it will sell its aluminum assets.

In British Columbia, KTD L.L.C, an independent U.S.-based consulting firm providing engineering and design services, management/operations expertise and project

development, completed a pre-feasibility study for a new 360 000-t/y smelter to be located near Port Alberni, Vancouver Island. Results of the study indicated that the project was viable and work is under way to seek investors in the project. The proposed smelter will require 650 MW of power and new infrastructure is required. In late 2001, KTD and officials from the town of Port Alberni expected a full feasibility study to start shortly, with full engineering and permitting studies expected to take up to three years, followed by a 34-month construction period. A total of 650 direct jobs and a substantial number of indirect jobs would be created with this proposed US\$1.5 billion smelter, which could produce its first metal in 2007. The smelter will utilize aluminum reduction technology from KTD.

# Copper

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Canadian copper mine production (recoverable copper in concentrate) is expected to total approximately 633 000 t in 2001, matching the 2000 level of 634 000 t. Mine production in 2002 is forecast to total 606 000 t. The anticipated decline in output is mainly attributable to announced suspensions and/or closures taking effect in 2001 and 2002. Refined copper production is forecast to grow by 3.3% to 569 000 t in 2001 and by a further 11.6% to 592 000 t in 2002. The rise in production is attributable to a planned increase in output at Falconbridge Ltd.'s Kidd Creek refinery following completion of an expansion that raised capacity to 147 000 t/y. Canadian refined copper use is expected to total 265 000 t in 2001, a 3.3% decline from 274 000 t in 2000. Refined use is forecast to increase by 10% to 301 000 t in 2002. The expected rise in demand stems from growing demand for power cable and building wire coming from the oil and gas and pulp and paper industries, strong demand for use in new housing construction, and an incremental expansion at Nexans' wire rod facility in Montréal-Est.

In July 2001, Imperial Metals Corp. announced plans to suspend production at its Mount Polley copper-gold operations in British Columbia on September 30, 2001, because of low metal prices.

In October 2001, Hudson Bay Mining and Smelting Co. announced that it will permanently close the Ruttan zinc-copper mine in northern Manitoba no later than May 2002. Low metal prices, a slowing world economy and a poor economic outlook were the reasons cited for the closure. The Ruttan mine produces approximately 13 500 t/y of copper in concentrate.

Also in October 2001, Boliden AB announced a three-month suspension of production at its Myra Falls zinc-copper mine in British Columbia beginning on December 3 in response to low metal prices. The mine produces 15 000 t/y of copper in concentrate.

On November 30, Noranda Inc. announced that it would close its Gaspé copper smelter in Murdochville, Quebec, at the end of April 2002 for a period of at least six months. The announcement indicated that copper production from Noranda's CCR refinery in Montréal-Est, where output from the Gaspé smelter is further processed, would be reduced by 45 000 t/y from its design capacity of 360 000 t/y. Noranda stated that its decision to close the smelter is in response to weak market conditions, high copper inventories and metal prices, and concentrate treatment charges that are at their lowest levels in 14 years.

# Gold

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Canadian gold production totalled 158 t in 2001, about 2.6% higher than the 2000 total of 155 t. The huge increase in gold production at the Red Lake mine and, to a lesser extent, at the LaRonde and Kemess South mines, have more than compensated for production loss resulting from the closures of gold and base-metal mines during 2000 and 2001. A total of 13 gold mines closed in the past two years in response to depressed gold prices or ore exhaustion. For 2002, production is expected to decline 5% to 151 t.

Ontario accounted for 50% of Canada's total gold production, followed by Quebec (21%) and British Columbia (15%). The other provinces and territories combined contributed 14%. Approximately 91% of Canada's gold production in 2000 came from hard-rock underground and open-pit gold mines. Of the remainder, 7% was from base-metal mines and 2% was from placer mining operations. The value of gold exports (including gold contained in scrap and base-metal concentrates) decreased by more than 12% to \$2.28 billion (about 169.7 t) due to a lower quantity shipped. Imports declined by 16% to \$805.5 million (about 60 t), also owing to a lower metal quantity delivered.

The average cash cost of production from Canadian underground and open-pit gold mines was about US\$176/oz, a US\$20/oz decrease compared with the previous year. The reduction in average cash costs is the result of a lower Canadian dollar value against the U.S. dollar and the huge expansion of gold production at the low-cost Red Lake mine.

Only one new gold mine was brought on stream in 2001, the small Hammerdown mine in Newfoundland and Labrador, where production will replace the now-closed Nugget Pond mine. Eight gold mines closed or suspended operations in 2001 (Nugget Pond in Newfoundland and Labrador, Francoeur and Sigma in Quebec, Glimmer and Edwards in Ontario, Bissett in Manitoba, Golden Bear in British Columbia, and Brewery Creek in the Yukon). In addition, low metal and gold prices were responsible for the suspension of mining operations at the Myra Falls and Mount Polley base-metal mines, which produced significant amounts of gold as a by-product. Gold production at the closed or suspended mines totalled about 8 t in 2001 (11 t in 2000). In all, 26 gold mines remained in production at the end of 2001 compared with 33 at the end of 2000. A total of 6629 people were employed by gold producers in 2001, down 20% from the preceding year, in continuity with the declining trend since 1996.

The big increase in gold output at Goldcorp Inc.'s Red Lake mine in northwestern Ontario, which totalled 15.6 t, was the highlight of the year for gold mining in Canada. With cash costs of approximately US\$65/troy oz, the mine is currently the lowest-cost gold mine in Canada and one of the lowest in the world. For years to come, the Red Lake mine will lead Canadian gold producers in volume of gold produced. At the end of 2001, a new reserves and resource estimate established proven and probable high-grade gold reserves at the Red Lake mine to be 1.85 Mt at a grade of 2.05 oz/ton gold (70.5 g/t gold), for a total gold content of 3.8 Moz, and high-grade resources to be 484 000 t at a grade of 2.84 oz/ton gold (97.3 g/t gold), for a total gold content of 1.4 Moz. Total high-grade reserves and resources are estimated to be 5.2 Moz. In addition, the Red Lake mine hosts another 2.3 Mt of refractory gold ore averaging 12.3 g/t Au, for a total gold content of more than 800 000 oz.

In August, Agnico-Eagle inaugurated a new shaft on its LaRonde property. With a depth of 2250 m, it will provide access to reserves of nearly 100 t of gold (3.3 Moz) and additional resources of 140 t (4.5 Moz). Agnico-Eagle also expanded its mill facilities from 2000 t to 5000 t/d, and the company expects to increase it further to 7000 t/d by the end of 2003. With this expansion, annual gold production will go from 230 000 troy oz (7 Mt) in 2001 to nearly 400 000 oz (12.3 Mt) in 2004. The ore at LaRonde also contains commercial-grade zinc, copper and silver, which will place this mine among those with the lowest production costs in Canada when the credits obtained for these metals are taken into account. Capital expenditures of \$44.8 million are budgeted for 2002 to complete the expansion of the mill and most of the underground development in the lower portion of the shaft.

Cambior completed the restructuring begun the previous year to cover operational debts stemming from its hedging program and the company had returned to profitability at the end of the year. Jipangu, a private Japanese gold company, now owns 37.8% of the issued common shares of Cambior.

In February 2001, McWatters was granted protection under the *Companies' Creditors Arrangement Act* to allow a financial restructuring process. Activities at the Sigma-Lamaque complex have been suspended until the company finds additional funds and negotiates an arrangement with its creditors. However, operations at the Kiena complex have been maintained. In December, the company filed for and obtained approval of a restructuring and implementation plan. Under the plan, production at Sigma should resume in the fourth quarter of 2002 and its full production level of 5000 t/d should be reached in the second half of 2003 with an expected annual output of 120 000 oz.

# Iron Ore

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In 2001, as a result of the global economic slowdown, particularly the depressed demand from the North American steel industry, Canada's iron ore production slumped to slightly less than 27.0 Mt, a decrease of 23.5% compared with the previous year. In line with this reduction, the value of Canada's production fell by 18.9% to \$1.16 billion. Likewise, Canada's iron ore exports fell by 16.7% to just under 22.0 Mt, with the pellet market registering a 13.5% drop in exports, while the concentrate market fared even worse with a drop of 24.1%. The drastic fall in demand for concentrate in 2001 mirrored that of the previous year when the hike in the price for gas, used for pelletization, was compounded by the economic slowdown.

On the strength of the world steel industry – despite reduced production in North America – iron ore producers were able to negotiate reasonable price increases for the year. Prices jumped by 4.55% and 4.29% for concentrate bound for Europe and Japan, respectively, and by 1.84% for pellets bound for Europe. However, despite these price increases, the value of Canada's exports fell by 10.7% to about \$943 million.

Since the closure in 1998 of the Algoma Iron Ore Division near Wawa, Ontario, nearly all of Canada's iron ore production is concentrated in the Labrador Trough, a major geological belt that extends through northern Quebec and Labrador. Canada's production comes from three mining operations owned by Iron Ore Company of Canada (IOC), Quebec Cartier Mining Co. (QCM), and Wabush Mines (Wabush).

Following its acquisition in August 2000 of North Ltd. of Australia and the latter's 56.1% controlling interest in IOC, Rio Tinto acquired a 20% share of the 18.9% stake in IOC owned by the Labrador Iron Ore Royalty Income Fund. Mitsubishi Corp. owns the remaining 25% stake in IOC.

In line with the consolidation and restructuring of the global iron ore industry, the co-owners (50:50) of QCM, CAEMI Mineração e Metalurgia SA and Dofasco Inc. announced their intention to sell their share of the company. Moreover, on September 27, 2001, in response to deteriorating market conditions, Rio Tinto announced that it was postponing the refurbishment and reactivation of its pellet plant in Sept-Iles, Quebec. Commissioning of the \$361.5 million project, scheduled for June 2002, would have resulted in the addition of 4.5 Mt of annual capacity to the company's pellet production.

Also affected by declining markets, both QCM and Wabush responded by shutting down their operations for 14 and 8 weeks, respectively, during the year and by laying off part of their work force. Wabush also shut down one of its three production lines in December, for about a year, and expects to produce at about 75% of its capacity in 2002.



# Lead and Zinc

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Zinc mine production in Canada totalled 1 052 172 t in 2001, about 5.5% higher than the 996 921 t produced in 2000. Lead mine production totalled 153 934 t in 2001.

Zinc metal production in Canada was 16% lower than the 779 586 t produced in 2000 to reach a total of 657 576 t in 2001. Lead metal production in 2001 totalled 230 928 t, of which some 103 921 t, or 45%, was from recycled sources.

In April, Teck Corp. and Cominco Ltd. announced that the two companies would merge. Teck Cominco Ltd. was formed in July and ranks as the fourth largest North American-based base-metals mining and refining company. Prior to the merger, Cominco began a series of announced production cutbacks at its Trail smelter in southern British Columbia. Lead and zinc production was reduced for the December 2000 to October 2001 period. The cutbacks were part of a plan to allow for a fixed price power-swap agreement with a major U.S. energy company. Zinc production at Trail resumed in October and reached full capacity by the end of the month. All work at the lead smelter stopped in September to examine health concerns related to workers exposed to thallium while performing furnace maintenance. Lead production resumed in November.

Elsewhere in British Columbia, Teck Cominco's Sullivan mine at Kimberley closed after 92 years of active production. The mine produced more than \$20 billion in lead, zinc and silver over its life and provided employment for more than four generations of miners in the Kimberley region.

Boliden Ltd. announced that it would temporarily halt production for three months, starting in December, at its Myra Falls mine in British Columbia because of low metal prices. In addition to the temporary closure, Boliden's board of directors decided to seek a partner to provide financing for part of the capital investments required at Myra Falls. The company also announced that it would explore the possibility of selling the mine.

Hudson Bay Mining & Smelting Co. Ltd. completed the work on a new zinc tank house at the Flin Flon smelter in Manitoba, increasing capacity by 15% to 115 000 t/y. The project was completed in October, three months ahead of schedule. Elsewhere, the company announced that the Ruttan mine in Manitoba would close permanently at the end of May 2002. The Ruttan mine supplies concentrates for the Flin Flon smelter.

In October, Breakwater Resources Ltd. announced the accelerated closure of the Nanisivik mine in Nunavut. The mine will be closed in September 2002. The company cited continued weak metal prices as the primary reason for accelerating the mine's closure. The new mining plan for Nanisivik focuses on the accelerated removal of the mine pillars until its closure next September. Elsewhere in Nunavut, Teck Cominco's Polaris mine is expected to shut down upon depletion of ore reserves in August 2002.

# Magnesium

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Canadian production<sup>1</sup> capacity for primary magnesium metal is expected to reach 112 000 t/y in 2002 as a result of debottlenecking at the Norsk Hydro Bécancour smelter and completion of the ramp-up of Magnola Metallurgy Inc.'s Danville smelter. On a global basis, Canada ranks second after China in magnesium production capacity. The value of Canadian exports of magnesium metal and metal products in 2001 was \$220 million, up approximately 15% from a revised 2000 figure of \$190 million.

Construction of Magnola's 58 000-t/y magnesium metal plant at Danville, Quebec, is complete. Initially, after the plant start-up, the number of cells in production and the operating voltage were reduced from the planned levels. At the end of 2001, progress on solving start-up problems was well under way with many of the initial technical problems resolved. It has now been reported that voltage in cells has been increased to 65% of the power rate capacity. The plant was operating 16 cells at the end of 2001 and Noranda Inc. reported that the plant produced 9339 t of pure magnesium and alloys in 2001. The company expects the plant to produce 30 000 t of metal in 2002 and to reach full capacity rates in early 2003. Noranda Magnesium Inc. is marketing pure magnesium and magnesium-aluminium alloys, and has set itself up as a full-service magnesium supplier offering a range of pure and alloy products and technical support to its customers.

Norsk Hydro ASA of Norway produces magnesium metal at a 44 000-t/y capacity at its Bécancour, Quebec, plant using an electrolytic process. The plant also recycles magnesium scrap produced by its customers. Norsk Hydro is debottlenecking the existing operations and making them more efficient. With this work the plant capacity was expected to reach 48 000-t/y in 2002. Both Norsk Hydro and Noranda Inc. are developing new magnesium alloys for use in higher temperature applications.

Timminco Ltd. produces high-purity metal (up to 99.98% Mg) for specialized markets at its 6000-t/y magnesium plant at Haley Station, Ontario. The company also produces highly corrosion-resistant magnesium die-casting alloys and extruded anode rods for hot-water heaters. During the year, the company continued to restructure its operations and made several management changes. After defaulting on a principal repayment, the company

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<sup>1</sup> Canadian magnesium production data are confidential due to the limited number of companies reporting.

obtained a forbearance agreement with its principal lender to allow it to continue operations. The company is actively pursuing alternatives to maximize its shareholder value.

Globex Mining Enterprises Inc. engaged Hatch Associates to complete a scoping study on Globex's Timmins area magnesium-talc deposit located 13 km south of Timmins, Ontario. Previous work has indicated potential for the production of both magnesium metal and high-quality talc from the deposit. Results of the study were positive and indicated good economic potential. The company is reviewing the results in anticipation of conducting the recommended full bankable feasibility study at an expected cost of US\$12 million. The project would include a mine-mill complex located near Timmins, Ontario, and a 95 000-t/y smelter located west of Rouyn-Noranda in Quebec.

Leader Mining International Inc. acquired the Cogburn magnesium deposit, an ultramafic intrusive near Hope, British Columbia, that contains magnesium-bearing silicates. Samples of outcrops were tested for magnesium extraction with positive results. Scoping-level studies were undertaken and completed in October, again with positive results, and a drilling program was undertaken. A number of contractors, including Hatch Associates, were hired to complete a study for a mine and a 120 000-t/y smelter project. Work is expected to be completed by December 2002.

Cassiar Mines and Metals Inc. maintained its interest in a project based on residues from asbestos mining in Cassiar in northern British Columbia. The fibre project at that location suffered a fire in December 2000 and remains closed. The company is currently exploring its options.

Gossan Resources Ltd. maintained its interest in a dolomite property at Inwood, Manitoba, with a dolomite resource estimated at 67 Mt averaging 21.6% magnesium oxide, with additional inferred resources.

The town of Thetford Mines, Quebec, continued work on a proposal to process mining residues from asbestos mines into magnesium metal. The town reports that in excess of 300 Mt of material grading approximately 24% magnesium are available in the area for processing.

# Nickel

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In 2001, Canadian production of nickel in concentrates was 194 000 t and primary nickel use was about 14 300 t. The strike at Falconbridge Ltd.'s facilities in Sudbury, which began in August 2000, was settled in February 2001. Falconbridge's production of nickel in concentrates totalled just under 60 000 t, up 8% from 2000. During 2001, mill throughput at the Raglan mine in Quebec increased to 3000 t/d, up 25%. Falconbridge completed the purchase of the Montcalm property near Timmins, Ontario; the property has the potential to produce 8000 t/y of nickel in concentrates from 5 Mt of ore. In 2002, Falconbridge plans to produce 27 000 t of nickel from Sudbury and 26 000 t of nickel from Raglan.

Inco Ltd.'s production of finished nickel in 2001 was 95 000 t from the Sudbury, Ontario, operations and 49 000 t from the Thompson, Manitoba, operations. Part of this output was sourced from nickel concentrates imported from Australia. During the year, Inco closed two mines in the Sudbury area. Mine development continued at Inco's deep project at the Creighton mine with production from Phase 1 during the year; production in 2002 from the project is forecast to be 2300 t of nickel, increasing subsequently to 8200 t/y of nickel. Phase 2 of the project is expected to start production in 2006. At McCreedy East, ramp development was completed for the US\$33 million project announced in 2000. At the Stobie mine, production started up from a low-grade area and is expected to reach 23 000 t/y of nickel during 2002 and to last until 2005. Exploration continued in PGM-rich areas of the North mine and the McCreedy East mine. During the year, Inco produced 12.57 t of PGM, up from 10.7 t in 2000. At the Totten mine, environmental permitting began in 2001, and Inco anticipates production start-up in 2005. In Manitoba, Inco continued the deepening of the Birchtree mine to develop reserves that will sustain mine production until 2015. At Voisey's Bay, negotiations between Inco and the Province of Newfoundland and Labrador over the proposed development of Inco's Voisey's Bay property resumed in June and continued throughout the year.

Sherritt International Corp. owns a 50% share in the hydrometallurgical refinery at Fort Saskatchewan where production in 2001 reached a record of over 29 000 t of nickel and over 2900 t of cobalt. Sherritt and its Cuban partner import feed in the form of a mixed nickel-cobalt sulphide produced at their laterite mine and leach plant in Cuba.

Canmine Resources Corp. secured financing to complete the refurbishment and modernisation of its cobalt and nickel hydrometallurgical refinery in Cobalt, Ontario.

Commissioning of the refinery began in December and a five-month ramp-up period is expected. The initial production rate will be 300 t of cobalt.

In 2001, North American Palladium Ltd. commissioned its new 15 000-t/d mill at its palladium mine near Thunder Bay, Ontario, where by-product nickel production increased from 470 t to 728 t of nickel. The company's concentrate, containing PGM, gold, nickel and copper, is sent to Inco and Falconbridge for processing.

# Potash

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Canada, the world leader of potash production at 8.23 Mt, accounted for 32% of the world's total production of 25.79 Mt in 2001. However, Canada's production was about 11% below the previous year's level of 9.20 Mt. This decline was mainly due to lower demand from the world agricultural industry and increased supply from Russia, Belarus, China and Chile.

The largest potash producer, Potash Corp. of Saskatchewan, suffered a 14% production decline in 2001 to 6.13 Mt, compared with 7.13 Mt in 2000. Two other producers, IMC Global and Agrium, were also forced to reduce their production.

Canada was the largest potash exporter in the world in 2001. It exported 7.73 Mt, down about 8.7% from the 2000 level of 8.47 Mt. The main destination was the United States, which received about 57% of the total. Asia, including China, was the second largest destination (about 28%) and Latin America was the third largest (about 10%). Other destinations were Australia (about 3%) and Europe (about 1.5%).

The potash industry is expecting an increase in production in 2002 as the world grain stock fell to its lowest level since 1995/96. It is expected that grain production will increase in 2002, prompting a sharp increase in demand for fertilizer, including potash.

# Uranium

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Canada retained its position as world leader in uranium production in 2001 as annual production reached a record high of 12 522 t (tonnes of uranium metal), valued at about \$600 million. As of January 1, 2002, Canada's "known" recoverable uranium resources totalled 452 000 t, compared with 437 000 t as of January 1, 2001. With over 85% of the resource base categorized as "low-cost," Canada is well positioned to continue its leadership in uranium production.

All operating mines are situated in the province of Saskatchewan. Two companies, both with head offices in the province, operate all five uranium production facilities. Cameco Corporation wholly owns and operates Rabbit Lake, and is the operator of the Key Lake and McArthur River joint ventures. COGEMA Resources Inc. (CRI) wholly owns and operates Cluff Lake, and is the operator of the McClean Lake joint venture. In December 2001, Cameco became the operator of the Cigar Lake joint venture, which is currently under development.

Increased 2001 production (about 17% above 2000) is due mainly to contributions from two recently opened facilities: McArthur River and McClean Lake. The McArthur River mine, commissioned in 1999, continued to ramp up towards its annual licensed production capacity of over 6900 t, producing 6639 t in 2001. The McClean Lake project, also commissioned in 1999, produced 2540 t in 2001, and recently received an increase of some 33% in its annual licensed production capacity (to 3077 t/y).

McArthur River is the world's largest high-grade uranium deposit discovered to date (>150 000 t with an average grade of 18%). Mining high-grade uranium requires the use of innovative high-tech methods. The high water content of the deposit and surrounding rock necessitates the use of ground-freezing techniques. The use of remote-controlled mining methods, underground crushing and grinding facilities, and transportation of the ore in purpose-designed containers that are loaded and unloaded in specially designed, remote-controlled stations minimizes worker radiation exposure.

The world's second largest high-grade uranium deposit, Cigar Lake (approximately 90 000 t at an average grade of 15%), is currently under development with production expected to begin in 2005. High-tech mining methods specifically adapted to the local geology have been developed through test mining programs at the site. An environmental



assessment outlining the preferred option for disposing of potentially acid-generating Cigar Lake waste rock is ongoing.

Although local deposits at Key Lake were mined out in 1997, the mill is being used to process all ore from the McArthur River mine, which is located some 80 km north of Key Lake by road. The Key Lake mill produced a total of 6938 t in 2001, up sharply from the 1999 total of 4142 t, as the McArthur River mine achieved commercial production. The small contribution to total mill production from Key Lake deposits (299 t) came from stockpiled mineralized waste rock that is used in order to lower the grade of McArthur River ore to produce a mill feed of about 3.4% U.

Production at Rabbit Lake in 2001 totalled 1755 t, down significantly from 2000 production of 2790 t. This decline is the result of Cameco's decision to temporarily suspend operations in June 2001 after all stockpiled ore had been processed. The mining plan for the Rabbit Lake Eagle Point underground mine has been re-evaluated and production is expected to begin again in mid-2002.

Cluff Lake production totalled 1288 t U in 2001, down from the 1443 t produced in 2000. Although mining is expected to end in mid-2002, the mill will continue operating until all stockpiled ore is processed (expected in December 2002). Production beyond this date is limited as the total available capacity of the Tailings Management Area (TMA) will be reached. Because of the significant capital expense required to build a new TMA, CRI is proposing to mothball the mill and decommission other site facilities (the TMA, mined-out open pits, waste rock piles, etc.). The facility may be re-opened, depending upon the identification of additional local resources, market conditions and regulatory approvals. An environmental assessment of the decommissioning plan is ongoing.

McClellan Lake production totalled 2540 t in 2001, up from 2308 t produced in 2000, its first full year of production. Mining operations were suspended in early 2002 after the Sue C deposit was mined out, as stockpiled ore from the Sue C and the previously mined JEB deposit is sufficient to feed the mill until about 2005. Plans for mining the remaining cluster of deposits on the property are currently under development. In 2001, the McClellan Lake operation received ISO 14001 certification for its environmental management system, the first uranium mine in North America to do so.

Cameco and CRI provide significant opportunities for local participation in these developments (e.g., by promoting education and training through scholarships and other programs). Local business development has also been stimulated by preferential contracting to northern-based companies (over \$150 million was injected into the economy of northern Saskatchewan in 2000 alone). In recognition of these efforts, the Canadian Council for Aboriginal Business presented a Gold Level Achievement award in progressive Aboriginal relations to Cameco in February 2002.