CANADA

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Overview

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The total value of all domestically mined mineral commodities produced in Canada, including metals, nonmetals and mineral fuels, increased by 55.9% from C$54.0 billion in 1999 to an estimated C$84.2 billion in 2000, a record high. This upsurge was primarily the result of an increase in the value of production of the mineral fuels group from C$36.9 billion to C$65.7 billion. The value of mineral production excluding mineral fuels increased moderately by 8.3% in 2000 to C$18.5 billion. Both the value of metallic mineral production and the value of nonmetallic mineral production (which now includes structural materials) increased in 2000 – metals by 13.1% and nonmetals by 1.8%.

For the second year in a row, a record level for the value of fuel production in Canada was established in 2000 at C$65.7 billion. As in 1999, the rise is attributable to increases in the prices of oil and natural gas. The coal component of the fuel sector did not fare as well. The volume of coal produced fell by 4.6% to 69.1 Mt while the value declined more steeply by 10.8% to C$1.3 billion. The total value of natural gas by-products more than doubled to C$5.3 billion in spite of an increase in the volume of production of only 2.8%. The value of natural gas production nearly doubled as the result of both an increase in average price and a modest gain in production levels. The volume of crude oil production rose by 7.7% while its value soared by 68.5% to C$31.5 billion due to a rise in oil prices.

The value of metal production increased by 13.1% from C$9.8 billion in 1999 to C$11.1 billion in 2000, mainly due to a sharp rise in the value of production of nickel and the platinum group metals and a modest rise in the value of copper production. The value of nickel produced surged by nearly 50% as the result of a slight rise in production and a significant rise in the average price. In 2000, the price of nickel averaged US$3.92/lb, up from an average of US$2.10/lb in 1998 and US$2.73/lb in 1999. Over the past two years, demand has outweighed supply for both platinum and palladium, leading to sharply higher prices. In Canada, the value of platinum group metals production increased by 85.5% to C$464.5 million. The value of copper produced increased by 23.5% to C$1.7 billion as both the volume produced and the price received rose. The value of gold production fell by 2.6% to C$2.0 billion in 2000 in line with a similar reduction in the volume produced. The value of zinc production remained relatively steady at C$1.6 billion while the value of iron ore production rose by 9.6% to C$1.5 billion.

Canadian Mineral Industry Value of Production, 1999 and 2000 (C$ million)

	1999[r]	2000[p]	Change (%)
Metallic minerals	9,796.5	11,078.9	13.1
Nonmetallic minerals	7,315.4	7, 448.5	1.8
Total non-fuels	*17,111.9*	*18,527.4*	*8.3*
Fuels	36,899.7	65,698.6	78.0
Total minerals	**54,011.6**	**84,226.0**	**55.9**

Sources: Natural Resources Canada; Statistics Canada.
[p] Preliminary; [r] Revised.
Note: Totals may not add due to rounding.

The value of output of the nonmetallic minerals, which include potash, diamonds, asbestos, salt, peat, sulphur, and structural materials such as stone, sand and gravel and cement, rose by 1.8% from about C$7.3 billion in 1999 to C$7.4 billion in 2000. The value of production of the leading mineral in this group, potash, increased by 4.9%. At C$1.7 billion, the value of potash trailed only the value of nickel and gold in Canada during 2000.

In its second complete year of production, the Ekati diamond mine in the Northwest Territories produced 2.56 Mct valued at C$638.2 million. These figures compare to 2.43 Mct, worth some C$606.3 million, in 1999.

Both the volume and value of asbestos production declined in 2000, the volume falling from 337,000 t in 1999 to 320,000 t in 2000 and the value dropping from C$161.0 million in 1999 to C$143.9 million in 2000. The volume and value of salt production also declined in 2000, with the value dropping from C$373.6 million in 1999 to C$346.5 million in 2000. In contrast, the value of production for the structural materials group (now included with nonmetallic minerals) increased by 2.5% to C$3.5 billion. The values of production of cement, stone, lime and clay products all increased, offsetting a slight decline in the value of sand and gravel production.

The Canadian non-fuel sector (defined to include mining, including coal, smelting and refining, and the mineral manufacturing industries, but excluding the crude petroleum and natural gas industries) accounted for

C$28.0 billion, or 3.6%, of Canada's Gross Domestic Product (GDP), as measured at factor cost in 1992 prices, an increase of 2.2% over 1999 levels. Mining contributed 26.9% of the industry's GDP while smelting and refining and primary steel production added a further 14.9% to the total. Metal and nonmetal mineral manufacturing accounted for the remainder.

Employment in the non-fuel sector recorded a 3.7% increase in 2000, growing to an estimated 401,400 and accounting for roughly 3.3% of total Canadian full-time employment. Direct employment in metal mining, non-metal mining, quarrying and coal mining was estimated at 54,000, up from the 1999 level of about 53,300. Mine openings and re-openings, including several gold mines and an asbestos tailings operation to recover magnesium, offset closures, particularly in the coal-mining sector. Employment in the smelting and refining and primary steel industries, estimated at about 60,200 in 1999, increased by about a thousand in 2000 to 61,200. As was the case last year, the major gains in employment occurred in the mineral manufacturing industries as employment rose from 273,700 in 1999 to 286,300 in 2000, an increase of 4.6%.

Exports of crude minerals, coal, smelted and refined outputs and mineral products contributed C$49.1 billion to the value of Canada's domestic exports in 2000, a 10.0% increase over 1999. This represented 12.8% of Canada's total domestic exports of C$384.1 billion. Metallic mineral and mineral product exports accounted for 77.3% (C$37.9 billion) of the total non-fuel (including coal) value; nonmetal (excluding structural materials) exports accounted for 16.5% (C$8.1 billion); structural materials for 2.5% (C$1.2 billion); and coal for 3.7% (C$1.8 billion). The US remains Canada's principal trading partner with exports to that destination valued at C$38.3 billion, followed by Japan at C$1.9 billion and the UK at C$1.2 billion. Rounding out the top five countries were Belgium at C$791 million and the People's Republic of China at C$783 million.

Canadian imports of non-fuel minerals and mineral products, including coal, rose by 13.9% to C$50.7 billion, resulting in a small merchandise trade deficit (total mineral

Canadian Metals and Minerals Production ('000t except where stated)

	1998	1999[r]	2000[p]
Aluminium	2,374	2,390	2,373
Antimony (t)	359	357	364
Asbestos	321	337	320
Bismuth (t)	186	217	202
Cadmium (t)	1,179	1,115	1,095
Coal	75,360	72,497	69,149
Cobalt (t)	2,262	2,014	2,013
Copper	691	582	623
Gold (kg)	164,773	157,617	153,781
Gypsum	8,307	9,345	8,548
Iron ore	36,586	33,990	35,707
Lead	150	155	143
Molybdenum	8.1	6.3	6.8
Natural gas (M m^3)	160,515	162,219	166,078
Nepheline syenite	636	676	703
Nickel	198	177	181
Peat	1,125	1,180	1,194
Petroleum ('000 m^3)	128,401	122,247	131,631
Platinum group (kg)	14,033	13,872	15,439
Potash (K_2O)	8,884	8,475	9,107
Salt	13,034	12,686	11,935
Sand and gravel	225,338	242,369	246,331
Selenium (t)	398	359	350
Silver (t)	1,140	1,174	1,161
Stone	108,924	109,184	112,348
Sulphur, elemental	8,404	8,656	8,515
Sulphur (smelter gas)	836	843	849
Tellurium (t)	62	64	80
Uranium (U)	10.0	10.2	9.9
Zinc	992	963	936

Sources: Natural Resources Canada; Statistics Canada.
[p] Preliminary; [r] Revised.

exports minus total mineral imports) of C$255 million in 2000, compared with a 1999 surplus of C$1.2 billion. Although the value of total non-fuel (including coal) exports (domestic exports plus re-exports) rose by 10.4% to C$50.4 billion in 2000, the rise was offset by a 13.9% increase in the value of imports to Canada. The value of total exports of natural gas, natural gas by-products, petroleum and other fuels (excluding coal) rose in 2000 to C$50.0 billion from C$27.3 billion in 1999. The value of imports also increased from C$10.4 billion in 1999 to C$18.2 billion in 2000. When the values for fuels are combined with the non-fuels, total exports for the mineral, mineral product and fuel sector reached C$100.4 billion in 2000, up from C$73.0 billion in 1999. As a result, in 2000, the mineral industry (fuels and non-fuels) contributed C$31.5 billion to Canada's overall trade surplus of C$54.5 billion.

Exploration

By Donald Cranstone
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In 2000, preliminary annual exploration expenditures in Canada show further evidence of a decline that is about typical of the decline in exploration expenditures worldwide.

In Newfoundland, Thundermin Resources Inc. and Queenston Mining Inc. drilled the Duck Pond and Boundary Pond deposits. Resources at Duck Pond are 6.2 Mt at 3.4% Cu, 6.2% Zn, 1.0% Pb, 63 g/t Ag and 0.8 g/t Au. The deposits, discovered in 1987, are under option from Noranda Inc. Metallurgical tests have been carried out and a bankable feasibility study is nearing completion.

In Quebec, Noranda Inc. discovered the Perseverance zinc deposit (5 Mt at 16.8% Zn, 1.3% Cu, 34 g/t Ag and 0.4 g/t Au) near its mining operation at Matagami. This deposit will add seven years to the life of the operation. On its Raglan nickel-copper property, Falconbridge Ltd discovered a new ore lens at West Boundary Zone, 15 km east of the concentrator, the eighth deposit discovered by Falconbridge on the property since 1995.
At Sudbury, Ontario, where more than ten nickel-copper deposits have been discovered since 1990, Inco announced the discovery of a new deposit at Pump Lake. Drilling indicated 3.5 Mt at 1.5% Ni, 1.0% Cu and 1.5 g/t combined Pt, Pd and Au, and is expected to increase this resource.

Exploration by North American Palladium Ltd continues to increase ore reserves at the Lac des Iles mine in northwestern Ontario where mill capacity has recently been increased from 2,400 t/d to 15,000 t/d. At the end of 2000, measured and indicated resources had increased to 145.7 Mt averaging 1.57 g/t Pd, 0.17 g/t Pt, 0.12 g/t Au, 0.06% Cu and 0.05% Ni. A further 19.7 Mt are classified as inferred. This tonnage contains 8.4 Moz of palladium. The orebody remains open to the east, west and at depth. Further increases in reserves and resources are expected.

Metallurgical work and a pre-feasibility study on the Big Whopper pegmatite deposit of Avalon Ventures Ltd, discovered in northwestern Ontario in 1997, which contains 13.8 Mt averaging 1.34% Li_2O and 0.30 Rb_2O and is open at depth, indicate that selective flotation can recover more than 90% of the petalite with an average grade of 4.4% Li_2O and an exceptionally low iron content (less than 0.02% Fe_2O_3). In addition to petalite, the flowsheet also provides for the recovery of separate concentrates of Rb-K-feldspar, albite, spodumene, mica, tantalum and tin. The pre-feasibility study indicated that the project (mineable by open pit) will yield a discounted cash flow rate of return of 39.5%. The company plans to proceed with a full feasibility study at a cost of C$5.0 million. Drilling is in progress on a separate tantalum-bearing lepidolite dyke on the property.

An initial 300 t bulk sample taken by De Beers from the Victor kimberlite, located in Ontario to the west of James Bay, yielded diamonds valued at US$154/ct with a

kimberlite value of US$50/t. Results have not yet been announced for a 7,000 t bulk sample taken in the 1999-2000 winter season.
Kimberlite indicator mineral dispersal trains have been found by provincial geological survey geologists in the Superior province, of Achaean age, in the northeastern part of Manitoba to the north and south of Knee Lake and near the Echimamish River. This has led to the acquisition of 60-70 exploration permits by more than 20 companies, including De Beers and BHP, covering an area of 31,000 km^2 as of mid-April 2001. Detailed exploration, including drilling, is under way on some of these permits.

In Saskatchewan, one year after production commenced, Cameco Corp. announced that proven and probable reserves at its McArthur River mine, the world's largest and highest-grade uranium mine, have been increased by more than 50% to 394.5 Mlb of U_3O_8 in ore grading an average of 21.18% U_3O_8. The increase is based on drilling carried out during 1999-2000, together with results of the initial year of production. Cameco continued to drill a property at La Rocque Lake, where high-grade uranium intersections were first reported in 1999. Results of this work have not yet been released.

Exploration of Foran Mining Corp.'s McIlvena Bay zinc-copper deposit continues. Indicated and inferred resources for this deposit now stand at 14.5 Mt with grades of 0.91% Cu, 6.08% Zn, 0.40% Pb, 0.45 g/t Au and 23.70 g/t Ag, plus another 12.1 Mt at 1.81% Cu, 0.54% Zn, 0.63 g/t Au and 12.47 g/t Ag. The deposit is open down-plunge and to the northeast.

The Northwest Territories is expected to be producing diamonds at a rate of C$1.5 billion/y by 2004 and diamonds continue to be the principal exploration target in the region. De Beers is continuing exploration and bulk sampling of the Snap Lake deposit, acquired by the company at a cost of C$379 million, and plans to commence production in 2004. Elsewhere, exploration of the Ekati diamond mine property continues following the discovery of an additional 11 kimberlite pipes in 2000, bringing the total to 136.
In Nunavut, the Naartok gold deposit was discovered on the Hope Bay gold property, bringing the number of known gold deposits on that property to four. A C$10 million exploration programme is being carried out on the property, where more than C$85 million has been spent on exploration to date. At the Meadowbank gold project, to the north of Baker Lake, the Vault gold deposit was discovered, the fifth deposit to be discovered and outlined on the property in five years.

Aluminium

By Wayne Wagner
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Production of primary aluminium decreased 0.7% to 2.373 Mt in 2000, compared with 2.390 Mt in 1999, ranking Canada fourth after the US, Russia and China in terms of world production. The decrease reflects the planned closure of the 73,000 t/y Isle-Maligne smelter in March 2000.

The value of Canadian production in 2000 is estimated at C$5.5 billion, up from the estimated C$4.8 billion in 1999, reflecting the increased aluminium price during the year. As all aluminium ore and alumina are imported, this value is not included in the total valuation of Canadian-produced metals above. Canada, the second largest aluminium-exporting country in the world after Russia, exported 1.84 Mt of unwrought aluminium valued at C$4.53 billion in 2000.

Because of the Power for Jobs Strategy that makes surplus electrical power available to industry, under flexible terms, to create jobs and investment, the Province of British Columbia has continued discussions with aluminium producers on planning and feasibility studies for the development of smelters and value-added facilities in BC. For example, KPI Technology and Development LLC, an independent US consulting firm,

worked with the Town of Port Alberni on a prefeasibility study for a new 360,000 t/y smelter. The smelter would require 650 MW of power and, therefore, new power facilities. BC Hydro and the provincial government are currently conducting a power supply study for the project and a feasibility study is expected to start in late 2001.

Alcan Aluminium Ltd completed its merger with Alusuisse Lonza Group Ltd (Algroup) of Switzerland in October 2000 and formally changed its name to Alcan Inc. to reflect its diversified product mix and global character. The new Alcan has combined revenues of US$12.4 billion and employs 53,000 people in 37 countries. Alcan's new 400,000 t/y smelter at Alma, Quebec, which replaces the Isle-Maligne smelter, started production in October 2000. Once it reaches full production in mid-2001, Alcan will have 1.44 Mt, or 53%, of the primary aluminium capacity in Canada.

In 2000, Alcoa became the second largest aluminium producer in Canada with the completion of its merger with Reynolds Metals Co. As a result of the merger, Alcoa holds approximately 44% of Canada's total primary aluminium smelting capacity, including sole ownership of the 240,000 t/y Lauralco smelter and the 418,000 t/y Baie-Comeau smelter, plus a 74.95% interest in the 390,000 t/y Aluminerie de Bécancour Inc. (ABI) smelter (Pechiney Corp. holds the remaining 25.05%). Alcoa has indicated that it is looking at possible expansions, including its Canadian smelters.

In 2000, the ABI smelter, the second largest in Canada, signed a four-year labour contract. Subject to obtaining new power supplies, ABI has indicated that it would like to add a fourth potline to increase capacity.

Meanwhile, partners in the 244,000 t/y Alouette smelter at Sept-Îles, Quebec, undertook studies on a doubling of capacity in a potential C$1 billion expansion. Partners in the smelter include: Aluminium Austria Metall Québec (20%), VAW Aluminium Canada (20%), Corus Aluminium Québec Inc. (20%), Société Générale de Financement du Québec (20%), Kobe Aluminium Canada Inc. (13.33%) and Marubeni Québec Inc. (6.66%).

Elsewhere in Quebec, Lavalum LP opened a C$20 million recycled secondary aluminium smelter with a capacity of 6.5 Mlb/mth. Lavalum, a joint venture of Société Nationale des Ferrailles Inc. (SNF) with 60% and SGF Mineral Inc. with 40%, will employ 60 people.

In 2000, the Government of Canada published an Aluminium Industry Technology Road Map. This co-operative effort between several government departments, the Aluminium Association of Canada, major industry stakeholders, suppliers and universities, has resulted in the establishment of a new research centre at Chicoutimi, Quebec.

Copper

By Maureen Coulas
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Canada's provisional mine production of copper in 2000 totalled 622,343 t, about 7% higher than the 1999 total of 583,817 t (mine production figures are based on recoverable copper in concentrate shipped). Full production from the Highland Valley, Gibraltar and Myra Falls mines, all of which were shut down temporarily in 1999, was offset by lower output from Falconbridge's mines owing to a strike at the Sudbury operations and lower ore grades at Kidd Creek. Canada's provisional production of refined copper metal in 2000 totalled 551,434 t, about 2% higher than the 540,446 t produced in 1999.

In May, Breakwater Resources Ltd acquired the Bouchard-Hébert and Langlois zinc mines, located in northwestern Quebec, from Cambior Inc. Earlier in the year, Cambior had announced mechanical problems with the SAG mill at the Bouchard-Hébert mine that resulted in a temporary shutdown of the mill. The repaired SAG mill was back in production

in October and reached its full capacity of 2,900 t/d by year-end. Then, in November, Breakwater announced that it would be temporarily suspending operations at the Langlois mine due to operating problems associated with the main ore-pass system. In 1999, the Bouchard-Hébert mine produced 7,200 t of copper in concentrate and the Langlois mine produced 1,000 t of copper in concentrate.

In July, Falconbridge announced that it will proceed with a C$640 million project to extend the depth of its Kidd Creek mine in Timmins, Ontario, by 1,000 m to a total depth of 3,100 m. At the new depth, the Kidd Creek mine will be the world's deepest base-metal mine. With production scheduled to begin in 2004, the extension is expected to contribute 2 Mt of ore annually when full production levels are reached.

A series of explosions in the main smelting furnace at Hudson Bay Mining and Smelting Company Ltd's Flin Flon metallurgical complex in Manitoba on August 8, 2000, forced the company to shut down copper smelting operations and to declare *force majeure* on copper shipments for a period of almost three months. The explosion was triggered when water being used to cool the furnace in preparation for rebricking came into contact with molten metal. One worker was killed and thirteen others were injured. *Force majeure* was lifted on November 27. The rated capacity of the smelter is 90,000 t/y of copper.

In October, Cominco Engineering Services signed a memorandum of understanding with Taseko Mines Ltd to commence a C$3 million study to investigate the feasibility of constructing a 35,000 t/y copper refinery at the Gibraltar mine site near Williams Lake, British Columbia. The refinery would use Cominco's hydrometallurgical technology to leach copper concentrate. The study will be completed in early 2001.

Gold

By Lo-Sun Jen
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Canadian gold production totalled 155 t in 2000, about 2% less than in 1999. This small decline was mainly the result of lower production from several mines, as opposed to mine closures exceeding mine openings, which caused Canadian gold production to fall by almost 10% from 1997 to 1999. Gold exports rose more than 8% to 207 t, but the value dropped (albeit by less than 1%) to C$2.54 billion due to lower prices. Imports declined 38% to 79 t with a drop of 5% in value.

Ontario accounted for 47% of Canada's total gold production in 2000, followed by Quebec (22%), British Columbia (17%) and Manitoba (5%). Newfoundland, New Brunswick, Saskatchewan, Alberta, the Yukon, the Northwest Territories and Nunavut combined contributed 9%. Approximately 90% of Canada's gold production in 2000 came from hard rock underground and open-pit gold mines. Of the remaining 10%, 8% was from base-metal mines and 2% was from placer mining operations. The average cash cost of production from Canadian underground and open-pit gold mines was about US$195/oz. Canada maintained its position in 2000 as the fifth largest gold producer in the world after South Africa, the US, Australia and China. For 2001, Canada's gold output is expected to increase marginally.

In all, 33 gold mines remained in production at the end of 2000, similar to the 1999 level. In a welcome departure from the declining trend evident since 1996, however, employment levels rose by 2% to 8,390.

Whilst no new gold mines were brought on stream in 2000, six gold mines were re-opened – Francoeur and Joe Mann in Quebec, Red Lake and Stock in Ontario, Giant in the Northwest Territories, and Lupin in Nunavut. Production at both Joe Mann and

Stock was later suspended, however, as a result of low gold prices.

The re-opening of the Red Lake mine in northwestern Ontario in August, after a four-year shutdown due to a labour dispute, was the highlight of the year for gold mining in Canada. Highly successful exploration work, which resulted in the discovery of the non-refractory High Grade Zone, has allowed the mine to be redeveloped into a world-class, exceptionally high-grade and low-cost gold mine. The mine is currently the lowest-cost gold mine in Canada and one of the lowest in the world.

A number of other gold mines closed or suspended operations during the year. While the decision to permanently close the Sigma underground mine in Quebec was due to economic reasons, the closure of the Keystone mine in Manitoba and the Hislop West mine in Ontario was the result of pit ore depletion. In addition, production was suspended at the Beaufor mine in Quebec because of low gold prices.

Despite lingering weak gold prices, several significant capital expansion and mine-life extension projects were carried out at existing mines throughout the year. An eight-year, US$218 million capital expansion and extension programme at the LaRonde mine in Quebec, which started in 1997, doubled the mine's production capacity to 4,500 t/d in 2000. With estimated gold reserves and resources of 7.8 Moz in 2000, up 28% from a year ago, this gold deposit is shaping up to be one of Canada's largest. A study is under way to determine the economics of further expanding capacity to 6,500 t/d. Production in 2001 is expected to be 230,000 oz at a cash cost of less than US$150/oz. By 2004, annual gold production at LaRonde is expected to increase to 331,000 oz at a cash cost of US$100/oz. In addition, significant zinc and copper production continues to boost the profitability of the mine.

Continued exploration success at the Red Lake mine in northwestern Ontario has resulted in a 43% increase in ore reserves in the High Grade Zone to over 3 Moz in 2000. In the first quarter of 2001, the head grade was averaging 95.33 g/t (2.78 oz/st) and a recently revised 2001 production forecast points to the production of 440,000 oz of gold at a cash cost of below US$75/oz, making it the largest gold mine in Canada. In addition, the Red Lake mine hosts another 1.63 Mt of refractory gold ore grading 12.7 g/t (0.37 oz/st) gold, which was the main source of ore prior to the mine's shut-down in 1996. Both high-grade and refractory ore reserves are expected to increase in 2001.

At the adjacent Campbell mine, a US$51 million deep-ore development that started in 1997 was completed in early 2000 and the mine is currently on track to produce 250,000 oz/y of gold. Other significant expansion and extension projects in 2000 included: a US$11 million deep-ore development and shaft extension at the Doyon and Mouska mines in Quebec; an increase of mill capacity at the Holt-McDermott mine to accommodate ore from the mine and the custom milling needs of all of the Holloway mine's annual production in Ontario; and a US$6 million capital programme to expand production at the Bissett mine in eastern Manitoba.

In addition, a US$126.5 million, three-year expansion programme at the Lac des Iles palladium-platinum-gold-nickel-copper mine in northwestern Ontario, under way since 1998, will increase mill capacity to 15,000 t/d from the current 2,400 t/d and triple mine production by 2002. By-product gold production will triple to 19,100 oz. During 2000, mill capacity at the Sigma-Lamaque complex increased 50% to 3,000 t/d. The plan was to expand further the milling capacity to 4,000 t/d in 2001 but production at the complex was suspended in mid-February 2001 because of high costs.

As at January 1, 2000, Canada's gold reserves stood at 1,330 t, a 6% decline from a year ago (1,415 t). Declining gold prices have eroded Canada's economically

mineable gold reserves steadily since 1996 when gold reserves were 1,724 t, the second highest level in Canadian history after the 1,801 t recorded in 1988.

The current price level for gold is unlikely to encourage the development of significant new mines in Canada in 2001 or in the first half of 2002. However, should prices improve above US$300/oz, several new gold mines could be brought on stream within two years. These include the Hammerdown deposit in Newfoundland; the East Amphi underground project in Quebec; the Damoti Lake and Nicholas Lake deposits in the Northwest Territories; and the Ulu, Hope Bay, George Lake, Meliadine East and West, and Meadowbank projects in Nunavut. In addition, several mines closed previously could be re-opened, including the Casa Berardi East and West, and the Copper-Rand 5000 (Copper Rand gold-copper) mines in Quebec, and the Aquarius mine in northern Ontario, amongst others.

Iron Ore

By Louis Perron
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In 2000, on account of strong demand from the steel industry, especially for pellets, Canada's iron-ore production rose by 5.1% to 35.7 Mt. In line with this increase, the value of Canada's iron-ore production grew by 9.6% to C$1.54 billion. But despite this strong showing, iron-ore exports fell by 0.56% to just over 26.3 Mt because of weakening demand starting in September. The pellet market remained strong with a 9.3% increase in exports, but a 17.6% drop experienced in the concentrate market dragged down trade numbers. The drastic fall in demand for concentrate was brought about by the hike in the price for gas, used for pelletisation, and by the onset of an economic slowdown.

On the strength of market demand for iron ore in the first quarter of the year, when prices are established for the year, iron-ore producers negotiated significant price increases to compensate for the price drop incurred in 1999. Prices jumped respectively by 5.15% and 4.34% for concentrate bound for Europe and Japan, and by 7.32% for pellets bound for Europe. Despite lower exports, these price increases helped maintain the value of Canada's exports, which rose by 0.1% to about C$1,053 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 extending through northern Quebec and Labrador. Canada's production comes from three mining operations owned by Iron Ore Company of Canada (IOC), Quebec Cartier Mining Company (QCM), and Wabush Mines.

In August 2000, Rio Tinto Ltd completed the acquisition of North Ltd. of Australia and the latter's 56.1% controlling interest in IOC. The remaining ownership is split 25% for Mitsubishi Corp. and 18.9% for the Labrador Iron Ore Royalty Income Fund. Upon completion of the transaction, Rio Tinto sanctioned the refurbishment and reactivation of its pellet plant in Sept-Îles, Quebec, which had been announced earlier in the year by IOC. Commissioning of the C$361.5 million project, scheduled for June 2002, will result in the addition of 4.5 Mt of capacity to the company's pellet production.

Lead and Zinc

By Patrick Chevalier
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Zinc mine production in Canada totalled 996,921 t in 2000, about 2.4% lower than the 1,020,982 t produced in 1999. Lead mine production totalled 148,769 t in 2000.

Zinc metal production in Canada was up less than 1% from 776,927 t in 1999 to 779,586 t in 2000. Lead metal production in 2000 totalled 283,763 t, of which some 124,571 t, or 44%, was from recycled sources.

Falconbridge Ltd approved the development of Mine D (Deep) at the Kidd Creek copper-zinc operation at Timmins, Ontario. The project, which will extend the mine from 2,100 m to 3,100 m below the surface, will contribute 2 Mt/y of ore when full production is reached in 2004. When completed, the project will make the Kidd mine the deepest base metal mine in the world. The first stage of the project is estimated to contain 15.7 Mt at 2.8% Cu, 5.7% Zn and 58 g/t Ag. Current estimates for stage two are for 10.5 Mt of ore at 2.2% Cu, 5.3% Zn and 97 g/t Ag.

In the Matagami region of northwestern Quebec, Noranda Inc. reported good drilling results from a programme to find new sources of feed for its milling and smelting operations. The presence of a significant zinc and copper deposit consisting of three distinct ore zones (Equinox, Perseverance and Perseverance West) was discovered within the Matagami mining camp. Preliminary results for the Equinox Zone indicate an inferred resource of 5 Mt at 16.8% Zn, 1.3% Cu, 34 g/t Ag and 0.4 g/t Au. Work continues to define the zones further.

In May, Breakwater Resources Ltd acquired the Bouchard-Hébert and Langlois zinc mines, located in northwestern Quebec, from Cambior Inc. Earlier in the year, Cambior announced mechanical problems with the SAG mill at the Bouchard-Hébert mine, which resulted in its temporary shut-down. The repaired SAG mill was back in production in October and reached its full capacity of 2,900 t/d by year-end. In November, Breakwater announced that it would be temporarily suspending operations at the Langlois mine due to operating problems associated with the main ore-pass system. The difficulties with the ore-pass system, combined with the recent drop in metal prices and high treatment charges, made it uneconomic for the company to operate the mine.

Rock stability problems at Cominco's Sullivan mine in British Columbia that started at the end of 1999 continued to result in lower concentrate production in early 2000. Improvements at the mine during the first quarter, however, resulted in higher zinc and lead concentrate production. The mine is expected to continue to operate on an economic basis until the planned closure date, which is now expected to be December 2001. In December 2000, Cominco announced that it would be reducing zinc production by about 20,000 t through to January 2001 as the result of a power swap agreement with a major US energy company.

Noranda Inc. ratified new three-year collective agreements with union employees at its Brunswick smelter in Belledune, New Brunswick. In 1999, the Brunswick bulk concentrate facility handled some 360,000 t of zinc and lead concentrate. The lead smelter produced more than 100,000 t of lead and custom alloys.

Evaluation continues on several advanced projects, including Expatriate Resources Ltd's Kudz Ze Kayah property in the Yukon, Canadian Zinc Corporation's Prairie Creek project in the Northwest Territories, and Redfern Resources Ltd's Tulsequah Chief project in British Columbia.

Magnesium

By Wayne Wagner
Senior Industry Specialist for Magnesium, Natural Resources Canada

On a global basis, Canada ranks third after China and the US in magnesium production and national production in 2000 rose by 6%. The value of Canadian production in 2000 is estimated at C$325 million, down 10% from 1999's estimated production of C$360 million, reflecting the price decline in magnesium metal. This follows a similar 10% decline experienced in 1999. Canada's exports of magnesium in 2000 at C$204.6 million were lower than the C$225.9 million exported in 1999. As significant quantities of magnesite ore are imported, this production value is not included in the total valuation of Canadian produced metals above.

Construction of Magnola Metallurgy Inc.'s 63,000 t/y magnesium metal plant at Danville, Quebec, is complete and the commissioning of electrolytic cells is under way. The C$840 million facility started producing magnesium metal in October 2000, creating 320 jobs. The company expected to produce about 30,000 t of metal in 2001 and to reach full production levels in late 2001. Noranda Magnesium Inc. has developed a new high-temperature alloy that shows great potential to provide an affordable composition for applications such as automotive power trains. Noranda is now marketing this alloy, as well as pure magnesium and magnesium-aluminium alloys. The company 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 the 43,000 t/y Bécancour plant in Quebec 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. Expansion may take place in the future provided sufficient customer contractual commitments for the production are in place. Norsk Hydro has also developed a new alloy for use at higher temperatures.

Timminco Ltd produces high-purity metal (up to 99.98% pure) for specialised markets at its 6,000 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.

Cassiar Mines and Metals Inc. continues planning for a US$600 million magnesium metal project with a capacity of 70,000-90,000 t/y based on asbestos mining residues in northern British Columbia. A banking report was due in early 2001 and if financing and other studies are successful the company plans to start production in late 2003.

Gossan Resources Ltd maintained its interest in a dolomite property at Inwood, Manitoba, with a dolomite resource estimated at 67 Mt averaging 21.6% MgO, with additional inferred resources. Gossan has discussed production from the deposit with metal producers in South Africa and the US, and completed an economic assessment study of the proposed project, which shows a 15% internal rate of return.

The town of Thetford Mines, Quebec, started a prefeasibility study on a proposal to process mining residues from asbestos mines into magnesium metal. The town reports that in excess of 300 Mt of material with a grade of approximately 24% Mg are available in the area for processing. Work was under way to find and license a process that could be used to extract the magnesium. Discussions were also under way with possible partners in the project.

Nickel

By Bill McCutcheon
Commodity Specialist, Natural Resources Canada

Canadian production of nickel in concentrates was 191,000 t and refined nickel usage 134,000 t in 2000.

Lower production at Falconbridge Ltd's strike-hit facilities in Sudbury in August 2000 was somewhat offset by increased production from its Raglan mine in Quebec where mill

Canadian Magnesium statistics (t)

	1996[e]	1997[e]	1998[e]	1999[e]	2000[e]
Production[1]	54,000	57,700	77,100	71,000	75,000
Use	27,600	34,000	32,600	42,600[a]	45,000
Exports	39,937[r]	46,989[r]	50,115	49,747[r]	47,155
Imports	22,733	34,976	32,310	37,890[r]	33,835

[a] Additional companies reporting; [e] Estimated; [r] Revised.
[1] Canadian magnesium production data are confidential due to the limited number of companies reporting. This is a US Geological Survey estimate, which includes recycled magnesium production that was provided to the International Consultative Group on Nonferrous Metals Statistics.

capacity was increased to 1 Mt/y in 2000. Evaluation of Falconbridge's Onaping Depth project was delayed by the strike.

Production at Inco's Thompson mine/ smelter/refinery complex recovered in 2000 following the shortfall the previous year due to of industrial action at the facility. As a result, this contributed to the higher refined production in Canada in 2000, up 10 000 t compared with 1999.

Meanwhile, mine development continued at Inco's deep project at the Creighton mine (10,900 t/y starting in 2002) whilst an expansion was announced at the McCreedy East mine that will increase output there by 8,600 t/y of nickel. Inco also plans to develop a low-grade area of the Stobie mine and in January 2000 announced the deepening of the Birchtree mine. Exploration in the Sudbury area continued at the company's Totten and Kelly Lake properties.

Negotiations between the Province of Newfoundland and Inco over the proposed development of Inco's Voisey's Bay property were halted in January 2000; no further negotiations took place during the year.

Sherritt International Corp. owns a 50% share in the hydrometallurgical refinery at Fort Saskatchewan where total refined production was 28,000 t in 2000 and cobalt production reached a record 2,855 t.

Canmine Resources Corp. commenced refurbishment and modernisation of the former Cobatec hydrometallurgical refinery in Cobalt, Ontario, purchased in1999.

North American Palladium Ltd produced less than 1,000 t of nickel at its palladium mine near Thunder Bay in 2000. Nickel production will increase at the mine by mid-2001 when a new 15,000 t/y mill commences operation.

Sulphur

By Patrick Morel-à-l'Huissier
Associate Director, Business Development, Minerals and Metals Sector, Natural Resources Canada

In 2000, production of elemental sulphur in Canada is estimated to have decreased by 1.5% to 8.68 Mt, compared with 8.81 Mt in 1999. Production from natural gas processing accounted for 86.6% of the total, the remainder being derived from oil sands plants (8.3%) and oil refineries (5.8%). Sulphur output in British Columbia showed a significant increase of 9.8% over 1999, although much of this gain was offset by lower production in Alberta from both natural gas and oil sands. Alberta, British Columbia and Saskatchewan are the largest producing provinces; other provinces produced small amounts of sulphur, mainly from oil refining.

Shipments of elemental sulphur were estimated at 8 Mt, a 1.8% decrease from 1999. Domestic deliveries in 2000 amounted to about 900,000 t while exports to the US accounted for 1.45 Mt, a decrease of 25.6% from 1999. Offshore sales increased by about 3.6% over 1999 to reach 5.5 Mt. This increase was largely due to strong sales in China and Brazil while other customers of Canadian sulphur, like Morocco, reduced their offtake.

Most, if not all, of the activity in 2000 took place in the oil sands sector where a number of new major projects were announced. As a result of the increased activity in the oil sands industry, and in light of its future importance regarding its contribution to Canada's oil industry, the National Energy Board has published a report entitled *Canada's Oil Sands: A Supply and Market Outlook to 2015.* It is expected that over 50% of Canada's crude oil production will be derived from oil sands by 2015 and, because oils sands contain between 5% and 7% sulphur, they will be a major contributor to future Canadian sulphur production – increasing current production by up to 2 Mt/y.

In all, nearly 60 projects worth $34 billion are planned for the period 1996-2010, some of which are described below.

In August 2000, Syncrude Canada Ltd, the largest Canadian source of crude oil and the world's largest oil sands producer, announced the official opening of its Aurora mine as part of its Syncrude 21 Program. Located 35 km north of the Mildred Lake site, the project is the first remote mine/extraction facility in the oil sands industry. The new technology developed by Syncrude researchers and engineers will improve both production efficiency and environmental performance. In 2000, the total capital investment in the Syncrude 21 Program was C$510 million. In 2001, about C$900 million will be spent. By the end of the project in 2007, C$8 billion will have been spent. The Syncrude Project is a joint venture operated by Syncrude Canada and owned by AEC Oil Sands, Athabasca Oil Sands Investments, Canadian Occidental Petroleum Ltd, Canadian Oil Sands Investments, Gulf Canada Resources, Imperial Oil Resources, Mocal Energy, Murphy Oil Co. and Petro-Canada. Syncrude also pursued its underground storage trials with Alberta Sulphur Research during the year.

Work continued on the C$2.8 billion second phase of Suncor Energy Inc.'s Project Millennium, which is designed to increase oil sands production capacity to 225,000 bbl/d by 2002. In January 2000, the company announced its plans to invest C$750 million to add a commercial-scale in situ plant at its Firebag lease and to expand its upgrading capacity. This expansion will allow production of approximately 260,000 bbl/d of oil in 2004 and result in the doubling of Suncor's current sulphur production to about 220,000 t/y.

Elsewhere, work has started at the Athabasca Oil Sands Project, a partnership between Shell Canada Ltd (60%), Chevron Canada Resources Ltd (20%) and Western Oil Sands Inc. (20%). The project includes C$1.8 billion for development of the Muskeg River mine located 75 km north of Fort McMurray, Alberta, and is expected to begin production in 2002. In addition, the project requires C$1.7 billion for the Scotford Upgrader located beside Shell's Scotford refinery north of Fort Saskatchewan, Alberta.

In September, Petro-Canada announced a C$290 million plan to develop its MacKay River oil sand property with production expected to start in late 2002. The company is also looking at the possibility of building an upgrader at its Edmonton refinery. This upgrader could produce an estimated 600 t/d of sulphur.

In November, Canadian Natural Resources Ltd (CNRL) announced its C$6.5 billion plan to develop, by the end of the decade, its Mic Mac project 70 km north of Fort McMurray, Alberta. CNRL acquired the Mic Mac lease from BP in 1999.

TrueNorth Energy (formerly Koch Petroleum Canada Ltd) continued its exploratory programme at Fort Hills, 90 km north of Fort McMurray, where there are plans to build a C$2 billion mine, processing facility and on-site utilities and infrastructure.

Coal

By Don Downing
VP, Management Consulting
Norwest Mine Services Ltd

The year 2000 will be seen as another turning point for the Canadian coal industry as export prices bottomed out and turned upwards, and the domestic market for coal began to gather momentum in the face of rising natural gas prices.

There are now 20 operating coal mines in Canada, down from previous years as companies continued to rationalise export production. Closures during the year included the surface and underground operations of Smoky River Coal and the Gregg River mine (Luscar) in Alberta, as

well as the Quintette mine (Teck Corp.) in northeastern British Columbia. These were all export coking-coal producers. Teck consolidated some Quintette export sales with its Elkview mine and Elkview has expanded production as a result.

The various changes at mines had a negative effect on production levels for the second consecutive year and total coal production totalled 69.2 Mt in 2000, down 4% from 1999. Export prices dropped once again and, as expected in light of further mine closures, export tonnage fell to 31.7 Mt. All exports are from western Canadian producers and coking coal remains Canada's major export (28.1 Mt). The stronger, lower-cost exporters continued to pick up volume from the less competitive mines and the depressed market has led to a rationalised Canadian industry. By year-end, however, spot coking and steam coal prices were on the rise, improving the outlook for 2001.

Natural gas prices surged across North America during 2000 and focused attention on natural gas-fired electricity generation as a result. In some jurisdictions, emerging deregulation of electricity generation, together with the higher gas prices, led to significant increases in electricity prices. The situation has led to renewed interest in coal-fired electricity generation. In Alberta, three new coal-fired units were being contemplated as the year drew to a close. These stations will increase domestic demand by at least 2 Mt/y.

Overall, domestic coal consumption remained vigorous at 58.2 Mt, with much of the eastern Canadian demand being supplied by imports which rose to 21.8 Mt. Bituminous coal from the US (Appalachia) and Colombia is imported for the steel and electricity industries, and western US sub-bituminous coal is being delivered into the province of Ontario as well. The supply/demand balance in the US and the Atlantic basin tightened considerably late in 2000, and prices for all brands of imported coal are expected to rise.

The prospect of new export developments or expansions remains fleeting. Luscar announced the shelving of its Cheviot export coking-coal project and its Telkwa export steam-coal project. Cheviot is a joint venture between Luscar and Consolidation Coal, and the parties decided to extend the joint venture relationship to the Line Creek mine in southeast British Columbia where production will be expanded. Luscar sold 50% of Line Creek to Consol to facilitate the deal and production is expected to increase by 1 Mt/y to 3.5 Mt/y over the next two years. In northeastern BC, project operator Globaltex made additional progress on the Pine Valley export development and Western Canadian Coal Corp. began work on a new export prospect called Wolverine. Each of these prospective developments would likely produce in the order of 1 Mt/y of coking coal. In Alberta a private company began reviewing the potential to open a new underground mine on the former Smoky River property. The mine is being planned to produce 1 Mt/y of export coking coal.

No new domestic mines are being considered at present although growing electricity demand in western Canada could support additional local production especially in Alberta where new generating capacity has been announced, and more is expected.