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# Canadian Overview

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The total value of all mineral commodities mined in Canada, including metals, nonmetals and coal, increased to a record \$24.2 billion in 2004 compared with \$20.1 billion in 2003.<sup>1</sup> This large 20% increase was due in large measure to significant increases in the prices of most metallic minerals.

This measure of Canadian mineral production reflects only the production and value of domestically mined minerals - basically the value of Canadian mine production. Imported ores such as bauxite are therefore not included in the above value. The value added by the further processing of both domestically mined and imported ores is, however, captured when considering the broader Canadian mineral industry, which includes not only mining, but also primary metal manufacturing, nonmetallic mineral product manufacturing, and fabricated metal product manufacturing. This broader definition of the industry is discussed later in this Overview.

The value of coal production increased to \$1.6 billion in 2004 from \$1.5 billion in 2003 in response to increased production.

Although most metal prices rose in 2004, changes in output levels varied considerably. Nickel production increased by 17% and, combined with the increase in the price of nickel, attained a value of production of \$3.3 billion, a huge 57% increase over 2003. In terms of value of production, nickel was Canada's most important mineral in 2004. The value of gold production, Canada's second most valuable mineral commodity in 2004, declined by 4.4% to \$2.2 billion and the volume of production declined by 8.6%. Copper production remained virtually unchanged but, because of sharply higher copper prices, the value of production soared by 56% to \$2.0 billion. Again, because of higher prices received for iron ore, the value of iron ore production increased by 7% despite a 15.6% drop in production. In total, the value of metal production in 2004 reached a record \$12.5 billion, 30% above the 2003 level. As a result of the placing of Canada's one tungsten mine on care and maintenance in late 2003, no tungsten was produced in Canada in 2004, compared with 3600 t valued at nearly \$30 million in 2003. The mine remains on care and maintenance.

The value of nonmetallic mining production reached a record \$10.0 billion in 2004, a 12.6% increase over 2003. Production values in excess of \$1 billion were recorded for five nonmetal commodities. The leading nonmetal commodity (and third overall in terms of value of production) was diamonds with a

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<sup>1</sup>The 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 *Year in Review* paper. The data do not include crude oil, natural gas or natural gas by-products. The 2004 data are preliminary annual figures released in February 2005.

value of \$2.1 billion, 35% above the 2003 level. The value of the second most important nonmetallic mineral (in terms of value of production), potash, increased by 20.0% to \$1.9 billion on the strength of international demand. Canada continues to rank first in the world in potash production. Three structural materials, cement, sand and gravel, and stone, rounded out the nonmetals with values of production in excess of \$1 billion.

In 2004, diamond mining in Canada completed its sixth full year of production and the first with two mines operating for the entire year. Both are in the Northwest Territories. A third mine is scheduled to open in the northern territory of Nunavut in 2006. Canada ranks third in terms of the value of global production of rough diamonds, trailing only Botswana and Russia.

The Canadian mineral industry includes mining (including coal), primary metal manufacturing, nonmetallic mineral product manufacturing, and fabricated metal product manufacturing. It does not include the crude petroleum and natural gas industries, although crude bitumen production from the tar sands is included in some aggregations. The industry (excluding bitumen) accounted for \$41.8 billion, or 4.0%, of Canada's Gross Domestic Product (GDP) in 2004, measured at basic prices in chained 1997 dollars, an increase of 3.8% over 2003 levels. Mining contributed 25.6% of the industry's GDP, primary metal manufacturing, 28.7%, nonmetallic mineral manufacturing, 13.5%, and fabricated metals, the remaining 32.2%.

According to preliminary data compiled by Natural Resources Canada, employment in the Canadian mining industry recorded a fractional 1.4% decline in 2004, falling to an estimated 45 399, down from 46 035 in 2003. This represented the ninth straight year of declining employment. Employment in metal mining decreased 3.2% to 23 094 (also the ninth consecutive decline) while nonmetal mining was up by 2.0% to 17 935. Employment in the coal mining sector fell by 4.8% to 4370 in 2004. Note that despite declining employment in the mining sector, the value of production has increased for each of the past three years and, as mentioned earlier, attained a record high in 2004.

When the primary metal, nonmetallic mineral and metal fabricating industries are included, employment in 2004 totalled an estimated 369 420, down from a preliminary 379 220 in 2003. Employment levels in all three sectors of the mineral manufacturing industry declined relative to 2003.

In 2004, there were 14 mine openings (6 new mines and 8 re-openings) and 12 mine closures (11 closures and 1 production suspension). Three of the new mine openings and one mine re-opening were coal mines. Six of the openings and re-openings were metal mines. Nine of the mine closures were metal mines.

Exports of crude minerals (excluding petroleum and natural gas), coal, smelted and refined outputs, and mineral products contributed \$54.8 billion to the value of Canada's domestic exports in 2004, a 16.6% increase compared with 2003. This represented 14.3% of Canada's total domestic exports of \$384.5 billion. Metallic mineral and mineral product domestic exports accounted for 77.2% (\$42.4 billion) of the total non-fuel (including coal) value, nonmetal domestic exports (including structural materials) accounted for 19.3% (\$10.6 billion), and coal and coke accounted for 3.5% (\$1.9 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 \$39.3 billion. Exports to the European Union totaled \$6.8 billion, to Japan, \$1.9 billion, and to Mexico (a partner with Canada and the United States in the North American Free Trade Agreement), \$0.3 billion.

In 2004, Canadian imports of non-fuel minerals and mineral products, including coal, increased by 15.7% to \$52.3 billion. Canada's merchandise trade surplus in minerals and mineral products (domestic mineral exports plus re-exports minus total mineral imports) totalled \$4.3 billion in 2004, up from \$3.0 billion in 2003. The value of both total minerals and mineral products exports, and total minerals and mineral products imports, increased quite significantly in 2004 compared with 2003.

*Note: Information in this article was current as of May 2005. The data presented are subject to revision as more recent data become available.*

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

	2003 (r)	2004 (p)	Change (%)
Metallic minerals	9 669.8	12 529.6	29.6
Nonmetallic minerals	8 915.2	10 039.9	12.6
<b>Total, non-fuels</b>	<b>18 585.0</b>	<b>22 569.6</b>	<b>21.4</b>
Coal	1 492.2	1 598.1	7.1
<b>Total minerals</b>	<b>20 077.2</b>	<b>24 167.6</b>	<b>20.4</b>

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary; (r) Revised.

Note: Totals may not add due to rounding.

## Minerals and Metals Production (Shipments)

	Unit	2000	2001	2002	2003 (r)	2004 (p)
	(000)					
Aluminum	t	2 373	2 583	2 709	2 792	2 592
Antimony	kg	364	234	145	129	94
Bismuth	kg	202	258	203	138	185
Cadmium	kg	934	979	899	716	699
Cement	t	12 612	12 986	13 710	14 190	14 884
Chrysotile (asbestos)	t	310	277	242	x	x
Coal	t	69 163	70 335	66 608	62 125	66 019
Cobalt	kg	2 022	2 112	2 065	1 842	2 126
Columbium (niobium)	kg	2 183	2 911	3 333	3 237	3 450
Copper	t	622	614	584	541	542
Diamonds	ct	2 435	3 716	4 937	10 756	12 618
Gold	g (r)	153 715	158 875	151 904	140 861	128 733
Gypsum	t	8 572	7 821	8 809	8 378	9 339
Iron ore	t	35 247	27 119	30 902	33 322	28 131
Lead	t	143	150	101	93	71
Lime	t (r)	2 525	2 213	2 248	2 221	2 443
Molybdenum	kg	6 980	8 556	7 953	8 887	9 506
Natural gas	000 m <sup>3</sup>	167 790	171 388	..	..	..
Nepheline syenite	t	717	710	717	703	702
Nickel	t	181	184	180	155	182
Peat	t	1 277	1 319	1 385	1 180	1 180
Petroleum	000 m <sup>3</sup>	128	130	..	..	..
Platinum group	g	15 304	20 694	24 372	21 528	26 364
Potash (K <sub>2</sub> O)	t	9 033	8 237	8 361	9 229	10 792
Quartz (silica)	t	1 508	1 613	1 540	1 581	1 690
Salt	t	12 164	13 725	12 736	13 718	14 125
Sand and gravel	t	238 901	236 486	238 120	244 532	248 159
Selenium	kg	335	238	175	288	277
Silver	kg	1 169	1 265	1 352	1 282	1 265
Stone	t (r)	118 335	124 758	124 746	124 528	127 559
Sulphur, elemental	t	8 621	8 154	7 761	7 891	8 271
Sulphur in smelter gas	t	831	762	703	614	621
Tantalum	kg	70	94	71	67	69
Tellurium	kg	53	51	39	45	69
Uranium (U)	kg	9 921	12 991	12 855	9 939	11 948
Zinc	t	936	1 012	924	757	736

Sources: Natural Resources Canada; Statistics Canada.

.. Not available; (p) Preliminary; (r) Revised; x Confidential.

# Canadian Exploration Scene

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This review of mineral exploration in Canada is based on data obtained from the federal-provincial/territorial Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures. Under this survey, the mineral development cycle is divided into three phases: exploration, deposit appraisal and mine complex development. Only the first two phases are considered for the purposes of this article. The *exploration* work phase includes activities leading up to and including the discovery and first delineation of a previously unknown mineral deposit to establish its potential economic value (tonnage and grade) and to justify further work. The *deposit appraisal* work phase includes activities carried out to bring a delineated deposit to the stage of detailed knowledge required for a feasibility study to justify and support a production decision and the investment required.

Survey results show that the Canadian mineral exploration sector is currently enjoying impressive levels of activity as evidenced by rapidly growing exploration and deposit appraisal expenditures. This heightened commitment to the search for minerals and metals in Canada is a result of strong commodity prices, the availability of generous tax and non-tax incentives, a strong appetite by investors for the shares of exploration and mining companies, and growing momentum as positive exploration reports generate even more interest on the part of companies and investors alike.

This favourable context is quite the opposite from the one that existed just a few years ago when exploration and deposit appraisal spending levels reached historical lows. On a 2004 constant dollar basis, the totals registered in 1999 (\$572 million), 2000 (\$540 million) and 2001 (\$552 million) were among the lowest on record since at least 1969. The turnaround began in 2002 and continued in 2003 with spending for these two years reaching \$611 million and \$709 million, respectively.<sup>1</sup>

Expenditures rose substantially in 2004 to reach \$1091 million (Table 3). This 54% increase in spending over 2003 revitalized the Canadian mineral exploration sector. It also marked the first year that spending had exceeded the \$1 billion level since 1997. The best years in Canadian history in terms of exploration spending remain those of 1987 and 1988 when expenditures reached almost \$1.9 billion (constant 2004 dollars) in both of these two years. The combination of strong metal prices and the tax incentive resulting from the enhancement of flow-through shares by a super deduction, called the Mining Exploration Depletion Allowance (MEDA), was mostly responsible for the anomalous levels of spending recorded during that period.

According to company spending intentions, exploration and deposit appraisal expenditures are expected to reach \$1128 million in 2005. Although expenditures would once again be considerable, this amount

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<sup>1</sup> More data are available on the Minerals and Mining Statistics On-Line web site at [http://mmsd1.mms.nrcan.gc.ca/mmsd/exploration/default\\_e.asp](http://mmsd1.mms.nrcan.gc.ca/mmsd/exploration/default_e.asp).

would represent only a small increase over the previous year's total. However, early results from a *revised spending intentions* survey, to be released during summer 2005, indicate that the current spending intentions for 2005 will likely be surpassed as exploration budgets for the coming field season are being firmed up and concerns over project funding are being alleviated by capital markets that remain very receptive to the needs of the exploration and mining industry.

The current upward trend in exploration and deposit appraisal expenditures has been felt across all of Canada's mining jurisdictions. Together, Ontario (\$314 million), Quebec (\$209 million) and Nunavut (\$157 million) should account for 60% of total expenditures in 2005. British Columbia (\$111 million) and the Northwest Territories (\$110 million) will also break the \$100 million barrier while spending in Saskatchewan, buoyed by soaring uranium prices and intensive diamond exploration, is expected to reach \$85 million. For many of these jurisdictions, the expected levels of spending represent some of the best totals on record. As mentioned earlier, the data currently being compiled for the summer 2005 release of the *revised spending intentions* point to even better performances in some jurisdictions, particularly in British Columbia, the Northwest Territories, Saskatchewan and Ontario. Even smaller jurisdictions like the Yukon, Nova Scotia and New Brunswick are currently in the midst of a strong recovery.

Exploration work taking place away from mine sites is responsible for most of the exploration and deposit appraisal spending being incurred in Canada these days. For both 2004 and 2005, this type of spending is expected to account for over two-thirds of total expenditures. This focus on grassroots-type exploration implies that new areas of interest are being identified and previously abandoned projects and old properties are being revisited. The downside, however, is that less effort appears to be concentrated on tapping the further discovery potential of currently producing properties. The remaining one-third of total spending is divided between the on-mine-site exploration, on-mine-site deposit appraisal, and off-mine-site deposit appraisal expenditure categories.

The relative importance of junior company spending versus senior company spending is perhaps the most outstanding feature of the current upward trend. After falling below the 30% level in both 1998 and 1999, junior company expenditures gradually accounted for larger shares of total spending in the 2000-2003 period. In 2004, junior spending jumped to \$531 million and represented 49% of amalgamated junior and senior expenditures. This proportion is expected to keep growing in 2005 with junior spending intentions amounting to 54% of the total for that year. In percentage terms, the anticipated \$606 million in junior company spending for 2005 would surpass even the levels of 1987 and 1988, which previously represented the best performance on record for the relative importance of junior mining companies in the Canadian exploration and deposit appraisal sector.

The strength in the prices of commodities for which Canada has a rich mining history (gold, nickel, copper, zinc, lead, uranium, metallurgical coal, iron ore) and the intensive search for diamonds in the northern regions of the country have contributed to this positive junior mineral exploration context. Another important factor is the generous level of incentives currently available to encourage grassroots-type exploration in Canada. Tax incentives such as the flow-through-share mechanism, the federal Investment Tax Credit for Exploration (tied to flow-through shares), provincial tax credits, and other measures, along with a favourable disposition by investors towards mineral exploration, have helped Canadian junior companies garner the funds necessary to mobilize a substantial mineral exploration effort.

Precious metals (mostly gold) remain the most popular mineral exploration target in Canada with total expenditures of \$506 million in 2004 and spending intentions of \$478 million for 2005. In 2001, diamonds overtook base metals (in the survey, base metals include copper, nickel, zinc and lead) for second place and have retained that rank until now. However, the data compiled so far for the *revised intentions* survey show that base metals could very well reclaim that second spot in 2005. This expected rise in base-metal spending is good news as concerns have been mounting about the sustainability of some of Canada's most prolific base-metal mining camps. Although not of the same magnitude as the previous three commodity groups, activities related to the search for uranium (Saskatchewan), coal (British Columbia) and iron ore (Nunavut) have also been attracting larger amounts of investment.

The convergence towards higher levels of exploration and deposit appraisal activity for Canada's key metals and minerals bodes well for the short-term outlook of the Canadian mineral exploration sector. New discoveries and the additional knowledge generated about existing occurrences and deposits will, in turn, add to the current momentum. Over the longer term, the direction of mineral commodity prices, continued access to financing, and the mineral discovery success rate will remain the dominant factors in charting the evolution of the Canadian mineral exploration industry.

While commodity price levels are determined by global markets, Canadian companies (in particular juniors) can expect that some adjustments to their financing methods will be needed to cope with the planned phase-out of the federal Investment Tax Credit for Exploration. This 15% tax credit, which had been introduced in October 2000 to help solve the crisis in grassroots exploration and support the junior mining sector, is scheduled to lapse at the end of 2005, although companies will still have until the end of 2006 to incur eligible expenses. In conjunction with flow-through shares and provincial/territorial incentives (some of which are harmonized to the federal tax credit), this temporary tax measure has been singled out as a major contributing factor in the outstanding performance of the Canadian junior mining sector in recent years. In fact, it has been estimated by Natural Resources Canada that, from the tax credit's inception in October 2000 to the end of December 2004, a total of \$1.1 billion had been raised via the flow-through-share mechanism to finance mineral exploration in Canada.

It remains to be seen what the impact of losing this tax credit will be on junior company and grassroots exploration spending. However, given the substantial amounts invested in grassroots exploration in recent years, the focus of attention is now shifting to how these expenditures can translate into more advanced work. Going forward, it will be important for Canada's mineral exploration sector to increase its efforts at the deposit appraisal and mine development stages so that sufficient mineral reserves are delineated to ensure the sustainability and growth of the industry, particularly the base-metals sector.

*Note: Information in this article was current as of March 31, 2005.*



## **Mineral Exploration and Deposit Appraisal Expenditures,<sup>(1)</sup> 2004 and 2005**

Province/Territory	Exploration and Deposit Appraisal 2004 (p)	Exploration Off- Mine-Site Only 2004 (p)	Exploration and Deposit Appraisal 2005 (si)	Exploration Off- Mine-Site Only 2005 (p)
(\$ millions)				
Newfoundland and Labrador	29.4	20.7	40.6	19.6
Nova Scotia	9.3	4.6	13.9	7.3
New Brunswick	9.0	9.0	10.8	10.8
Quebec	204.4	152.8	209.2	150.3
Ontario	296.8	181.7	313.8	174.9
Manitoba	31.0	26.3	37.1	31.9
Saskatchewan	76.7	52.0	85.2	71.3
Alberta	6.1	2.0	8.2	7.6
British Columbia	128.4	82.3	110.5	78.4
Yukon	18.2	16.7	32.4	21.5
Northwest Territories	109.4	37.9	109.5	42.1
Nunavut	172.0	162.8	157.0	154.5
<b>Total</b>	<b>1 090.6</b>	<b>748.7</b>	<b>1 128.2</b>	<b>769.9</b>
Exploration	832.5		863.4	
Deposit appraisal	258.1		264.8	

Source: Natural Resources Canada.

(p) Preliminary; (si) Spending intentions.

(1) Includes field work, overhead, engineering, economic and feasibility studies, environment and land access costs.

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

# Aluminum

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Production of primary aluminum in Canada declined by 7.2% to 2.59 Mt in 2004, compared with 2.79 Mt in 2003, ranking Canada third after China and Russia in terms of world primary production. The decline was due to lost production at Aluminerie de Bécancour Inc. and the closure of Söderberg capacity at Alcan's Jonquière smelter. The value of Canadian primary aluminum production in 2004 is estimated at \$5.8 billion (US\$4.4 billion), up only slightly (4%) from \$5.6 billion (US\$4.0 billion) in 2003, owing to the strengthening of the Canadian currency.

Canadian exports of primary smelter products in 2004 decreased in quantity to 1.99 Mt valued at \$4.860 billion (US\$3.73 billion), compared with 2.23 Mt valued at \$4.08 billion (US\$3.43 billion) in 2003. Of this amount, unwrought exports to the United States totalled 1.68 Mt valued at \$4.08 billion (US\$3.14 billion).

Reported Canadian use of aluminum metal at the first processing stage, including the use of recycled aluminum, was 1 007 711 t in 2003, down slightly (1%) from a revised 1 019 713 t in 2002.

During the past year, changes in Canadian operations have included:

- Aluminerie Alouette Inc. is nearing completion of a \$1.4 billion expansion of its smelter located in Sept-Îles, from 245 000 t/y to 550 000 t/y. Preliminary work began in late 2002 and the company produced the first metal from the expansion in January 2005. Production at full capacity may occur by June, ahead of schedule. At that time, this smelter will be the largest in the Americas. Partners in this smelter are Alcan (40%), Aluminium Austria Metall Québec (20%), Hydro Aluminum (20%), Société Générale de Financement du Québec (SGF) (13.33%), and Marubeni Québec Inc. (6.66%).
- Alcan announced in September the filing of a prospectus and registration statements for the spin-off of its new rolled products company, Novelis, the world's largest aluminum rolled products company. The spin-off is Alcan's answer to conditions placed on it by regulatory bodies in the European Union and the United States regarding its takeover of Pechiney, requiring it to divest assets in Europe and the United States. Alcan received regulatory approvals on the spin-off late in 2004 and Novelis officially started operations on January 1, 2005.
- Alcan announced the closure of the four Söderberg potlines at the Jonquière smelter in early 2004, affecting 90 000 t/y of production capacity. The remaining 163 000 t/y of prebake capacity at the smelter remains in operation.
- Alcan's 277 000-t/y smelter at Kitimat, British Columbia, continued operating at a reduced rate of 240 000 t/y. Production rates had been reduced in 2001 owing to low water levels in the Nechako Reservoir and had increased to the current rate in mid-2002.

- Alcoa has participated in discussions on power with the Quebec government and Hydro-Québec over the past two years to obtain a block of power to upgrade the Baie Comeau and Luralco Deschambault smelters. Alcoa has not yet announced its intentions regarding the doubling of capacity at the Deschambault smelter, but did announce in June 2004 that it would not implement its proposed plan to modernize its Baie Comeau smelter.
- At Aluminerie de Bécancour, with a capacity of 409 000 t/y, owned by Alcoa (74.95%) and Alcan (25.05%), employees represented by the Syndicat des employés de l'Aluminerie de Bécancour, United Steelworkers' Local 9700, went on strike on July 7. Alcoa subsequently curtailed production from two of the three potlines in early July. The Union and Alcoa reached agreement in mid-November and the smelter resumed full production in April 2005.

In conclusion, Canadian installed capacity for the production of primary aluminum is now 2.75 Mt/y and, with the completion and ramp-up in production from the expanded Alouette smelter at Sept-Îles, installed capacity will reach 3.06 Mt in mid-2005. Canada is expected to produce approximately 2.9 Mt of primary aluminum in 2005 and 3.1 Mt in 2006.

*Note: Information in this article was current as of March 31, 2005.*

# Coal

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In Canada, four new coal mines came on stream in 2004. The Willow Creek mine of Pine Valley Mining Corp. commenced commercial production in August 2004. The mine is located approximately 45 km west of the town of Chetwynd in the Peace River District of northeastern British Columbia. The Willow Creek mine produces PCI coal with a permit of 950 000 t/y. Grande Cache Coal Corp. began its coal production in the 12S B2 surface mine in September and in the No. 7 underground mine in November 2004. The Grande Cache mines are located in the Smoky River Coalfield in west-central Alberta within the inner foothills of the Canadian Rocky Mountains. The Grande Cache mines produce hard coking coal at an annual production rate of 2 Mt. The Dillon mine of Western Canadian Coal Corp. started production in November 2004. The mine is located southwest of Chetwynd within Western Canadian Coal's Burnt River property in northeastern British Columbia. The Dillon mine produces PCI coal with a permit of 250 000 t/y. The Cheviot Creek Pit mine, owned by Elk Valley Coal Corp., started production in the fourth quarter of 2004. The mine is located near Hinton, Alberta; its production is expected to be 2.8 Mt/y of coking coal.

Canada produced 66 Mt of coal in 2004, an increase of 6% from 2003's production of 62 Mt. The 4-Mt increase was from British Columbia and all of the increases were for exports.

Canada exported 26 Mt of coal in 2004 of which 24 Mt was coking coal. The largest increase was exports to the North American market. Exports increased from 2.4 Mt in 2003 to 3.7 Mt in 2004, an increase of 56%. Exports to the United States increased to 2.6 Mt from the previous year's 1.9 Mt, an increase of 35%. Exports to European markets increased from 5.9 Mt in 2003 to 6.6 Mt in 2004, a 12% increase. Exports to Asian markets, the largest market for Canada, slid again in 2004, declining by 6%. Exports to Japan declined from 7.7 Mt in 2003 to 5.4 Mt in 2004, a decrease of 2.3 Mt. However, despite the regional decline, exports to China increased from 0.67 Mt in 2003 to 1.8 Mt in 2004, a threefold increase. Exports to Turkey almost doubled from 0.78 Mt in 2003 to 1.3 Mt in 2004.

Canada imported 19 Mt of coal in 2004, of which 15.6 Mt was thermal coal, mainly for coal-fired electricity generation use in the provinces of Ontario, Nova Scotia and New Brunswick. Coking coal imports were 3.4 Mt, consumed by Canada's steel industry. Of the total coal imports, the United States supplied 16.6 Mt, Colombia, 1.5 Mt, and Venezuela, 762 000 t.

Canada's coal imports decreased 3.4 Mt from the previous year's 22.7 Mt. The decline was in thermal coal imports, which dropped from 19.5 Mt in 2003 to 15.6 Mt in 2004. Ontario, the major thermal coal consumer, imported 11.9 Mt of thermal coal, a 23% decrease from the previous year's 15.4 Mt. This was due to Ontario's plan to phase out coal-fired electricity generation. In New Brunswick, coal imports also decreased from 1.3 Mt in 2003 to 0.95 Mt in 2004, a decrease of 340 000 t. Nova Scotia's imports remained the same at 1.8 Mt.

Canada's coal consumption was down to 59 Mt in 2004. Electricity generation accounted for 55 Mt and the remaining 4 Mt was consumed by Canada's steel, cement and other industries.

Canadian coal production is concentrated in western Canada in Alberta, British Columbia and Saskatchewan. British Columbia currently has eight coal production mines: Greenhills, Fording River, Line Creek, Elkview, Coal Mountain, Quinsam, Willow Creek, and Dillon. Alberta is home to eight coal mines: Obed Mountain, Luscar/Cheviot Creek, Coal Valley, Highvale, Whitewood, Genesee, Paintearth, and Sheerness. Saskatchewan has three mines: Poplar Rover, Boundary Dam and Bienfait. Elk Valley Coal Corp. operates six coking coal mines, Luscar Coal Ltd. operates 10 mines, and independent companies operate the remainder. In eastern Canada, New Brunswick has one operation and Nova Scotia has several small-scale operations without significant output.

Proposed coal mine developments in western Canada were in full swing during 2004. Proposed coal mine developments in northeastern British Columbia include: Western Canadian Coal Corp.'s Burnt River/Wolverine and Sukunka projects, Northern Energy & Mining's Trend project, and Aurora Coal's Wapiti project. In eastern Canada, the Nova Scotia government is in the process of bringing back coal mining to Cape Breton Island.

In Alberta, construction of the new coal-fired unit No. 3 at the Genesee generating station continues. The new unit will require additional sub-bituminous coal mining capacity at the adjacent Genesee mine. The co-owners of Genesee 3, Epcor and TransAlta, are also planning to collaborate on other generating projects, including the previously announced Keephills generating station expansion.

The year 2004 was an exciting one for the Canadian coal industry. Continuous global demand for coal boosted the industry's morale and "rebirth" was the popular phrase frequently used. The rising coal prices certainly boosted the increases in production and exports.

The outlook for 2005 is positive. Global demand for coking coal continues to increase. Demand exceeds supply. Canadian exporters settled various coking coal contracts at a price around US\$120-\$125/t. All of the producers are optimistic about the coking coal market. Canadian coal production is expected to reach 69-70 Mt in 2005 and exports are expected to increase to 30 Mt.

*Note: Information in this article was current as of March 31, 2005.*

# Copper

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Canadian copper production (recoverable metal in concentrates shipped) was estimated at 557 300 t in 2004, virtually unchanged from 557 100 t in 2003. Refined production in 2004 was 527 000 t, up from 455 000 t in 2003. All copper production data below refer to the production of copper in concentrates unless otherwise stated.

In Newfoundland and Labrador, Aur Resources Inc. announced it would develop its Duck Pond copper-zinc deposit on a fast-track basis with production expected to begin in late 2006. Projected copper production from Duck Pond is 18 600 t/y of copper over seven years. The first shipments of concentrate from Inco Limited's Voisey's Bay mine are expected in November 2005. The mine will produce 32 000 t/y of copper that will be sold to third parties for processing and 6800 t/y of copper that will be smelted at Inco's Ontario and Manitoba plants.

In Quebec, Campbell Resources Inc. is bringing the Copper Rand mine back into production in early 2005. Campbell Resources has spent US\$58 million in infrastructure renewal, including centralizing milling facilities for both the Copper Rand ore and the nearby Joe Mann mine. Projected average annual production is 6800 t of copper and 56 000 oz of gold. In October 2003, Noranda Inc. announced it would reduce its processing rate from 840 000 t/y to 630 000 t/y at the Horne smelter, effective June 2004, in order to reduce its reliance on low-margin offshore concentrates. Anode production rates will drop from 186 000 t/y to 140 000 t/y. Noranda's Bell-Allard copper-zinc mine ceased operation on October 15, 2004, due to the depletion of reserves. Breakwater Resources Ltd. intends to re-open the Langlois copper-zinc mine in 2006. Production from Langlois, as well as Breakwater's acquisition of the Myra Falls mine (see British Columbia), will help offset the impact of the closure of the Bouchard-Hébert mine in early 2005 and the Bougrine zinc mine in Tunisia. The Selbaie copper-zinc mine, owned by BHP Billiton, ceased production in March 2004 after 23 years of operation as a result of the depletion of reserves.

In **Ontario** and **Manitoba**, Falconbridge Ltd. is bringing the Montcalm nickel-copper orebody into production in early 2005. Probable mineral resources are 5.11 Mt averaging 1.46% nickel, 0.71% copper and 0.06% cobalt. The ore will be mined at a rate of 750 000 t/y and will be milled and concentrated at the Kidd Creek operations in Timmins. The nickel concentrate produced will be shipped to the Sudbury smelter for processing and the copper concentrate will be processed at the Kidd Creek smelter. Production from Mine D began in the fourth quarter of 2004. The Mine D project is the depth extension of the Kidd Creek orebody beyond the limits of the No. 3 mine at 6800 feet to a depth of 10 200 feet. In October, Ontzinc Corp. entered into an agreement to acquire 100% of Hudson Bay Mining and Smelting from Anglo American plc for \$316 million. Ontzinc has since renamed the company HudBay Minerals Inc.

In **British Columbia**, Teck Cominco Ltd. increased its share of the Highland Valley copper mine to 97.5% by exercising its right of first refusal with respect to BHP Billiton's 33.57% interest. Teck

Cominco will decide in 2006 whether to go ahead with an expansion that would extend the mine life a further five years to 2013. In July, Breakwater Resources acquired the assets of Boliden Westmin (Canada) Ltd., which include the Myra Falls zinc-copper-gold-silver mine located on Vancouver Island, British Columbia.

In October, Northgate Minerals Corp. completed a feasibility study on the development of the Kemess North project, which indicated a potential production of 2.6 million oz of gold and 1300 million lb (590 000 t) of copper at a net cash cost of US\$180/oz of gold and a capital cost of US\$190 million. The development scenario has ore production from the Kemess North pit commencing in late 2006 concurrent with ore from the existing Kemess South deposit at an increased mill capacity of 96 000 t/d until Kemess South reserves are exhausted in 2012. Should the project proceed, the mine life of Kemess would extend until 2019.

Production resumed at Taseko Mines Ltd.'s Gibraltar copper-gold mine near Williams Lake in October. Annual output is planned at 31 750 t of copper and 438 t of molybdenum. DRC Resources Corp. continues to advance the Afton copper-gold project to final feasibility. An advanced scoping study completed in February 2004 indicates that a 51.5-Mt resource could be mined at a rate of 9000 t/d to produce an average 34 000 t/y of copper and 80 000 oz/y of gold. Imperial Metals Corp. prepared to re-open the Mount Polley open-pit copper-gold mine in 2005 on the strength of positive drilling results at the recently discovered Northeast zone and improved metal prices.

*Note: Information in this article was current as of March 31, 2005.*

# Diamonds

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The Canadian diamond industry reached new heights in 2004, with mine production increasing to 12.8 million carats (Mct) valued at \$2.1 billion, compared with 10.8 Mct valued at just under \$1.6 billion in 2003. Canada accounts for approximately 15% of world diamond production and is the third largest producer by value after Botswana and Russia. Its production comes from two mines, both located in the Northwest Territories about 300 km northeast of Yellowknife.

Canada's first diamond-producing mine, Ekati™, came into production in 1998. It achieved a production level of 5.2 Mct in 2004, registering a drop of 25% compared with 2003. However, despite this lower output, its value of production increased by 12.5% on account of better quality stones. The mine is owned 80% by BHP Billiton Ltd. Charles Fipke and Stuart Blusson, who discovered the diamond deposit in 1991, each hold a 10% interest in the mine. BHP Billiton announced on May 4, 2004, the approval of the \$227 million Panda underground project at Ekati™. The project is expected to deliver approximately 4.7 Mct of high-value Panda diamonds over a six-year production life. Initial production is expected in early 2005 and full production is expected in early 2006.

Canada's second diamond mine, Diavik, began operating in late 2002. It is an unincorporated joint venture between Diavik Diamond Mines Inc. (DDMI), which owns 60%, and Aber Diamond Mines Inc. (ADML), which owns 40%. DDMI is a wholly owned subsidiary of Rio Tinto plc of London, U.K., and ADML is a wholly owned subsidiary of Aber Diamond Corp. of Toronto, Ontario. Production at Diavik in 2004 reached its designed capacity of 7.6 Mct, where it is expected to level off for the coming years. The mine employs about 630 people of which 35% are Aboriginals.

In December 2004, Diavik's owners approved a capital construction program valued at approximately \$360 million for construction of the mine's second dike, a process plant optimization study, and an underground mining feasibility study of the A154 and A418 pipes. Construction of the A418 dike to allow open-pit mining of the A418 orebody is expected to cost \$240 million and will start during the summer of 2005. First production from the A418 pit is scheduled in early 2008.

Together the Ekati™ and Diavik mines are the largest private employers in the Northwest Territories. They have created jobs for a total of 1200 people who work directly for the companies. In addition, it has been estimated that at least an additional 2800 indirect jobs have been created.

On June 1, 2004, De Beers Canada was granted its final permit to proceed with development of a diamond mine at Snap Lake. With the receipt of this permit, a "Class A" water licence, De Beers can now begin pre-production development of the mine. This work will focus on underground development and bulk sample plant testing. Construction of the mine, which is estimated to cost \$490 million, is anticipated to begin in 2005 after full mobilization to the site over the 2005 winter road. The mine is expected to begin production in 2007 and to produce about 1.5 Mct/y (average value of about US\$76/ct)



when it reaches full production in early 2008. The mine is expected to have a life of just over 20 years and to create about 350 direct jobs and another 600 indirect jobs.

Canada's first diamond mine outside the Northwest Territories will be the Jericho project located in Nunavut about 420 km northeast of Yellowknife. The project is owned by Toronto-based Tahera Corp. Approval of the project's "Class A" water licence was announced by the company in mid-January 2005. Tahera now needs to finalize the land leases for the project before mobilization and construction of the open pit can start. Commercial production is scheduled for early 2006 and will enable the production of about 350 000 ct/y over the nine-year mine life. Tahera announced in November 2004 that it has entered into a diamond purchase and marketing agreement and a US\$35 million credit agreement with a wholly owned subsidiary of Tiffany & Co. Under this agreement, the latter will purchase a portion of the diamond production from Tahera's Jericho mine for its own manufacturing requirements and will sell the balance of the production on behalf of Tahera into the international market for a fee.

In northern Ontario, about 100 km west of the James Bay coast, De Beers' Victor project is undergoing a comprehensive study for its environmental assessment process. Permits to construct and operate the mine are anticipated in mid-2005 and construction is expected to begin in 2006. De Beers plans to begin commercial production in 2008 and to recover about 600 000 ct/y over a 12-year open-pit mine life. The capital costs for the project have been estimated at about \$800 million.

Across Canada, diamond exploration involving 129 companies is under way in Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Newfoundland and Labrador, with expenditures reaching \$260 million in 2004. Projects at an advanced stage of exploration are located in Saskatchewan and Quebec. In Saskatchewan, in the Fort-à-la-Corne region, there are two projects. The Star diamond project, owned and operated by Shore Gold Inc., extracted a 25 000-t bulk sample from a 235-m-deep concrete-lined shaft. By year-end, diamond counts from a total of 19 738 t of kimberlite were available resulting in the recovery of 2738 ct. The company is optimistic that it will recover the expected 3000 ct from the total sample.

Nearby is the Fort-à-la-Corne diamond project, a joint venture between De Beers Canada Inc. (42.25%), Kensington Resources Ltd. (42.25%), Cameco Corp. (5.5%) and UEM Inc. (10% carried). The land position contains some 25 kimberlite bodies within a 5-km radius in the southern portion of the claims. This area is the focus of the current advanced exploration and evaluation program, which is designed to explore and evaluate kimberlites larger than 20 ha, with a goal to prove a resource of close to 100 Mct. In September 2004, De Beers, the project operator, undertook a \$7.6 million diamond-drilling program, including large-diameter mini-bulk drillholes. Most of this work is targeted on the 140/141 and 122 kimberlite bodies.

In north-central Quebec, Ashton Mining of Canada Inc., in a 50:50 joint venture with SOQUEM Inc., has recovered diamonds from its Foxtrot property where nine kimberlite bodies have been identified. The 2004 program included the drilling of 180 core holes and reverse circulation holes for the collection of a 664-t bulk sample from Renard 2, 3, 4 and 65, which are four of the six kimberlitic bodies in the Core Area of the Renard cluster. Processing of this sample recovered 457 ct of diamonds with 25 stones exceeding 1 ct, the largest being a 4.3-ct clear, colourless octahedron. The joint venture is proceeding with a \$12 million drilling program in 2005 to evaluate the known kimberlitic bodies further and to identify new ones.

Canada also has a small but growing diamond manufacturing industry. There are four factories operating in Yellowknife in the Northwest Territories where, under territorial government policy, the diamond mining companies are obligated to provide a portion of their production for sale to the northern factories. There are also manufacturers located in Vancouver, Toronto, Montréal, and Matane (Quebec).

*Note: Information in this article was current as of March 31, 2005.*

# Gold

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In 2004, Canadian gold production reached its lowest level since 1987, totalling 128.5 t, a decrease of 8.7% compared with the 2003 total of 141 t. As a result, the value of Canadian gold production fell to \$2.2 billion in 2004, down from \$2.3 billion in 2003. The lower production was primarily the result of mine closures in Newfoundland and Labrador, Ontario, Manitoba and the Northwest Territories, combined with lower grades at some producing mines.

Ontario accounts for 55% of Canada's total gold production, followed by Quebec (19%) and British Columbia (16%). The other provinces and territories contribute the remaining 10%. Gold exports increased in 2004, with their value (including gold contained in scrap and base-metal concentrates) at about \$3.45 billion, up from \$2.75 billion in 2003 but with a 16% decrease in the amount of gold exported (78.8 t, down from 171.1 t in 2003). Imports were an estimated 75.6 t valued at \$1178 million, up from 36.7 t worth \$535 million in 2003.

In **British Columbia**, Bralorne Gold Mines Ltd. continued work on the Bralorne Pioneer mine. New resource figures released in April, based on the current bulk sampling program, indicate a measured mineral resource of 3425 t averaging 8.4 g/t gold, an indicated resource of 17 729 t at 11.0 g/t gold, and an inferred resource of 412 700 t at approximately 10 g/t gold. A pilot test-mill facility was built to treat a 10 000-t bulk sample. The company poured its first ounce of gold in April 2004. The Bralorne property comprises the former King, Bralorne and Pioneer mines that collectively produced some 127 t of gold from 1897 to 1971.

Northgate Minerals Corp. is proceeding with the permitting stage for its Kemess North mine development in northern British Columbia. The Kemess North project will increase the productive life of the company's existing infrastructure in the region by more than 11 years and sustain some 450 jobs until at least 2019. Kemess North is an undeveloped gold-copper deposit located about 6 km north of the Kemess South mine. Annual metal production during the mine's 13-year life is expected to average 7.5 t of gold and 51 000 t of copper.

In **Manitoba**, mining and milling operations at the New Britannia mine were suspended in September 2004. By January 2005, exploration efforts were unsuccessful at defining more ore and the mine owners, Kinross Gold Corp. (50%) and High River Gold Mines Ltd. (50%), decided to discontinue development at the mine, which is now on care and maintenance. New Britannia began commercial production in 1995 and exceeded its original eight-year mine life.

In **Newfoundland and Labrador**, Richmond Mines Inc. closed the Hammerdown mine in May 2004. In total, 40 058 t of ore with a recovered average grade of 12.88 g/t gold were processed during the year, compared with 87 659 t at a recovered average grade of 13.17 g/t gold in 2003.

In the **Northwest Territories**, Miramar Mining Corp. ended mining operations at the Giant mine near Yellowknife in July. The company's only other producing mine, the Con mine, also in the Yellowknife region, closed in November 2003. The termination of mining operations in Yellowknife enabled the company to focus its full attention on development projects at Hope Bay and Back River in Nunavut.

In **Nunavut**, Kinross Gold Corp. reactivated the Lupin mine in March 2004 and is expected to continue production through to mid-2005. Kinross suspended operations at Lupin in 2003 owing to the poor economic performance of the operation. The plant and equipment were placed on care and maintenance pending the results of a review. The company decided to extract the shaft and crown pillars as well as previously developed remnant ore.

In **Ontario**, Barrick Gold Corp. completed a deal in July 2004 to sell the Holt-McDermott mine, adjacent land holdings, and the mill and mill-related facilities to Newmont Canada Ltd., which owns and operates the adjacent Holloway mine in northeastern Ontario. Newmont assumed ownership of the property in October following closure of the mine. In addition to acquiring the assets, Newmont also acquired the asset retirement and other environmental obligations associated with the mine. Newmont retained 25 former Barrick employees to continue with milling operations.

Cambior Inc.'s Mouska mine in northwestern Quebec resumed operations in October 2004 following the completion of a shaft-deepening program. The resumption of mining at Mouska provided high-grade ore for processing at the Doyon mill. Together with the Doyon mine reorganization, the company expects the Doyon Division (which includes both the Doyon and Mouska mines) to mill 834 000 t of ore in 2005 at an average grade of 6.5 g/t gold.

Agnico-Eagle Mines Ltd.'s LaRonde mine, also in northwestern Quebec, reported record production in 2004, with gold production increasing by 15% to 8.4 t (271 567 oz). The company reduced cash costs to \$56/oz, down by 79% from the previous year, as a result of higher production, lower unit mining costs, improved prices for metals, and the elimination of production royalties. At the end of 2004, gold reserves at LaRonde were essentially unchanged at 159 t (5.1 million oz).

Inmet Mining Corp. completed a mill expansion at its Troilus mine, which increased average throughput to 18 500 t/d. The \$16.5 million expansion involved the installation of a larger secondary crusher and new ball-mill circuit. Troilus is now fine-tuning the new metallurgical circuits of the expansion to achieve the expected approximate 2% improvement in gold recoveries for 2005.

Aurizon Mines Ltd. completed a feasibility study on its \$84 million Casa Berardi project in northwestern Quebec. The study completes the second stage of the company's development program for the project, which includes an initial 5.5-year start-up plan for the project, built around a mineral reserve based on drilling above the 700-m level. The pre-production time required to bring the project to commercial production is expected to be 18 months. The study also addressed the technical problems encountered prior to the mine's closure in 1997.

Campbell Resources Inc. focussed its development activities on preparing the Copper Rand project to enter into commercial production by the end of 2004. The project was delayed by five months because of ground conditions and difficulty in securing a ventilation raise. The difficulties were resolved in February 2005 and the commissioning of other major components for the project was completed on schedule.

In **Saskatchewan**, Claude Resources Inc.'s board of directors approved the capital expenditure necessary to double the throughput of the Seabee mill from its current rate of 550 t/d to 1100 t/d. The Seabee mine and mill, located in north-central Saskatchewan, have produced in excess of 20 t of gold since they entered into production in 1991. The mine is a high-grade, narrow-vein underground operation with approximately 733 000 t of reserves and an additional 1.4 Mt of resources. Delineated gold-bearing structures at Porky Lake and the recently announced discovery at Santoy Lake are both within trucking distance of the Seabee mill. Batch processing of the Porky and Santoy Lake bulk samples is forecast for the second half of 2005. The expanded mill capacity and successful bulk sampling of Porky and Santoy could enable Seabee to expand gold production into the 2- to 3-t/y range by 2006.

*Note: Information in this article was current as of March 31, 2005.*

# Iron Ore

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Iron ore is one of Canada's most important mineral products in terms of both tonnage and value. Canada is the world's ninth largest iron ore producer and ranks fifth for exports. Canada's iron ore production is concentrated in the Labrador Trough, a major geological belt extending through northern Quebec and Labrador. Production comes from three mines operated by Iron Ore Co. of Canada (IOC), Quebec Cartier Mining Co. (QCM), and Wabush Mines.

In 2004, Canada shipped 28.1 Mt of iron ore, a decrease of 15.4% compared with the previous year. The value of production was \$1.37 billion, an increase of 7% compared with 2003. Exports decreased by 14.8% to 23.0 Mt and were valued at \$941 million. Pellet production increased by 4.4% to 21.5 Mt. The three largest importers of Canadian iron ore were the United States, Germany and the United Kingdom accounting for 27.4%, 23.8% and 9.7%, respectively, of total Canadian iron ore exports.

Production at IOC in 2004 decreased by 21.8% to 11.5 Mt as the result of a 10-week strike at the mine operations. The company is implementing a major cost reduction program aimed at cutting \$120 million by 2005. It also carried on its tailings management program to comply with the Canadian government's Metal Mining Effluent Regulations. The first phase of that project is scheduled for completion by 2007.

QCM's concentrate production for the year amounted to 12.9 Mt and a new record was set for pellet production of 9.2 million dry metric tonnes of pellets from its 6-Mt/y pellet plant. There were no changes in shareholdings in 2004.

In 2004, Wabush Mines produced 3.8 Mt of pellets, compared with 5.2 Mt in 2003. The decrease was the result of a 14-week labour strike at its operations. A new five-year labour agreement has been reached with the labour union. The current capacity of the plant is 6.0 Mt/y.

Craigmont Mines, located in Merritt, British Columbia, produced 85 000 t of specialty magnetite from copper mine tailings.

In 2004, on account of strong demand for iron ore products from steelmakers (especially in China) plus recent price hikes for steel products, the negotiated price for Canadian iron ore concentrate or fines was raised by 22.33% to US\$38.9/Fe unit for concentrate and the price for acid pellets increased by 21.20% to US\$64.5/Fe unit. Canadian shipments of iron ore are expected to reach approximately 34 Mt in 2005. The price increases for 2005 were 71.5% higher for concentrates at US\$66.71/Fe unit, and 86.14% higher for acid pellets at US\$120.66/Fe unit.

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# Magnesium

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Canadian primary magnesium production<sup>1</sup> capacity fell by 20% in 2003 to approximately 56 000 t/y after Magnola Metallurgy Inc. closed its Danville smelter in Quebec. In 2004, Canada ranked second after China in magnesium production capacity. Canada exported \$164 million worth of magnesium metal and metal products, down 8% from a revised \$188 million in 2003.

Since 1989, Norsk Hydro Canada Inc. has produced primary magnesium metal at its smelter in Bécancour, Quebec, using an electrolytic process. The plant also recycles magnesium scrap produced by its customers and has a recycling/remelt capacity of 22 000 t/y. Norsk Hydro announced in January 2005 that it was expanding the capacity of the plant by 7000 t/y to 58 000 t/y over the subsequent 18 months. The company is the world leader in the production of pure and alloyed magnesium and has a global service support network for technical support, recycling, and application development.

Timminco Ltd. operates a silicothermic reduction facility producing high-purity metal (up to 99.98% pure) for specialized markets at its 6000-t/y capacity magnesium plant in Haley, Ontario. The operation includes a dolomitic limestone deposit and facilities to produce high-purity metal from that resource. Metal processing facilities include an extrusion and anode fabrication and assembly plant, as well as magnesium billet and slab processing facilities. Timminco suspended a previously announced temporary closure of the Haley smelter for the second half of 2004 because of the increased demand for metal.

Magnola Metallurgy Inc. (owned 80% by Noranda Inc. and 20% by Société générale de financement du Québec) has kept closed its 58 000-t/y capacity magnesium metal plant at Danville, Quebec. The company cited low magnesium prices as the reason for the closure in April 2003 and has indicated that metal prices would have to rise from the current levels for the plant to re-open.

Globex Mining Enterprises Inc. continued work on its magnesium-talc deposit near Timmins, Ontario, from which production of magnesium metal and high-quality talc is possible. During 2004, the company undertook mineralogical testwork on samples from four cross-sectional drill holes. Globex is seeking a financial and/or technical partner for a bankable feasibility study.

Gossan Resources Ltd. holds a high-purity dolomite property at Inwood, Manitoba. In March 2004, the company entered into an agreement with Hatch Associates for the first in a series of studies for a preliminary feasibility study. Environmental studies on the property were also conducted. An initial economic assessment using Mintek's atmospheric silicothermic magnesium extraction process was under

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<sup>1</sup> Canadian magnesium production data are confidential due to the limited number of companies reporting. This production capacity has been reported in financial and press reports.

way in 2004 and the company has indicated that it may send a bulk sample to Mintek for further testing in 2005. The timing of this latter work depends on the progress of Mintek's new process.

Leader Mining International Inc. continued work on its Cogburn ultramafic intrusive near Hope, B.C., which contains magnesium-bearing silicates. Activities have included initial work on environmental permitting, infrastructure and other studies. The company reports that all work is now being carried out by a wholly owned subsidiary, North Pacific Alloys Ltd., and that it is looking for an experienced company with the capability and capacity to become the operator and/or major owner of the project.

The town of Thetford Mines, Quebec, continued studying a proposal to produce magnesium from asbestos mining residues. These total more than 300 Mt of material averaging approximately 24% magnesium.

*Note: Information in this article was current as of March 31, 2005.*



# Nickel

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Canadian mine production of nickel rose in 2004 by over 22 000 t, compared with 2003, to 186 500 t, and refined production, including nickel in chemicals and oxide sinters, rose by over 20 000 t to 175 800 t. Output in 2003 had been adversely affected by a six-week strike by Inco workers at Sudbury.

The 2004 nickel output came from nine Inco mines (12.6 Mt averaging 1.51% nickel), six Falconbridge mines (3.3 Mt averaging 1.88% nickel), the Sudbury Joint Venture (0.26 Mt at 1.43% nickel), and North American Palladium Ltd.'s mine (4.6 Mt averaging 0.08% nickel) and a bulk sample from the Alexo deposit. Refineries in Alberta, Manitoba and Ontario operated in 2004. High nickel prices continued to spur nickel exploration activities near the Raglan area in Quebec, the Sudbury and Timmins areas of Ontario, and the Thompson area in Manitoba.

A three-week strike in January 2004 reduced nickel production at Falconbridge's Sudbury operations to 22 600 t in 2004 from the 25 000 t that had been forecast. Falconbridge opened its US\$77 million Montcalm mine near Timmins, which will add 9000 t/y to the company's refined output. A preliminary study to increase Montcalm's output by 33% to 1 Mt/y was under way and results were expected in the first half of 2005. The Raglan mine in northern Quebec produced 26 500 t of nickel in concentrates in 2004; an optimization project there targets increasing output by 5000 t/y nickel from 2007. The Falconbridge smelter processed 8265 t of nickel in custom and recycled materials in 2004, in addition to all of Falconbridge's Canadian mine production. The Lockerby mine in Sudbury closed in September 2004 and First Nickel Inc. proposed to buy it. In March 2004, Falconbridge authorized a US\$370 million program to define reserves at its Nickel Rim South deposit; possible production of about 11 000 t/y of nickel from the deposit by 2010 was projected. In 2004, China Minmetals Corp. was unable to reach agreement to purchase Noranda Inc.; the latter increased its ownership of Falconbridge to 91% by May 2005.

Inco had record production at its refineries: 61 000 t at Sudbury and 53 000 t at Thompson. About half of Voisey's Bay future production, or nominally 25 000 t/y, will represent replacement feed for imported material and some Inco Canadian mine production. Inco's projected 2005-09 average production of recoverable nickel from Canadian operations was: Thompson, 31 500 t/y; Sudbury, 78 000 t/y; and Voisey's Bay, 57 600 t/y. Over the same period, external feeds, including feed from Australia, will fall sharply from 35 400 t in 2005 to 9100 t in 2006 and to 6800 t in 2008 and 2009.

Inco's Voisey's Bay Nickel Co. Ltd. will start milling ore on August 1, 2005, and ship concentrates in November 2005. By April 2005, the mine/mill construction was 83% complete. Inco will send concentrates to its smelters in Thompson and Sudbury and to its hydrometallurgical demonstration plant at Argentia. The 1:100-scale demonstration plant was 50% complete by April 2005.

The Sudbury Joint Venture (SJV), owned 75% by FNX Mining Co. and 25% by Dynatec Corp., mined 278 000 t averaging 2.5% nickel containing nearly 3000 t of payable nickel from its McCreedy West mine. The ore is trucked to the Clarabelle mill for processing by Inco. SJV expects to start production at the Levack mine during 2006 after a \$10 million rehabilitation of the No. 2 shaft that began in late 2004. At the Podolsky property, SJV committed to a US\$30 million advanced exploration program that includes a ramp, a 750-m shaft, level development, and definition drilling to allow a feasibility study that, if favourable, could result in mine production by 2007.

North American Palladium operates an open pit that produces by-product nickel. During 2004, a total of 1960 t of nickel in concentrate was produced. A bulk concentrate was smelted at Sudbury by Inco and Falconbridge. In the second quarter of 2004, the company started development of a \$52 million underground mine below the open pit. The new mine was scheduled to reach its full production rate of 2000 t/d in the first quarter of 2006.

In 2004, Canadian Arrow Mines Ltd. shipped 14 759 t of bulk samples averaging 2.14% nickel from its Alexo property near Timmins to Falconbridge's Strathcona mill. In January 2005, the company received provincial permits to start a mine at the Alexo property. The company planned to truck about 5000 t per month of ore averaging between 2% and 3% nickel to Strathcona.

Sherritt International Corp. indirectly owns half of the nickel-cobalt refinery in Alberta. It gets 95% of its feed from a mine at Moa Bay, Cuba, where nickel laterite is leached to a nickel-cobalt sulphide residue. In 2004, the refinery produced a record 31 800 t of nickel and 3326 t of cobalt. In April 2005, Sherritt announced approval of a US\$450 million expansion of the Moa mine/leach plant in Cuba and the refinery in Canada. Sherritt and the Cuban government will each fund 50% of the expansion to 49 000 t/y nickel plus cobalt. Commissioning of the expansion is expected to start in 2007.

Both the federal and provincial governments have certain regulatory powers with respect to emissions. In September 2004, new limits for nonferrous smelters in Canada were proposed by Environment Canada in *Canada Gazette Part I*. The proposed limits in tonnes per year of sulphur dioxide for year-end 2008 and year-end 2015, respectively, were: Falconbridge Sudbury, 57 000 and 11 000; Inco Thompson, 174 000 and 12 000; and Inco Sudbury, 76 000 and 38 000.

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# Potash

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In 2004, Canada achieved record production of potash at 17 Mt KCl (10.5 Mt K<sub>2</sub>O), accounting for 33% of world production of 51.7 Mt KCl (30.5 Mt K<sub>2</sub>O). The increase was 2.2 Mt KCl in volume, or 15% in percentage terms, from the previous year's 14.8 Mt KCl (9.1 Mt K<sub>2</sub>O) and was a response to growing global demand for potash.

Two of the three producers saw significant production increases. The four Canadian operations of The Mosaic Company (Mosaic) produced 7.4 Mt KCl, an increase of 1.3 Mt, or 21%, from the previous year. Mosaic's increase in production was the highest of the three producers in Canada. The largest producer, Potash Corp. of Saskatchewan (PotashCorp), produced 7.9 Mt KCl, an increase of 11.5% from the previous year's 7.1 Mt. Agrium Inc.'s production was similar to 2003's level of 1.7 Mt KCl.

Canada's potash sales reached 17.5 Mt KCl in 2004, of which 16.7 Mt were exported, and Canada remained the largest potash exporter in the world. Canadian exports of KCl increased by 13% from the previous year's 14.7 Mt. Canpotex Limited, an exclusive offshore marketing company for Saskatchewan potash producers, had record sales of 7.8 Mt in 2004. Exports to offshore markets increased by 18.4% and exports to Asia increased by 20% from 4.6 Mt to 5.5 Mt. Exports to Latin America increased by 11% from 2.2 Mt to 2.4 Mt. Exports to the United States were up by 8.2%, from 7.5 Mt to 8.1 Mt, and the United States remained Canada's largest market.

Canada's potash operations are concentrated in the province of Saskatchewan. PotashCorp, based in Saskatoon, has five mines there. The merger of IMC Global and Cargill Crop Nutrition officially formed Mosaic in October 2004. Mosaic's head office is in Plymouth, Minnesota. The merger process did not affect its four potash operations in Saskatchewan. Agrium of Calgary, Alberta, operates one mine in the province. PotashCorp also has one operation located in the province of New Brunswick.

In the second half of the year, potash prices increased. Quoted prices for KCl standard grade, fob Vancouver, were between US\$110/t and US\$130/t for the first nine months, but they have increased to US\$140-US\$155/t since September 2004. Part of the reason for the price increases was increased inland transportation and ocean freight costs for potash producers.

The growing global demand and favourable potash selling prices have provided Canadian potash producers with a record sales volume and a higher gross margin. PotashCorp reached 8.3 Mt KCl in sales volume and US\$1056 million in total sales value, an increase of US\$297.4 million, or 39%, from 2003's sales. The average selling price increased to US\$102.97/t in 2004 from the previous year's US\$80.01/t, an increase of US\$22.96/t, or 29%. Cost components also increased: freight increased by 17%, transportation-distribution increased by 10%, and the cost of goods sold increased by 14%. However, the favourable sales prices and increased sales volume have compensated for some cost increases. The average cost of goods sold on a per-tonne basis actually decreased by 3% from 2003's

US\$58.65 down to US\$57.03. The result was promising. PotashCorp achieved US\$422.8 million of gross margin in 2004, an increase of 108% from the previous year's US\$203.7 million. Agrium produced 1.7 Mt KCl in 2004. Its sales volume reached 1.8 Mt compared with 1.66 Mt in 2003. Part of the sales volume came from inventory. Total sales were valued at US\$214 million and the gross profit reached US\$106 million. The average realized price was US\$119/t.

The outlook for Canadian potash production in 2005 is positive. Global demand for potash is continuing to grow and has not shown any signs of slowing down. Demand from China, Brazil, India and other Asian developing countries is strong. This is largely driven by increased agricultural activities in these countries.

In response to the growing demand, potash producers in Canada have plans to expand their production capacities. PotashCorp's production capacity increased to 12.5 Mt/y KCl as the result of a 400 000-t KCl capacity expansion at Rocanville that came on stream in the first quarter of 2005. In April 2005, the Government of Saskatchewan announced new mining tax initiatives that will provide a 10-year tax holiday from base payment on expansions exceeding 200 000 t/y of KCl production capacity. All three producers have announced production capacity expansions. PotashCorp will bring back 1.9 Mt of its idle production capacity at Lanigan and Allan at a cost of US\$275 million. Mosaic will add 400 000 t/y of production capacity at Esterhazy at a cost of US\$26 million. Mosaic is also planning to increase its capacity by an additional 1.6 Mt/y at a later stage. Agrium will increase its production capacity by 310 000 t/y at its Vanscoy operation at a cost of US\$65 million to achieve a total production capacity of 2.1 Mt/y KCl. The Canadian potash industry currently has an annual production capacity of approximately 21.3 Mt KCl. With the new expansions, Canada's production capacity will reach 22.5 Mt/y by the fall of 2006.

*Note: Information in this article was current as of March 31, 2005.*

# Salt

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Canada has 10 salt producers operating 19 plants in the provinces of Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan and Alberta.

In 2004, Canadian shipments were valued at \$431.5 million, a \$10.9 million increase from 2003. The tonnage increased by 3% from 13.7 Mt to 14.1 Mt. The percentage values of shipments were: mined rock at 76.2%, brine at 2.4%, and fine vacuum at 21.4%; tonnage percentages were 85.3%, 8.2%, and 6.5%, respectively.

In 2004, Canada's salt exports were valued at \$83.5 million. The majority of the salt is exported to the United States. Canada's salt imports were valued at \$50.8 million in 2004, a \$7.5 million increase from 2003, and its import tonnage increased to 2.17 Mt from 951 600 t in 2003. The bulk salt imported (1.6 Mt) was from the United States (74.8% of all salt imports) and was valued at \$40.2 million. Mexico is the second-largest exporter to Canada with 405 900 t valued at \$6.3 million.

*Note: Information in this article was current as of March 31, 2005.*

# Silica

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Canada has 24 silica producers. The silica-producing provinces are Quebec, Ontario, Alberta, and Newfoundland and Labrador. In 2004, silica shipments were 1.7 Mt valued at \$46.6 million, a \$4.8 million increase from 2003. The nonferrous smelting and refining industry represents 29.5% of the total use of silica in Canada and sustained a decrease of 22.8% from 2003. Demand by the primary glass and glass containers, and glass fibre wool sectors, which represent 19.9% of total use, decreased by 3.9% from 2003. Demand by foundries, which represent 9.8% of total silica use in Canada, observed a decrease of 5.3% compared with 2003. Silica use by the chemicals industry was 3.4% of total use, a 4.2% increase compared to 2002 usage. The “other products” category, which includes a multitude of industry users, including cement, represented 37.4% of total silica use in Canada, an increase of 18.1% from 2002. Overall, Canadian consumption of silica decreased by 4% from 2.6 Mt in 2002.

In 2004, preliminary estimates for imports were 1.4 Mt valued at \$108 million. The three main manufacturing sectors that imported the bulk of the silica were the foundry, well drilling, and inorganic chemicals sectors. Preliminary estimates for 2004 exports are \$15.9 million, an increase of \$4.0 million compared with 2003, with the tonnage having increased to 683 900 t from 354 700 t in 2003. Approximately 95% of Canada’s silica exports are destined for the United States.

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# Uranium

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With uranium spot market prices continuing to increase over the past year, growing by about 36% to reach US\$24/lb U<sub>3</sub>O<sub>8</sub> at the end of April 2005, uranium mining in Canada has been very active. The strengthening market helped underpin the decision to proceed with construction of the Cigar Lake mine, stimulated producers to seek regulatory approvals to mine additional deposits and increase output at existing mines, and created a surge in exploration activity. Although the focus of this activity remains the Athabasca Basin of Saskatchewan, uranium exploration has been reported in Quebec, Newfoundland and Labrador, Ontario, Manitoba, Alberta and the Northwest Territories.

All operating mines and mills are situated in Saskatchewan. Cameco Corp. wholly owns and operates the Rabbit Lake mine and mill and is the majority owner and operator of the Key Lake mill and the McArthur River mine. AREVA subsidiary, COGEMA Resources Inc. (CRI), is the majority owner and operator of the McClean Lake mine and mill. With a solid low-cost resource base and environmentally sustainable operations, Canadian uranium producers are well positioned to capitalize on the improving market.

In 2004, Canada retained its position as world leader in uranium production with output totalling 11 597 tU (tonnes of uranium metal) valued at over \$530 million. As of January 1, 2005, Canada's recoverable uranium resources amounted to 444 000 tU, up some 3% from the 2004 total of 432 000 tU due to recent discoveries and deposit appraisal exceeding mining depletion. With over 85% of the resource base categorized as "low-cost," Canada is well positioned to continue its leadership in uranium production.

Canada hosts the world's two largest high-grade deposits discovered to date: McArthur River (~170 000 tU; average grade of ~20% U) and Cigar Lake (~90 000 tU; average grade of ~17% U). Mining high-grade uranium in this groundwater-saturated setting requires ground freezing and high-tech mining methods. In December 2004, Cigar Lake's joint-venture partners announced a decision to proceed immediately with construction of the Cigar Lake mine. Production is currently anticipated to begin as early as 2007 with a three-year period expected to ramp up to full production capacity of some 7000 tU.

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. The Key Lake mill produced a total of 7200 tU in 2004, up from the 2003 total of 5830 tU as production returned to full capacity following repair of damage caused by a breach in a development drift in April 2003. A small contribution (165 tU) of total 2004 mill production was derived from Key Lake stockpiled mineralized waste rock, which is used to *lower* the grade of McArthur River ore to produce a mill feed of about 3.4% U. A proposal to increase production by 18% at McArthur River and Key Lake is currently the subject of an environmental assessment.

Rabbit Lake produced a total of 2087 tU in 2004, down slightly from the 2003 total of 2280 tU, as difficult mining conditions reduced mill feed. Surface and underground exploration led to the delineation of 2300 tU of probable reserves in 2004, extending the mine life to 2007. Cameco has indicated that it intends to continue underground and surface drilling in 2005.

McClellan Lake production remained steady at 2310 tU in 2004 (2318 tU were produced in 2003). Although the mill continues to be fed by stockpiled Sue C ore, CRI is seeking regulatory approval to begin open-pit mining of the Sue A and Sue E deposits. Subject to the receipt of regulatory approvals, mining could begin as early as July 2005 at Sue A and in late 2005 at Sue E. CRI is also in the process of seeking regulatory approval to test-mine small deposits on the McClellan Lake property using surface-mining techniques.

On June 4, 2004, the Federal Court of Appeal unanimously overturned a September 2002 Federal Court of Canada decision to quash a 1999 McClellan Lake operating licence on the grounds that an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA) had not been conducted prior to issuing the licence. An environmental assessment of the McClellan Lake project was conducted pursuant to the Environmental Assessment and Review Process Guidelines Order, prior to the date that the CEAA was brought into force. On March 24, 2005, the Supreme Court of Canada dismissed with costs an application to appeal the Federal Court of Appeal decision. The end of this legal challenge to the McClellan Lake operating licence significantly reduces uncertainties surrounding environmental assessment requirements at this and other uranium mines and mills in Canada.

Decommissioning of the Cluff Lake mine proceeded as planned in 2004, and included backfilling the Claude pit, dismantling the mill, and covering the tailings management area being the major work areas. Water treatment and minor engineering works continued to be the main activities at the closed Elliot Lake area uranium mine and mill sites in 2004. Long-term monitoring following containment and flooding of the tailings continued. Sampling for the second cycle of the Serpent River Watershed Monitoring Program took place in the autumn of 2004. This comprehensive basin-wide monitoring program was developed to assess the impact of the decommissioned mine facilities in five-year cycles. A full report on the most recent sampling program is expected in 2005. To date, monitoring indicates that the mine and mill decommissioning has been a success.

*Note: Information in this review was current as of March 31, 2005.*