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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 second straight record of \$26.4 billion in 2005 compared with \$24.3 billion in 2004¹ (Table 1). This 8.5% increase was due almost entirely to further significant increases in the prices of most metallic minerals. As a matter of fact, the volume of production of most metals remained relatively stable or even declined in 2005 compared with the previous year (Table 2). 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 addition to the \$26.4 billion cited above, other components of the Canadian mineral industry – the smelting and refining of domestic and imported ores, concentrates and recyclables (including steel and aluminum) – and oil sands bitumen production bring the 2005 value of mineral industry production to about \$60 billion.

The value added by the further processing of both domestically mined and imported ores is captured when considering the broader Canadian mineral industry, which includes not only mining and primary metal manufacturing, but also nonmetallic mineral product manufacturing and fabricated metal product manufacturing. This broader definition of the industry is discussed later in the section on the Gross Domestic Product (GDP) of the industry.

The value of coal production increased to \$2.3 billion in 2005 from \$1.6 billion in 2004 in response to much higher prices for coal. The volume of coal produced actually declined by 1.0% in 2005.

The value of mined metal production for 2005 increased by \$0.9 billion to \$13.3 billion, a 7.7% increase. For individual metals, the value of nickel production increased to \$3.3 billion, a gain of 2.4% despite a 1.6% decline in the volume of nickel produced. The value of copper produced rose sharply, by 20.9%, although the volume of production increased by a more modest 4.8%. Gold was the only major metal that registered a significant decline in production value, falling by 7.9% to \$2.0 billion. However, gold was Canada's third leading metal, following nickel and copper. Of Canada's other major metals, the value of iron ore increased by 13.5% to \$1.5 billion and the value of uranium rose dramatically to \$1.0 billion, a 65.4% increase. The volume of zinc production declined by 15.1% and the value remained relatively stable, at \$998.2 million, down only 0.2%. Canada's lone tungsten mine in the Northwest Territories, which was placed on care and maintenance in late 2003, re-opened in late 2005.

¹The 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 review. The data do not include crude oil, natural gas or natural gas by-products. The 2005 data are preliminary annual figures released in February 2006.

The value of nonmetallic mining production reached another record \$10.8 billion in 2005, a 3.6% increase over 2004. Production values in excess of \$1 billion were recorded for five nonmetal commodities. The leading nonmetal commodity (and second overall in terms of value of production) was potash, with a value of \$2.8 billion, 31.3% above the 2004 level. This significant increase was due to higher prices received for potash as the volume of potash production increased by only 1.6%. Canada continues to rank first in the world in potash production. Cement production, the second most important nonmetallic mineral in 2005, increased by 3.8% in value to \$1.69 billion. Following closely in terms of value of production were diamonds at \$1.68 billion, a 19.7% decline compared with 2004. The structural materials, sand and gravel and stone, rounded out the nonmetals with values of production in excess of \$1 billion.

Underlying the discussion of the value of Canadian mineral production was the appreciation of the Canadian dollar relative to its U.S. counterpart. The average value of the Canadian dollar versus the U.S. dollar in 2005 rose 7.4% compared to 2004. Because most commodities are priced in terms of U.S. dollars, the effect is to moderate increases and exaggerate declines in production values when expressed in Canadian dollar terms.

Even though the value of Canadian diamond production declined in 2005, primarily as a result of the lower quality of stones mined during the year, it still remains a dynamic part of the Canadian mining industry. In addition to the two diamond mines operating in the Northwest Territories, a third commenced production in early 2006 in the northern territory of Nunavut and two other projects are expected to begin production by 2008. In 2005, Canada was the third leading diamond-producing country in the world in terms of value, trailing only Botswana and Russia.

A broad definition of 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. The industry (excluding bitumen) accounted for \$42.0 billion, or 3.9%, of Canada's GDP in 2005, measured at basic prices in chained 1997 dollars, the same percentage as in 2004. Mining contributed 23.7% to the industry's GDP, primary metal manufacturing, 29.2%, nonmetallic mineral manufacturing, 13.4%, and fabricated metals, the remaining 33.7%.

According to preliminary data compiled by Natural Resources Canada, employment in the Canadian mining industry recorded a fractional 0.9% decline in 2005, falling to an estimated 44 889, down from 45 287 in 2004. This represented the tenth straight year of declining employment. Gains in employment in the nonmetal and coal mining sectors were more than offset by a decline in the metal mining sector. Employment in metal mining decreased 4.8% to 21 519 (also the tenth consecutive decline) whereas nonmetal mining was up by 1.1% to 18 537. Employment in the coal mining sector rose by 11.3% to 4 833 in 2005, the first increase in that sector since 1996. Note that despite declining employment in the mining sector, the value of production has increased for each of the past four years and, as mentioned earlier, attained a new record high in 2005.

Based on data supplied by Statistics Canada, when the primary metal, nonmetallic mineral and metal fabricating industries are included, employment in 2005 totaled an estimated 388 000, down slightly from 390 000 in 2004. Employment levels for the three sectors of the mineral manufacturing industry in 2005 were about 60 000 for nonmetallic mineral manufacturing, 84 000 for primary metal manufacturing, and 199 000 for metal fabricating, in all cases similar to employment numbers for 2004.

In 2005, there were ten significant mine openings (three new mines and seven re-openings) and only four mine closures. Of the three new mine openings, one was the nickel-copper mine at Voisey's Bay in Newfoundland and Labrador, one was a limestone mine in Alberta, and one was a coal mine in British Columbia. All of the mine closures were metal mines.

The trade data discussed in the following paragraphs include coal and coke but exclude petroleum and natural gas.

Exports of crude minerals, smelted and refined outputs, and mineral products contributed \$64.2 billion to the value of Canada's exports in 2005, a 13.6% increase compared with 2004. This represented 14.7% of Canada's total domestic exports of \$435.8 billion. Metallic mineral and mineral product exports accounted for 75.8% (\$48.7 billion) of the total value, nonmetal exports (including structural materials) accounted for 18.8% (\$12.1 billion), and coal and coke accounted for 5.4% (\$3.5 billion). The United States remains Canada's principal trading partner with exports of minerals and mineral products to that country valued at \$43.5 billion. Exports totaled \$8.9 billion to the European Union, \$2.6 billion to Japan and \$0.4 billion to Mexico (a partner with Canada and the United States in the North American Free Trade Agreement).

When considering only exports from the mining industry (i.e., excluding smelting, refining and mineral manufacturing), Canada exported \$15.2 billion worth of goods in 2005. Leading commodities were potash and potassium compounds (\$2.8 billion), diamonds (\$1.7 billion), iron ore (\$1.6 billion), and copper (\$1.2 billion).

China has become an increasingly important trading partner with Canada, both in terms of Canada's exports to China and China's imports into Canada. In 2005, Canada exported \$2.1 billion worth of metals and mineral products to China, making it Canada's fourth largest export customer in these products, trailing the United States, the United Kingdom and Japan.

In 2005, Canadian imports of minerals and mineral products increased by 8.4%, to \$56.7 billion from \$52.4 billion in 2004. Of this total, the United States contributed \$33.2 billion, or 58.5%. After the United States, China was the largest importing country to Canada with \$3.9 billion worth of minerals and mineral products.

Canada's merchandise trade surplus in minerals and mineral products totaled \$7.5 billion in 2005, up from \$4.2 billion in 2004. The value of both total minerals and mineral products exports, and total minerals and mineral products imports, increased quite significantly in 2005 compared to 2004.

Note: Information in this article was current as of May 2006. The data presented are subject to revision as more recent data become available.

Table 1. Mining Industry Value of Production

	2004 (r) (\$ millions)	2005 (p) (\$ millions)	Change (%)
Metallic minerals	12 361.8	13 308.6	7.7
Nonmetallic minerals	10 344.4	10 719.8	3.6
Total non-fuels	22 706.2	24 028.4	5.8
Coal	1 596.5	2 328.5	45.9
Total minerals	24 302.7	26 357.0	8.5

Sources: Natural Resources Canada; Statistics Canada.

(p) Preliminary; (r) Revised.

Note: Totals may not add due to rounding.

Table 2. Metals and Minerals Production (Shipments¹)

	Unit	2001	2002	2003	2004 (r)	2005 (p)
	(000)					
Aluminum	t	2 583	2 709	2 792	2 592	2 894
Antimony	kg	234	145	129	88	81
Bismuth	kg	258	203	138	180	160
Cadmium	kg	979	899	716	740	588
Cement	t	12 986	13 710	14 190	14 842	14 922
Chrysotile (asbestos)	t	277	242	x	x	x
Coal	t	70 355	66 608	62 125	65 997	65 317
Cobalt	kg	2 112	2 065	1 842	2 085	2 105
Columbium (niobium)	kg	2 911	3 333	3 237	3 599	3 704
Copper	t	614	584	541	545	571
Diamonds	ct	3 716	4 937	10 756	12 680	12 300
Gold	g	158 875	151 904	140 861	129 478	119 689
Gypsum	t	7 821	8 809	8 378	9 205	8 272
Iron ore	t	27 119	30 902	33 322	28 596	28 343
Lead	t	150	101	93	73	73
Lime	t	2 213	2 248	2 221	2 386	2 316
Molybdenum	kg	8 556	7 953	8 887	9 946	7 898
Natural gas	000 m ³	..	..	..	..	..
Nepheline syenite	t	710	717	703	714	769
Nickel	t	184	180	155	177	175
Peat	t	1 319	1 385	1 180	1 347	1 325
Petroleum	000 m ³	..	..	..	..	..
Platinum group	g	20 694	24 372	21 528	26 164	21 456
Potash (K ₂ O)	t	8 237	8 361	9 229	10 332	10 497
Quartz (silica)	t	1 613	1 540	1 581	1 466	1 924
Salt	t	13 725	12 736	13 718	14 096	13 737
Sand and gravel	t	236 486	238 120	244 532	250 067	245 534
Selenium	kg	238	175	288	271	216
Silver	kg	1 265	1 352	1 282	1 295	1 068
Stone	t	124 758	124 746	124 528	135 988	134 873
Sulphur, elemental	t	8 154	7 671	7 891	7 834	7 041
Sulphur in smelter gas	t	762	703	614	678	683
Tantalum	kg	94	71	67	69	77
Tellurium	kg	51	39	45	55	28
Tungsten	kg	–	2 295	3 636	–	700
Uranium (U)	kg	12 991	12 855	9 939	11 548	12 597
Zinc	t	1 012	924	757	734	623

Sources: Natural Resources Canada; Statistics Canada.

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

¹The figure for aluminum is production, not shipments.

Canadian Exploration Scene

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This review 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 resource development cycle is divided into three work phases: exploration, deposit appraisal, and mine complex development. Only the first two work phases are considered for the purposes of this review and cover activities taking place on-mine-site and off-mine-site. The *exploration* work phase includes activities up to and including the discovery and first delineation of a 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 commitment to production.

The latest survey results (2005 preliminary estimates and 2006 spending intentions as of March 2006) involve 736 project operators at roughly 2300 properties across Canada. The results confirm a continuing robust level of exploration and deposit appraisal activity. In 2005, total expenditures reached \$1.3 billion, up 10% from \$1.2 billion in 2004, and a further increase of 9% to \$1.4 billion is expected for 2006 (Table 1). Total expenditures have more than doubled in constant dollars since 2000. The recent increases are mainly due to growing off-mine-site exploration activity, which represents close to three quarters of total exploration and deposit appraisal expenditures. Of the total \$949 million in off-mine-site exploration in 2005 (\$819 million in 2004), junior company project operators accounted for 71% (compared with 64% in 2004), and again for 71% of the \$1 billion in spending intentions for 2006.

In 2005, most of the increase in total expenditures resulted from sharp upturns in Saskatchewan (uranium and diamonds) and British Columbia (coal and copper-gold). Other increases were also recorded in Newfoundland and Labrador, Ontario, Manitoba and the Yukon. By decreasing order of expenditures, Ontario, British Columbia, Quebec, Nunavut and Saskatchewan together contributed 80% of the total exploration and deposit appraisal expenditures. In 2006, all jurisdictions with the exception of one are expected to show increases in spending intentions. Ranking by jurisdiction is expected to stay the same as in 2005, with the exception of Quebec, which moves into second place ahead of British Columbia.

In terms of spending, the second most important work phase after off-mine-site exploration consists of off-mine-site deposit appraisal, which is an indicator of possible new mines. Although the expenditure level was around \$225 million in both 2004 and 2005, the number of projects has decreased considerably from 78 to 53 in 2005. This decline reveals not only that about 28 advanced projects in 2004 were suspended or downgraded in 2005, but also that 15 projects were new or resurrected and 12 became committed to production (i.e., projects under construction and not producing ore yet). British Columbia was the leading jurisdiction in terms of the number of off-mine-site deposit appraisal projects, partly because of coal and molybdenum projects that are expected to be committed to production in the near future.

The number of on-mine-site projects (receiving either exploration or deposit appraisal expenditures or both) has declined noticeably since 1997 (the first year that such data were available). Comparatively, around 100 mines received \$200 million in constant dollars in 1997 whereas, in 2004 and 2005, less than 50 mines received around \$130 million. This is also reflected by the declining number of projects under mine complex development and principal mines in operation in Canada.

The current upward trend in mineral and metal prices has been a major impetus for the exploration and mining industry to intensify its activities in the search for, and development of, mineral deposits in Canada. In 2005, expenditures for precious metals, diamonds and nonmetals fell, and those for base metals, uranium, iron ore, other metals and coal rose (Table 2). The precious metals group remained first, with total expenditures of \$524 million, but spending in that group is expected to decline further in 2006. The base metals group, third in total expenditures behind precious metals and diamonds between 2001 and 2004, surged into second place in 2005 and is expected to maintain this ranking in 2006. About \$300 million in base metals expenditures was reported for 2005 and around \$384 million is expected for 2006. Among other commodities, expenditures for iron ore (the most sought-after mineral in Nunavut and Newfoundland and Labrador), coal (the most sought-after in British Columbia), and uranium (the most sought-after in Saskatchewan) were exceptionally high in 2005. Uranium expenditures are forecast to reach an unprecedented \$123 million in 2006, whereas coal expenditures are expected to decline as some coal projects that are being fast-tracked enter the mine complex development work phase.

Diamond expenditures reached a record high of \$275 million in 2004. They fell to \$251 million in 2005, but are anticipated to recover slightly to \$262 million in 2006. These are impressive levels considering that three diamond projects (Snap Lake in the Northwest Territories, Jericho in Nunavut, and Victor in Ontario) entered the mine complex development work phase in 2005. Although Quebec and Ontario continue to show substantial levels of expenditures, the Northwest Territories, followed by Nunavut and Saskatchewan (with its Fort-à-la-Corne activity), lead all Canadian jurisdictions.

Starting in 2004, exploration and deposit appraisal spending by juniors surpassed that of seniors and became the major driver for Canadian exploration activity. The 51% junior share of total expenditures in 2004 was previously encountered during the impressive 1987 peak in exploration expenditures. For both 2005 and 2006, the juniors' share will account for an impressive 58% of total expenditures. A total of \$757 million was recorded by juniors in 2005 and a total of \$816 million is expected for 2006. However, these totals are still below those recorded in 1987 and 1988 when more than \$1 billion, in constant dollars, was reached in both years.

Since October 2000, tax incentives such as the 15% federal investment tax credit, which is tied to the flow-through-share mechanism (extended until the end of March 2007), similar tax credits and other measures in different provinces and territories, and a favourable disposition by investors towards mineral resources have helped Canadian junior companies raise the funds necessary to sustain this substantial effort, which has been concentrated mainly on grass-roots mineral exploration.

In conclusion, despite a promising outlook for the mineral exploration industry, immediate challenges need to be addressed in Canada. As ore reserves (especially for base metals) continue to be depleted, more important discoveries resulting in more promising deposits are needed to fill the gap created by the strong turnover in advanced projects (in the off-mine-site deposit appraisal work phase). As well, more effort is required to tap into the discovery potential at currently producing mines (on-mine-site exploration and deposit appraisal). Those on-mine-site projects have the advantage that they can usually be fast-tracked and are less costly to bring into production.

Apart from major new discoveries, the duration of the current cycle in mineral commodity prices and continued access to financing will remain essential factors that will have an impact on the success of the industry.

The final 2005 survey results and the revised 2006 spending intentions will be available during the summer of 2006. Data will be posted on the Internet at http://mmsd1.mms.nrcan.gc.ca/mmsd/exploration/default_e.asp.

Note: Information in this article was current as of May 2006.

Table 1. Mineral Exploration and Deposit Appraisal Expenditures, (1) 2004-06

Province/Territory	2004	2005 (p)	2005 (p)		2006 (si)	
			Exploration Off-Mine-Site Only	2006 (si)	Exploration Off-Mine-Site Only	2006 (si)
(\$ millions)						
Newfoundland and Labrador	33.2	45.4	37.0	50.7	43.1	
Nova Scotia	9.1	8.4	6.9	23.3	19.3	
New Brunswick	13.4	12.1	8.8	15.3	15.3	
Quebec	227.2	209.2	152.2	234.3	177.2	
Ontario	306.9	321.1	168.3	339.8	186.8	
Manitoba	36.0	43.4	37.3	48.8	38.5	
Saskatchewan	71.8	129.2	126.5	161.4	154.8	
Alberta	6.3	5.4	2.9	6.2	5.0	
British Columbia	151.9	212.3	153.7	185.3	127.9	
Yukon	22.0	48.8	28.0	52.8	36.8	
Northwest Territories	112.4	93.1	66.2	128.7	70.8	
Nunavut	187.5	170.2	161.1	173.0	154.0	
Total	1 177.8	1 298.7	948.9	1 419.5	1 029.6	
Exploration	903.5	1 049.0		1 134.7		
Deposit appraisal	274.3	249.7		284.8		

(p) Preliminary estimates; (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.

Table 2. Mineral Exploration and Deposit Appraisal Expenditures, (1) by Commodity Sought, 2004-06

	2004	2005 (p)	2005 (p) Exploration Off- Mine-Site Only	2006 (si)	2006 (si) Exploration Off- Mine-Site Only
	(\$ millions)				
Base metals	241.3	300.7	196.7	384.5	225.4
Precious metals	542.9	524.4	381.6	486.9	369.4
Iron	12.4	22.3	21.9	36.5	28.4
Uranium	43.8	86.5	86.5	123.2	123.0
Other metals	25.9	54.0	19.9	81.8	38.5
Nonmetals	17.8	16.8	9.7	14.7	10.0
Diamonds	275.0	250.7	206.8	261.5	216.6
Coal	18.7	43.4	25.8	30.5	18.3
Total	1 177.8	1 298.7	948.9	1 419.5	1 029.6

(p) Preliminary estimates; (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 increased by 12% to reach 2.89 Mt in 2005, compared with 2.59 Mt in 2004, ranking Canada third after China and Russia in terms of world primary production. The increase was due to the Alouette smelter expansion and the restarting of idled lines at Aluminerie Bécancour. The value of Canadian primary aluminum production in 2005 is estimated at \$6.6 billion, up 15% from \$5.8 billion in 2004. This increase in value resulted from the increase in metal prices during the year and an increase in production, which countered an increase in the value of the Canadian dollar relative to the U.S. dollar.

Canadian exports of primary ingot in 2005 increased in quantity to 2.26 Mt valued at \$5.398 billion, compared with a revised 2.0 Mt valued at \$4.87 billion in 2004. Of this amount, unwrought exports to the United States totaled 1.94 Mt valued at \$4.62 billion.

Reported Canadian use of aluminum metal at the first processing stage, including the use of recycled aluminum, was 1.06 Mt in 2004, up almost 5% from a revised 1.01 Mt in 2003.

Alcan Inc. continued to follow through with its acquisition of Pechiney and to strengthen the new company. It has completed the spin-off of Novelis Inc., the world's largest aluminum rolled-products company, and opened a packaging plant and automotive structures plants in Quebec.

During the past year, Canadian developments included the following:

- Aluminerie Alouette Inc. completed \$1.4 billion expansion of its smelter capacity near Sept-Îles, Quebec, from 245 000 t/y to 550 000 t/y. Preliminary work began in late 2002 and the company started placing the expansion into production in January 2005; the last new cell started up in June. At that time, this smelter became the largest in the Americas. The expansion created 340 permanent new jobs at the smelter and 1500 indirect jobs in other areas of the province. Partners in this smelter are Alcan (40%), Aluminium Austria Metall Québec (20%), Hydro Aluminium (20%), Société générale de financement du Québec (SGF) (13.33%), and Marubeni Québec Inc. (6.66%). Further details are available on the company's web site at www.alouette.qc.ca.
- At Alcan's 277 000-t/y smelter at Kitimat, British Columbia, power generation at the Alcan-owned Kemano hydro-electric facilities was reported to have reached a new record. The facility has been operating at lower-than-capacity rates since 2000 when reduced water levels required the company to curtail production at the smelter.
- Aluminerie de Bécancour restarted production at the 409 000-t/y Bécancour smelter (Alcoa 75% and Alcan 25%) in April 2005. Production at the smelter had been curtailed at two of the three potlines due to a strike by the Syndicat des Employés de l'Aluminerie de Bécancour, United

Steelworkers' Local 9700. Alcoa and Alcan announced that billet production at Bécancour will be expanded to 234 000 t/y in 2007.

- Alcoa, Nova Pb and St. Lawrence Cement announced a long-term agreement to recycle spent potliner to create a commercial product called CALSiFrit at the Nova Pb secondary lead smelter near Montréal. Nova Pb received a Phoenix environmental award for its work in developing this process to recycle spent potliner.

With the completion and ramp-up in production from the expanded Alouette smelter at Sept-Îles, Canadian installed capacity for the production of primary aluminum is now just under 3.1 Mt/y. Canada is expected to produce approximately 3.1 Mt of primary aluminum in 2006 and 2007.

Note: Information in this article was current as of May 2006.

Coal

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Canada produced 67.3 Mt of coal in 2005, a slight increase over 2004's production of 66.5 Mt. The increase was mainly from Alberta, which produced 28.6 Mt of coal in 2005. Production from British Columbia and Saskatchewan remained at a level similar to 2004.

Canada exported 28.2 Mt of coal, of which 26.7 Mt was coking coal and 1.5 Mt was thermal coal. Canada's export volume increased by 8% in 2005 compared with 2004. Canada's exports to Asia, the largest market for Canada, increased 24% and its volume reached 15 Mt in 2005, compared with 12 Mt in 2004. Exports to Japan increased to 7.5 Mt, up 40% compared with the previous year's 5.4 Mt. Exports to Korea increased 36% and the volume was 4.9 Mt, compared with 3.6 Mt the previous year. Canada's exports to European markets continued the increasing trend in 2005. Exports to Europe were 8.8 Mt, an increase of 6% from the previous year's 8.3 Mt. Exports to Latin America increased 16% and the volume increased to 2.3 Mt from the previous year's 2 Mt. However, exports to the United States and Mexico took a tumble and declined 40% in 2005 due to increases in both countries' domestic supply.

Canada imported 21 Mt of coal in 2005, an increase of 11% from the previous year's 19 Mt. Of the total imports, 17 Mt was thermal coal, mainly for coal-fired electricity generation in the provinces of Ontario, Nova Scotia and New Brunswick. Coking coal imports were 4 Mt, consumed by Canada's steel industry. Of the total coal imports, the United States supplied 17.7 Mt, an increase of 1.1 Mt compared with 2004. Colombia supplied 2.6 Mt, an increase of 70% compared with 1.5 Mt in 2004.

Canada's coal consumption in 2005 was estimated to be at a level similar to the previous year at about 60 Mt. Electricity generation consumed about 56 Mt, of which 39 Mt was sourced domestically and 17 Mt was imported. Canada's steel, cement and other industries consumed about 4 Mt of coal.

Based on robust prices and strong demand, coal developments in western Canada continued in full swing in 2005. In northeastern British Columbia, Western Canadian Coal Corp.'s (WCC) Wolverine/Perry Creek mine received the required regulatory approval and started mine construction in April 2005. The mine is projected to be completed in June 2006 and production will begin in July 2006. The mine's designed production capacity is 2.4 Mt/y and will eventually increase to 3 Mt/y in 2007. Northern Energy and Mining Inc. completed its Trend Small mine construction at the end of 2005 and production began in January 2006. The design capacity is 1 Mt/y of coking coal. In southern British Columbia, construction of Compliance Energy Corp.'s Basin mine was also completed and the mine is ready to produce in 2006. The Basin mine is a thermal coal mine with a design capacity of 400 000 t/y.

After 36 months of construction, Alberta's new coal-fired power plant, Genesee Phase 3, was completed and began commercial operation on March 1, 2005. The \$695 million, 455-MW power plant is the most technologically advanced coal-fired power plant ever built in Canada. It is equipped with \$90 million worth of clean air technologies that reduce its nitrogen oxide emissions by 50%, CO₂ emissions by 18%, and sulphur dioxide emissions significantly. In total, greenhouse gas emissions at the Genesee Phase 3

plant have been reduced by 52% compared with the current standard coal-fired power plants. The plant also prevents 99.8% of particulates (fly ash) from being released into the atmosphere. The plant uses sub-bituminous coal from the adjacent Genesee mine.

In addition to the mines that have been newly completed and those that are still under construction, three new coal projects have been submitted to the government for environmental assessment. WCC's Brule mine and Hillsborough Resources Ltd.'s Horizon mine projects are located in northeastern British Columbia, and Cline Mining Corp.'s Lodgepole mine project is located in southeastern B.C. In addition, more than 10 prospects are currently at the feasibility study stage. In eastern Canada, the Nova Scotia government selected Xstrata Plc in December 2005 as the successful bidder to develop coal resources at the Donkin mine on Cape Breton Island.

The year 2005 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 record high coking coal price was certainly the driver for Canadian coal production and export increases.

There were 24 coal mines operating in Canada at the end of 2005. Most large-scale coal mines are located in western Canada. British Columbia currently has ten coal mines in operation: Greenhills, Fording River, Line Creek, Elkview, Coal Mountain, Quinsam, Willow Creek, Dillon, Trend Small and Basin. Alberta is home to nine coal mines: Obed Mountain, Cheviot Creek, Coal Valley, Highvale, Whitewood, Genesee, Paintearth, Sheerness and Grande Cache. Saskatchewan has three mines: Poplar Rover, Boundary Dam and Bienfait. New Brunswick has one coal mine and Nova Scotia has several small-scale mines without significant output. Elk Valley Coal Corp. operates six coking coal mines, Luscar Coal Ltd. operates ten mines, and the remaining eight mines are operated by independent companies.

The outlook for 2006 is positive. Global demand for coking coal appears to have started slowing down and supply increases seem to be catching up with demand. Canadian exporters settled various coking coal contracts for the 2006-07 coal year at prices of US\$107-\$110/t, lower than the 2005-06 coal year price of US\$120-\$125/t. Meanwhile, global thermal coal demand continues to be strong, particularly in developing countries as the demand for heat and electricity keeps the demand for thermal coal at a high level. Canadian coal production is expected to reach 70 Mt in 2006 and exports are also expected to increase to 30 Mt.

Note: Information in this article was current as of May 2006.

Copper

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Canadian copper production (recoverable metal in concentrates shipped) was estimated at 570 400 t in 2005, an increase of 4.7% from 544 588 t in 2004. The higher output was mainly a result of restarts at the Mount Polley and Gibraltar mines in British Columbia, as well as the start-up of the Voisey's Bay mine in Newfoundland and Labrador. Refined production in 2005 was an estimated 536 000 t, up slightly from 529 000 t in 2004. All copper production data below refer to the production of copper in concentrates in 2005 unless otherwise stated.

Newfoundland and Labrador

Aur Resources Inc. announced it would develop the Duck Pond copper-zinc deposit on a fast-track basis with production expected to begin in late 2006. Aur expects to produce about 18 600 t/y of copper contained in concentrates plus by-products of about 34 000 t/y of zinc, 16 t/y of silver and 128 kg/y of gold over a seven-year period.

Inco Ltd.'s Voisey's Bay mine and concentrator became operational in the August/September period and the first shipments of concentrate were shipped in early November (see section on Nickel). Planned average annual output from the mine during the first phase of the project is approximately 50 000 t/y of nickel and 38 550 t/y of copper (31 750 t from copper concentrate and 6800 t from nickel concentrate).

Quebec

Campbell Resources Inc. brought the Copper Rand mine back into production in March 2005. The copper-gold mine is in the Chibougamau area. It was closed in 1997 due to poor economic conditions. Campbell Resources spent \$58 million on infrastructure renewal, including centralizing milling facilities for both Copper Rand ore and the nearby Joe Mann mine. Start-up problems, mainly a result of poor ground conditions, affected the progress of construction of a ventilation raise and prevented the company from producing at planned rates. Resulting cash-flow problems led to a suspension of development work by mid-year. The mine continues to produce at reduced levels and the company is seeking strategic partners to secure additional capital.

Noranda Inc. announced that it would increase production at the Horne smelter to 170 000 t/y of anode by the end of 2005. In 2003, Noranda announced a reduced processing rate at Horne, from 840 000 t/y to 630 000 t/y, and a decrease in anode production from 186 000 t/y to 140 000 t/y, effective June 2004, in order to reduce its reliance on low-margin imported concentrates.

Breakwater Resources Ltd.'s Bouchard-Hébert zinc-copper mine stopped production in February 2005 due to the depletion of economic reserves. The company expects to spend \$3.8 million on reclamation in 2006. The mill at Bouchard-Hébert will remain in place pending the outcome of exploration program in the region.

Ontario

Inco Ltd. entered into a long-term agreement with Falconbridge Limited under which Inco will send copper anodes produced at its Sudbury copper smelter to Falconbridge's Canadian Copper Refinery (CCR) in Montréal for processing into refined copper and precious metals. Under the 10-year agreement, Falconbridge will purchase and pay Inco for the copper, gold and silver recovered, less treatment and related charges, and Inco will receive back the nickel and platinum group metals recovered from the anodes, subject to certain treatment charges. Inco is expected to ship between 104 000 and 122 000 t/y of copper in anode to CCR. Inco had indicated earlier in the year that it would be closing its copper refinery in Sudbury, citing the facility's size and high cost structure relative to the leading copper refineries as the major factor in the decision. A four-week strike at Falconbridge's Kidd Creek metallurgical division near Timmins was resolved on October 30 when workers from two unions ratified a new three-year agreement.

Manitoba

Winnipeg-based HudBay Minerals Inc. reached an agreement with White Pine Copper Refinery Inc. to acquire the White Pine copper refinery in White Pine, Michigan, for US\$13 million. The refinery produces copper cathode from the copper anode produced at HudBay's Flin Flon copper smelter.

British Columbia

Teck Cominco Ltd. announced it will extend the mine life at the Highland Valley copper mine near Kamloops by approximately five years to September 2013. The extension will be achieved by pushing back the pit wall of the Highland Valley mine to release additional ore. The capital cost of the project is \$40 million.

Vancouver-based Redcorp Ventures Ltd. announced in May that it will curtail development work on the Tulsequah Chief zinc-copper project near Aitlin. Preliminary results from an ongoing feasibility update study indicated that reduced resource estimates and increased capital and operating cost estimates require additional work to be completed to develop a financeable project. All work on the project has been put on hold while the company considers options to either expand the resource base or reduce costs. The deposit contains measured and indicated resources totaling 5.4 Mt averaging 1.42% copper, 1.32% lead, 6.73% zinc, 2.73 g/t gold and 100.8 g/t silver. In November 2004, Redcorp received a provincial Certificate of Authorization to proceed, as well as a screening-level environmental assessment approval under the *Canadian Environmental Assessment Act* (CEAA) in July 2005.

The Mount Polley copper-gold mine restarted operations in March 2005 on the strength of positive drilling results at the recently discovered Northeast Zone and improved metal prices. In 2004, Imperial Metals Corp. updated the reserve estimate for the Northeast, Bell and Springer zones at Mount Polley and obtained a permit amendment to include mining of the Northeast Zone. Total proven and probable reserves in the Wight, Bell and Springer open pits are 44 Mt averaging 0.45% copper and 0.30 g/t gold, which contain approximately 198 000 t of copper and 13.5 t of gold. The mine life as of February 2005 was 6.75 years.

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Diamonds

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The Canadian diamond industry suffered a few setbacks in 2005, and mine production is estimated at 12.3 million carats (Mct) valued at \$1.7 billion, compared with 12.7 Mct valued at \$2.1 billion in 2004. The 3.0% decrease in output and 19.7% fall in value resulted from the processing of lower-grade ore at the two producing mines, as part of their mine plan, and the appreciation of the Canadian dollar against the U.S. dollar (sales are made in U.S. dollars). The two mines are both in the Northwest Territories (NWT) about 300 km northeast of Yellowknife.

Canada's first diamond-producing mine, Ekati, came into production in 1998. It achieved a production level of 4.0 Mct in 2005, registering a 22.5% drop compared with 2004. The mine is owned 80% by BHP Billiton Ltd. Chuck Fipke and Stuart Blusson, who discovered the diamond deposit in 1991, each hold a 10% interest in the mine. BHP's \$227 million Panda underground project at the Ekati mine started production in April 2005. The project is expected to deliver approximately 4.7 Mct of high-value Panda diamonds over a six-year production life.

Canada's second diamond mine, Diavik, began production in early 2003. It is an unincorporated joint venture between Diavik Diamond Mines Inc. (DDMI), which owns 60%, and Aber Diamond Mines Ltd. (ADML), which owns 40%. DDMI is a wholly owned subsidiary of Rio Tinto plc of London, United Kingdom, and ADML is a wholly owned subsidiary of Aber Diamond Corp. of Toronto, Ontario. Production at Diavik in 2005 reached 8.3 Mct, an 8.4% increase compared with 2004.

Construction of the A418 dyke to allow open-pit mining of Diavik's A418 orebody started during the summer of 2005 and is expected to cost \$260 million. First production from the A418 pit is scheduled in early 2008. Diavik also started driving two declines, one to intersect the A154 and A418 kimberlite pipes and the other to intersect the A21 pipe. This work will provide the information required to conduct the underground mining feasibility study of the A154 and A418 pipes and to better estimate the value of the A21 pipe.

Together the Ekati and Diavik mines are the largest private employers in the Northwest Territories. The opening of these mines has resulted in the creation of about 6700 direct and indirect jobs in Canada and the formation of several hundred companies by Aboriginals. In addition, the diamond industry is the largest contributor to the Northwest Territories' Gross Domestic Product, providing more than 50% of the amount.

Canada's diamond production currently accounts for approximately 13.5% of world output on a value basis, making it the world's third largest producer by value after Botswana and Russia. However, with the scheduled opening of the Jericho mine in 2006, the Snap Lake mine in 2007, the Victor mine in 2008, and the Gahcho Kué mine in 2011, Canada's share of world diamond production is expected to increase to over 20%.

Mining Development

Canada's first diamond mine outside the Northwest Territories, Jericho, is in Nunavut, about 420 km northeast of Yellowknife. Mobilization and construction of the mine's open pit started in 2005 and is scheduled to be completed in February 2006. Commercial production, scheduled for April 2006, will enable the production of about 500 000 ct/y over a nine-year mine life. Tahera Diamond Corp., the Toronto-based firm that owns the mine, has a diamond purchasing and marketing 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.

Meanwhile, construction of De Beers Canada's Snap Lake underground mine moved from the stage of pre-production development into full construction at a cost of \$636 million. 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. At the Victor project in northern Ontario, De Beers received final environmental approval for the development in October 2005. Victor will be the first diamond mine in Ontario and will take three years to construct. Development of the \$982 million mine is scheduled to begin in early 2006 to allow production to start at the end of 2008. At full capacity, Victor is expected to produce about 600 000 ct/y over a 12-year open-pit mine life.

De Beers Canada Inc. also confirmed funding of \$38.5 million to advance the Gahcho Kué project, a joint venture between De Beers Canada Exploration Inc. (51%), Mountain Province Diamonds Inc. (44%) and Camphor Ventures (4.9%). The Gahcho Kué project is located south of Lac de Gras, 80 km southeast of the Snap Lake project and approximately 300 km northeast of Yellowknife. Eight diamondiferous kimberlites, along with several sills and dykes, have been found to date on the Gahcho Kué property. The larger 5034, Hearne and Tuzo kimberlite bodies are currently considered to be potentially economically viable. As of August 2004, the weighted average modeled values per carat for the three pipes were US\$74.20 for 5034, US\$61.00 for Hearne and US\$49.00 for Tuzo. The technical study completed in 2005 indicated that 30 Mt could be mined at a rate of 2.1 Mt/y of ore over 15 years, with an average grade of 1.48 ct/t. In November 2005, De Beers Canada Inc. applied to the Mackenzie Valley Land and Water Board for a Class A Water Licence and a Type A Land Use Permit. These are the permits required to construct and operate the Gahcho Kué mine.

Exploration Development

Across Canada, diamond exploration involving 123 companies is under way in the Northwest Territories, Nunavut, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Newfoundland and Labrador, with expenditures reaching \$251 million in 2005. Projects at an advanced stage of exploration are located in the Northwest Territories, Saskatchewan and Quebec.

Exploration on BHP's Ekati property is returning encouraging results in the Lac du Sauvage area. A 73-t bulk sample recovered by reverse circulation (RC) drilling was reported to have yielded 60 ct of diamonds for an average grade of 0.80 ct/t. A total of 154 kimberlite occurrences have now been confirmed on the property.

In north-central Quebec, Ashton Mining of Canada Inc., in a 50:50 joint venture with Soquem Inc., continued exploration on its Foxtrot property and 13 kimberlite bodies had been identified by year-end.

In April 2005, a rough diamond valuation estimate returned a modeled value of US\$88/ct from a 459-ct parcel of diamonds extracted from a 664-t bulk sample collected in 2004 at Renard 2, 3, 4 and 65. In November, the joint venture announced that Renard bodies 2, 3, 4 and 9 could potentially contain 18.6-22.0 Mct of diamonds in 23.2-27.5 Mt of kimberlitic material. The joint venture is proceeding with a \$24 million exploration program in 2006 that will include a bulk sampling program to recover at least 6000 ct from Renard 2, 3, 4 and 9. The valuation of these diamonds is expected in 2007.

Core drilling between the nine diamond-bearing Renard kimberlite bodies and the Lynx diamond-bearing kimberlite dyke system led to the discovery of two important kimberlite dykes (Hibou and North). Analysis of the Lynx dyke system led to the recovery of 56.6 ct of diamonds from 46 t of surface erratics and dyke material collected by trenching, for an average diamond content of 123 ct/100 t. Included in these diamonds was a stone weighing 5.66 ct, the largest diamond discovered to date in the province of Quebec.

In **Saskatchewan**, there are two advanced projects in the Fort-à-la-Corne (FalC) region. The Star diamond project, owned and operated by Shore Gold Inc., completed the mining of a 25 253-t bulk sample from a 250-m-deep exploration shaft and lateral drifts on the 235-m level in the second quarter of 2005. A total of 33 820 diamonds were recovered from this sample with a total weight of 4048.81 ct for an average grade of 0.16 ct/t. Estimated modeled values are US\$135/ct, with a minimum of US\$110/ct and a suggested high of US\$162/ct (not a maximum). On May 19, 2005, Shore Gold announced the start of a \$43 million pre-feasibility study to define a National Instrument (NI) 43-101 compliant mineral reserve. The work program, to be completed by the end of 2007, includes delineation drilling and the extraction and analysis of an additional 15 000-t bulk sample. The budget for this program was increased to \$60 million in early 2006 to accommodate drilling and bulk sampling on additional kimberlite facies defined during the early stage of pre-feasibility.

Nearby is the Fort-à-la-Corne diamond project owned by a joint venture between Shore Gold's wholly owned subsidiary, Kensington Resources Ltd. (42.245%), De Beers Canada Inc. (42.245%), Cameco Corp. (5.51%) and UEM Inc. (10% carried). With over 60 kimberlite bodies identified on the property, the Fort-à-la-Corne field forms one of the largest diamondiferous clusters in the world. In early 2005, the joint venture accelerated its work, adopting a 43-month program, with the goal of reaching a decision on going ahead with a pre-feasibility study by mid-2008.

The 2005 portion of this program, budgeted at \$25.6 million, was focused on higher-grade zones in kimberlites in the southern part of the FalC main cluster where 25 kimberlite bodies have been found within a 5-km radius. This program included the drilling of some 130 HQ core holes and microdiamond analysis on approximately 10 000 kg of core, as well as delineation drilling on selected high-potential targets and preliminary environmental and engineering studies. This is done on the premise that higher-grade portions of multiple kimberlites may, in aggregate, constitute a resource that can be profitably mined.

To date, the FalC joint venture has identified 33 Mct of diamonds in 369 Mt (non-NI 43-101 compliant) from kimberlites 140/141, 148 and 122. The \$43.2 million 2006 exploration program will include core (300 holes) and large-diameter drilling on the Orion Cluster, Star West and three additional priority targets.

Canada has a small diamond manufacturing industry. There are four factories operating in Yellowknife, Northwest Territories, where, under territorial government policy, the diamond mining companies have agreed to provide a portion of their production to the northern factories at market price. The success of these factories has been mixed and, in 2005, the factory of Sirius Diamonds NWT Ltd. was forced to close. The assets were purchased by the Arslanian Cutting Works (NWT) Ltd. factory. There are also manufacturers in Vancouver, British Columbia (one); and Matane, Quebec (one). These cutting and polishing factories provide work for about 200 workers.

In February 2005, Diarough Canada, a subsidiary of Diarough NV, an Indian company with headquarters in Antwerp, Belgium, opened up a new cutting and polishing factory in Matane, Quebec. Operations at this plant will provide work for about 37 workers initially and will expand to 60 workers by 2007. The plant is expected to have a production capacity of about 10 000 ct/y and to specialize in the production of cut diamonds ranging from 0.3 to 2 ct in size, destined for the North American and Asian markets.

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Gold

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In 2005, Canadian gold production continued to decline, reaching its lowest level since 1987, totaling 118.5 t, down from the 2004 total of 128.7 t. As a result, the value of gold production fell to \$2 billion in 2005 from \$2.5 billion in 2004. Additional production from several new mines did not keep pace with the closure of some larger operations in Quebec and Nunavut. The sharp rise in the value of gold at the end of 2005 and into 2006 has sparked renewed exploration and development activity at a number of potential new and existing gold mines across the country.

Ontario accounted for 60% of Canada's total gold production in 2005, followed by Quebec (20%) and British Columbia (14%). The other provinces and territories combined contributed the remaining 6%. Gold exports increased in 2005 with the preliminary value of gold exports (including gold contained in scrap and base-metal concentrates) at about \$4.3 billion, up from \$3.5 billion in 2004. The preliminary value of imports was \$2.8 billion, up from \$1.9 billion in 2004.

In October 2005, Toronto-based Barrick Gold Corp. made an unsolicited offer to acquire all of the outstanding shares of Vancouver-based Placer Dome Inc. By December, Barrick had revised its offer to US\$10.4 billion and the board at Placer Dome recommended its acceptance. Included in the deal, Vancouver-based Goldcorp Inc. agreed to acquire a number of Placer's operations from Barrick. In May 2006, Goldcorp completed the acquisition of four Placer Dome mines and other agreed-upon interests from Barrick for approximately US\$1.6 billion, including the Campbell mine and the Porcupine and Musselwhite joint ventures in Ontario, as well as a 50% interest in the La Coipa gold-silver mine in Chile and a 40% interest in the Pueblo Viejo development project in the Dominican Republic.

British Columbia

Imperial Metals Corp. restarted mining operations at its Mount Polley copper-gold mine, northeast of Williams Lake, in March 2005. In addition to copper, planned precious metals production for 2006 is 1500 kg of gold and 15 000 kg of silver.

Northgate Minerals Corp. is proceeding with the permitting stage for its Kemess North mine development in northern British Columbia. The 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 existing Kemess South mine. Annual metal production during Kemess North's 13-year life is expected to average 7.5 t of gold and 51 000 t of copper.

The proposed Red Chris copper-gold mine project received environmental approval following a comprehensive review by the provincial Environmental Assessment Office. Located 80 km south of the town of Dease Lake in the northwest of the province, construction at the \$228 million open-pit mine is expected to begin in the second quarter of 2006. Red Chris Development Co. Ltd., a wholly owned

subsidiary of bcMetals Corp. of Vancouver, expects to produce some 37 t of gold over the mine's expected 25-year life.

Manitoba

San Gold Resources and Gold City Industries merged to form San Gold Corp. San Gold owns the Rice Lake gold operation near the town of Bissett in the southeastern part of the province. The property comprises an 1100-t/d capacity mill and mine with proven and probable reserves of 818 000 t averaging 9.2 g/t gold. The San Gold # 1 deposit contains an indicated resource of 256 870 t at 7.5 g/t gold. An access decline is advancing towards the orebody and ore development on the first level started in December 2005. San Gold #1 is expected to contribute half the mill feed.

Newfoundland and Labrador

Anaconda Gold Corp. continued to work towards starting operations at its Pine Cove gold deposit on the Baie Verte Peninsula. With an indicated resource of 2.2 Mt at 2.9 g/t gold and an inferred resource of 0.8 Mt at 2.2 g/t gold, the company expects to begin work at the open-pit operation sometime in 2006.

Nunavut

Wolfden Resources Inc. acquired a 100% interest in the Lupin gold mine from Kinross Gold Corp. Lupin produced more than 93 t of gold at an average grade of over 9 g/t gold. Wolfden intends to assess the potential for further near-term production at Lupin; however, the primary use of Lupin is expected to be for the processing of ore from the nearby Izok Lake, Hood and Gondor zinc-copper deposits, and potentially from Wolfden's Ulu gold deposit. The acquisition of Lupin is expected to significantly lower the capital costs associated with developing these deposits.

Ontario

Open-pit development at the Pamour mine near Timmins was completed in early 2005 and the mine started producing gold in June. The Pamour mine is jointly owned by Kinross Gold Corp. (49%) and Goldcorp (51%) under the Porcupine joint venture.

Citing rising costs and the strength of the Canadian dollar, River Gold Mines Ltd. announced that it was adopting a new mining plan at the Eagle River mine near Wawa that involved cutting operations, employment and gold production in half to 1.12 t/y in 2006. In February 2006, River Gold Mines and Wesdome Gold Mines Inc. merged to form Wesdome Gold Mines Ltd.

In December 2005, Placer Dome announced the discovery of the extension of Goldcorp's Red Lake property High Grade Zone (HGZ) on the Campbell mine property (now owned by Goldcorp). Separately, mining and drilling activity within the Deep Campbell project discovered a high-grade mineralized zone with significant visible gold. Drilling confirmed continuity of the structure over a length of 100 m down dip. Both discoveries confirmed the exploration potential to extend the life of the Campbell orebody. Further work is required to define the extent and significance of both discoveries.

Quebec

In 2005, Richmond Mines Inc. continued development work on its East Amphi project located west of Val-d'Or. Some 26 500 t of development ore were processed at the Camflo mill during the year. A decision was taken in early 2006 to put the East Amphi property into production at a rate of about 200 000 t/y of ore at an average grade of 4 g/t gold.

Cambior Inc. entered into an agreement with Aurizon Mines Ltd. to purchase its remaining 50% interest in the Sleeping Giant gold mine north of Amos for a cash purchase price of \$5 million. The deal was completed in April 2005. Gold production at the mine fell from May to September due to the loss of experienced miners. Following the implementation of a recruitment and training program for new miners, Cambior reported a 42% increase in gold production in the fourth quarter of 2005, to 432 kg, from 304 kg in the third quarter. Elsewhere in Quebec, Cambior's Doyon Division (which includes both the Doyon and Mouska mines) reported gold production at 4900 kg for 2005. The 7.5% increase was due to a full year of production at the Mouska mine following completion of the shaft-deepening project, and to operational improvements following the reorganization of the Doyon mine in late 2004.

Century Mining Corp. restarted production at the Sigma open pit at Val-d'Or in the first quarter of 2005. According to company reports, the Sigma-Lamaque Complex contains 139 t of gold in resources, of which 27 t have been upgraded to reserves.

In July 2005, Agnico-Eagle Mines Ltd. announced its decision to go ahead with construction of the Goldex mine on the western edge of the town of Val-d'Or. Gold production is expected to begin in 2008, averaging 5300 kg/y.

Pre-production construction is currently under way at Aurizon Mines Ltd.'s Casa Berardi mine in the northwest of the province. Commercial production is expected to start in late 2006 at an average rate of 5400 kg/y of gold.

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Graphite

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Canada has three natural graphite producers: Timcal Canada Inc. (formerly Stratmin Graphite Inc.) is located in Quebec, Industrial Minerals Inc. (IMI) operates a mine in Ontario, and Crystal Graphite Corp. (CGC) is in British Columbia.

Because IMI and CGC operations are relatively recent, no shipment data have yet been gathered from them via our annual surveys. Shipment data for the Quebec producer cannot be disclosed for confidentiality reasons. Nevertheless, the U.S. Geological Survey reports Canada's shipments for the past few years at an estimated unchanged 25 000 t/y.

NRCan's 2005 voluntary survey on the use of nonmetallic minerals by Canadian manufacturing plants indicated that the use of graphite in Canada in 2004 increased by 8.6% to 15 942 t from 14 674 t in 2003. Of these figures, natural graphite represented 3664 t (23%) and synthetic graphite represented 12 278 t (77%). Natural graphite consumption was mainly in the foundry facing (63%) industry, and the balance reported (37%) was for other uses (i.e., brake lining, chemicals, abrasives, primary steel, and other uses).

In 2005, preliminary estimates of the total value of Canadian exports reported by Statistic Canada were \$30.7 million, a decrease of 8.4% from \$33.5 million in 2004. Of these exports, \$17.1 million (15 428 t) was natural graphite, the balance being refractory products and carbon/graphite brushes. The United States was the main destination for Canadian natural graphite. Preliminary estimates for 2005 imports totaled \$36.5 million, a decrease of 26.4% from \$49.6 million in 2004. Of these imports, \$4.6 million (119 009 t) was natural graphite and the balance was refractory products and carbon/graphite brushes. The United States was the main supplier for Canadian natural graphite.

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Nickel

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Canadian nickel production in 2005 (and 2004) was: nickel in concentrate produced, 198 000 t (187 000 t), recoverable nickel in concentrate shipped, 182 000 t (117 000 t), and refined nickel, including nickel in chemicals and oxide sinters, 140 000 t (152 000 t). Although a large producer, Canada uses less than 10 000 t of primary plus secondary nickel produced, so the vast majority of nickel is exported.

Traditionally, Sudbury, Ontario, and Thompson, Manitoba, have been the principal sources of Canadian nickel production. The Raglan mine in Quebec started production in 1997 and, in 2005, Voisey's Bay in the province of Newfoundland and Labrador began producing nickel, copper, and cobalt in concentrates.

After Noranda Inc.'s successful takeover of Falconbridge Ltd., the two companies merged in June under the name Falconbridge Limited. Xstrata Plc purchased 20% of Falconbridge common stock in August 2005; earlier in 2005, Xstrata had been outbid by BHP Billiton plc for WMC Resources Ltd. of Australia, then the third-largest nickel miner. In October 2005, Inco announced a takeover offer for Falconbridge as both companies have operations in Sudbury and anticipated substantial cost savings by combining certain operations. The Canadian Competition Bureau approved the transaction in January 2006. As of May 2006, regulators in the European Union and the United States had yet to complete their review of the proposed transaction. Inco has offered to divest Falconbridge's Norwegian refinery if required. In May 2006, Teck Cominco Ltd. announced an unsolicited takeover bid for Inco, contingent upon the merger with Falconbridge not proceeding.

In Newfoundland and Labrador, Inco's Voisey's Bay mine and mill operations started ahead of schedule, producing 530 000 t of ore averaging 3.44% nickel and 1.78% copper in 2005. Voisey's Bay nickel-cobalt concentrate was delivered to Inco's hydrometallurgical demonstration plant at Argentia in October 2005, after which commercial shipments of concentrate were delivered to Inco's Thompson and Sudbury smelters. In late 2005, Inco decided that Argentia would not be a suitable site for a commercial hydrometallurgical plant and later chose, instead, a site further north on the Avalon Peninsula at Long Harbour.

Falconbridge's Raglan mine in the northern Ungava Peninsula, Quebec, produced concentrates containing 22 200 t of nickel, 5800 t of copper and 350 t of cobalt after processing 0.9 Mt of ore. Nickel production in 2005 declined by 16% while a \$33 million concentrator expansion program was completed. A second phase of the mill expansion is to be completed in 2008 to increase capacity to 1.3 Mt/y of ore to produce 30 500 t/y of nickel in concentrates. All output was smelted at Falconbridge's Sudbury smelter in Ontario. Production in the first quarter of 2006 was 5300 t of nickel in concentrates.

In Ontario, nickel was mined in Sudbury, Timmins, and near Thunder Bay. Falconbridge operated three mines in Sudbury in 2005, producing concentrates containing 19 700 t of nickel (22 600 t), 23 400 t of copper (24 700 t) and 354 t of cobalt (427 t) from the processing of 2.17 Mt of ore. Falconbridge's

smelter produced a record 63 100 t of nickel in matte in 2005. Production in the first quarter of 2006 was 15 800 t. Main shaft sinking at Nickel Rim South near Sudbury reached 672 m by the first quarter of 2006, with the ventilation shaft advancing to 1307 m; mining at Nickel Rim South is expected to begin in 2009. Falconbridge has other resources at the Onaping Depth and Fraser Morgan deposits. First Nickel Inc. re-opened the Lockerby mine, purchased from Falconbridge, and began shipping ore to Falconbridge for processing in December 2005. The mine plan in mid-2005 outlined a two-year production schedule.

Inco's seven mines produced 8.75 Mt at 1.28% nickel and 1.38% copper in 2005, with Inco Sudbury's finished nickel production estimated at about 60 000 t in various forms, including 16 300 t of nickel, mainly from imported concentrates. About 37 500 t of nickel from the Sudbury smelter was sent to Inco's U.K. refinery for final processing. Smelting of Voisey's Bay concentrates at Inco's Sudbury smelter was expected to yield about 19 500 t of finished nickel in 2006. Inco is to produce a separate copper concentrate at its concentrator, similar to Falconbridge's practice, in order to increase nickel throughput in its Sudbury smelter. A fluidized bed roaster and new oxygen plant were scheduled to be completed by mid-2006. Inco also purchased ore from FNX Mining Co. Inc.'s operation in Sudbury at the McCreedy West mine. FNX continued rehabilitating the Levack mine shaft and sinking a new shaft at the Podolsky deposit.

In Timmins, Falconbridge's Montcalm mine produced 750 000 t of ore, which was concentrated at the Kidd Creek Metallurgical Site and then sent to the Sudbury smelter. These concentrates contained 9000 t of nickel (2200 t) and 5000 t of copper (1200 t) in 2005. Production in the first quarter of 2006 was 2800 t of nickel and 1400 t of copper. In January 2005, Canadian Arrow Mines Ltd. obtained provincial permission to mine the Alexo deposit, and 15 300 t of ore averaging 1.17% nickel, 0.19% copper and 0.07% cobalt was shipped from the company's open pits to Falconbridge's Strathcona concentrator in Sudbury. Liberty Mines Inc. negotiated a multi-year off-take agreement with Jilin Jien Nickel of China for production from the Redstone nickel mine near Timmins. Jilin provided US\$4 million in financing, and the mine was expected to start up by mid-May 2006; 200 t/y of ore will be milled off site and the concentrates will be sent to Jilin in China. Liberty purchased a mill in February 2006 to be moved to the Redstone site.

North American Palladium Ltd. produced 1067 t of by-product nickel from its Lac des Iles open-pit palladium operation near Thunder Bay. Commercial production from its new underground mine at the site was achieved in March, with output from underground rising to 2000 t/d by April. Mill throughput in the March quarter averaged 12 500 t/d.

URSA Major Minerals Inc. and North American Palladium completed a feasibility study of the Shakespeare deposit west of Sudbury. A 4500-t/d open-pit mine and concentrator were evaluated based upon 11.2 Mt of ore feed averaging 0.33% nickel, 0.35% copper, 0.023% cobalt and 0.89 g/t gold plus platinum plus palladium.

In Manitoba, Inco operated two mines, a concentrator, and a smelter and refinery at Thompson. In 2005, Inco produced 2.4 Mt of ore averaging 1.8% nickel at its Manitoba operations. The refinery produced 48 500 t of nickel in 2005 (52 600 t), of which 11 800 t (13 200 t) was from imported concentrates. Approval was given for a US\$34 million project to develop the 1-D Lower orebody beginning in 2008. In 2006, refined production was expected to be 54 400 t, of which 18 100 t will be from Voisey's Bay feed and 4500 t will be from imported concentrates.

Sherritt International Corp. and the Cuban government own equal shares in Metals Enterprise, which operated a refinery in Alberta and a laterite mine and leach plant in Cuba. Production in 2005 was 31 900 t (31 800 t) of refined nickel and 3390 t (3320 t) of refined cobalt; production in the first quarter of 2006 was 7360 and 820 t, respectively. Sherritt and its Cuban partner announced a 50% expansion of nickel-cobalt production capacity by 2008. Both parties will fund equal shares of the US\$500 million expansion of capacity to 49 000 t/y of nickel plus cobalt. Work began in Cuba in April and was expected to begin in Alberta in the September quarter of 2006.

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Potash

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Canada once again achieved record potash production in 2005 with an output of 17.4 Mt KCl (10.6 Mt K₂O), accounting for 33% of the world's production of 55 Mt KCl (33 Mt K₂O). Potash Corp. of Saskatchewan (PotashCorp) produced a record 8.8 Mt KCl, an increase of 11.4% from the previous year's 7.9 Mt KCl. The four Canadian operations of The Mosaic Company (Mosaic) produced 7 Mt of KCl, and Agrium Inc. produced 1.7 Mt of KCl. The production by both Mosaic and Agrium was similar to the previous year's output level.

Canada's potash sales were 16.5 Mt KCl, a decline of 4% from 2004's 17.2 Mt KCl. The decline was in exports, which were down to 15.8 Mt KCl, compared with 2004's 16.5 Mt KCl. Exports to China continued to increase with a record volume of 2.4 Mt KCl, up 28% from the previous year's 1.9 Mt KCl. Exports to other Asian countries experienced some ups and downs, but the total export volume remained at a level similar to 2004. The United States remained Canada's largest market, with a volume of 9.2 Mt of KCl in 2005, an increase of 3.2% compared with 8.9 Mt in 2004. However, Canada's exports to Latin America declined, mainly due to a decline in exports to Brazil, which declined from 1.64 Mt in 2004 to 1.16 Mt KCl in 2005.

Canada's potash operations are concentrated in the province of Saskatchewan. PotashCorp, based in Saskatoon, has five mines in Saskatchewan and one operation located in New Brunswick. Mosaic, headquartered in Plymouth, Minnesota, has four potash operations in Saskatchewan. Agrium of Calgary, Alberta, operates one mine in Saskatchewan. Canpotex Limited, an exclusive offshore marketing company, handles potash sales globally for Saskatchewan potash producers.

During 2005, potash market prices remained favourable for suppliers. At the beginning of the year, the global potash market indicator price (standard grade f.o.b. Vancouver) was US\$131-\$148/t contract and US\$135-\$160/t spot. In April, an increase of US\$10 was well accepted and the price went up to US\$145-\$148/t contract and US\$145-\$160/t spot. The contract price stayed at US\$145-\$148/t for the remainder of year and the spot price continued its upward swing. In July, the spot price climbed to US\$155-\$170/t and, in August, it went up to US\$155-\$185/t. Further, in September, it increased to US\$155-\$190/t and remained the same to the end of the year. The main reason for the price upswing was that global demand for potash continued to be strong. Other reasons for the price increases included a sharp spike in energy costs in North America, which increased the cost of production and the cost of inland transportation.

The growing global demand and favourable potash prices have provided Canadian potash producers with new record revenues and higher gross margins. PotashCorp's sales revenue reached US\$1341 million, an increase of 27% from the previous year's US\$1056 million. The average price increased to US\$142.56/t in 2005, an increase of 38% compared with US\$102.97/t in 2004. The cost of goods sold was down by 1% to US\$469.5 million from the previous year's US\$472 million. PotashCorp's gross margin reached US\$707.4 million in 2005, an increase of 67% from 2004's US\$422.8 million. Agrium's potash sales revenue was US\$255 million, an increase of 19% from the previous year's US\$214 million. The gross

margin increased to US\$157 million in 2005, an increase of 48% compared with 2004's US\$106 million. The average sales price was US\$158/t whereas the 2004 price was US\$119/t.

The outlook for potash demand in 2006 is positive. Global demand for potash has grown at 3.3% per year on average over the past ten years. For the past three years, the growth rate has averaged 6%. The growth in potash demand has mainly occurred in developing countries, noticeably in China and India, as well as in some other Asian countries and in Latin America. Strong demand for potash in China and most of the Asian countries is expected to continue in 2006. However, there was a sign that the demand growth was slowing down. Brazil, one of the leading potash consumers, registered its first decline in potash use in a decade. Brazilian potash imports declined by 1.4 Mt KCl to 5.0 Mt, from 6.4 Mt in 2004, as a result of drought, lower crop margins, and slower economic growth. It is anticipated that Brazil's potash demand will likely recover in 2006 and possibly return to the 6-Mt level as the current potash inventory is very low. Global demand for potash will likely grow at 3-4% and most demand increases will come from China, India, and other Asian countries.

Potash supply will undoubtedly increase as three Canadian potash producers' capacity expansions will be completed in the first half of 2006 and will add about 1.1 Mt/y of new capacity to Canadian production in the second half of the year. The Canadian potash industry currently has an annual production capacity of approximately 21.4 Mt of KCl. With the new expansions, Canada's production capacity will reach 22.5 Mt/y in the second half of 2006. Globally, potash supply will likely increase 2-3% to about 56.5 Mt KCl in 2006.

The potash spot price is expected to be stable at the current US\$160-\$190/t. The indicator contract price has not yet been reached. Negotiations between Canpotex and China stalled over the price increase. Canada sought an increase of US\$40/t based on the current spot price. However, the Chinese government's involvement has delayed negotiations, but has not affected Canada's shipping volume to China.

In conclusion, the outlook for Canadian potash production and exports is positive and the Canadian potash industry can certainly provide more potash if global demand for it continues to be strong in 2006.

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Salt

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Canada has 12 salt producers operating 20 plants in the provinces of Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan and Alberta.

In 2005, Canadian shipments were valued at \$419.9 million, a \$12.8 million decrease from 2004. The tonnage decreased by 2.6% from 14.1 Mt to 13.7 Mt. The percentage values of shipments were: mined rock at 75%, brine at 1.6%, and fine vacuum at 23.4%; tonnage percentages were 85.3%, 8%, and 6.7%, respectively.

In 2005, Canada's salt exports were valued at \$78.7 million. The majority of the salt is exported to the United States (99.9% in tonnage and 99.4% in value). Canada's salt imports were valued at \$50.1 million in 2005, a \$0.6 million decrease from 2004, and its import tonnage decreased to 1.3 Mt from 2.1 Mt in 2004. The bulk of the 1.3 Mt of salt imported was from the United States (67.6% of all salt imports), valued at \$38.6 million. Mexico is the second largest exporter to Canada with 348 366 t valued at \$4.8 million.

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Silica

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Canada has 24 silica producers and, with the exception of Prince Edward Island and the territories, all other provinces in Canada have silica operations. In 2005, preliminary silica shipments were 1.9 Mt, 31% higher than in 2004, valued at \$59.4 million, \$4.8 million higher than in 2004. In 2004, the nonferrous smelting and refining industry represented 33.8% of the total preliminary use of silica in Canada and showed an increase of 20.8% from 2003. Demand by the primary glass and glass container, and glass fibre wool sectors, which represent 18.7% of total use, decreased by 1% from 2003. Demand by foundries, which represent 8.7% of total silica use in Canada, also decreased, by 6.1% compared with 2003. Silica use by the chemicals industry was 3% of total use, an 8.5% decrease compared with 2003 usage. The “other products” category, which includes a multitude of industry users, including cement, represented 35.8% of total silica use in Canada, an increase of 1.1% from 2003. Overall, Canadian consumption of silica increased by 5.5% from 2.5 Mt in 2003.

In 2005, preliminary estimates for imports were 2 Mt valued at \$97.2 million. The three main manufacturing sectors that imported the bulk of the silica are the foundry, well drilling, and organic chemicals sectors. Preliminary estimates for 2005 for the value of exports are \$26.5 million, an increase of \$10.6 million compared with 2004, and somewhat surprising as the tonnage exported appears to have decreased to 617 153 t from 683 914 t in 2004. 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 80% to reach US\$42.50/lb U₃O₈ at the end of March 2006, the Canadian uranium mining sector continues to be very active. Strengthening market conditions helped underpin the decision to seek regulatory approval to proceed with development of the Midwest mine and continued to fuel the hectic pace of exploration activity. Although the exploration focus remains the Athabasca Basin of Saskatchewan, uranium exploration activity has also been reported in the Northwest Territories, Yukon, Nunavut, Quebec, Newfoundland and Labrador, Ontario, Manitoba and Alberta with as many as 90 junior exploration companies involved.

All currently operating mines and mills are situated in the province of Saskatchewan. Cameco Corp. wholly owns and operates the Rabbit Lake mine and mill, and is the majority owner and operator of the McArthur River mine and the Key Lake mill, where all McArthur River ore is processed. AREVA subsidiary COGEMA Resources Inc. (CRI) is the majority owner and operator of the McClean Lake mining and milling facility. Canadian uranium producers are considered world leaders in the development of environmentally sustainable mining and milling practices: all effluents are treated prior to off-site release; tailings are treated and disposed of below ground elevation; and significant training, employment and business development opportunities arising from the construction and operation of the mines and mills are preferentially awarded to locally based businesses and residents of northern Saskatchewan.

In 2005, Canada retained its position as world leader in uranium production, with output totaling 11 629 tU (tonnes of uranium metal) valued at over \$620 million. As of January 1, 2006, Canada's recoverable uranium resources amounted to 431 000 tU, down some 3% from the 2005 total of 444 000 tU due principally to depletion through mining. With over 80% 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 (~160 000 tU, average grade of ~22% U) and Cigar Lake (~90 000 tU, average grade of ~16% U). Mining high-grade uranium in this groundwater-saturated setting requires ground freezing and high-tech mining methods. McArthur River began production in late 1999 and construction of the Cigar Lake mine is proceeding with production expected to begin in late 2007 with a three-year period required to ramp up to full production capacity of some 7000 t/y U.

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 2005, equaling 2004 production. A small contribution (615 tU) of total mill production in 2005 was derived from Key Lake stockpiled mineralized waste rock, 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. Pending receipt of regulatory approvals, Cameco expects that it will take about two years to ramp up to the increased production level of over 8450 t/y U.

Rabbit Lake produced a total of 2317 tU in 2005, up from the 2004 total of 2087 tU due to a significant increase in ore processed in the mill. Underground drilling led to the delineation of over 3800 t of uranium reserves and resources in 2005, extending the life of the mine beyond 2007. Cameco has indicated that it intends to continue the drilling program in 2006. Over 4 km of underground development was completed in the Eagle Point underground mine in 2005 to access two new ore zones identified in the 2004 exploration program. It is expected that about half of the first phase of Cigar Lake ore will be partially processed at the Rabbit Lake mill, pending receipt of regulatory approvals. A proposal to produce and ship on a dedicated haul road a uranium-rich solution produced from Cigar Lake ore at McClean Lake for final processing at the Rabbit Lake mill is currently the subject of an environmental assessment.

McClean Lake production declined slightly to 2112 tU in 2005 from 2310 tU produced in 2004 due to difficulties encountered in recovering high-grade Sue C ore in the stockpile, resulting in lower-grade mill feed. Regulatory approvals to increase mill production from 3075 t/y to 4600 t/y U, and to mine the Sue A and Sue E deposits, were obtained in 2005, and a \$60 million construction program at the JEB mill to increase production and modify the facility to receive and process Cigar Lake ore was initiated. Open-pit mining began in July 2005 at Sue A and in late 2005 at Sue E. CRI also received regulatory approval to test mine small deposits on the McClean Lake property using surface mining techniques. This “blind boring/jet boring” testing program began in 2005 and is slated to continue with mining of the McClean Lake north deposit planned in 2006. The lower grades of ore being processed, and a four- to six-week shut-down required for JEB mill construction, are expected to reduce 2006 production to about 1550 tU.

On December 28, 2005, the Midwest project description was submitted to federal and provincial regulatory agencies. The Midwest project is a joint venture between CRI (69.16%), Denison Mines Ltd. (25.17%) and OURD (Canada) Co. Ltd. (5.67%), a subsidiary of Overseas Uranium Resources Development Corp. (OURD) of Japan. CRI is the operator. It is proposed that the Midwest deposit (16 000 tU averaging 4.6% U) will be mined by open pit and hauled about 15 km on a dedicated road to McClean Lake for milling (where a further expansion of the JEB mill would be required). Pending receipt of regulatory approvals, stripping of the deposit could begin in 2008. It is expected that it will take over two years to strip the deposit and a further two years to mine it. Milling of the Midwest ore could take from five to seven years depending on the optimal milling rate determined by the owners and approved by regulators.

Work at the closed Cluff Lake uranium mining facility proceeded essentially as planned in 2005, although unusually wet conditions caused CRI to postpone some earth-moving and seeding until 2006. The mill demolition was essentially completed in 2005 and the debris was buried in the Claude open pit. Backfilling of the Claude pit was completed with a layer of till that was planted with trees. The Claude waste rock pile was re-sloped and covered with 1 m of till, and the liquids pond backfilling and perimeter grading of the tailings management area were nearly completed. Pumping water to fill the DJX open pit is now expected to be completed in 2006. Once the remaining tasks are completed in 2006, the site will enter a five-year on-site monitoring phase.

Water treatment and minor engineering works continued to be the main activities at the closed Elliot Lake area uranium mine and mill sites in 2005. *The Serpent River Watershed Annual Water Quality Report* was completed in 2005 (the second five-year cycle of a major monitoring program in the watershed that hosted uranium mining for over 40 years). Results indicate that, in general, the quality of the water and

sediment throughout the watershed continues to improve, indicating a general improvement in the ecological health of the watershed.

Note: Information in this article was current as of May 2006.