THE MINERAL INDUSTRY OF

CANADA

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Canada, which was the second largest economy in the American continent with about 31 million people in 2000, had a gross domestic product (GDP) of $958 billion[1]. Canada's GDP growth was 4.1% compared with 3.6% in 1999, which was a record growth among the seven industrialized countries, or Group of Seven (G-7) economies (Goodale, 2000, p. 4; U.S. Central Intelligence Agency, 2000, p. 79; Washington Times, 2001a). Canada's economy strengthened significantly in the third quarter of 2000 and performed well during the year. Unemployment fell to a long-time low of 6.9% at the end of October 2000. Overall, Canada's economic picture for 2000 showed the country as a whole to have been doing well; the minerals, metals, and energy sectors contributed 8.7% of its GDP. Mining played an integral part in Canada's new-technology-driven and knowledge-based economy (Goodale, 2000, p. 4).

For the most part, Canadian mining changed for the better in 2000 despite such concerns as the global competition for exploration funds and the continuing expenditure of exploration monies outside of the country by major and junior Canadian mining companies. The value of Canadian minerals production increased to $84.2 billion in 2000, which was the third continuous record high, from $54 billion in 1999. This increased value of almost 56% was principally due to the substantial gains in the fuels sector. In 2000, mine output of base and precious metals and nonmetals increased in value to $18.5 billion compared with that of 1999. The value of metal output increased to $11.1 billion in 2000 from $9.8 billion in 1999 after declining for the past 3 years (Natural Resources Canada, 2001b).

Changing prices in world markets have affected mine openings and closings in Canada.[2] The value of production for base metals and nonmetals remained close to 1999 levels despite weakening prices. After the cutting of production, market metals prices began a gradual climb in 2000. The top metal produced in the country was nickel; its higher price moved it ahead of gold and potash. The price of the platinum-group metals (PGM) increased significantly in 2000 because of higher demand for use in autocatalysts. The price of copper remained firm during 2000. Prices for precious metals, especially gold, however, remained weak because of supply and demand imbalances created by the dumping of gold by central banks in the European Union (EU) and the resultant reduced output worldwide. Prices for oil and gas increased dramatically in 2000 because of reduced production by the Organization of Petroleum Exporting Countries (OPEC). Coal production declined for the third consecutive year because of lower demand (Natural Resources Canada, 2001a, b).

Overall exploration spending for Canada remained about the same level of that of 1999, which had decreased by almost 35% compared with that of 1998 ($518 million). Although this decrease was fairly characteristic of all the Provinces, it was particularly apparent in the Northwest Territories, Ontario, and Quebec, which together accounted for about 60% of exploration expenditures for the entire country. Despite the decline in global exploration levels, Canada's larger mining companies remained internationally active by continuing to spend 80% of their exploration budgets in other countries, particularly in Latin America, Asia-Pacific, and Africa and the Middle East, and 20% in Canada, much to the aggravation of the geophysical companies, drilling contractors, helicopter companies, professional geologists and engineers, outfitters, and hotel services, all of which contribute to the country's economy. Although a large number of Canadian mining companies have been exploring in other countries, such discoveries as Voisey's Bay and the Ekati diamond mines reaffirmed that there is much still to be found in Canada (Goodale, 2000, p. 10-11).

According to predictions for the forthcoming year, spending for metals exploration would be flat or decline, and that for diamond exploration would increase by as much as 25%. After spreading to most of Canada, diamond exploration continued with some public excitement because of an increasing number of discoveries. The value of diamond production increased by 5.3% ($0.6 billion) as the Ekati diamond mine completed its second full year of operation in the Northwest Territories. For the first time, the mine became a factor in world diamond markets. In 2000, diamond was expected to be the most sought after mineral commodity in the country (Natural Resources Canada, 2001b).

Voisey's Bay Nickel Co. (a subsidiary of Inco Ltd.), based in St. John's, Newfoundland, was established as a separate firm to finance and develop the huge and rich nickel, copper, and cobalt deposit on the Labrador Peninsula in far eastern Canada. Differences between the Provincial Government and Inco over how the Voisey's Bay deposit should be developed have delayed the project again (Metal Bulletin, 2000b).

Although the number of junior exploration firms has declined considerably in recent years, junior spending remained an

[1]Where necessary, values have been converted from Canadian dollars (CAN$) to U.S. dollars at an average rate of CAN$1.49=US$1.00 for 2000. All values in this report, unless otherwise specified, are expressed in U.S. dollars.

[2]For more detailed information on the mineral production in Canada, see the Canadian Minerals Yearbooks for 1998 and 1999, prepared by the Mining Sector, Natural Resources Canada, Ottawa, Canada, which were used extensively as source material for this report. The U.S. Department of the Interior has arranged to have these Canadian publications placed in selected depository libraries of the 50 States and Puerto Rico. Please note that any datum or statistic not referenced elsewhere may be assumed to be from either the Yearbook or the related series of separate, preliminary, topical papers presenting information compiled by Statistics Canada and issued by Natural Resources Canada.

important component of total expenditures. In 1999, it amounted to $137 million, or 27% of total spending compared with the $364 million spent by senior companies. In 2000, junior company spending was $165 million, or about 33% of the forecasted total of $502 million. Globally, Canada remained one of the world's top mineral exploration targets by attracting the interest of the world's larger exploration and mining companies. Canadian companies were very active abroad as well (Natural Resources Canada, 2000d).

Environmental concerns continued to interact with mineral exploration and development activity throughout Canada. Canadian mining firms were acquiring mineral properties in Latin America where Governments offered incentives to attract foreign investments; their mining laws, like those of Canada, were coherent and reasonable, up to 100% of ownership was allowed, and profits could be repatriated.

Mineral exploration search criteria seem to have become increasingly subject to legal and sociological influences in much of Canada. Land use, which had never been given much attention in the past, has become an issue. First Nation rights were receiving long-awaited consideration. Canada's Minister of Natural Resources stated that Federal and Provincial Governments were working on legislative reforms that should afford an improved regulatory climate.

Government Policies and Programs

Primary jurisdiction over mineral resources in Canada is exercised by the Provinces. Through their mining acts, the Provincial Governments regulate most aspects of exploration and mining. Exceptions have been the Yukon Territory and the Northwest Territories, which, although still under the resource-management control of the Canadian Federal Government, were slowly accumulating more independent powers. Federal and Provincial policies (though not entirely consistent among Provinces) are generally stable and have traditionally favored the research and information services that relate to the mining industry. The Federal Government has negotiated multiyear Mineral Development Agreements, which fund initiatives intended to strengthen the mining industry in each region, with Provincial Governments. Although new environmental assessment legislation was passed in 1992, the Federal Government has been deliberate in producing regulations to implement the new laws. One subsequent measure, however, was tax deductibility for funds set aside for the cleanup of closed mine sites, thus complementing emerging Provincial reclamation requirements.

The territory of Nunavut was created in April 1999 by dividing the former Northwest Territories into two territories, Nunavut and the Northwest Territories. The new Territory includes about one-fifth of the landmass of Canada and includes Baffin Island, Ellesmere Island, and the Queen Elizabeth Islands. Its southernmost boundary is the northern boundary of Manitoba, and the northernmost boundary extends slightly north of the northern coast of Greenland. Although Nunavut depended on the Federal Government for 90% of its budget of almost $400 million, it had a modest private sector that included mining, retail sales, and transportation (Wall Street Journal, 1999; Natural Resources Canada, 2000c, p. 31). Exploration for metals and petroleum has tended to move north in recent years into what is now Nunavut and has resulted in Baffin Island's Nanisivik lead-zinc mine, which was owned by Breakwater Resources Ltd., 750 kilometers (km) north of the Arctic Circle. The Inuit have been generally receptive to mining proposals as a way of bringing more business and employment into their region.

The Canadian Securities Administrators (CSA) have finalized the National Instrument 43-101, which pertains to the "Standards of Disclosure for Mineral Projects." This instrument, which will be enacted into law in early 2001, will apply to all technical public disclosure on mineral projects and will require all technical disclosure to be based on the work of a qualified person (QP). This law will preserve Canada's preeminent position in world mining exploration, development, and financing. The QP is to be responsible for scientific and technical matters, which will include not only exploration, development, definitions of resources and reserves, and mining matters, but also quality-control standards for analytical laboratories, the form of technical reports, professional supervision, corporate governance practices, regulatory oversight of the mining industry, and enforcement of securities laws (McCombe, 2001, p. 4). This instrument was a result of the Bre-X scandal in which so many investors lost heavily.

In August 2000, a new set of definitions and guidelines has been approved for reporting exploration information, mineral resources, and mineral reserves in Canada; they will replace the previous classification system contained in the Canadian Institute of Mining, Metallurgy and Petroleum Ad Hoc Committee report of February 1996. The standards are applicable to all minerals, which include industrial minerals, diamonds and other gemstones, but will not apply to bitumen, natural gas and oil (Canadian Mining Journal, 2000).

In October 2000, the Canadian Federal Government introduced a 15% nonrefundable tax credit. The credit is in addition to the existing 100% deduction of eligible exploration expenditures from the Federal portion of investors' income tax. The two types of flow-through share investments are the "super" flow-through, or additional Federal tax credits, for "grassroots" exploration and the regular flow-through plus provincial and territorial harmonization initiatives. Both flow-through share investments will assist the sector in gaining new investment and stimulating minerals exploration activity in Canada. The Federal Government is laying a foundation for the sector by providing sound economic fundamentals, encouraging innovation and knowledge, and promoting sustainable development. Income tax benefits to individual investors will vary depending on the company's residence for income tax purposes and marginal tax rate. Quebec will offer the largest potential tax savings for flow-through share investments followed by British Columbia and Ontario (Steele, 2001).

Environmental Issues

The Canadian Mining Association noted that for the first time, the 5-year-old Canadian Environmental Assessment Act (CEAA) put several Federal departments in a position to review mining activity, a purview that had been limited to Provincial jurisdiction. The CEAA includes many provisions that bring

Federal agencies into the review process to evaluate impacts on area fisheries and navigable rivers or where explosions or public works are involved. In that any mining operation is virtually certain to affect at least one of these considerations, the Federal Government is now involved in any significant mining project. Because of overlapping Federal jurisdictions, investors no longer have a clear idea of what they have to do to secure approval for their projects. Observers believed that if the CEAA resulted in difficulties for raising capital because investors could become wary of Canada's approval regime, they would invest their monies in other countries where regulations were more straightforward and transparent (Financial Times, 2000).

In a further effort to define goals, approaches, and alternatives in the name of sustainable development, the Prospectors and Developers Association of Canada (PDAC), a private sector organization, has issued a paper entitled "Total Landscape Management (TLM): An Integrated Approach to Conservation Protection and Resource Development." The PDAC asserts that TLM goes beyond the growing reliance on multiple-use exclusive areas to achieve conservation objectives, which has produced unsatisfactory results because the complex and changing needs of the landscape require a more-comprehensive and integrated approach. The paper acknowledges that access to land and certainty of title are crucial to resource development and that biological diversity, wilderness protection, and the preservation of unique and exceptional areas are fundamental to conservation objectives. TLM prescribes management of entire ecological landscapes by employing the overarching principal of conservation diversity; a system of "floating reserves" designed to accomplish protection in a constantly changing, dynamic landscape; adaptive management that allows the flexibility to accommodate new information, evolving ecosystems, and natural disturbances; and comanagement that ensures the provision of local community input. Failure to understand local realities and to involve the community constructively creates the risk of costly delays or even termination of mineral exploration and development projects owing to disruption, confrontation, and conflict over social, cultural, and environmental issues (Thomson, 2001). Too comprehensive to detail here, this paper appears to be a carefully crafted and far-reaching attempt to rationalize and harmonize the differences among adversarial viewpoints by the PDAC.

Toronto health officials reported that air quality in southern Ontario has worsened sharply since the temporary closure of seven nuclear powerplants in 1997 and will probably deteriorate further after deregulation of the Province's electricity market in 2000. The report lays much of the blame on a sharp increase in emissions from five coal-fired plants operated by Ontario Hydro, the provincially owned electric utility, which is the sole supplier of electricity in Ontario. In the years since 1996, sulfur dioxide (SO_2) emissions from the plants have increased by 68%, and nitric oxide (NO) emissions have increased by 58%; SO_2 is a major contributor to acid rain, and NO emissions is the principal source of ground-level ozone that produces visible smog. Ontario Hydro planned to reintroduce upgraded nuclear plants in 2000 (Financial Times, 1999).

After the Provincial Government ruled that ore from Voisey's Bay must be processed only in Newfoundland or Labrador, Inco announced plans for a smelter and refinery at Argentia, Newfoundland. Inco projected that 99% of SO_2 emissions would be captured and that the complex would produce less atmospheric SO_2 than any existing industry in Newfoundland.

Production

The value of Canadian mineral production moved to a second record high in 2000, which was principally attributed to a sharp increase in the value of the output of crude oil and natural gas. In the three nonfuel groups (metals, nonmetals, and structural materials), changes from 1999 also were positive. Production values of metals increased by 13.1% compared with that of 1999, and those of nonmetals, which includes structural materials, increased slightly to $7.4 billion in 2000 from $7.3 billion in 1999. The performance of the fuels group, which totaled $65.7 billion, showed a 78% increase compared with that of 1999 ($36.9 billion) primarily because of the skyrocketing prices for crude oil and natural gas. The dramatic increase in value was led by natural gas, which climbed by 94.3% compared with that of 1999; the value of this output was $27.6 billion. Production of natural gas byproducts escalated by 109.1% with a value of $5.3 billion compared with that of 1999. Crude oil and equivalent output increased by 68.5% compared with that of 1999, but value soared by 147.7% to $31.5 billion because of the surge in world crude prices. Finally, the value of coal production decreased by about 10.8% to $1.3 billion in 2000, although output was down by only 4.6%, which reflected a sag in market prices (Natural Resources Canada, 2001a, b). Geographically, the sources of mineral fuels production in 2000 were Alberta, 77.5%; Saskatchewan, 10.3%; British Columbia, 7.9%; and all other Provinces and Territories, 4.3% (Natural Resources Canada, 2001a).

In terms of value of production in 2000, the top nonfuel commodities were nickel at $2.4 billion; gold, $2.0 billion; potash, $1.7 billion; copper, $1.7 billion; zinc, $1.6 billion; iron ore, $1.5 billion; cement, $1.3 billion; and diamond, $600 million (Natural Resources Canada, 2001b).

Market prices played a changing role in the mineral commodity values. For example, skyrocketing prices for crude oil and natural gas led to a hefty increase in the value of fuel output in 2000. The higher realized price for nickel as production increased slightly resulted in a significant increase in the value of nickel production to $2.4 billion in 2000 from $1.6 billion in 1999, which moved it ahead of gold and potash as the major nonfuel mineral produced in Canada. The price of the PGM increased significantly in 2000; the largest increase was for palladium to $951 per ounce from $444 per ounce in early 2000. The iron ore output increased by 5.1% compared with that of 1999, and the value of this production increased by 9.2%, which reflected an improved market price. The value of copper output increased owing to higher production, and the market price remained firm in 2000. Moderate declines in output led to a decreased value of production for silver (-5.8%), uranium (-7.7%), cobalt (-10%), and lead (-17.3%). The value of output for most other metals remained at about the 1999 levels despite weakening prices (Natural Resources Canada, 2001a, b).

Changes in outputs can be accompanied by robust increases in their value, thus illustrating the compelling effect of market prices when higher demands for minerals are prevalent. Likewise, the destructive effect of price deterioration in relation to mineral production during periods of oversupply and price weakness will be harmful to the minerals sector.

Ontario, which was the leading producer of nonfuel mineral commodities, accounted for 30.8% of the total value followed by Quebec, 19.5%; Saskatchewan, 11.9%; British Columbia, 11.2%; Manitoba, 5.9%; Newfoundland, 5.6%; New Brunswick, 4.1%; Northwest Territories, 3.8%; Alberta, 3.5%; Nunavut, 2.1%; Nova Scotia, 1.2%; and Yukon, 0.3% (total does not add to 100% because of rounding). Although the production of fuels tended to be concentrated in the western plains Provinces, the output of nonfuel mineral commodities was characterized by a much wider distribution throughout Canada (Natural Resources Canada, 2001a, b).

Trade

As the world's largest exporter of minerals and metals, Canada enjoyed economic benefits from its mineral industry that included a significant contribution to its trade surplus and, hence, to its merchandise trade balance, as well as major support of the national standard of living. In 2000, minerals and metals exports earned $44 billion, or 13% of all exports. Mineral and mineral product exports, which included fuels, totaled $49 billion; this was an increase of 6.1% compared with that of 1999, and represented about one-quarter of all Canadian exports for that year (Goodale, 2001).

In 1999 (the latest year for which more-detailed export information is available regarding total mineral and mineral product exports), metals registered 51%; fuels, 37.3%; nonmetals, about 10.3%, and structural or building materials, about 1.4%. Value of exports of nonfuel minerals, which included coal, was $45 billion; this represented a decrease of 2.8% compared with that of 1998 (Natural Resources Canada, 2000d).

Included in these exports were crude minerals and smelted and refined products. Prominent among the crude minerals exported were iron ore, potash, and sulfur to the United States; copper concentrates to Japan; and iron ore and zinc concentrates to the EU. Smelted and refined metals included aluminum, copper, gold, iron and steel, nickel, silver, and zinc to the United States; aluminum and gold to Japan; and copper and nickel to the EU. Coal exports went mostly to Japan.

Mineral and mineral product imports, which included fuels, were valued at $55.3 billion and amounted to more than 17.3% of the value of all imports. In terms of net trade, the mineral surplus, which included fuels, was valued at $17.2 billion. Total trade between the United States and Canada exceeded that of any other two countries in the world. Exports of mineral commodities and mineral-related products, which included fuels, to the United States from Canada were $38.1 billion in 1999 (Natural Resources Canada, 2000d).

Structure of the Mineral Industry

The Canadian mineral industry comprised about 3,000 domestic and perhaps 150 foreign companies, although less than 10% of these companies were actively engaged in actual mining. Many were engaged in exploration, some were in advanced stages of mine development, and some, especially very junior companies, were relatively dormant while they sought sources of investment or finance. Companies whose corporate voting rights were at least 50% non-Canadian were considered to be foreign, although other distinctions could apply in some large companies. More than 200 mine sites, which included coal, were active (Giancola, 2001). Another 3,000 mines and quarries produced sand, gravel, and other construction materials. About 40 smelters and refineries, as well as other processing plants, were operating in the cement, sodium chlorate, and sulfuric acid industries. Foreign companies were subject to the same taxes as domestic companies, but repatriation of earnings was unimpeded.

Most of the Canadian mineral industry was privately owned with the notable exception of Government participation in potash and petroleum, but even these were in transition to private ownership. Some companies, such as Potash Corp. of Saskatchewan Inc. (PCS), which was based in Saskatoon, and Saskatchewan Oil & Gas Corp. had been owned, in part, by the Province of Saskatchewan. The Province of Alberta had owned part of Alberta Energy Co. Ltd. The proportion of Provincial Government ownership was changeable, but the trend was also toward privatization in 2003. Petro-Canada (PC) was owned partly by Federal and partly by Provincial Governments but was completely privatized in 2000. A large proportion of the total number of mining and petroleum companies was partly publicly owned with shares trading on various exchanges in Canada and, in many cases, the United States.

Overall, the mineral industry in Canada consisted of underground and open pit mines, leaching operations, concentrators, smelters, and refineries, as well as drilling and production operations characteristic of the petroleum industry. Table 2 lists the structure of the mineral industry, by sectors, of the major mineral commodities.

Employment in the mining and mineral manufacturing industries stabilized after a decline that began in 1989 when the number of jobs in those industries peaked at 422,000. Preliminary employment estimates for 2000 by Statistics Canada indicated that total employment in mining and mineral manufacturing, which included coal, was about 400,000. The total number of employees in coal, metal, and nonmetal mining and quarrying was estimated to be 55,750, or down about 2,700 jobs compared with the 1999 level. Employment in ferrous and nonferrous smelting and refining was estimated to be 59,600, or up about 1,000 jobs compared with 1999. About 8,000 people were also employed in diamond drilling and other support services incidental to mining operations. The mining sector was considered to be a pillar of the Canadian economy and a way of life for Canadians (Goodale, 2001).

Commodity Review

Metals

Aluminum.—Production of primary aluminum was 2.4 million metric tons (Mt), which was a decrease of 0.7%

compared with that of 1999 (Natural Resources Canada, 2001a). This put Canada fourth, after the United States, Russia, and China, in the world in volume of production and first, with Russia second, in volume of exports to the United States. Primary aluminum exports during 1999 were valued at $4.1 billion (Wagner, 2000a, p. 8.1; Plunkert, 2001).

In March 1998, Alcan Aluminum Ltd. started construction of a 375,000-metric-ton-per-year (t/yr) primary aluminum smelter at Alma, Quebec, to replace the 73,000-t/yr Isle-Maligne, Quebec, smelter and to add new capacity at a cost of about $2.2 billion. The facility started production in fall 2000, and full capacity was expected in mid-2001. Because the new plant's capacity required 620 megawatts (MW) of power, 270 MW would come from Alcan's own grid, and 350 MW, from provincial utility Hydro-Quebec. The company had negotiated a projected 22-year power-exchange project with Hydro-Quebec. With Hydro-Quebec furnishing additional power that Alcan may need for modernization and expansion of its various smelters in Quebec, Alcan's hydroelectric power system stood ready to accommodate Hydro-Quebec's requirements when feasible. Alcan projected that it would require an average market price of $1,400 per metric ton to meet its cost of capital. The new potlines would comprise 432 pots in two lines. This new facility would raise Alcan's overall primary aluminum capacity from all of its plants to 1.9 million metric tons per year (Mt/yr) (Natural Resources Canada, 2000a, p. 8.3).

Cobalt.—Mine production of cobalt amounted to 2,013 metric tons (t), which was about the same level as that of 1999, and reflected decreased nickel production value by 10%. Rising demand for cobalt for alloys, catalysts, magnets and batteries, and even pigment, however, has focused new attention on cobalt resources in Canada led by the Voisey's Bay discovery of at least 40,000 t contained within the nickel-copper deposit; further results were expected as exploration progressed (Natural Resources Canada, 2001a, b).

Cobatec Inc., which operated a cobalt-nickel solvent extraction plant in North Cobalt, Ontario, had negotiated a long-term supply agreement with the Cuban Government to process cobalt-nickel sulfate precipitates from Cuba. Processing, which began early in 1998, never amounted to more than minimal output from this $15 million facility established by Ego Resources Inc. (renamed Cobatec). The operation filed for bankruptcy protection in October, which was not granted, and was closed near the end of the year. The company had developed a proprietary hydrometallurgical process for extracting cobalt from ore, tailings, or mine spoil that involves crushing, grinding, flotation, and solvent extraction. This cobalt is then further treated to produce simple salts, such as carbonates. Their process had been endorsed by the Ontario Government as being consistent with its "green" industries strategy, the purpose of which is to demonstrate that resource development can coexist with environmental responsibility.

Columbium (Niobium).—Mine output decreased to 2,170 t in 2000 from 2,313 t in 1999, or 6.2% decline (Natural Resources Canada, 2001a). In 2000, the Niobec Mine, which was the only operating columbium mine in North America, was jointly owned (50% each) by Cambior Inc. and Teck Corp. situated near Chicoutimi, Quebec, the mine ranked as the world's third largest producer. The equal partners have undertaken a study of the feasibility of increasing production by 40% in at least two steps. Included in the upgrade would be an expansion of the crushing and grinding circuit by 20% to 50%. Columbium is used primarily as an alloying agent in specialty steels.

Copper.—Mine output of copper increased by 7.2% to 623,451 t from 581,583 t in 1999, which reflected the stronger world copper prices that resulted in an increase in value of $1.7 billion, or 23.5%, in 2000 (Natural Resources Canada, 2001a, b). Canada exported $1.96 billion worth of copper during 1999 (Coulas, 2000, p. 21.1).

After firming to a peak in 1995, the softening of copper prices in 1997, 1998, and early 1999 resulted in suspension or shutdown of some copper production. Mine output in 1999 was low owing to the temporary closure of the Highland Valley Copper and Myra Falls Mines, as well as the permanent closure of the Mines Gaspé in October 1999 (table 2; Giancola, 2000, p. 442, 463). No new copper mines were scheduled to come on-stream until 2002. Highland Valley Copper mined copper at an average grade of 0.39% and processed about 45 Mt/yr to produce copper in concentrate at a cost of about $0.68 per pound (about $1.50 per kilogram). Operations at Boliden Ltd.'s Gibraltar copper mine in British Columbia were suspended, and the mine was closed in February 1999 owing to high operating costs and weak copper (Coulas, 2000, p. 21.1; Giancola, 2000, p. 67).

Princeton Mining Corp.'s British Columbia Huckleberry project expected production of 37,000 t/yr of contained copper after startup in November 1997 when it made its first shipment of concentrates to Japan. This polymetallic ore body would also yield 218 kilograms per year (kg/yr) of gold, 11,800 kg/yr of silver, and 670 t/yr of molybdenum. Princeton merged with Imperial Metals Corporation, which was the operator and 55% owner of the Mount Polley copper-gold mine near Williams Lake, British Columbia, to form a new company to be called New Princeton, of which Imperial owned 60%. By early 1999, Princeton could not meet all its long-term debt obligations, so the company adopted a financial restructuring package that deferred all principal and interest payments through the rest of the year. As with Huckleberry, Imperial's Mount Polley encountered difficulty carrying its long-term financing and had to adopt an economic relief plan brokered by the Canadian Job Protection Commission (Northern Miner, 1999b).

The potential copper production at Voisey's Bay suggested that Canada, which ranked fifth after Chile, the United States, Indonesia, and Australia, will continue to be a major world copper producer (Edelstein, 2001). Expectations were that Voisey's Bay might yield 99,000 t/yr of contained copper, but in terms of a variety of administrative concerns, such as the aforementioned dispute with the Newfoundland Provincial Government, the mine was a long way from production.

Gold.—Gold output dropped to a little less than 155 t, which was down by 1.8% compared with that of 1999. The value of 2000 gold production dropped by about 4.8% to $2 billion from $2.1 billion in 1999, which reflected low market prices (Natural

Resources Canada, 2001a, b). Ontario produced 48%; Quebec, 24%; British Columbia, 16%; Manitoba, 5%; and Yukon, the Northwest Territories, Saskatchewan, Newfoundland, Alberta, and New Brunswick, a total of 7%. Predictions made in 1995 that output would reach 170 t by 1998 were then seen as somewhat pessimistic, but a record high of 171.4 t was actually achieved in 1997. Although 3 mines opened, low gold prices and/or depletion were responsible for 13 mine closures, which had a deleterious effect on production throughout 1999 and 2000. By yearend, 33 mines were operating. Gold mines accounted for 88% of Canada's output, and 19 base-metal mines and numerous placers contributed with 10% and 2% of production, respectively. Canada was the fifth largest gold producer after South Africa, the United States, Australia, and China. Canada exported $2.1 billion worth of gold in various forms during 1999. The principal gold refiners were Noranda Inc., which was Canada's largest mining company, in southern Quebec; the Royal Canadian Mint at Ottawa, Ontario; and Johnson Matthey Ltd. near Mississauga, Ontario (Keating, 2000, p. 23.1; Amey, 2001).

In early 1998, Rea Gold Corporation sold the San Antonio Mine at Bissett, Manitoba, to Harmony Gold Mining Company Ltd. of South Africa, which began an immediate reevaluation of the mine and forecast an output of about 1.3 t of gold in the first year of production. In mid-1999, Harmony decided to increase its extraction rate per day to 900 t from 635 t of ore, thus decreasing production costs from $278 per metric ton to an estimated $220 per ton (Northern Miner, 1999a).

Echo Bay Mines Ltd. put its Lupin gold mine in Nunavut, about 138 km south of the Arctic Circle, on care and maintenance while it examined its options in the light of low market prices. After nearly 2 years of shutdown, Echo Bay decided to reopen the mine with $12 million of new financing and commercial production targeted for April 2000.

Effective February 14, 2000, Northgate Exploration Ltd. acquired the Kemess gold mine from Royal Oak Mines Inc. at a cost of $145 million. This royalty interest was purchased pursuant to the proposal that Royal Oak filed under the Bankruptcy and Insolvency Act of Canada in December 1999, which received Court approval on January 4, 2000. The Kemess Mine was forecasted to produce 280,000 ounces per year (about 8.7 t/yr) of gold and 27,500 t/yr of copper. Kemess' proven and probable reserves were estimated to be 165 Mt of ore at a grade of 0.7 gram per ton (g/t) gold and 0.23% copper (Lyons, 2000).

Although gold still seemed to be the principal metal targeted for exploration virtually throughout Canada, gold was exceeded by nickel in terms of value of production. With the threat of more gold mine closures, which depended upon market confidence, gold seemed to have lost at least some of its traditional luster. Compounding the problem had been the announced future sale of gold in the open market by the United Kingdom, the possibility of significant sales by the Swiss Government from their large holdings, and repeated suggestions that the International Monetary Fund would release much of its gold to the open market to pay for projects in Third World countries. In September, however, the European central banks' commitment to sell no more than 2,000 t of bullion during the ensuing 5 years caused a positive spike in the market price that subsided in the succeeding months as market hedging resumed.

Iron Ore.—Output of iron ore increased by about 5.1% compared with that of 1999, and the value of production increased by 9.6% (Natural Resources Canada, 2001b). This category comprised concentrates, pellets, and sinter from hematite and siderite ores. Major iron-ore-producing companies included Quebec Cartier Mining Co. (QCM), Iron Ore Co. of Canada (IOC), and Wabush Mines Ltd. The Algoma Ore Division (AOD) of the Algoma Steel Inc. closed its mining operations because it was not economical (Giancola, 2000, p. 463). Data for 1999 (the latest year for which data are available) give an approximation of the proportions of pellets and sinter versus concentrates. QCM produced 16.1 Mt of ore, of which 8.3 Mt was used for pelletization, and the remainder, sinter feed. Shipments exceeded production so that stocks were drawn down to meet demand. IOC produced 15.9 Mt of ore, of which 10.8 Mt went to pelletization, and the remainder to concentrates that were not used for pellets. Wabush Mines turned out 5.3 Mt of iron ore pellets. AOD produced 975,000 t of sinter at its complex in Wawa, Ontario.

After paying $230 million in return for a 59.3% stake in IOC, North Ltd., which was a diversified Australian resources group, decided to reactivate IOC's dormant (since 1981) Sept-Iles pellet plant, which had port facilities on the Gulf of St. Lawrence in Quebec. This expansion will increase IOC's capacity for production of high-quality pellets to 17 Mt/yr from the 1999 capacity of 11 Mt/yr. A redesigned plant at Sept-Iles was expected to reduce IOC's average production costs by $5 per ton. Exploration continued in various parts of Canada, such as Roche Bay in the Northwest Territories, the Peace River area of Alberta, and Ungava Bay and Schefferville in Quebec.

Pig iron production decreased to 8.8 Mt from 8.9 Mt in 1999, or about 2%. The proportion of direct-reduced iron to pig iron produced was about 10%, thus confirming the ratio of 10% forecast 3 years before. Crude steel production was about 16.3 Mt compared with 15.9 Mt in 1999; the old peak was 15.5 Mt in 1989.

Lead and Zinc.—Canada was tied with Peru as the world's third largest mine producer of zinc at 935,700 t of zinc and was tied with Mexico as the world's fifth largest producer of lead at more than 143,000 t of lead in concentrate. Showing a decrease of 7.9% in 2000 compared with that of 1999, lead production fell back about 15% compared with the 1.6% gain in 1998. Zinc mine output showed a loss of about 2.9% in 2000 compared with the 1999 output (Chevalier, 2000, p. 62.1; Natural Resources Canada, 2001b; Plachy, 2001; Smith, 2001). Zinc markets recovered somewhat in 2000 despite continued poor demand in Japan, slow growth in Europe, and increased mine production worldwide. Because of new mine capacity in Australia, Ireland, and Peru; expansions in Chile, Peru, and the United States; and increased exports from China, weak market prices continued to take their toll despite a continued decline in stock levels (Chevalier, 2000, p. 62.1).

Boliden Ltd. restarted operations at its Myra Falls Mine in Strathcona Provincial Park, British Columbia, on March 24, 1999, after a 3-month suspension for rehabilitation of ground-control conditions after problems with rock falls and ore

dilution. About four-fifths of the labor force remained on duty during the suspension and devoted attention to rebolting 1,340 meters (m) of drifts in tighter patterns and to clearing backfill work that had lagged behind schedule. The company carried out a $9.8 million rehabilitation and additional development, which was expected to result in lower operating costs and more-efficient and controlled mining of the Battle and the Gap zones of the mine and to bring it back to full production of 110,000 t/yr of zinc (Chevalier, 2000, p. 62.1).

Breakwater Resources Ltd. established milling improvements at its Nanisivik zinc mine on Baffin Island, New Brunswick, in the form of a regrind circuit that improved the zinc concentrate grade from 55.5% to 57.5% and increased recovery by 0.5% to 96.5%, thus resulting in significant savings in shipping and treatment costs.

Hudson Bay Mining and Smelting Co. Ltd. began an underground development program at its Chisel North zinc deposit at Chisel Lake, Manitoba, which is not far from Snow Lake. A decline will be driven from the 140-m level of the main deposit to the north deposit for drilling and bulk sampling to confirm the surface-drill indicated resource of 2.4 Mt at a grade of 10.8% zinc. Hudson Bay was investing $240 million at Flin Flon operations in Manitoba. The project included a new shaft to develop the "777 deposit," which contains some 14.5 Mt of proven and probable zinc reserves (Chevalier, 2000, p. 62.1-62.4).

In the first quarter of 1999, Inmet Mining Corporation permanently closed operations at the Winston Lake zinc mine on the north shore of Lake Superior in Ontario after studies showed that it was not economic at the current low zinc prices. Although the small high-grade mine had been nearing the projected end of its mine life, Inmet sought to extend it another 4 years by developing the lower Pick Lake zone, which was estimated to include 1.2 Mt at a grade of about 16% zinc, but development work failed to confirm this resource (Chevalier, 2000, p. 62.3).

After closing its operations in the Matagami district of northern Quebec with the exhaustion of the Isle Dieu and Norita East zinc-copper mines, Noranda (the operator) completed development of the $119 million Bell Allard zinc-copper mine, also in the Matagami district. The projected started underground operations in January 2000, which would counter the exhaustion of Isle Dieu and Norita East. The Bell Allard Mine was expected to have a capacity of 80,000 t/yr of zinc and 5,000 t/yr of copper. Armed with local experience from two closed mines, Noranda pressed exploration in the Matagami district for further discoveries of copper-zinc deposits (Giancola, 2000, p. 279).

Finally, Agnico Eagle Mines Limited will spend $104 million to complete the expansion of its LaRonde zinc mine in northwestern Quebec, which was expected to produce 52,000 t/yr of zinc in concentrates in early 2001 (Chevalier, 2000, p. 62.3).

Magnesium.—Noranda was pursuing an unusual venture—a $733 million plant to turn asbestos waste, which is cheap and plentiful, into magnesium metal, whose market price averaged just less than $2,500 per ton in 1999. The processing of asbestos commonly leaves tailings that are very rich in magnesium silicate. After successfully competing a 250-t/yr pilot operation, Noranda committed to the construction of a $486 million primary magnesium plant at Asbestos, Quebec, where 250 Mt of tailings will be the feedstock for a 58,000-t/yr throughput beginning in 2000. Magnola Metallurgy Inc. (Noranda, 80%, and Societe Generale de Financement du Quebec, 20%) will be the operator. By using a hydrochloric acid leaching process, the resulting magnesium chloride will be electrolyzed to yield magnesium metal. The plant was expected to reach full production capacity by yearend 2001 (Canadian Mining Journal, 1999; Wagner, 2000b, p. 31.1-31.2).

Cassiar Mines & Metals Inc. changed to Cassiar Magnesium Inc. on May 9, 2000, and held 100% interest in the chrysotile project in Cassiar, British Columbia (Giancola, 2000, p. 95). The company planned to complete a bankable feasibility study on its magnesium metal project by early 2001 and to bring its 100,000-t/yr plant into production by 2003. Metal will be extracted from a stockpile of 200 Mt of serpentine tailings that contains 4 Mt of recoverable magnesium metal. Cassiar entered into a memorandum of understanding with Aluminum of Korea Ltd. (Koralu). If Koralu finances the $600 million project, it could earn up to 65% equity (Metal Bulletin, 2000a).

Nickel.—Mine output increased by about 2.4% from that of 1999 with a corresponding huge increase of 48.1% in value of production, which reflected the higher realized price for nickel in world markets in 2000. Nickel was the most valuable metal (surpassing both gold and potash) produced in Canada during the year. Some of the increase in the value of nickel could be attributed to the higher value of production of the PGM, which almost doubled in 2000 (Natural Resources Canada, 2001b).

Falconbridge Ltd. operated four nickel-copper-cobalt mines near Sudbury, Ontario, and one in northern Quebec. The concentrate from the Craig, the Fraser, the Lindsley, and the Lockerby Mines in the Sudbury area and from the Raglan Mine in northern Quebec was smelted in the firm's smelter near Sudbury. The matte, which contained 50% nickel from the smelter, was shipped to Falconbridge's Nikkelverk refinery in Norway where nickel, copper, cobalt, and precious metals were recovered. The $360 million Raglan operation was scheduled to produce concentrates of about 20,800 t/yr of nickel and 5,200 t/yr of copper. Raglan concentrates were to be shipped from Deception Bay, which is 100 km north of the mine, to Quebec City and to continue by rail to Falconbridge's Sudbury smelter in Ontario (McCutcheon, 2000, p. 37.1).

In 2000, Inco Ltd. operated nickel mines, mills, smelters, and refineries in Sudbury, which produced 99,800 t, and in Thompson, Manitoba, which produced 34,000 t of nickel, as well as a copper smelter and refinery in Sudbury. Inco produced refined nickel and nickel oxide sinter.

Predictably, the world's biggest newsmaker in nickel continued to be Inco's nickel-copper-cobalt project at Voisey's Bay, where the saga, which involves exploration, environmental activism, aboriginal claims, financial straits, and provincial politics, continued to unfold. While the exploration program progressed in Labrador and at the Voisey's Bay site, other developmental problems (see the section on Environmental Issues) came to the fore. Inco announced in early 2000 that the hydrometallurgical research and development work will

continue. In 2000, proved reserves at the site totaled 32 Mt at a grade of 2.83% nickel and 1.68% copper; indicated resources, 91 Mt at a grade of 1.25% nickel and 0.59% copper; and inferred resources, 14 Mt at a grade of 1.00% nickel and 0.70% copper. Of the resources noted, 95 Mt at a grade of 1.24% nickel and 0.59% copper would be minable by underground mining methods, and 10 Mt at a grade of 0.92% nickel and 0.72% copper would be minable by open pit. No cobalt grades were released for the Voisey's Bay deposit (McCutcheon, 2000, p. 37.6). Existing plans had proposed the production of 15,000 metric tons per day (t/d) of concentrates, which would be shipped to a smelter-refinery complex at Argentia, where refinery output would be 122,500 t/yr. Total capital costs would exceed $1 billion.

Further negotiation, after world market pricing of nickel showed signs of improvement, could effect the tentative agreement on Inuit land claims after negotiations among the Government of Canada, the Government of Newfoundland and Labrador, and the Labrador Inuit Association. Nickel price improvements in 2000 may have removed one obstacle to successful negotiations with the Government of Newfoundland, but new low-cost lateritic nickel operations in Australia might influence any equation for settlement.

Sherrit International Corp. and General Nickel Company S.A. of Cuba entered into the joint venture Metals Enterprise; each company would have a 50% interest. Metals Enterprise operated a lateritic nickel-cobalt mine in Moa, Cuba. The oxides of Ni-Co are transformed into Ni-Co sulfides by leaching with sulfuric acid, which is shipped to Nova Scotia and then railed to Metals Enterprise's hydrometallurgical nickel-cobalt refinery in Fort Saskatchewan, Alberta (McCutcheon, 2000, p. 37.6).

About 120 km northeast of the town of Matagami, exploration in the Lac Rocher area by Nuinsco Resources Inc. found strong nickel/copper mineralization. This caused a staking rush into the region that included activity by junior and major mining companies.

Platinum-Group Metals.—Mine production of the PGM increased by about 11.3% compared with that of 1999; this closely reflected the significant increase in price owing to higher demand for use in autocatalysts in 2000 (Natural Resources Canada, 2001b). Most production has been from Inco's and Falconbridge's Sudbury mines and a smaller amount in Manitoba from Inco's Thompson Mine and by Hudson Bay Mining and Smelting and Outokumpo Mines Ltd.'s Namew Lake Mine near Flin Flon, which was being decommissioned.

As an approximation based on past experience, Inco's ratio of PGM produced worked out to about 12:7.6:1 for palladium, platinum, and rhodium, respectively. Although rhodium amounted to only slightly more than one-twentieth of the PGM, its prices have traditionally been significantly higher than those for other members of the group, having traded at more than $4,000 per ounce in recent years. The largest increase among the PGM was in the price of palladium, which more than doubled at the beginning of 2000. Canada ranked third behind South Africa and Russia in world PGM production (Hilliard, 2001a).

Silver.—Canada ranked fifth in world silver production after Mexico, the United States, Peru, and Australia (Hilliard, 2001b). Canadian silver production has been largely a coproduct of base-metal and gold mining and, therefore, subject to whatever mining incentive applies to the major product, whether gold, copper, and/or lead and zinc. Accordingly, silver output suffers when mines close or go on suspension for reasons that involve supply, demand, and pricing for the major mineral commodities. Production of silver in concentrate decreased by about 4.7% compared with that of 1999; the value of this production dropped by about 5.8% with a decline in silver prices. Silver production increased significantly starting in 1995 when Prime Resources Group Inc.'s Eskay Creek gold mine in British Columbia came on-stream as the largest producer of silver in Canada; output of silver from this mine alone has been projected to be 28% of the total for the entire country.

Titanium.—Output of titanium has risen to 950,000 t, which was an increase of about 12%, since 1997. QIT-Fer et Titane Inc. of Canada invested $260 million in the construction of a plant at Sorel, Quebec, to produce an upgraded titanium slag that contains 95% titanium dioxide (TiO_2) compared with its previous Sorel slag that contained 80% TiO_2. The company aimed for extraction of 3 Mt/yr of ore. Mine output was used primarily to produce titaniferous slag. Reserves and reserve base are ilmenite. Canada ranked third in world titanium production after Australia and South Africa (Gambogi, 2001).

Uranium.—After the previous upward trend in production of uranium oxide (U_3O_8) ended in 1998 with a decrease of 8% compared with 1997, the 1999 output dropped by 28%, and the 2000 production decreased by an additional 2.3%. Weakness of demand caused this precipitous drop, but uranium prices march to a different drummer, so to speak, and did not turn around in 1999-2000 as did the base metals and the PGM. As the world's leading supplier of uranium, Canada was well placed in terms of resources, reserves, mining labor experience, and technology to maintain this position amidst increasing longer term world demand in spite of weak prices during the year. As older mines were shut down in the Elliot Lake district of Ontario, newer ones were being developed and mined in the Cigar Lake, the Cluff Lake, the Key Lake, and the Rabbit Lake districts of Saskatchewan (table 2).

Industrial Minerals

Asbestos.—Canadian asbestos production and value decreased about 10.4% and 10.6%, respectively, compared with those of 1999 (Natural Resources Canada, 2001a). Owing to human health concerns, world production has declined since the early 1980s. After Russia, Canada was the second largest producer of asbestos, which includes the minerals chrysotile, crocidolite, and amosite in that order of importance (Perron, 2000; Virta, 2001). Total shipments for 1999 were estimated to be 345,000 t at a value of $162.5 million compared with revised shipment tonnage for 1998 of 321,330 t at a value of $167.4 million. China's asbestos production (almost exclusively short fibers for asbestos cement), which was rapidly gaining on that

of Canada and meeting demand in Asian markets, could eventually threaten Russia's leading position. Mounting concern regarding chrysotile substitutes was expected to benefit the chrysotile industry in the near to medium term. Marginal gains were expected in Latin American consumption of Canadian chrysotile; Asia, which was already a significant market (taking more than 50% of exports), was seen as expanding the demand for longer Canadian fibers. Asbestos-cement product demand was fairly steady because many users continued to favor this combination over substitute fibers and steel.

After a 6-year suspension of operations, the Cassiar asbestos mine of Cassiar Magnesium was slated to be put back into production by early 2000 and to expand production from 18,000 t/yr to 24,000 t/yr at a cost of $400,000 (Giancola, 2000, p. 95). By far the greatest proportion of Canadian asbestos production was in Quebec in the region that includes Thetford Mines of Bell Operations and the town of Asbestos. Principal operators were LAB Chrysotile Inc. and JM Asbestos Inc. The production of metallic magnesium from asbestos mine waste materials should improve the economics of the asbestos industry and create better overall labor expectations, particularly in Quebec, where decreased production has taken its toll.

Cement.—Production of cement remained about the same level as that of 1999 with a small increase in value of production of about 2.2%. Shipments of cement in 2000 were estimated to be 13 Mt at a value of $1.3 billion based on preliminary data. This compares with shipments of 12.6 Mt at a value of $1.2 billion in 1999 (Vagt, 2000; Natural Resources Canada, 2001a). This trend reflected continued strengthening of the export market in the midst of declined prices. Weakening of the Canadian dollar versus the U.S. dollar has made Canadian cement prices attractive to U.S. consumers. Canada has usually been the chief exporter of cement to the United States except for a brief period in the 1980s when Mexican shipments moderately exceeded those of Canada. The 1990 International Trade Commission ruling against the dumping of cement by Mexican producers essentially removed them as competitors and left the field to Canada as the principal foreign source. For the immediate future, the success of Canadian cement producers seems to be based significantly on exports to the United States and, hence, upon the prospects for U.S. economic growth. Canadian growth and construction, particularly in Ontario, which is the largest cement market, will play the key role in determining a balance between domestic and U.S. consumption.

The influx of Asian cement to the United States negatively affected Canadian exports between 1998 and 2000. Canadian shipments, however, remained at historically high levels. They have exceeded 5.3 Mt/yr for the past 5 years. The fact that Canada is the major exporter to the United States has kept Canadian cement kilns operating at high rates throughout the past decade and has allowed for gains in pricing (International Cement Review, 2000, p. 93-96).

Diamond.—Diamond was Canada's new best friend. The country's first commercial production of diamond by BHP Diamonds Inc., which was the majority interest holder and operator in the Ekati Mine [BHP, 51%; Dia Met Minerals Ltd. (Dia Met), 29%; Charles Fipke, 10%; and Stewart Blussom, 10%], began in October 1998 with project construction, which included such extensive support facilities as arctic living quarters and a powerplant. In 1999, output of the mining complex, the Ekati diamond mine, was 2.51 million carats valued at $606.3 million, which jumped to 2.6 million carats valued at $638.2 million in 2000 as operations gained in efficiency (Giancola, 2000, p. 130). The value of diamond production increased by 5.3% as the Ekati diamond mine completed its second full year of operations. BHP contracted to sell 35% of the Ekati's production to De Beers of South Africa through its subsidiary De Beers Canada Corporation (Giancola, 2000, p. 127). In 1999, De Beers' rough diamond sales to the United States increased by 56% to $5.24 billion from $3.34 billion in 1998. In June 1999, the first diamond-cutting and polishing factory in the Northwest Territories began commercial production. Sirius Diamonds N.W.T. owned and operated the factory, and BHP supplied rough diamonds (Law-West, 2000, p. 22-1; Natural Resources Canada, 2001a, b).

BHP officials reported that the quality of diamond recovered to date from the five kimberlite pipes at their Lac de Gras property compared favorably with the best pipes in other parts of the world; the property is about 300 km northeast of Yellowknife. The five pipes were located under Panda, Koala, Misery, Fox, and Leslie Lakes and would be mined during a 30-year period. The centralized processing plant, which is southwest of the Koala pit, was to receive 9,000 t/d of ore during the first 9 years of operation and 18,000 t/d thereafter. The cutoff grade would be 0.01 carat. Processing was expected to involve mainly crushing, scrubbing, and dense-media separation, as well as high-intensity magnetic separation, X-ray concentration, and sorting. The construction phase work force reached 1,000 at its peak; after that, about 650 workers were to be employed during production. Future output was projected to be 3 million to 4 million carats per year, or about 5% of the world's diamond supply. Capital investment was to be in excess of $360 million, but observers expected that at least $4 billion would eventually be spent in association with the project. As early as May, BHP noted that it would channel a portion of its production through the De Beers' Central Selling Organization (CSO). In July, De Beers Consolidated Mines Ltd. completed a sales contract to take 35% of Ekati's run-of-mine production for a period of 3 years.

In Canada, De Beers, through its prospecting subsidiary Monopros Limited (Giancola, 2000, p. 127), has discovered more than 220 kimberlites, several of which have the potential to become diamond mines, such as the Snap Lake project that will be in full production by 2004 at a cost of $1 billion. This project will be De Beers' first mine outside of Africa, the first underground mine in Canada, and the first time that a kimberlite dike will be mined on a large scale (Ralfe, 2001).

Diavik Diamond Mines Inc., which was the Rio Tinto PLC (60%) and Aber Resources Ltd. (40%) joint venture, proceeded with plans for a 2-Mt/yr operation beginning probably in 2001 or 2002. Located about 35 km southeast of Ekati and 300 km northeast of Yellowknife, the project would mine four separate kimberlite pipes with projected production that could reach 8 million carats per year in the first year of an estimated mine life of 16 to 22 years. At least 90% of Diavik's production would

be of gem quality. Throughout much of the year, the Diavik project awaited a decision by the Canadian Minister of the Environment to permit development. Following a favorable decision in November, the Diavik project then had to contend with the Canadian Department of Indian Affairs and Northern Development's decision not to issue an interim land-use permit for activities that would lead to development and operations. At yearend, Diavik prepared to suspend all work activities and to repatriate all workers not essential to care and maintenance. Frustration levels at this predicament were not only high at Diavik, but discernible throughout other parts of the Canadian mining industry.

More than 500 companies, off and on, have been exploring for diamond, especially in the Northwest Territories, but also in Alberta, British Columbia, Labrador, Manitoba, Ontario, Quebec, and Saskatchewan. The field seemed to be narrowing somewhat as various kimberlite pipes proved disappointing upon testing. Dia Met supported the establishment of a diamond- valuation facility in a community in the Northwest Territories to be used for training, basic sorting, and valuation for Government royalty purposes. This could lead to more-skilled and detailed sorting that would afford sales to qualified manufacturers in the northern region at prices, terms, and conditions similar to Dia Met's other marketing arrangements in Europe and with the CSO. The First Canadian Diamond Cutting Works in Montreal became Canada's first fully integrated cutting and polishing factory with the aim of handling Canadian diamond production at lower cost than European competitors; artisans were brought over from Belgium.

Gypsum and Anhydrite.—Production of gypsum and anhydrite increased to about 9.9 Mt in 2000 from 9 Mt in 1999. Production thus far in 2000, however, has not equaled the 1989 output of more than 12 Mt (Natural Resources Canada, 2001a).

Production has been mostly by Canadian subsidiaries of U.S. and British companies, such as USG Corp. and National Gypsum (Canada) Ltd., and governed by demand for wallboard in all building categories by consumers in the United States and Canada. Nova Scotia and Newfoundland produced the bulk of Canadian gypsum with lesser amounts from, in order of commodity value, Ontario, British Columbia, and Manitoba. Although gypsum occurs widely in Canada and the world, the high unit weight, low unit cost, and vulnerability to damage of wallboard combine to give gypsum products a relatively high place value, which discourages long-distance transportation. Instead, gypsum industries tend to develop in localities that serve developing construction requirements. As with the cement industry, gypsum production in Canada and the United States tends to develop in populous areas on both sides of the border in localized cross-border competition rather than among all the Provinces or all the States.

Production data for anhydrite are combined with those for gypsum but make up only about 2% or 3% of the total for the two materials. Heavier than gypsum and about twice as hard, anhydrite was produced in Nova Scotia by Fundy Gypsum Co. Ltd. at Wentworth and Little Narrows Gypsum Co. Ltd. at Little Narrows. In 2000, Canada was the world's third leading producer of gypsum after the United States and Iran (Olson, 2001).

Potash.—Potash production, which increased by about 7.5% compared with that of 1999, totaled 9.1 Mt of K_2O equivalent, and its value rose by 4.9% as increased production helped this boost. Most of the production came from mines in Saskatchewan, but about 5% came from New Brunswick. Canada led the world in potash production and had probably the largest reserve base of the material. Value of production increased to about $1.7 billion in 2000 from $1.6 billion in 1999; this reflected higher market prices (Natural Resources Canada 2001a, b). In 2000, Canada was the world's leading producer and exporter of potash. Most Canadian potash was shipped to the United States (about 55%), Asia (about 30%), Latin America (about 10%), and Oceania and Western Europe (about 5%). Exports to the United States have risen steadily to satisfy agricultural needs, but lower prices for grains during 1999 and decreased production in Canada and the United States diminished the requirement for fertilizers. Exports to Asia, which climbed owing to an increase in shipments to China, accounted for about one-third of all seaborne exports of potash from Canada.

On January 1, 2000, the U.S. International Trade Commission issued a termination notice for the antidumping suspension agreement against Canadian potash producers that had been in effect since 1988. The United States imported 4.3 Mt of potash, or 93% of its total needs, and was the dominant destination for Canadian potash in 2000 (Prud'homme, 2000, p. 41.3; Searls, 2001).

PCS was the largest publicly held potash producer in the world. PCS operated five mines in Saskatchewan and one underground mine and two mills in Sussex, New Brunswick. Its production milling capacity was estimated to be 8.2 Mt/yr of K_2O equivalent, which equated to 61% of Canada's total potash capacity (Prud'homme, 2000, p. 41.3).

Sulfur.—Production of all forms of sulfur increased compared with that of 1999. Sulfur from smelter gases climbed by 0.7% to 849,000 t with an accompanying decrease in value of about 5.8%. Output of sulfur from natural gas, crude oil, and byproducts decreased by about 1.6% to 8.5 Mt with an increase in value of 1.4% compared with those of 1999. Most smelter-gas sulfur is converted to sulfuric acid. No Canadian production was derived from Frasch mining (Natural Resources Canada, 2001a).

With a projected 17% share, Canada maintained its position as the world's second largest producer after the United States of sulfur and remained a leading exporter with roughly a 38% slice of world trade in sulfur. Most sulfur production is in Alberta, British Columbia, and Saskatchewan. Other provinces produce small amounts of sulfur, mostly from oil refineries (Morel-à-l'Huissier, 2000, p. 53.1).

Mineral Fuels

Coal.—Coal production reached 69.1 Mt, but was still declining from the record high of about 78.9 Mt in 1997 and down about 4.6% compared with that of 1999. The total value of production was $1.3 billion, which was down about 10.8%

compared with that of 1999 and about 16% compared with that of 1997 owing mainly to price declines and only slightly to a progressively lower conversion rate for the Canadian dollar (Natural Resources Canada, 2001a, b). In April, industry spokesmen noted that price slumps in hard coking coal for Japanese steel mill consumption were going to contribute to the worst export year in a decade for Canadian coal and that companies were going to have to be cutting, chopping, and bargaining on all fronts to keep mines open and operating. In 2000, fewer than 20 coal mines were operating in Canada, and the number was decreasing. At the same time, increased diversification and expansion into foreign markets were called for as a means to survival. In 2000, Canada produced 69.1 Mt of coal, which accounted for only about 2% of the world's coal production; it exported almost one-half of that production, thus making it the world's fifth largest exporter after Australia, the United States, China, and South Africa. All exports were from the western Canadian lower cost exporters, and metallurgical coal remained the country's major export (28.5 Mt). Domestic coal consumption remained high at about 58 Mt, and much of the eastern Canadian demand was being supplied by imports. The Appalachia region of the United States and the Cerrojón area of Colombia were supplying bituminous coal for the Canadian steel and electricity industries, and Western U.S. subbituminous coal was being delivered into Manitoba and Ontario. Imports of coal into Canada during 1999 were about 14 Mt, of which the United States supplied more than 8 Mt and Colombia furnished the remainder (Natural Resources Canada, 2000a).

Luscar Ltd., which was Canada's largest coal producer, intended opening the Cheviot Mine 65 km south of Hinton, Alberta, as a replacement for the nearly depleted Luscar Mine 42 km south of the town of Hinton, both mines in the foothills of the Rockies (Giancola, 2000, p. 245). A consortium of environmental groups led by the Sierra Club Legal Defense Fund vigorously opposed the Cheviot opening and won a preliminary ruling that Luscar's environmental assessment was incomplete. The previously approved Cheviot project was overturned, and the Sierra Club faction urged that the region shift from dependence on mining to other sources of income, such as tourism. Environmental air and climate change issues are priorities for coal mining companies and industries that use coal and will affect coal production and consumption in the future. The Zero Emission Coal Alliance (formed by coal companies and stakeholders and led by the Coal Association of Canada) has been pursuing long-term solutions to coal-related environmental issues and concerns (Natural Resources Canada, 2000a).

In eastern Canada, domestic supplies of coal generally have to be augmented by imports (mostly thermal coal from the United States), which put Canada in the unusual position of being a major exporter and a major importer of coal. This paradox reflects transportation costs between mines and consumers and is one more example of the natural integration of U.S. and Canadian interests in mineral commodities; others include cement and gypsum.

Natural Gas.—The values of natural gas ($27.6 billion) and natural gas byproducts ($5.3 billion) escalated by 94.3% and 109.1%, respectively, compared with those of 1999 as both products benefitted from supply-and-demand imbalances. Canada ranked third in the world after Russia and the United States in output of natural gas (Natural Resources Canada, 2001b). Increasingly, the production of natural gas has played a major role in the mineral economy of Canada and has had a palpable effect on the GDP. Gross output increased to about 210 billion cubic meters from 204 billion cubic meters in 1998. Production of marketed gas was 162 billion cubic meters compared with173 billion cubic meters in 1998; marketed gas is gross production minus reinjected gas, shrinkage, and producer consumption (plant use).

About 89.4 billion cubic meters of natural gas, or roughly 10% of the U.S. supply, was exported to the United States in 1998. Gas exports to the United States were expected to increase to about 100 billion cubic meters by 2006 in anticipation of the increasing inability of U.S. domestic production to meet demand. At the beginning of 1999, Canada's natural gas reserves were projected to be about 1.81 trillion cubic meters, which was a net decrease of 1.8% from the preceding year.

Spurred by increasing U.S. demand, exploration for new discoveries of natural gas continued the expansion, primarily in Alberta and Saskatchewan, that began at least two decades ago. Chevron Canada Resources Ltd., which was a unit of Chevron Corp., had one of the largest natural gas strikes in recent history near Fort Laird, Northwest Territories, where projections by the company showed between 11.3 billion and 17.0 billion cubic meters (400 billion and 600 billion cubic feet) of gas in place in more than 366 meters (1,200 feet) of pay zone. Accessing Canada's abundance of fuels, particularly oil in northern Alberta and natural gas in the Northwest Territories, has become economically feasible because of new technology and rising fuel prices. Opposition to natural gas exploration, production, and transmission, however, has grown in recent years. Environmental groups opposed construction of proposed pipelines to feed demand in the United States, and the Rocky Mountain Ecosystem Coalition attempted to slow the expansion of natural gas exploration and production activities in northern Alberta. In 2000, a National Energy Board report, which assessed supplies and demand to 2025, put known natural gas reserves in Canada's "northern frontier" at 680 billion cubic meters (24 trillion cubic feet) with estimated reserves at 4.8 trillion cubic meters (170 trillion cubic feet). The United States now consumes almost 609 billion cubic meters (21.5 trillion cubic feet) per year of gas with demand expected to grow by about 2% per year for the next 20 years (Washington Times, 2001b).

Petroleum, Crude.—Production of petroleum reached a new record high of 828 million barrels (Mbbl) in 2000 compared with 807.6 Mbbl in 1998; this was an increase of almost 7.7%. The value of this increased production climbed by a startling 68.5%, which reflected the worldwide effect on market pricing of the coordinated decrease in production by the exporting states of OPEC later in 1999 and in 2000. Value of the crude oil produced amounted to $31.5 billion, which was up from $18.7 billion in 1999 (Natural Resources Canada, 2001a, b).

After selling 30% of the integrated oil company PC, the

Government continued with privatization by offering much of the other 70% with the aim of reducing its share to perhaps 20%. During 1999, PC relinquished conventional crude production in western Canada in shifting its interest toward oil sands, natural gas, and offshore projects. The company was lauded as a model for state-owned oil company privatization and appeared to be expanding its revenues in upgrading by cost cutting and restructuring. It owned a 25% share of the immense Hibernia petroleum field offshore Newfoundland and a 25% share in Terra Nova field adjacent to Hibernia in the Jeanne d'Arc basin, for which PC can claim discovery. Terra Nova development began in mid-1999 with first production in 2000. After Terra Nova, the White Rose field, also in the Jeanne d'Arc basin, was eyed for development.

The Hibernia field, which is beneath 75 m of water, was earlier thought by its operators to contain perhaps 615 Mbbl of light waxy oil. The field was being developed in a $6.5 billion project by PC and a consortium of companies that included Mobil Oil Canada Ltd. (ExxonMobil), Chevron Canada Resources, and Murphy Oil Company Ltd.; large subsidies were provided by the Government. Production began in late 1997, which was ahead of schedule, with an output of 24,000 barrels per day (bbl/d). The offshore platform, which was put on location in early 1998, used new and unique technical design features to resist damage by icebergs. ExxonMobil, which owned 33% of the project, predicted that output will increase to 180,000 bbl/d and upped its reserve estimate for the Hibernia field to 750 Mbbl out of about 3 billion barrels (Gbbl) in place.

The Athabasca oil sands (bitumen) north of Fort McMurray, Alberta, played an increasingly important role in Canadian oil production. Output from bitumen plus synthetic crude was 215 Mbbl in 1999, which was about 27% of Canada's total production that year. Technological development and increased operating efficiencies have steadily reduced production costs by Suncor Energy Inc. and Syncrude Canada Ltd., which were the two major operators, at their sites in northern Alberta and Saskatchewan, respectively. Both of these operations, which accounted for more than one-fifth of Canada's crude oil, were in the process of substantial expansion. Suncor's operating costs at the Suncor oil sands plant in Alberta dropped from $15 per barrel in 1992 to below $12 per barrel in 1995 and was projected to drop to $9 per barrel in 1998. Hence, the crude from the Athabasca sands has sold for $6 or $7 more than the cost of production. Canada's National Energy Board predicted that the oil sands could contribute 50% of national production by 2010 (Steele, 2001).

The Athabasca, the Peace River, and other bitumen and heavy-oil deposits in Alberta amount to 2.5 trillion barrels of oil in place, which is about 40% of the world's known bitumen. As of 1996, the 300 Gbbl considered recoverable exceeded the 265-Gbbl reserves of Saudi Arabia, but the latter could be extracted for less than $1 per barrel. The Province of Alberta lowered its royalty on oil sand crude late in 1995 and stipulated that it be 1% on all production until companies pay off capital costs and earn a return that matches interest rates for long-term bonds. They would then pay a 25% royalty on each barrel produced.

Syncrude's North Mine expansion will increase bitumen production to support output of 260,000 bbl/d of synthetic crude oil. Further expansions will increase crude oil production to 460,000 bbl/d by 2007. Suncor's Steepbank Mine and New Millennium Mine will increase production by more than 80% as crude oil production increases to 220,000 bbl/d by 2003. The total capital investment in these large surface mines would be on the order of $6.25 billion from 1999 through 2007. The Athabasca oil sands mining region is positioned to become a hub of mining technology innovation and equipment advances that will have an impact on open pit mining worldwide (Natural Resources Canada, 2000b, p. 11).

Reserves

Table 3 lists the levels of Canadian reserves of copper, gold, lead, molybdenum, nickel, silver, zinc, and other selected mineral commodities on or about January 1, 2000. Data are shown in terms of metal contained in ore for the base and precious metals or recoverable quantities of other mineral commodities, which included industrial minerals and mineral fuels. These mineral reserves represent "proven" and "probable" categories and exclude quantities reported as "possible." Reserves were defined as being well-delineated and economically minable ore from mines committed to production.

Yearly changes in assessment of reserves are, in simplest terms, the arithmetic result of additions to reserves, deletions from reserves, and production. A complication in Canada is that a large number of mines produce more than one metal, thus necessitating close attention to market price and processing costs for two or possibly several mineral commodities simultaneously to enable production as coproducts.

Other than for gold, reserves of major metals fell steadily from 1977 through 1999. During this period, gold reserves trebled from about 500 t to more than 1,500 t as rising prices and the possibility of more price increases provided a strong incentive to exploration. Silver reserves, however, fell by 45% to less than 17,000 t from about 31,000 t during the same period.

In 1999, reserves of the leading base and precious metals decreased significantly. The only exception was nickel, which increased by 11%. Other metals declined—lead, 21%; molybdenum, 19%; copper, 7%; gold, 6%; silver, 6%; and zinc, 4%.

Reserves of major metals were distributed unevenly throughout Canada, and were influenced mostly by mineralization of the Precambrian shield, the Rockies (Cordillera), and the Coast Ranges. Several Provinces dominated the reserves position in terms of proven and probable minable reserves of major metals. From east to west, New Brunswick had 76% of the lead reserves, 35% of the zinc, and 25% of the silver; Quebec had 26% of the zinc, 20% of the gold, 18% of the silver, 10% of the nickel, and 9% of the copper; Ontario had 72% of the nickel, about 51% of the gold, 50% of the copper, 22% of the silver, and 18% of the zinc; Manitoba had 18% of the nickel, 6% of the zinc, and 4% each of copper and gold; and British Columbia had 100% of the molybdenum, about 35% of the copper, 32% of the silver, and 19% of the gold. Future discoveries will alter the distribution of reserves among Provinces.

Infrastructure

With a total land area of about 9,221,000 square kilometers, which is slightly larger than the United States, Canada had networks of highly developed infrastructure, as well as vast areas of trackless wilderness. The country had 910,000 km of roads that comprised 318,400 km of paved highway, which included 16,600 km of expressways, and 584,000 km of unpaved gravel or other loose-surface roads. Bulldozed temporary roads have been established for mining exploration in many remote places, but these deteriorate readily where not maintained.

A total of 36,114 km of standard-gauge railroads included two main systems, the Canadian National and the Canadian Pacific. The country also had about 3,000 km of inland waterways, which included the Saint Lawrence Seaway (one of the busiest in the world), that lead into the Great Lakes and mark the boundary with the United States in many places. Principal ports were Halifax, Montreal, Quebec, St. John (New Brunswick), St. John's (Newfoundland), and Toronto in the east and Vancouver on the west coast. Canada's merchant marine comprised about 114 ships of 1,000 or more gross registered tons.

The country had 1,411 airports. Among these, 515 had permanent-surface runways—16 had runways longer than 3,047 m; 16 runways from 2,438 to 3,047 m long; and 154 had runways from 1,524 to 2,437 m in length. Civil aviation included about 636 major transport aircraft; Air Canada was the major carrier.

Canada generated electrical power from coal, natural gas, and nuclear fuels, as well as massive hydroelectric facilities. Total capacity was roughly 114 gigawatts. About 550 net terawatthours, which was significantly less than capacity, was produced in 1996 (the last year for which complete data are available). Hydroelectric plants generated more than 63% of Canada's electricity; nuclear reactors, about 16%; coal, 15%; and crude oil and gas, 6%. Quebec and Ontario produced the most electricity, 154 and 141 megawatthours, respectively. Nearly 97% of Quebec's electricity came from hydroelectric plants, and the remaining 3% was produced mainly by nuclear facilities. In contrast, about 61% of Ontario's electric power was derived from nuclear plants, and the remainder, from hydroelectric and coal-fired plants. Most of Canada's electricity exports originated in New Brunswick, Ontario, and Quebec and was sold to consumers in New England and New York. British Columbia and Manitoba also exported large amounts of electricity, mainly to California, Minnesota, Oregon, and Washington. Except for Alberta, all Canadian Provinces that border the United States had transmission links to the neighboring systems.

An extensive system of pipelines connected oil- and gas-producing and consuming areas in Canada and the United States. The system was dominated by the Interprovincial Pipe Line, which delivered oil from Edmonton east to Montreal, Quebec, and the U.S. Great Lakes region, and the TransMountain Pipe Line, which delivered oil mainly from Alberta west to refineries and terminals in the Vancouver area, as well as to the Puget Sound area of Washington. Canadian natural gas was transported largely by TransCanada PipeLines Ltd. of Calgary, which owned 13,600 km of mainline gas pipelines in Canada, as well as 56 compressor stations that linked western Canadian gas producers with consumers in eastern Canada and the United States. Total Canadian pipeline network included about 24,000 km for crude oil and refined products and 75,000 km for transmission of natural gas. Alberta's network represents the greatest length for any Province (U.S. Central Intelligence Agency, 2000, p. 80-82).

Outlook

Mining continues to offer the prospect of diversifying and strengthening the Canadian economy. Canada's mineral industry is encouraged by a real commitment by the Federal Government to work with the sector to improve the permitting process. The goal is to allow exploration and mining companies to comply with the regulatory requirements in a timely and efficient way and at the same time to operate within high environmental and social standards. Progress is being made toward improving the regulatory regime in northern Canada. Government and industry are enthusiastic about the concept of a Northern Mines Ministers Conference to be held each year to report on progress, to identify challenges, and to network with all affected stakeholders to reestablish an attractive investment climate and to reverse any economic difficulties, in particular, of the Yukon Territories, after having been battered by economic and environmental factors (Excell, 2001).

Canada's dollar weakened slightly once more against the U.S. dollar; presumably this helped exports but discouraged imports of certain necessary commodities, specialized equipment, and ad hoc professional expertise. Increased exports boded well for credit markets, but equity markets, especially for junior mining companies, still suffered in the wake of the Bre-X scandal. Although the CSA has finalized the "Standards of Disclosure for Mineral Projects," which will be enacted into law across Canada in early 2001. This law will apply to all technical public disclosure on mineral projects and will require all technical disclosure based on the work of a QP. Demand for base metals in world markets strengthened after prices had been soft at a critical time for many companies, whether starting up or expanding, and relief was slow in coming. The increase of the value of metal production in 2000 after declining for the past 3 years can be attributed to a significant increase in the value of nickel production and higher value of production of the PGM, which almost doubled during the year because of the higher demand in autocatalyst usage. Palladium has tremendous value in a market where demand for PGM remains strong (Natural Resources Canada, 2001b).

The Canadian oil and natural gas industries continued to grow. The dramatic increases in prices for oil, natural gas, and natural gas byproducts were the consequence of supply and demand imbalances and higher prices were sustained by OPEC's reduced oil production. Canadian coal production declined as reduced demand led to the third consecutive year of lower output because of low world coal prices and will continue to endure competition with lower cost Australian coal in an oversupplied market (Morrison, 2000).

Exploration is reaching new levels of activity, and Canada is an expanding exporter to the United States of crude oil, natural

gas, and refinery products. After years of doubts concerning the feasibility of the Hibernia offshore oil project, it began production with the promise of rich payoffs to come. After Hibernia will come Terra Nova and White Rose fields in the Jeanne d'Arc basin; others will be tested. Comparisons continue to be heard between the Canadian offshore and the development of the now-legendary North Sea fields.

The nickel-copper-cobalt discovery at Voisey's Bay makes an impressive case for more exploration in Canada, no matter how attractive the situations in Asia, Australia, and/or Latin America. Furthermore, new prospects are found for gold in many parts of Canada even though current (2000) market pricing promises little encouragement for the near future.

The concerted effort to reconcile conflicting interests in the formulation of policy concerning ownership, aboriginal issues, mining development, environmental constraints and remediation, social instabilities, and economic necessity in furthering the concept of sustainable development has been difficult to assess or predict. Active engagement of these issues will probably help provide outcomes that would support the future of the mining industry.

Despite declining reserves, Canada is well positioned in terms of its mineral-resource base and its access to markets in the United States and the rest of the world. Canada's mineral industry is primarily export oriented with as much as 90% of the production of some commodities going to world markets. The United States should continue to be a major market for Canada's metals and minerals. In this regard, the industry's export capability is enhanced significantly by a lower exchange rate for the Canadian dollar.

Canada cannot escape the realities of growing international competition, especially from mineral-rich developing countries that have liberalized economic and political systems to attract foreign investment; Canada's greatest long-term asset may be the achievement of a popular consensus in support of sustainable development that respects the interests of mining companies, First Nation peoples, and the preservation of the environment.

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TABLE 1
CANADA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1996	1997	1998	1999	2000 p/
METALS						
Aluminum:						
Alumina, gross weight	thousand tons	1,060	1,165	1,229	1,233	1,200 e/
Primary: Metal		2,283,210	2,327,188	2,374,118	2,389,835	2,373,460
Antimony 3/		1,773	630	428	357 r/	364
Arsenic trioxide e/		250	250	250	250	250
Bismuth 3/		150	196	219	311	202
Cadmium:						
Mine output, Cd content 3/		1,771	1,471	1,361	1,390	1,095
Metal, refined		2,433	2,260	2,090	1,911 r/	2,024
Calcium	kilograms	W	W	W	W	W
Cobalt:						
Mine output, Co content 3/		5,714	5,709	5,861	5,324	5,300 e/
Metal:						
Shipments 4/		2,150	2,168	2,262	2,015	2,013
Refined, including oxide		3,601	3,792	4,415	3,972 r/	4,091
Columbium and tantalum:						
Pyrochlore concentrate:						
Gross weight		5,160	5,090	5,110	5,140 r/	4,820
Nb content		2,320	2,290	2,300	2,313 r/	2,170
Tantalite concentrate:						
Gross weight		220	196	228	208	217
Ta content		55	49	57	66 r/	69
Nb content		11	10	11	13 r/	14
Copper:						
Mine output, Cu content 3/		685,926	659,500	703,245	581,583 r/	623,451
Electrowon		2,500	2,700	1,800	--	--
Total		688,426	662,200	705,045	581,583 r/	623,451
Metal:						
Smelter:						
Primary, blister		529,349	529,525	553,133	542,439	542,400
Secondary and scrap		83,344	96,957	71,338	66,782	66,800
Total		612,693	626,482	624,471	609,221	609,200
Refined:						
Primary		477,500	464,000	489,941	476,079 r/	480,900
Secondary		81,700	99,300	72,635	72,484 r/	71,300
Total		559,200	563,300	562,576	548,563 r/	552,200
Gold, mine ouput	kilograms	166,378	171,376	165,599	157,617 r/	153,781
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand tons	34,400	37,277	37,808	33,900 r/	35,707
Fe content	do.	21,911	24,914	24,082	21,650 r/	22,744
Metal:						
Pig iron	do.	8,638	8,679	8,937	8,783	8,780
Direct-reduced iron	do.	1,420	1,391	1,240	920	920
Ferroalloys, electric arc furnace: e/						
Ferrosilicon	do.	56	56	56	56	56
Silicon metal	do.	26	30	30	30	30
Ferrovanadium	do.	1	1	1	1	1
Total	do.	83	87	87	87	87
Crude steel	do.	14,735	15,554	15,930	16,300	1,600 e/
Lead:						
Mine output, Pb content		257,253	186,234	189,752	162,180 r/	152,765
Metal, refined:						
Primary		192,877	139,736	129,750	137,172 r/	145,640
Secondary		117,914	131,659	135,737	129,243 r/	137,212
Total		310,791	271,395	265,487	266,415 r/	282,852
Lithium, spodumene e/		22,000	22,500	22,500	22,500	22,500
Magnesium metal, primary e/		54,000	57,700	77,109	80,000 e/	80,000 e/
Molybdenum, mine output, Mo content		8,097	8,223	8,469	6,250 r/	6,833
Nickel:						
Mine output, Ni content 3/		192,649	190,529	208,302	176,749 r/	181,027
Refined 5/		130,136	131,639	146,755	124,260	134,225

See footnotes at end of table.

TABLE 1--Continued
CANADA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1996	1997	1998	1999	2000 p/
METALS--Continued						
Platinum-group metals, mine output	kilograms	14,668	12,459	16,408	13,872 r/	15,439
Selenium, refined 6/	kilograms	694,000	592,000	398,000	359,000	350,000
Silver						
Mine output, Ag content	do.	1,308,758	1,223,983	1,195,943	1,174,000 r/	1,161,000
Refined	do.	1,402,983	1,322,779	1,579,030	1,246,000 r/	1,188,000
Tellurium, refined 6/	do.	59,000	59,000	62,000	64,000 r/	80,000
Titanium Sorel slag e/ 7/		825,000	850,000	950,000	950,000	950,000
Uranium oxide (U_3O_8)		13,784	14,174	12,896	10,157 r/	9,919
Zinc:						
Mine output, Zn content		1,222,388	1,076,385	1,061,645	963,321 r/	935,686
Metal, refined, primary		716,467	703,798	745,131	776,927 r/	787,527
INDUSTRIAL MINERALS						
Asbestos		506,000	455,000	302,000	337,000 r/	320,000
Barite		58,000	77,000	90,000	123,000 r/	67,000
Cement, hydraulic 8/	thousand tons	11,587	11,736	12,124	12,634 r/	12,612
Clay and clay products 9/	value, thousands	$80,834	$105,269	$91,579	$164,718 r/	$175,449
Diamond	carats	--	--	300,006	2,429,000 r/	2,558,000
Diatomite e/		10,000	10,000	10,000	10,000	10,000
Gemstones, amethyst and jade		294	394	136	218 r/	200
Gypsum and anhydrite	thousand tons	8,202	9,117	8,967	9,345 r/	8,548
Lime 8/	do.	2,402	2,477	2,514	2,565 r/	2,547
Magnesite, dolomite, brucite e/		180,000	180,000	180,000	180,000	180,000
Mica, scrap and flake e/		17,500	17,500	17,500	17,500	17,500
Nepheline syenite		606,000	647,000	636,000	676,000 r/	703,000
Nitrogen, content of ammonia		3,839,600	4,081,000	3,899,900	4,134,900	4,135,000 e/
Potash, K_2O equivalent	thousand tons	8,120	8,989	9,201	8,475 r/	9,107
Pyrite and pyrrhotite, gross weight e/		5,000	5,000	5,000	5,000	5,000
Salt	thousand tons	12,248	13,534	13,296	12,686 r/	11,935
Sand and gravel	do.	213,831	225,419	229,780	242,369 r/	246,331
Silica (quartz) 10/	do.	1,558	1,896	1,905	1,702 r/	1,946
Sodium compounds, n.e.s.:						
Sodium carbonate (soda ash) e/	do.	300	300	300	300	300
Sodium sulfate, natural 11/	do.	323	326	320	305	305
Stone 12/	do.	92,449	120,953	129,057	130,226 r/	136,789
Sulfur, byproduct:						
Metallurgy	do.	789	801	836	843 r/	849
Petroleum	do.	8,329	8,280	8,404	8,656 r/	8,515
Total	do.	9,118	9,081	9,240	9,499 r/	9,364
Talc, soapstone, pyrophyllite	do.	77	73	71	79 r/	86
MINERAL FUELS AND RELATED MATERIALS						
Carbon black e/		165,000	165,000	165,000	165,000	165,000
Coal:						
Bituminous and subbituminous	thousand tons	65,006	67,034	63,596	60,834 r/	58,025
Lignite	do.	10,854	11,653	11,790	11,663 r/	11,124
Total	do.	75,860	78,867	75,386	72,497 r/	69,149
Coke, high-temperature	do.	3,357	3,370	3,142	3,307	3,307
Gas, natural:						
Gross	million cubic meters	198,107	199,422	204,022	190,912 r/	195,457
Marketed	do.	153,578	156,842	173,359	162,219 r/	166,078
Natural gas liquids:						
Pentanes plus	thousand 42-gallon barrels	61,832	67,439	68,370	67,735	67,700
Condensate	do.	1,944	2,735	2,827	2,930	2,900
Total	do.	63,776	70,174	71,197	70,665	70,600
Peat		901,000	100,100	1,132	1,180 r/	1,194

See footnotes at end of table.

TABLE 1--Continued
CANADA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1996	1997	1998	1999	2000 p/
MINERAL FUELS AND RELATED MATERIALS--Continued						
Petroleum:						
Crude 13/	thousand 42-gallon barrels	739,814	770,275	807,612	768,934 r/	827,959
Refinery products:						
Propane; butane; naphtha; LPG 14/	do.	26,454	15,265	14,990	12,700 e/	13,700 e/
Gasoline:						
Aviation	do.	789	726	933	790 e/	850 e/
Other	do.	245,618	254,386	256,372	218,000 e/	235,000 e/
Petrochemical feedstocks	do.	33,137	33,746	33,530	28,500 e/	30,800 e/
Jet fuel	do.	32,048	33,935	34,953	29,700 e/	32,100 e/
Kerosene	do.	18,446	3,106	1,995	1,700 e/	1,800 e/
Distillate fuel oil, diesel and light	do.	184,738	201,737	196,511	167,000 e/	180,000 e/
Lubricants including grease	do.	6,344	8,478	7,884	6,700 e/	7,200 e/
Residual fuel oil, heavy	do.	41,999	47,477	50,736	43,100 e/	46,500 e/
Asphalt	do.	19,586	24,938	26,007	22,100 e/	23,900 e/
Petroleum coke	do.	7,416	7,122	7,207	6,200 e/	6,700 e/
Unspecified	do.	21,144	25,114	26,489	22,500 e/	24,300 e/
Refinery fuel and losses 15/	do.	25,172	24,491	25,601	21,800 e/	23,500 e/
Total	do.	662,891	680,521	683,208	581,000 e/	613,000 e/

e/ Estimated. p/ Preliminary. r/ Revised. W Withheld. -- Zero.

1/ Estimated data have been rounded to no more than three significant digits; may not add to totals shown.

2/ Table includes data available through May 7, 2001.

3/ Metal content of concentrates produced.

4/ Cobalt content of all products derived from Canadian ores, which includes cobalt oxide shipped to the United Kingdom for further processing and nickel-copper-cobalt shipped to Norway for refining.

5/ Nickel contained in products of smelters and refineries in forms which are ready for use by consumers. Natural Resources Canada has revised all refined nickel figures to conform with International Nickel Study Group guidelines.

6/ From all sources, which include imports and secondary sources. Excludes intermediate products exported for refining.

7/ Refined Sorel slag has been upgraded to 95% titanium dioxide.

8/ Producers' shipments and quantities used by producers.

9/ Includes bentonite products from common clay, fire, stoneware clay, and other clays. Values are in current Canadian dollars.

10/ Producers' shipments of quartz.

11/ Excludes byproduct production from chemical plants.

12/ Crushed, building, ornamental, paving, and similar stone.

13/ Including synthetic crude (from oil shale and/or tar sands).

14/ Liquefied petroleum gas.

15/ Refinery fuel represents total reported production of still gas, which includes a small amount sold.

TABLE 2
CANADA: STRUCTURE OF THE MINERAL INDUSTRY IN 2000

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	Alcan Aluminum Ltd.	Smelter, Laterriere, Quebec	204.
Do.	do.	Smelter, Isle-Maligne, Quebec	73.
Do.	do.	Smelter, Beauharnois, Quebec	48.
Do.	do.	Smelter, Shawinigan, Quebec	84.
Do.	do.	Smelter, Grande-Baie, Quebec	180.
Do.	do.	Smelter, Arvida, Quebec	232.
Do.	do.	Smelter, Kitimat, British Columbia	272.
Do.	Aluminiere de Becancour Inc. (Pechiney Corp., 25%; Quebec Government, 24.95%)	Smelter, Beacancour, Quebec	360.
Do.	Canadian Reynolds Metals Co. Ltd. (Reynolds Metals Co., 100%)	Smelter, Baie-Comeau, Quebec	400.
Do.	Aluminerie Alouette Inc. [Vereinigte Aluminium-Werke (VAW), Germany, 20%; Corus Group plc, the Netherlands, 20%; Austria Metall (AMAG), Austria, 20%; La Société Générale de Financement, Canada, 20% Kobe Steel, 13.3%; Marubeni Corp., 6.7%; Japan, 3.7%]	Smelter, Sept-Iles, Quebec	218.
Do.	Aluminerie Lauralco Inc. (Alumax Inc.of the U.S.)	Deschambault, Quebec	215.
Asbestos	Lac d'Amiante du Quebec, Ltee (LAQ) (Jean Dupere, President of LAB Chrysotile, Inc.; Connell Bros. Co. Ltd.)	Black Lake, Quebec	160 (fiber).
Do.	Bell Operations (Mines D'Amiante Bell)	Thetford mines, Quebec	70 (fiber).
Do.	JM Asbestos Inc.	Jeffrey mines, Asbestos, Quebec	250 (fiber).
Cement	Lafarge Canada Inc.	Bath, Ontario	1,045 (dry-process).
Do.	do.	Exshaw, Alberta	1,029 (dry-process).
Do.	do.	Kamloops, British Columbia	194 (dry-process).
Do.	do.	Richmond, British Columbia	474 (wet-process).
Do.	do.	St. Constant, Quebec	991 (dry-process).
Do.	do.	Brookfield, Nova Scotia	527 (dry-process).
Do.	St. Lawrence Cement Inc. (Independent Cement Inc.)	Joliette, Quebec	991 (dry-process).
Do.	do.	Mississauga, Ontario	1,876 (wet and dry).
Do.	ESSROC Canada Inc.	St. Basile, Quebec	1,124 (dry-process).
Do.	North Star Cement Ltd.	Corner Brook, Newfoundland	152 (dry-process).
Do.	Federal White Cement Ltd.	Woodstock, Ontario	170 (dry-process).
Do.	St. Marys Cement Corp.	Bowmanville, Ontario	1,550 (dry-process).
Do.	do.	St. Marys, Ontario	645 (dry-process).
Do.	Inland Cement Ltd. (S.A. Cimenteries CBR)	Edmonton, Alberta	726 (dry-process).
Do.	Tilbury Cement Ltd. (S.A. Cimenteries CBR)	Delta, British Columbia	1,040 (dry-process).
Coal	Quinsam Coal Corp. (Hillsborough Resources Ltd., 63%; Marubeni Corp., 33%; remainder unknown, 4%)	Quinsam coal mine, Campbell River, British Columbia	14,400 (open pit and underground).
Do.	Cape Breton Development Corp. (Government of Canada, 100%)	Sydney, Nova Scotia	22,000 (longwall).
Do.	Luscar, Ltd.	Obed Mountain Mine, Hinton, Alberta	3,500.
Do.	Gregg River Resources Ltd. (Gregg River Coal Inc., 60%; 7 Japanese companies, 40%)	Gregg River Mine, Hinton, Alberta	3,960 (open pit).
Do.	Manalta Coal Ltd. (Transalta Utilities Corp.)	Highvale Mine, Seba Beach, Alberta	11,610 (open pit).
Do.	Smoky River Coal Ltd. (Smoky River Holdings Ltd., 100%)	Grande Cache, Alberta	3,600 (open pit and underground).
Copper	Cassiar Mining Corp. (Princeton Mining Corp., 100%)	Similcom Mine, Princeton, British Columbia (suspended, 1996)	9,000.
Do.	Falconbridge Ltd. (Noranda Inc. 50%; Trelleborg AB, 50%)	Sudbury operations, Sudbury, Ontario	4,250.
Do.	do.	Strathcona and Timmins operations, Timmins, Ontario	4,860.
Do.	do.	Smelter, Timmins, Ontario	440.
Do.	Gibraltar Mines Ltd.	McLease Lake, British Columbia (suspended)	29.

See footnote at end of the table.

TABLE 2--Continued
CANADA: STRUCTURE OF THE MINERAL INDUSTRY IN 2000

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper--Continued:	Highland Valley Copper (Cominco Ltd., 50%; Rio Alom Ltd., 33.6%; Teck Corp., 13.9%; Highmont Mining Co., 2.5%)	Logan Lake, British Columbia (suspended)	4,500.
Do.	Inco Ltd.	Thompson District, Manitoba	Variable (polymetallic).
Do.	do.	Smelter, Sudbury, Ontario	500.
Do.	do.	Refinery, Sudbury, Ontario	170.
Do.	Noranda Inc.	Smelter, Thompson, Manitoba	686 (projected).
Do.	do.	Mines Gaspe, Murdochville, Quebec	4,000 (ore).
Do.	do.	Horne Smelter, Noranda, Quebec	770.
Do.	Huckleberry Mines Ltd. (Princeton Mining Corp., 60%; Japanese consortium, 40%).	SE of Houston, British Columbia	33,000 (Cu contained).
Diamond carats	Dia Met Minerals Ltd. (BHP Diamonds Inc., 51%; Dia Met Minerals Ltd., 29%; Charles Fipke and Stuart Blossom, 20%)	Ekati Mine, Lac de Gras region, Northwest Territories	1,350,000.
Gold	Barrick Gold Corp.	Holt-McDermott Mine, Harker Twp., Ontario	405 (ore).
Do.	do.	Bosquet Mines 1 and 2, NW Quebec	954 (ore).
Do.	do.	Macassa Mine, Teck Twp. N. Ontario	473 (ore).
Do.	Princeton Mining Corp.	Similco Mine, Princeton, British Columbia (suspended)	450 (kilograms metal).
Do.	Echo Bay Mines Ltd.	Lupin Mine, Contwoyo Lake; Northwest Territories (suspended)	612 (ore).
Do.	Royal Oak Mines Inc.	Giant Mine, Yellowknife, Northwest Territories	407 (ore).
Do.	do.	Giant mill--tailings, Yellowknife, Northwest Territories	3,265 (ore).
Do.	Hemlo Gold Mines Inc. (Noranda Inc., 44.1%)	Golden Giant Mine, Hemlo, Ontario	1,080 (ore).
Do.	Placer Dome Inc.	Campbell Mine, Red Lake, Ontario	584 (ore).
Do.	do.	Detour Lake Mine, Northeast Ontario	1,278 (ore)
Do.	do.	Dome Mine, South Porcupine, Ontario	9.8 (tons metal).
Do.	do.	Sigma Mine, Val d'Or, Quebec Kiena Mine, Val d'Or, Quebec	730 (ore).
Do.	Teck-Corona Corp. (Teck Corp., 100%)	David Bell Mine, Hemlo, Ontario	456 (ore).
Graphite	Strategic Exploration Inc.	Kearney Lake, Ontario	W.
Gypsum	Atlantic Gypsum Resources Inc.	Fischell Brook, St. George's, Newfoundland	1,300.
Do.	Georgia-Pacific Corp.	River Denys, Sugar Camp, Nova Scotia	1,460.
Do.	Little Narrows Gypsum Co. Ltd. (USG Corp., 100%)	Little Narrows, Nova Scotia	1,640.
Do.	National Gypsum (Canada) Ltd. (Aancor Holdings Corp., 100%)	Milford, Nova Scotia	3,300.
Do.	Westroc Industries Ltd.	Windermere, British Columbia	1,170.
Iron and steel	Iron Ore Company of Canada (North Ltd., 56.1%; Mitsubishi Corp., 25%; Labrador Iron Ore Royalty Income Fund, 18.9%)	Carol Lake, Labrador	8,800 (concentrate), 10,300 (pellets).
Do.	Quebec Cartier Mining Co. (Dofasco Inc., 50%)	Mount Wright, Quebec	16,950 (concentrate), 7,500 (acid pellets), 657 (sinter).
Do.	Dofasco Inc.	Hamilton, Ontario	3,642 (pig iron), 4,500 (crude steel).
Do.	Wabush Mines (Stelco Inc., 37.9%; Dofasco Inc., 24.2%; Cliffs Mining Co., 22.8%; Acme Steel Co., 15.1%)	Wabush, Labrador, and Pointe Noire, Quebec	6,200 (concentrate).
Lead	Brunswick Mining and Smelting Corp. Ltd. (Norada Inc., 63.3%)	No. 12 Mine, Bathurst and smelter in Belledune, New Brunswick	72 (Pb contained).
Do.	Hudson Bay Mining and Smelting Co., Ltd. (Minorco, 100%)	Flin Flon and Snow Lake, Manitoba	60 (Pb-Zn contained).
Do.	Cominco Ltd. (Teck Corp. 36.34%)	Trail, British Columbia	95 (refined lead).
Do.	do.	Sullivan Mine, Kimberly, British Columbia	3,600 (ore).
Do.	do.	Polaris Mine, Cornwallis Island, Northwest Territories	1,000 (ore).

See footnote at end of the table.

TABLE 2--Continued
CANADA: STRUCTURE OF THE MINERAL INDUSTRY IN 2000

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Lead--Continued:	Breakwater Resources Ltd.	Nanisivik Mine, Baffin Island, Northwest Territories	785 (ore).
Limestone	Lafarge Canada Inc.	Steep Rock, Manitoba	906 (quarry).
Do.	Atlantic Industrial Minerals Inc.	Iris Cove, Sydney, Nova Scotia	720.
Do.	Inland Cement Ltd. (CBR Materials Corp.)	Cadomin, Alberta	2,160.
Do.	do.	do.	2,160 (quarry).
Do.	Havelock Co. (Kickenson Mines Co., 100%)	Havelock, New Brunswick	864 (limestone).
Do.	Continental Lime Ltd.	Faulkner, Manitoba	1,440 (crushed stone).
Molybdenum	Huckleberry Mines Ltd. (Princeton Mines Corp., 60%; Japanese consortium, 40%)	SE of Houston, British Columbia	635 (Mo contained).
Nickel	Falconbridge Ltd. (Noranda Inc., 46.4%; underwriting syndicate, 28.3%)	Fraser, Lockerby, Onaping, and Strathcona, Sudbury district, Ontario	30 (metal contained).
Do.	do.	Raglan mine, Ungave, Quebec	21 (metal contained).
Do.	do.	Smelter, Falconbridge, Ontario	45 (rated capacity).
Do.	Inco Ltd.	Sudbury, Ontario, district mines: Frood, Stobie, Creighton, Copper Cliff North and South, Garson-Offsets, McCreedy East and West, Coleman, Crean Hill, and Totten in Sudbury district, Ontario	106 (metal contained).
Do.	do.	Smelter, Sudbury, Ontario	110 (metal contained).
Do.	do.	Refinery, Sudbury, Ontario	57 (metal contained).
Do.	do.	Refinery, Port Colborne, Ontario	30 (metal contained).
Do.	do.	Thompson, Birchtree Mines in Manitoba	62 (metal contained).
Do.	do.	Smelter, Thompson, Manitoba	82 (metal contained).
Do.	Sherritt International Corp.	Refinery, Fort Saskachewan, Alberta	24 (metal contained).
Petroleum: 1/			
Gas million cubic meters	BP Canada Inc. (The British Petroleum Co. PLC London, 100%)	Noel Area, northern Alberta; Chauvin, Sibbald, North Pembina, Alberta	47.
Crude million 42-gallon barrels	do.	do.	12.
Do. do.	Gulf Canada Corp. (Olympia & York Developments, 80%; Gulf, 20%)	Fenn-Big Valley, Swan Hills, Goose River, Peerless, and Sene, Alberta	18.
Do. do.	Home Oil Co. Ltd. (Interhome Energy Inc., 100%)	Red Earth, Garrington, Cherhill, Medicine River, and Swan Hills, Alberta	11.5.
Gas billion cubic meters	do.	do.	1.8.
Crude thousand 42-gallon barrels	Imperial Oil Ltd. (ExxonMobil Corp., USA, 70%; others, 30%)	Judy Creek, Cold Lake, Alberta; Mackenzie Delta, Beaufort Sea, Yukon Territory and Northwest Territories	670.
Gas million cubic meters	do.	do.	36.4.
Crude million 42-gallon barrels	Mobil Oil Canada Ltd. (ExxonMobil, Corp., USA, 100%)	Hibernia, Grand Banks, Southeast of Newfoundland and Sable Island, Nova Scotia, and others in Alberta	26.1.
Gas billion cubic meters	do.	do.	3.0.
Crude million 42-gallon barrels	Norcen Energy Resources Ltd. (Hollinger Inc., 59%; Hees International, 41%)	Pembina, Bodo, Majorville, Alberta	12.1.
Do. do.	Oakwood Petroleums Ltd. (Sceptre Resources Ltd., 100%)	Grantham, Hays Ronalane, Peace River, Normandville, Randell, Alberta, and Grizzly Valley, British Columbia	24.6.
Do. do.	PanCanadian Petroleum Ltd. (Canadian Pacific Enterprises, 87%; others, 13%)	Rycroft, Wembley, Elk Point, Rio Bravo, Alberta	19.7.
Gas billion cubic meters	do.	do.	3.53.
Crude million 42-gallon barrels	Shell Canada Ltd. (Shell Investments, 79%; others, 21%)	Dimsdale, Little Smoky Lake, Sousa, Alberta, Midale, Benson, Saskatchewan	22.2.
Gas billion cubic meters	do.	do.	6.53.
Crude million 42-gallon barrels	Suncor Inc. (Sun Co. Inc., United States, 75%; Ontario Energy Resources, 25%)	Kidney, Zama Lake, Cosway, Albersun Prevo, and Medicine River, Alberta, and Leitchville, Unwin, Saskatchewan	4.1.
Crude thousand 42-gallon barrels	Texaco Canada Petroleum Inc. (Texaco Inc., United States, 78%; others, 22%)	Eaglesham, Virgo, Alberta, and Desan, British Columbia	158.
Gas million cubic meters	do.	do.	67.3.
Crude million 42-gallon barrels	UNOCAL Canada Ltd. (UNOCAL Corp., United States, 100%)	Calgary, Alberta	14.7.

See footnote at end of the table.

TABLE 2--Continued
CANADA: STRUCTURE OF THE MINERAL INDUSTRY IN 2000

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Potash (K_2O equivalent):	Potash Corp. of Saskatchewan Inc. (private, 37%; Provincial government, 63%)	Lanigan, near Lanigan, Saskatchewan	3,828 (KCl).
Do.	do.	Rocanville, southeast Saskatchewan	2,295 (KCl).
Do.	do.	Allan Division, Allan, Saskatchewan.	5,256 (KCl).
Do.	International Minerals & Chemical Corp. (Canada) Ltd. (IMC Fertilizer Corp., 100%)	Esterhazy, southeast Saskatchewan	951 (KCl).
Do.	Agrium Products Inc.	Vanscoy, Saskatchewan	1,750 (KCl).
Salt and brine operations	The Canadian Salt Co.	Pugwash, Nova Scotia	1,400 (rock salt and brine salt).
Do.	do.	Iles-de-la-Madeleine, Quebec	1,625 (rock salt).
Do.	do.	Ojibway, Ontario	2,600 (rock salt).
Silver	Prime Resources Group Inc.	Eskay Creek Mine, British Columbia	340.
Do.	Breakwater Resources Ltd.	Caribou Mine, Bathurst, New Brunswick	7.5 (tons mill feed).
Do.	Kinross Gold Corp.	Macassa Mine, Ontario	438 (mill feed).
Do.	Barrick Gold Corp.	Bousquet Mine, Quebec	876 (mill feed).
Do.	Similco Mines Ltd.	Princeton, British Columbia (on suspension)	8,250 (Ag-Au-Cu concentrate).
Sodium chlorate production using salt	Dow Chemical Canada Inc. (Dow Chemical Co. Michigan, United States, 100%)	Fort Saskatchewan, Alberta	524 (caustic soda).
Do.	do.	Sarnia, Ontario	350 (caustic soda).
Do.	General Chemical Canada Ltd.	Amherstburg, Ontario	363 (sodium carbonate).
Sulfur:			
Petroleum refinery capacities	Consumer's Cooperative Refineries Ltd. (Federated Cooperatives Ltd., 100%)	Regina, Saskatchewan	54.
Do.	Esso Petroleum Canada (Exxon Mobil Corp., 100%)	Sarnia, Ontario	50.
Do.	Sulconam Inc. (Petro Canada, 7.6%)	Montreal, Quebec	108.
Main sulfur extraction plants (sour gas and oil sands)	Amoco Canada Petroleum Co., Ltd. (Amoco Corp. USA, 100%)	East Crossfield-Elkton, Alberta	650.
Do.	Canadian Occidental Petroleum, Ltd.	East Calgany-Crossfield, Alberta	610.
Do.	Chevron Canada Resources Inc. (ChevronTexaco Corp. USA, 100%	Kaybob South III, Alberta	1,281.
Do.	Husky Oil Ltd.	Ram River, Ricinus, Alberta	1,646.
Do.	Shell Canada Ltd.	Waterton, Alberta	1,120.
Principal SO_2 and H_2SO_4 productin capacities	Canadian Electro Zinc Ltd. (CEZ) (Noranda Inc., 90.17%)	Valleyfield, Quebec	430 (H_2SO_4).
Do.	Inco Ltd.	Copper Cliff, Ontario	950 (H_2SO_4).
Do.	Falconbridge Ltd. (Noranda Inc., 50%; Trelleborg AB, 50%)	Kidd Creek, Ontario	690 (H_2SO_4).
Do.	ESSO Chemical Canada (ExxonMobil Corp., 100%)	Redwater, Alberta	910 (H_2SO_4).
Uranium	Cogema Resources Inc.	Cluff Lake , Saskatchewan	1,815 (metal).
Do.	Cameco Corp.	Key Lake, Saskatchewan	6,395 (oxide).
Do.	do.	Rabbit Lake, Saskachewan	5,445 (oxide).
Zinc	Breakwater Resources Ltd.	Nanisivik Mine, Baffin Island, Northwest Territories	53 (Zn contained).
Do.	Brunswick Mining and Smelting Corp. Ltd. (Noranda Inc., 100%)	Bathurst, New Brunswick	232 (Zn in concentrate).
Do.	Falconbridge Ltd. (Noranda Inc., 49.9%)	Timmins operations, Ontario	212 (Pb-Zn contained).
Do.	do.	Smelter, Timmins, Ontario	133 (slab zinc).
Do.	Hudson Bay Mining and Smelting Co., Ltd. (Minorco, 100%)	Snow Lake concentrator, Manitoba	1,125 (Pb-Zn ore).
Do.	do.	Flin Flon Mine and smelter, Manitoba	85 (slab zinc).
Do.	Cominco Ltd. (Teck Corp, 36.34%)	Sullivan Mine, Kimberley, British Columbia	70 (Pb-Zn contained).
Do.	do.	Smelter, Trail, British Columbia	300 (slab zinc).

W Withheld to avoid disclosing company proprietary data.

1/ Projections of annual capacity involve matching decline curves against later discoveries and are generalized extrapolations only based on data presented in the Canadian Oil and Gas Handbook, 1991 and subsequent years. Ownership of various companies and proportionate participation in various leaseblocks and/or joint ventures changes continually. The ownership proportions shown here must be considered to be illustrative only.

TABLE 3
CANADA: RESERVES OF MAJOR MINERALS IN 2000

(Thousand metric tons unless otherwise specified) 1/

Commodity		Reserves	
Asbestos, fiber		35,700	e/
Coal, all types		6,220,000	e/
Copper		8,400	
Gold	metric tons	1,415	2/
Gypsum		482,000	e/
Iron ore		1,261,000	e/
Lead		1,845	
Molybdenum		121	
Natural gas	billion cubic meters	1,810	e/
Nickel		5,700	
Petroleum crude	million barrels	4,930	e/
Potash, K_2O equivalent	metric tons	13,990	e/
Salt	thousand short tons	264,000	e/
Silver	metric tons	15,738	
Sodium sulfate	thousand short tons	81,300	e/
Sulfur		130,000	e/
Uranium		416	3/
Zinc		10,200	

e/ Estimated.

1/ As reported in 1998 and 1999 "Canadian Minerals Yearbook," Natura
Resources Canada, except for natural gas and petroleum crude.

2/ Excludes metal in placer deposits.

3/ Recoverable at prices of $100 or less per kilogram of uranium.