

# THE MINERAL INDUSTRY OF CANADA

By David B. Doan

Canada's gross domestic product (GDP) during 1995 reached \$622.4 billion,<sup>2</sup> an increase of about 2.5% over that of 1994, while the total value of production of all mineral commodities exceeded 5% of GDP, up from a corresponding figure of about 4% the year before. This was a robust performance by the mineral industry of Canada that boded well for the future of this sector of the national economy. For most of 1995, the economy, as well as the entire nation, had been concerned over the prospect of secession by the Province of Quebec from the remainder of Canada. The country was troubled by "...high debt, an intrusive public sector, sky-high taxes, and a weak currency"<sup>3</sup> and facing the spectre of default on its debt, according to various academicians, if Quebec delivered a "Yes" vote on secession. Things turned out otherwise by a narrow margin, but this was enough to provide positive impetus to the currency and credit markets for a relatively strong fourth quarter. Unit labor costs and payrolls turned around during the year, exports as a proportion of real GDP were up smartly, Government spending decreased further, and employment in the public sector turned down sharply. Lifted by improved productivity, strong U.S. demand, and the Free Trade Agreement, exports rose to 42% of the GDP. Overall, the economy strengthened to a degree that engendered forecasts that the Canadian dollar would reach parity with the U.S. dollar by the end of the decade.

Higher prices were a significant factor in the mineral sector, especially in the base metals, which helped to revive exploration and production. Moreover, exploration for diamond spread to most of Canada, with prospects identified all the way from the Northwest Territories to Quebec. In Labrador, diamond prospectors happened across a gossan, or strongly oxidized surface zone, capping what has emerged as a huge nickel-copper-cobalt deposit at Voisey Bay, where drilling results confirmed an unusually large, high-grade ore body that excited great interest in the mining world. Although a steady stream of Canadian mining companies has entered Central America and South America, where the welcome has been reassuring, such discoveries as Voisey's Bay reaffirmed that there is much still to be explored in Canada. Outlay for 1995 exploration costs amounted to about \$458 million, up sharply from the \$348 million spent the previous year. The total area covered by mineral claims totalled 16 million

hectares, equal to 160,000 square kilometers (km<sup>2</sup>).

Environmental concerns continued to influence mineral exploration and development activity throughout Canada, leading some companies to look elsewhere for projects. Latin America beckoned, as companies became aware of countries where foreign investment was welcomed, mining laws were seemingly coherent and reasonable, and profits could be repatriated. In the meantime, however, under the rubric of sustainable development, Canada mounted a strong effort to reconcile the disparate views of the mining industry, the Federal Government, Provincial interests, the economy, environmentalists, the First Nation or aboriginal peoples, the social infrastructure, and requirements for materials. It is not yet clear how these interests will react with one another, nor whether a complete equilibrium will ever be achieved, but efforts thus far reflect great effort by the many entities that are striving to preserve the Canadian mineral industry.

## Government Policies and Programs

Primary jurisdiction over mineral resources in Canada is exercised by Provincial governments. Exceptions have been the Yukon Territory and the Northwest Territories which, while still under the resource-management control of the Federal Government, were slowly moving toward greater powers.

Federal and Provincial policies (though not entirely consistent between Provinces) are generally stable and have traditionally favored research and information services relating to the mining industry. The Federal Government had negotiated multiyear Mineral Development Agreements with Provincial governments that fund initiatives intended to strengthen the mining industry in each region. One of these is a Canadian Geoscience Information Center to provide centralized access to technical information on the geology of Canada.

Although new environmental assessment legislation was passed in 1992, the Government has been deliberate in producing regulations implementing the new laws. One subsequent measure, however, was tax deductibility for funds set aside for cleanup of closed mine sites, thus complementing emerging Provincial reclamation requirements.

The recent shift of international mining investment away

from Canada has prompted industry representatives to urge changes in both regulation and taxation of the mining industry. For example, the industry has been critical of the complex regulatory process for approving new mines in the Province of British Columbia, where mining has traditionally been a major activity. The eventual disapproval of the Windy Craggy project, with a potential value of billions of dollars and untold significance to the Provincial economy, shocked the companies involved and registered poorly with the mineral industries across Canada. Although the Province itself promised to speed up the mine approval process, the national situation was brought into sharp focus in 1995 by the huge nickel-copper-cobalt discovery at Voisey's Bay. A media consensus held that the Governments have come to realize that if this project, with its immense potential, does not go forward, then no project will.

Meanwhile, the Government of British Columbia announced an arrangement to compensate Royal Oak Mines Inc. for the loss of the Windy Craggy project. Royal Oak would receive some \$29 million in cash as well as other complex considerations relating to the development of another deposit in the Province, that essentially cost tax dollars to the Province and precluded the possibility of mining the deposit for the foreseeable future.

### **Environmental Issues**

Natural Resources Canada published a paper, "Sustainable Development and Minerals and Metals",<sup>4</sup> that probed deeply the plethora of issues relating to exploration, mining, reclamation, recycling, toxicities, energy efficiencies, the roles of industry and Government, assessment of risk, mineral access and tenure, social infrastructure, and international linkages in science and technology. Designed to stimulate thinking by tackling environmental considerations head-on, the paper represented a move toward the amicable organization of policy between factions as well as the establishment of commonality in terms of reference within the issues involved. Although this publication was only a first step in the reconciliation of interests, it seemed to represent a substantial response politically, technically, and socially to the environmental problems facing not only Canada but much of the remainder of the world.

Meanwhile, the Supreme Court of Canada upheld Ontario's rigorous Environmental Protection Act, rejecting arguments that wording of the law was too vague. As approved, the law forbids the release of any contaminant that "causes or is likely to cause impairment of the quality of the natural environment for any use that can be made of it." This suggested such imponderables as how to define terms in this law so as to accept the application of salt to icy roads but preclude any release of greenhouse gases into the atmosphere by snowplows.

A study prepared for Federal and Provincial energy ministers projects that it would cost Canada's petroleum refineries more than \$3 billion to meet new environmental standards aimed at limiting greenhouse gas emissions. Changes to gasoline formulation and emissions standards would add about 8 cents to the cost of a liter of gasoline, or about \$0.30 per gallon.

Having shut down the multibillion-dollar Windy Craggy copper-gold-silver-zinc-cobalt mine development in northern British Columbia two years ago, environmental forces were mobilizing to do the same thing to Huckleberry Mines Ltd.'s \$120-million copper-gold-molybdenum-silver mine development near Smithers, British Columbia. A group calling itself the "Canadian EarthCare Society" charged that the Huckleberry project was being rushed to approval in secret dealings to which the media and public were excluded. However, Environmental Assessment Office authorities stated that meetings were proceeding in an orderly way, being closed to the public only to permit frank and open discussion, and that minutes of all meetings were available. At that, they estimated that any approval of the project would not come before late 1996.

### **Production**

Total value of 1995 production of all mineral commodities, including mineral fuels, amounted to \$31.62 billion, an increase of about 5.4% over that of the previous year.

Copper production in 1995, at 729,000 metric tons (t), climbed by more than 23% compared with that of the previous year. Silver output, although quantitatively smaller, increased a conspicuous 61% beyond that of the previous year. Gold, nickel, and zinc mine production registered gains of 1.8%, 17.5%, and 12% respectively. Generally higher base-metal prices since 1994 resulted in improvement in overall production value such that increases in volume of production were eclipsed by greater relative increases in value of production.

The value of production for the metals group overall, \$8.74 billion, showed an increase of 23% over that for the previous year. The total value of production for the nonmetallic group and structural minerals, at \$2.07 billion and \$1.90 billion, respectively, showed increases over the previous year of 8.8% and 1.1%, respectively, in 1995.

Based on value of production, the top nonfuel commodities in 1995 were copper (\$2.04 billion), gold (\$1.82 billion), nickel (\$1.46 billion), zinc (\$1.17 billion), potash (\$1.09 billion), and iron ore (\$870 million). Among the fuels, coal added \$1.38 billion to the value of production. As in previous years, the fluid hydrocarbons led the field of all mineral products, petroleum crude production having reached a value of \$11.24 billion. Natural gas output, at a value of

\$4.987 billion, was down sharply from the previous year. (See table 1.)

## Trade

As the world's greatest exporter of minerals and metals, Canada enjoyed benefits to its economy from its mineral industry that included a significant contribution to its trade surplus position, and hence to its merchandise trade balance, as well as major support of the national standard of living. Mineral and mineral-product exports, including fuels, totalled \$44.66 billion in 1995, an increase of about 14.8% over the comparable figure for 1994. Metals registered 58% of the increase in exports, fuels accounted for about 29%, nonmetals about 9%, building materials about 1.8%, and other minerals about 2.2%.

Value of exports of nonfuel minerals (but including coal) was \$29.2 billion for 1995, representing an increase of 16.2% over the previous year. Included in these exports were crude minerals, smelted and refined products, and semifabricated and fabricated products. Prominent among the crude minerals exported were iron ore, potash, and sulfur to the United States; copper concentrates to Japan; iron ore and zinc concentrates to the European Union (EU); smelted and refined metals, including 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, including fuels, were valued at \$29 billion, amounting to about 17.6% of the value of all imports by Canada in 1995. In terms of net trade, a \$20.4-billion surplus was gained for minerals, including fuels, for the year.

Total trade between the United States and Canada exceeded that of any other two countries in the world, amounting to \$147 billion in 1995. This was down about 2% from 1994 but represented greater diversification of Canada's export markets.<sup>5</sup>

## Structure of the Mineral Industry

The Canadian mineral industry comprised as many as 3,000 domestic and perhaps 150 foreign companies. Companies whose corporate voting rights were at least 50% non-Canadian were considered foreign, although other distinctions could apply in some large companies. About 320 mine sites were active, including coal but excluding sand, gravel, and other construction materials. At least 40 smelters were in operation, as well as other processing plants in the iron and aluminum industries that were not smelters in the usual sense. Foreign companies were subject to the same taxes as domestic companies, but repatriation of earnings was unimpeded.

As a whole, the Canadian mineral industry was privately owned, with the exception of some Government participation in potash and petroleum, but even these were in transition to private ownership. Some companies, such as Potash Corp. of Saskatchewan Inc. and Saskatchewan Oil & Gas Corp., were owned in part by the Province of Saskatchewan. Moreover, the Province of Alberta owned part of Alberta Energy Co. Ltd. Although the proportion of Government ownership was changeable, the trend was toward privatization. Petro-Canada was owned partly by Federal and partly by Provincial Governments but was expected to become completely privatized. A large proportion of the total number of mining and petroleum companies was partly public-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 mines, open pits, leaching operations, concentrators, smelters, and refineries, as well as drilling and production operations characteristic of the petroleum industry. Table 2 depicts the structure of the mineral industry by sectors of the major mineral commodities.

Employment in the mining and mineral manufacturing industries has stabilized after a decline that began in 1989, when the number of jobs in those industries peaked at 422,000. Preliminary employment estimates by Statistics Canada for 1995 indicated that total employment in mining and mineral manufacturing, including coal, was about 341,000, up 4% from that of 328,000 in 1994.

The total number of employees in metal mining, nonmetal mining, quarrying, and coal mining was estimated by Statistics Canada at 61,000, an increase of 3.6% over that of 1994. Employment in nonferrous smelting and refining was estimated at 59,000, up about 4.3% from 1994. Altogether, the mining, smelting, and refining sectors, with an estimated 120,000 jobs, showed a net gain of about 3.9% compared with the previous year. About 9,800 people were also employed in diamond drilling and other support services incidental to mining operations.

## Commodity Review

### Metals

**Aluminum.**—Canadian production of primary aluminum in 1995 was 2.172 million metric tons (Mt), a decrease of about 3.7% from the previous year. This put Canada third, after the United States and Russia, in the world in volume of production.

Alcan Aluminum (Alcan) realized increased revenues in 1995 in spite of a \$420-million write-down of its Kemano hydroelectric power project near Kitimat, British Columbia, which had been languishing for several years since the beginning of the decade. The \$1.4-billion project was the

second phase of Alcan's hydroelectric development of the Nechako River system and was scheduled to add 540 megawatts (MW) to Alcan's Kemano generating station, upgrading capacity from 896 MW to 1,436 MW. Construction had been halted pending an appeal filed by Alcan to a court ruling providing for an independent environmental review. The company had initiated the project in the first place only after previous environmental reviews and changes to meet Federal and Provincial requirements. Plans were to sell excess power to the British Columbia Hydro Power Authority until such time as Alcan decided to add additional smelting capacity. However, in January 1995, British Columbia's Government announced its intention to cancel the half-built Kemano project following the public release of the British Columbia's Utilities Commission's review of the undertaking. After due consideration, Alcan had little choice but to take the write-down of its losses.

After postponing an investment of \$729 million to double its smelter's capacity, Aluminerie Alouette announced that, in 1996, it will begin a 3-year shift from carbon to graphitized cathodes costing about \$27 million. This would increase the smelter's capacity from 218,000 tons per year (t/yr) to 229,000 t/yr by boosting the current from the present 218,000 amperes to 315,000 amperes.

**Cobalt.**—Production of refined cobalt reached 3,092 t in 1995, a modest increase from the previous year but neglecting output, if any, from the new \$15-million production facility near Cobalt, Ontario, established by Ego Resources Inc. Ego has developed a proprietary hydrometallurgical process for extracting cobalt from ore, tailings, or mine spoil that involves crushing, grinding, flotation, and solvent extraction. Pure cobalt is then further treated to produce simple salts such as cobalt carbonate. At midyear, the company announced a startup output rate of 300 to 500 pounds [(136 to 227 kilograms (kg)] per day, aiming for 1,600 pounds (727 kg) per day upon reaching capacity. They added that their process has been endorsed by the Ontario Government as consistent with its "green" industries strategy demonstrating that resource development can coexist with environmental responsibility.

**Copper.**—Mine output of copper increased 23% in 1995, reflecting a dramatic reversal of the previous downtrend of world copper prices. Production of primary refined copper dropped 15% in 1995 as a consequence of the drop in mine production in 1994. At that time metal prices had been soft enough that a number of mines were temporarily closed in British Columbia, reopening again in 1995.

Noranda Mining and Metals Group planned to spend \$7 million at its Mines Gaspé copper mine in Quebec to develop the new E-34 ore body, whose minable reserves are projected at more than 1 Mt grading between 3% and 4% copper. An

estimated 33,400 t of copper would be extracted, extending the mine life well into 1999. Noranda further announced that it would build a \$3-million pilot plant for recovery of copper from stockpiled oxide ore using a solvent extraction-electrowinning (SX/EW) process. Subsequently, over 9 years, a full-scale SX/EW plant would produce about 8,000 t/a of copper cathode at Mines Gaspé. A subsidiary, Noranda Metallurgy Inc., planned an \$8-million concentrate-drying and concentrate-injection system that would increase the capacity of its Gaspé smelter from 85,000 t/yr to 110,000 t/yr of copper.

It may be noted that although the SX/EW technique for copper production leads to significant cost savings, all byproduct credits are lost in the process. The revenue flow is thus completely dependent on the price of copper. Canada's many polymetallic copper deposits, normally conferring a so-called risk-reduction advantage as byproduct prices help buoy the revenue stream, lose this benefit during SX/EW operations.

In preparation for a 30th anniversary celebration of the Kidd Creek operation at Timmins, Ontario, Falconbridge Ltd. announced that in drilling downward from their 68 Level (6,800 feet) in the deepest part of the mine, they encountered a copper stockwork, or "feeder" system, between the future 78 Level and the 98 Level that comprises massive sulfides grading 3% copper, 4.8% zinc, 0.85% lead, and 180 grams silver per ton over an estimated average horizontal width of 50 m, plus another 50 meter (m) width of lower-grade material.<sup>6</sup>

The Voisey's Bay discovery, still being evaluated, suggested that Canada, ranking third after Chile and the United States, will continue to be a major world copper producer.

**Gold.**—Reversing 3 consecutive years of decline, gold production turned around during 1995 and increased to 149 t from the 146 t produced the year before, leading observers to predict that production will reach approximately 170 t by 1998. The pitch of exploration seemed to increase steadily, with various innovations in the chemistry and physics of search techniques supporting the effort both in Canada and by Canadian companies in other countries. Canada was the fourth largest gold producer behind South Africa, the United States, and Australia. There were about 50 primary gold mines in Canada at the beginning of 1995, accounting for 91% of the gold produced, with the remainder coming from basemetal mines (6.5%) and placer operations (2.5%). Total employment in primary gold mines totaled 8,800 in 1993; 8,600 in 1994; and 8,900 in 1995. Employment figures in the gold industry had been declining steadily from the 1988 peak of 12,600 but turned around in 1993.

The Eskay Creek gold mine in northwestern British Columbia, owned by Prime Resources Group, started

production in January 1995 at a rate of 6 t/yr of gold. The mine was one of the highest grade precious-metal deposits in the world, according to the company, with reserves of 1.1 Mt, grading 66 grams per metric ton (g/t) of gold and 2,930 g/t of silver. The ore also contained 5.6% zinc and 0.77% copper. Also in British Columbia, Kinross Gold began mining the QR deposit, having reserves of 1.3 Mt grading 4.7 g/t gold, and projected production at the rate of 1.7 t/yr for 6 years, evidently in the expectation of discovering additional reserves.

In the Yukon Territory, Loki Gold readied its Brewery Creek project to begin producing in 1996 at a rate of 2.5 t/yr utilizing heap leaching from reserves of 16 Mt grading 1.5 g/t gold. Cameco and Uranerz Exploration and Mining saw the beginning of production at their Contact Lake Mine, Saskatchewan, at a rate of about 2 t/yr from reserves of 1.6 Mt grading 9.6 g/t gold.

In Manitoba, Rea Gold finished its reevaluation of the old San Antonio Mine at Bissett, which has already produced more than a million ounces (31.1 t) according to mining records held by the former owners. Rea carried out a sampling program after pumping out all the levels of the mine, which is more than a mile deep. Reserves are projected at 3.2 Mt grading 9 g/t, and production is anticipated starting in 1997. Also in Manitoba, TVX Gold Inc. and High River Gold Mines Ltd. started production at a rate of about 3 t/yr, from reserves of 4.2 Mt grading 6 g/t gold, in a joint venture to reopen the old Nor-Acme mine 125 kilometers (km) east of Flin Flon.

In Ontario, production was started at the relatively small Eagle River mine, owned by Eagle River Gold Mines, where reserves are projected at 800,000 t but with a grade of 14.1 g/t gold to justify the effort. Eagle expects to produce 1.3 t/yr. Elsewhere in Ontario, in the realm of low-grade production at higher throughput, Placer Dome began production at the Dome open pit mine that has reserves of 32.5 Mt grading 2.4 g/t gold. Mill capacity was increased from 3,800 tons per day (t/d) to 9,100 t/d. Adjacent to the Dome mine, the Paymaster mine began production in 1995 and became part of the Dome complex. Production is projected to increase overall from 6 t/yr to 10 t/yr.

In Quebec TVX and Golden Knight Resources announced plans to develop the Principale deposit at a cost of at least \$22 million. Production at the Casa Berardi complex, currently 3 t/yr, was programmed to increase to 4.5 t/yr by the end of 1996. MSV Resources had started production at the Eastmain mine at a rate of 1.6 t/yr, but problems obtruded to the extent that production targets were not met and operations were suspended. Aurizon Mines and Beaufort Mines initiated production at the Beaufort mine with the expectation of reaching an output of 1 t/yr.

Summing up, gold seemed to be the principal targeted metal for exploration virtually throughout Canada. In terms

of value of production in Canada, gold was second only to copper in 1995.

**Iron Ore.**—Canadian production of iron ore climbed in 1995 to 38.28 Mt compared with output in 1994 of 36.42 Mt for a difference of about 5%. This category comprised concentrates, pellets, and sinter from hematite and siderite ores. Major iron-ore producing companies included Quebec Cartier Mining (QCM), Iron Ore Company of Canada (IOC), Wabush Mines, and the Algoma Ore Division (AOD) of Algoma Steel Inc.

QCM produced 16.1 Mt of ore in 1995, 0.1 Mt more than in 1994. Of this, 8.3 Mt, more than one-half, was used for pelletization; the remainder went to 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.

Attention turned to exploration and development in various parts of Canada, including Roche Bay in the Northwest Territories; the Peace River area of Alberta; and at Ungava Bay and Schefferville, both in Quebec.

Pig iron production recovered somewhat from a low output of 8.15 Mt in 1994 to reach a slightly more than 8.46 Mt in 1995, an increase of about 4%. Production of direct-reduced iron was projected at roughly one-tenth of the tonnage of pig iron output. Crude steel production was 14.4 Mt compared with 13.9 Mt in 1994, turning out to be the highest in 5 years, but not equalling the 15.5 Mt of 1989.

**Lead and Zinc.**—Canada was the world's largest mine producer of zinc and the fifth largest producer of lead in 1995 with a total of 1.111 Mt of zinc and 210,415 tons of lead in concentrates, in both cases an increase over 1994 output. Lead, in particular, was up sharply in showing an increase of 26% compared with production the previous year, while zinc showed a parallel gain of 10%.

The Faro mine in the Yukon, which had been closed in 1993, was purchased by Anvil Range Mining Corp. after completing the necessary financing to reopen the mine. Stripping of the Grum deposit at Faro began late in 1994, and commercial production began in 1995. By August it had reached its capacity of 150,000 t/yr of zinc and 98,000 t/yr of lead in concentrate. These concentrates were shipped from the Port of Skagway, Alaska, beginning in September 1995.

Noranda went ahead with development of its Bell Allard zinc-copper project near Matagami in northern Quebec. After construction of surface facilities, the shaft will be sunk and underground workings undertaken. The projected startup in 1998 would coincide with exhaustion of the Noranda operations at Isle Dieu and Norita East, also in the Matagami

district. Bell Allard is expected to have a capacity of 80,000 t/yr of zinc and 5,000 t/yr of copper.

**Nickel.**—Canadian mine output of nickel in 1995 rebounded strongly from that of the previous year to about 181,000 t of contained nickel, an increase of 21% compared to production in 1994. That year's low figure was primarily due to production cuts by Inco Ltd. during the first quarter of the year while coping with labor problems in the midst of soft market prices.

For most of 1995, the biggest news in nickel was the Voisey's Bay nickel-copper-cobalt discovery by Diamond Fields Resources Inc. (DFR) on the coast of Labrador. After 210 exploratory drill holes were completed by the end of the year, a preliminary projection of reserves, relating only to the main ("ovoid") zone, showed 31.7 Mt grading 2.83% nickel, 1.68% copper, and 0.12% cobalt at a total stripping ratio of 0.36:1. But this was not the whole story, as further drilling to eastward, in the "Eastern Deeps" zone, showed even larger targets that in some cases included thicknesses of several hundred m of massive and disseminated sulfide mineralization. By yearend, there were estimates of at least 100 Mt of ore.<sup>7</sup> It was clear that this discovery would affect the economics of nickel production and marketing for some time to come. Also by yearend, Inco had acquired a 30% combined direct and indirect interest in DFR.

Inco's \$53-million development program at its new Victor deposit near Sudbury included a 1,768-m exploration shaft, scheduled to be completed by 1998. Inco has also started development work at the McCreedy East Mine near Sudbury, expected to produce 10,000 t/yr of contained nickel and 35,000 t/yr of contained copper by 1999.

Falconbridge Ltd. obtained environmental approval for its Raglan nickel-copper property in northern Quebec. The \$350-million operation is scheduled to produce about 20,000 t/a of nickel in concentrate and about 5,000 t/a of copper in concentrate by mid-1998.

Sherritt Inc. formed a separate company, Sherritt International, to pursue its contract with Cuba to set up an enterprise to mine, refine, and market nickel and cobalt internationally. Sherritt's Fort Saskatchewan refinery in Alberta and Cuba's Moa Bay nickel and cobalt concentration plants were included in the joint-venture agreement.

**Platinum-Group Metals.**—Mine production of platinum group metals (PGM) increased by 11% compared with output in 1994. Canadian production data for these metals represent captive recovery from nickel ore rather than response to market demand. Most Canadian production has been by Inco and Falconbridge from their Sudbury mines plus a smaller amount in Manitoba from Inco's Thompson mine, the HBMS Namew Lake mine, and Outokumpo Mines Ltd. near Flin Flon.

As an approximation based on past corporate reports, Inco's ratio of PGM produced worked out to about 12 : 7.6 : 1 for the group members palladium : platinum : rhodium. Although rhodium thus amounted to only slightly more than one-twentieth of the PGM, its prices have traditionally been significantly higher than for other members of the group, having reached \$4,000 per ounce at one point in the past decade. In 1995, however, rhodium prices dipped to levels only slightly higher than those of gold.

PGM recovery is expected to continue in new nickel mining in the Sudbury district. Inco's Victor discovery contains an estimated 18 Mt grading 11.6 g/t PGM plus gold. The McCreedy discovery contains 5 Mt grading 10.6 g/t PGM plus gold.

**Silver.**—Mine output of silver in concentrate jumped sharply upward in 1995 to a 62% increase over production of the previous year, reaching 1,245 t. This was the highest turnout since 1991, when production equalled 1,339 t, and reflected new mines coming on-stream more than any lasting price incentives in world markets.

Canadian silver production has been largely a coproduct of base metal mining or gold mining, subject to whatever mining incentive applies to the major product, whether, gold, copper, or lead-zinc. Accordingly, silver output suffers when mines close or go on suspension for reasons involving supply, demand, and pricing for other major mineral commodities. A significant addition to production occurred in 1995 when Eskay Creek gold mine in British Columbia came on-stream as the largest producer of silver in Canada, with an expected annual production of 340 t. At yearend, United Keno Hill Mines Ltd. announced plans to reopen the Belle-Keno and Silver King mines in the Yukon Territory, which were shut down in 1989. Total cost would be almost \$9 million, but together the mines were thought capable of producing 125 t/yr to 155 t/yr for about 5 years.

### ***Industrial Minerals***

**Asbestos.**—During 1995, Canadian asbestos mines operated at an average of 96% of capacity, while prices increased by about 3%, but preliminary data for the year indicated a drop in output of between 2% and 3% compared with that of 1994.

Increasing concern regarding chrysotile substitutes were expected to benefit the chrysotile industry over the near- to medium term. Marginal gains were expected in Latin American consumption of Canadian chrysotile; but Asia, already a significant market by taking up about 58% of exports, was seen as expanding its demand for Canadian fibers. The U.S. Bureau of Mines estimated that Canadian asbestos imports into the United States in 1995 were about 23,000 t compared with 26,000 t in 1994. Asbestos-cement

product demand was consistent as many users continued to favor this combination over substitute fibers and steel.

Quebec's LAB Chrysotile, the largest producer in Canada, was to be closed at some indeterminate time according to announcements in May, 1995. The future of the mine hinged on the results of an exploration program that was already underway so that a decision might be made sometime in 1996. At JM Asbestos Inc., after mine workers invested \$2 million in their company and the Government of Québec guaranteed a \$25 million loan for the purpose, its development phase was completed and the company contemplated a change from an open pit operation to underground mining.

At Cassiar, British Columbia, a joint-venture group comprising Mineral Resources Corp. (formerly Cliff Resources), Strategic Investments, and Black Hill Minerals Ltd., after investing \$1.8 million in preparatory work for the construction of a wet milling pilot plant, would need at least \$7 million for construction of a full-scale plant for operation in 1997.

**Cement.**—Canada's 1995 production of cement increased about 1% over that of the prior year, reflecting continued strengthening of the export market in the midst of declining cement prices since 1978 if valued in 1986 dollars.<sup>8</sup> Weakening of the Canadian dollar versus the U.S. dollar since the beginning of the nineties, especially in early 1995, has made Canadian cement prices attractive to U.S. consumers across the border at time when domestic consumption withered in the face of diminishing residential and nonresidential construction. Canada has always been the chief exporter of cement to the United States, except for a brief period in the 1980's when Mexico moderately exceeded Canadian shipments. The 1990 International Trade Commission ruling against dumping of cement by Mexican producers essentially removed them as competitors, leaving the field to Canada as the principal foreign source. For the immediate future, certainly, the success of Canadian cement producers will 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, the largest cement market of all the Provinces, will play the key role in determining the balance between domestic and U.S. consumption.

**Diamond.**—Canada as yet has no commercial production of diamond but the search for potential mines continued unabated. More than 500 companies have been exploring for diamond in Canada, especially in the Northwest Territories, but also in Saskatchewan, Québec, Alberta, Ontario, British Columbia, Manitoba, and Labrador. The field seemed to be narrowing somewhat as various pipes proved disappointing upon testing.

DeBeers, the world's largest diamond group, announced termination of its Yamba Lake joint-venture project with Mill City Gold and Tanqueray Resources in the Lac de Gras area, the focal point of the diamond rush in the Northwest Territories. Observers noted that, with DeBeers' departure, the leading contenders in the area were the BHP/Dia-met joint venture and the Kennecott/Aber Resources Diavik Project. BHP's Diamond Division reported that diamond recovered to date from five kimberlite pipes at its Lac de Gras property, about 300 km northeast of Yellowknife, compared favorably with those at other diamond mines in the world. The company stated that, at current prices for rough diamond, the project to develop the pipes was economically feasible. Capital investment was expected to be in excess of \$360 million. The five pipes were located under lakes bearing the same names: Panda, Misery, Koala, Fox, and Leslie, and would be mined during a 30-year period. Preliminary results on two pipes were as follows: Koala, containing 0.75 carat/t, at an average of \$110 per carat resulting in an ore value of \$82/t; and Panda, 1.18 carat/t at \$127 per carat, resulting in an ore value of \$150/t. The planned centralized processing plant was to be located southwest of the Koala pit. It would 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, plus high-intensity magnetic separation, X-ray concentration, and sorting. The construction phase work force was projected to reach 1,000 at its peak. After that, about 650 workers would be employed during production.

**Graphite.**—Canadian shipments of graphite rose slightly in 1995 compared to those of 1994. At the beginning of 1995, Stratmin Graphite Inc. was the only producer of natural flake graphite in North America and, according to the company, was the largest producer and exporter in the world of natural flake graphite from a single mine. In 1994, Applied Carbon Technology (ACT) ceased production in midyear at its plant near Kearney, Ontario. Later that year, Stratmin purchased 49.5% of ACT's shares and advised that the plant would open at such time as the graphite market regained its strength.

Other graphite mines and prospects, primarily in Ontario and Quebec were studied in terms of economics of development and/or production in relation to overall market demand and pricing. It was clear that probabilities of success were marginal, given the dominant position of Stratmin.

**Gypsum and Anhydrite.**—Production of gypsum and anhydrite declined slightly compared to that of 1994 but nonetheless was higher than in 1993. Production thus far in the 1990's, however, has not equalled the 1989 output of

more than 9 Mt prior to Canada's economic recession and accompanying sag in domestic construction.

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

At Caledonia, Ontario, Domtar Inc. operates continuous-mining machines used to extract material from gypsum reserves thought to be sufficient for 75 years. Domtar's Surrey, British Columbia, plant was the first in North America to use large quantities of reclaimed and recycled wallboard. At Hagersville, Ontario, CGC Inc., partly owned (75%) by USG Corp. of Chicago, operated an underground mine and a wallboard facility. Westroc Industries Ltd., a subsidiary of BPB Industries Plc., the largest gypsum products manufacturer in Europe and with worldwide interests, operated in (from east to west) New Brunswick, Quebec, Ontario, Manitoba, Alberta, and British Columbia. Westroc manufactured wallboard or other products in each of these Provinces and mined gypsum in Ontario, Manitoba, and British Columbia.

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. About twice as hard and heavier than gypsum, anhydrite is produced in Nova Scotia by Fundy Gypsum Co. Ltd. at Wentworth and by Little Narrows Gypsum Co. Ltd. at Little Narrows.

**Potash.**—Canadian potash production in 1995 rose by 10% to more than 9 Mt of  $K_2O$  equivalent, mostly from mines in Saskatchewan but with about 12% coming from New Brunswick. Canadian potash was shipped mostly to the United States (almost 60%), Asia (about 30%), and Latin America (about 8%), with the remainder going to Oceania and Western Europe. Exports to the United States have risen steadily to satisfy agricultural needs.

Vigoro Corp., Kalium Canada's Chicago-based parent company, acquired the Central Potash Canada operation of Noranda. The transaction, completed in early January 1995,

involved a disbursement of \$89 million plus \$12 million in working capital. Moreover, Vigoro and IMC Global Inc. agreed to merge both companies in an arrangement worth \$1.4 billion, pending approval by Government regulatory authority. The merged company would hold 30% of potash capacity in North America to become the second largest producer.

The International Trade Administration of the U.S. Department of Commerce extended for another year the suspension agreement between the United States and Canadian potash producers, which had been due for termination. During the year, investigation continued into allegations of price-fixing in North America by several U.S. and Canadian potash exporters. The investigations were prompted by a class action lawsuit consolidated in Federal District Court in Saint Paul, Minnesota, with a U.S. grand jury studying the matter.

**Sulfur.**—Production of elemental sulfur increased by about 2% to more than 9 Mt in 1995, representing output from sour natural gas, petroleum refineries, smelters, and tar sands. From the latter, sulfur production increased by more than 6% to a record level of 670,000 t. Smelter gases yielded 860,000 t; petroleum refining and natural-gas scrubbing accounted for the remaining 7.48 Mt. No Canadian production is derived from Frasch mining.

Canada maintained its position as the world's second largest producer, after the United States, of elemental sulfur with a 22% share and remained the leading exporter with a 38% slice of world trade in sulfur. In January 1995, Husky Oil Operations Ltd., Shell Canada Ltd., and Amoco Canada Petroleum Co. Ltd., three major members of the PRISM Sulfur Corp., withdrew from that export organization to begin exporting independently, thus increasing the number of major Canadian exporters from two to five. In July 1995, the U.S. Department of Commerce released preliminary results of its antidumping administrative review of sulfur sales by Canada to the United States during the period December 1991 to November 1992, as requested by Pennzoil Sulfur Co., a former U.S. Frasch producer. The Department set a preliminary dumping margin of 5.66% for three active exporters, a 28.9% rate for nonrespondents, and a 5.56% rate for other exporters who were not listed in petitions or who received revocation. Final determination is anticipated in 1996. Pennzoil has filed two more consecutive requests for the subsequent two 1-year periods, invoking the administrative review process for the next several years.

### **Mineral Fuels**

**Coal.**—The year 1995 saw Canadian coal production reach a record high of 74.9 Mt, surpassing the previous high of 72.8 Mt produced in 1994. The total value of 1995



production was \$1.39 billion, about 5% higher than that of 1994's output. At least part of the incentive for this new record was provided by coal price increases. Overall, production was up in the Western Provinces (Alberta, British Columbia, and Saskatchewan) and down in the Eastern Provinces of New Brunswick and Nova Scotia. Canadian coal consumption in 1995 was about 53 Mt, with 47 Mt going to the generation of electricity, 4 Mt used in steel-making, and 2 Mt for other industrial uses.

In eastern Canada, domestic supplies of coal generally have to be augmented by imports of U.S. coal, mostly thermal coal, putting Canada in the unusual position of being both a major exporter and 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 interest in mineral commodities; others include cement and gypsum.

Although Canada accounts for only about 2% of the world's coal production, it exports about one-half of its production, making it the world's fourth largest exporter after Australia, the United States, and the South Africa. During 1995, Canada shipped 34 Mt of coal to about 23 different countries, with much of it going to the Pacific Rim countries and Brazil. Traditionally, more than 80% of Canada's coal exports has been coking coal, sold mostly to Japan; and about 70% of Canadian thermal coal exports were to Japan and the Republic of Korea. Imports of coal into Canada during 1995 exceeded 9 Mt, slightly above the level of the year before. The United States furnished about 8 Mt of this coal, with the remainder from Colombia.

**Natural Gas.**—Canada ranked third in the world, after Russia and the United States, in output of natural gas. Increasingly, the production of natural gas has played a major role in the mineral economy of Canada and has had a palpable effect on GDP. In 1995, production rose to a gross output of 193 billion cubic meters (m<sup>3</sup>), up from 183 billion m<sup>3</sup> in 1994, and production of marketable gas was 148 billion m<sup>3</sup>. Marketable gas is gross (total) production minus reinjected gas and producer consumption. Canada exported about 79.3 billion m<sup>3</sup> (2.8 trillion cubic feet) of natural gas to the United States during 1995, which was about 10% of the U.S. supply. Gas exports to the United States were expected to increase to about 100 billion m<sup>3</sup> by 2006, anticipating the increasing inability of U.S. domestic production to meet demand. The Alberta Energy and Utilities Board projected the Province's natural gas reserves at the end of 1995 to be 1.489 trillion m<sup>3</sup> (52.5 trillion cubic feet), a net decline of 0.1% from the preceding year.

Opposition to natural gas exploration, production, and transmission 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.

**Petroleum Crude.**—Production of crude reached a record high of 662 million barrels (Mbbbl) in 1995, more than 4% higher than in 1994 and between 17% and 18% higher than in 1991. Canada exported 380 Mbbbl of crude to the United States in 1995.

After selling 30% of the integrated oil company Petro-Canada in 1991, the Government moved further ahead in privatization in 1995 by announcing the sale of much or most of the other 70%, with the aim of reducing its share to perhaps 20%. Petro-Canada was lauded as a model for state-owned oil company privatization<sup>9</sup> and seemed to be headed for expansion of its operations, after upgrading in terms of cost cutting and restructuring. Petro-Canada owned 25% of the immense Hibernia petroleum prospect offshore Newfoundland, and another 25% share in Terra Nova field in the Jeanne d'Arc basin adjacent to Hibernia, for which Petro-Canada can claim discovery. The Hibernia Field, offshore Newfoundland in 75 m of water is thought to contain 615 Mbbbl of light waxy oil. The field was being developed in a \$6.5-billion project by Petro-Canada plus a consortium of U.S.-based companies, including Mobil, Chevron, and Murphy, plus large subsidies from the Canadian Government. Production is scheduled to begin in 1997, with peak production estimated as high as 125,000 barrels per day (bbl/d)<sup>10</sup>

The Athabasca oil sands north of Fort McMurray, Alberta, played an increasingly important role in Canadian oil production. Output in 1995, in the form of a light sweet crude, was 25% of total Canadian output for the year. Technological development and increased operating efficiencies have steadily reduced production costs by the two major operators, Suncor Inc. and Syncrude Canada Ltd., at their two sites in Alberta and northern Saskatchewan. Suncor's operating costs at the Suncor oil sands plant in Alberta dropped from \$15 per bbl in 1992 to below \$12 per bbl in 1995, and a projected \$9 per bbl in 1997. 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 oilsands could contribute 50% of national production by 2010.

Athabasca, Peace River, and other bitumen and heavy oil deposits in Alberta amount to 2.5 trillion bbl of oil in place, about 40% of the world's known bitumen. The 300 billion bbl presently considered recoverable exceeds the 265 billion bbl of Saudi Arabia, but the latter can extract their oil for less than \$1 per barrel. The Province of Alberta lowered its royalty on oil sand crude late in 1995, stipulating 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.

### **Reserves**

Table 3 shows the levels of Canadian reserves of major minerals on or about January 1, 1995, in terms of metal contained in ore for the base and precious metals or in terms of recoverable quantities of other mineral commodities such as industrial minerals and mineral fuels. These mineral reserves represent “proven” and “probable” categories and exclude quantities reported as “possible.” Reserves were defined as well delineated and economically minable ore from mines committed to production.

Other than for gold, reserves of major metals have fallen steadily from 1977 to 1995. During this period, gold reserves trebled from about 500 t to better than 1,500 t as rising prices, and the possibility of new price increases, provided strong incentive to exploration. Silver reserves, however, fell by one-third from about 31,000 tons to less than 20,000 tons during the same period.

Reserves of the leading base metals decreased conspicuously, led by molybdenum, which fell 60%, with lead down 57%, zinc falling 46%, copper retreating 44%, and nickel down 31% through the period in question. In each case the downtrend was not monotonic but varied positively as well as negatively. The absolute high values showed a clustering in 1980 to 1982 at a time when successful exploration had increased rapidly and extraction had not kept pace.

Yearly changes in assessment of reserves are, in simplest terms, the arithmetic result of (a) additions to reserves, (b) deletions of reserves, and (c) production. Additions are caused by exploration, discoveries, new technical information, and commodity price increases; deletions are caused by increases in mining costs, decreases in market prices, and unforeseen requirements for additional capital. Production is driven by the favorable balance between cost and return, which normally changes continually. Most mining operations aim at extracting the lowest grade ore that is profitable at prevailing prices for the product, thus not infrequently causing redefinition of the ore reserves. One further complication in Canada is that a large proportion of Canadian mines is polymetallic, necessitating close attention to market price and processing costs for two, or several, mineral commodities simultaneously to enable production as coproducts.

Reserves of major metals were distributed unevenly throughout Canada, influenced mostly by mineralization of the Precambrian shield, the Rockies (Cordillera), and the Coast Ranges. New Brunswick had more than half of lead reserves and roughly 40% of zinc and silver. Ontario had three-quarters of the nickel, about 57% of the gold, and

slightly less than half of the copper. British Columbia had 100% of the molybdenum and about one-third of the copper. New reserves in discoveries yet to be made will alter the overall reserves relationship.

### **Infrastructure**

With a total land area of about 9,221,000 km<sup>2</sup>, slightly larger than the United States, Canada had networks of highly developed infrastructure as well as other vast areas of trackless wilderness. The country had 884,272 km of roads, comprising 250,023 km of paved highway, 462,913 km of gravel or other loose surface, and 171,336 km of earth-surface roads, the latter not graded or drained in many places. Bulldozed temporary roads have been established for mining exploration in many out-of-the-way places, but these deteriorated quickly where not maintained.

A total of 78,148 km of railroads included two main systems, the Canadian National and the Canadian Pacific. The country also had about 3,000 km of inland waterways, including the St. Lawrence Seaway, one of the busiest in the world, leading into the Great Lakes marking the boundary with the United States in many places. Principal Ports were Halifax; Montreal; Quebec; St. John (New Brunswick); St. John's (Newfoundland); Toronto; and, on the west coast, Vancouver. Canada's merchant marine comprised approximately 75 ships of 1,000 or more gross registered tons.

The country had 1,386 airports. Among these, 964 had permanent-surface runways; 17 had runways longer than 3,047 m; 16 had runways 2,438 to 3,047 m long; and 215 had runways 1,524 to 2,437 m in length; of the latter, 69 were unpaved. Civil aviation included about 636 major transport aircraft, with Air Canada as the major carrier.

Canada generated electrical power from coal, natural gas, and nuclear fuels as well as massive hydroelectric facilities. Total capacity was approximately 108 gigawatts. About 511 billion megawatt hours (MWh), or 18 MWh per capita, was produced in 1993, the last year for which complete data were available. More than 62% of Canada's electricity was generated by hydroelectric plants, about 17% by nuclear reactors, 15% by coal, and 6% by oil and gas. Quebec and Ontario produced the most electricity, 154 MWh and 141 MWh, respectively. Nearly 97% of Quebec's electricity came from hydroelectric plants, with the remaining 3% produced mainly by nuclear facilities. In contrast, about 56% of Ontario's electric power derived from nuclear plants, 29% from hydroelectric, and 14% from coal-fired plants. The majority of Canada's electricity exports originated in the eastern Provinces of Quebec, Ontario, and New Brunswick and were sold to consumers in New England and New York. The western Provinces of British Columbia and Manitoba also exported large amounts of electricity, mainly to

Washington, Minnesota, California, and Oregon. Except for Alberta, all Canadian Provinces bordering the United States had transmission links to neighboring U.S. systems. Canadian electricity exports to the United States surged in late 1993 and early 1994, largely the result of favorable hydrological conditions. In November 1994, Québec announced cancellation of the controversial \$10-billion Great Whale hydroelectric power project. Under discussion since the mid-1970's, Great Whale was dealt a severe setback when New York's Power Authority, a major Hydro-Quebec customer, announced cancellation of a \$5-billion power contract, citing environmental concerns and decreased power needs.

An extensive system of pipelines connected oil-producing (mostly western Canada) and oil-consuming areas (mostly central and eastern Canada and the United States). This system was dominated by two major pipelines: the Interprovincial Pipe Line (IPL), which delivered oil from Edmonton east to Montreal, Quebec, and the U.S. Great Lakes region; and the Trans Mountain Pipe Line (TMPL), 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 owns 13,600 km of mainline gas pipelines in Canada, along with 56 compressor stations, linking western Canadian gas producers with eastern Canadian and U.S. consumers. In 1993, the TransCanada system shipped a record 60 billion m<sup>3</sup> of natural gas, up from 40 billion m<sup>3</sup> in 1989, including 25 billion m<sup>3</sup> to the United States. Total Canadian pipeline network included about 25,000 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.<sup>11</sup>

## Outlook

Canada's mineral industry was influenced by several positive factors in 1995. The first was an overall turnaround of the national economy after the Quebec secession vote, with new life in the credit markets, strengthening of the currency, curtailment of expenditures and downsizing in certain of the public sectors, rapidly increasing exports, and a better tone to equity markets. Second, in the midst of all of this, prices of base metals in world markets were stronger than they had been for some time, with firm demand in both Europe and Asia.

Third, but no less significantly, the Canadian petroleum industry just kept growing. Exploration and production reached new levels of activity; and Canada became an expanding exporter to the United States of crude, natural gas, and refinery products. After years of questions concerning the feasibility of the Hibernia offshore oil project, it was

forging ahead in fine style with an implied promise of rich payoffs to come. Moreover, comparisons were heard between the Canadian offshore and the development of the now-legendary North Sea fields.

Fourth, and more important to the long view within the mineral industry, the huge nickel-copper-cobalt discovery at Voisey's Bay made a spectacular case for more exploration in Canada, no matter how attractive the situation in Latin America, Asia, or Australia. Furthermore, new prospects were found for gold in many parts of Canada; even though market pricing seemed to ignore the many predictions of great increases to come.

Fifth, and more difficult to assess or predict, was 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. Active engagement of these issues may help provide outcomes that would support the future of the mining industry.

Canada is well positioned in terms of its mineral-resource base and its access to the United States and other markets. Its mineral industry is primarily export oriented with as much as 90% of the production of some commodities going to foreign purchasers. 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.

Some issues facing Canada's mineral industry remain complex. Many of them are international in nature and may lie beyond Canada's direct industrial or market influence, such as those involving Russia or China.

No country can escape the realities of growing international competition, especially from mineral-rich developing countries that have liberalized economic and political systems in order to attract foreign investment. But Canada's best asset may be its achievement of a popular consensus in support of sustainable development.

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<sup>1</sup>For more detailed information on the mineral industry of Canada, see the Canadian Minerals Yearbooks for 1994 and 1995, 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, U.S. Bureau of Mines, 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 in the text not referenced elsewhere may be assumed to be from either the Yearbook or the related series of separate, preliminary, topical periodicals containing information compiled by Statistics Canada and issued by Natural Resources Canada.

<sup>2</sup>Where necessary, values have been converted from Canadian dollars (CAN\$) to U.S. dollars at an average rate of CAN\$1.3727=US\$1.00 for 1995. All values in this report are expressed in U.S. dollars.

<sup>3</sup>Simon, Bernard. Financial Times, London. (United Kingdom), July 1, 1996, p. 15.

<sup>4</sup>Natural Resources Canada. Sustainable Development and Minerals and Metals, Feb. 12, 1996.

<sup>5</sup>Pilsworth, Diana, and Kokkinos, Kosta. General Review: The Canadian Economy (1995), Natural Resources Canada, Mar. 1996.

<sup>6</sup>Falconbridge Ltd. 106 Million Tons and Counting, supplement to the Canadian Mining Journal, June 1996, p.13.

<sup>7</sup>Diamond Fields Resources Inc. Annual Report 1995, 200 Burrard St., Vancouver, British Columbia.

<sup>8</sup>Roy, Robert. Oh Canada, International Report, International Cement Review, Aug. 1995, p. 24.

<sup>9</sup>Oil and Gas Journal. Petro-Canada Emerging as a Model of State Oil Company privatization, Dec. 25, 1995, p. 21..

<sup>10</sup>U.S. Department of Energy, Energy Information Administration. Canada Country Analysis Briefs: 1995.

<sup>11</sup>Work cited in footnote 11.

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580 Booth Street  
Ottawa, Ontario K1A 0E4  
Canada

Mining Sector  
Geological Survey of Canada  
Surveys, Mapping, and Remote Sensing Sector  
Canada Centre for Mineral and Energy Technology  
(CANMET)

### Statistics Canada

Tunney's Pasture  
Ottawa, Ontario  
Canada

### Department of Indian Affairs and Northern Development

Les Terrasses de la Chaudière,  
Ottawa, Ontario K1A 0H4  
Canada

### Environment Canada

Les Terrasses de la Chaudière  
27th Floor  
10 Wellington St.  
Ottawa, Ontario K1A 0H3  
Canada

### Ministry of Energy, Mines, and Petroleum Resources

Parliament Buildings  
Victoria, British Columbia V8V 1X4  
Canada

### Department of Energy

Petroleum Plaza, North Tower, 9945 108 St.  
Edmonton, Alberta T5K 2G6  
Canada

### Department of Energy and Mines

Room 306, Legislative Building  
Regina, Saskatchewan S4S 0B3  
Canada

### Administration of Mining Lands

Toronto-Dominion Bank Building  
1914 Hamilton St.  
Regina, Saskatchewan S4P 4V4  
Canada

### Department of Energy and Mines

Room 301, Legislative Building  
Winnipeg, Manitoba R3C 0V8  
Canada

### Ministry of Northern Development and Mines

10 Wellesley St. East  
Toronto, Ontario M4Y 1G2  
Canada

### Mines and Minerals Division:

Mineral Development and Lands Branch  
Ontario Geological Survey  
Southern Ontario Region  
Northeastern Region  
Northwestern Region

### Ministère de L'Energie et des Ressources, Secteur Mines

1620 Boulevard de l'Entente  
Quebec, Quebec G1S 4N6  
Canada

### Department of Natural Resources and Energy

Minerals and Energy Division  
Hugh John Flemming Forestry Centre  
Fredericton, New Brunswick E3B 5H1  
Canada

### Mines and Minerals Division:

Geological Surveys Branch  
Mineral Development Branch  
Planning and Administration Branch  
Energy Branch

### Department of Mines and Energy

1701 Hollis St.  
P.O. Box 1087  
Halifax, Nova Scotia B3J 2X1  
Canada

### Department of Energy and Forestry

P.O. Box 2000  
Charlottetown, Prince Edward Island C1A 7N8  
Canada

### Newfoundland Department of Mines and Energy

P.O. Box 8700  
St. John's, Newfoundland A1B 4J6  
Canada

### The Mining Association of Canada

1105-350 Sparks St.  
Ottawa, Ontario K1R 7S8  
Canada

### Northwest Territories Chamber of Mines

P.O. Box 2818  
Yellowknife, Northwest Territories X1A 2S1  
Canada

### Yukon Chamber of Mines

P.O. Box 4427  
Whitehorse, Yukon Territory 1A 3T5  
Canada

### British Columbia and Yukon Chamber of Mines

840 West Hastings St.  
 Vancouver, British Columbia V6C 1C8  
 Canada

Chamber of Mines of Eastern British Columbia  
 215 Hall St.  
 Nelson, British Columbia V1L 5X4  
 Canada

Mining Association of British Columbia  
 P.O. Box 12540, 860, 1066 West Hastings St.  
 Vancouver, British Columbia V6E 3X1  
 Canada

Alberta Chamber of Resources  
 1410 Oxford Tower, 10235 101 St.  
 Edmonton, Alberta T5J 3G1  
 Canada

Saskatchewan Mining Association Inc.  
 1740 Avord Tower  
 Regina, Saskatchewan S4P 0R7  
 Canada

The Mining Association of Manitoba  
 700-305 Broadway  
 Winnipeg, Manitoba R3C 3J7  
 Canada

Ontario Mining Association  
 1114-111 Richmond Street West  
 Toronto, Ontario M5H 2G4  
 Canada

Québec Asbestos Mining Association  
 410-1140 Sherbrooke Street West,  
 Montreal, Québec H3A 2M8  
 Canada

Québec Mining Association Inc.  
 942-2635 Boulevard.  
 Hochelaga, Ste. Foy  
 Québec G1V 4W2  
 Canada

The New Brunswick Mining Association  
 Suite 312-236 St. George St.  
 Moncton, New Brunswick E1C 1W1  
 Canada

Chamber of Mineral Resources of Nova Scotia  
 202-5525 Artillery Place  
 Halifax, Nova Scotia NS B3J 1J2  
 Canada

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Canadian Geoscience Council, annual report.

Canadian Institute of Mining and Metallurgy, monthly.  
 Canadian Mineral Analysts, monthly.  
 Canadian Mining Journal, Canada's Top Mining Companies, monthly.  
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 Coal and Coke Statistics, monthly.  
 Crude Petroleum and Natural Gas Production, monthly.  
 International Trade Division, Imports by Commodity, yearly;  
 Exports: Trade Merchandise, yearly.  
 U. S. Embassy, Ottawa: Periodic Economic and Industrial Outlook reporting.  
 United Nations, Energy Statistics Yearbook, annual.  
 Corporate Annual Reports of mining companies.

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

(Metric tons unless otherwise specified)

Commodity	1991	1992	1993	1994	1995
<b>METALS</b>					
<b>Aluminum:</b>					
Alumina, gross weight thousand tons	1,131	1,104	1,182	1,170	1,064
Primary: metal	1,821,642	1,971,843	2,308,868	2,250,000	2,171,992
Antimony 3/	469	948	673	540 r/	789
Arsenic trioxide e/	236 4/	250	250	250	250
Bismuth 3/	65	224	144	129 r/	126
<b>Cadmium:</b>					
Mine output, Cd content 3/	1,787	1,630	1,340	1,500 r/	1,783
Metal, refined	1,829	1,963	1,944 r/	2,173 r/	2,360
Calcium kilograms	W	W	W	W	W
<b>Cobalt:</b>					
Mine output, Co content 3/	5,274	5,102	5,108	4,265 r/	5,266
<b>Metal:</b>					
Shipments 5/	2,171	2,223	2,150	1,846 r/	2,148
Refined, including oxide	2,248	2,210	2,695	2,950	3,092
<b>Columbium and tantalum:</b>					
<b>Pyrochlore concentrate:</b>					
Gross weight	5,230	5,100	5,320	5,130	5,230
Cb content	2,354	2,295	2,393	2,310	2,353
<b>Tantalite concentrate:</b>					
Gross weight	373 r/	193 r/	102 r/	144 r/	104
Ta content	93	48	25	36 r/	26
Cb content	19 r/	10 r/	5	7 r/	5
<b>Copper:</b>					
Mine output, Cu content 3/	811,134	768,582	733,606	590,863 r/	728,678
<b>Metal:</b>					
<b>Smelter:</b>					
Primary, blister	505,425	515,028	518,301	515,088	522,467
Secondary and scrap	26,757	37,408	44,059	45,445 r/	90,929
Total	532,182	552,436	562,360	560,533 r/	613,396
<b>Refined:</b>					
Primary	538,339 r/	539,302 r/	561,580 r/	549,869 r/	468,897
Secondary	34,500	31,100	41,600	45,000	91,100
Total	572,839 r/	570,402 r/	603,180 r/	594,869 r/	559,997
Gold, mine output kilograms	176,552	161,402	152,929	146,428	150,273
<b>Iron and steel:</b>					
<b>Ore and concentrate:</b>					
Gross weight thousand tons	39,307 r/	33,167 r/	31,830 r/	37,703 r/	38,560
Fe content do.	24,920 r/	21,183 r/	19,990 r/	24,235	24,561
<b>Metal:</b>					
Pig iron do.	8,268	8,621	8,633	8,150	8,464
Direct reduced iron do.	553	639	758	770	780 e/
<b>Ferroalloys, electric arc furnace: e/</b>					
Ferromanganese and silicomanganese do.	45	--	--	--	--
Ferrosilicon do.	75	55	55	55	56
Silicon metal do.	20	20	20	20	22
Ferrovandium do.	2	2	2	2	1
Total do.	142	77	77	77	79
Crude steel do.	12,987	13,933	14,387	13,897	14,415
<b>Lead:</b>					
Mine output, Pb content	276,528 r/	343,808	182,234 r/	167,584 r/	210,415
<b>Metal, refined:</b>					
Primary	106,420	151,252	147,907 r/	153,035 r/	173,731
Secondary	105,948	101,633	69,107	98,605 r/	103,641
Total	212,368	252,885	217,014 r/	251,640 r/	277,372
Lithium: spodumene e/	12,000	18,500	18,900	20,000	21,000
Magnesium metal, primary e/	35,512 4/	25,800	23,000	28,900	41,900 e/
Molybdenum, mine output, Mo content	11,329	9,405	9,699	9,188 r/	9,535
<b>Nickel:</b>					
Mine output, Ni content 3/	192,259	186,384	188,080	149,886	180,984
Refined 6/	131,500	135,200	123,139	105,144	121,523
Platinum-group metals, mine output kilograms	11,708	11,907	12,441	14,313 r/	15,904
Selenium, refined 7/ do.	207,286	294,057	500,000 e/	566,000 r/	553,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1991	1992	1993	1994	1995
<b>METALS -- Continued</b>					
Silver:					
Mine output, Ag content kilograms	1,338,799	1,215,388	895,837	767,842 r/	1,244,992
Refined do.	1,001,722	1,027,965	1,011,956	915,128 r/	1,002,708
Tellurium, refined 7/ do.	12,374	21,776	24,000	42,000 r/	91,000
Tin:					
Mine output, Sn content	4,455	--	--	-- e/	--
Metal, smelter, secondary e/	200	200	200	200	--
Titanium: Sorel slag 8/	701,000	753,000	653,000	764,000	815,000
Uranium oxide (U <sub>3</sub> O <sub>8</sub> )	9,624	10,965	10,795	11,372 r/	12,404
Zinc:					
Mine output, Zn content	1,156,582	1,324,675	1,004,367	1,010,712 r/	1,111,497
Metal, refined, primary	660,552	671,702	659,881 r/	690,965 r/	720,145
<b>INDUSTRIAL MINERALS</b>					
Asbestos	639,008	590,641	522,967 r/	531,000 r/	515,587
Barite	50,000	37,000	59,000	55,000	57,000
Cement, hydraulic 9/ thousand tons	9,370	8,590	9,390	10,584 r/	10,722
Clay and clay products 10/ value, thousands	\$119,838	\$117,326	\$120,000 e/	\$120,000 e/	\$98,876
Diatomite e/	8,000	10,000	10,000	10,000	10,000
Gemstones, amethyst and jade	542	1,335	3,680	1,212 r/	1,593
Graphite (exports)	6,200	17,400	18,800	21,711 r/	22,000 e/
Gypsum and anhydrite thousand tons	6,830	7,566	7,880	8,500	7,956
Lime 9/ do.	2,375	2,380	2,380	2,390	2,567
Magnesite, dolomite, brucite e/	180,000	180,000	180,000	180,000	180,000
Mica, scrap and flake e/	17,000	17,500	17,500	17,500	17,500
Nepheline syenite	484,000	554,000	550,000	602,000 r/	616,000
Nitrogen: N content of ammonia	3,016,247	3,104,119	3,410,000	3,470,000	3,773,000
Potash, K <sub>2</sub> O equivalent thousand tons	7,406	7,270	6,841	8,517 r/	9,007
Pyrite and pyrrhotite, gross weight e/	5,000	5,000	5,000	5,000	5,000
Salt thousand tons	11,993	11,171	10,900	11,700	10,893
Sand and gravel do.	214,410	238,134	237,000	247,148 r/	240,189
Silica (quartz) 11/ do.	1,495	1,754	1,600 e/	1,600 e/	1,650 e/
Sodium compounds, n.e.s.:					
Sodium carbonate (soda ash) e/ do.	310	305	305	300	300
Sodium sulfate, natural 12/ do.	332	282	320	317 r/	311
Stone 13/ do.	102,986	104,549	106,000	110,411 r/	111,404
Sulfur, elemental byproduct:					
Metallurgy do.	872	931	900 r/	870 r/	860
Natural gas do.	5,488	5,769	6,600 r/	7,000 r/	7,100
Petroleum e/ do.	230	235	340 r/	350 r/	380
Tar sands do.	540	552	590 r/	630 r/	670
Total do.	7,130	7,487	8,430 r/	8,850 r/	9,010
Talc, soapstone, pyrophyllite do.	123	104	108	130	116
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Carbon black	157,115	161,218	161,000 e/	160,000 e/	165,000 e/
Coal:					
Bituminous and subbituminous thousand tons	62,149	55,600	59,000	62,700	64,176
Lignite do.	9,000	10,027	10,000	10,100	10,740
Total do.	71,149	65,627	69,000	72,800	74,916
Coke, high-temperature do.	3,622	3,711	3,657	3,684	3,283
Gas, natural:					
Gross million cubic meters	144,987	158,067	171,000	183,000	192,530
Marketed do.	105,201	117,000	129,000	139,000	148,204
Natural gas liquids:					
Pentanes plus do.	43,392	48,069	50,500	55,900	56,450
Condensate do.	1,217	1,396	1,430	1,730	2,323
Total do.	44,609 r/	49,465 r/	51,930 r/	57,630 r/	58,773
Peat	856,000	740,000	801,000	914,000 r/	1,010,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1991	1992	1993	1994	1995	
<b>MINERAL FUELS AND RELATED MATERIALS--Continued</b>						
<b>Petroleum:</b>						
Crude 14/ thousand 42-gallon barrels	563,985	585,076	610,000	636,000	662,110	
<b>Refinery products:</b>						
Liquefied petroleum gas, propane, butane, ar	do.	16,538	17,293	15,800	14,900	13,745
<b>Gasoline:</b>						
Aviation	do.	759	706	824	835	846
Other	do.	229,665	229,316	234,000	239,000	243,455
Petrochemical feedstocks	do.	31,942	30,721	29,400	28,200	33,554
Jet fuel	do.	28,592	24,668	26,600	26,800	29,315
Kerosene	do.	3,493	2,015	3,670	2,690	5,470
Distillate fuel oil, diesel and light	do.	169,184	163,159	178,000	186,000	183,597
Lubricants including grease	do.	6,176	5,363	5,360	6,250	5,807
Residual fuel oil, heavy	do.	54,081	50,131	48,500	44,200	41,352
Asphalt	do.	15,922	15,221	17,800	20,400	20,048
Petroleum coke	do.	5,692	6,310	7,220	6,660	6,961
Unspecified	do.	30,791	30,322	28,900	28,100	24,271
Refinery fuel and losses 15/	do.	24,697	29,140	24,800	25,100	37,583
Total	do.	617,532	604,365	620,874	629,135	649,779

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data.

1/ Data published for 1990 through 1994 in the preceding year were rounded by the U.S. Bureau of Mines to three significant digits. With very few exceptions, data in the present table have been unrounded to their original state.

2/ Table includes data available through July 1995.

3/ Metal content of concentrates produced.

4/ Reported figure.

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

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

7/ From all sources, including imports and secondary sources. Excludes intermediate products exported for refining.

8/ Refined Sorel slag contains 80% titanium dioxide.

9/ Producers' shipments and quantities used by producers.

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

11/ Producers' shipments of quartz.

12/ Excludes byproduct production from chemical plants.

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

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

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



TABLE 2  
CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(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 AG, Germany, 20%; Hoogovens Groep BP, Netherlands, 20%; Metall Aktiengesellschaft, Austria, 20%; SGF, Alunor, 20%; Marubeni, Italy, 16.3% Kobe Steel, Japan, 3.7%)	Smelter, Sept-Iles, Quebec	215
Do.	Aluminerie Luralco 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.	Asbestos Corp. Ltd. (Mazarin Mining Exploration Inc.)	British Canadian Mine, Black Lake, Quebec	70 (fiber)
Do.	Bell Operations. (Mines D'Amiante Bell)	Thetford Mines, Quebec	70 (fiber)
Do.	JM Asbestos Inc.	Jeffrey Mines, Asbestos, Quebec	250 (fiber)
Do.	Teranov Mining Corp. (Black Hill Minerals Ltd., 50%; Cliff Resources, 50%)	Baie Verte, Newfoundland	20 (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.	do.	Beauport, Quebec	611 (wet-process)
Do.	ESSROC Canada Inc.	Picton, Ontario	1,124 (dry-process)
Do.	North Star cement Ltd.	Corner Brook, Newfoundland	152 (dry-process)
Do.	Ciment Quebec Inc.	St. Basile, Quebec	1,074 (wet and dry)
Do.	Federal White Cement Ltd.	Woodstock, Ontario	170 (dry-process)
Do.	St. Marys Cement Co.	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 60%; 7 Japanese Cos. 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)

See footnotes at end of the table.

TABLE 2--Continued  
CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper	Broken Hill Proprietary Co. Ltd. (BHP Holdings Inc. 100%)	Island Copper Mine, Port Hardy, British Columbia	16,200
Do.	Cassiar Mining Corp. (Princeton Mining Corp. 100%)	Similco Mine, Princeton, British Columbia	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.	Gibraltar Mines Ltd.	Smelter, Timmins, Ontario	440
Do.	Highland Valley Copper (Cominco, 50%; Rio Alom Ltd., 33.6%; Teck Corp., 13.9%; and Highmont Mining Co., 2.5%)	McLease Lake, British Columbia	13,070
Do.	Inco Ltd.	Logan Lake, British Columbia	4,500
Do.	do.	Sudbury and Shebandowan, Ontario	20,250 (mine)
Do.	do.	Thompson District, Manitoba	
Do.	do.	Smelter, Sudbury, Ontario	500
Do.	do.	Refinery, Sudbury, Ontario	170
Do.	Noranda Inc.	Bell Copper Mine, Babine Lake, British Columbia	5,550 (mine)
Do.	do.	Smelter Horne, Noranda, Quebec	770
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.	Doyon Mine, NW Quebec	1,323 (ore)
Do.	do.	Golden Patricia Mine, Pickle Lake, Ontario	156 (ore)
Do.	do.	Macassa Mine, Teck Twp. N. Ontario	473 (ore)
Do.	Princeton Mining Corp.	Similco Mine, Princeton, British Columbia	450 (kilograms metal)
Do.	Echo Bay Mines Ltd.	Lupin Mine, Contwoyo Lake; Northwest Territories	612
Do.	Royal Oak Mines Inc.	Giant Mine, Yellowknife, Northwest Territories	407 (ore)
Do.	do.	Giant Mill--tailings, Yellowknife, Northwest Territories	3,265 (ore)
Do.	do.	Pamour, Ontario	945 (ore)
Do.	do.	Hope Brook Mine, Conteau Bay, Newfoundland	1,090 (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	400 (ore)
Do.	do.	Detour Lake Mine, Northeast Ontario	900 (ore)
Do.	do.	Dome Mine, South Porcupine, Ontario	1,300 (ore)
Do.	do.	Sigma Mine, Val d'Or, Quebec	500 (ore)
Do.	do.	Kiena Mine, Val d'Or, Quebec	500 (ore)
Do.	Teck-Corona Corp. (Teck Corp., 100%)	David Bell Mine, Hemlo, Ontario	456 (ore)
Gypsum	Domtar Inc.	Flat Bay, 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 Co. of Canada (Dofasco 6.9%)	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)
Do.	The Algoma Steel Corp. Ltd. (Dofasco Inc., 100%)	Sault Ste. Marie, Ontario	2,478 (pig iron), 3,135 (crude steel), 657 (sinter)
Do.	Dofasco Inc.	Hamilton, Ontario	3,642 (pig iron), 4,500 (crude steel)
Do.	Stelco, Inc.	do.	2,733 (pig iron), 7,990 (crude steel), 560 (sinter)

See footnotes at end of the table.

TABLE 2--Continued  
CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron and steel--Continued		Wabush Mines Ltd. (Inland Steel Co. 15.1%; Acme Steel 15.1%; Stelco Inc. 37.9%; Dofasco Inc. 24.2%; Inland Steel Co. 15.1%; Acme Steel Co. 15.1%; Cliffs Mining Co. 7.7%)	Wabush, Labrador, and Pointe Noire, Quebec	6,200 (concentrate)
Lead		Brunswick Mining and Smelting Corp. Ltd. (Noranda 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)
Do.		Conwest Eploration Co. Ltd.	Nanisivik Mine, Baffin Island, Northwest Territories	785 (ore)
Do.		Anvil Range Mining Corporation	Faro Mine, Yukon Territory	184 (Pb-Zn contained)
Limestone		Lafarge Canada Inc.	Steep Rock, Manitoba	906 (quarry)
Do.		Scotia Limestone Ltd.	Iris Cove, Sydney, Nova Scotia	720
Do.		Inland Cement Ltd. (CBR Materials Corp.	Cadoman, Alberta	2,160
Do.		do.	Cadomin, Alberta	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)
Nickel		Falconbridge Ltd. (Noranda Inc., 46.4% Underwriting syndicate 28.3%)	East, Fraser, Lockerby, Onaping, Strathcona, and Craig in Sudbury	30 (metal contained)
Do.		do.	Smelter, Falconbridge	45 (rated capacity)
Do.		Inco Ltd.	Sudbury, Ontario, district mines: Frood, Stobie, Little Stobie, Creighton, Copper Cliff North and South, Garson-Offsets, Levack, McCreedy East and West, Coleman, Crean Hill, Murray, and Totten in Sudbury area, Ontario; also Shebandowan mine in Western 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, Pipe, Birchtree mines in Manitoba	62 (metal contained)
Do.		do.	Smelter, Thompson, Manitoba	82 (metal contained)
Do.		Sherritt Gordon Ltd.	Refinery, Fort Saskatchewan, Alberta	24 (metal contained)
Petroleum: 1/				
Gas	million cubic meters	BP Canada Inc. (The British Petroleum Co. PLC London, 100%)	Noel Area, North 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. (Exxon Corp., USA, 70%; others, 30%)	Judy Creek, Cold Lake, Alberta, Mackenzie Delta, Beaufort Sea, Yukon and Northwest Territories	670
Gas	million cubic meters	do.	do.	36.4
Crude	million 42-gallon barrels	Mobil Oil Canada Ltd. (Mobil Corp., United States, 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 Petrooleums Ltd. (Sceptre Resources Ltd., 100%)	Grantham, Hays Ronalane, Peace River, Normandville, Randell, Alberta, and Grizzly Valley, British Columbia	24.6

See footnotes at end of the table.

TABLE 2--Continued  
CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity	
Petroleum--Continued:				
Crude	million 42-gallon barrels	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
Potash (K <sub>2</sub> O equivalent):		Potash Corp. of Saskatchewan Inc. (Private, 37%; Provincial government, 63%)	Lanigan, near Lanigan Saskatchewan	3,400 (KCl)
Do.		do.	Rocanville, southeast Saskatchewan	1,750 (KCl)
Do.		International Minerals & Chemical Corp. (Canada) Ltd. (IMC Fertilizer Corp., 100%)	Esterhazy, southeast Saskatchewan	1,814 (KCl)
Do.		Kalium Chemicals (Kalium Canada Ltd., The Canadian Salt Co.)	Potash Mine, Moose Jaw, Saskatchewan	2,040 (KCl)
Salt and brine operations			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	Eskay Creek Mine, British Columbia	227
Do.		Equity Silver Mines Ltd. (Placer Dome Inc., 58.8%)	Houston, British Columbia	2,970 (Ag-Au-Cu concentrate)
Do.		Faro Mine (Anvil Range Mining Corp. 100%)		4,745 (Pb-Zn-Ag-Au mill feed)
Do.		LAC Minerals Ltd.	Macassa Mine, Ontario	165 (mill feed)
Do.		do.	Bousquet Mine, Quebec	580 (mill feed)
Do.		Similco Mines Ltd.	Princeton, British Columbia	8,250 (Ag-Au-Cu concentrate)
Sodium chlorate production using salt		Dow Chemical Canada Inc. (The 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	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 Calgary-Crossfield, Alberta	610
Do.		Chevron Canada Resources Ltd. (Chevron 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 <sub>2</sub> and H <sub>2</sub> SO <sub>4</sub> production capacities		Canadian Electro Zinc Ltd. (CEZ) (Noranda Inc., 90.17%)	Valleyfield, Quebec	430 (H <sub>2</sub> SO <sub>4</sub> )
Do.		INCO Ltd.	Copper Cliff, Ontario	950 (H <sub>2</sub> SO <sub>4</sub> )
Do.		Falconbridge Ltd. (Noranda Inc., 50%; Trelleborg AB, 50%)	Kidd Creek, Ontario	690 (H <sub>2</sub> SO <sub>4</sub> )
Do.		ESSO Chemical Canada (Imperial Oil, Ltd., 100%)	Redwater, Alberta	910 (H <sub>2</sub> SO <sub>4</sub> )
Uranium		Stanleigh Mine (Rio Algom Ltd. 100%)	Elliot Lake, Ontario	815 (metal)
Do.		Cameco Corp. (Province of Saskatchewan, 61.5%; Government of Canada, 38.5%)	Key Lake, Saskatchewan	4,976 (metal)

See footnotes at end of the table.

TABLE 2--Continued  
CANADA: STRUCTURE OF THE MINERAL INDUSTRY FOR 1995

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Zinc	Brunswick Mining and Smelting Corp. Ltd. (Noranda Inc., 63.3%)	Bathurst, New Brunswick	232 (Zn in concentrate)
Do.	Falconbridge Ltd. (Noranda Inc., 50%; Trelleborg AB, 50%)	Timmins Operations, Ontario	212 (Pb-Zn contained)
Do.	do.	Smelter	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	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)
Do.	Anvil Range Mining Corp. (100%)	Faro Mine, Yukon Territory	184 (Pb-Zn contained)

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

TABLE 3  
CANADA: RESERVES OF MAJOR MINERALS IN 1995

(Thousand metric tons unless otherwise specified) 1/

Commodity	Reserves
Abestos, fiber	39,000 e/
Coal, all types	6,365,000 e/
Copper, metal content	9,533
Gold, metal	metric tons 1,513 2/
Gypsum	500,000 e/ 4/
Iron ore, iron content	1,305,000 e/
Lead, metal content	3,861
Molybdenum, metal content	148
Natural gas	billion cubic meters 2,100 e/
Nickel, metal content	5,334
Petroleum crude	million barrels 6,775 e/
Potash, K <sub>2</sub> O equivalent	million tons 14,500 e/
Salt	315,000 3/
Silver, metal	metric tons 19,146
Sodium sulfate	91,500 3/
Sulfur	145,000 e/
Uranium	280 4/
Zinc, metal content	14,514

e/ Estimated.

1/ 1994 and 1993 Canadian Minerals Yearbook, Natural Resources Canada, unless noted.

2/ Excludes metal in placer deposits.

3/ Data in thousand short tons.

4/ Recoverable at prices of \$100 per kilogram of U, or less.