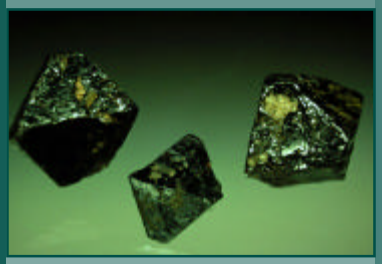
British Columbia
Mineral Exploration Review 2001



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BRITISH COLUMBIA
2001 MINERAL EXPLORATION REVIEW

British Columbia Ministry of Energy and Mines

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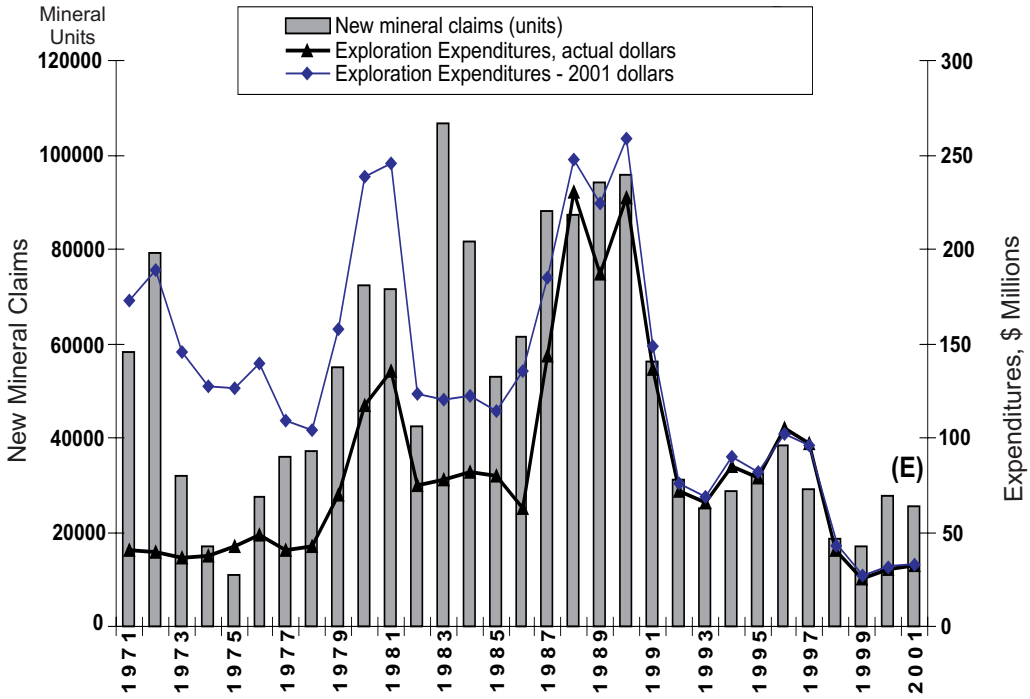
INTRODUCTION

The mining industry in British Columbia faced difficult challenges in 2001, as a result of the current global recession, low metal prices and previous government policy. However, under a new government, exploration companies have been dusting off their files on the province, conducting property examinations and acquiring ground. Others, who have been successful in raising financing, have undertaken drilling programs on established targets, some of which have been very successful (*e.g.* **Kemess North**, **Kena**, **Lorraine**, **RDN**, **Cariboo Gold Quartz**, **Afton** and **Verity/Fir**). Several new grassroots mineral discoveries were made in 2000. Unfortunately, due in large part to financing difficulties, only limited follow-up programs were implemented on some of these (*e.g.* **Fox**, **Broken Hill**, **Spire**, and **Silver Lynx**). In addition, many prospectors who normally would be active in the field were not in 2001 because of the generally poor economic conditions.

Northgate's discovery of significant additional resources at the **Kemess North** property in the Toodoggone region, 6 kilometres north of the Kemess South mine, has not only provided the potential to extend the mine life but has also led to a revitalization of exploration in the entire camp.

Sultan Minerals' discovery of intrusion-related gold at the Gold Mountain zone on the **Kena** property, near Nelson, has captured the attention of many major gold min-

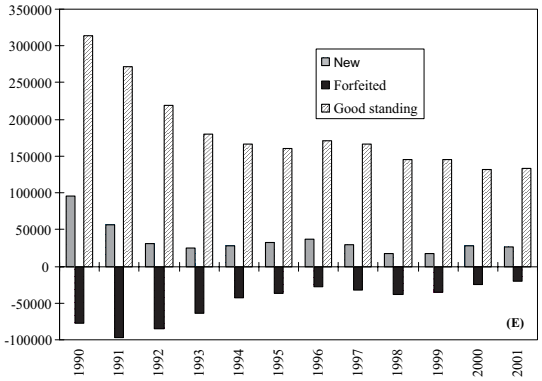
Figure 1...



Mineral exploration (fieldwork) expenditures and number of new mineral claims recorded in British Columbia: 1971 to 2001

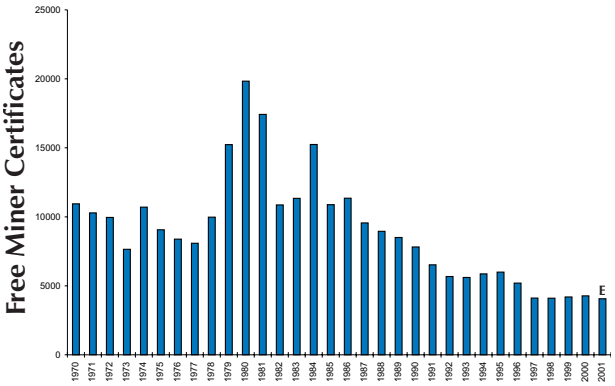
As in past years, information obtained in this review, including tonnages and grades, are from data released by the individual owners or operators. The Ministry of Energy and Mines makes every effort to ensure accuracy in the information presented, however, the Ministry is not responsible for errors or omissions. Monetary figures are in Canadian dollars. All information should be checked and verified before use in other products.

Figure 2 ...



Mineral units (new, forfeited, good standing); 1990 - 2001

Figure 3 ...



Free Miner Certificates: 1970 to 2001

ing companies. Gold mineralization on the property identified to date is bimodally distributed and suggests the potential for both bulk-tonnage and small high-grade deposits. Preliminary metallurgical studies suggest that a bulk-mineable, heap-leachable operation may be feasible. This discovery has precipitated a mini-staking rush in the region.

On the advanced level, several porphyry deposits were examined; most notably the **Afton** and **Lorraine**, where DRC Resources Inc. and Eastfield Resources Ltd. respectively completed large diamond drilling programs in 2001. Good success has been reported from both.

International Wayside Gold Mines Ltd. continued to define additional ore at its Bonanza Ledge discovery on the **Cariboo Gold Quartz** project in the Wells-Barkerville camp. The company and others also acquired additional properties in the region for work in 2002.

The potential for platinum group elements deposits in British Columbia received renewed interest, resulting in several property acquisitions, especially in a belt approximately 75 kilometres long, extending northwesterly from the Giant Mascot mine, east of Harrison Lake. Leader Mining International Inc. identified a large magnesium-rich ultramafic body on its **Cogburn** property, northwest of Hope. It is examining the potential to produce magnesium metal.

Several exploration programs targeted carbonatites for their tantalum ± niobium ± phosphate contents (*e.g.* **Verity**, **Fir**, **Myoff Creek**).

Coal exploration saw a dramatic increase during 2002. In addition, there was strong interest in coalbed methane.

STATISTICS

Estimated expenditures on exploration fieldwork are $32 million for 2001. Fifty seven exploration projects (versus 44 the previous year), with budgets in excess of $100 000 contributed to this total. The number of mineral claim units recorded in 2001 is forecast at 26 000, compared to approximately 28 000 the previous year, representing a decrease of about 7%. Figure 1 presents the trends in exploration spending and mineral claim staking between 1971 and 2001. Figure 2 illustrates the number of new and forfeited mineral units in the province between 1990 and 2001 and shows that the number of mineral claims in good standing has been relatively stable since 1994. The number of forfeited units in 2001 is forecast at 20 400, compared to about 24 000 in 2000, representing a 15% decrease. The number of Free Miner Certificates issued each year (Fig. 3) indicates that the numer of certificates is relatively constant over the past few years. Drilling, at over 80 projects in British Columbia during 2001, is estimated to total approximately 220 000 metres (versus 192 000 metres in 2000); of this, approximately 130 000 metres were for metals and 90 000 metres for coal.

During 2001, approximately 40% of exploration spending was around minesites. An estimated 38% of exploration expenditures were on advanced projects, and 22% on grassroots programs (Fig. 4). Minesite exploration program expenditures were dominated by programs at **Eskay Creek** (9.6%), **Line Creek** (5.3%), **Fording Coal** (5%), **Kemess** (3.8%) and **Myra Falls** (3.8%).

MINING HIGHLIGHTS

Final production figures for operating mines will be included in the forthcoming annual publication, *Exploration and Mining in British Columbia*. The locations of the nine metal, eight coal, seventeen (of 41) industrial minerals mines and one tailings project that were in operation in 2001 are indicated on Figure 7 (*see also* Table 1; Figs. 5 and 6). During 2001 the mines employed a workforce of about 8000.

The value of solid mineral production for 2001 is estimated at $2.9 billion, representing an increase of 2% from 2000 (Figs. 5 and 6).

Highlights of metal mining operations included significant productivity improvements at the **Kemess South** gold-copper mine in the Toodoggone district, and continued important gold and silver production at **Eskay Creek**. On the down side, the **Sullivan** mine ceased mining operations on December 21, 2001; an estimated $20 billion worth of silver, zinc, and lead has been won from this operation since 1909. The **Myra Falls** mine closed temporarily in December 2001, the **Golden Bear** mine is being decommissioned and the **Mount Polley** mine closed temporarily in October, 2001.

Copper represents 22% of total solid minerals production value, projected at $638 million, about the same as in 2000. Production was up by approximately 3%; the copper price was much lower in 2001 resulting in a decreased value of approximately $32 million. Increased production was recorded at **Kemess South**, **Highland Valley Copper** and **Huckleberry**.

Gold production is forecast to be 24.3 million grams (781 000 oz), down 3% from 2000, and valued at about $328 million. A small increase in production was recorded at **Kemess South,** but was more than offset by a small decrease at **Eskay Creek**, and much lower production from **Golden Bear**, which is being decommissioned. **Eskay Creek** is the largest producer, with 9750 kilograms (313 500 oz).

Silver output is estimated to be 582 million grams (18.7 million oz), up 1% from 2000, and valued at about $127 million. Again **Eskay Creek** is the largest producer with 414 000 kg (13.3 million oz) with **Highland Valley Copper** a distant second.

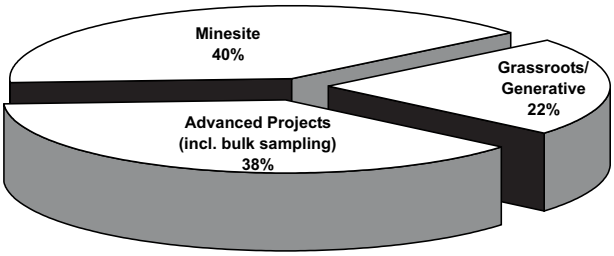
Zinc production is estimated to be 99 million kilograms worth $150 million, and lead output is forecast at 27 million kilograms valued at $20 million. These are 32% and 42% decreases in production for zinc and lead, respectively, due primarily to the winding down of operations at **Sullivan**. More zinc was produced at **Myra Falls**, relative to 2000; however, the value was much lower.

Molybdenum production is estimated to be 8.8 million kilograms, valued at $70.4 million. The 20% increase results from improved recovery at **Huckleberry**. Other molybdenum producers in B.C. are **Endako** and **Highland Valley Copper**.

The forecast value of structural materials, at approximately $470 million, is up about 10% over last year; while industrial minerals is up about 2% at approximately $54 million. The new **Ashcroft** quarry and roofing-granule plant of IG Machine and Fibers Ltd. began commercial production late in the year. There are approximately 1100 construction aggregate operations in the province.

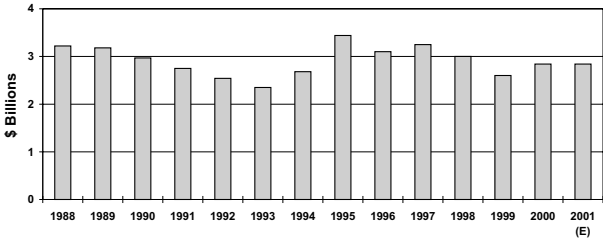
Clean coal production in 2001 is expected to total about 26.6 million tonnes, with a forecast value of ap-

Figure 4 ...



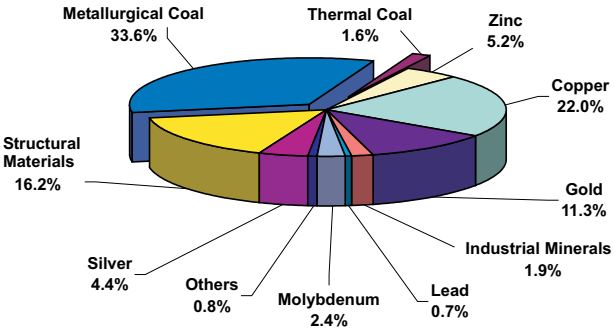
Exploration expenditures 2001; by level or category of program

Figure 5 ...



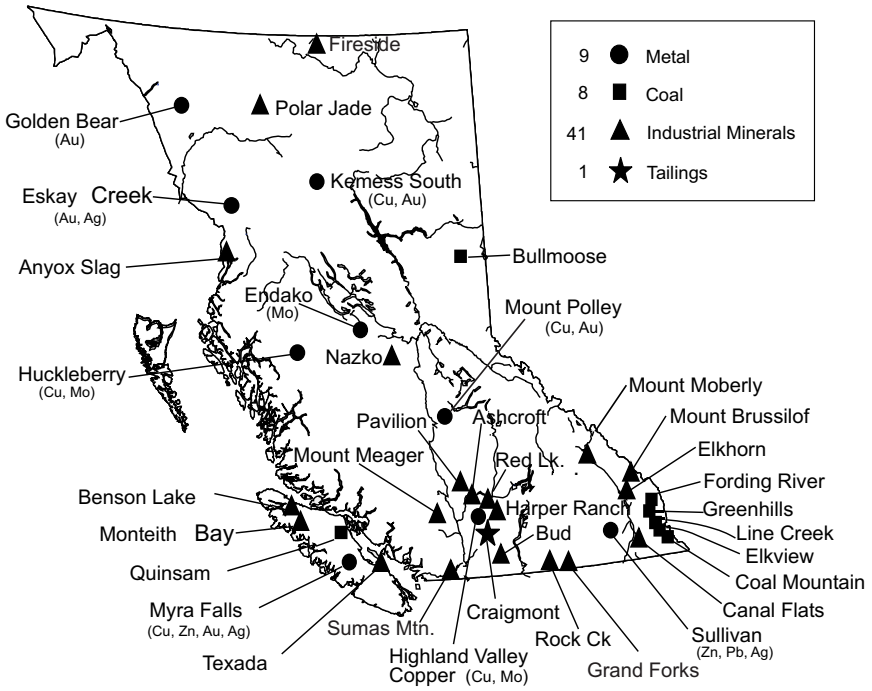
Solid mineral production value in British Columbia: 1988 to 2001

Figure 6 ...



Forecast value of solid mineral production in British Columbia; by percentage of total value - 2001

Figure 7 ...



Operating Mines in British Columbia - 2001

proximately $1.0 billion, approximately 35% of the total solid mineral production (versus 29% in 2000). The reported value is at the mine gate and does not include rail and port costs which are paid by the customer.

Mine production and reserves/resources for 2001 are listed in Table 1.

METALS

OPERATIONS

The **Eskay Creek** massive sulphide, underground mine, now owned and operated by Barrick Gold Corporation, is the fifth largest silver producer in the world and one of the highest grade gold and silver mines. Between January, 1995 and the end of December, 2001, 1.04 million tonnes containing 64.07 million grams (2.06 million oz) of gold and 2.83 billion grams (91 million oz) of silver have been produced. Direct shipping ore is blended on site; it comprises about 55% of the total and contains about 72% of the gold. The remainder of the ore is treated by conventional milling. The latter process produces precious metals in high-grade concentrates, with approximately 60% recovered in the gravity circuit and 40% by flotation. The mine is forecast to produce 9750 kilograms (313 470 oz) of gold and 413 000 kilograms (13.28 million oz) of silver in 2001, at a total cash cost of approximately US$60 per ounce gold equivalent. The total past production, reserves and resources at Eskay Creek are equivalent in value to about 7 million ounces at current prices. In 2001, the company began tailings disposal underwater in Tom Mackay Lake. Late in the year, the company applied to increase its daily milling rate to 750 tonnes, a significant increase from the 600 tonnes per day in 2001. With the existing reserves, ore will be depleted by the end of 2005.

During 2001, nearly 35 000 metres of exploration drilling was completed at the minesite and in the immediate vicinity. It focused on deep targets on the NEX trend, the west limb of the Eskay anticline and the footwall below the 21B deposit.

The **Highland Valley Copper** porphyry copper-molybdenum mine, a partnership among Teck Cominco Ltd., BHP Billiton and Highmont Mining Company, is one of the largest open pit operations in the world, ranking fourth or fifth on the basis of daily mill throughput in excess of 135 000 tonnes. The mine employs about 950 people. A B.C. Job Protection Agreement was initiated for the mine, and current mine life is projected to 2009.

At the **Kemess South** porphyry gold-copper mine, Northgate Exploration Limited continued to improve mining, milling and transportation operations. The mine is forecast to produce 8000 kilograms (257 000 oz) of gold and 31 700 tonnes (69 million lbs) of copper at an operating cash cost of US$190 per ounce gold, net of copper credits. The mine employs about 430 workers. The daily milling rate is approximately 48 000 tonnes. During 2001, two concentrates were produced - one from hypogene ore averaging 23% Cu and 50 to 60 g/t Au, and the other from supergene ore averaging 30% Cu and 80 to 150 g/t Au. Six kilometres north of the mine, the company completed a 16-hole, 8200-metre diamond-drilling program on its **Kemess North** porphyry gold-copper deposit. As a result, inferred resources have been increased to 442 million tonnes grading 0.4 g/t gold and 0.29% Cu. The drilling focused on the northeast extension of a previ-

TABLE 1 - Forecast Mine Production 2001

ously defined resource. The porphyry system at Kemess North, which has many similarities to the Kemess South system, is characterized by an extensive gossan measuring 3.5 kilometres in strike length. Earlier in 2001, the company completed a scoping study to determine the feasibility of transporting ore from Kemess North to the millsite. Kemess North has significant potential to extend the mine life at Kemess.

The **Myra Falls** mine, owned by Boliden-Westmin (Canada) Ltd., has been in production since 1966. In excess of 21 million tonnes of massive sulphide, copper-zinc-gold-silver ore has been mined from several orebodies along a 6-kilometre northwest trend. Average annual production, from just over 1 million tonnes of ore, is 60 to 70 000 tonnes of zinc in concentrate, 15 to 18 000 tonnes of copper in concentrate, plus approximately 700 kilograms (22 500 oz) of gold and 22 000 kilograms (707 300 oz) of silver. In 2001, production came mainly from the H-W deposit, the 43 block and the Battle-Gap deposits. In addition, a small tonnage of ore was mined from an underground reserve in the bottom of the old Lynx open pit. Drilling totalled 13 300 metres and focused primarily on testing the Price and Lynx deposits, in order to upgrade their reserve/resource categories and better assess their mining potential. The operation was suspended for about 3 months beginning in early December, 2001 due to low metal prices. The decline from the 18 level to the 22 level

will continue to be advanced; however, exploration ceased and the mine is currently for sale.

The **Mount Polley** porphyry gold-copper mine, owned and operated by Imperial Metals Corporation, operated at a daily rate of approximately 18 000 tonnes, prior to a temporary closure in October, 2001. The mine employed 240 people. During 2001, the company completed a large exploration-drilling program, resulting in the identification of additional potential ore in the Springer zone, which has yet to be mined.

Huckleberry Mines Ltd., owned by Princeton Mining Corporation (50%) and a consortium of Mitsubishi Materials Corporation, Dowa Mining Company Ltd., Furakawa Company Ltd and Marubeni Corporation (50%), milled approximately 21 000 tonnes of ore daily at the **Huckleberry** porphyry Cu-Mo open-pit mine. All millfeed in 2001 has come from the Main zone, where mining is expected to be completed in the first quarter of 2002. Stripping of the East zone second-phase pit began in late 2001. Although some good grades were encountered during exploration drilling in 2001, the targets are relatively small.

At the **Golden Bear** heap-leach, Carlin-type gold mine, Wheaton River Minerals Limited and North American Metals Corporation produced about 1040 kilograms (33 400 oz) of gold, while it began decommissioning the mine for permanent closure in 2002. Between 1996 and 2001, a total of 8240 kilograms (265 000 oz) of gold were recovered, at an annual cash cost of approximately US$170 per ounce.

Teck Cominco Ltd.'s **Sullivan** underground sedex zinc-lead-silver mine, employing 660 people, closed on December 21, 2001. Since the beginning of operation in 1909, the mine produced some 8 million tonnes of zinc, 9 million tonnes of lead and more than 8 865 000 kilograms (285 million oz) of silver for a total value of more than $20 billion at today's prices. The company plans to spend in the order of $70 million to ensure Sullivan is reclaimed in an environmentally safe manner.

At the **Endako** porphyry molybdenum mine, Thompson Creek Metals Company (75%) and Nissho Iwai (25%) continued milling at a daily rate of approximately 28 000 tonnes. The company reached agreements with suppliers and with the B.C. Job Protection Commission in 2001, which enabled it to stay in operation. A small drilling program was conducted in December 2001.

In late 2001, Taseko Mines Ltd. announced that it had arranged financing which will fund a final determination of the feasibility of commercializing a new copper refining technology, developed at a cost in excess of $50 million by Cominco Engineering Services Ltd., for use at a proposed refinery to be located at the **Gibraltar** porphyry Cu-Mo mine. Mine start up and refinery construction costs are estimated to be $120 million. In August, 2001 a scoping study concluded that the proposed refinery could result in a 22% reduction in copper production costs.

From July through to September 2001, Sable Resources Ltd. extracted 1440 tonnes of ore from both the vein A and vein B open pits at its **Baker** mine. The company reported production revenues of approximately $260 000. In September it carried out an IP geophysical survey over the postulated north extension of the vein A and the north and south extensions of the vein B.

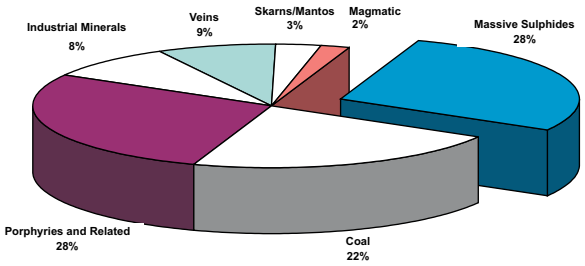
EXPLORATION PROJECTS

Exploration targets in 2001 were varied (Fig. 8). Massive sulphide deposits, which include volcanogenic, sedex and sub-aqueous hot-spring (*e.g.* Eskay Creek) types, and porphyry deposits each accounted for about 28% of expenditures. The largest percentage increase was for coal exploration, which accounted for about 22% of expenditures (versus 5% in 2000). Vein deposits accounted for approximately 9% of expenditures, in good part a reflection of low gold prices. The search for platinum group elements attracted about 2% of exploration spending, the same as in 2000.

The highlights of the 2001 exploration season include several follow-up trenching and/or drilling programs on grassroots prospects discovered in 2000, *e.g.* **Bonanza Ledge**, **Kena**, **Fox**, **Spire**, **Broken Hill**, and **Silver Lynx.** Other programs tested properties with known mineralization *e.g.*, **Afton, Lorraine, RDN, Lustdust** and **Goldstream**. Teck Cominco Ltd conducted a major regional exploration program in the upper Kitsault River region. As in 2000, a number of new discoveries were made throughout the province *e.g.* **Cogburn**, **Bonanza Ledge** zones, **Katt**, **Prospect Valley** and **Silver Lake** (Discovery zone) (*see* Fig. 9 and Table 3).

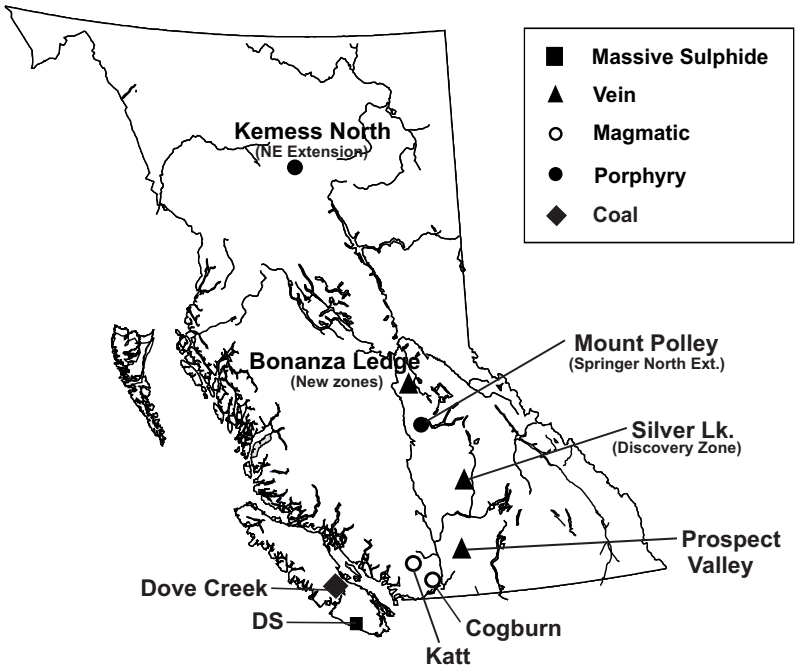
Projects in the Environmental Assessment Process include: **Silvertip**, **Red Chris**, **Prosperity** and **Tulsequah Chief**. Over twenty bulk-sampling programs were conducted in 2001, including four for metals; the remainder involving industrial minerals.

Figure 8 ...



Exploration Targets 2001: by Deposit Type (%)

Figure 9 ...



New Discoveries in British Columbia - 2001

Figure 10 illustrates the location of selected major exploration projects undertaken in 2001. Major exploration projects, with expenditures in excess of $100 000, are listed in Table 2.

Massive Sulphide Deposits

Under an option agreement with discoverer Michael Moore, Gitennes Exploration Inc. completed approximately 1000 metres of diamond drilling in eight holes on the **Fox** property during the spring of 2001. The work was designed to investigate a volcanogenic massive sulphide discovery, 27 kilometres north of Merritt adjacent to the Coquihalla Highway. Mineralization occurs in the hangingwall of a major fault zone; the best hole intersected 0.7 metre grading 16.5% Zn, 1.18% Cu, 87.4 g/t Ag and 450 ppb Au. Further work is planned for 2002.

At the **Broken Hill** property, where three new areas of Shuswap-type stratabound zinc-lead, massive sulphide mineralization were discovered in 2000, Cassidy Gold Corporation (under an option agreement with discoverer Leo Lindinger) completed approximately 900 metres of drilling in 13 holes in January-February, 2001. Most of the drilling targeted gravity anomalies along the trend of the Vista, Navan and Mike showings. Although no economic intersections were reported, the program has led to a much better understanding of the property geology and several targets remain to be tested. The property has been returned to the vendor.

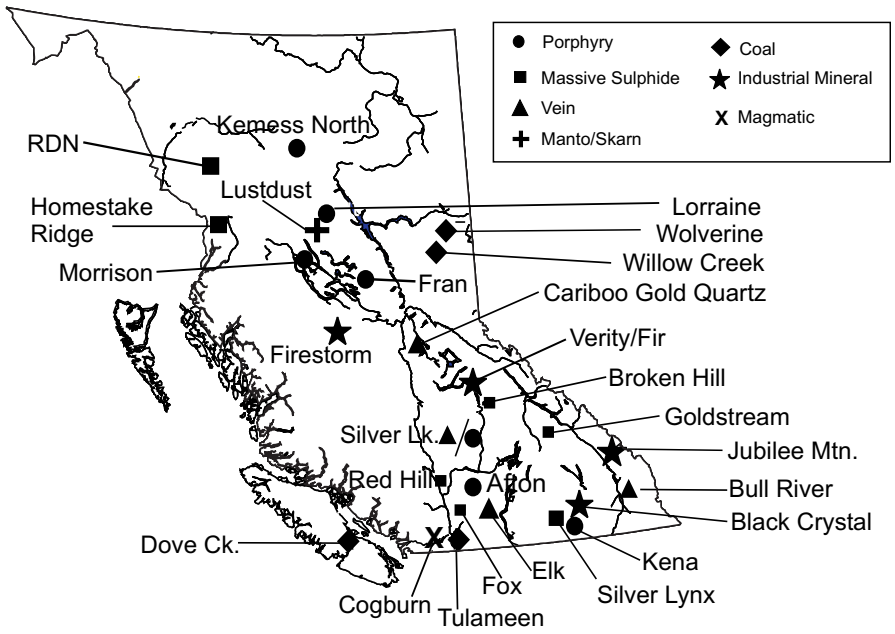
In the **Goldstream** mine area, Orphan Boy Resources Inc., under an option agreement with Imperial Metals Corporation, drilled five holes east of the Goldstream mine. Elsewhere on the large property, the company completed geophysical and geochemical surveys and prospecting in the C-1 area, 10 kilometres west of the mine. This work resulted in the discovery of angular massive sulphide boulders up to one metre in size. The boulders are weakly anomalous in copper and similar in appearance to the Besshi-style VMS mineralization at Goldstream. They occur within a soil geochemical anomaly about 600 metres long and 700 metres wide. In addition, a garnet horizon (similar to that at the Goldstream mine) crops out close by. Follow-up work is planned for 2002.

On the **Spire** claims to the south, Imperial Metals Corporation conducted a trenching program on its massive sulphide copper-zinc prospect discovered in 2000. Located 7 kilometres southwest of the Goldstream mine, the Spire mineralization is also similar in appearance to Goldstream. The 2001 trenching extended the width of the sulphide zone to a maximum of 10 metres. Additional trenching and drilling are planned in the future.

During 2001, Newmont Exploration of Canada Limited, under an option agreement with Rimfire Minerals Corp., completed a two-phase diamond-drilling program totaling 2255 metres in 13 holes on the **RDN** property, approximately 40 kilometres north-northwest of the Eskay Creek mine. Drilling on the Wedge zone along Carcass Creek confirmed the close similarity to the Eskay Creek setting, including stratigraphy and analogous geochemical signatures. The stratigraphic package at RDN appears to be overturned. Strong, pervasive sericite alteration, especially in the felsic volcanic rocks, and minor amounts of mineralization were encountered.

During 2001, Teck Cominco Ltd. drilled 17 holes totaling 3640 metres on its Noranda-type, massive sulphide **Red Hill** target, located near Ashcroft. Mineralization is hosted in Early Triassic bimodal volcanic rocks, a similar

Figure 10 ...



Selected Exploration Projects in British Columbia - 2001

setting to the Kutcho Creek Cu-Zn deposit in northwestern British Columbia. Previous drilling intersected wide zones, up to 20 metres, of disseminated to semimassive pyrite with traces of zinc and copper.

At the **Silver Lynx** massive sulphide copper-zinc-silver-lead prospect, discovered in 2000, and located 20 kilometres west of Nelson, Cassidy Gold Corporation, under an option agreement with Bruce Doyle, completed geochemical, geological and geophysical surveys in early 2001. Sphalerite, galena, chalcopyrite and pyrrhotite are located near the contact between felsic volcanic rocks and black argillaceous sedimentary rocks, within a folded sequence of favourable rocks, estimated to be approximately 200 metres thick, at least 500 metres long, and dipping 70 to the southwest. A short drilling program designed to test the main showing was carried out on the property in December.

During 2001, Teck Cominco Ltd. conducted a systematic regional geological and geochemical exploration program in the **Upper Kitsault River** area, 30 kilometres southeast of Stewart. The prime target is stratigraphy correlative to the Eskay Creek mine and other associated volcanogenic massive sulphide deposits. Drilling is planned for 2002.

Porphyry and Related Deposits

At the **Kena** intrusion-related gold project near Nelson, a large diamond-drilling program on the Gold Mountain zone by Sultan Minerals Ltd. is testing a target area measuring 1400 by 500 metres, to depths of 200 metres. Numerous coincident geochemical and geophysical anomalies occur within the target area. Assays to date, and preliminary petrographic and metallurgical studies, suggest potential for a large tonnage, possibly heap-leachable nonrefractory gold deposit. In addition, there is potential for bonanza-grade gold zones internal to the lower grade areas, *e.g.* hole 01GM-08 intersected a 2-metre interval with an uncut grade of 172.1 g/t Au. Drilling to date suggests that the higher-grade zones are spatially related to the eastern footwall contact of the Early to Middle Jurassic Silver King porphyry with the Early Jurassic Elise Formation mafic volcanic rocks. The Silver King plagioclase porphyry has undergone various phases of alteration, from propylitic and siliceous to potassic and argillic. Mineralization comprises disseminated and fracture-filling pyrite, with minor quantities of chalcopyrite, malachite, magnetite and specular hematite. Fine-grained visible gold has been observed locally in drill core. Sultan also conducted a regional program of soil sampling, prospecting and reconnaissance geological mapping over the 17-kilometre length of the Kena property that covers the trend of the Silver King porphyritic intrusions. At least six new gold soil anomalies have already been outlined.

During 2001, DRC Resources Corp. conducted a large drilling program (planned 37 holes totaling ~18 300 metres) to test the deep mineralization beneath and adjacent to the southwest end of the **Afton** porphyry copper-gold-silver-palladium deposit. Last year the company announced a resource estimated at 22.7 million tonnes grading 2% Cu, 1.54 g/t Au, 6.86 g/t Ag and 0.14 g/t Pd. The 2001 drilling is testing partially oxidized, structurally controlled, alkalic porphyry mineralization over an area 760 metres long, 75 metres wide and at least 300 metres deep. Earlier in the year, Behre Dolbear and Company ex-

amined the potential for development of an underground block-caving operation.

Drilling on the **Lorraine** property northwest of Germansen Landing, by Eastfield Resources Ltd., indicates the extent of porphyry/iron-oxide copper-gold mineralization may be much larger than previously believed; three discrete zones (Upper Main, Lower Main and Bishop) traced along a 1.4-kilometre strike length, may coalesce and continue to depth. Previously defined resources on the property were estimated at 32 million tonnes grading 0.66% Cu and 0.17 g/t Au. In addition to drilling, preliminary soil geochemical and geophysical surveys on the Page and adjacent BM Breccia area were completed. Resumption of drilling is planned in early 2002.

Pacific Booker Minerals Inc. completed approximately 10 560 metres of drilling in 39 holes on its **Morrison** porphyry copper-gold-silver property, 65 kilometres northeast of Smithers, in a joint venture with Noranda Inc. A resource of 190 million tonnes grading 0.4% Cu and 0.2 g/t Au was originally calculated for the deposit by Noranda, based on relatively shallow drilling in the 1960s and 1970s. Drilling over the past couple of years has defined the mineralized porphyry system over a length of 1.2 kilometres and a width of 600 metres. The current program is designed to re-drill the entire deposit on 60-metre centres and to depths of 300 metres, using current standards for an improved resource estimate, and is expected to be completed in spring 2002.

Navasota Resources Ltd., under a joint venture agreement with Cassidy Gold Corp., completed a five-hole, 993-metre diamond-drilling program on the **Fran** porphyry-related gold-copper property, 70 kilometres northeast of Fort St. James. Drilling targeted a 1500-metre, northwesterly trending gold soil geochemical anomaly. Polymetallic quartz veins and sulphide stockwork zones with gold and copper mineralization occur in both diorite to granodioritic intrusive rocks and hornfelsed sedimentary rocks of the Inzana Lake succession (Takla Group). Higher grade gold values are present in shear zones.

In 2001, Christopher James Gold Corp. completed a trenching and seven-hole, 880-metre diamond-drilling program on its Worldstock porphyry copper-molybdenum-gold target, **Silver Lake** property, 17 kilometres northwest of Little Fort. It tested a 700-metre segment of a larger coincident geological, geochemical and geophysical target. Broad pyritic alteration zones, up to 250 metres wide, with local fracture/veinlet and disseminated chalcopyrite mineralization were encountered in Nicola Group volcanic rocks.

Precious Metal Veins and Bulk-mineable Deposits

Follow-up drilling by International Wayside Gold Mines Ltd. on its **Cariboo Gold Quartz** mesothermal gold project in the Wells-Barkerville camp tested the newly discovered Bonanza Ledge zone(s) and other targets to the northwest along the Wells Trend. The targets are auriferous pyrite replacement deposits. A zone of alteration and mineralization, 1 kilometre long, has been traced across faults to the northwest and southwest and in the hangingwall of the BC vein, in the vicinity of the Bonanza Ledge zone. A large induced chargeability anomaly beneath the zone was drilled late in the season. There appear to be five parallel lenticular zones; 1) BC vein; 2) a zone in the hangingwall of the BC vein; 3 and 4) Bonanza Ledge, which has two zones; and 5) a footwall zone to the Bonanza Ledge. Drill hole BC01-20, drilled at the northwest end of the BC vein in the hangingwall of the Goldfinch fault, cut an intersection of 8.3 metres grading 8 g/t Au. This intercept includes the vein and 3.6 metres of the magnetite siltstone and sandstone unit in its hangingwall. Baseline studies for the Cariboo Gold Quartz project have been compiled by the company to reenter the provincial Environmental Assessment process. International Wayside also explored the **Mosquito Creek** property, under an option agreement with Island Mountain Gold Mines Ltd. It focused its exploration, including a seven-hole diamond-drilling program, on the Kutney zone where recent surface sampling yielded multi-ounce gold grab samples. Golden Cariboo Resources conducted a regional exploration program to the southeast of Bonanza Ledge and located new showings on the **GM** property.

During 2001, Christopher James Gold Corp. completed trenching and twenty-one-hole, 2400-metre diamond-drilling program on its **Silver Lake** property, 17 kilometres northwest of Little Fort. In the Discovery A area, drilling tested coincident IP chargeability and VLF geophysical and soil geochemical anomalies along a northwesterly trend. Quartz-chalcopyrite-carbonate vein mineralization, containing grades up to 14.7% Cu and 98.9 g/t Ag over 0.55 metre was discovered by trenching and drilling. The veins have alteration selvages of chlorite-magnetite and are hosted by augite basalt of the Nicola Group. Similar mineralization was also tested by drilling and trenching on the Discovery B target, 600 metres to the west.

During late 2001, Fairfield Minerals Ltd. completed a 230-metre trenching program, comprising seven trenches, in the Siwash East and Gold Creek West areas on its **Elk** epithermal gold vein property. Six trenches in the Siwash East area, 1.7 kilometres to the east of the Siwash minesite, exposed quartz veins up to 20 centimetres wide. Grab samples returned averaged analyses of 31.6 g/t Au and 104.4 g/t Ag. In the Gold Creek West area, trenching revealed a mineralized quartz vein. In October, Fairfield also completed a preliminary program of prospecting and reconnaissance-scale rock and soil geochemistry on its newly acquired **Prospect Valley** epithermal gold vein discovery, 50 kilometres west of Merritt. The property was staked to cover widespread occurrences of significant gold-bearing quartz vein and quartz breccia float showing textures typical of low-sulphidation epithermal systems.

Skarn/Manto Deposits

Alpha Gold Corp. completed a seventeen-hole, 5400-metre diamond-drilling program testing a large, zoned, auriferous polymetallic vein-manto-skarn-porphyry system on its **Lustdust** property, 150 kilometres northwest of Fort St. James. At least four en echelon skarn zones, hosted by limestones and meta-argillites of the Permian Cache Creek Group, have been identified over a strike length of 2500 metres and a width of 500 metres. The 2001 drilling program focused on the Canyon Creek copper-molybdenum skarn and porphyry zones. Mineralization in the porphyry was traced for 1000 metres along the western side of the skarn zone. On the skarn zone, deep drilling intersected the most significant widths of mineralization encountered to date, *e.g.* 59 metres grading 0. 8% Cu and 0.67 g/t Au. Follow-up drilling in 2002 will focus on tracing the skarn mineralization to depth and along the Canyon Creek fault trend to the west.

Magmatic Deposits

Although exploration expenditures for nickel + platinum group element-bearing magmatic deposits only accounted for about 2% of total expenditures, significant ground acquisitions continued to be made in 2001 and exploration for these targets is expected to increase in 2002. The most active area in the province for PGE exploration was the east side of Harrison Lake, for over 75 kilometres northwesterly from Hope.

During an examination of a previously known area of nickel-copper mineralization on the **Cogburn** property, Leader Mining International Corp. discovered a magne-

sium-rich ultramafic intrusive body with 10 kilometres of strike length and an average width of 2 kilometres. Diamond drilling in 1971 by Giant Exploration Limited on a nickel-copper target, confirmed that the ultramafic rock is at least 200 metres thick. Systematic sampling profiles by Leader, covering an area 3 kilometres by 1 kilometre, returned assays consistently over 25% Mg. Detailed analysis of samples confirmed that the magnesium-enriched ultramafic body carries low levels of deleterious elements such as sulphur, boron, nickel, copper and chromium. Late in 2001, Leader conducted a 22-hole, 1200-metre diamond-drilling program to depths of 50 to 150 metres. The company hopes to identify the highest grade zone with the lowest impurity levels; a minimum target size is at least 10 million tonnes of potentially surface-mineable resources. Hatch Associates Ltd. performed a preliminary metallurgical and engineering study; it reported that the Cogburn magnesium project has good economic potential.

Also in the Harrison belt, platinum group elements' exploration programs were carried out on the **Harrison Lake** (Garex International), **Emory Creek** (Santoy Resources), **Jason** (David Haughton) and **Sable** and **Katt** (McClaren) properties. Elsewhere in the province, minor exploration programs investigated elevated PGE concentrations (especially palladium) in alkaline porphyry deposits (*e.g.* **Afton**) and mineralization associated with mafic intrusions and related flood basalts (*e.g.* Port Renfrew area).

COAL

Coal mining and exploration showed significant increases in 2001 in response to increased prices. There was an 8% increase in production, an 18% increase in coal's share of total solid mineral production and a 280% increase in exploration expenditures. Most of the mines in southeast British Columbia are operating at or close to capacity.

British Columbia will export an estimated 26.6 million tonnes of coal in 2001, close to the record production of 27.8 million tonnes in 1997. The f.o.b. value of coal exports is over $1.6 billion making coal by far the most important mineral export. The projected tonnage for 2002 is 28 million tonnes. Volume is expected to decrease in 2003 when the **Bullmoose** mine closes, but may rise again if other planned developments in the northeast come on stream.

Coking coal prices improved in 2001, mainly because of a decrease of 6.5 million tonnes of export coking coal caused by the closure of the **Quintette** mine in northeastern B.C. and the Smoky River and Gregg mines in Alberta in 2000. American mines also began withdrawing from the export coking coal market in 2001.

Thermal coal prices have also increased, but for different reasons. Unfortunately, B.C. exports very little thermal coal. As yet, the increased prices have not resulted in interest in developing new thermal coal mines in the province, such as the **Telkwa** property, or an increase in the production from the **Quinsam** mine.

There were a number of changes in ownership: Fording Inc. (owner of the Fording River, Greenhills and Coal Mountain mines) became an independent public company; Luscar Energy Partnership (owner of the Line Creek mine) changed from Luscar Inc. and Sherritt International Corporation; and Teck (owner of the Elkview mine) took control of Cominco to form Teck Cominco Limited.

OPERATIONS

In the following section tonnages reported are clean tonnes. The annual production at a mine may not match sales because of changes in inventory levels at the mines and at the port.

The **Fording River** (Fording Inc.) mine expects to produce 9.45 million tonnes in both 2001 and 2002. By the end of the year, the mine will be operating six new, 320-ton, waste haul trucks and has bought a 60-yard shovel. Exploration licenses on the east side of Fording River have been acquired and are the focus of some of the 1800 metres of development drilling completed in 27 holes. In-pit drilling totaled 7020 metres in seven holes.

Production at the **Greenhills** (Fording Inc.) mine has increased over the last few years and is now stable at 4.7 million tonnes. There was no development drilling and in-pit drilling totaled 65 holes with an aggregate length of 7500 metres. The plant is being expanded to a capacity of 5 million tonnes per year.

Production at the **Line Creek** mine (Luscar Energy Partnership) in 2001 is estimated to be over 2.8 million

tonnes and there are plans for 3.5 million tonnes in 2002. The mine had a major exploration and development program aimed at increasing its resource base. Sixty-five holes were drilled for a total length of 16 600 metres and a cost of $1.2 million. In-pit drilling comprised of 150 holes with an aggregate length of 12 000 metres.

The **Elkview** (Teck Cominco Limited) mine has doubled production since 1999, to 5.6 million tonnes in 2001, and is planning a further increase to 6 million tonnes in 2002. This represents close to the maximum output for the wash plant. Reserves in the present mine plan are over 260 million tonnes of coal, which represents more than 40 years of a mine life. In 2001, 64 holes totaling 5430 metres were drilled within active pits for mine planning. Four holes were drilled outside the pit to delineate of long-term reserves. Total depth was 1370 metres. An additional 2000 metres of exploration drilling in four holes is planned for the winter of 2001-2002.

Production at the **Coal Mountain** (Fording Inc.) mine in 2001 is estimated at 2.4 million tonnes and will be unchanged in 2002. Exploration was all in pit and amounted to 5848 metres of drilling in 21 holes.

The **Bullmoose** (Teck Cominco Limited) mine is preparing to close in 2003 and there was no exploration in 2001. Production in 2001 is expected to be 2.1 million tonnes, reducing to 2.0 million tonnes in 2002. The mine will operate for about three months in 2003, before closing.

The **Quinsam** (Hillsborough Resources Limited) mine continues to operate below capacity and will probably sell about 300 000 tonnes this year. The company stockpiled coal on Texada Island in the hope of obtaining offshore spot sales. It undertook an aggressive exploration program around the mine and reported to have increased reserves. About 2323 metres of drilling were completed in twelve holes. There are plans to drill up to four holes totaling 2200 metres in the Quinsam East area, near the Campbell River airport. Two of these holes are scheduled for completion in 2001.

The **Willow Creek** (Pine Valley Coal Company) mine, owned two-thirds by Globaltex Industries Inc. and one-third by Matsushima of Japan, has a permit for a trial cargo of 100 000 tonnes and, to date, has shipped and sold 36 000 tonnes. A second trial cargo shipment is planned. The company submitted an application to amend the mine plan to allow it to mine up to 400 000 tonnes of raw coal annually in an area where 6 and 7 seams are close to surface. This block is referred to as the Peninsular area and has reserves of 830 000 tonnes There was minor exploration in the spring when 23 holes were drilled for a total length of 1100 metres.

EXPLORATION PROJECTS

Exploration expenditures at minesites and elsewhere have risen dramatically, from $2.3 million in 2000 to $6.4 million in 2001. It is encouraging to note that over $1.5 million was spent on grassroots exploration programs. Exploration expenditures do not include the costs for bulk samples obtained for the purposes of test marketing.

Vancouver Island

The coal rights in the **Tsable River** area are assigned to Hillsborough Resources Limited and its subsidiary T'Sable River Coal Corporation and they have plans to develop a thermal coal mine. Past exploration outlined 40 million tonnes of underground reserves. This year's modest exploration program comprised five holes (800 metres). A development drilling program totaling approximately 5500 metres in 18 holes is planned for 2002. The company plans to drive a decline to access the coal seams and extract 90 000 tonnes of coal at a cost of $4.5 million.

Priority Ventures Limited acquired coal licenses and freehold gas rights in an area northwest of **Courtenay** on Vancouver Island (**Dove Creek** property). The company drilled three holes to the base of the Comox Formation to test for potential coal, coalbed methane (CBM) and natural gas resources. About 1270 metres of core was recovered. The CBM data will be published in the Geological Survey Branch paper 2002-1. The company has plans to drill three deep core-holes and ten delineation holes to better define the coal resource. It has also applied to the Oil and Gas Commission to drill a test hole for CBM.

Northeast British Columbia

Western Canadian Coal Corporation has been aggressively exploring for areas of Gething and Gates coals in northeast B.C. that offer low-cost development possibilities. It has outlined a number of promising areas and, over the last year, has raised funding to start developing the best targets, including the **Perry Creek** underground property and the **Wolverine EB** open-pit area. Both areas contain reserves of medium-volatile bituminous coking coal. The company has entered the provincial Environmental Assessment process for a project approval certificate. It anticipates a two-stage process for its $100-million capital project and expects to employ 300 people. The project is about 20 kilometres west of Tumbler Ridge, and contemplates a 1.5 to 2-million tonnes per year, open-pit coal mine. A detailed feasibility study is expected in March, 2002. Other targets receiving attention are the **Burnt River** and **Brazion** open-pit areas; both have reserves of low-volatile bituminous pulverized coal injection coal. The company expects to apply for permits in Spring 2002 to begin mining at Burnt River. Exploration on all four properties amounted to 61 holes (6400 metres) at a total cost of $1.07 million.

Interior coalfields

The lease held by Pacific Western Coal on the **Tulameen** coal basin has been optioned to Compliance Coal Corporation. In 2001, a 10 000-tonne bulk sample

was extracted by selective mining and screened at 50 mm. The company is test marketing the product in the Lower Mainland and Kamloops areas as a thermal coal to be used in the cement industry, power plants and greenhouse operations. There are plans for some pre- stripping this winter and to move a mobile heavy-medium wash plant onto the site in 2002. It is also planned to ramp up production incrementally to about 250 000 tonnes per year in a few years.

INDUSTRIAL MINERALS

The value of industrial mineral production in 2001 is estimated at $54 million and mineral exploration expenditures are estimated at approximately $2.6 million, representing 8% of total expenditures. Operations are concentrated close to existing infrastructure and markets (*see* Figure 5 for selected major operations). The most economically significant industrial minerals produced are: sulphur, magnesite, white calcium carbonate, limestone, silica, dimension stone, gypsum, construction aggregate and crushed rock. Commodities produced in lesser quantities include jade (nephrite), magnetite, dolomite, barite, volcanic cinder, pumice, clay, fuller's earth and zeolites. There are more than 40 mines or quarries and at least 20 major sites where upgrading of industrial minerals into value-added products takes place, not counting the aggregate operations listed by the British Columbia Aggregate Producers Association.

Over the last two years, perhaps the most significant industrial minerals trend in British Columbia is the increasing export of crushed stone and natural aggregate to urban centres along the west coast of the United States. This growth is expected to continue in the coming years due to high demand and shortages of more local supply. Another important development was the startup of a basalt quarry and related roofing-granule plant in the Ashcroft area. The November 2000 spike in tantalum prices attracted the attention of the exploration community to a variety of high technology minerals in the province.

Gypsum

Westroc Inc. is producing approximately 500 000 tonnes of gypsum annually from its **Elkhorn** quarries near Windermere. During the last three years, the company drilled 98 holes indicating a resource of 16.7 million tonnes of gypsum on its **Koot** property, northeast of Canal Flats. Georgia Pacific Canada Inc. ships 100 000 tonnes of gypsum per year from its **Four J** quarry near Canal Flats to Edmonton, Alberta. Both Westroc and Georgia Pacific operate wallboard plants in the Vancouver area. Lafarge Canada Inc. mined about 5000 tonnes of gypsum from its **Falkland** pit for its Kamloops cement plant.

Magnesite

Baymag Mines Company Ltd. mines magnesite at **Mount Brussilof** at a rate of about 200 000 tonnes annually. The company has two plants in Exshaw, Alberta. The first site is a converted lime kiln producing sintered magnesia; the second houses a 50 000-tonne capacity, multiple hearth furnace, vertical-kiln, dedicated to specialty calcined MgO and also an electrofusing installation. Calcined magnesia is the main product; however, a portion of production is further processed to produce high-quality fused magnesia for export.

Over the past few years, several of British Columbia's many magnesite deposits have changed hands and are being re-examined. Near Marysville, Stralak Resources Inc. and its joint venture partner, Magna Precious & Industrial Metals Inc., took control of the **Marysville** sparry magnesite deposit from Teck Cominco Ltd.

Silica

In 2001, Highwood Resources Ltd. produced approximately 60 000 tonnes of silica at its **Moberly** mine, for shipment to Springfield, Oregon; Lavington, B.C. and other destinations. The **Horse Creek** silica mine, which is owned by Silicon Metaltech of Seattle and was operated by Nugget Contracting Ltd., remained idle in 2001 as a result of the 1998 shutdown of the Wenatchee metallurgical grade silicon and ferrosilicon plant. Monteith Bay Resources Ltd. supplied 37 000 tonnes of silica to the Tilbury Cement Ltd. plant in Delta, from its quarry at **Monteith Bay** on western Vancouver Island. Tilbury also recently bulk sampled silica (chalky geyserite) from the **Pem 100** deposit, owned by Homegold Resources Ltd. Lafarge Canada Inc. mined about 10 000 tonnes of silica-alumina material from the **Buse Lake** deposit, as feedstock for its Kamloops cement plant.

Limestone

The largest limestone production centre in the province is Texada Island, where two quarries, **Gillies Bay** (Texada Quarrying Ltd.) and **Blubber Bay** (Ashgrove Cement Corporation), traditionally ship 5 to 6 million tonnes annually to customers in British Columbia, Washington, Oregon and California for cement, chemical and more recently, agricultural use. In 2000, 3.78 and 3.86 million tonnes of rock were quarried from Gillies Bay and Blubber Bay respectively, but not all of it was shipped. The 2001 figures are expected to be slightly lower, including about 3.2 million tonnes for Texada Quarrying Ltd. who recently invested $10 million into an aggregate crushing plant and shipped crushed rock as far as Los Angeles and San Diego, California. Shipments by Ashgrove Cement in 2001 are estimated at 1.8 million tonnes of limestone.

Three cement plants and two lime plants in British Columbia process limestone. Graymont Western Canada Inc.'s **Pavilion Lake** limestone quarry and lime plant,

near Cache Creek, produces about 200 000 tonnes of lime annually. Pulp and paper mills prefer to produce their own lime. The Kamloops cement plant of Lafarge Canada Inc. acquired 180 000 tonnes of limestone from the **Harper Ranch** quarry. Lafarge's plant located in Richmond and Tilbury Cement's plants in Delta are state-of-the -art operations. Lafarge's plant has the capacity to produce one million tonnes of cement. Pacific Lime Products Ltd. at **Giscome**, near Prince George, sells small quantities of limestone to pulp mills in the region.

Northrock Industries Ltd. provided a limited amount of limestone from its **Dahl Lake** quarry for rip-rap and landscaping. Graymont Western Canada Inc. is examining the process for advancing its proposed 250 000-tonnes per year chemical limestone **Var** quarry, on Rupert Inlet near Port Hardy, into the Environmental Assessment Process.

White Calcium Carbonate

White high-calcium carbonate is produced from deposits on Texada Island (**Vananda** and **Gillies Bay**), at **Benson Lake** on Vancouver Island, and at **Lost Creek** near Salmo. It has a variety of uses including paper, paint and plastic filler.

Dolomite

Dolomite is quarried by IMASCO Minerals Ltd. at its **Crawford Bay** mine on Kootenay Lake and by Mighty White Dolomite Ltd. near **Rock Creek**. Dolomite is used for soil conditioning, white ornamental aggregate, for stucco and roofing, as a fine aggregate, and for synthetic marble products.

Crushed Stone and Aggregate

Grassroots exploration for traditional construction materials is expanding along the British Columbia coastline. It is expected that shipments of crushed stone from Texada Island and other coastal sources will make more significant inroads into the Vancouver, Seattle, San Diego, San Francisco and Los Angeles markets. Texada Island limestone producers have already started to take advantage of this opportunity (see under Limestone). The same economics apply to natural aggregate. For example, Tilbury Cement Ltd. shipped aggregate from its facility at **Sechelt** to the San Francisco Bay area in 2001. Polaris Minerals Corporation is in the permitting process for a combined crushed rock/natural aggregate operation in the **Bella Coola** and **Port Alberni** areas.

The situation also improved for inland crushed stone producers. Approximately 400 000 tonnes of railroad ballast were produced from Canadian Pacific Railway's **Giscome** basalt quarry and about 200 000 tonnes from British Columbia Railway's **Ahbau** basalt quarry. Canadian Pacific Railway mined, crushed and shipped railroad ballast at its **Swansea Ridge** gabbro quarry south of Cranbrook.

Roofing granules

In October 2001, IG Machine and Fibers Ltd., a subsidiary of IKO Industries Ltd., opened its **Ashcroft** basalt quarry and roofing-granule plant. The company plans to produce 150 000 tonnes per year of granules which will be crushed, sized and coloured on site, prior to shipping to IKO Industries shingle plants in Sumas, Washington, and Calgary, Alberta. The plant began crushing, screening and colouring granules in November and expects to be at full production in 2002.

Clay and Shale/Sandstone

Clayburn Industries Ltd. of Abbotsford processes fireclay from **Sumas Mountain** into a variety of refractory bricks and castable products that are exported worldwide. Sumas Clay Products Ltd also produces small quantities of flueline pipe and ornamental and facing bricks near Abbotsford. Lafarge Canada Inc. and Tilbury Cement Ltd. are scheduled to produce 450 000 tonnes of shale and sandstone from their Sumas shale quarry in 2001.

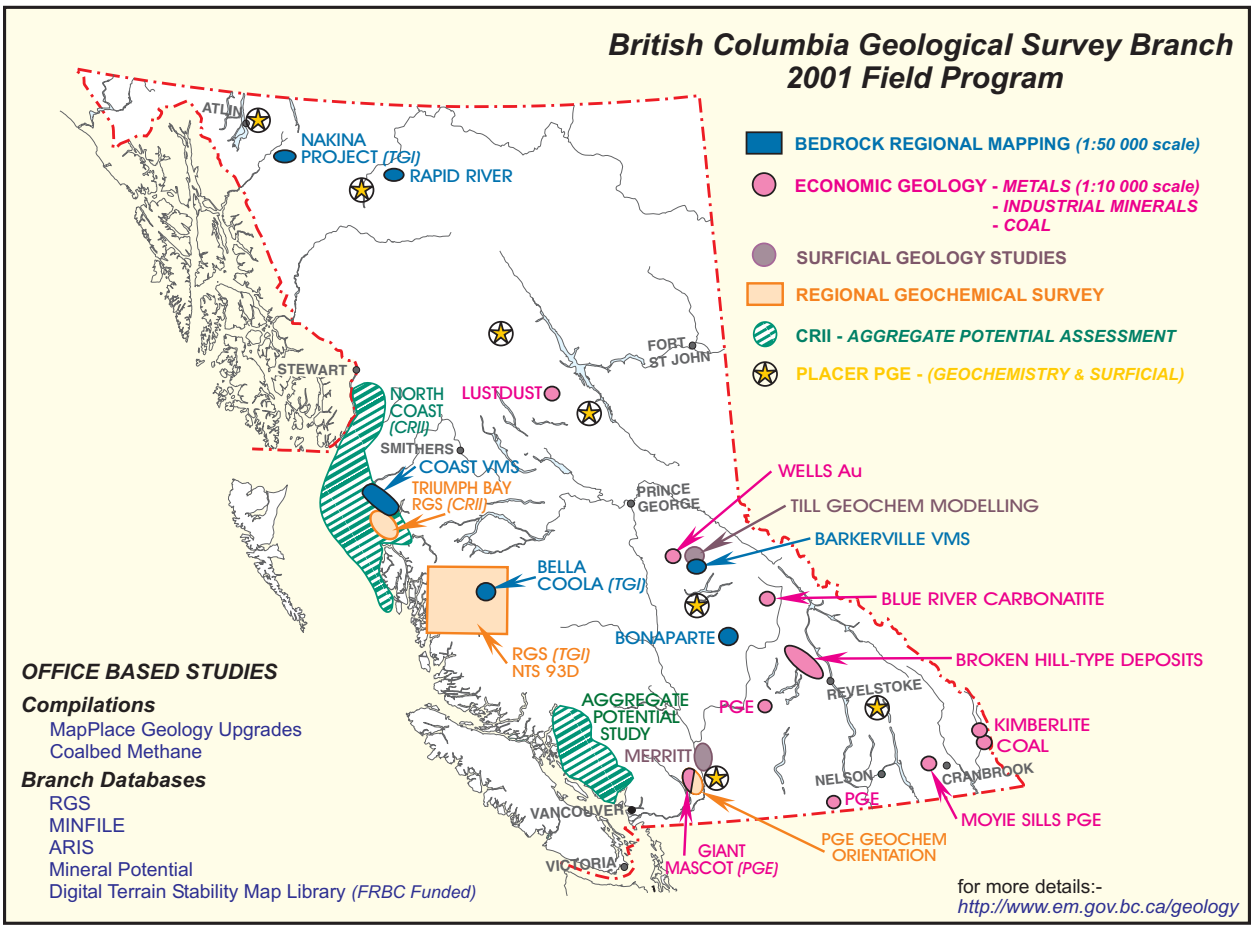
Diatomite and Zeolite

Western Industrial Clay Products Ltd. produces domestic and industrial absorbents, principally from its **Red Lake** fuller's earth deposit near Kamloops. In the Princeton area, the company also controls the **Bee** and **Brom** zeolite properties and is mining small quantities of bentonite from the **Bud** property. The company also began to market "leonardite" (low-grade coal) as an organic soil conditioner. The leonardite occurs between the diatomite horizons at Red Lake.

Highwood Resources Ltd. reports increasing annual sales of zeolite from the **Ranchlands Z-1** quarry near Cache Creek. It has drawn from existing stockpiles and there was no mining in 2001. C_2C Zeolite Mining Corporation recently sold its **Z-2** zeolite quarry near Cache Creek and its Ashcroft processing and packaging plant to Industrial Mineral Processors of Calgary, Alberta. C_2C Zeolite and Zeo Tech Enviro Corp. have created an alliance for processing, product and technology development, and marketing production from respective zeolite deposits in the Cache Creek and Princeton areas. Zeo-Tech is preparing an application for a 75 000 tonne per year quarry on the Zeo property at Princeton. C_2C announced that a related company, Canmark International Resources Inc., continues to develop a market in the Lower Mainland for zeolite from its **Sunday Creek** deposit near Princeton.

New zeolite occurrences near Manual Creek, in the Keremeos area, were discovered by Neil Church under the auspices of the Ministry of Energy and Mines' 2001 Prospectors Assistance Program. The x-ray diffraction results and the cation exchange capacity of grab samples are promising.

Figure 11 ...



Dimension Stone

Stone-processing plants are operated by Westcoast Granite Manufacturing Inc. in Delta, Margranite Industries in Surrey, Matrix Marble Corporation in Duncan and Garibaldi Granite Group Inc. in Squamish. Margranite is processing imported granite and nine granite varieties from at least three quarry sites located in the East Anderson River, Beaverdell and Skagit Valley areas. Garibaldi Granite owns a processing plant in **Squamish** and is processing six granite varieties from six nearby quarry sites as well as other stones. The company also produces a variety of basalt landscape products. In 2001, Matrix Marble Ltd. concentrated on processing materials at its plant near Duncan.

Hardy Island Granite Quarries Ltd. extracted about 2700 tonnes of stone this year. Quadra Stone Ltd. produced approximately 1000 tonnes of Cascade Coral blocks from a new quarry near **Beaverdell**. Near Kelowna, the Kettle Valley Stone Company produces flagstone, ashlar, thin veneer and landscape rock products from several quarries. Flagstone has been quarried by Revelstoke Flagstone Quarries, Kootenay Stone Centre and other small operators in the West Kootenays. Dome Creek Structural Slate Company quarried a limited tonnage of attractive green slate from its **Dome Creek** deposit on Highway 16, east of Prince George.

Jade

Jade West Resources Ltd. and its affiliated company, Polar Gemstones Ltd., are the main nephrite producers. They produced about 200 tonnes of nephrite from the **Kutcho Creek** and **Serpentine Lake** areas in northwestern B.C. Jade West also operates a jade processing facility in south Surrey. The company is currently looking for partners to set up the facility to produce nephrite tiles.

Pumice and Tephra

Canada Pumice Corporation produced about 19 000 cubic metres of tephra from its **Nazko** quarry, west of Quesnel. The material is used for landscaping, sporting facilities, growing and filtration media, and lightweight aggregate applications. Great Pacific Pumice Ltd. is shipping a variety of pumice-based products from its **Pum** property on Mount Meager, north of Pemberton. Production in 2001 was estimated at 12 000 cubic metres.

Mineral Wool

An insulation/mineral wool manufacturing plant in Grand Forks is operated by Roxul (West) International Inc. The new source of rock for the plant was the **Winner** diorite quarry in the Greenwood mining camp, 4 kilometres south of the former Phoenix mine. Samples were also collected at a number of other sites in the area. The company continues exploration for new raw materials to optimize the operation.

Slag

Pacific Abrasives & Supply Inc. is producing and processing slag from **Grand Forks** dumps for a variety of applications, but mainly for sandblasting at major shipyards and for roofing granules. Some slag was also shipped from **Anyox** by Tru-Grit as abrasives for use in the cement industry, mainly in the Vancouver area, for roofing granules and some abrasive applications. Teck Cominco Ltd. is also a major slag producer from operations at its Trail smelter. It markets its products mainly for cement production and abrasive applications. The company is converting one of the old furnaces into a second fuming furnace. The use of two furnaces doubles the fuming time and results in substantially lower base metal levels in the slag, improving the quality of the product. Slag is also recovered in the **Greenwood** area and is used as one of the raw materials in the production of mineral wool by Roxul (West) International Inc. in Grand Forks.

Magnetite

M-Seven Industries Inc. produces between 60 000 and 70 000 tonnes per year of magnetite for industrial applications by processing the **Craigmont** tailings. The company is supplying most coal mines in western Canada with material for heavy media use in their wash plants. Homegold Resources Ltd. is bulk sampling the **Iron Ross** magnetite occurrence, approximately 6 kilometres south of Sayward.

Graphite

Crystal Graphite Corp. excavated a 10 000-tonne bulk sample during 2001 on its **Black Crystal** graphite property, near Nelson. To date, the company reports that 20 400 tonnes of graphitic material, with an estimated grade of 3% graphite, have been made available as plant feed, of which 2000 tonnes have been processed at its Koch Creek pilot plant. Products of 94% and 97.5 % graphitic carbon have been achieved by use of the flotation and concentrate grinding process. In addition, the company conducted a diamond-drilling program consisting of 2128 metres in 39 holes. Mine Design Systems Ltd. calculated the total resource at Black Crystal to be 12 974 000 tonnes with an average grade of 1.34% graphite; of this total, 1 922 000 tonnes are measured, 10 196 500 tonnes indicated and 856 300 tonnes inferred.

Sulphur

Sulphur, a byproduct of natural gas, is produced at a number of processing plants in the northeast of the province by West Coast Energy Inc., Petro-Canada Inc., TransCanada Midstream and Amoco Canada Petroleum Company Limited. Liquefied SO_2 and sulphuric acid are also produced at Cominco's smelter in Trail. Year 2000 production is estimated at 899 000 tonnes.

High Tech Minerals

Chapleau Resources Ltd. explored the Hellroaring Creek pegmatite stock for beryllium, rubidium, tantalum and rare earths. Late in 2000, the company drilled eight short holes to test the **Pakk** property. In 2001, Chapleau drilled four short holes on the Peg beryllium target under a joint venture agreement with Naneco Minerals Ltd.

Commerce Resources Corporation drilled its **Verity** and **Fir** carbonatite deposits near Blue River. Its recent resource estimate for Verity is 3.06 million tonnes at 196 g/t tantalum pentoxide, 646 g/t niobium pentoxide, and 3.2% phosphate. At the Fir project the company completed six drill holes; the thickness of the carbonatite intersected averaged 40 metres. The Fir ferrocolumbite and pychlore-bearing carbonatite appears to be flatlying, and has been outlined over an area 425 by 325 metres.

Cross Lake Minerals Ltd. trenched its **Myoff Creek** carbonatite, 55 kilometres northwest of Revelstoke, as a potential target for niobium, tantalum, and rare earths.

Pacific Ridge Exploration Limited conducted a modest chip-sampling program on the RAR 3, RAR 5 and RAR 7 zones of its tantalum and rare earth elements bearing **Xeno** property, 140 kilometres east of Dease Lake. A 10-kilogram bulk sample was also taken from a diatreme with a kimberlite signature for processing for diamonds.

Gemstones

Skeena Resources Limited drilled five holes to test the RAM 5 and RAM 6 kimberlite pipes on its **Ice** diamond property near Elkford. One hole on the RAM 5 site intersected 105 metres of kimberlite. In addition, a 4-tonne bulk sample was collected from surface on the nearby **Bonus** kimberlite pipe. Analytical results have not yet been released.

Okanagan Opal Inc. continues to cut, test and market precious opal from the **Klinker** locality near Vernon. The 2001 follow-up exploration work resulted in the discovery of a new precious opal occurrence outside the original claim group. Follow-up prospecting and excavating was conducted on the **Northern Lights** precious opal occurrence in the Whitesail Range, south of Houston. Mr. Schaefer of Burns Lake discovered precious opal bearing boulders, or subcrop, in 1999 on the Firestorm property west of the Burns Lake area. In 2001, Cantec Ventures Inc. excavated trenches to bedrock and washed a 20 cubic metre bulk sample to recover opal and opalized basalt.

Trial marketing is planned to determine the value of the gems.

Barite

Tiger Ridge Resources Ltd. continued underground development of two adits on its barite project at **Jubilee Mountain**, west of Spillimacheen and collected a bulk sample. The company installed a jig concentrator at the minesite to preconcentrate the barite and reduce the cost of transportation to the mill. Exploration drilling was also undertaken on several other targets. Further underground development, bulk sampling and exploration drilling are planned for 2002.

In 2001, Fireside Minerals Inc. mined 15 000 tonnes from the Bear vein at its **Fireside** barite mine, 125 kilometres east of Watson Lake, and used jigs to recover 10 000 tonnes of barite that will be sold to the northwest British Columbia and Alberta oil and gas drilling industry.

GOVERNMENT INITIATIVES

During 2001, the Government of British Columbia continued a number of measures to assist mineral resource planning, exploration and development. Highlights are as follows:

- The **British Columbia Mining Exploration Tax Credit Program (METC)** continued in its third year. It provides for a 20% refundable credit of qualified expenses not funded by flow-through shares. On July 31, 2001, the Government of British Columbia introduced a 20% non-refundable tax credit for qualifying investments made in new mineral exploration. This is in addition to the 15% federal tax credit and the existing 100% deduction of Canadian Exploration Expense (CEE), equivalent to a 139% tax reduction. Starting in 2002, British Columbia will have one of the most attractive exploration incentive program in Canada.
- The **Prospectors' Assistance Program (PAP)** promoted grassroots prospecting for new mineral deposits in British Columbia. It contributed up to 75% of eligible costs for approved projects to a maximum of $10 000. Fifty-two grants were awarded in 2001, worth more than $430 000, which supported prospectors for more than 2500 prospecting days in the field. The Ministry annually issues grants to seven mining-sector organizations to help them deliver training programs to prospectors. The Ministry also provided basic prospector training.
- A wide variety of **Geological Survey Branch** field programs (Fig. 11) continued to develop the geoscience database. Much of the Survey's extensive geoscience information is available on the Ministry's website (*www.em.gov.bc.ca/geology*). A new project examining the **PGE** potential in British Columbia focused on the Harrison Lake (East) belt, 80 kilometres east-northeast of Vancouver. Several smaller scale projects were carried out on **coal** (*e.g.* **Dove Creek**, **Merritt Coal** and SE Coal) and **industrial minerals** (*e.g.* **Blue River** *(***Verity/Fir**) carbonatite and **Ice** diamonds).
- **In partnership with the Geological Survey of Canada, a Regional Geochemical Survey (RGS)**, was completed in the Dease Lake (NTS 104J) area. Results released in early July, 2001.
- RGS results from the Ecstall River area (NTS 103H/I) and Porcher Island, Dundas Island and along the Inside Passage (NTS 103 G/H/J) were released in early June, 2001, by the B.C. Geological Survey Branch.
- The **ARIS** (assessment reports), **MINFILE, MapPlace,** and publications databases continue to be upgraded and made more easily accessible to clients on the Ministry website: *www.em.gov.bc.ca/geology*.

OUTLOOK FOR 2002

The new, harmonized federal *Exploration Investment Tax Credit* for flow-through share investors in new B.C. projects, coupled with the *B.C. Mining Exploration Tax Credit* is expected to provide a much-needed boost for exploration financing in 2002 and future years. Although actual exploration expenditures in 2001 were lower than anticipated, several property acquisitions were made and numerous work programs are already financed for 2002.

The economic significance of the Eskay Creek mine continues to attract province-wide attention, but particularly in the northwest, to the potential for stratabound, precious metal enriched, subaqueous hot-spring deposits.

Regional and detailed exploration programs, and property consolidations in the Wells-Barkerville area during 2001 are expected to result in drill-target identification on several projects in 2002.

The interest in the association of nickel + PGEs with mafic to ultramafic rocks in British Columbia is expected to increase in 2002.

The relatively strong coal markets, and interest in coalbed methane, should continue to sustain expanding coal exploration and development programs. A significant increase in coalbed methane exploration and development is also expected.

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Internet access to B.C. Ministry of Energy and Mines geoscience information

B.C. Geological Survey Branch internet website
www.em.gov.bc.ca/Mining/Geolsurv/

GSB publications catalog
www.em.gov.bc.ca/Mining/Geolsurv/Publications/

GSB MapPlace
www.em.gov.bc.ca/Mining/Geolsurv/MapPlace/

MINFILE - B.C. mines and mineral occurrence database
www.em.gov.bc.ca/Mining/Geolsurv/Minfile/

ARIS - Assessment Reports
http://www.em.gov.bc.ca/Mining/Geolsurv/Aris/

GSB Information for Public Education
www.em.gov.bc.ca/Mining/Geolsurv/PublicEducation/

GeoFiles - digital geoscience maps and reports
www.em.gov.bc.ca/Mining/Geolsurv/Publications/catalog/