BC Mineral Exploration Review 1997

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Introduction

Two new open-pit porphyry copper±molybdenum±gold mines (**Mount Polley** and **Huckleberry**), one heap-leach gold operation (**Golden Bear**) and one significant mill expansion (**Eskay Creek**) highlighted metal mine developments in 1997. The total capital costs for these projects was approximately $284 million and about 430 jobs were created. In addition, construction at the **Kemess South** porphyry gold-copper mine, in the Toodoggone district, was approximately 75% completed by year's end, with up to 1000 construction workers on site in the fall. The capital cost of this project, including a new 380-kilometre, 230-kilovolt electric transmission line, is estimated at $430 million; mine start-up is projected for the spring of 1998.

The largest exploration program was on the **Prosperity** porphyry copper-gold deposit, at approximately $5 million. Other large (>$3 million) programs included **Specogna**, **Getty Copper** and **Polaris-Taku**.

Exploration expenditures in 1997 are estimated to be approximately $75 million, a 25% decrease from 1996. The number of projects with budgets in excess of $100 000 is estimated at approximately 130, a 38% decrease from 1996. Drilling in the province is estimated to total approximately 407 000 metres, a 18% decrease from the previous year. Targets included many of the classic deposit types for which British Columbia is known.

Despite lower metal prices, and lower production due to mine closures, the value of output (approximately $1.59 billion) from metal mines in 1997 was at about the same level as in 1996. The total value of solid mineral production for 1997 is estimated at $3.25 billion, slightly higher than in the previous year. The **Ajax** porphyry copper-gold mine closed in April, 1997. Closures of the **Nickel Plate, Similco, Premier** and **Goldstream** mines in 1996 also had an effect on production. The losses from these mines were made up by significant increases in gold and silver production from the **Eskay Creek** mine and the newly opened **Golden Bear** heap leach mine and copper production from the newly opened **Mount Polley** and **Huckleberry** mines.

Clean coal production in 1997 is expected to total about 28.2 million tonnes, with a forecast value of approximately $1.195 billion, or approximately 37% of the total solid mineral production for the province. This is the value at the mine mouth and does not include rail and port costs which are paid by the customer and increase the value of coal exports to over $1.8 billion. The $1.195 billion figure represents an increase of about 5% over 1996 figures. Exploration at coal mines and leases increased by about 2%. The latter was led by expenditures at **Telkwa** and **Willow Creek**.

The forecast value of structural materials at approximately $423 million, and of industrial minerals at approximately $44 million, represent slight increases from 1996.
The estimate for the number of claim units (approximately 29 135) recorded in 1997 indicates a decrease of about 27% from the level of activity experienced in 1996; also a significant number of claim units were forfeited (approximately 31 000). The number of Free Miner Certificates issued during the year is estimated at 4111, down approximately 28% from 1996.

Several bulk sampling projects were carried out (*e.g.* **Pellaire**, **Telkwa**, **Debbie**). A number of advanced projects in the Environmental Assessment Process are in the feasibility stage (*e.g.* **Tulsequah Chief, Red Mountain, Bronson Slope, Telkwa, Willow Creek** and **Red Chris**. Some (*e.g.* **Mt. Milligan** and **Cirque**) have received Mine Development Certificates and await production decisions.

In 1997 the Geological Survey Branch released Regional Geochemical Survey (RGS) data for the **Toodoggone River** (NTS 94E) and **McConnell Creek** (NTS 94D) map sheets; this resulted in the staking of several new claims. The Survey also completed sampling in the **Mesilinka** (NTS 94C) map area and will release the data in July, 1998. It also released airborne geophysical data from the **Yahk-Creston** area, as part of the East Kootenay project, which led to new claim staking. The British Columbia government allocated approximately $500,000 for exploration under the Prospectors' Assistance Program. Positive and encouraging results have been reported.

Regional Trends

As already noted, preliminary estimates indicate that total exploration and development expenditures in British Columbia during 1997 have decreased about 25% from the level of the previous year. Much of this significant decrease is attributed to the fallout from the Bre-X fiasco, particularly the problem of raising risk capital. Lower metal prices and the uncertainty in land-use planning issues and Treaty negotiations are other significant factors. Regionally, approximately 35% of total expenditures were spent in the northwest part of the province; this is down from the average of 45% over the past several years. The very low level of expenditures on grassroots or generative projects (*i.e.* 6% of the total) is of real concern; this figure is down 50% from 1996. All regional Ministry offices except Cranbrook, recorded decreases in exploration spending in their respective areas: Smithers (-37%), Prince George (-15%), Kamloops (-16%), Cranbrook (+16%) and Vancouver(-37%). Exploration spending, by region, breaks down as follows: Smithers (36%), Prince George (17%), Kamloops (22%), Cranbrook (19%) and Vancouver (6%). Figure 1 illustrates the fluctuation of exploration expenditures in British Columbia compared to the rest of Canada over the past decade. Included are comments, together with the average annual prices for copper and gold, which influenced the increase or decrease in expenditures over the period. The peak year, 1990, with expenditures of $227 million, coincided with the height of flow-through funding. In subsequent years, expenditures show a steady decline to a low of $66 million in 1993. Although there have been slight increases since then, annual expenditures in the $130 million to $140 million range are considered necessary to sustain a healthy, viable mining industry in British Columbia. For the same ten-year period, the pattern of exploration spending is broadly similar to changes in the value of total solid mineral production (Figure 2).

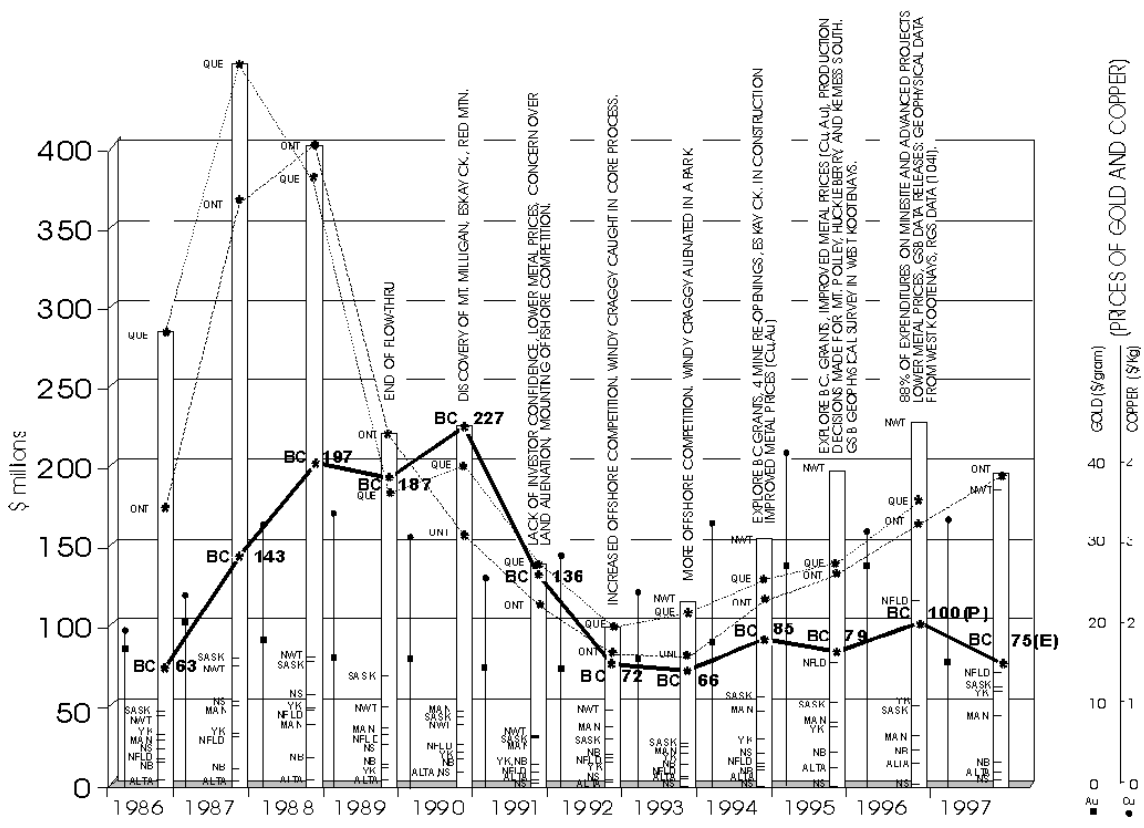


Figure 1. Mineral Expenditures in British Columbia

Mineral exploration expenditures in BC relative to other Provinces: 1986 to 1997 (P= preliminary, E= estimated).

Exploration targets are varied and include: vein deposits (epithermal and mesothermal), massive sulphide deposits, porphyry and related deposits, skarn and/or manto deposits, magmatic nickel deposits, industrial minerals deposits, coal deposits, placer deposits and others (Figure 3a). Veins (35%) have taken over from porphyry and related deposits (27%) as the most favoured target in 1997.

Approximately 22% of exploration expenditures (including $5.24 million or 7.4% at coal mines) were at minesites. This represents a 32% increase from 1996. An estimated 72% of exploration expenditures (35 million or 66% on advanced projects, including bulk sampling and environmental programs, and $18 million or 34% on major projects) were on established or previously drilled properties, leaving only 6% of expenditures for less advanced and generative exploration programs (Figure 3b).

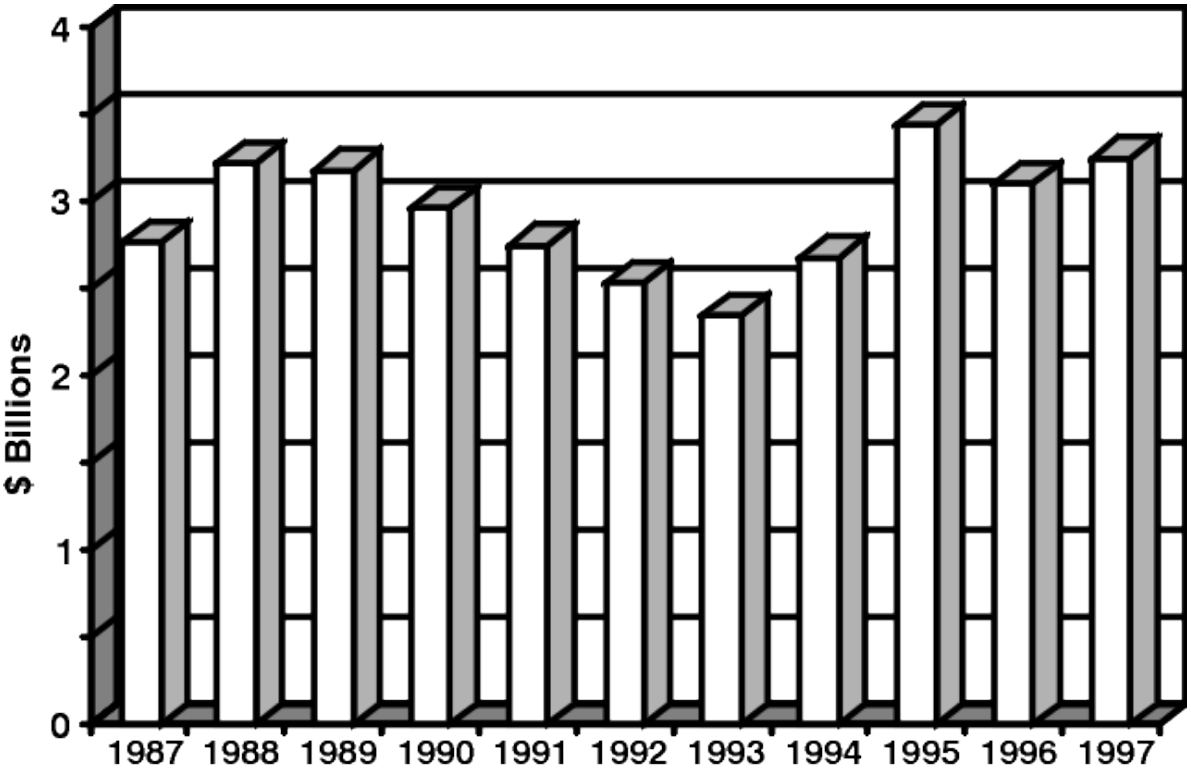
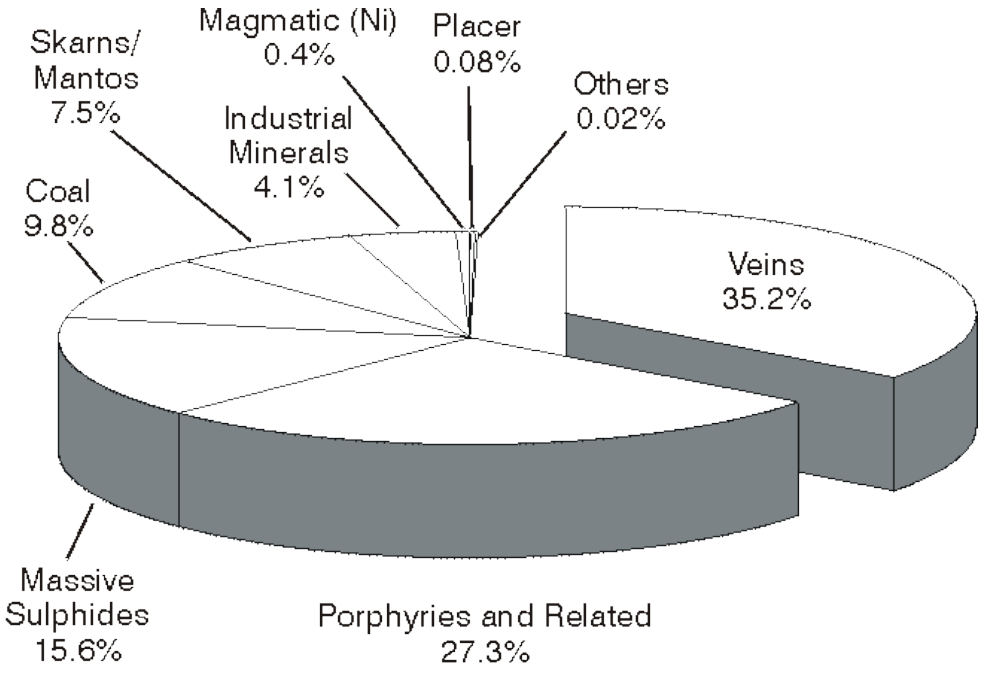


Figure 2. Solid mineral production value in British Columbia: 1987 to 1997.

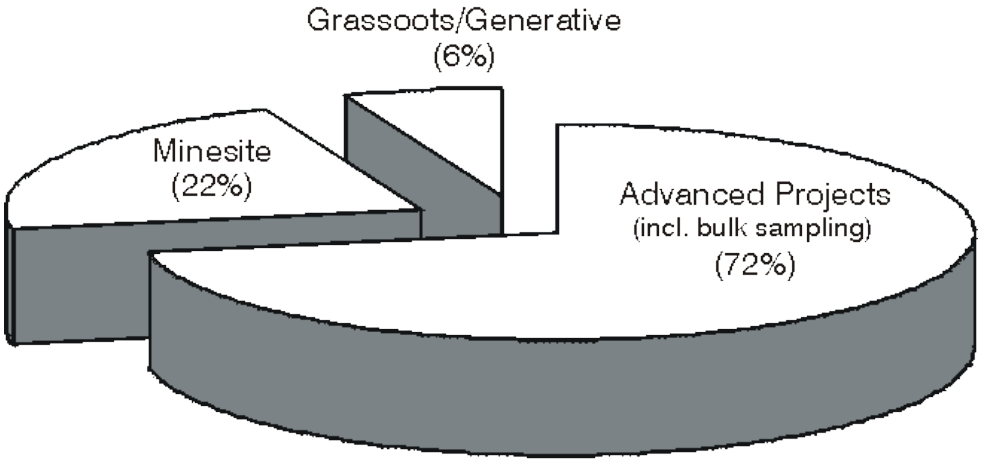
There were approximately 130 projects with budgets in excess of $100 000, down about 38% from 1996. Those projects (16) with budgets over $1 million accounted for approximately 52% of the total; those (35) in the range $300 000 to $1 million added a further 22%, thus collectively accounting for approximately 74% of 1997 expenditures. Figures 4a and 4b show the number of projects with expenditures in excess of $100 000. The largest program was by Taseko Mines Ltd. on the **Prosperity (Fish Lake)**porphyry copper-gold project, southwest of Williams Lake, estimated at $5 million. Apart from exploration at minesites, expenditures in excess of $1 million were also directed at re-evaluation of advanced projects such as: **Specogna (Cinola), Polaris-Taku, Getty Copper, Bull River, Midway (Silvertip), Hearne Hill, Telkwa, Pellaire, Cariboo Gold Quartz** an**d JD**. Exploration work was focused in and around existing minesites or areas with existing infrastructure (*e.g*. Highland Valley Copper and Sullivan areas).

Figure 3. Exploration Targets - 1997



Note: Industrial Minerals does not include structural materials.

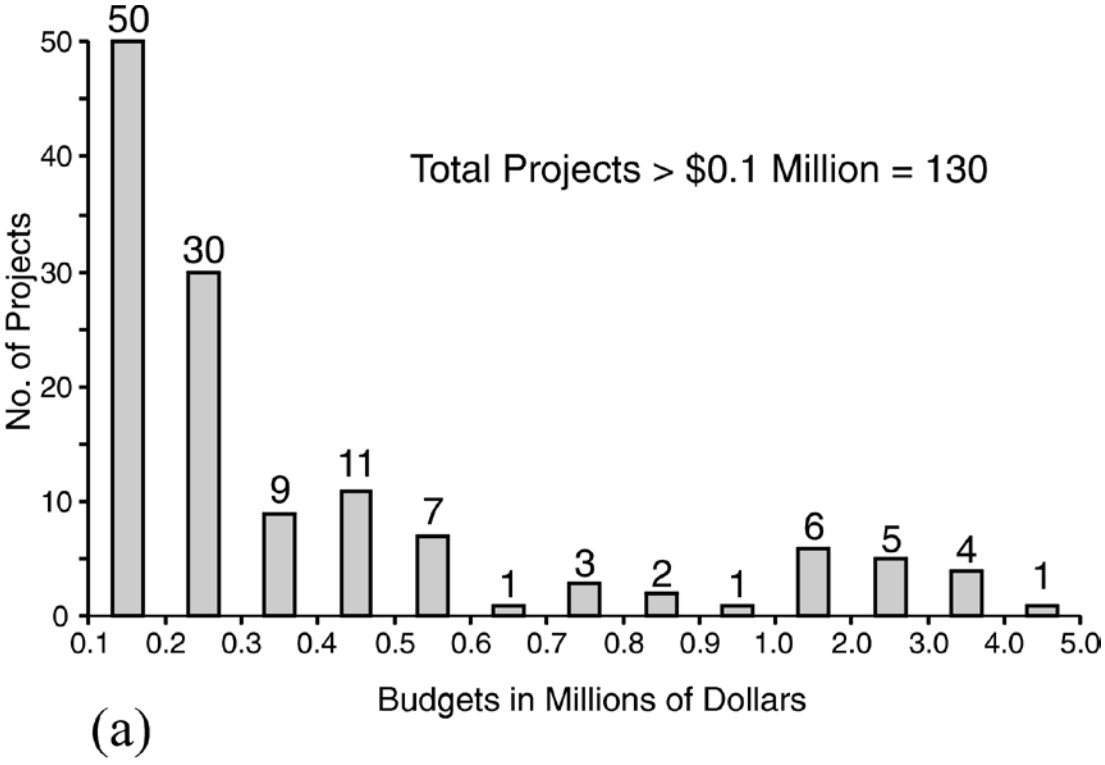
(a)



(b)

Figure 3. Exploration targets - 1997
(a) by deposit type (%)
(b) by level or category of program (%).

Figure 4. Estimated Number Of Major Projects (>$100 000)



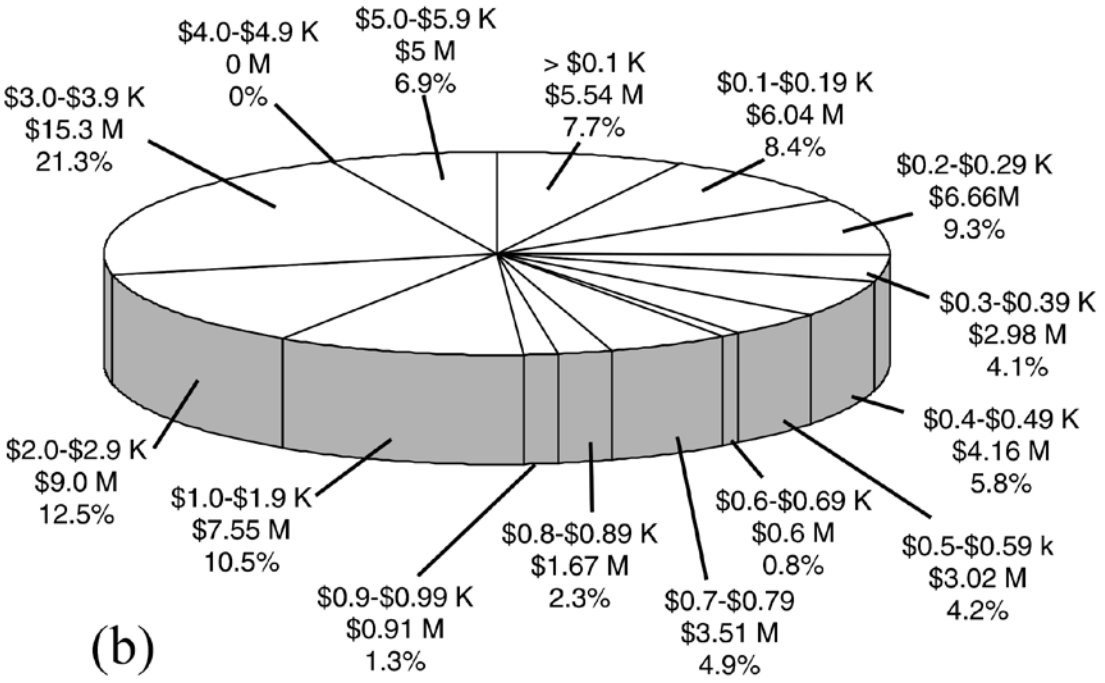


Figure 4. Estimated number of major projects (> $100,000)
(a) by incremental $0.1 M;
(b) by percentage of total expended.

Grassroots programs were carried out in:

1) the Quesnel Trough (**Cariboo** and **Philip Lakes** to **Toodoggone** areas) for gold-enriched porphyries;
2) the eastern areas (**Sullivan** and **North Gataga** areas) for sedex deposits;
3) the south-central **(Interior Plateau)** and northwest (**Toodoggone**) areas for bonanza and bulk-mineable epithermal gold deposits;
4) the northwest **(Stewart** camp) areas for mesothermal and transitional gold deposits similar to Snip and Red Mountain;
5) the **Wells-Barkerville-Likely** camps for mesothermal veins and bulk-mineable gold; and for bulk-mineable, potentially heap-leachable nickel±cobalt ±copper deposits, hosted by ultramafics; and
6) the **Turnagain**, Rock Creek (**Old Nick**), **Mt. Sidney Williams** and Tulameen (**Grasshopper**) areas.

Hudson Bay Exploration and Development Co. Ltd. conducted an airborne geophysical survey over the Babine country in early 1997 and staked several claim blocks as a result. Homestake Canada Inc. carried out large reconnaissance geological and geochemical surveys around the north and northwestern edge of the Bowser Basin, in search of more Eskay Creek-style mineralized environments. Kennecott Canada Inc. examined numerous properties and areas in the southeastern part of the province in search of another Sullivan-type deposit. Echo Bay Mines Ltd. completed an option agreement with Kettle River Resources Ltd., concerning a large number of properties in the Greenwood-Boundary camp and conducted reconnaissance and drilling programs in search of auriferous skarn deposits, such as Crown Jewel and Phoenix, as well as gold deposits such as the Lamefoot and Overlook replacement deposits and the Republic and Kettle epithermal deposits. Cominco Ltd. carried out both reconnaissance and follow-up exploration programs in the North Gataga belt in the northeast, and in the southeastern part of the province, in the search of sedex deposits.

During 1997, exploration expenditures for industrial minerals and coal increased by 43% and 2%, respectively. The estimated number of claim units (approximately 29 135) recorded in 1997 indicates a decrease of about 26% in the level of activity of 1996; the level is the lowest in the past four years, as shown in Figure 5.

Figure 5. All Mineral Tenure Recorded By Month: 1994 To 1997

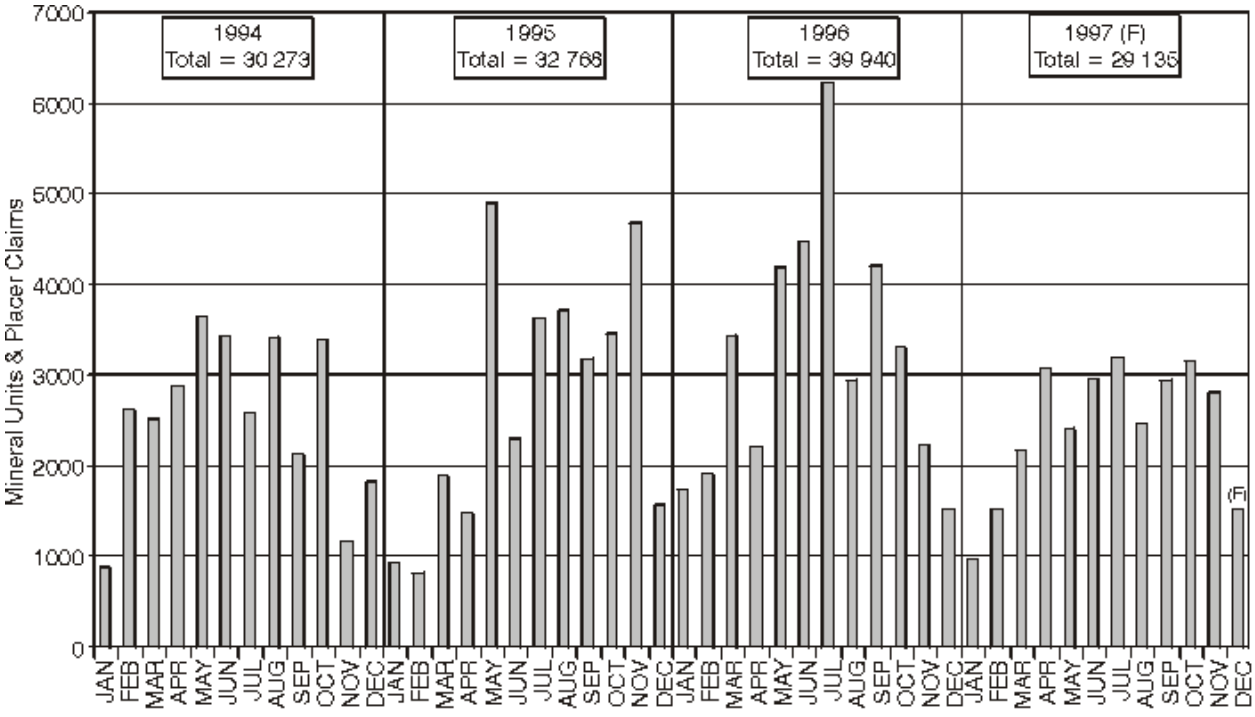
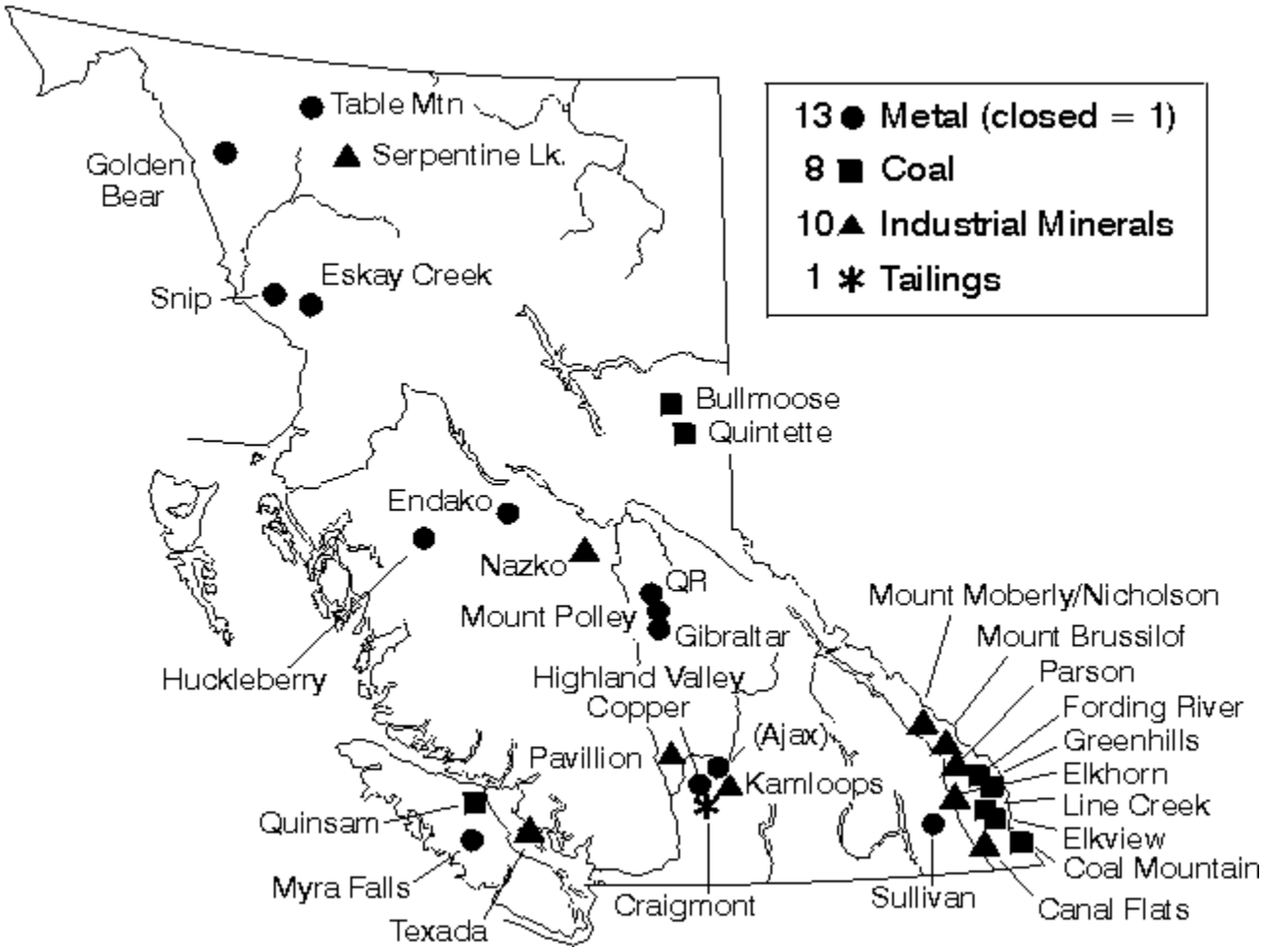


Figure 5. All mineral tenure recorded by month; 1994 to 1997.

Highlights at Operating Mines

The 13 metal mines operating in British Columbia in 1997 are indicated in Figure 6. There were three new metal mine openings (Mount Polley, Golden Bear and Huckleberry) and one significant mill expansion (Eskay Creek). One metal mine closed during the year - Ajax. Many mines had significant exploration programs, some with good results. Several small high-grade projects (e.g. Pellaire and Debbie) have the potential to produce using custom milling arrangements (Table 1; see also Operations). The number of direct mining employees in British Columbia in 1997 is estimated at approximately 9700, including 3600 at metal mines, with wages totalling $550 million. The forecast value of solid mineral production for 1997 in British Columbia is $3.25 billion, slightly higher than in 1996 (Figure 7; Table 2).

Figure 6. Operating Mines In British Columbia - 1997.



Coal represents approximately 37% of total production value, at a projected $1.195 billion, a slight increase from 1996. Copper represents 22% of production, at a projected value of approximately $711 million, about the same as in 1996. The production losses of copper associated with the closures of the Ajax, Similco and Goldstream mines were balanced by production from the new mines at Mount Polley and Huckleberry. During 1997 copper prices averaged around US$1.05 per pound, very similar to 1996. However, during the fourth quarter, the copper price dropped to the 80 cent per pound range. The production of gold is forecast to be 19.3 million grams (620 510 oz) of

Table 1 Active and Potential Custom Milling Projects

Mill Or Smelter/ Location	Project Name (Potential)	Commodity	Operator
Asarco/Helena, Montana	Elk	Au	Fairfield Minerals Ltd.
Trail	Brett	Au	Huntington Res. Ltd.
Trail	*Pellaire	Au	Int'l Jaguar Equities
Trail?	Skinner	Au	Ottarasko Mines Ltd.
Bow Mines/ Greenwood, B.C.	*Debbie	Au	White Hawk Ventures Inc.
Premier	(Johnson River)	Au,Cu,Ag,Pb,Zn	Westmin Res. Ltd.
Premier	(Jualin)	Au,Ag	Coeur d'Alene Mines Ltd.
Premier	(Red Mtn.)	Au,Ag	Royal Oak Mines Inc.
Premier	(SB)	Au	Tenajon Res. Ltd./Westmin Res. Ltd.
?	(Engineer)	Au	Ampex Mining
?	(Valentine Mtn.)	Au	Beau Pre Explorations Ltd.
?	(Lexington)	Au	Britannia Gold Corp./Bren-Mar Res.

* = Active

gold valued at $286.5 million, up slightly from 17.8 million grams (572 280 oz) last year, primarily due to increased production from Eskay Creek. By early December, the gold price had reached an 18-year low of below US$280/oz.

Silver output is forecast at 490 million grams (15.8 million oz) valued at $103.8 million, up slightly from last year, again as a result of increased production from Eskay Creek. Zinc production in 1997 is forecast to be 164.2 million kilograms worth $323.5 million and lead output is forecast to be 51.8 million kilograms valued at $45.1 million. This represents a slight increase in zinc production and a slight decrease for lead. The total metals value is about the same as in 1996, for output and percentage of total production.

The value of 1997 production of industrial minerals and structural materials is forecast to be approximately $44.2 million and $423.3 million respectively, both slightly up from 1996.

Figure 7. Forecast value of solid mineral production in British Columbia - 1997.

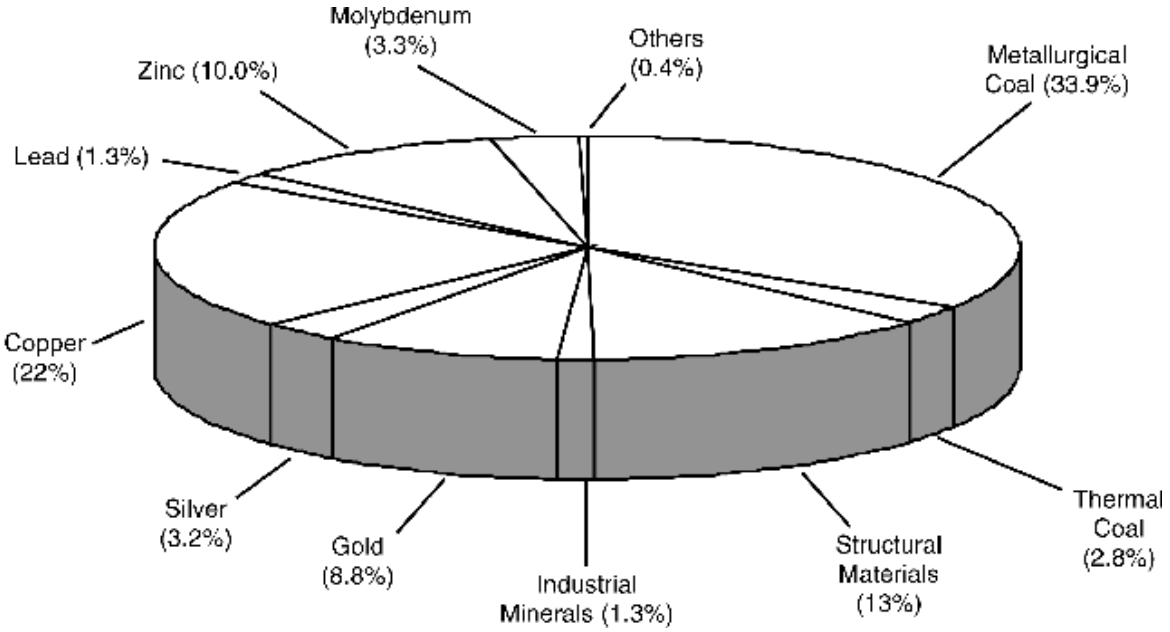


Table 2. 1997 Forecast Value Of Mineral Production In B.C.

Commodity	Quantity (Millions)	C$ Value (Millions)	Percent Of Total Value
Metals			
Copper	222.9 kg	711.0	22.0%
Zinc	164.2 kg	323.5	10.0%
Gold	19.3 g	286.5	8.8%
Molybdenum	9.0 kg	106.9	3.3%
Silver	490.0 g	103.8	3.2%
Lead	51.8 kg	45.1	1.3%
Others			0.4%
Total Metals		1600	49.0%
Coal			
Metallurgical Coal	25.0t	1102	33.9%
Thermal Coal	3.2t	92.6	2.8%
Total Coal	28.2 t	1195	36.7%
Other			
Industrial Minerals		44.2	1.3%
Structural Minerals		423.3	13.0%
Total Solid Minerals		3521	100%

NOTE: Prices are F.O.B. for metals only.

Operations

Metal Mines

Production during 1996 at the **Eskay Creek** gold-silver mine, owned and operated by Prime Resources Group Inc. (50.6% controlled by Homestake Canada Inc.), totalled 6571 kilograms (211 276 oz) of gold and 374 921 kilograms (12.05 million oz) of silver from 105 212 tonnes of ore milled. This equates to a gold equivalent production of 11 970 kilograms (372 279 oz); total cash costs were US$170 per gold equivalent ounce. Employment stood at 120 persons.

Eskay Creek is the fifth largest silver producer in the world and one of the highest grade gold and silver deposits ($1800 to $2200 per tonne of ore). Ore is blended on site, trucked to load-out facilities at Stewart and Kitwanga and shipped directly to smelters in Japan and Quebec, by ship and rail, respectively. In July 1997, Prime began constructing a $17-million, 150-tonne-per-day gravity flotation mill at the mine site, to process lower grade ore from the newly outlined NEX and 109 zones, which carries less deleterious elements than feed from the 21 B zone,. Annual production from the mill is projected at 2 180 kilograms (70 000 oz) gold-equivalent at a cash cost of US$175 per ounce, resulting in an increase of 933 kilograms (30 000 oz) gold-equivalent from Eskay Creek. The mill was tuned up in early November and is expected to be operational by the end of the year. It will create 20 new jobs and extend the mine life by an additional two years to a total of ten years.

At the start of 1997, Eskay Creek contained a proven and probable reserve of 1.27 million tonnes grading 59.31 g/t Au and 2719 g/t Ag. An additional geological resource is estimated at 252 146 tonnes grading 18.5 g/t Au and 1083 g/t Ag. Operations continued to exceed expectations as the year progressed. During the first nine months, Prime produced 12 180 kilograms (391 582 oz) gold-equivalent at a cash cost of US$173 per ounce - an 11.4% increase over the same period of time in 1996, when costs averaged $US171 per oz. Increased production and a planned reduction in underground development during the third quarter led to a decrease in the total cash cost to US$163 per ounce gold-equivalent. Prime's production target for 1997 is 15 400 kilograms (495 000 oz) of gold-equivalent.

In-mine (10 058 m) and surface (14 935 m) exploration drilling during 1997, to test the NEX and 109 zones and the 21C and other zones respectively, is expected to increase reserves.

Production at the **QR** gold mine, at an average milling rate of 1056 tonnes per day, totalled 1 342 250 grams (43 154 oz) of gold and 515 kilograms (16 558 oz) of silver from 382 472 tonnes of ore milled in 1996, the first full year of production. Employment stood at 85 persons. Reserves estimated by Kinross Gold Corporation at January 1, 1997 were 1 574 000 tonnes grading 3.99 g/t Au. Most of the millfeed during 1997 came from the Main zone pit; reserves in the pit were exhausted during the year. The milling rate increased to over 1400 tonnes per day; total gold production was budgeted at 1555 kilograms (50 000 oz) of gold at cash operating costs of US$244 per ounce. Mining of the underground Midwest zone (985 level) began at 600 tonnes per day in the fall of 1997, using longwall stoping methods. Towards the end of the year, the mill was processing 800 to 900 tonnes per day. Gold production in the third quarter was 274 kilograms (8 808 oz), 37% lower than the same period in 1996. Cash operating costs had soared to US$459 per ounce gold; costs for the first nine months averaged US$391 per ounce gold. Lower production and increased costs were incurred because of a slope failure in the Main zone pit which temporarily halted production and decreased both millhead grades and daily throughput. Underground production from the Midwest zone carries inherently higher mining costs, and development of a new ramp to access remaining reserves in the Main zone also contributed to higher costs.

Increased costs coupled with a lower gold price have led to a detailed re-evaluation of the mine life, and a decision to close down operations on March 1, 1998 was announced in December. Surface exploration drilling was carried out in several areas of the property in 1997. The drilling tested the North zone and areas between the Midwest and West zones, focusing principally on the siltstone-basalt contact within a few hundred metres of the contact with the diorite.

In 1996, the **Snip** mine, owned and operated by Prime Resources Group Inc., milled 425 tonnes of ore per day, to produce 3844 kilograms (123 589 oz) of gold, 1616 kilograms (51 950 oz) of silver and 103.19 tonnes of copper from 155 179 tonnes of ore milled. As anticipated, total cash costs for the year increased to US$190 per ounce gold. To date, the mine has produced over 28 000 kilograms (900 000 oz) of gold. Approximately 35% of the gold is recovered as doré by processing the ore through a gravity concentration circuit. The balance is contained in a high-grade flotation concentrate. Total gold recovery was 92%. Concentrate was piggy- backed with Eskay Creek shipments to the Dowa smelter in Japan. Reserves estimated by Prime at January 1, 1997 were 334 683 tonnes grading 24.7 g/t Au; mine life is forecast to the year 2000. Employment stood at 150 persons. Tonnage mined and processed in 1997 is expected to be similar to 1996, and gold production is expected to be 3732 kilograms (120 000 oz). Third-quarter production amounted to 968 kilograms (31 129 oz) of gold at a total cash cost of US$210 per oz. A lower (by 11%) grade and lower throughput were responsible for the decline in production and the higher costs were attributed to the mine's reliance on labour-intensive, narrow-vein mining methods. Underground exploration drilling (28 345 m) was completed. Surface drilling (9000 m) by Homestake Canada Inc., on behalf of Prime, was also carried out on the Upper Bronson, and Chopin East targets, east of and along strike from the Twin zone trend.

The **Highland Valley Copper** mine, a partnership among Cominco Ltd. (50%). Rio Algom Limited (33.6%), Teck Corporation (13.9%) and Highmont Mining Company (2.5%), milled 42 620 246 tonnes of ore during 1996 at an average daily throughput of 116 449 tonnes. Some 275 000 tonnes of ore and waste are mined daily. Production totalled 153 838 tonnes of copper contained in concentrate, 56 600 kilograms (1.82 million oz) of silver, 360 kilograms (11 600 oz) of gold and 1400 tonnes of molybdenum. Annual capital expenditures at the mine average $25 to $30 million while revenues amount to approximately $400 million. The mine is one of the largest operations in the world, ranking third on the basis of tonnage milled, and employs about 1100 people. Reserves estimated by the partnership, as of January 1, 1997, were 495 million tonnes grading 0.42% Cu and 0.006% Mo. Nearly all of the millfeed comes from the Valley pit, a very small proportion (<5%) comes from the Lornex pit. Mining cut-off grade in 1996 averaged 0.25% Cu equivalent (or approximately 0.2% Cu). Current mine plans call for deepening the Valley pit an additional 200 metres by the year 2008. Drilling in 1996 in the Valley pit, below the current designed depth, identified an indicated resource of 350 million tonnes grading 0.384% Cu which could extend the life of the operation by about 7.5 years. There was no on-site exploration during 1997. Stripping continued in the north area of the Valley pit and the east end of the Lornex pit.

During 1996 the Westmin Resources Limited **Myra Falls** mine produced 16 912 tonnes of copper, 37 061 tonnes of zinc, 1219 tonnes of lead, 11 894 kilograms (382 386 oz) of silver and 687.4 kilograms (22 101 oz) of gold from 1

267 583 tonnes of ore milled at a daily throughput of 3487 tonnes. Zinc recovery was up dramatically to 88.3% while maintaining a concentrate grade of 50.5%. Proven and probable reserves estimated by the company, as of January 1, 1997, were 9 098 407 tonnes grading 1.6% Cu, 6.1% Zn, 1.5 g/t Au and 27.5 g/t Ag, sufficient for 8 years of production. In addition nearly 2 million tonnes of possible geological reserves have been outlined in several zones on the property. The mine employs 468 people. Battle zone ore, with head grades rising to 1.64% Cu and 5.4% Zn, now makes up approximately 30% of mill feed. The H-W zone accounts for approximately 70% of current production. Westmin spent approximately $2.5 million on surface and underground exploration programs in 1997. A detailed structural analysis of the entire property has been extremely useful in focusing drilling and geological modelling. Drilling of two deep holes from Myra Ridge, west of the Trumpeter zone, returned ore-grade intersections, and further work is planned. Surface drilling also tested targets in the Thelwood Valley. Underground drilling was also carried in the Trumpeter zone, the 10-level underground extension to test the Marshall zone, and in the Ridge Wedge area to test for H-W "Main Trend" mineralization in the Ridge zone east and to the west of the Extension zone. Underground development and exploration on the Battle zone continued to yield some positive results.

At the Westmin Resources Limited **Gibraltar** mine, production during 1996 totalled 31 720 tonnes of copper, 182.4 tonnes of molybdenum and 4227 kilograms (135 900 oz) of silver, from milling of 13 161 757 tonnes of ore at a daily throughput of approximately 36 000 tonnes. Reserves estimated by the company at January 1, 1997 were 142 344 000 tonnes grading 0.303% Cu and 0.009% Mo. The mine life was estimated at 10 years, not including resources in the Gib North, GM or Sawmill zones. Current mining is from Phase 3 of the Gibraltar East pit (1 year reserve remaining); the cut-off milling grade was 0.2% Cu. The company expected to mine approximately 30 000 tonnes of ore from the Pollyanna pit in 1997. This operation, with approximately 270 employees, is highly efficient and one of the lowest grade (if not the lowest) copper mines in North America. Total operating costs for 1996 were estimated at US$0.93 per pound copper. The SX-EW plant accounts for approximately one seventh of copper production, with four active dumps providing the copper solution. Drilling during 1997 on the Connector zone added approximately 49 million tonnes of mineable sulphide reserves, representing an additional 3.3 years of mine life. Also, approximately 15 million tonnes of oxide reserves were outlined above the Connector zone sulphide ore, and will extend the life of the SX-EW plant by 6 to 7 years. As a result of the recent exploration success, the company is considering mine expansion. An induced polarization program was conducted on the GM claims, east of the Pollyanna pit.

In early 1997, Placer Dome Canada Limited sold the **Endako** molybdenum mine to Thompson Creek Mining Company of Denver, Colorado (75%) and Nissho Iwai Corp. of Japan (25%). The new owners indicated that their preliminary plans for ongoing operations include generally maintaining current employment (257 people) and compensation levels at Endako. They also expect that Endako's existing commitments will be honoured. During 1996, the mine produced 6580 tonnes of molybdenum from 10 023 000 tonnes of ore milled at a daily throughput of approximately 30 000 tonnes. Proven and probable reserves estimated by Placer Dome were 124 887 000 tonnes grading 0.066% Mo at January 1, 1997. The life of the Main zone pit was estimated at 10 years mining at an average grade of 0.126% Mo with a cut-off grade of 0.07% MoS_2. During 1997, Endako expected to mine 20.8 million tonnes and mill 10.6 million tonnes grading 0.131% MoS_2, to produce approximately 6500 tonnes of molybdenum.

A modest drilling program and geophysical survey were carried out in 1997.
Production at Cominco Ltd.'s **Sullivan** underground zinc-lead-silver mine in 1996 was 53 258 tonnes of lead, 113 579 tonnes of zinc and 20 237 kilograms (650 623 oz) of silver from 1 538 700 tonnes of ore milled at a daily throughput of approximately 6900 tonnes. Zinc concentrate production was the highest level achieved in the last 32 years. Lead concentrate grade (at 63.8%) production was the highest achieved in the last 22 years. Reserves estimated by the company at January 31, 1997 were 8 800 000 tonnes grading 8.0% Zn, 4.4% Pb and 24 g/t Ag, sufficient until planned closure on December 31, 2001. Sullivan supplies 40% of the zinc concentrate and 80% of the lead concentrate treated in the Trail metallurgical complex; the remainder coming from Cominco's Red Dog mine and a number of smaller operations in North America. Since 1923, when the concentrator started treating ore, approximately 142 million tonnes of ore grading 6.2% Pb and 5.6% Zn have been milled; about 13.6 million tonnes of zinc concentrate and 10.9 million tonnes of lead concentrate have been produced and sold to Trail. At todays metal prices, this represents an estimated value of production in excess of $6 billion. Mining during the last years of the mines' life is focused on pillar recovery and ore remnants left after 87 years of operation. Cominco is still contemplating further deep drilling in the Mark Creek area, northwest of the mine, to further evaluate a dislocated segment of the Sullivan deposit.

At the **Table Mountain** mine, Cusac Gold Mines Ltd. produced 671 kilograms (21 576 oz) of gold from 24 365 tonnes of ore milled intermittently at an average daily throughput of 90 tonnes during 1996. The average millhead grade was 27.8 g/t Au. Ore came mainly from the high-grade Lily vein, the richest vein discovered on the property. Reserves estimated by the company in Vollaug vein, at January 1, 1997 were 39 400 tonnes grading 15.6 g/t Au. In March 1997, milling resumed following an 8- week seasonal shutdown. Production came from the Melissa and Vollaug veins. A large exploration drilling program targeted the eastern extension of veins in the Erickson Creek fault zone and the down-dip extension of the Vollaug vein. A 76-metre decline development, designed to provide better access for underground exploration drilling, was completed on the Michelle Highgrade zone. Underground mining was suspended in June. Open-cut mining of the Vollaug vein continued through August; the mill shut down in September. Gold production is forecast at 270.6 kilograms (8700 oz). Surface drilling has yielded some local high-grade intersections; follow-up work is required. No work was carried out on the 10-portal project in 1997.

At the **Huckleberry** porphyry copper-molybdenum mine, Huckleberry Mines Ltd., which is owned by Princeton Mining Corporation (60%) and a consortium of Mitsubishi Materials Corporation, Dowa Mining Company Ltd., Furakawa Company Ltd. and Marubeni Corporation, commenced commercial production in October 1997. Capital costs were $141.5 million. including a $15-million provincial loan to finance construction of roads, power lines and port facilities; 167 people are directly employed. Reserves estimated by the company were 90.4 million tonnes grading 0.513% Cu, 0.014% Mo, 0.06 g/t Au and 2.8 g/t Ag. At a daily milling rate of 18 000 tonnes, the mine is forecast to produce 37 000 tonnes of copper, 670 tonnes of molybdenum, 218 kilograms (7000 oz) of gold and 11 820 kilograms (380 000 oz) of silver annually, over a mine life of 16 years. The first and second shipments of approximately 7400 and 10 700 wet tonnes of copper concentrate to Japan left the port of Stewart on November 1, and December 15, 1997, respectively. The mine is forecast to produce between 10 000 and 12 000 wet tonnes of concentrate monthly. Commissioning of the molybdenum circuit is underway and the first shipment of concentrate is expected to take place in early 1998. Operating cash costs, net of byproducts, are forecast to average US$0.65 per pound copper over the life of the mine. Initial tonnage rates are at or above feasibility, and mine grades are as planned.

At the **Mount Polley** gold-copper mine, Imperial Metals Corporation (55%) and Sumitomo Corporation of Japan (45%) commenced commercial production in September 1997. Capital costs were $115 million and the mine employs 170 people. Mine start-up was 5 months ahead of schedule. Most of the mine equipment was bought second-hand and brought to the site from all over the world. The project has a simple and compact layout, with only two major buildings - the crusher and the mill/administrative complexes. Start-up reserves, estimated by the partners, were 82.3 million tonnes grading 0.3% cu and 0.42 g/t Au. At a daily milling rate of 18 000 tonnes, the mine is forecast to produce 2220 kilograms (71 500 oz) of gold and 13 200 tonnes (29 million pounds) of copper annually, over a mine life of 12 years. Cash production costs are projected by the partners to be US$170 per oz gold. Mining commenced in the Cariboo pit and will be followed by mining in the Bell and Springer pits.

At the **Golden Bear** mine site, Wheaton River Minerals Limited and North American Minerals Corporation commissioned Canada's second heap-leach gold mine during the third quarter of 1997. Capital costs over the projected 6-year mine life are estimated at $10.5 million, and 70 people are directly employed. Start-up reserves, estimated by the partners, were 1 528 000 tonnes grading 5.1 g/t Au, all in the heap-leach category. Total cash costs are estimated at US$232 per ounce of gold. In addition, the Grizzly zone contains an estimated 152 945 tonnes of refractory ore grading 20.5 g/t Au.

During 1997, mining and heap leaching were completed on the Kodiak A deposit (reserves estimated at 759 000 tonnes grading 3.3 g/t Au), one of three deposits to be mined. A total of 360 000 tonnes of ore was crushed and put on the 528 000-tonne capacity Fleece Bowl pad for processing. The first gold bar was poured on August 13th. The high leaching rate predicted in the feasibility study was quickly confirmed and, by the end of October, when the operation was shut down for the winter months, a total of 952 kilograms (30 600 oz) of gold had been produced, exceeding the planned output for 1997 by 19%. The average grade of the ore stacked on the leaching pad, at 3.47 g/t Au, surpassed feasibility projections by about 16%. Recovery rates exceeded 90%. Another 168 000 tonnes of Kodiak A ore will be placed on this pad next June.

The Ursa deposit has reserves estimated at 519 000 tonnes grading 7.0 g/t Au. Pre-stripping of the deposit continued into mid-October and the liner for the second, (1 000 000-tonne capacity Totem Creek) leach pad was installed during the third quarter and it is ready for stacking when mining and processing resumes next spring. A second

processing plant will be built adjacent to this pad. Next year, the first full year of production, mining at Kodiak A and Ursa is expected to boost production to 1229 kilograms (39 500 oz) of gold.

With the exception of the Grizzly, all the zones at Golden Bear are oxidized and exhibit many characteristics of Carlin-type, sediment-hosted micron gold deposits. Mineralization is hosted by hydrothermally brecciated and silicified dolomites. While only three deposits are included in the mine plan, others are known; the most advanced of these is the Kodiak C, which contains about 276 000 tonnes of material grading 7.8 g/t Au.

During 1997, drilling on the higher grade Grizzly deposit extended the structure by at least 75 metres to the north. Wheaton River is evaluating the potential for heap leaching the East low grade stockpile, which it estimates to contain 3297 kilograms (106 000 oz) of gold. A feasibility study is expected during 1998. Elsewhere, trenching and drilling exploration programs tested the C+C zone along Limestone Creek in the western part of the property.
At the Afton Operating Corporation **Ajax** copper-gold mine, production in 1996 totalled 11 427 tonnes of copper, 786.6 kilograms (25 290 oz) of gold and 1690 kilograms (54 323 oz) of silver from 2 972 500 tonnes of ore milled at an average daily rate of approximately 8800 tonnes. The mine employed 175 workers. At January 1, 1997 the company estimated reserves were 1 217 000 tonnes grading 0.49% Cu and 0.34 g/t Au. Due to rising operating costs and falling metal prices, the mine closed in May 1997.

During 1996, the Princeton Mining Corporation **Similco (Copper Mountain)** mine produced 18 446 tonnes of copper, 915 kilograms (29 422 oz) of gold and 2673 kilograms (85 943 oz) of silver from 6 488 678 tonnes of ore milled at an average daily throughput of 19 140 tonnes. Employment was 230 persons. Mining and milling ceased on November 8 and 12th, 1996 respectively and the operation has remained closed, on a care-and-maintenance basis. Reserves estimated by the company at January 1, 1997 were 129 163 140 tonnes grading 0.40% Cu, and it is studying several options for Similco. These include a joint-venture partner reopening the mine, and shutting it down permanently. During 1997, the company initiated a 3300-metre diamond drilling program to provide data to assess the feasibility of reopening. Analysis of the 13 300-metre drilling program completed in early 1997 has shown there is a potential to develop a mineable reserve in excess of 45 350 000 tonnes in the Pit 2 and 3 areas. The first stage drilling targeted deeper mineralization under Pit 2. A reopening of the mine would require some upgrading of the grinding circuit and new mining equipment. The company is looking for a 5 to 10 year mine life.

Production at the Westmin Resources Limited **Premier** gold mine during 1996 totalled 115.5 kilograms (3714 oz) of gold and 1401 kilograms (45 055 oz) of silver from 47 290 tonnes of ore milled at a daily throughput of 700 tonnes. Proven and probable reserves estimated by the company at January 1, 1997 were 350 000 tonnes grading 7.2 g/t Au, 37 g/t Ag and 1.6% Zn. In addition, the mine has possible reserves of 111 560 tonnes grading 8.57 g/t Au and 27.9 g/t Ag. Underground mining was suspended on April 12, 1996 and the mine has remained closed on a care-and-maintenance basis. Early in 1997 the company evaluated several proposals from potential joint-venture partners or buyers; however, with a rapidly dropping gold price and the Bre-X Minerals fiasco, negotiations were halted.

Coal Mines

Total production of clean coal in 1997 is estimated at about 28.2 million tonnes, approximately 25 million tonnes metallurgical and 3.2 million tonnes thermal. The value of coal shipped was about $1 billion dollars loaded into ships at the 4 coal terminals on the coast. Most mines have recorded slight increases in production. Prices negotiated for 1998 are flat or have decreased slightly. Thermal coal prices have decreased markedly and metallurgical coal prices have remained flat or decreased by about 5%. Most mines are contracted to ship similar tonnages as in 1997. Markets are becoming more diversified with the Japanese market decreasing and European and Indian markets increasing. In the future coal suppliers will have to respond to new non-coke based steel-making technology and the implications of CO_2 regulations in the greenhouse gases controversy. It is unlikely that either of these factors will have immediate impacts on British Columbia's coal exports.

Total expenditure on exploration and development at existing coal mines is forecast to be approximately $5.24 million in 1997, a 30% increase from 1996.

At the **Quinsam** mine on Vancouver Island, Quinsam Coal Corporation planned to produce approximately 1.2 million tonnes of clean coal in 1997. The company spent approximately $440,000 on exploration in the vicinity of the 4 South and 2 North mining leases. A few drill holes were completed to delineate new reserves; results are being

evaluated. Coal is being shipped from the Middle Point loadout, north of Campbell River. This facility can store 12 000 tonnes of coal and load at the rate of 1800 tonnes per hour.

Five mines in the Elk Valley, **East Kootenay** region, owned by Fording Coal Ltd. (3), Manalta Coal Ltd. (1) and Teck Corporation (1) employ about 2400 people with an annual gross payroll of $170 million per year. Coal mining in the area generates over 6000 direct and indirect high-paying jobs.

In early 1997, Fording Coal Ltd. signed an agreement to supply Thai Special Steel Industry Plc. with 500 000 tonnes of metallurgical coal a year in a 5-year deal worth about $150 million. The first delivery is scheduled to coincide with the startup of Thai Special Steel's new production facility in mid-1999. Fording will supply the coal from its three mines in the southeast: Fording River, Greenhills and Coal Mountain.

The **Fording River** mine is the largest coal mine in British Columbia. It produced about 8.2 million tonnes in 1997, a significant increase over the 1996 production of 7.9 million tonnes. Major drilling programs on the mine lease were completed at Castle Mountain (including 20 deep holes averaging 600 metres, and 50 shallow holes). Total exploration expenditures are estimated at $2.3 million, a 48% increase from 1996.

At the **Greenhills** mine, the company planned to mine approximately 4.4 million tonnes in 1997, including some 500 000 tonnes of thermal coal, mainly from the Cougar pit. This operation employs a work force of approximately 460 persons, making the Greenhills mine one of the most productive surface coal mines in the world. The mine has approval for the development of the West Spoil area (12-year mine life) and site preparation work is progressing. Exploration programs were completed on the mine lease and in adjacent areas. In-pit drilling (12 000 metres) and pit development is estimated to have cost approximately $660 000. Two off-site exploration programs were conducted. In the Crow area, east of the mine, 1200 metres of drilling were completed at an estimated cost of $120 000. At Ewin Pass, a $45 000 surface geophysical program (DC profiling) was completed.

The **Coal Mountain** mine, operated by Fording Coal Limited, is expected to produce 2.3 million tonnes in 1997, increasing to 2.5 million tonnes in 1998. The workforce numbers approximately 180. Production is divided into approximately 20% thermal, 40% PCI and 40% weak coking coal. Exploration in 1997 comprised 4200 metres of in-pit drilling at an estimated cost of $240 000 and a $25 000 surface geophysical program on the adjacent Middle Mountain coal license to the north.

At the **Line Creek** mine, Line Creek Resources Ltd. expects to ship approximately 2.5 million tonnes of metallurgical coal and 700 000 tonnes of thermal coal in 1997, slightly less than in 1996. During 1997, in-pit drilling was completed at an estimated cost of $500 000; there was no out-of-pit exploration. Coal from the Horseshoe Ridge pit is now being processed and will account for 10% of 1998 production, increasing to about 40% in four years. The new 10-kilometre-long conveyor is operating but is still undergoing some development work.

At the **Elkview** mine, Teck Corporation expected to ship approximately 2.7 million tonnes in 1997, increasing production by about 100 000 tonnes per year in the future. Severe winter conditions in January and February and constraints on CP Rail's ability to move coal, resulted in lower production than the previous year. Most of the coal produced is metallurgical, although two varieties of weak coking coal are also sold. In the long term, coal will come from the Natal Ridge area; gradually replacing production from the Baldy and Elk pits and possibly the South pit. Approximately 9400 metres of drilling were completed in 46 holes in the Natal Ridge area, at an estimated cost of $400 000, together with a 7000-metre program of in-pit drilling.

In the N**ortheast**, Teck Corporation reached an agreement with a consortium of eight Japanese steel mills and will continue to supply metallurgical coal from the Quintette and Bullmoose mines until March 2003. Under the agreement, Quintette will provide 3 million tonnes annually, commencing in 1998 and Bullmoose will contribute 1.6 million tonnes beginning in 1999.

The **Bullmoose** mine (Teck Corporation, 60.9%; Rio Algom Limited, 29.1%; Nissho Iwai Coal Development/Canada Ltd., 10%) is estimated to produce approximately 1.85 million tonnes in 1997. Severe weather conditions in January and February slowed production in 1997. A $120 000 winter exploration program, comprising of 3300 metres of rotary drilling, is planned in the West Fork area and is designed to refine FSI boundaries and to

better delineate changes in coal fluidity. Reserves in the South Fork pit will be exhausted in 2003. There was a single sale of oxidized thermal coal in 1997, that did not meet specifications for the Japanese contract.

The **Quintette** mine, operated by Quintette Coal Limited and managed by Teck Corporation, is forecast to ship approximately 4 million tonnes of metallurgical coal in 1997. Most of the 3 million tonnes/year production over the next 5 years is scheduled to come from the Babcock area (2 million tonnes/year). Two thousand metres of on-site reverse circulation drilling were completed at an estimated cost of $250 000.

Industrial Mineral Producers

British Columbia is producing a wide variety of industrial minerals and interest is increasing steadily. There are ten major mines and more than thirty smaller quarries. These operations are located mainly in the southern half of the province, close to existing infrastructure. The most economically significant industrial minerals produced are sulphur, magnesite, gypsum, white calcium carbonate, silica, barite, limestone and construction aggregate. Commodities produced in lesser quantities include jade, diatomite, magnetite, dolomite, dimension stone, pyrophyllite, volcanic cinder, clay, fuller's earth and zeolites. The annual value of production of all industrial minerals (including sand and gravel and crushed rock) is in the order of $465 million.

Sulphur, a byproduct of natural gas, is produced at five processing plants in the northeast of the province. Some sulphur is also produced at the Trail smelter. Total annual production in British Columbia is between 600 000 and 650 000 tonnes.

In the Rocky Mountains, Westroc Industries Limited is producing approximately 455 000 tonnes of gypsum from its **Elkhorn** I and II quarries near Windermere. Reserves are expected to last approximately 10 years. The company plans to mine the Kootenay West deposit near **Canal Flats**, where a major exploration and development program is planned for 2000.

Baymag Mines Company Limited continued to mine **magnesite** at **Mount Brussilof** at a rate of 180 000 tonnes annually. The new 100 000-tonne capacity vertical-kiln processing plant has been completed in Exshaw, Alberta and a trial operation is under way. This will increase the processing capacity of the operation to 250 000 tonnes per year. Blending of magnesite from different parts of the quarry, and more stringent grade control reduced the volume of waste.

The **Mount Moberly** and **Nicholson** silica mines in the Golden area account for all high-grade **silica** production in British Columbia. The Silica Division of Highwood Resources Ltd. produced approximately 120 000 tonnes in 1997 at Moberly, for shipment for Springfield, Oregon, Lavington, B.C. and other destinations. The company has developed technology to reprocess some coarse waste. In spite of increased sales to 100 000 tonnes, mine production was about 20% less than in previous years. Bert Miller Contracting Ltd. is developing a higher bench in the upper part of the **Nicholson** silica deposit. The quarry output is approximately 60 000 tonnes annually, of which 50 000 tonnes is shipped to Wenatchee, Washington.

Limestone is processed by three cement plants and two lime plants in British Columbia. The majority of pulp and paper mills produce their own lime from nearby limestone quarries. The largest production centre is **Texada Island**, where two quarries, the **Gilles Bay** (Holnam West) and **Blubber Bay** (Ashgrove Cement), ship some 5 million tonnes annually to customers in British Columbia, Washington, Oregon and California. About 1 million tonnes of waste rock is sold annually as construction aggregate. The Continental Lime Ltd. **Pavilion Lake** plant produces up to 200 000 tonnes of lime per year from limestone quarried on the site, and the **Kamloops** cement plant of Lafarge Canada Inc. is producing up to 200 000 tonnes of cement annually from locally quarried limestone. Lafarge is spending $130 million on upgrading its plant in Richmond, to allow it to produce 1.0 million tonnes of cement using limestone from Texada Island, coal from Quinsam coal mine and silica mainly from Fraser River sands. Near Prince George, Kode-Jerrat Quarries Ltd. at **Giscome** sells about 50 000 tonnes of limestone annually to pulp mills in the region. **White calcium carbonate** is produced from deposits **on Texada Island** (**Vananda** and **Gilles Bay**), **Benson Lake** on Vancouver Island and **Lost Creek** near Salmo, at a rate of 160 000 tonnes annually. A small limestone producer at **Dahl Lake**, west of Prince George, has been processing old waste rock into decorative aggregate at a rate of some 20 000 tonnes per year.

Highwood Resources Ltd. operates the **Parson** mine, one of two British Columbia **barite** producers. The barite is processed in Lethbridge, Alberta into drilling mud and fillers. Reserves are almost depleted and the mine will close by the year 2000. In 1997, the company completed a significant exploration program, both underground and around the mine.

During 1997, Fireside Minerals Ltd. reactivated the **Fireside barite** quarry, east of Watson Lake, mining and crushing ore on site and processing it at a plant (approximately 200 tonnes per day) in Watson Lake. The company processed approximately 4545 tonnes and 640 tonnes from open cuts on the Moose and Bear deposits, respectively. The product, marketed by Macobar Industries Ltd., was shipped east to Grand Prairie and north to Alaska. Fireside plans to continue surface mining in 1998, followed by underground mining in later years.
Clayburn Industries Ltd. of Abbotsford is processing locally mined **fireclay** from **Sumas Mountain** into a variety of refractory bricks and castable refractory products. Its **pyrophyllite** operation at **Princeton** was dormant in 1997. The company is reclaiming its **diatomite** pit near **Quesnel**. Western Industrial Clay Products Ltd. in Kamloops supplies approximately half of the **kitty litter** market (and other domestic and industrial absorbents) in Western Canada, principally from its **Red Lake** property near Kamloops. The company is shipping part of its production overseas. It plans to further diversify its product line into the horticulture area, using a stockpiled layer of coaly clay. Western Industrial Clay also examined a variety of properties from Quesnel to Princeton in 1997. Small quantities of **ornamental** and **facing brick,** and **flueline pipe,** are produced near Abbotsford by Sumas Clay Products Ltd., operated by the Sumas Band.

Granite and **marble** are produced by several companies. 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 in Squamish. Margranite is processing nine granite varieties from at least five quarry sites and has doubled its plant capacity by adding a wire saw and hydraulic splitter. Garibaldi Granite is using full plant capacity to process three granite varieties from two quarry sites and is preparing a third site in the **Squamish** area. Garibaldi signed a lease on a site in Burnaby, B.C. to open its first granite and stone products retail outlet (The Stone Depot). Westcoast Granite Manufacturing has installed a second gang saw, doubling its plant capacity. Quadra Stone Ltd. started production of Cascade Coral blocks from a new quarry near **Beaverdell**. San Pedro Stone experimentally produced black granite blocks from a quarry near Grand Forks. This site and the Garibaldi Granite operation in Squamish are controlled by Pender Capital Inc. In 1997, Garibaldi completed initial drilling and surface bulk-sampling on its JD claims. Other active quarry sites include: Tsitika Stone Industries on northern Vancouver Island (grey granite), Yoho National Stone Inc. near Sayward and Adera Natural Stone Supplies Ltd. on Granite Island near Sechelt (selling blocks for the Coal Harbour seawall in Vancouver). Matrix Marble Ltd. is preparing to reopen its **Tahsis Inlet** marble quarry, inactive since the early 1900s. Franz Capital Corporation Ltd. built a small processing plant in Enderby to process **marble** from its **Kingfisher** quarry, and started producing ashlar-size blocks of its white/greyish marble quarried north of Mable Lake. The stone is used in residential construction in Vancouver and the Okanagan. The plant also produces custom-cut marble pieces, such as sills and lintels, and is testing the markets for other local stones, such as serpentinite.

Flagstone has traditionally been quarried by Revelstoke Flagstone Quarries and Begbie Flagstone Ltd., together producing approximately 200 tonnes of mica schist flagstone. Kootenay Stone Centre, in Salmo, is producing about 4000 tonnes of **quartzite flagstone**. Two local companies produce slate on a small scale near **Port Renfrew** on Vancouver Island. Similarly, **flagstone** is also produced on a small scale from **Nipple Mountain**, east of Kelowna. **Dolomite** is quarried by IMASCO Minerals Ltd. at Crawford Bay 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, fine aggregate and synthetic marble products.

Jade production is currently concentrated in the Kutcho Creek area. Two active companies in that area were Polar Gemstones Ltd. (**Serpentine Lake** property) and Jade West Resources Ltd. Exploration was also carried out on the **Serpentine Lake**property in 1997. Jade West Resources Ltd. operates a jade processing facility in Surrey. Jade is recovered from the old **Cassiar Asbestos** mine waste dumps and sawn for sale on site by Jedway Enterprises. Canada Pumice Corporation produced red and black **volcanic cinder** from its **Nazko** quarry west of Quesnel, for markets in the Lower Mainland. During 1997, the company shipped approximately 11 900 cubic yards; an additional 7500 cubic yards of stockpiled material remained on site. The products are used for landscaping, baseball diamonds and sport tracks, and growing and filtration media. On a smaller scale, Great Pacific Pumice Ltd. is shipping **pumice** from its **Pum** property on Mount Meager, north of Pemberton.

Limeco Products Division of Highwood Resources Ltd. continued to develop its market, in a variety of agricultural applications in Alberta, for **zeolite** from the **Ranchlands** Z-1 and Z-2 pits near Cache Creek. The company was also exploring for **bentonite**.

Canmark International Resources Inc. continued to develop a market in the Lower Mainland for **zeolite** from its **Sunday Creek** deposit near Princeton.

Tailings

M. Seven Industries Inc. continues to produce about 60 000 tonnes per year of **magnetite** by processing the **Craigmont** tailings. The company is supplying most coal mines in western Canada.

Advanced Exploration and Development Projects

Metals

It is estimated that about 72% expenditures in 1997 has been for advanced exploration and development projects including bulk sampling, metallurgical testing, environmental and scoping programs. Approximately 40 projects involved major programs totalling approximately $35 million, and another 150 were less-advanced projects with aggregate expenditures totalling approximately $21.6 million. One large porphyry gold-copper development, Kemess South, is in the construction phase. The Tulsequah Chief, Bronson Slope, Red Chris, Red Mountain, Telkwa and Willow Creek projects are in the Environmental Assessment Process. The Mt. Milligan gold-copper porphyry deposit has received a Mine Development Certificate. Several other advanced projects are nearing the requirement or commitment to enter the Environmental Assessment Process. (*e.g.*, Cariboo Gold Quartz, Prosperity, Specogna, [Harmony], Getty Copper, Hearne Hill, Isk, J+L, Midway, Giant Copper and Polaris-Taku) (*see* Figures 8a and 8b).

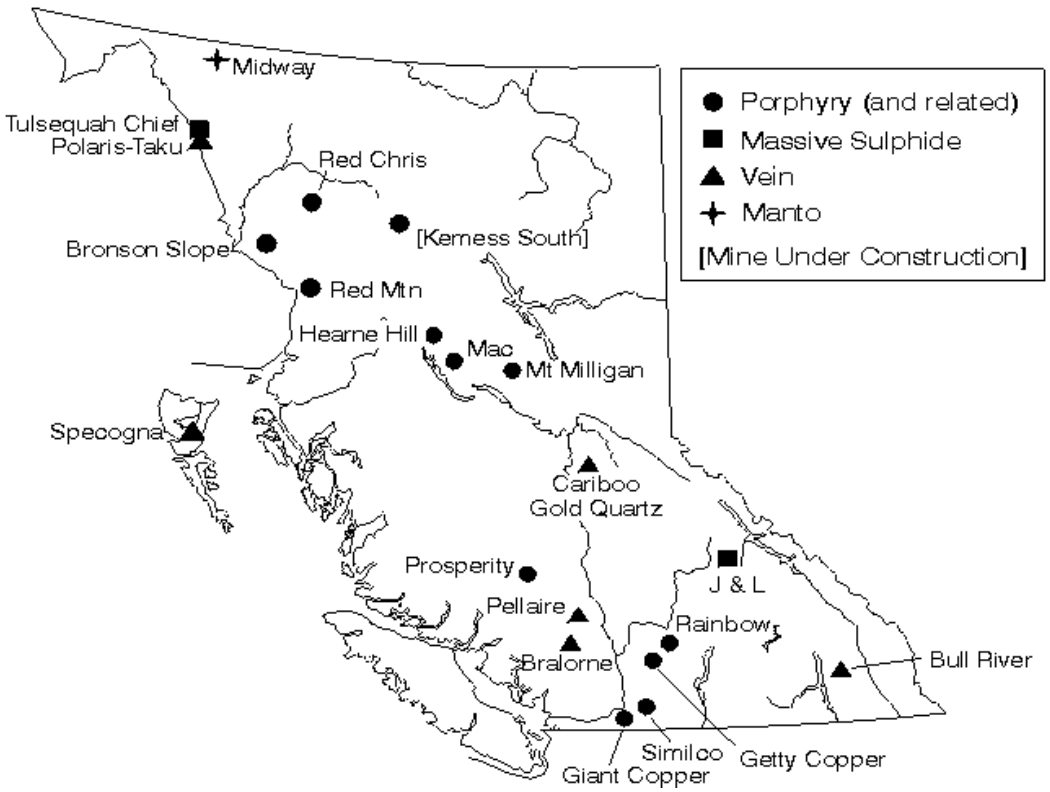


Figure 8a. Advanced Projects - Metals, 1997.

Porphyry and Related Deposits

Construction at the Kemess South project, owned and operated by Kemess Mines Inc., a wholly owned subsidiary of Royal Oak Mines Inc., progressed smoothly during 1997, with over 1000 construction workers on site during the latter part of the summer months. The projected capital costs are estimated at $430 million; the mine is scheduled to open in the second quarter of 1998. When in full operation, it will employ 375 workers. Reserves are estimated by the company at 200.4 million tonnes grading 0.63 g/t Au, 0.22% Cu and 0.008% Mo. Over its 16-year life, the 45 000-tonne per day milling operation is forecast to produce 7775 kilograms (250 000 oz) of gold and 27 220 tonnes (60 million pounds) of copper annually at an estimated cash cost of US$ 79 per ounce after copper credits at US $1.00 per pound. The potential for the discovery of additional resources is good. Several other gold-copper deposits, such as Kemess North with resources estimated at 175 million tonnes grading 0.18% Cu and 0.37 g/t Au, occur close to the mine site, on claims owned by Royal Oak Mines. Funding for development of the Kemess South project includes an economic assistance and investment package of up to $166 million from the British Columbia government, negotiated in compensation for the Windy-Craggy decision. Royal Oak has signed a 5-year agreement for the sale of its concentrate.

The company built an airstrip and construction and mine workers are flown to and from the property on a rotation basis. Construction of permanent camp facilitates, service complex, mill buildings and tailings dams are expected to be 85% complete by the end of 1997. A total of $420 million of the capital cost of $430 million has been committed to purchase orders for equipment and construction contracts. Pre-production stripping of the open pit began in July 1997. Clearing of the right-of-way and installation of towers for a 380-kilometre, 230 kilovolt electric transmission line to the BC Hydro Kennedy Substation near Mackenzie is well advanced; completion date is early 1998. All heavy materials and equipment are transported along the Omineca Resource Road; initial shipment of concentrates will utilize this route.

Figure 8b. Advanced Projects - Coal And Industrial Metals, 1997.

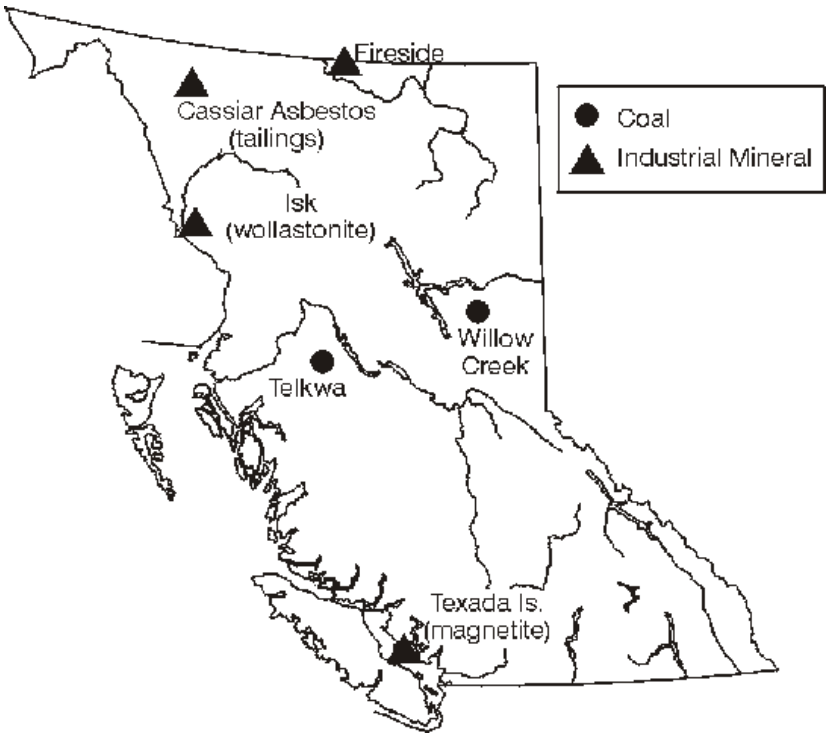


Table 3 New Mines, Closures, Development and Advanced Exploration Projects - 1997

Company Name	Project Name	Commodity	Estimated Tonnes (000s)	Estimated Grade	Reference
New Mines					
Imperial Metals Corp.	Mount Polley	Cu, Au	82 300	0.3% Cu, 0.417 g/t Au	Imperial Metals, 1996
Huckleberry Mines Ltd.	Huckleberry	Cu, Mo	90 400	0.513%Cu, 0.014%Mo 0.06 g/t Au 2.8 g/t Ag	
Wheaton River Minerals Ltd./ North American Minerals Ltd.	Golden Bear	Au	1 528 153	5.1 g/t Au (leachable) 20.5 g/t Au (refractory)	Wheaton River, 1997
Development					
Royal Oak Mines Inc.	Kemess South	Cu, Au	200 400	0.22% Cu, 0.63% g/t Au, 0.008% Mo	Royal Oak, 1996
Primes Resources Gp. Inc.	Eskay Creek	Au, Ag	1 270	59.31 g/t Au, 2 719 g/t Ag	Primes Res., 1996
Fireside Minerals Ltd.	Fireside	Barite	5.2		Fireside, 1997
Closures					
Afton Operating Corporation	Ajax	Cu, Au			
Advanced Exploration					
Porphyry (and related) Deposits					
Taseko Mines Ltd.	Prosperity (Fish Lake)	Cu, Au	675 000	0.236% Cu, 0.435 g/t Au	Taseko Mines, 1995
Placer Dome Inc.	Mt. Milligan	Cu, Au	257 000	0.24% Cu, 0.51 g/t Au	Placer Dome, 1997
American Bullion Minerals Ltd.	Red Chris	Cu, Au	210 000	0.46% Cu, 0.38g/t Au	American Bullion, 1997
Princeton Mining Corp.	Similco - all zones	Cu, Au	129 163	0.393% Cu, 0.155 g/t Au, 1.576 g/t Ag	Princeton, 1996

Spokane Res. Ltd.	Mac	Mo,Cu	99 940	0.13% Mo eq.	Spokane, 1997
Westmin Res. Ltd.	Gibraltar (total)	Cu	142 334	0.303 Cu, 0.009% Mo	Gibraltar, 1996
Royal Oak Mines Inc.	Red Mountain	Au, Ag	1 922	9.8 g/t Au	Royal Oak, 1996
International Skyline Gold Corp.	Bronson Slope	Cu, Au, Ag	76 000	0.44 g/t Au, 0.16% Cu, 2.75 g/t Ag, 0.007% Mo	International Skyline, 1997
Britannia Gold Corp./ Bren-Mar Res. Ltd.	Lexington	Cu, Au	162	8.9 g/t Au 0.96% Cu	Bren-Mar, 1995
Getchell Res./Teck Corp	Rainbow (Kamloops)	Cu, Au	15 860	0.52% Cu	Teck, 1996
Imperial Metals Corp.	Giant Copper (AM)	Cu, Au	29 500	0.65% Cu, 0.38 g/t Au, 12.34 g/t Ag	Imperial Metals, 1995
Booker Gold Expl'n. Ltd./ Noranda Mining and Expl'n Inc.	Morrison Hearne Hill	Cu Cu	190 000 180	0.4% Cu, 0.2 g/t Au, 1.7% Cu	Noranda, 1996 Prospectus, 1992
Getty Copper Corp.	Getty North Getty South	Cu Cu	66 300 36 000	0.31% Cu 0.47% Cu	Getty, 1997
Massive Sulphide Deposits					
Redfern Res. Ltd.	Tulsequah Chief	Cu, Pb, Zn, Au, Ag	7 910	1.27% Cu, 1.18% Pb, 6.35% Zn, 2.42 g/t Au, 100.9 g/t Ag	Redfern, 1996
Weymin Mining Corp.	J&L	Zn, Pb, Ag	3 600 (Main) 1000 (Yellowjacket)	3.9% Zn, 3.0% Pb, 81 g/t Ag, 7.24 g/t Au 7.1% Zn, 2.5% Pb, 52.5 g/t Ag	Weymin, 1997
Vein Deposits					
Bralorne-Pioneer Gold Mines Ltd./Avino Mines and Res. Ltd.	Bralorne Above 800 level	Au, Ag	432.5	10.6 g/t Au	Bralorne-Pioneer, 1996
International Jaquar Equities Inc.	Pellaire (Lord River)	Au		bulk sample	International Jaquar, 1997
International Wayside Gold Mines Ltd.	Cariboo Gold Quartz	Au	3 080	3.5 g/t Au	International Wayside, 1997
Canarc Res. Corp.	Polaris-Taku	Au	3 270	13.7 g/t Au	Canarc, 1997

Misty Mountain Gold Ltd.	Specogna (Cinola)	Au, Ag	33 500	2.11 g/t Au	Misty Mountain Gold, 1997
Prime Resources Ltd.	Snip- Twin West	Au	335	24.7 g/t Au	Prime, 1996
Westmin Res. Ltd.	Premier	Au, Ag	350	7.2 g/t Au 37 g/t Ag	
Cusac Gold Mines Ltd.	Table Mountain	Au	39.4	15.6 g/t Au	Cusac, 1996
Skarn/Manto Deposit					
Imperial Metals Corp.	Midway	Zn, Pb, Ag	1400	8.3% Zn 5.8% Pb 317 g/t Au	Imperial, 1997
Coal and Industrial Mineral Deposits					
Mountain Minerals Co. Ltd.	Ranchlands	zeolite			Mountain Minerals, 1996
Canmark Int'l Res. Ltd.	Sunday Creek	zeolite			Canmark, 1995
Okanagan Opal Inc.	Klinker	fire opal			Okanagan, 1995
Quinto Mining Corp. Ltd.	Lumby	graphite, sericite	340		Quinto, 1997
New Global Res. Ltd.	Monteith Bay	silica, pyrophyllite			New Global, 1995
Whitegold Res. Corp.	Isk	wollastonite	1 800	80%	Whitegold, 1997
Manalta Coal Ltd.	Telkwa	coal	50 000	thermal	Manalta, 1997
Pine Valley Coal Ltd.	Willow Creek	coal	15 600	metallurgical	Pine Valley, 1997
Quinsam Coal Corp.	Tsable River	coal	38 478	thermal	Quinsam, 1996
Pacific West Coal Ltd.	Tulameen	coal	21 000	thermal	Pacific West, 1997
IMP Ind.Min. Park	Black Crystal	graphite	27 000		IMP, 1995
Anglo Swiss Ind. Ltd.	Blu Starr Blu Moon	sapphire			Anglo Swiss, 1997
B.C. Chrysolite Corp.	Cassiar	asbestos			B.C. Chrysotile, 1995
Quest Int'l Res. Corp.	Ice	diamond			Quest, 1995
Ava Res. Ltd.	Wishaw	quartzite			Ava, 1995
R.H. Stanfield & Assoc.	Aspen	syenite			R.H. Stanfield, 1997

Note: Estimated Tonnes and Grade are "Resources".

During 1997, Taseko Mines Ltd. completed pilot plant metallurgical and process testing programs, including bulk sample testing of the Prosperity (formerly Fish Lake) porphyry gold-copper deposit. All pilot plant program results were reported to compare favourably with the previously announced pre-feasibility metallurgical results. Results from a 50 000-kilogram test program averaged 90% copper recovery and 75.6% gold recovery producing a 25% copper concentrate containing 38.9 g/t Au. A detailed geological and gold-copper grade computer model of the deposit, based on 123 414 metres of drilling in 248 holes, is nearing completion and will lead to a new mineable reserve estimate and open pit design and production schedules. In addition, comprehensive environmental and socio-economic studies for presentation to the government Project Review Committee are continuing. The previously established mineable reserve for the deposit was 675 million tonnes grading 0.236% Cu and 0.435 g/t Au. At a projected 90 000-tonnes per day milling rate, the company forecasted annual production of 11 350 kilograms (365 000 oz) of gold and 69 460 tonnes (153 million pounds) of copper, over a mine life of 21 years. The capital costs were estimated at US $430 million. Between 1996 and 1997, Taseko completed a large ($13.5 million), in-fill drilling program; this was the largest exploration program ($5 million) in the province in 1997.

The Placer Dome Inc. Mt. Milligan porphyry gold-copper deposit, about 90 kilometers northeast of Fort St. James, contains a reserve estimated by the company at 257 000 000 tonnes grading 0.24% Cu and 0.51 g/t Au. Capital costs are projected by the company at $615 million for a 45 000-tonnes per day operation. Mine life is estimated at 16 years; the mine will employ 310 persons. The company holds a Mine Development Certificate for the project and is still reviewing options to lower the capital costs. One option is to use a hydrometallurgical technique to process the concentrate on site in an autoclave.

In April 1996, a prefeasibility report by Fluor Daniel Wright for the American Bullion Minerals Ltd. **Red Chris** copper-gold project identified a geological resource, defined by 244 drill holes totalling 71 000 metres, of 550 000 000 tonnes grading 0.323% Cu and 0.254 g/t Au, defined by a 0.2% Cu cut-off. The capital cost for a 90 000-tonne per day milling operation was estimated at $541 million; mine life was estimated at 16 years. In June 1997, the company came under new management and by November had formulated a new strategy for the project, based on a detailed review of the extensive and excellent geological database, a review of the mine plan and brief field visits to the site. In general, the new strategy calls for a dozer push open-pit mining method resulting in a daily mill throughput of 30 000 tonnes over a 20 year mine life, allowing for selective mining of the higher-grade core of the deposit, estimated to contain 210 million tonnes grading approximately 0.46% Cu and 0.38 g/t Au. This new plan would result in significant reductions in development cost, capital cost of mining equipment, and simplify the operation. The company intends to present this new strategy to the Northwest Mine Development Review Committee early in 1998 and plans an aggressive program in 1998.

Based on 14 800 m of drilling in 77 holes, International Skyline Gold Corporation estimates a resource of 76 000 000 tonnes grading 0.162% Cu, 0.44 g/t Au, 2.747 g/t Ag and 0.007% Mo for its Bronson Slope polymetallic porphyry property, adjacent to the Snip mine. The company plans mining in three stages over 14 years, beginning with a low strip ratio, high-grade starter pit with an estimated reserve of 22 million tonnes grading 0.207% Cu, 0.504 g/t Au, 2.953 g/t Ag and 0.005% Mo. The mill is planned to produce a gold and silver-rich copper concentrate and a separate molybdenum concentrate. The plant is also designed to recover a high-quality magnetite concentrate. Metallurgical testing has indicated good recoveries for copper, gold and silver; tests have also demonstrated that molybdenum and magnetite are recoverable. During 1997 the company continued with the preparation of a feasibility study and its environmental assessment project report. The project, as currently proposed, is a 15 000-tonne-per-day milling operation; capital costs were estimated at $150 million.

In mid-1997, International Skyline acquired two mineral titles (Kathleen Fraction and Highwall), adjacent to the Bronson Slope deposit, from Prime Resources Group. These acquisitions will allow Skyline to consolidate its claim block into one contiguous unit measuring 1.8 by 0.45 kilometres, which will facilitate mining of the deposit. In order to acquire the Highwall property, International Skyline was required to drill six condemnation holes under the direction of Prime. This drilling defined a zone of gold mineralization parallel to both the Bronson Slope porphyry

deposit and the Snip shear-zone vein deposit. The company is now evaluating the potential for additional disseminated mineralization, as well as deeper, narrow high-grade gold veins to add to its mineral inventory. It is seeking a joint venture or partnership to develop the open pit and underground potential of the property

There was no activity during 1997 at the Royal Oak Mines Inc. Red Mountain gold-silver project, 10 kilometres east of Stewart. Prior to 1996, Royal Oak estimated a resource of 1 921 680 tonnes grading 9.8 g/t Au. Despite the success of the 1996 exploration programs, Royal Oak decided to concentrate its efforts on its Kemess South project.

In the spring of 1997, Teck Corporation drill-tested the Rainbow No. 2 porphyry copper-gold deposit, west of the Ajax mine, under a joint venture agreement with Getchell Resources Inc. (30%). Teck estimated a geological reserve of 15.86 million tonnes grading 0.52% Cu, plus potential credits in gold and molybdenum, using a 0.25% Cu cut-off. This estimate is based on the evaluation of the results of 104 diamond-drill holes, to a depth of 300 metres. Most of the higher-grade mineralization is hosted by hydrothermal/intrusive breccia and dikes. While Teck considered the grades at depth to be respectable for open pit production, poor grades near surface and the steeply dipping geometry of the breccia unit results in a high stripping ratio. The company concluded that the deposit will not support underground mining and no further work is planned.

In the northern part of the Highland Valley, southwest of Kamloops, Getty Copper Corporation completed a major drilling program on its Getty North (Krain) and Getty South (Trojan) deposits in 1997. The property covers approximately 212 square kilometres. To the end of the year, the company has completed 36 351 m of diamond drilling on the Getty North porphyry deposit and limited reconnaissance diamond drilling (3236 m) and bedrock trenching (1500 m) on the Getty South breccia-hosted deposit. A small amount (3374 m) of exploratory diamond drilling on the Getty West (Transvaal) area, optioned from Globe Resources Inc., confirmed the presence of a copper-molybdenum porphyry system. The Getty North deposit, which has been systematically drilled on northeast sections at 30-metre intervals, has a geological resource, estimated by the company, of 66.3 million tonnes grading 0.31% Cu, including 9.4 million tonnes of oxidized material grading 0.41% Cu and 42.8 million tonnes of sulphide mineralization grading 0.35% Cu. The deposit is approximately 400 metres long with a northwesterly strike, 300 metres wide and dips moderately to steeply to the southwest. Metallurgical testing has shown the oxide copper is amenable to recovery by heap leaching and solvent extraction-electrowinning techniques. Preliminary metallurgical studies have shown that leaching recovers approximately 62 to 65% of copper from the sulphide resource. Subject to a positive feasibility study and issuance of the relevant permits, the company is considering processing both the oxide and the sulphide copper by heap leaching SX-EW technology. The Getty South deposit has an inferred resource of 36 million tonnes grading 0.47% Cu, including 2 to 3 million tonnes of oxidized material. To date, the oxidized ore has been traced over an area 600 metres long and up to 250 metres wide. These deposits are located respectively 8 and 5 kilometres north of the mined out Bethlehem deposits; Getty North displays characteristics similar to the Bethlehem orebodies.

In the Babine camp, Booker Gold Explorations Ltd. continued diamond drilling on its Hearne Hill porphyry copper-gold breccia property, 20 kilometres north of the Bell mine. The company focused on the high-grade breccia mineralization, but also examined the potential of the surrounding porphyry system. Ground and airborne geophysical programs, geochemical sampling programs and trenching were carried out. The Chapman zone, 250 metres southeast of the Peter Bland zone, was extended to a length of at least 635 metres, a width of 200 metres and to a depth of 300 metres. The Peter Bland zone has dimensions of 300 metres by 150 metres by 300 metres. Both zones are high-grade copper breccias. Booker is preparing a resource estimate for these zones as part of a feasibility study. In late October, Booker signed an option with Noranda Mining and Exploration Inc. to jointly explore Booker's Hearne Hill and Noranda's Morrison deposits. The Hearne Hill breccia zones are approximately 1500 metres southeast of the Morrison deposit, which Noranda estimates has a geological resource of 190 million tonnes grading 0.4% Cu and 0.2 g/t Au. Booker feels that with further drilling, and utilization of a higher grade starter pit on the breccias on Hearne Hill, a mining plan could be developed for the region. The nearby Bell mine, closed since 1992, has remaining reserves estimated at 70.4 million tonnes grading 0.44% Cu and 0.2 g/t Au.

Spokane Resources Ltd. conducted a modest (2600 m) drilling program on its Mac molybdenum deposit, 40 kilometres southeast of the Granisle and Bell mines, in the early winter of 1997. A geostatistical resource estimate by Giroux Consultants Ltd. identified an indicated and inferred resource of approximately 100 million tonnes, at a cut-off grade of 0.04% Mo, in the Camp zone, including an indicated resource of 52 420 000 tonnes grading 0.14% MoS_2 equivalent and an inferred resource of 47 520 000 tonnes grading 0.12% MoS_2 equivalent (a small amount of copper is present). The overall porphyry system, with two other zones of mineralization identified, is at least 3.5 kilometres long and up to 2 kilometres wide. The company has engaged Fluor Daniel Wright to complete a preliminary economic study by 1998. A follow-up engineering and drilling program was planned to begin in late November.

Imperial Metals Corporation did no fieldwork on its Giant Copper copper-gold porphyry deposit near Hope in 1997. Drilling in 1996 of the AM and Invermay zones has resulted in two open-pit resources being outlined for the property. The AM zone is estimated by the company to contain an open-pit resource of 29.5 million tonnes grading 0.65% Cu, 0.38 g/t Au and 1.23 g/t Ag. The company has filed an application for a 10 000 tonne bulk sample from the AM zone, to be hauled to the Mount Polley mill for testing in 1998. The company is conducting a feasibility study for a 6-year, 1800 tonne-per-day open pit and underground copper-gold-silver operation, with milling at the Similco mine.

Massive Sulphide Deposits

Redfern Resources Ltd. submitted a revised Project Report for the Tulsequah Chief polymetallic volcanogenic massive sulphide project to the Environmental Assessment office on July 8, 1997. Reserves on this property, 100 kilometres south of Atlin, are estimated by the company at 7.9 million tonnes grading 6.35% Zn, 1.27% Cu, 1.18%Pb, 100.91 g/t Ag and 2.42 g/t Au, and open to depth and along strike. At full production, milling 900 000 tonnes per year, the mine is forecast to produce 53 200 tonnes of zinc, 10 090 tonnes of copper, 9350 tonnes of lead, 75 270 kilograms (2.42 million oz) of silver and 1742 kilograms (56 000 oz) of gold annually over a minimum mine life of 9 years. The mine will employ 260 people; the capital cost is estimated at $155 million. Restricted access is proposed via a 160-kilometre road from Atlin. Redfern has established a maximum public awareness program, including close contacts with the Taku River Tlingit First Nation Band. The company hopes to receive approval for the mine in early 1998.

During 1997, Weymin Mining Corp. completed three diamond-drill holes totalling 503 metres on its J+L (McKinnon Creek) massive sulphide deposit near Revelstoke. These holes were designed to intersect and extend the two major known deposits, the Yellowjacket and Main zones, to the northwest of previously identified structure and mineralization. The Yellowjacket zone is a stratabound carbonate-hosted zinc-lead deposit containing a mineral resource of 1.0 million tonnes grading 7.1% Zn, 2.5% Pb and 52.5 g/t Ag. The 1997 drilling extended the known mineralization up-plunge and to the northwest. The Main zone is a shear-hosted massive sulphide deposit with a mineral resource of 3.6 million tonnes grading 3.9% Zn, 3.0% Pb, 81 g/t Ag and 7.24 g/t Au. It is open along strike and down-dip from the existing underground workings. Weymin has extended the surface trace of the Main zone by geological and geochemical surveys for approximately three kilometres to the southeast. The drilling has extended it to the northwest by approximately 300 metres. A 100-tonne bulk sample for metallurgical testing was taken from underground in the Main zone and shipped to Process Research Associates in Vancouver for processing. Weymin is planning a large surface and underground exploration and development program in early 1998.

Precious Metal Bearing Veins and Bulk Mineable Deposits

At the Specogna (formerly Cinola) gold deposit, on Misty Mountain Gold Ltd.'s 440 square kilometre Harmony Gold property on Graham Island, Queen Charlotte Islands, the multi-million dollar exploration drilling program, consisting of 34 627 metres in 147 holes on a 20 by 20 metre grid, begun in 1996, was completed in the spring of 1997. Gold processing options are now being studied. A 1700-kilogram bulk sample was collected and is

undergoing testing using bio-oxidation heap-leach processing techniques. The company initiated additional diamond-drilling in the fall of 1997, designed to test for potential bonanza-type deposits which may have developed at depths of up to 200 metres below the currently known Specogna deposit in a deeper, throttled portion of the epithermal system. Independent Mining Consultants Inc., on behalf of Misty Mountain, estimates the deposit has a mineral reserve of 52 7000 000 tonnes grading 1.7 g/t Au. Based on a total of 80 000 metres of drilling in 538 holes and a cut-off grade of 1.2 g/t Au, an extensive study by Melis Engineering Ltd., Lakefield Research Limited and Oxidor-Gold Corp. provides for conventional processing of 33 500 000 tonnes grading 2.11 g/t Au to be followed by conventional processing of 19 200 000 tonnes of stockpiled material grading between 0.80 to 1.2 g/t Au. Milling throughput is forecast at 7500 tonnes per day with 5417 kilograms (174 170 oz) of gold produced in each of the first five years of operation. Over the projected 20-year mine life, production is forecast to average 3440 kilograms (110 625 oz) of gold per year. Based on representative samples, gold recoveries in the 75 to 80% range are expected. The study, including environmental work, deposit modelling, resource estimates, various mine designs, mineralogy, metallurgy, site facility locations and infrastructure planning is in progress and will provide a framework to complete a comprehensive pre-feasibility study.

Gold is distributed throughout a hydrothermal breccia unit that parallels the northwesterly striking Specogna fault for at least 700 metres and also throughout stockwork quartz veining and pervasively silicified sedimentary rocks which extend laterally from the hydrothermal breccia for up to 210 metres. The deposit extends over 300 metres down-dip to the northeast.

Gold recovery tests using a gravity circuit followed by standard flotation techniques were completed on deposit material grading 2.40 g/t Au. Preliminary results indicate that conventional gravity circuits may recover 10-20% of the gold, and flotation results indicate an 80% or better overall gold recovery is achievable in a concentrate grading 30 to 40 g/t Au. Tests on the flotation concentrate indicate that it is very amenable to bio-oxidation pre-treatment; oxidation rates are rapid and the gold recovery is excellent. Misty Mountain is currently conducting a program to test bio-oxidation pretreatment of crushed ore, followed by simple heap leaching.

During 1997, Canarc Resource Corporation completed a multi-million underground exploration and development program on its New Polaris (Polaris-Taku) project in the Tulsequah area. The program was suspended due to financing problems, after dewatering down to the 600 level and completing approximately 12 190 metres of diamond-drilling out of a planned 30 480 metres. The best intersection was a 34.2-metre interval assaying 14.4 g/t Au in the C zone, below the 600 level workings. Drilling on the AJ level intersected ore grades in the AB and Y zones that were either neglected or not previously known. Confidentiality agreements were signed with several large companies in an effort to secure a joint venture partner to continue the feasibility program. Reserves estimated by Canarc in 1996 are 3.27 million tonnes grading 13.7 g/t Au at a cut-off grade of 6.86 g/t Au. The company announced a 10% increase in contained gold in early 1997, as a result of the continuing 1997 drilling program. Environmental engineering and socio-economic studies are continuing as part of the company's program aimed at entering the Environmental Assessment Process. Planned test work included the processing of a flotation concentrate using pressure oxidation and bio-oxidation techniques. Other studies analyzed the viability and profitability of shipping raw ore off site for processing at existing, permitted mill facilities within 300 kilometres of the minesite. Any positive developments at the nearby Tulsequah Chief deposit would have a significant positive spin-off for the New Polaris project.

Bralorne-Pioneer Gold Mines Ltd., in a joint venture with International Avino Mines and Resources Ltd., continued to seek financing to put its Bralorne gold mine back into production. Existing geological reserves above the 800 level (main haulage tunnel) were estimated by the company at 432 500 tonnes grading 10.63 g/t Au. Bralorne-Pioneer proposed surface mining from the Peter vein to provide early millfeed; unfortunately, drilling in 1997 was not successful in defining additional reserves. Re-installation of the 150-tonne-per-day milling plant was almost complete in 1997.

At the Pellaire (Lord River) gold deposit, in the Taseko Lakes area, International Jaguar Equities Inc. completed a bulk sampling and exploration program in 1997. The balance of 450 tonnes of the approximately 2000 tonnes of high-grade ore (*e.g.* 34.2 g/t Au and 102.9 g/t Ag) mined during 1996 from two adits and raises on the No. 4 and 5 veins, was scheduled to be delivered to the Trail smelter during November 1997. During the year the company carried out a program of mapping, trenching and sampling on eight of the presently known veins on the property. Gold-silver mineralization occurs in veins along a 400-metre contact between granodiorite of the Coast Plutonic Complex and volcanic rocks of the lower Cretaceous Taylor Creek Group. The No. 3 vein (750 metres long by 3 metres wide) is the main structure; the No. 4 and No. 5 veins are splays off it. The company also completed an engineering report on the 1997 underground operation. A 2500-metre diamond-drilling program is planned for 1998, to establish a reserve base for year round mining.

In the Wells-Barkerville area, famous for both its lode and placer gold production, International Wayside Gold Mines Ltd. conducted a major surface and underground exploration program during 1997 on its Cariboo Gold Quartz gold property. This work is in preparation for entering the pre-application process with the Cariboo Mine Development Review Committee. To December 1997 the company had completed 193 holes, including 78 holes drilled during 1997. The company purchased the remaining 50% of the Cariboo Gold Quartz mine, the Island Mountain mine and the permitted Mosquito Creek Gold mine and formed the Cariboo Gold project. The permit application under the Environmental Assessment Act will encompass all three former producing gold mines, expand the existing permit to increase daily tonnage milled and include relocating the mill to a more advantageous site.

Based on assays to July 31, 1997, Geologic Systems Ltd., on behalf of International Wayside, calculated a mineral resource of approximately 3.08 million tonnes grading 3.5 g/t Au at a cut-off grade of 1 g/t Au, above the 1200 level of the Cariboo Gold Quartz mine. Programs during 1997 included grid-style surface diamond-drilling above the previously productive Pinkerton zone, and underground percussion drilling from the 1200 level across the Baker-Rainbow contact near the Sanders zone. Drilling has focused on the Rainbow, Sanders and Pinkerton zones. The objective is to define a mineable open-pit reserve. A geochemical survey was completed over the Barkerville, Cow, Richfield and Island Mountain areas. Trenching tested the new, 1.4-kilometre-long Wells trend, a northwest-trending zone that lies southwest of and subparallel to the Sanders-Rainbow-Pinkerton trend.

At the Baker mine, in the Toodoggone district, Sable Resources Ltd. produced 52.7 kilograms (1695 oz) of gold and 507 kilograms (16 309 oz) of silver from 2337 tonnes of ore from underground mining on the B vein in 1996. During 1997, the company milled approximately 1600 tonnes of ore from the B-vein open pit and re-processed approximately 545 tonnes of tailings, yielding 35 kilograms (1128 oz) of gold, 220 kilograms (7084 oz) of silver and 4.5 tonnes (9868 lb) of copper. It also explored the North Black Gossan zone with nine diamond-drill holes totalling 657 m.

During 1997, R.H. Stanfield and Associates conducted underground exploration and development at the Bull River gold mine, where quartz-ferrocarbonate veins in fractures are hosted by Middle Aldridge Group siliciclastic rocks.

Skarn/Manto Deposit

During 1997, Imperial Metals Corporation conducted a $2 million surface exploration program, including 8000 metres of diamond-drilling, on its recently acquired Midway (Silvertip) silver-lead-zinc manto and chimney deposit, 80 kilometres west of Watson Lake. An estimated resource of 1.4 million tonnes grading 317 g/t Ag, 5.8% Pb and 8.3% Zn had previously been outlined by other operators in the Silver Creek (North and South) zone. The deposits are hosted by the mid-Devonian McDame limestone, and are associated with karsting below an unconformity overlain by the Earn Group shales and siltstones. Mineralization is postulated to have originated from a poorly exposed intrusive suite along the eastern margin of the Cassiar batholith. The Silver Creek zone averages 10 metres thick over a width of 80 metres. In-fill drilling further explored this zone in 1997. Two new zones of high-grade

massive sulphide mineralization were outlined immediately north of the Silver Creek zone in an area now termed the Silver Creek Extension zone. The second zone, termed Discovery North, is 150 metres north of the Discovery zone.

The company contracted an innovative seismic reflection technique, developed at The University of British Columbia, to locate the Earn/McDame unconformity and sulphide zones in the McDame rocks beneath it. Imperial Metals has initiated a new ore reserve calculation and has applied for a 10 000 tonne bulk sample permit during 1998, in anticipation of entering the Environmental Assessment Process.

Coal Deposits

There were at least five coal exploration programs in 1997 which were not on existing mine leases. Expenditures are estimated at approximately $1.85 million, down from an estimated $4.5 million in 1996. Predictions for stronger thermal coal markets has led to renewed interest in coal deposits close to existing infrastructure, or in the case of Tsable River, close to tidewater. There is also a trend in demand away from hard coking coals to weak and semi-soft coking coals. Exploration was dominated by the Telkwa coal project, though significant programs were carried out at Willow Creek in the Northwest and by Fording Coal Corporation in the Southeast.

The Tulameen program is an example of the ability of small players to still get into the coal business, especially as some coal licenses are being dropped by larger companies no longer interested in coal development. There are markets for small quantities of thermal coal in British Columbia (cement plants) and in Washington.

At the Telkwa thermal coal project, Manalta Coal Limited conducted another extensive exploration program at an estimated cost in excess of $1 million, generally designed to better define existing resources. A total of 128 holes were drilled in the Tenas Creek, Pit 3 and West Goathorn areas. The drilling east of Goathorn Creek delineated new resources; the resource estimates in other areas did not change substantially. The in situ resource of the Telkwa property is now estimated to be 125 million tonnes. The in situ mineable reserve, contained in six separate pits, is estimated to be 50 million tonnes. Manalta has submitted a report to the government as part of the Environmental Assessment Process and hopes to receive project approval with all its permits by 1999. The company proposes to produce 1.5 million tonnes per year over a 23-year mine life, employing 211 persons.

At the Tsable River project, south of Courtenay on Vancouver Island, Quinsam Coal Corporation (63%) and Marubeni Corporation (37%) sought government approval to mine a bulk sample of up to 90000 tonnes from underground. As part of the requirements, a hole was drilled to provide acid-rock drainage information on formations which will be penetrated by the decline. The bulk sampling permit remains to be approved; the company hopes to extract the bulk sample in 1998; other permits have been received. In situ resources in all categories are estimated at 38 477 900 tonnes, which would be sufficient for a 1 million tonne per year mine, if the product is marketable.

In the Northeast, at the Willow Creek project, Pine Valley Coal Limited has submitted a Stage 2 report which outlines plans for a 900 000 tonnes per year operation for 15 years, based on a 15.6-million tonne reserve of metallurgical coal. The company hopes to begin construction in the spring of 1998, with production scheduled for later in the year. Employment during full operation is forecast at 80 to 100 persons during 1997 and into 1998. An ongoing program of infill drilling and bulk sampling (3000 kg) is being conducted during 1997 and into 1998, at an estimated cost of $250 000.

Fording Coal Corporation acquired the Lodgepole property in the Crowsnest coalfield and completed a 1000-metre drilling program at an estimated cost of $200 000. This property was originally described as a low-ratio thermal coal prospect, but some of the upper seams may be PCI or weak coking coal quality.

Pacific West Coal Limited planned a modest drilling program on its Tulameen property. The property was last worked on by Cyprus Anvil between 1976 and 1982. Resources are estimated at 21 million tonnes of good quality, low-sulphur bituminous coal.

Coal licenses have been acquired for the Belcourt and Saxon properties and office studies are in progress to determine the viability of exploration and development.

Industrial Minerals Deposits

In 1997, industrial minerals exploration expenditures are estimated at approximately $3 million, a significant increase from the $1.7 million spent in 1996. During 1997, Whitegold Resources Corporation conducted extensive field and laboratory programs on its Isk wollastonite property on Zippa Mountain in the Iskut River area. These included 1890 metres of diamond-drilling in twelve holes in the Main zone of the Bril deposit which outlined a resource of 1.8 million tonnes of high-grade wollastonite mineralization. Approximately 6.5 tonnes of wollastonite was collected from an area beneath the talus at the Main zone of the Bril deposit, and will be used for further marketing studies. Approximately 500 kilograms of representative samples were collected from the talus pile at the base of the Bril deposit and a ground-penetration radar survey was conducted to determine the depth of this material. Detailed geological mapping confirmed extensions and other zones of wollastonite on the property. The company completed airborne laser mapping and aerial photography for the proposed 16-kilometre pipeline corridor and the proposed 34-kilometre road extension to the Eskay Creek mine road. The company is of preparing a detailed prospectus for submission to the Northwest Mine Development Committee in late 1997. If approved, the mine will create 20 full-time jobs and produce 24 000 tonnes of wollastonite annually, over a 90-day production period.

Quinto Mining Corporation Ltd. and IMP Industrial Park Mining Corporation continued market studies for graphite/sericite and graphite from their Lumby and Black Crystal (near Slocan) properties, respectively. At Lumby, Quinto has processed approximately 635 tonnes of material, from underground on the 808-metre level, in its nearby laboratory and conducted product research and testing over the last eight years. During 1996, it stockpiled approximately 9000 tonnes of material outside the 808-level and an unspecified tonnage at the mill. The mineral resources above the 808-metre level are estimated by the company at 340 000 tonnes with a further geological resource of 30 million tonnes from the 808-metre level down to the valley floor. IMP has drilled 19 holes from 30 to 100 metres deep on the Black Crystal property. A further drilling program began in late 1997.

Anglo Swiss Resources Inc. continued sampling and evaluating the economic potential of the Blu Starr/ Blu Moon sapphireproperties and other prospects in the Slocan Valley. United Radiant Applications of southern California is testing to see if the colour and clarity of the stones can be improved by heat treatment. They occur in core gneisses of the Valhalla complexes of the Omineca Crystalline Belt. Gem-quality aquamarine has been found in pegmatitic dikes in the Valhalla Gneiss Complex near Airey Creek, west of the Slocan Valley. Westpine Metals Ltd., in co-operation with the B.C. Geological Survey Branch, conducted a small program to evaluate the occurrence of sapphires on its Empress porphyry copper deposit, about 250 kilometres north of Vancouver.

Okanagan Opal Inc. continued small scale test mining and marketing of precious opal from the Klinker locality near Vernon, during 1997. A new precious opal find, hosted in vesicles of the Kamloops Group basalt, was made by Lloyd Nilson in the Vernon area.

Mining companies, as well as individual prospectors, are evaluating new dimension stone properties. Northwest Landscape Supply Ltd. is considering applying for a lease on its Spumoni claim on Brohm Ridge, following successful marketing of basalt facing stone in Whistler. Near Golden, a zone of bedded dark pink quartzite 50 metres thick, and, suitable for ashlar and other split stone products, is being evaluated. Ava Resources Ltd. continued test sampling of its attractive pink, banded Wishaw(Kakwa) quartzite deposit, east of Prince George. It may attempt to market split-stone and tiling products in the Lower Mainland.

A large snow avalanche in 1997 delayed most work on the sodalite occurrence at Mt. Laussedat, north of Golden. Logging in adjacent areas will make the site road accessible within the next couple of years.

A pilot plant, to recover short fibre asbestos from the Cassiar Asbestos tailings (16 million tonnes) has been assembled by B.C. Chrysotile Corporation. The company operated the plant for four days in late October, producing 8 tonnes of product, enough for its market testing.

On Texada Island, Consolidated Vananda Gold Ltd. constructed a processing mill and has approval to process a 10 000-tonne bulk sample of magnetite from the Paxton pit area. The mill will initially produce magnetite as a heavy medium for use in the coal industry. Magnetite has also been successfully tested as a sandblasting abrasive; it may be a substitute for silica sands in this application.

General Exploration Highlights

Gold-enriched porphyry copper and porphyry-related gold deposits, polymetallic massive sulphide deposits, and vein deposits (epithermal and mesothermal) accounted for approximately 78% of 1997 exploration expenditures in British Columbia. The remainder were directed to coal, industrial minerals, skarn and mantos, and less traditional targets such as ultramafic-hosted nickel and redbed copper. Of the estimated $75 million spent on exploration, only approximately 6% falls in the less advanced to grassroots category addressed in this section. Although most of the programs were focused in and around areas with mines, mines under construction or new showings and existing infrastructure, several new, relatively low budget, regional programs were conducted throughout the province. The diversity of targets from large, world-class deposits to smaller but profitable targets, and the profitability of these smaller, higher grade deposits such as Eskay Creek and Snip, continue to make British Columbia a good place to explore. The properties reported are shown on Figure 9 and listed in Table 4, with estimated resources, where available.

Figure 9. Major Exploration Projects in British Columbia - 1997.

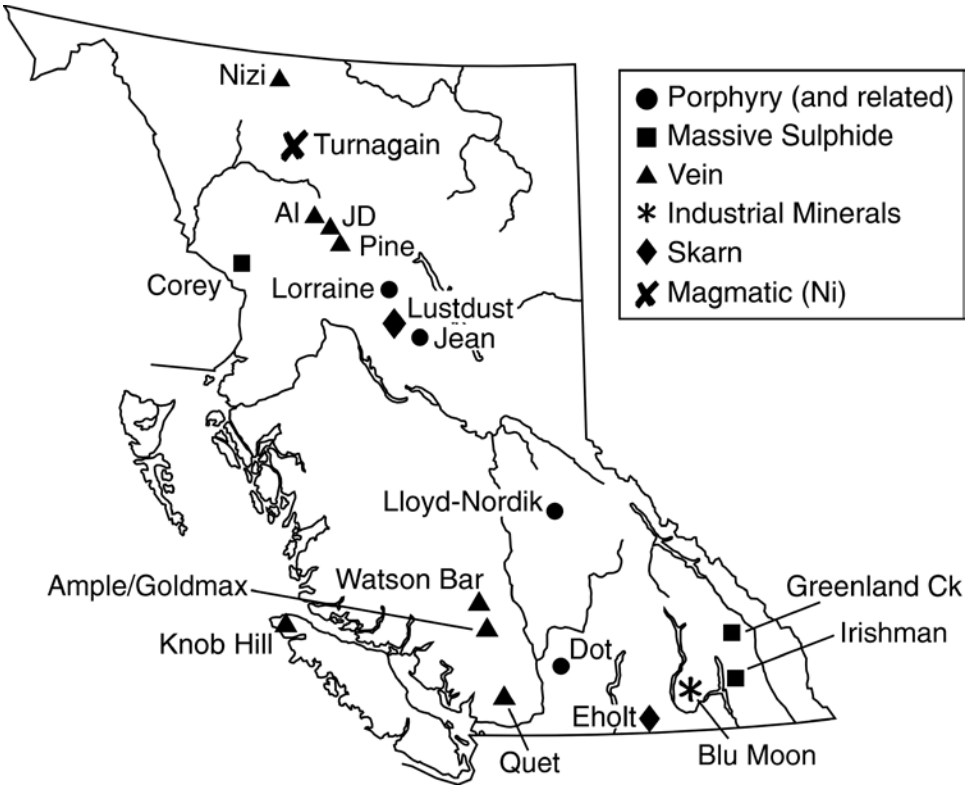


Table 4. 1997 Exploration Highlights

Company Name	Project Name	Commodity	Estimated Tonnes (000s)	Estimated Grade	Reference
Massive Sulphide Deposits					
Kennecott Can. Expln Inc./ Miner River Res. Ltd./ Eagle Plain Res. Ltd.	Greenland Ck.	Zn, Pb, Ag			Miner River, 1997
Kenrich Mining Corp./ Prime Res. Gp. Inc.	Corey	Au, Ag, Zn,Pb			Kenrich, 1997
Sultan Minerals Ltd.	Jersey-Emerald	Au, Ag, Zn, Pb			Sultan, 1997
Mount Hope Res. Corp.	Quet(Hotspring)	Au, Ag, Cu, Pb, Zn			Mount Hope, 1997
Kennecott Can. Expln. Inc./Sedex Mining Corp.	Irishman	Zn, Pb, Ag			Sedex, 1997
Porphyry (and related) Deposits					
Alhambra Res.	Dot	Cu			Alhambra, 1997
Continental Energy Corp.	Jean	Cu, Mo			Cont'l Energy, 1997
First Choice Ind. Ltd.	Knob Hill	Au, Cu			First Choice, 1997
Lysander Gold Corp./ Kennecott Canada Inc.	Lorraine	Cu, Au	10 000	0.675% Cu, 0.34 g/t Au	Kennecott, 1993
Big Valley Res. Ltd.	Lloyd-Nordik	Cu, Au	7190	0.31% Cu, 0.243 g/t Au	Big Valley, 1996
Stealth Mining Corp.	Pine	Cu, Au	70 000	0.15% Cu, 0.57 g/t Au	Stealth, 1997
Skarn Deposits					
Teck Corp.	Eholt	Cu, Au			Teck, 1996
Teck Corp./ Alpha Gold Corp.	Lustdust	Au, Ag Pb, Zn, Cu			Teck, 1997
Vein Deposits					
AGC American Gold Corp./ Antares Mining and Expl'n. Corp.	JD-Finn	Au			AGC, 1997
Teck Corp./Corona Gold Corp.	Tsacha	Au, Ag	440	8.5 g/t Au	Teck, 1996
Stirrup Creek Gold Corp.	Watson Bar	Au	282	8.13 g/t Au	Stirrup Creek, 1997
Homestake Canada Inc.	Ample/Goldmax	Au			Homestake, 1997

Madrona Mining Ltd.	Nizi	Au			Madrona, 1997
AGC Americas Gold Corp./ Antares Mining and Expl'n. Corp.	A1	Au			AGC, 1997
Magmatic Deposits (Ni)					
Bren-Mar Res. Ltd.	Turnagain	Ni, Co, Cu			Bren-Mar, 1997
Cons. Gold City Mining Corp./ Applied Mine Technologies Inc.	Old Nick	Ni, Co			Cons. Gold City, 1997
Industrial Minerals					
?	St. Anne	feldspathic sand			1997
Minestar Res. Corp.	Harrison Lake Lake	white silica sand			Minestar, 1997

During 1997, Big Valley Resources Inc. conducted diamond-drilling on the Lloyd 2 deposit and other zones on its Lloyd-Nordikcopper-gold porphyry property, 1.5 kilometres north of the Mount Polley mine. The Lloyd 2 zone mineralization consists of pyrite and chalcopyrite in a monzonitic breccia healed with magnetite. Similar mineralization occurs at the Road showing at Mount Polley, immediately to the east. In March 1996 the company reported a preliminary resource estimate for the Lloyd 2 deposit of 7 190 000 tonnes grading 0.31% Cu and 0.243 g/t Au.

At the Dot porphyry copper property in the southern part of the Highland Valley, Alhambra Resources Ltd. completed approximately 4570 metres of diamond-drilling during 1997. In an area to the west of the Southeast zone, drilling intersected native copper in oxidized and unoxidized porphyry, representing an apparently very low sulphur, oxygenated porphyry system.

At the Pine porphyry copper-gold property, in the Toodoggone district approximately 8 kilometres north of the Kemess mine, Stealth Mining Corporation increased its geological resource from 40 million tonnes to 70 million tonnes at higher grades than the initial resource (*i.e.* 0.15% Cu and 0.57 g/t Au), as a result of its 12-hole diamond-drilling program in 1997. The Pine zone, one of three on the large property (150 square kilometres), is estimated by the company to be 2 kilometres in length and 1 kilometre wide and remains open. The company postulates that the porphyry system has been influenced by a late stage, gold-enriched event.

On the Jean porphyry copper-molybdenum property, 80 kilometres northwest of Fort St. James, Continental Energy Corp. completed 11 diamond-drill holes, principally testing the B zone. The I.P. anomaly over the zone measures 1600 by 500 metres. Preliminary results are encouraging.

At the Lorraine copper-gold-silver alkaline porphyry properties, Lysander Gold Corporation carried out further drilling on the Bishop zone, significantly extending the mineralization outlined by earlier drilling and identifying a high-grade copper-gold core. Over the past 2 years, Lysander has acquired rights to several properties lying within a roughly circular structure termed the Jajay Ring. In 1997, reconnaissance drilling programs were completed on the Dorothy and Pal claims. A soil and talus sampling program was also carried out southeast of Jajay and identified several areas of interest. Data compilation and evaluation is in progress; further drilling is required on the Bishop zone for possible ore reserve calculations.

Precious Metal Bearing Veins and Bulk-Mineable Deposits

In the northern Toodoggone district, AGC Americas Gold Corporation, and joint-venture partner Antares Mining and Exploration Corp., conducted large surface programs on their A1 and JD epithermal gold properties, 65 kilometres north of the Kemess mine. The targets on both properties are zones amenable to large-tonnage, low-grade bulk mining. The program consisted of 10 630 metres of diamond-drilling in 75 holes on ten different zones. On the JD property AGC conducted in-fill drilling (25 holes) on the Finn zone and exploration drilling on the JC zone (one hole), EOS zone (six holes), MVT zone (three holes), Crown zone (two holes) and Creek zone (eight holes). The Finn zone was expanded in 1996 to 600 by 400 metres in area, with a central brecciated and silicified gold zone, surrounded by a large zone of stockwork quartz-carbonate veining and polymetallic disseminated and massive sulphides. One hole was drilled to obtain samples for metallurgical testing.

On the Al high-level epithermal gold system, in-fill drilling (18 holes) was conducted on the Bonanza zone, over a small area (350 by 100 metres), within the larger mineralized trend traced for over 3600 metres. Exploration drilling was also carried out on the Thesis zone. Airborne and ground geophysical surveys were completed over both properties. Several new targets were drilled as a result of these surveys; results are pending. An extensive program of metallurgical testing and engineering studies is planned for 1998.

In the Lillooet area, Homestake Canada Inc. drilled the Ample/Goldmax mesothermal gold vein target, located east of the historic Bralorne gold camp. Native gold, arsenopyrite and minor pyrite occur in quartz veins with minor carbonate, in a gently-dipping thrust zone in Lower Cretaceous Cayoosh Creek Assemblage argillites, sandstones and minor greenstone. Fill-in drilling was completed on the Cougar zone, and the mineralized structure was also tested along strike.

North of Lillooet, Stirrup Creek Gold Corp. completed further trenching and diamond-drilling on Zone V of its Watson Barsediment-hosted gold target. Zone V has a strike length of 80 metres, a width of 3 metres and a minimum depth of 400 metres. The zone comprises a gently southwest-dipping carbonaceous fault zone and subparallel mineralized quartz veins in Cretaceous sedimentary rocks of the Jackass Mountain Group, intruded by Eocene hornblende diorite. The company estimated a geological resource of 282 187 tonnes at a grade of 8.13 g/t Au and a 1.7 g/t cut-off. The bulk-mineable potential of the property is also of interest to the company. Immediately along strike to the northwest, First Point Capital Corp. undertook a modest drilling program on the Mad epithermal prospect.

West of Port Hardy, First Choice Industries Ltd. completed a twenty-hole, 1905-metre diamond-drilling program on its high-sulphidation, gold-enriched Knob Hill prospect. A fine-grained sulphide stockwork in brecciated rhyolite, intermediate volcanics and intrusive dikes was intersected; however, the drilling program was unable to establish a discrete gold zone in the Obling Creek area. The targets tested in the latter part of the program appear to be related to alteration in a porphyry environment. Additional ground was acquired to the south of the Obling Creek zone.
At the Nizi epithermal gold prospect, 80 kilometres east of Dease Lake, Madrona Mining Limited drilled four holes in 1997 to further evaluate the stockwork mineralization in the Discovery vein area and a fifth hole to test a rhyolite flow-dome complex. To date, a zone measuring 100 by 225 metres, extending to a depth of 125 metres has been identified as having bulk mining potential in the Discovery area. Gold and silver mineralization occurs in a subvertical to vertical, multistage, quartz vein-stockwork system and associated hydrothermal breccia, hosted by altered andesitic to rhyolitic flows, tuffs and subvolcanic intrusions of probable Tertiary age.

Polymettalic Massive Sulphide Deposits

Base and precious metal rich (sedex, volcanogenic and seafloor hydrothermal) massive sulphide deposits were very important exploration targets in 1997. The success of projects at Myra Falls, Tulsequah Chief, Eskay Creek and Akie over the past few years testifies to the exploration potential for these deposit types. The discoveries and fast development of the Wolverine and Kudz Ze Kaya deposits in Yukon-Tanana Terrane in the Yukon, and the successful re-opening of the precious metals rich Greens Creek mine west of Juneau, Alaska, are reminders that the rocks which host these deposits project into British Columbia.

At the Corey property, 15 kilometres south of the high-grade Eskay Creek gold-silver mine, Homestake Canada Inc., under an option agreement with Kenrich Mining Corporation, completed a program of detailed mapping over the southwestern part of the PRU block as part of its testing of the 12 kilometres of prospective Eskay Creek stratigraphy. A previously unmapped zone of rhyolitic volcanics and felsic epiclastics, with associated mudstones, was discovered over a minimum strike length of 1500 metres and a thickness of up to 100 metres. Mineralization and host stratigraphy are considered by the company to be analogous to the 21B zone at Eskay Creek.
On the Kenrich block, Kenrich conducted geological mapping and prospecting and developed drill targets on the HSOV, Mandy Creek, Nica 1, Sheelagh Creek, TM and GFJ occurrences.

In the Purcell Basin of southeastern British Columbia, several sedex targets were explored in the search for a Sullivan-type target. At the Irishman prospect, Kennecott Canada Exploration Inc., under an option agreement with Sedex Mining Corp., drilled four deep holes in the Panda vent system, testing Sullivan stratigraphy and geophysical anomalies. One hole intersected 2.55 metres grading 9.65% Zn, 5.82% Pb and 49.4 g/t Ag in a postulated stratabound setting. Sedex and its joint venture partners are exploring several other properties in the area.
At the Greenland Creek prospect, Miner River Resources Ltd. and Eagle Plain Resources Ltd. drilled approximately 610 metres on their sedex target. Drilling resulted in the discovery of a sulphide breccia with rounded quartz fragments in a massive pyrrhotite matrix with broad, subtle sphalerite and galena-rich bands. The zone appears to be stratabound within thin-bedded siltstones of the Lower Aldridge Formation.

At the Quet (Hotspring) gold prospect, northwest of Harrison Lake, Mount Hope Resources Corp. expanded its drilling program to approximately 1950 metres in eleven holes, to test the down-dip extension of a zone of gold-silver-base metal mineralization in quartz veins and stockworks in steep structures within pyritic, stratabound felsic volcanics of the Gambier Group. The company believes the property has the potential to develop into a large, low-grade bulk-mineable deposit. Furthermore, the style of mineralization may be related to a buried intrusion rather than volcanogenic.

Skarn/Manto Deposits

At the Lustdust manto prospect, 150 kilometres northwest of Fort St. James, Teck Corp., under an option agreement with Alpha Gold Corp, drilled 16 holes totalling 3063 metres. The property hosts multiple zones of gold, silver, lead, zinc and copper mineralization, primarily as structurally controlled sulphide replacements related to fracturing an antiformal fold crests and limbs in limestones of the Cache Creek Group. A large calcsilicate skarn zone adjacent to a quartz monzonite is also mineralized.

In the Greenwood camp, Teck Corp. continued exploration of the Eholt copper-gold skarn target. Results from trenching on the Dead Honda zone suggests that the zone has east-west trend, rather than a north-south one, as previously thought.

Industrial Mineral Deposits

A new occurrence of bentonite was discovered near Monashee Summit. A layer of blue clay, 1 metre thick, is exposed over a distance of approximately 300 metres, underlain by at least 3 metres of grey plastic clay.
R.H. Stanfield and Associates Ltd. contracted a market study on its Aspen feldspar project, east of Cranbrook. The hostrock is a large, leucocratic syenite. The deposit is being evaluated as a possible glass, ceramic, and filler grade resource.

The St. Anne feldspathic sand deposit, an unsorted silt/sand, glaciolacustrine fill of two converging valleys, exposed over a length of several kilometres and locally in excess of 20 metres thick, is being evaluated as a possible glass-quality resource.

Enertech Products International Inc. purchased the Bradford Enercon glass wool insulation project in Grand Forks and plans to reopen the plant. Enertech has staked claims in British Columbia on potential sources of raw materials.
Minestar Resources Corp. is expanding its marketing program for silica sands to include golf and recreational facilities on the U.S. Pacific Coast. The sands are also being tested for use in various other industrial applications. Minestar's white silica sand from near Harrison Lake is used as golf course bunker sands, forestry silviculture media, specialty aggregates and fillers for industrial products.

The Elkhorn barite prospect (Cameron and Lucky showings) on Madias Creek, southeast of Windermere, was drilled by WWC Consulting Ltd. Barite occurs as small veins and irregular breccia zones in a structurally complex area, hosted by dolomite of the Cambrian Jubilee Formation. There are several large, strong gravity and soil geochemical anomalies which have not yet been tested, in addition to many known showings.
Hedley Technologies Inc. is evaluating samples from the Buckhorn Ridge diatomite property, south of Quesnel, for use in insecticide production. It could replace imported products.

A new showing of fluorite in veins in Cambrian dolomites, was discovered in the Blaeberry River area north of Golden, in the same area as a sodalite prospect at Mather Mountain. Esmeralda Exploration Inc. explored its claim south of Watson Lake for beryl gemstones.

Magmatic Deposits

Bren-Mar Resources Ltd. completed a nine-hole diamond-drilling program on its Turnagain nickel, cobalt and copper ultrabasic-hosted deposit, 68 kilometres east of Dease Lake. Bren-Mar has drilled 14 diamond-drill holes totalling 2467 metres during 1996 and 1997; all holes intersected nickel-bearing sulphide mineralization. Mineralization is associated with the olivine pyroxenite and pyroxenite rocks within an ultramafic complex of Late Triassic age, approximately 8 kilometres long and up to 3 kilometres wide. Sulphides have been intersected over a strike length of 3.7 kilometres, a width of 2 kilometres and up to 300 metres in depth. Metallurgical testing, including flotation and leaching studies, has been initiated. The company's geologic model and exploration target is a bulk tonnage (>225 million tonnes) nickel-cobalt deposit.

Consolidated Gold City Mining Corporation and Applied Mine Technologies Inc. continued to evaluate their Old Nick nickel-cobalt prospect in the Rock Creek area, for its low-grade, bulk-tonnage heap-leach potential. They believe this unique sulphide deposit contains a near-surface mineral inventory of approximately 30 million tonnes

grading 0.22% Ni and 0.015% Co. Previous operators estimated the deposit may contain in excess of 100 million tonnes. Metallurgical testing, including leaching, solvent extraction and electrowinning processes, continues as part of a prefeasibility study.

At the Grasshopper platinum project in the Tulameen area, Phoenix Gold Resources Ltd. is exploring for economically viable platinum lode deposits in an ultramafic complex with a 2.5 kilometres by 5 kilometre dunite core hosting veinlets of chrome containing platiniferous elements.

Redbed Copper Deposits

High-grade redbed copper prospects were re-examined in the Bear Lake and Driftwood Creek areas, north of Smithers, (*e.g.*Northstar and Spur). Also, Cross Lake Minerals Ltd. examined the feasibility of the Sustut Copper deposit, under a due diligence agreement with Falconbridge Limited.

Initiatives In British Columbia

Several government programs that influence mineral resource planning, exploration and development in British Columbia were active during 1997.

- The **Prospectors Assistance Grant Program** (PAA) is designed to promote grassroots prospecting for new mineral deposits in British Columbia. It contributed up to 75% of eligible costs of an approved project to a maximum of $10 000. Forty-seven grants were awarded in 1997. Approximately $40 000 was also issued to six industry organizations to help them deliver training programs for prospectors. The Ministry also provided basic prospector training. The total budget of the PAA program was approximately $500 000.

- The **Geological Survey Branch** programs focused on regions where significant mineral potential is indicated [Gataga North, Devono-Mississippian massive sulphide deposits in northern B.C., Toodoggone Southeast - McConnell, Babine, Sitlika, Kootenay Terrane (Eagle Bay) and Yahk-Creston]. A new project is investigating the existence of and potential for Carlin-type deposits. A modest new project examined the province's nickel potential. Several smaller scale projects were carried out on coal and industrial minerals. Results of these programs are expected to encourage base and precious metal exploration in these areas and elsewhere.

- The Nechako Plateau - Babine Porphyry Belt **NATMAP** program by the Geological Survey Branch and the Geological Survey of Canada in the Nechako River (93F), Fort Fraser (93K) and parts of the Smithers (93L) and Prince George (93G) map areas was in full swing, as part of a 5-year project.

- The results of the East Kootenay multi-parameter **airborne geophysical survey** of the Yahk-Creston area were released in July 1997. Several new claims were staked, primarily targeting Sullivan-type targets.

- The release of **Regional Geochemical Survey** (RGS) data for the Toodoggone River (94E) and McConnell Creek (94D) map sheets in July, 1997 resulted in numerous claims being staked. During the summer of 1997, a similar survey was completed in the Mesilinka (94C) map area; results will be released in the early summer of 1998.

- The Ministry continued working on a comprehensive review of mineral exploration practices and permitting procedures to develop standards compatible with the Forest Practices Code. The new **Mineral Exploration Code** is expected to be adapted in early 1998.

- The Ministry participated in a **Partnership Program** with seven mining companies involving data collection, map compilation and mapping of the Creston-Kimberley area in southeastern British Columbia.

- The government, through B.C. Rail, is also a partner with the private sector in the development of the **Willow Creek** coal deposit in the Northeast.

- The Ministry is developing and maintaining a province-wide digital database of **Terrain and Terrain Stability maps**.

- The Geological Survey Branch completed the **Mineral Resource Assessment Project** at 1:250 000 scale; results are available over the Internet.

- The **ARIS** (assessment reports) and **MINFILE** databases were upgraded and made easily accessible by clients.

- The Ministry is actively participating in the **Iskut LRMP** covering much of the northwestern part of the province.

- The Ministry established a newly named **Vancouver Mineral Development Office** to be an advocate for the mineral industry and assist clients with exploration, development, land-use planning and permitting procedures.

- The Geological Survey Branch provided leadership in the organization and delivery of the international **"Pathways 98"** meeting held in Vancouver in late January 1998.

Summary And Outlook For 1998

The very low level of grassroots or generative expenditures in 1997 is of concern now and for the future. The Kemess South project is scheduled to come on stream in the spring of 1998. A decision on the Tulsequah Chief project submission is expected early in 1998; approval might encourage further development at the Polaris-Taku deposit, creating a significant mining-related development scenario for the Tulsequah area. Several projects are expected to enter the Environmental Assessment Process, including Specogna, Midway, Giant Copper, Getty Copper and Polaris-Taku. The Red Chris project is being resurrected with a new, innovative mining proposal which will be tested during the 1998 season.

The search for sedex deposits in the Southeast is expected to intensify, following up on success at the Irishman, Duncan and Greenland Creek properties in 1997. Successful exploration and development projects at several metal mines have increased reserves and mine life (e.g. Myra Falls, Gibraltar and Eskay Creek). The potential for smaller projects (e.g. Pellaire and Debbie), utilizing custom milling facilities, will be important in the future. Productivity from southeastern coal mines increased again in 1997, partly as a result of the completion of major expansions or large exploration programs over the past couple of years (e.g. Fording River, Greenhills, Coal Mountain and Line Creek). Significant exploration programs were undertaken on the Telkwa and Willow Creek advanced coal projects; these are currently in the Environmental Assessment Process and development decisions are expected in 1998.

One mine (Ajax) closed in 1997; three new metal mines (Mount Polley, Huckleberry and Golden Bear) opened and a major mill expansion was completed (Eskay Creek).

Solid mineral production, forecast at $3.25 billion in 1997, represents a slight increase from 1996. The total metals output was also about the same as for 1996. Both total solid mineral production and value of output are expected to decrease in 1998, due to falling metal prices and the possibility of mine closures. Copper production is expected to increase in 1998, with the additional production from Mount Polley, Huckleberry and Kemess South.

Exploration expenditures, estimated at $75 million in 1997, represent a 25% decrease from 1997. Increases were reported at minesites (to 22% of total expenditures) whilst spending on advanced and major projects was at the same level as in 1997. Projects with expenditures in excess of $300 000 accounted for approximately 74% of the total expenditures; projects with budgets over $1 million accounted for 52% alone. Claim staking decreased by 27% in 1997; but is expected to increase in 1998, partly as a result of the release of RGS data for the Mesilinka (NTS 94C) map sheet.

The many copper and gold-bearing porphyry deposits discovered during the 1960s and 1970s (e.g. Red Chris, Lorraine, Galore Creek, Hearne Hill and Morrison) will continue to be explored and developed.

Renewed interest in these deposits is indicated by the success at the Mac molybdenum-copper project in 1996-1997. Sedex (e.g. Akie) and volcanogenic polymetallic sulphide deposits (e.g. Tulsequah Chief and the recent discoveries in the Finlayson Lake camp in Yukon-Tanana rocks in Yukon Territory) offer small to medium tonnage and high-grade potential, particularly those enriched in precious metals. The stratiform, gold-enriched (seafloor hydrothermal) Eskay Creek-type deposits are examples of low-tonnage, but potentially extremely profitable, high-grade targets. The transitional setting, which includes vein and skarn/manto deposits related to porphyry systems (e.g. Red Mountain, Snip, Midway), offers similar small to medium tonnage and high-grade potential.

The potential for bulk-mineable (heap-leachable) gold deposits, hosted by intrusions, sediments or volcanics, will continue to be examined. Future development at the Golden Bear mine and possibly elsewhere in the region, will focus on the "no se'eum" (Carlin-type) gold mineralization hosted by carbonate rocks.

Development proposals in the Iskut River area, such as a road link between the Isk wollastonite project and the Eskay Creek mine road and the recent mill expansion at Eskay Creek, will assist exploration and development of other properties in the region.