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Mineral Resources Division
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British Columbia Exploration and Development Highlights and Initiatives 1992



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BRITISH COLUMBIA EXPLORATION and DEVELOPMENT HIGHLIGHTS and INITIATIVES - 1992

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Ministry of Energy, Mines and Petroleum Resources

INTRODUCTION

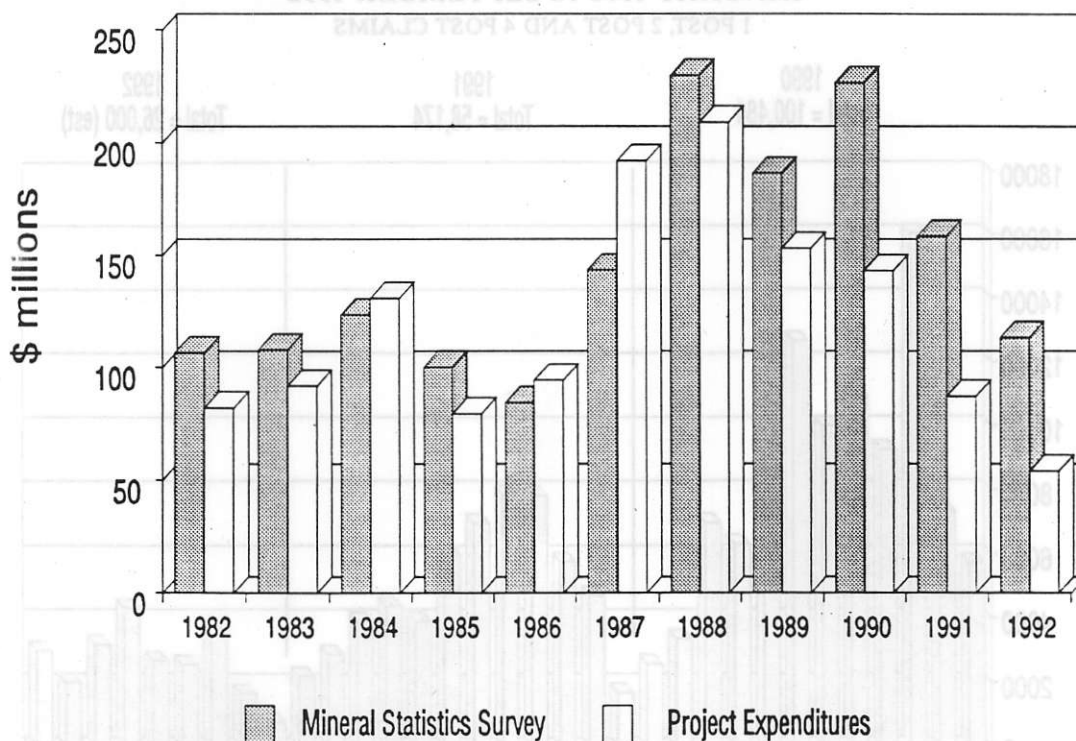
The exploration industry in British Columbia has undergone a major transition during the past few years. An industry that normally thrives on operating in an aggressive high-risk environment has re-directed exploration investment to more conservative ventures. The spectrum of exploration activities that normally covers grassroots projects to drill-testing of new targets has, in large part, been refocused toward those in the upper range of mature prospects; those having more available data, known resources in the ground and a potentially higher probability for development and production. These are the exploration targets for British Columbia in 1992.

As a result the major and junior exploration companies that operated in British Columbia this year have concentrated on classic mineral deposit models and targets that are the mainstay of the province's mining industry and known to yield the highest quality results.

EXPLORATION EXPENDITURES: NATIONAL AND REGIONAL PERSPECTIVES AND TRENDS

Preliminary estimates from industry sources indicate that total expenditures on exploration projects in British Columbia during 1992 will be in the order of \$50 to \$60 million. This figure is consolidated from regional explo-

MINERAL EXPLORATION EXPENDITURES IN B.C.
1982 TO 1992

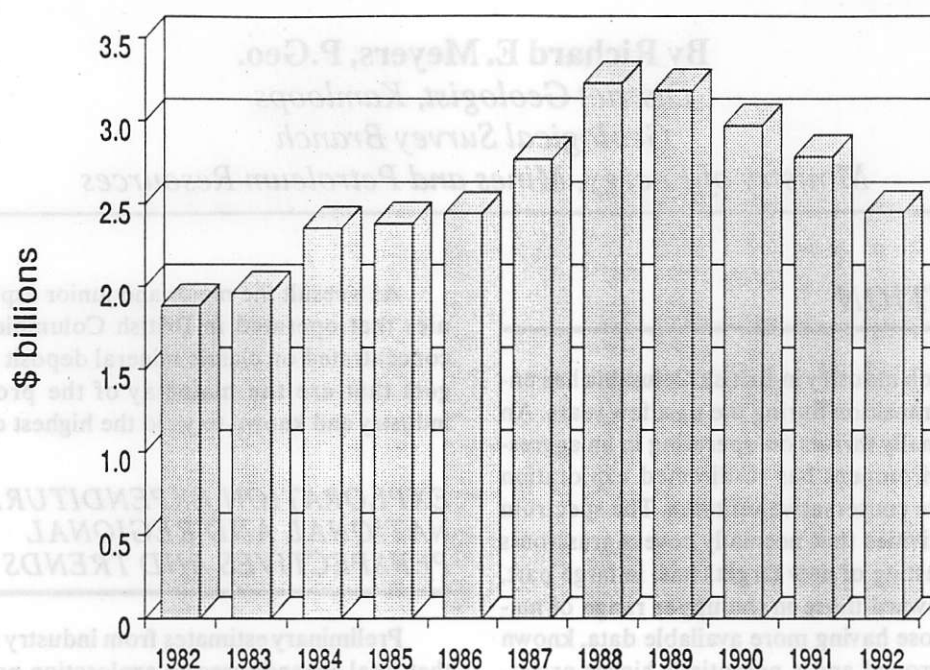


Source: MEMPR, Mineral Policy, Geological Survey

Figure 1

MINERAL PRODUCTION IN B.C. 1982 TO 1992

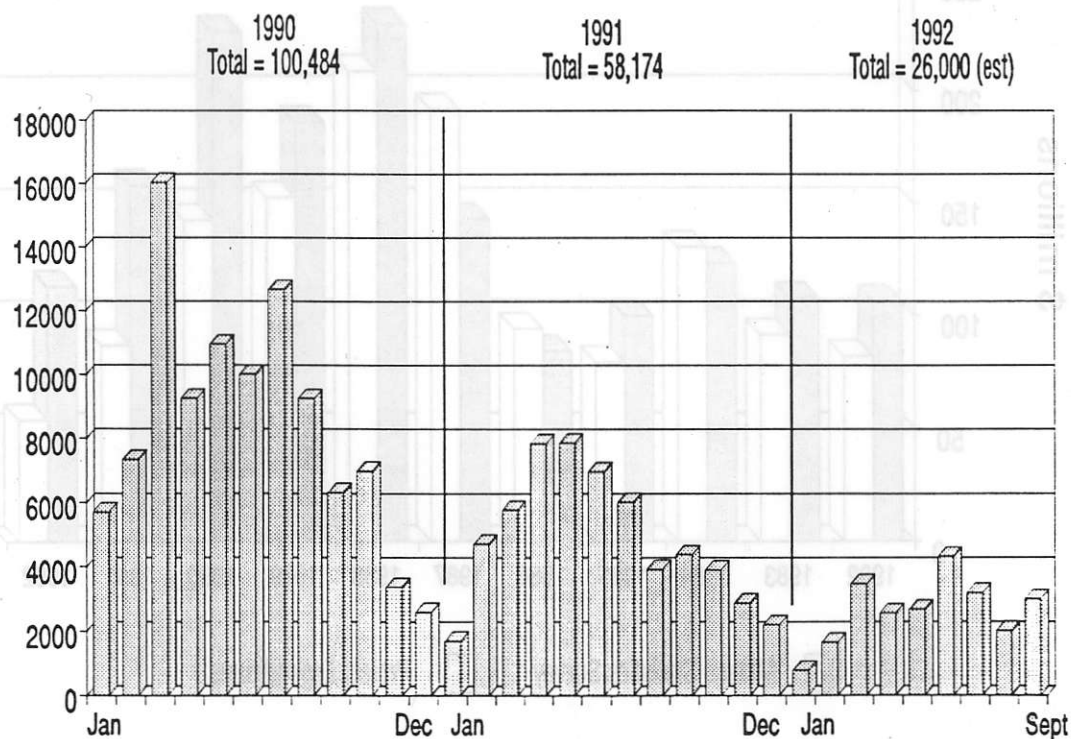
Total Solid Minerals



Source: MEMPR, Mineral Policy

Figure 2

TOTAL MINERAL UNITS RECORDED BY MONTH JANUARY 1990 TO SEPTEMBER 1992 1 POST, 2 POST AND 4 POST CLAIMS



Source: MEMPR, Mineral Titles

Figure 3

FREE MINER CERTIFICATES RECORDED BY TYPE AND BY MONTH JANUARY 1990 TO SEPTEMBER 1992

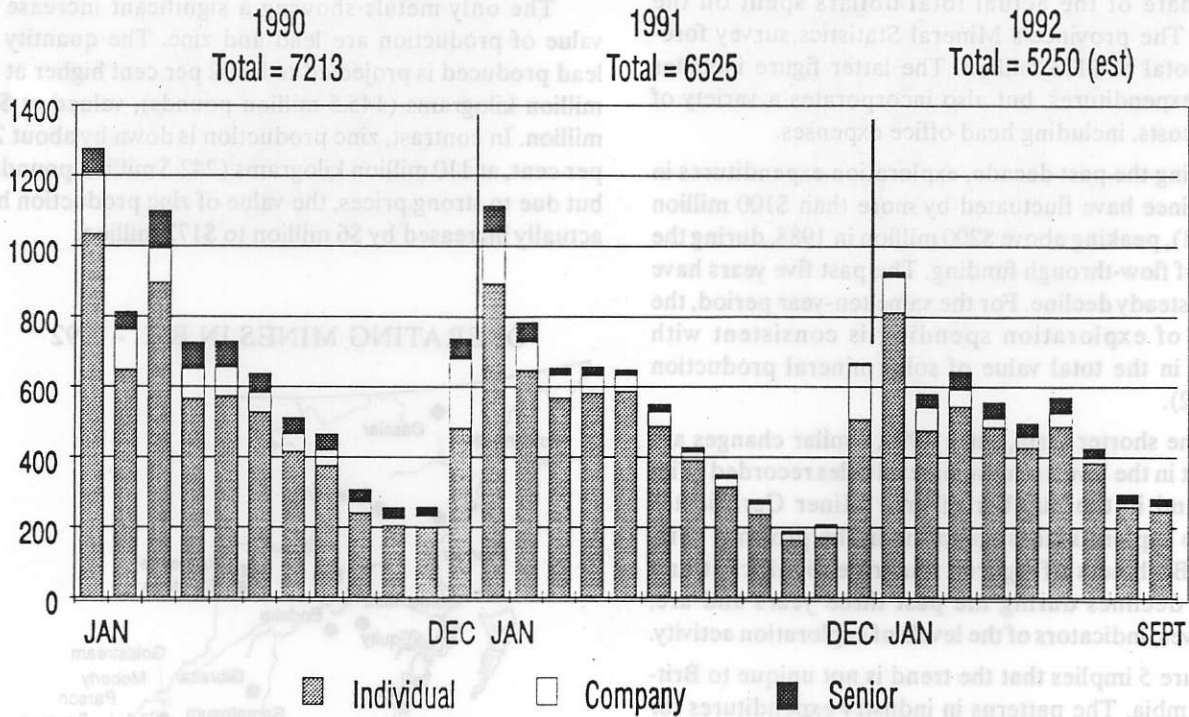


Figure 4

EXPLORATION EXPENDITURES B.C. - QUE - ONT; 1988 TO 1992

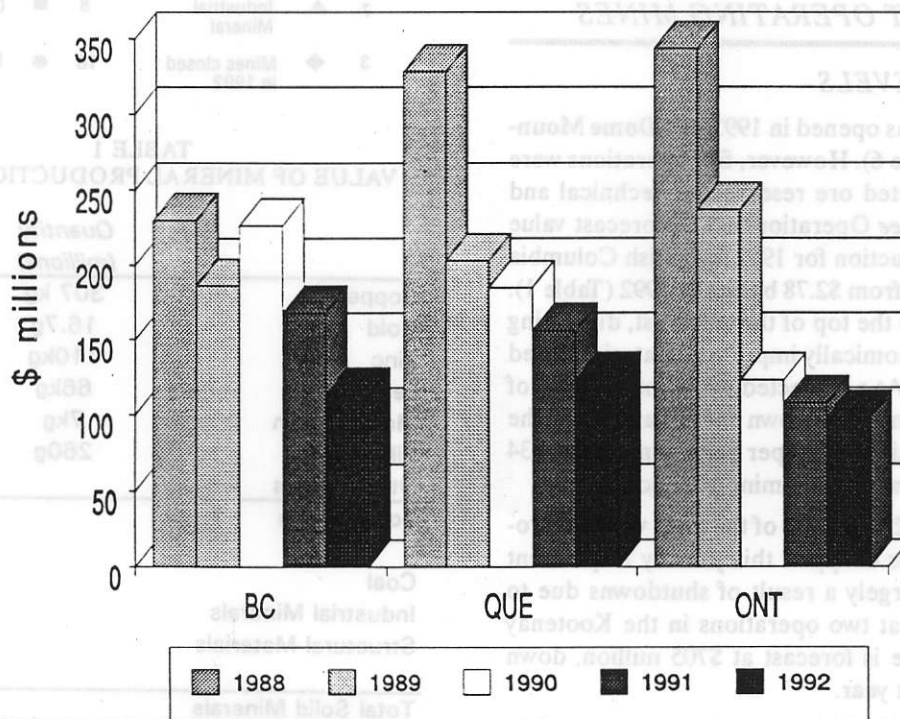


Figure 5

ration data surveys, carried out by District Geologists on a project-by-project basis throughout the province and is an estimate of the actual total dollars spent on the ground. The province's Mineral Statistics survey forecasts a total of \$113 million. The latter figure includes project expenditures, but also incorporates a variety of general costs, including head office expenses.

During the past decade, exploration expenditures in the province have fluctuated by more than \$100 million (Figure 1), peaking above \$200 million in 1988, during the heyday of flow-through funding. The past five years have shown a steady decline. For the same ten-year period, the pattern of exploration spending is consistent with changes in the total value of solid mineral production (Figure 2).

In the shorter term, since 1990, similar changes are apparent in the levels of new mineral titles recorded (Figure 3) and in the number of Free Miner Certificates issued to explorationists operating in the province (Figure 4). Both sets of figures illustrate significant and parallel declines during the past three years and are, themselves, indicators of the levels of exploration activity.

Figure 5 implies that the trend is not unique to British Columbia. The patterns in industry expenditures for three Canadian provinces are similar and portray an analogous set of factors and results. Quebec, Ontario and British Columbia are traditionally the most actively explored regions in Canada and together account for an average of 73 per cent of total Canadian exploration expenditures annually.

HIGHLIGHTS AT OPERATING MINES

PRODUCTION LEVELS

One new mine was opened in 1992, the Dome Mountain gold mine (Figure 6). However, five operations were closed due to exhausted ore reserves, or technical and financial problems (*see Operations*). The forecast value of solid mineral production for 1992 in British Columbia is \$2.45 billion, down from \$2.78 billion in 1991 (Table 1). Copper has moved to the top of the value list, displacing coal as the most economically important material mined in British Columbia. At a projected value for the year of approximately \$830 million, down marginally from the 1991 value of \$833 million, copper represents nearly 34 per cent of the total value of all mine production.

Coal represents 29 per cent of the total value of production, as output has dropped this year by 22 per cent from 1991. This is largely a result of shutdowns due to strikes and lockouts at two operations in the Kootenay coalfields. Total value is forecast at \$705 million, down from \$949 million last year.

The production of gold is also expected to be slightly lower, at a forecast level of 16.7 million grams (536 917

ounces), valued at \$230 million, down from 17.7 million grams (568 943 ounces) last year.

The only metals showing a significant increase in value of production are lead and zinc. The quantity of lead produced is projected to be 32 per cent higher at 66 million kilograms (145.5 million pounds), valued at \$44 million. In contrast, zinc production is down by about 2.6 per cent, at 110 million kilograms (242.5 million pounds), but due to strong prices, the value of zinc production has actually increased by \$6 million to \$172 million.

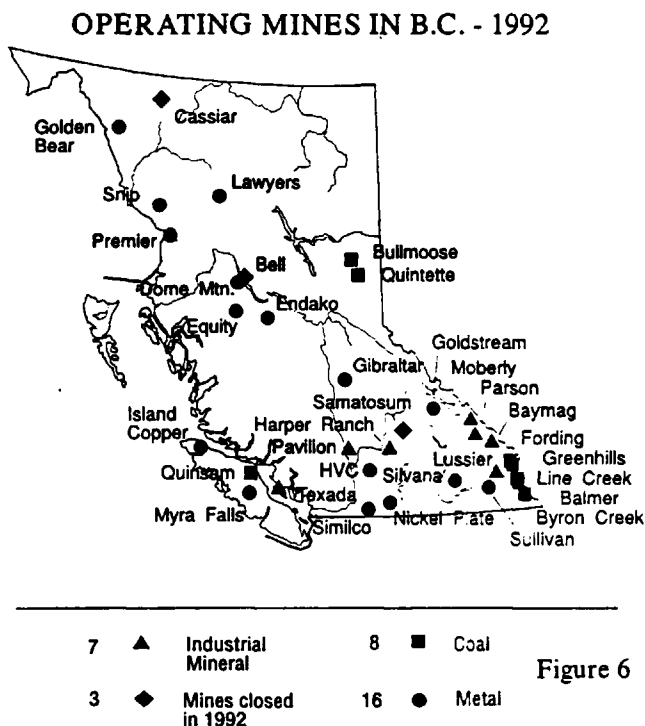


TABLE 1
VALUE OF MINERAL PRODUCTION IN B.C.

	Quantity (millions)	\$ Value (millions)
Copper	307 kg	830
Gold	16.7g	230
Zinc	110kg	172
Lead	66kg	44
Molybdenum	7kg	43
Silver	260g	40
Other metals		9
Total Metals		1368
Coal		705
Industrial Minerals		76
Structural Materials		300
Total Solid Minerals		2449

Source: MEMPR, Mineral Policy

Silver shows the greatest drop of all at 260 million grams (8.3 million ounces) valued at \$40 million, down from 484 million grams (15.5 million ounces) in 1991, which represents a 46 per cent decrease in production. The closure of the Equity Silver pit and Samatsum mine, and reduced production at the Lawyers and Premier operations are the main factors contributing to the substantial decrease in silver output.

OPERATIONS

METAL MINES

The **Snip** gold mine is certainly one of the recent mining success stories for both British Columbia and for Cominco Ltd. (60%) and Prime Resources Ltd. (40%). Snip operates at 450 tonnes per day, well above design capacity of 300 tonnes per day. At \$130 to \$160 per ounce of gold produced, production costs are by far the lowest in the province. On-going exploration drilling within the mine continues to replenish reserves and the operation produced its 200 000th ounce on September 15, 1992.

At the **Golden Bear** gold mine, Homestake Canada Ltd. has overcome enormous start-up problems to make the transition from major losses in 1991 to a modest profit in 1992. To complement the effort, the company has also had successful exploration programs at several prospects on the property, including the Bear Deep South and Fleece A and B zones.

Westmin Resources Limited's **Premier** gold mine ended open-pit mining during the year and continued with underground production. The company is looking at the option of custom milling ore from various sources including the Brucejack West zone (see Advanced and Development Projects), Chichagof and Greens Creek, Alaska, Mount Skinner and Westmin's own Debbie property. In the latter case the company has applied to mine a 7500-tonne sample from the 900 zone at the Debbie property.

Reserves have been exhausted at the AGB and Cliff Creek zones at the **Lawyers** mine, operated by Cheni Gold Mines Ltd. In total, some 642 000 tonnes of 8.91 grams per tonne gold ore was produced. Cheni has optioned the **Mets** deposit from Golden Rule Resources Ltd. (50%) and Manson Creek Resources Ltd. (50%) and plans to begin production from this property in 1993. Reserves are 53 518 tonnes grading 11.62 grams per tonne gold. In the interim, a small high-grade gold tonnage has been delineated in the **Phoenix** zone and was mined late in the year, yielding approximately 310 kilograms of gold.

British Columbia's newest mining operation is the **Dome Mountain** gold mine, which opened in 1992 near Houston. The operation is a joint venture between Timmins Nickel Ltd. (operator) and Habsburg Resources Ltd. Start-up production of 100 to 200 tonnes per day is

trucked to the Equity Silver mill. The deposit is a mesothermal quartz vein system containing gold and base metal sulphides, with reserves of 295 000 tonnes grading 12.34 grams per tonne gold.

Following 12 years of successful production at the **Equity Silver** mine of Placer Dome Inc. (55.8%), open pit mining is complete. Production totalled 32 391 000 tonnes grading 94.3 grams per tonne silver, 1.03 grams per tonne gold and 0.35 per cent copper. Underground development is in progress on the North (Waterline) zone, which has reserves of 750 000 tonnes grading 0.68 per cent copper, 209 grams silver and, 4.18 grams per tonne gold at a cut-off of 250 grams per tonne silver equivalent.

Gibraltar Mines Ltd. carried out two extensive drilling programs on the **Gibraltar North** copper deposit discovered in 1990-91. The new zone is northwest of the Gibraltar East pit. A potential geological resource is believed to be in the order of at least 50 million tonnes grading more than 0.4 per cent copper, plus gold, silver and zinc values. The company plans to carry out detailed reserve and engineering evaluations by year-end.

The outlook has improved at the **Myra Falls** operation of Westmin Resources Limited following an extended period of high operating costs. The operation has switched to cheaper, long-hole stope mining at the **H-W** mine, with the objective of reducing costs to below \$50 per tonne. During the same period, Westmin has had a particularly successful exploration program. Several new zones are now, or soon will be potentially available for development; the **Lynx "G"**, **Ridge**, **Battle**, **Gap**, **H-W Extension**, **H-W 42** and **43** blocks and the newly discovered **Trumpeter Zone** in Thelwood Creek. Total geological reserves for the **Battle** lens are currently estimated at 3 018 400 tonnes, grading 2.9 per cent copper, 0.4 per cent lead, 14 per cent zinc, 24 grams per tonne silver and 1.3 grams per tonne gold. Present mining reserves for this zone are 1 518 000 tonnes grading 2.3 per cent copper, 0.3 per cent lead, 10.7 per cent zinc, 1.0 gram per tonne gold and 18.4 grams per tonne silver. Development should be complete on this zone by year-end.

Since starting up its second life in May of 1991, the **Goldstream** copper-zinc mine of Bethlehem Resources Corporation has mined more than 600 000 tonnes of ore and has shipped about 19 000 tonnes of copper in concentrate to Nippon Mining Company in Japan. The operation's zinc circuit was brought on stream in early 1992. Zinc recovery is estimated at 22 per cent, to produce a concentrate grade of 47 per cent zinc.

COAL MINES

British Columbia's coal production was plagued with interruptions in 1992. Reduced demands from the Japanese steel industry for metallurgical coal and competition

in international markets have also contributed significantly to lower production levels in this sector.

The Kootenay coalfields were the worst hit. The **Fording River** operations of Fording Coal Ltd. went on strike in May, with no resolution in sight at time of writing. The **Balmer** and **Greenhills** mines, both assets of Westar Mining Ltd., were forced into bankruptcy at the end of August. Westar was subsequently offered for sale by the bankruptcy trustee. The trustees have received offers but ultimate ownership has yet to be decided. The Balmer mine has been shutdown by a lockout since May. The Greenhills mine operated profitably and at full capacity until bankruptcy was declared in August and continued production to the end of October, when it too, was shutdown.

Elsewhere in the Kootenays, the **Line Creek** mine of Line Creek Resources Ltd. continued operations throughout the year. Successful exploration efforts there have expanded reserves. The company is currently developing a new pit on the MSA North zone and is evaluating other newly outlined zones for future production.

The **Byron Creek** thermal coal operations, formerly owned by Esso Resources Canada Limited, was recently sold to employee-owned Corbin Creek Resources Ltd. Most coal produced from this mine is purchased by Ontario Hydro.

On Vancouver Island, near Campbell River, Hillsborough Resources Ltd. recently acquired the **Quinsam Coal** mine from Consolidated Brinco Ltd. and is proceeding with a major restructuring to enhance profitability. The company plans to increase production four-fold to 1 million tonnes per year. Open pit production has been cut back and the use of continuous miners underground has improved efficiency. Ore blending to customer specifications has been a key element of production planning. The company is also evaluating options of building new handling facilities at Campbell River, or expanding those at Texada Island, where it currently barges production to be transferred to ocean-going freighters.

MINE CLOSURES

In addition to the coal mine shutdowns in southeastern British Columbia, three mining operations were closed permanently during 1992. The Noranda Inc. **Bell Copper** mine was shut down in May after 18 years of operation. The mine produced 190 million tonnes grading 0.463 per cent copper. Although potential reserves remain at depth, a critical factor is the lack of tailings storage on Newman Peninsula in Babine Lake.

Near Adams Lake, operations at the **Samatsum** silver-zinc-lead-copper-gold of Minnova Inc. were suspended prematurely after only three years of production. This operation fell victim to steadily decreasing

silver prices, which resulted in a drastic reduction in mineable reserves.

The Cassiar Mining Corporation **McDame** asbestos mine closed following less than two years of failing operations. Difficult ground conditions restricting the development of stopes was the primary problem. The Cassiar operation was placed in receivership in February following 40 years of production.

ADVANCED EXPLORATION AND DEVELOPMENT PROJECTS

At the beginning of the year a number of exploration projects had advanced to, or approached the development stage and throughout the year some have been undergoing various stages of review in the Mine Development Assessment Process. The projects described in this section are shown in Figure 7 and listed with reserves in Table 2.

The **Eskay Creek** project, now operated by Homestake Canada Ltd. (formerly by International Corona Corp.) continued with geophysical surveys and diamond drilling on the Eskay stratigraphic horizon. In addition, a 15-tonne bulk sample was taken from the 21B zone for metallurgical test work. Over all geological resources are 4.75 million tonnes grading 26.13 grams per tonne gold and 932.17 grams per tonne silver; a recently re-calculated mining reserve on the 21B Zone orebody is 1.19 million tonnes grading 59.41 grams per tonne gold

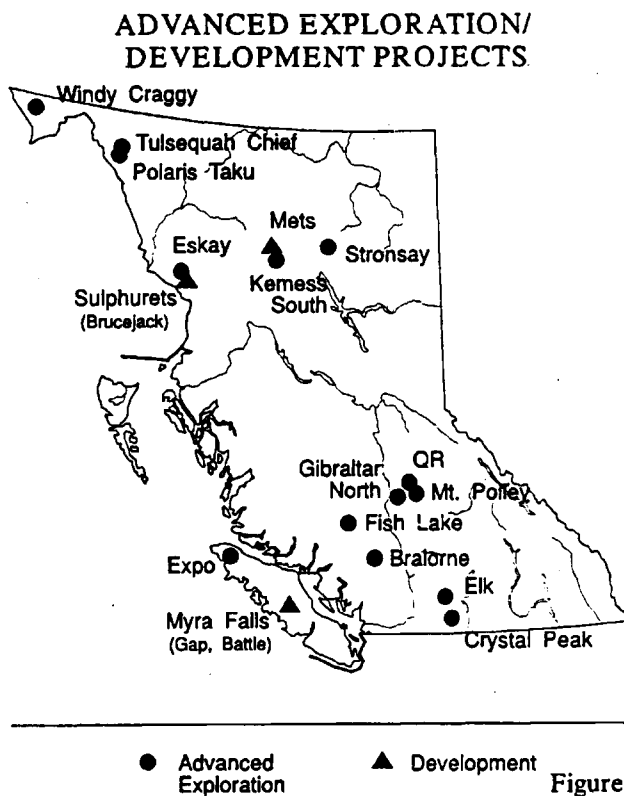


TABLE 2
NEW MINES, DEVELOPMENT AND ADVANCED EXPLORATION PROJECTS

Company Name	Project Name	Commodity	Estimated Tonnes (000s)	Estimated Grade	Reference	Estimated Employment
New Mines						
Timmins Nickel Inc., Habsburg Resources Inc.	Dome Mountain	Au	295	12.34 g/t Au	Habsburg Resources Ltd. 1992	55
Development (Production Decision Announced)						
Westmin Resources Ltd.	Battle Zone/ Myra Falls	Cu, Pb, Zn, Ag, Au	3 018	2.9% Cu, 0.4% Pb, 14.0% Zn, 24.0 g/t Ag, 1.0 g/t Au	Westmin Resources Ltd. Oct./92	568
Equity Silver Mines Ltd.	North Waterline Zone	Cu, Ag, Ag	750	0.68% Cu, 209 g/t Ag, 4.18 g/t Au	Equity Silver Mines Ltd. Sept./92	
Cheni Gold Mines Ltd. Golden Rule Resources Ltd. Manson Creek Resources Ltd.	Mets	Au	53.5	11.62 g/t Au	Cheni Gold Mines Ltd. 1992	
Advanced Exploration						
Geddes Resources Ltd.	Windy Craggy	Cu, Au, Ag, Co	297 440	1.38% Cu, 0.2 g/t Au, 3.83 g/t Ag, 0.069% Co	Geddes Resources Ltd. Annual Rept. 1991	600
Curragh Resources Ltd Asturiana de Zinc	Stronsay (Cirque)	Pb, Zn, Ag	22080	2.8% Pb, 9.4% Zn, 60 g/t Ag	Curragh Resources Ltd. MDAP Stage I Report	300+
Homestake Canada Ltd.	Eskay Creek 21B	Au, Ag	1190	59.41 g/t Au, 2659.3 g/t Ag	Homestake Canada Ltd. Oct./92	200+
Gibraltar Mines Ltd.	Gibraltar North	Cu	50 000+	0.4% Cu	Gibraltar Mines Ltd.	
Redfern Resources Ltd.	Tulsequah Chief	Cu, Pb, Zn, Au, Ag	7800	1.6% Cu, 1.18% Pb, 6.47% Zn 2.74 g/t Au, 109.72 g/t Ag	Redfern Resources Ltd. Oct./92	
Canarc Resources Corp. Suntac Minerals Corp.	Polaris-Taku	Au	2590	14.74 g/t Au	Suntac Minerals Corp. Press Release, Oct./92	
Newhawk Gold Mines Ltd. Granduc Gold Mines Ltd.	Brucejack Lake (Bruce side)	Au, Ag	749.3 (West Zone)	15.43 g/t Au, 647.2 g/t Ag	Newhawk Gold Mines Ltd. Press Release Oct./92	50 - 60
Fairfield Minerals Ltd.	Elk	Au	308.4	22.18 g/t Au, 24.68 g/t Ag	Fairfield Minerals Ltd.	
Taseko Mines Ltd.	Fish Lake	Cu, Au	1 080 000	0.23% Cu, 0.41 g/t Au	Taseko Mines Ltd. Press Release, Oct./92	300+
El Condor Resources Ltd. St Philips Resources Inc.	Kemess South	Cu, Au	207 000	0.23% Cu, 0.64 g/t Au	El Condor Resources Ltd. MDAP Prospectus 1992	300+
Jordex Resources Inc.	Expo/Hushamu	Cu, Au, Mo	173 260	0.25% Cu, 0.31 g/t Au 0.01% Mo	Jordex Resources Ltd. Oct-92	
Imperial Metals Corp.	Mount Polley	Cu, Au	49000	0.38% Cu, 0.55 g/t Au	Imperial Metals Corp. MDAP, Oct./92	
CMP Resources Ltd.	Q R	Au	1200	5.2 g/t Au	CMP Resources Ltd. N.Miner, Oct 5/92	

and 2659.35 grams per tonne silver, together with significant base metal values, using a 12.44 grams per tonne gold cut-off. Feasibility studies are currently in progress on the project and are expected to be completed to submit an application to the Mine Development Review Process by June of 1993.

One of the best known and controversial advanced exploration projects in British Columbia has been the **Windy Craggy** project, operated by Geddes Resources Ltd. In 1991 this project completed Stage I of the Mine Development Assessment Process. In 1992, however, review of the project was suspended in deference to a newly initiated land and water use evaluation of the area by the provincial Commission on Resources and the Environment (CORE, *see* New Initiatives). A re-evaluation of the overall reserves of the deposit now stands at approximately 297 million tonnes grading 1.38 per cent copper, applying a 0.5 per cent copper cut-off. Of additional importance to the project is the initiation by the BC Geological Survey of a regional mapping and mineral potential evaluation of the Tatsenshini area. This study discovered a new **high-grade copper massive sulphide zone** on the Geddes property about 5 kilometres south-east of the main deposit.

The **Tulsequah Chief** copper-lead-zinc-gold-silver project, operated by Redfern Resources Ltd., is located 75 kilometres northeast of Juneau, Alaska. Redfern continued underground drilling to test up-dip and down-dip extensions of the deposit, and is particularly encouraged that the H lens has been extended to depth. The deposit is a Kuroko-type volcanogenic massive sulphide deposit hosted in Devonian felsic volcanic rocks. It was mined from 1951 to 1957 by Cominco Ltd. Drilling since 1987 has delineated reserves of 7.8 million tonnes grading 1.6 per cent copper, 1.2 per cent lead, 6.5 per cent zinc, 2.74 grams per tonne gold and 109.7 grams per tonne silver. The government of Alaska is evaluating the feasibility of building a road to the British Columbia border, close to the project.

A few kilometres southwest of the Tulsequah Chief property, Suntac Minerals Corporation and Rembrandt Gold Mines Ltd. are proceeding with drilling on the **Polaris-Taku** deposit. The company hopes to double reserves with infill and stepout drilling. Work has confirmed the extension of the C-vein. The property was operated before and after the Second World War and produced 690 000 tonnes averaging 10.28 grams per tonne gold. Gold mineralization occurs in a mesothermal quartz-carbonate vein system in Paleozoic or Triassic rocks. Suntac has explored the property since 1988. Recently published geological reserves are 2.59 million tonnes grading 14.74 grams per tonne gold, with a cut-off grade of 8.6 grams per tonne.

Prospecting and trenching on the Northair Mines Ltd. **Brucejack Lake** (Bruceside) gold project at Sulphurets Creek turned up several new gold prospects, the best known is the "SG" zone. The zone is 130 metres long, 3 metres wide, with an average surface sample grade of 20.71 grams per tonne gold and 38.39 grams per tonne silver. The company is currently evaluating the possibility of shipping ore from the **Brucejack West** zone to Westmin's Premier mill, north of Stewart. The West zone is a vein and stockwork system containing 750 000 tonnes averaging 15.4 grams per tonne gold and 678 grams per tonne silver.

At the **Keiness South** project, El Condor Resources Ltd. (60%) and St. Philips Resources Inc. (40%) have delineated a calcalkaline porphyry gold-copper deposit of approximately 207 million tonnes grading 0.23 per cent copper and 0.64 gram per tonne gold. Much of the definition drilling and metallurgical testwork planned for 1992 was deferred. El Condor directed its 1992 efforts to the adjacent wholly owned Kemess North property (*see* Exploration Highlights). The Kemess properties are located southeast of the Toodoggone district, close to the Omineca mine road. El Condor has submitted a prospectus to the Mine Development Assessment Process and has begun environmental impact studies. Estimated capital costs for development are \$350 million.

The **Stronsay** lead-zinc-silver project (Cirque) of Curragh Resources Inc., north of Williston Lake, has experienced delays and uncertainties. However, most issues related to the Mine Development Assessment Process (MDAP) have been, or are close to being resolved, with certification expected soon. At Stage I of the MDAP, reserves were reported as 22.08 million tonnes of 2.8 per cent lead, 9.4 per cent zinc and 60 grams per tonne silver. Capital costs are approximately \$155 million.

The **Telkwa** coal project was recently acquired by Manalta Coal Ltd. from Shell Canada Resources Ltd. and is in the Mine Development Assessment Process. Production of one million tonnes per year is planned, at a capital investment of \$80 million. Reserves of 57 million tonnes occur in two zones. In 1992, Minalta completed a 5000-metre drilling program to upgrade reserves in the north zone deposit.

In October of 1992 a Mine Development Certificate was issued to Imperial Metals Corporation to develop the **Mount Polley** porphyry copper-gold project, located 56 kilometres northeast of Williams Lake. The certificate allows the company to proceed with open-pit development and production at 13 700 tonnes per day, on an initial ten-year mining reserve of 49 million tonnes grading 0.38 per cent copper and 0.55 gram per tonne gold. Capital costs are estimated at \$150 million; production costs are projected to be \$0.45 per pound of copper. Subject to

successful financing, construction is tentatively scheduled to start in 1993 and production in 1995.

Elsewhere in the Cariboo region, CMP Resources Ltd. has recently bought the QR alkali porphyry gold deposit from Rea Gold Corporation. This project has an Approval-in-Principle in good standing until July 1995. Total reserves, in three separate and widely spaced gold zones, are in the order of 1.2 million tonnes averaging about 5.2 grams per tonne gold. CMP has announced that it intends to proceed with underground bulk sampling in preparation for development as soon as possible.

At the **Fish Lake** porphyry copper-gold project, Taseko Mines Limited has completed an extensive program of some 69 000 metres of diamond drilling. As a result of this program, Taseko has announced an overall geological reserve of 1.08 billion tonnes grading 0.23 per cent copper and 0.41 gram per tonne gold, applying a 0.52 per cent copper equivalent cut-off grade. The deposit has been drilled-off at 100-metre centres, which has effectively doubled the extent of known mineralization and geological data. At approximately \$C7.0 million in exploration expenditures, this has been the largest single exploration project in the province during 1992. Taseko expects to complete pre-feasibility stage evaluation by mid-1993.

In the Bridge River camp, Avino Mines and Resources Ltd. has submitted a prospectus application for a Mine Development Certificate to re-open the **Bralorne Mine**. Avino's program is the third attempt to bring the mine back into production since 1983. The deposit is a mesothermal gold-silver vein system that produced continuously from 1932 to 1971. Combined with the neighboring Pioneer deposit, it produced more than 127 metric tonnes of gold.

In the southern interior of the province, near Merritt, Fairfield Minerals Ltd. has submitted the **Elk** project for Mine Development Assessment. The Siwash North zone is a small, high-grade gold-silver vein deposit with current reserves of 308 400 tonnes grading 22.18 grams per tonne gold and 24.68 grams per tonne silver. During the year Fairfield initiated a bulk sampling program on the vein. The first sample of 517 tonnes had an estimated grade of 130.3 grams per tonne gold and 99.4 grams per tonne silver. A larger sample is to be shipped later in the year.

In the northern Vancouver Island copper belt Jordex Resources Ltd. continued work on the **Expo/Hushamu** porphyry copper-gold project. Established reserves in the deposit are in two zones totalling 173.3 million tonnes that grade 0.25 per cent copper, 0.01 per cent molybdenum and 0.31 gram per tonne gold. The current strategy is to increase reserves by outlining additional tonnages between the zones to facilitate the design of a larger pit. Ultimate production plans would probably see ore from

this deposit shipped to the Island Copper operation for milling.

The **Crystal Peak** garnet project, operated by Polestar Exploration Ltd. near Hedley in southern British Columbia is still in the Mine Development Assessment Process. Concern was raised in 1991 over this project because of possible impacts on other land uses in the area, particularly on the adjacent Apex Mountain ski area. A report commissioned by government early in 1992 to examine marketing prospects, cost-benefit analysis and aboriginal concerns, determined that the project would, in general, not have major impacts on other activities in the area. A number of measures to harmonize land uses with the project were proposed. Further study on garnet marketability is currently in progress.

HIGHLIGHTS OF MAJOR EXPLORATION PROJECTS

Gold-enriched porphyries, polymetallic massive sulphide deposits and veins and transitional deposits remained the exploration targets of choice during 1992 in British Columbia. The inherent potential for discovering another Highland Valley Copper, Sullivan or Snip deposit in the diverse spectrum of metallogenic environments in the province continue to motivate explorationists. The properties mentioned below are shown in Figure 8 and listed in Table 3 with estimated preliminary reserves, when available.

EXPLORATION HIGHLIGHT PROJECTS

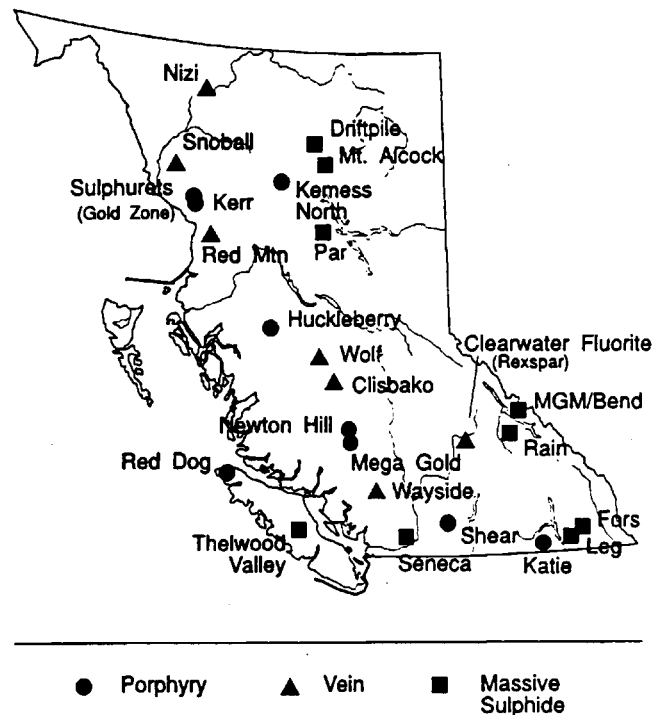


Figure 8

TABLE 3
1992 EXPLORATION HIGHLIGHTS

Company Name	Project Name	Commodity	Estimated Tonnes (000s)	Estimated Grade	Reference	Exploration Expenditures (\$ Millions)
Placer Dome Inc.	Kerr	Cu, Au	126 000	0.62% Cu, 0.274 g/t Au	Placer Dome Inc.	1.2
Placer Dome Inc.	Sulphurets Gold (Sulphside)	Au, Cu	18 000	0.35% Cu, 0.823 g/t Au	Placer Dome Inc.	1.3
New Canamin Res. Ltd.	Huckleberry	Cu, Au	78 000	0.401% Cu, 0.025% MoS ₂	CIM Spec Vol 15	0.55
El Condor Res. Ltd.	Kemess North	Cu, Au	116 109	0.19% Cu, 0.377 g/t Au	El Condor Res. Ltd.	1.0
Placer Dome Inc.	Shear	Cu, Au	n/a	n/a		0.3
Yellowjack Res. Ltd.	Katie	Cu, Au	n/a	n/a		0.385
Crew Natural Res. Ltd.	Red Dog	Cu, Au, Mo	25	0.35% Cu, 0.44 g/t Au 0.006% Mo	Crew Natural Res.	n/a
Cominco Ltd.	Par	Pb, Zn, Ag, Ba	n/a	n/a		0.5
Teck Explorations Ltd. Cominco Ltd.	MGM/Bend	Zn, Pb, Ag	n/a	n/a		0.6
Kokanee Explorations Ltd., Chapleau Res. Ltd., Barkhor Res. Inc.	Fors	Ag, Pb, Zn	n/a	n/a		0.3
Kokanee Explorations Ltd., Legion Res. Ltd.	Leg	Zn, Ag, Ba	n/a	n/a		0.25
Minnova Inc., International Curator Res. Ltd.	Seneca	Zn, Cu, Au, Ag	533	0.91% Cu, 0.22% Pb, 7.06% Zn, 68.8 g/t Ag, 1.44 g/t Au	Minnova Inc.	0.25
Westmin Resources Ltd.	Thelwood Valley (Myra Falls)	Cu, Pb, Zn, Ag, Au	n/a	n/a		3.5 (includes Gap, Battle)
Lac Minerals Inc.	Red Mountain (Marc Zone)	Au	840	12.68 g/t Au	Lac Minerals Ltd.	1.19
Gold Fields Canadian Ltd.	Nizi	Au, Ag	n/a	n/a		0.6
Minnova Inc.	Wolf	Au	n/a	n/a		0.35

PORPHYRY COPPER-GOLD DEPOSITS

In the Sulphurets Creek area, north of the Stewart camp, work by Placer Dome Inc. and predecessors in the area has established the existence of a complex area of porphyry mineralization several kilometres in diameter, that contains at least three major porphyry copper prospects as well as the Brucejack Lake gold vein deposit. Placer Domes's main focus has been on two zones: the **Kerr** deposit and the **Sulphurets Gold zone**. The Kerr deposit is a deformed porphyry copper-gold deposit, hosted by Early Jurassic volcanic and sedimentary rocks. Previous drilling established a geological resource of 126 million tonnes grading 0.62 per cent copper and 0.274 gram per tonne gold. Work in 1992 was directed to improving grade estimates in this zone through better core recoveries.

Two kilometres north of the Kerr deposit, Placer Dome Inc. also continued drilling on the **Sulphurets Gold zone** (Sulphside). Porphyry mineralization is associated with strongly silicified quartz monzonite dikes and sills that intrude altered epiclastics and tuffs. With a pre-1992 drill-indicated resource of 18 million tonnes grading 0.35 per cent copper and 0.823 gram per tonne gold, this property offers potential support for the Kerr project.

In the Tahtsa Reach area, east of the Coast Mountains, New Canamin Resources Ltd. has undertaken a re-evaluation of the **Huckleberry** porphyry copper-molybdenum deposit, completing two phases of diamond drilling. This property was explored extensively in the 1960s and 1970s. Published reserves are in the order of 78 million tonnes grading 0.401 per cent copper and 0.025 per cent molybdenite. The current objective is to establish a higher grade "starter pit" of about 30 million tonnes averaging 0.5 to 0.6 per cent copper. Copper zoning in the deposit appears to offer good potential for this to be accomplished.

At the **Kemess North** property, El Condor Resources Ltd. (100%) has delineated a geological reserve of 115 million tonnes grading 0.19 per cent copper and 0.39 gram per tonne gold. At present this deposit is considered to be uneconomic and would be evaluated as a supplemental reserve when production from the main Kemess South deposit is achieved.

In the Central Nicola volcanic belt in the southern interior, Placer Dome Inc. has had moderately encouraging drill results on the **Shear** copper-gold property, optioned from Northair Mines Ltd. The project covers several copper prospects associated with subvolcanic dioritic and monzonitic intrusive breccias in Upper Triassic Nicola volcanic rocks. The property is strategically located 25 kilometres southeast of the town of Merritt. It is crossed by a four-lane highway and a power transmission line.

Yellowjack Resources Ltd., in a joint venture with Hemlo Gold Mines Ltd. and Brenda Mines Ltd., continued with a major drilling program on the **Katie** porphyry copper-gold project. The property is located in the Salmo area of southeastern British Columbia. Mineralization is associated with Lower Jurassic Rossland Group volcanic rocks and comagmatic diorite intrusions. Of three zones tested by drilling, the Main zone so far shows the best continuity and size potential. Grades there range from 0.10 to 0.53 per cent copper and from 0.1 to 1.15 grams per tonne gold. With the 1992 work, Yellowjack has increased its interest in the project to 57 per cent.

In the northern Vancouver Island copper belt, Crew Natural Resources Ltd. has established mineable reserves on the **Red Dog** copper-gold deposit of 25 million tonnes grading 0.35 per cent copper and 0.44 gram per tonne gold at a 0.2 per cent copper cut-off grade. Crew Natural has submitted a prospectus to the Mine Development Assessment Branch. The production scenario is to convey 20 000 tonnes of ore per day to Holberg Inlet and barge it to the Island Copper mine of BHP-Utah for milling.

POLYMETALLIC MASSIVE SULPHIDE DEPOSITS

The returning exploration interest in base metals, particularly in the higher grade zinc-rich massive sulphide deposits, has developed in parallel with the recent porphyry programs. The success of projects such as Tulsequah Chief and the new discoveries at Myra Falls are indications of continued trends in short and intermediate term exploration programs for targets of this type.

In the **Gataga** district and adjacent areas in northeastern British Columbia several Devonian sedimentary exhalative barite-zinc-lead-silver prospects, explored extensively in the early 1980s, have been re-activated. As well, the recent advanced exploration and pre-development on the Stronsay (Cirque) deposit has contributed to the attraction of the area. Teck Explorations Ltd. carried out preliminary work on the **Mount Alcock** and **Bear** deposits and **Driftpile** prospects. In the same area, Minnova Inc. has acquired the **Pie**, **Akie** and **Yuen** prospects. Both companies plan more extensive programs in 1993.

Northeast of Germansen Landing, Cominco Ltd. has undertaken an aggressive drilling program on the **Par** lead-zinc-silver-barite project. This property covers a Paleozoic sequence of Cambrian to Devonian clastic and carbonate rocks. Within the section, stratiform horizons of galena, sphalerite and barite mineralization are hosted by shales and carbonate rocks. The 1992 work is follow-up to encouraging geochemical and trenching programs carried out in 1991.

On the northeast side of McNaughton Lake, in the Columbia River area, Teck Explorations Ltd. and Com-

inco Ltd. completed the second phase of an extensive drilling program on the **MGM/Bend** zinc-lead-silver project. Mineralization occurs in Cambrian Tzar Creek metapelites, near the contact with overlying Chancellor Group limestones. Massive and disseminated pyrrhotite, sphalerite and galena occur in thin horizons traced for approximately 7 kilometres by surface surveys and diamond drilling.

In the Purcell Mountains of southeastern B.C. a new sedimentary exhalative massive sulphides discovery has been made by Kokanee Explorations Ltd. on the **Fors** lead-zinc-silver prospect. The property is located southwest of Cranbrook near Munroe Lake and was optioned from Chapleau Resources Ltd. and Barkhor Resources Ltd. The discovery hole intersected 3.65 metres of bedded massive sulphides, plus an additional 23 metres of semimassive to disseminated sulphides. Mineralization occurs in calcisilicate rocks of the Proterozoic Middle Aldridge Formation and is associated with extensive albitic alteration.

On Wilds Creek, north of Creston, Consolidated Ramrod Gold Corporation drilled the **Leg** prospect to further delineate bedded zinc-barite mineralization in clastic sediments high in the Purcell Supergroup stratigraphy. The 1992 work confirmed previous intersections of two such horizons.

East of Vancouver, Minnova Inc. continued work on the **Seneca** project. This property comprises Kuroko-type massive sulphide lenses hosted by felsic volcanic rocks of the mid-Jurassic Harrison Lake Formation. Minnova explored south of the Fleetwood zone under the Chehalis River valley. One encouraging intersection returned 3.2 metres of 1.83 per cent copper, 23.3 per cent zinc, 1.71 per cent lead, 121.6 grams per tonne silver and 2.13 grams per tonne gold.

At the **Myra Falls** mine, near Butte Lake, Westmin Resources Limited is exploring the extension of the H-W horizon in the **Thelwood valley** (see Operating Mines). The area of interest is in a faulted-off section of the mine stratigraphic sequence, where encouraging drill intersections early in the year have prompted a more aggressive program.

PRECIOUS METALS BEARING VEINS AND TRANSITIONAL DEPOSITS

Exploration targets within this category cover a broad spectrum of epigenetic mineral deposits. They include deeper level mesothermal veins, high-level epithermal deposits and those that form in transitional zones at intermediate depths.

Northeast of Stewart, near the eastern margin of the Coast Ranges Lac Minerals Ltd. continued with a successful program on the **Red Mountain** project. Among several significant gold prospects on the property, the

Marc and North zones are the most economically important to date. The Marc zone has a preliminary geological resource of approximately 840 000 tonnes grading 12.68 grams per tonne gold. Detailed geological work in 1992 improved the deposit model, and added additional potential reserves to the North zone. New mapping suggests that the volcanic rocks cut by the Goldslide intrusion may be older (Stuhini?) than previously believed.

On the Nizi property, northeast of Dease Lake, Goldfields Canadian diamond drilled epithermal gold-silver-barite mineralization in the Devono-Mississippian Sylvester Group.

Minnova Inc. continued work on the **Wolf** gold project in Eocene Ootsa Lake volcanic rocks. Epithermal gold mineralization occurs as sulphide-bearing banded chalcedonic quartz veins and breccia matrix. A previous interpretation that the mineralization was cut off by thrust faulting was apparently invalidated by this season's drill program.

INDUSTRIAL MINERALS

Exploration interest in industrial minerals has shown a significant increase recently, with the slow-down in metallic minerals activity. In southern British Columbia, particularly, applications to develop various types of construction stone products has been on the rise. Among these are projects to produce marble, limestone, granitic dimension stone, feldspar and silica sand. In the southern Fraser Canyon, Cromlech Ltd. has applied to recover unconsolidated silica and feldspar sand deposits at Scuzzy Creek; at Sumas Mountain, near Abbotsford, Quality Mineral and Industry Supply Co. Ltd. proposes to develop a sodic feldspar deposit.

The existing spectrum of successful industrial minerals operations has provided encouragement to potential developers, as the variety and availability of high quality commodities is recognized. Examples of such operations are the barite and silica operations of Mountain Minerals Ltd. near Golden. This company has been a long-established supplier of barite to the drilling industry and relatively pure quartz to glass producers. Elsewhere in the region, Baymag Mines Co. Ltd. produces magnesite; gypsum is mined at Lussiere River and Windermere by Domtar Construction Materials Ltd. and Westrock Industries Ltd. Lime for cement and other industrial uses is produced by Lafarge Ltd. at Kamloops and Continental Lime Ltd. at Pavilion.

NEW INITIATIVES IN BRITISH COLUMBIA

Several new programs that will have a significant influence on future mineral resource development in British Columbia were initiated in 1992.

On July 13, 1992 the provincial government passed the *Commissioner on Resources and Environment Act*. The commission created by this act, the **Commission on Resources and Environment (CORE)** is charged with developing a province-wide land-use strategy.

As land use and resource management are major factors that will influence future directions in the mineral resource industry, the government of British Columbia approved a multi-agency program entitled **Corporate Resource Inventory Initiative (CRII)** to establish the inventories of the major land based resources of the province. As a part of this initiative, the Geological Survey Branch of the Ministry of Energy, Mines and Petroleum Resources has undertaken a project to evaluate the mineral potential of British Columbia. The **Mineral Potential Project** will evaluate known and unknown resources, that will be expressed in a variety of themes and formats such as in-place value, industry activity, revenues and employment. The databases established will be used for current and future applications and will be maintained on a geographic information system (GIS) and updated as conditions and knowledge change.

During the first year of the project the priority areas evaluated are Vancouver Island, the Kootenays and parts of the Cariboo-Chilcotin region. The scheduled completion date for these three areas is April, 1993.

A third major initiative undertaken in British Columbia during 1992 is the development of a **Protected Area Strategy** for the province. This initiative was introduced as part of the new government's commitment to preserve 12 per cent of the land base. The strategy incorporates previous programs including provincial and national parks, old-growth areas, wildlife habitats, ecological reserves and heritage sites. Under the program protected areas become part of a broad spectrum of land use designations that will range from Special Management Lands, Multiple Resource Use areas, Major Development Projects to Settlement Lands.

The results of studies being carried out under the Mineral Potential Project and other resource evaluation studies will play a major role in providing mineral resource inventories of study areas under review for various land use designations.

SUMMARY AND OUTLOOK FOR 1993

In the current period of re-adjustment in the exploration industry in British Columbia, operators are

evaluating many previously explored targets. A number of major mineral deposits discovered in the pre-1980 period are undergoing serious scrutiny by explorationists in anticipation of improved metal markets and potential upturns in the business cycle.

Sedimentary-hosted zinc-rich and volcanogenic copper-rich polymetallic massive sulphide deposits offer small to medium tonnage and high grade potential, particularly those enriched in precious metals. The many copper-bearing porphyry deposits discovered during the 1970s continue to receive major exploration efforts, which may very well lead to the next new mine to be developed in the province.

Currently, there are several advanced projects that are potentially close to a pre-production development decision. The Mount Polley and QR projects have most approvals in place to go ahead. Imperial Metals is negotiating financing arrangements for Mount Polley and CMP Resources Ltd. plans to carry out bulk sampling and metallurgical work at QR. Approvals for the Curragh Resources' Stronsay project are expected in the near future. Here too, funding is expected to be an important factor to overcome. The option of custom milling is looking attractive to some operations such as the Premier mine. The viability of this approach will undoubtedly be considered for a number of small, high-grade deposits. Other major projects such as Kemess, Elk and Red Dog are at, or near, the entry stage of the permitting process.

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