



Ministry of Energy and Mines
Energy and Minerals Division
Mines Branch

EXPLORATION IN BRITISH COLUMBIA - 1997

British Columbia Cataloguing in Publication Data

Main entry under title:

Exploration in British Columbia. --1975-

Annual.

With: Geology in British Columbia, ISSN 0823-1257;
and, Mining in British Columbia, ISSN 0823-1265, continues:
Geology, exploration and mining in British Columbia, ISSN
0085-1027.

1979 published in 1983.

Issuing body varies: 1975-1976, Ministry of Mines and
Petroleum Resources; 1977-1985, Ministry of Energy, Mines
and Petroleum Resources; 1986-1996, Geological Survey
Branch; 1997- , Mines Branch. ISSN 0823-2059 =
Exploration in British Columbia

1. Prospecting - British Columbia - Periodicals. 2. Geology,
Economic - British Columbia - Periodicals. 3. Mines and mineral
resources - British Columbia - Periodicals. I. British Columbia.
Ministry of Mines and Petroleum Resources. II. British Columbia.
Ministry of Energy, Mines and Petroleum Resources. III. British
Columbia. Geological Survey Branch. IV. British Columbia.
Mines Branch.

TN270.E96

622.1'09711

Rev. April 1998

COVER PHOTO . . .

Fly-weight diamond drill testing the Bishop porphyry copper-gold zone,
Lorraine property, located in the Swannell Ranges about 50 kilometres
northwest of Germansen Landing.

FOREWORD

Exploration expenditures in British Columbia in 1997 were an estimated \$75 million, similar to the 1995 total, but down 25% compared to last year. Of the five regions, only the Kootenay region experienced an increase in exploration spending. The majority of exploration targeted gold vein and precious metal enriched porphyry copper deposits. Polymetallic massive sulphide, coal and skarn and/or manto deposits were also popular targets. More than 90% of all 1997 exploration dollars were spent on minesites or projects in the advanced stages of development. The declining amount of grassroots exploration conducted in the province is a concern. The lack of activity is reflected by a 25% decrease in number of mineral units and placer claims staked in 1997 versus 1996. New initiatives announced by the government in April 1998 are intended to stimulate both grassroots and advanced exploration in the province.

Recent weak metal prices have had the most significant negative impact on mining and exploration in the province. The Afton-Ajax porphyry copper-gold mine closed in June, 1997, and late in the year it was announced that the QR gold mine would close early in 1998.

On the positive side, the Mount Polley copper-gold and Huckleberry copper-molybdenum mines opened in September and the Golden Bear gold mine reopened, as a heap leach operation, after almost a 3-year shutdown. At the Eskay Creek mine, construction of a 150 tonne per day mill was completed--this high grade gold-silver operation now produces concentrate and direct shipping ore. A new zinc-rich massive sulphide body was identified at the Myra Falls polymetallic mine and significant new sulphide and oxide reserves were outlined at the Gibraltar copper-molybdenum mine. Construction of the Kemess mine advanced rapidly and by year-end was about 80% complete. Several projects progressed through the provincial government's Environmental Assessment process and may receive their Mine Development Certificates early in 1998. They are the Tulsequah Chief polymetallic project, the Willow Creek coal project and the Telkwa coal project. In addition, the evaluation of the Prosperity and Mt. Milligan copper-gold deposits, the latter which has its Mine Development Certificate in place, may lead to bankable feasibility studies and/or production decisions in the near future.

Regional offices of the ministry, located in the communities of Cranbrook, Kamloops, Nanaimo, Prince George, Smithers and Vancouver, together with the head office in Victoria, are responsible for monitoring and regulating exploration and mining in the province. The following articles provide an account of mining and exploration activity in the province during 1997. These accounts are preceded by a provincial overview that addresses developing trends and issues in the industry and are followed by a summary of the assessment report database.

For the first time this publication is being produced by Mines Branch staff. However, it has benefited greatly from direction provided by Dorthe Jakobsen (Geological Survey Branch, Victoria) and from proficient editing by external editor, John Newell.

Bob Lane
Regional Geologist
Prince George

TABLE OF CONTENTS

FOREWORD.....	iii	Coal Mines.....	22
PART A		Industrial Minerals Operations.....	23
OVERVIEW OF EXPLORATION ACTIVITY		Mine Developments.....	23
BRITISH COLUMBIA MINING, DEVELOPMENT AND EXPLORATION 1997 OVERVIEW		Exploration Highlights.....	25
Introduction.....	1	Gataga/Kechika Trough.....	25
Regional Trends.....	2	Northern Quesnel Trough.....	25
Highlights At Operating Mines.....	4	Nechako Plateau.....	29
General Exploration Highlights.....	6	Cariboo.....	30
Initiatives in British Columbia.....	7	Other Areas.....	31
Summary and Outlook for 1998.....	7	Land Use Planning.....	31
Acknowledgments.....	8	Outlook.....	31
MINE AND EXPLORATION HIGHLIGHTS NORTHWEST BRITISH COLUMBIA - 1997		Acknowledgments.....	31
Overview And Trends.....	9	EXPLORATION AND DEVELOPMENT HIGHLIGHTS IN SOUTH-CENTRAL BRITISH COLUMBIA - 1997	
Operating Mines.....	12	Highlights.....	33
Endako Mine.....	12	Exploration Trends.....	33
Huckleberry Mine.....	12	Mines.....	34
Eskay Creek Mine.....	12	Exploration Projects.....	34
Snip Mine.....	12	Porphyry And Related Targets.....	37
Golden Bear Mine.....	13	Precious Metal Vein Targets.....	38
Table Mountain Mine.....	13	Stratiform Base Metal Targets.....	39
Premier Gold Mine.....	13	Magmatic Targets.....	40
Mineral Exploration.....	13	Industrial Minerals And Gemstones.....	40
Babine Camp.....	13	Grassroots Prospecting.....	40
Tahtsa Camp, Houston Area.....	14	Acknowledgments.....	41
Nechako Plateau.....	14	References.....	41
Smithers Camp.....	14	EXPLORATION AND DEVELOPMENT HIGHLIGHTS, KOOTENAY REGION - 1997	
North Coast Area.....	14	Summary.....	43
Queen Charlotte Islands.....	14	Exploration Highlights.....	44
Stewart Camp.....	15	Metals.....	44
Iskut Camp.....	15	Purcell Anticlinorium.....	44
Upper Skeena District.....	15	Kootenay Arc.....	47
Stikine District.....	16	Slocan Camp.....	48
Kutcho-Turnagain District.....	16	Greenwood Mining Division.....	48
Kechika District.....	16	Other Metal Projects.....	49
Cassiar Camp.....	17	Industrial Minerals.....	50
Rancheria Camp.....	17	Coal.....	51
Tulsequah Camp.....	17	Acknowledgments.....	52
Atlin Camp.....	17	EXPLORATION AND DEVELOPMENT HIGHLIGHTS, SOUTHWESTERN BRITISH COLUMBIA - 1997	
MINING AND EXPLORATION REVIEW FOR NORTHEAST-CENTRAL BRITISH COLUMBIA - 1997		Introduction.....	53
Highlights.....	19	Highlights.....	53
Exploration Trends.....	19	Exploration And Production Trends.....	53
Metal Mines.....	20	Producing Mines And Quarries.....	56
		Myra Falls Operation.....	56

Quinsam Coal.....	57
Limestone Quarries.....	57
Other Industrial Minerals.....	57
Exploration Activity.....	58
Vancouver and Inshore Islands.....	58
Knob Hill.....	58
T'Sable River Coal.....	58
Benson Lake Limestone.....	59
Tay.....	59
Debbie.....	59
Lucky/Toq.....	59
Marathon.....	60
Nitinat.....	60
Galleon.....	60
Quadra Island.....	60
Other Activity.....	61
Southern Coast.....	61
Monument.....	61
Margie.....	62
Giant Copper.....	62
Hotspring.....	62
Nugget Queen.....	63
Alexandria.....	63
Ruby.....	63
Brandywine.....	64
Seneca.....	64
Elk.....	64
Other Activity.....	64
Acknowledgments.....	64

PART B

MINERAL ASSESSMENT REPORTS

REVIEW OF OPERATIONS 1947 - 1997

Summary.....	65
Introduction.....	65
Portable Assessment Credit (PAC).....	67
Exploration Expenditures and Assessment Report Costs.....	67
Value of Assessment Reports.....	67
Summary of Statistics.....	68
Products.....	70
References.....	71

PART A

OVERVIEW OF EXPLORATION ACTIVITY

BRITISH COLUMBIA MINING, DEVELOPMENT AND EXPLORATION 1997 OVERVIEW

By Tom G. Schroeter, P. Eng.
Senior Regional Geologist, Vancouver

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 (+48%) 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,

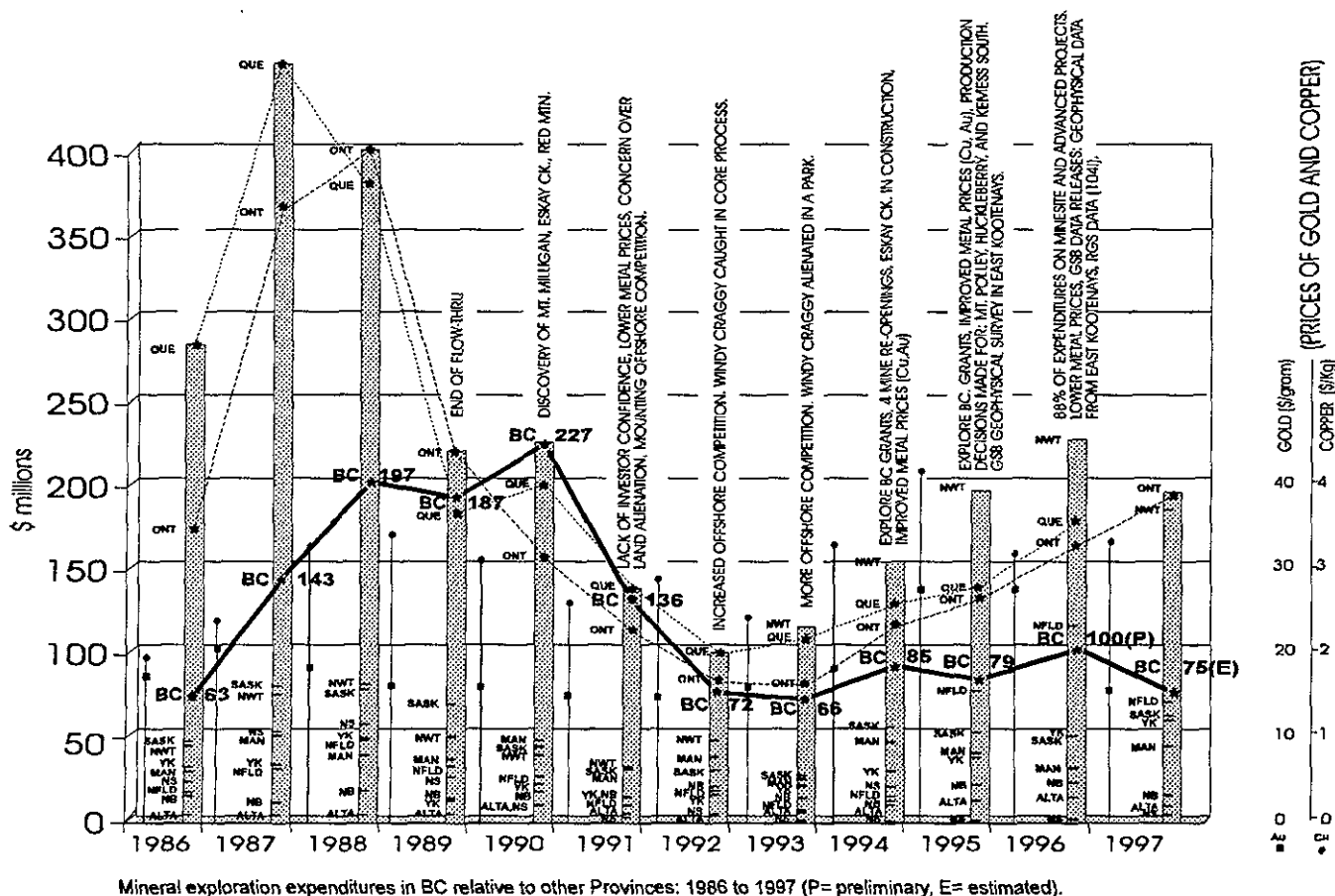


Figure 1. Mineral exploration expenditures in British Columbia relative to other Canadian Provinces: 1987 to 1997. Annual average prices for copper and gold are shown on the vertical line opposite the respective year. (Source MEI, Minerals, Oil and Gas Branch).

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).

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).

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 and JD**. Exploration work was focused in and around existing minesites or areas with existing infrastructure (e.g. Highland Valley Copper and Sullivan areas).

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;

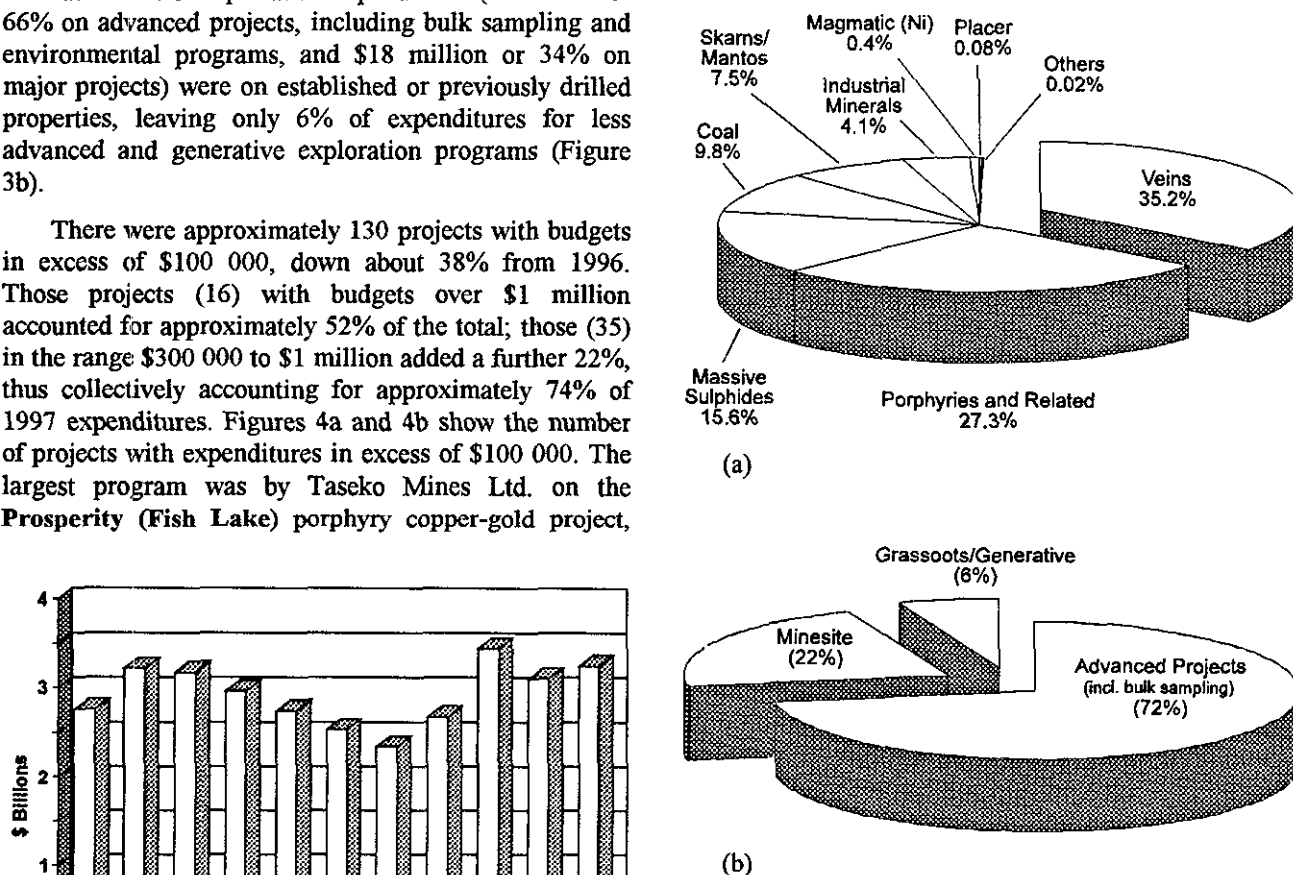


Figure 3. Exploration targets - 1997. (a) By deposit type (%); (b) By level or category of program (%).

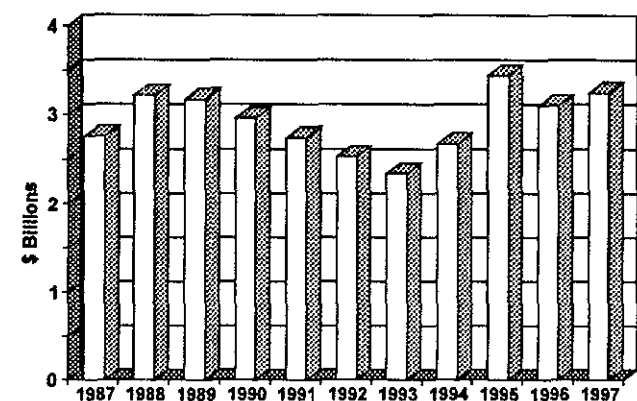
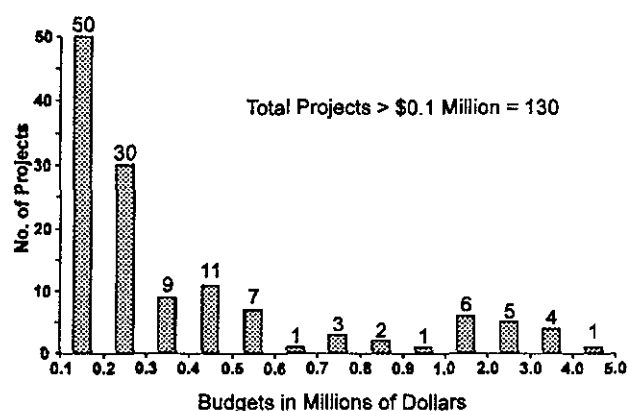
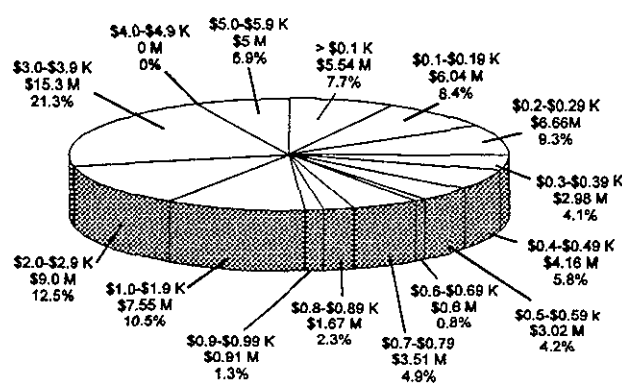


Figure 2. Solid mineral production value in British Columbia: 1987 to 1997.



(a)



(b)

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

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, 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. The joint venture of the Hastings Management Group of companies with 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 Lamfoot 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 29 500) 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.

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. 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 (Table 1).

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 gold

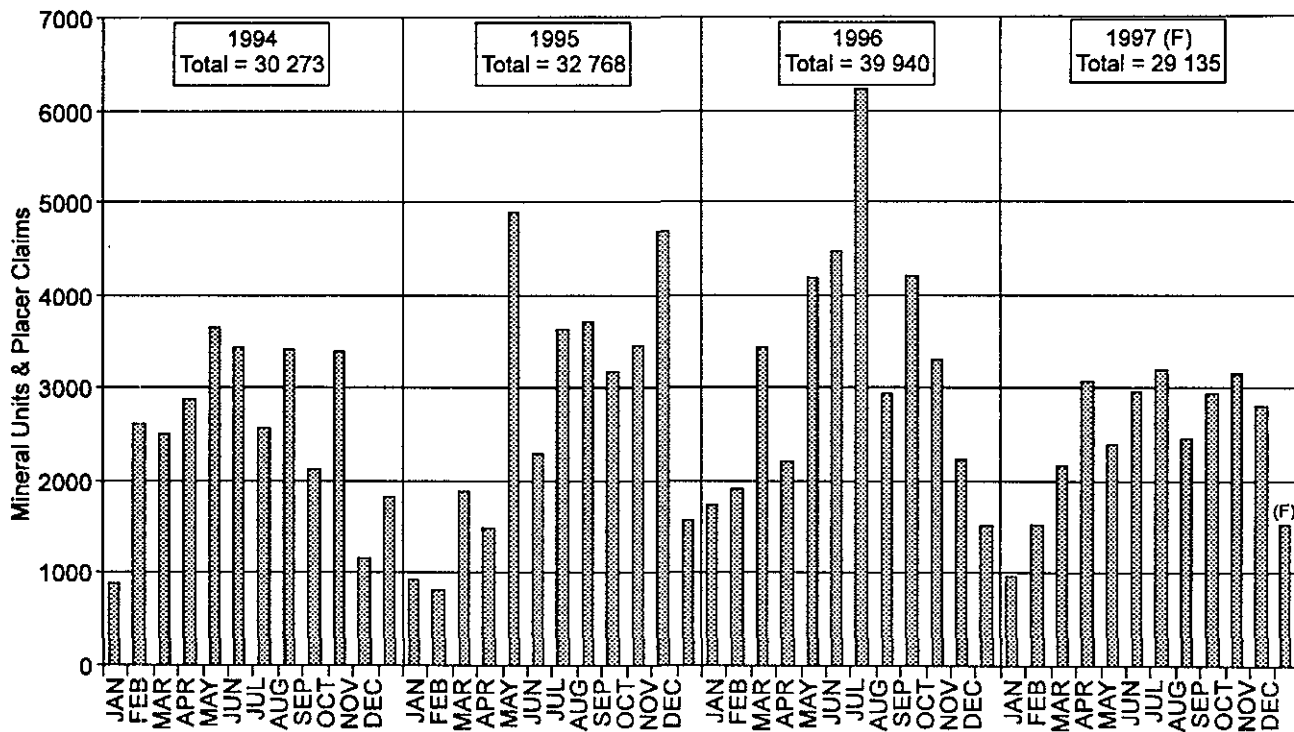


Figure 5. All mineral tenure recorded by month; 1994 to 1997.

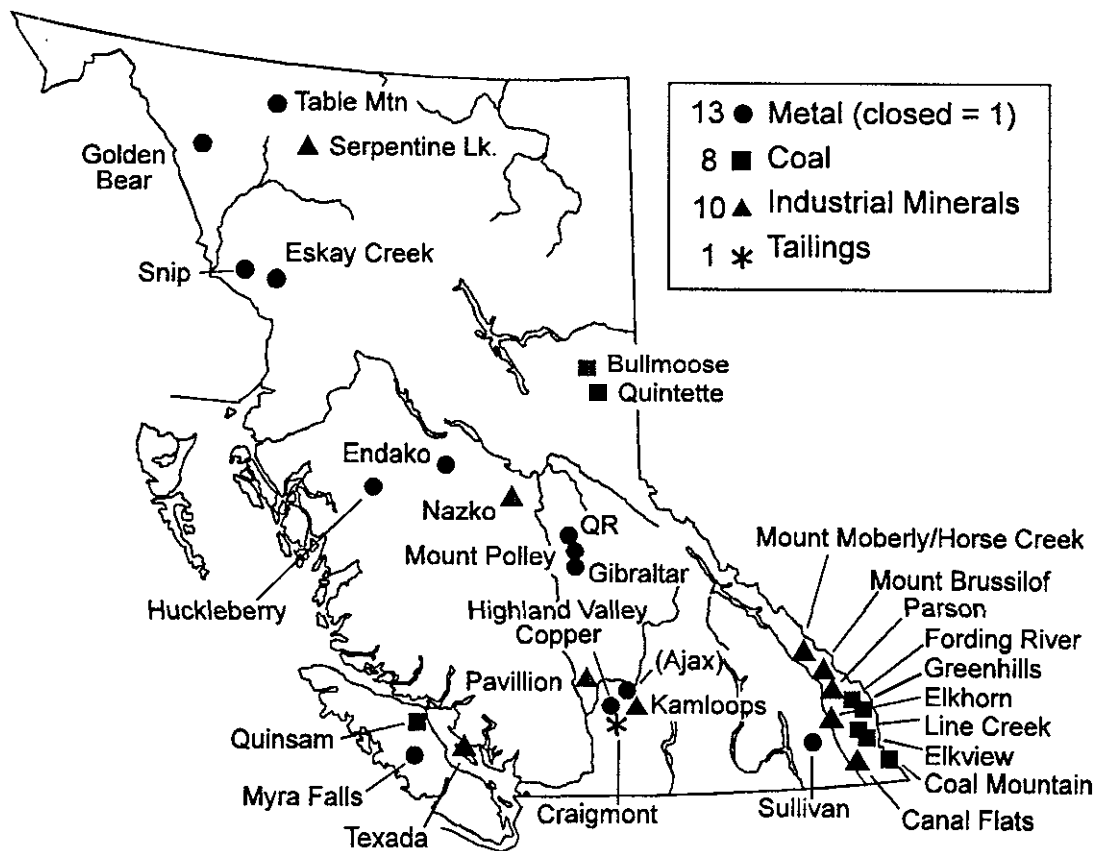


Figure 6. Operating mines in British Columbia - 1997.

TABLE 1
1997 FORECAST OF SOLID 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 Material		423.3	13.0%
	Total Solid Minerals		3251	100.0%

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

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.

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.

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 Assemblage) and Purcell Mountains (Aldridge Formation)]. 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 five-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. 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.

ACKNOWLEDGMENTS

This report has benefited from information provided by the Regional Geologists with the Mines Branch, based in five offices throughout the province: Paul Wojdak in Smithers, Bob Lane in Prince George, Mike Cathro in Kamloops, Paul Wilton in Cranbrook and Robert Pinsent in Vancouver. Dan Hora and Barry Ryan, both with the Geological Survey Branch in Victoria, provided summary information on industrial minerals and coal, respectively. Production forecasts were provided by the Statistics Group in Victoria. Mineral tenure statistics were provided by Janice Chan and Paul Hagen of the Mineral Titles Branch in Victoria. Mike Fournier and Janet Holland with the Geological Survey Branch in Victoria produced the figures and tables and typing of the manuscript, respectively. Janet's work on the layout and typesetting and her efforts to ensure that all last minute changes and revisions were included are greatly appreciated.

The Ministry appreciates the contribution of data by the exploration and mining community in British Columbia.

MINE AND EXPLORATION HIGHLIGHTS NORTHWEST BRITISH COLUMBIA - 1997

By Paul Wojdak, P. Geo.
Regional Geologist, Smithers

OVERVIEW AND TRENDS

Four gold mines and two base metal mines were in operation in 1997. The Eskay Creek, Snip, Golden Bear and Table Mountain mines produced 12 382 kilograms of gold. Eskay Creek also produced 367 000 kilograms of silver. The Endako mine continued in full operation under new ownership and produced 6517 tonnes of molybdenum metal. Commissioning of a flotation mill at Eskay Creek will allow mining of lower grade ore than can be extracted for direct shipping, leading to increased gold and silver production. Golden Bear became British Columbia's first heap-leach gold mine. Operating on a seasonal basis, it enjoyed a successful year, exceeding planned gold production. Shipment of copper concentrate from the new Huckleberry open-pit copper-molybdenum mine began in September.

Important exploration projects conducted in 1997 include:

- the search for Eskay Creek type deposits by Prime Resources Group Inc. which conducted minesite drilling and wide ranging reconnaissance programs
- continued drilling at Telkwa by Manalta Coal Ltd., that resulted in expansion of coal reserves
- reappraisal of the Silvertip (Midway) prospect by Imperial Metals Corporation increased the silver-lead-zinc resource
- underground rehabilitation and drilling at the New Polaris (Polaris Taku) gold mine by Canarc Resource Corporation.

Estimated expenditures in northwest British Columbia amounted to \$27 million. Of this amount, gold targets accounted for about 62%, base metal (copper, zinc, nickel) targets for 28% and 10% was spent on coal and industrial minerals. Most of the work was done on advanced projects. Grassroots exploration was undertaken in the Cry Lake, Kechika, Iskut and Babine areas, primarily for base metals, to follow up regional geochemical surveys conducted by the B.C. Geological Survey and private airborne geophysical surveys.

There were 246 mineral Notices of Work, similar to the number in 1996. However, exploration activity declined sharply in 1997 as many companies were unable to proceed with proposed projects or did less work than planned. Exploration expenditure decreased by 45% from 1996 (Figure 1). Exploration drilling fell to 102 176 metres (Figure 2) and mineral tenure in northwest region diminished by 4309 units. The number of mineral claims staked declined to 8115 units and the number of forfeitures increased sharply to 12 424 units (Figure 3).

Thirty major exploration projects are listed in Table 1 and locations are shown in Figure 4.

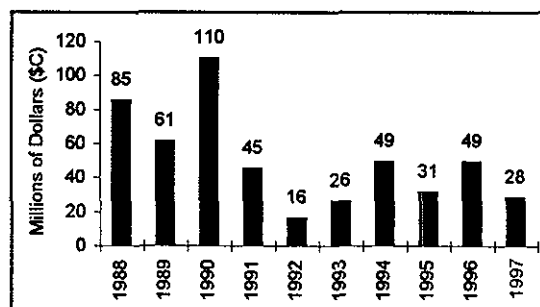


Figure 1. Mineral exploration expenditures in northwest British Columbia.

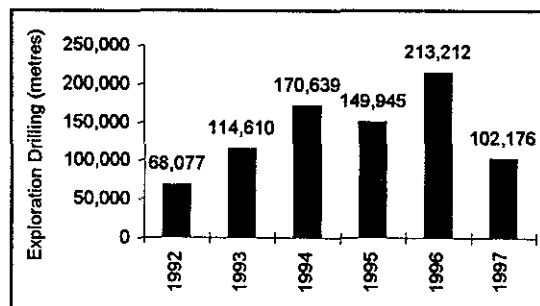


Figure 2. Exploration drilling in northwest British Columbia.

TABLE 1
MAJOR MINERAL EXPLORATION PROJECTS IN NORTHWEST REGION, B.C.

<u>PROPERTY</u>	<u>OPERATOR</u>	<u>MINFILE</u>	<u>NTS</u>	<u>COMMODITY</u>	<u>TYPE</u>	<u>WORK DONE</u>
Allin	Hudson Bay Exploration & Development Co. Ltd.	093L 293	93L/1	Cu, Ag, Au	Epithermal	Access, 1.6 kilometres; 11 ddh, 2177 m
Ashwood	Golden Fortune Investments Ltd.	103P 247, 248	103P/12	Au	Vein	6 ddh, 1050 m
Bennett	Brett Resources Inc.	104M 085	104M/15	Au, Co, Cu	Skarn	10 ddh, 1073 m
Bronson Slope	International Skyline Gold Corp.	104B 077	104B/11	Au, Cu	Porphyry	7ddh, 1835 m
Chopin	Prime Resources Group Inc.	104B 298, 299	104B/10	Au	Shear Vein	Geochem; Hand trench & pit; 4 ddh, 1675 m
Clone	Teuton Resources Corp.	103P 251	103P/13	Au, Co	Shear vein	18 ddh, 2135 m
Corey	Prime Resources Group Inc.	104B 011	104B/8	Au, Ag	Epithermal massive sulphide	Geol; Geochem; 1 ddh, 180 m
Eskay Creek	Prime Resources Group Inc.	104B 008	104B/9	Au, Ag, Cu, Zn	Epithermal massive sulphide	Geol; 90 ddh, 14 935 m
Eskay	Canamera Geological Ltd		104B/9, 10	Au, Ag	Epithermal massive sulphide	Geol; Geochem,
Fox/ Delta	Cordal Resources Ltd.	104A 004, 165, 166	104A/12	Au, Ag, Cu	Porphyry gold	Geol; Geochem; I.P., 11.5 kilometres; Trenching, 378 m
Fireside	Fireside Minerals Limited	094M 003	94M/14	Barite	Vein	Access road, 4.2 kilometres; Bulk sample, 9400 tonnes
Golden Bear	North American Metals Corp.	104K 087	104K/1	Au	Carlin	Trench, 1115 m; 9 ddh, 2497 m
Harmony	Misty Mountain Gold Limited	103F 034	103F/9	Au	Epithermal	Geochem; IP, 42 kilometres; 6 ddh, 3000 m; Met sample, 2 tonnes
Hearne Hill	Booker Gold Explorations Ltd.	93M 006	93M/1	Cu, Au	Porphyry	Geochem; IP, 8 kilometres; VLF & Mag, 15 kilometres; 53 ddh, 12,000 m
Isk	Whitegold Resource Corp.	104B 123	104B/11	Wollastonite	Skarn	Geol; Trench, 120m; 17 ddh, 1890 m; Engineering studies
Kechika	Donegal Developments Ltd		94M, 104P	Zn, Pb, Ag	Sedimentary exhalative	Geol; Geochem; Mag & VLF, 169 kilometres
Kutcho	Atna Resources Ltd.	104I 072	104I/1	Cu, Zn, Ag, Au	Volcanogenic massive sulphide	UTEM, 55 kilometres; Max-Min, 15 kilometres; 9 ddh, 1600 m
Mac	Spokane Resources Ltd.	093K 097	93K/13	Mo, Cu	Porphyry	3 ddh, 808 m
New Polaris	Canarc Resource Corp.	104K 003	104K/12	Au	Mesothermal vein	U/g rehabilitation; Geol; 46 U/g ddh, 8855 m
Nizi	Madrona Mining Limited	104I 032	104I/14,15	Au, Ag, Zn	Epithermal	Geol; 5 ddh, 915 m
Porcher Island	Porcher Island Gold Corp.	103J 017	103J/12	Au	Mesothermal vein	HLEM, 8.1 kilometres; Mag & VLF, 12.5 kilometres; 9 ddh, 1407 m
Reed-Haskins	Demand Gold Ltd.	104P 038	104P/5,6	Zn, Pb, Ag, Mo	Skarn, Porphyry	Geol; Geochem; 9 ddh, 1678 m
Scotia	Bishop Resources Inc.	103I 007	103I/4	Zn, Pb, Ag, Cu	Volcanogenic massive sulphide	Geol; 10 ddh 792 m
Silvertip (Midway)	Imperial Metals Corp.	104O 038	104O/16	Ag, Zn, Pb	Manto	Geol; Seismic, 7.1 kilometres; 63 ddh, 7124 m
Snip	Prime Resources Group Inc.	104B 004, 264	104B/11	Au	Shear vein	40 ddh, 7500 m
Southeaster	Okak Bay Resources Ltd.	103G 004	103G/5	Au	Epithermal	Geol; Geochem; IP, 21 kilometres

Table Mountain	Cusac Gold Mines Ltd.	104P 070	104P/4	Au	Greenstone gold ("Cassiar" type)	35 Sfc and U/g ddh, 4550 m
Telkwa	Manalta Coal Ltd.	93L 156	93L/11	Coal	Thermal coal	27 trenches; 121 Rotary dh, 15050 m
Treaty Creek	Teuton Resources Corp.	104B 078	104B/9	Au	Epithermal	8 ddh, 1370 m
Turnagain Nickel	Bren-Mar Resources Ltd.	104I 014,119, 120	104I/7	Ni, Co	Magmatic	9 ddh, 1671 m

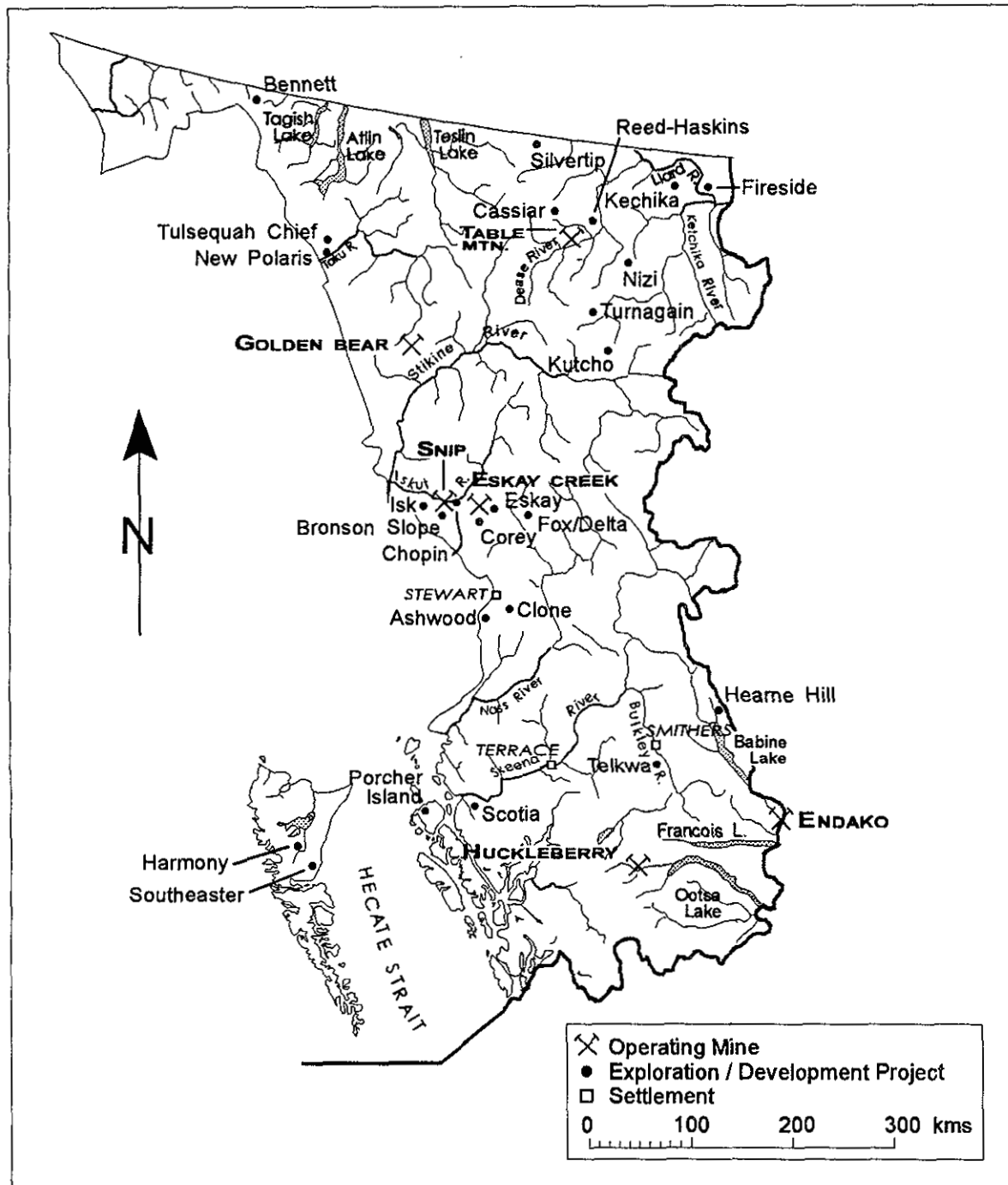


Figure 4. Location map, exploration projects in northwest British Columbia, 1997.

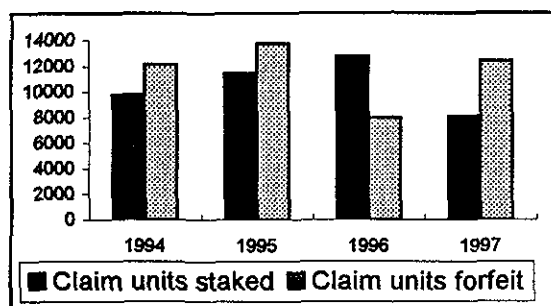


Figure 3. Claim summary, northwest British Columbia.

OPERATING MINES

ENDAKO MINE

The Endako molybdenum mine was acquired by Thompson Creek Mining Company (75%) and Nissho Iwai Corporation (25%) on May 30 without interruption in operation. Placer Dome Canada Limited had operated the open-pit mine since production began in 1965. The deposit is a quartz-molybdenite vein stockwork within the Cretaceous Francois Lake batholith, a multiphase intrusion of granite, quartz monzonite and alaskite. The mine comprises three pits, the 1.7 kilometre long Endako pit from which all ore is currently produced, the much smaller and mined out Denak East pit and the partially developed Denak West pit. Production in 1997 was 19 319 000 tonnes mined of which 9 377 000 tonnes were milled (nominal rate of 30 000 tonnes per day) yielding 6 517 000 kilograms of molybdenum. Proven and probable reserves (including stockpiles) on January 1, 1998 were 121 757 000 tonnes at 0.065% Mo. Mine cut off grade is 0.04% Mo. Drilling to test induced polarization anomalies was conducted east and west of the open pits.

HUCKLEBERRY MINE

Built at a cost of \$141.5 million, the new Huckleberry open-pit copper-molybdenum mine began operation in September. Huckleberry Mines Ltd. is owned 60% by Princeton Mining Corporation and 40% by a consortium of Japanese companies; Mitsubishi Materials Corporation, Marubeni Corporation, Dowa Mining Company Ltd. and Furukawa Company Ltd. The mill worked up toward full production of 18 000 tonnes per day and the molybdenum circuit was being commissioned at year end. Approximately 1.3 million tonnes were milled in 1997. Anticipated cost of production is US\$0.65 per pound of copper. The Huckleberry porphyry copper deposit is in the contact aureole of two small stocks. A pyrite-chalcopyrite-

molybdenite stockwork is developed in biotite-hornfelsed volcanic rocks and adjacent hornblende-biotite porphyritic granodiorite. Initial mining is in the East zone where reserves are 66.1 million tonnes grading 0.523% copper and 0.014% molybdenum at a cut-off grade of 0.3% copper and strip ratio of 1.23:1. Total mineable reserves are 90.3 million tonnes containing 0.513% copper and 0.014% molybdenum.

ESKAY CREEK MINE

The Eskay Creek mine is owned by Prime Resources Group Inc. and operated by Homestake Canada Inc. Production in 1997 was 7611.7 kilograms (244 722 ounces) of gold and 367 000 kilograms (11.8 million ounces) of silver from sale of 110 191 tonnes of direct shipping ore from the 21B zone. Cost of production, including shipping and smelting, was U.S.\$162 per ounce of gold equivalent. The stratiform 21B zone, consisting of sulphide and sulphosalt beds in mudstone, is underlain by the pipe-shaped 109 stockwork zone in rhyolite. Mining began in the 109 zone near the end of the year, with the ore being treated in a new 150 tonne per day mill constructed during the summer. The mill produces gravity and flotation concentrates. Proven and probable reserves of milling and direct shipping ore on January 1, 1998 were 1 356 000 tonnes grading 58.04 g/t gold and 2684 g/t silver. There is an additional geologic resource of 336 500 tonnes containing 20.12 g/t gold and 411 g/t silver.

Mill start-up required an increase in the mining rate from 300 to 400 tonnes of ore per day. Eskay Creek continues to direct ship ore that is not amenable to conventional milling, primarily due to its high mercury content, at a rate of about 250 tonnes per day. Completion of the mill allows Eskay Creek to process lower grade ore and the scope of exploration drilling expanded to include targets in the footwall rhyolite. An exploration drift was driven from the north end of the mine to carry out definition drilling of the northeast extension of stratiform ore (NEX zone). The NEX zone lies in the north-plunging nose of the Eskay anticline and is segmented by faults.

SNIP MINE

The Snip gold mine is owned by Prime Resources Group Inc. and operated by its controlling shareholder, Homestake Canada Inc. Production in 1997 amounted to 3560 kilograms (115 644 ounces) of gold. Mining of the main Twin zone orebody is nearly complete and much of the ore produced in 1997 came from narrow high-grade footwall veins. Production from the Twin West zone began in 1997. Costs increased to \$213 per ounce

because 75% of ore was supplied from conventional cut-and-fill stopes. The Twin zone is a moderate to steeply dipping quartz-carbonate-sulphide vein within the hornfels halo of a granodiorite stock. Proven and probable reserves on Jan. 1, 1998 were 210 500 tonnes at 23.24 g/t Au. Underground diamond drilling explored targets in the hangingwall and footwall of the Twin vein but results were disappointing. No encouragement was derived from exploration of the Jim claims west of Snip mine. The company chose not to pursue its application to extend the Iskut road to Snip mine.

GOLDEN BEAR MINE

Wheaton River Minerals Ltd. completed construction of the Fleece Bowl heap-leach facility and began treatment of ore from the Kodiak A open pit in August. Gold in the Kodiak A deposit is very finely disseminated in a hematitic limestone fault breccia. Mining at a rate of 5000 tonnes of ore and 13 000 tonnes of waste per day ended for the season in mid-September and leaching was halted one month later. Gold production amounted to 951 kilograms (30 600 ounces) recovered from 360 000 tonnes of crushed ore stacked on the heap-leach pad. Another 168 000 tonnes of ore from the Kodiak A deposit is scheduled to be stacked on the Fleece Bowl pad next season. One kilometre north of Kodiak, the Ursa deposit was prepared for production by pre-stripping waste rock and installing the liner on the nearby Totem Creek heap-leach pad. Heap-leach ore reserves in the Ursa deposit are 519 000 tonnes grading 7.0 g/t gold, mineable by open pit. The Kodiak B deposit contains 184 000 tonnes grading 8.7 g/t gold, mineable by underground methods.

On the Ridge zone gold geochemical anomaly, three core holes were drilled beneath previous holes, in search of higher gold grade, but returned low values. Overburden trenching failed to locate the source of auriferous boulders in the C&C zone but helped define a target for continued work. On the Grizzly refractory zone, drilling deviation resulted in two holes missing the projected northern extension of the zone, but a wedged hole intersected 9.6 g/t gold over 3 metres.

TABLE MOUNTAIN MINE

Cusac Gold Mines Ltd. produced 259 kilograms (8331 ounces) of gold from 24 041 tonnes of milled ore at the Table Mountain mine in 1997. Initial production was from the 5700 and 4900 level workings on the Vollaug vein, but gold grade declined to less than 9 g/t due to excessive dilution. Mining was switched to open cuts on the Vollaug vein and the ore averaged 14 g/t gold. The average grade mined was 11.7 g/t Au. Graphite

in Vollaug ore reduced mill recovery which averaged 90% for the year. Production late in the year came from the Melissa vein, accessed from the Cusac decline. Production ceased in November and is not expected to resume in 1998 due to depleted reserves and low gold price.

Exploration focused on the "main mine area" and was prompted by a revised interpretation of displacement of important productive veins east of the Erickson Creek fault. Two long flat drill holes were designed to test for steeply dipping blind veins beneath capping argillite. Two promising intercepts were followed up by closer spaced drill holes. From the Cusac decline, underground development and drilling tested extensions of the Lily and Melissa veins and sought discovery of new veins further to the north.

PREMIER GOLD MINE

The Premier Gold mine which ceased production in 1996, was put under long term care and maintenance by Westmin Resources Limited in August, 1997. Earlier in the year agreement on terms of sale was reached with a prospective buyer, but the transaction was not completed due to decline in gold price and deterioration of related equity markets.

MINERAL EXPLORATION

BABINE CAMP

At Hearn Hill, 75 kilometres northeast of Smithers, Booker Gold Explorations Limited continued a major drilling program for chalcopyrite-cemented breccia within a low grade porphyry copper deposit. The clast-supported breccia consists of angular wall rock rubble partially cemented by coarse grained chalcopyrite, pyrite, calcite and dolomite. Work by previous operators on the Chapman breccia pipe indicates a resource of 143 000 tonnes at an average grade of 1.73% Cu and 0.8 g/t Au. Booker Gold announced that a second breccia pipe, known as the Bland zone is 75 metres wide by 150 metres long and extends to 300 metres in depth, and is expected to release a new resource estimate. In October the company signed a letter of agreement with Noranda Mining and Exploration Inc. to option the adjoining property which contains the undeveloped Morrison porphyry copper deposit.

On the Mac property 70 kilometres north of Burns Lake, Spokane Resources Ltd. continued its exploration of a porphyry molybdenum-copper deposit. A large-diameter core hole was used to collect a metallurgical sample from the Camp zone for which the company

estimates a geological resource of 100 million tonnes grading 0.062% Mo and 0.085% Cu. Two holes tested the Peak zone one kilometre to the south.

Hudson Bay Exploration & Development Company Ltd. staked the **Kut, Len, Ful and Mor** claims in the Babine camp, based on results of a proprietary airborne geophysical survey. Ground geophysical and geochemical surveys were conducted on the claims.

TAHTSA CAMP, HOUSTON AREA

Hudson Bay Exploration & Development Co. Ltd. drilled for the source of boulders containing copper, silver and gold on the **Allin** property, east of the former Equity Silver mine. Only two of eleven holes penetrated capping Tertiary volcanic rocks and these did not intersect significant mineralization in the underlying Goosly ash-flow tuff. Development of the Huckleberry mine has encouraged exploration in the Tahtsa porphyry copper camp; on the Dual lakes property, prospector Robert Hamblin drilled fifteen percussion holes, a geological and geochemical survey was done on the Bay claims by Home Ventures Ltd. and Rupert Seel undertook a geochemical survey in search of gold on the Lean-To prospect.

NECHAKO PLATEAU

Atna Resources Ltd continued exploration of the **Uduk Lake** property for an epithermal precious metal deposit. Prior to 1997, sampling and drilling programs were completed on a 50 to 100-metre wide, 700 metre long silicified zone within Tertiary volcanic rocks. A three dimensional geo-electric survey completed in 1997 detected three areas of high resistivity. One correlates with the previously explored zone of silicification and the other two, both unexplored, are interpreted to be steeply plunging pipes. Previous backhoe trenching encountered strongly anomalous gold values on the edge of one of the 200 to 300-metre wide "pipes" (P. Holbek, p. comm.).

SMITHERS CAMP

Manalta Coal Ltd. continued definition drilling on the **Telkwa** coal prospect 10 kilometres southwest of Telkwa. A total of 72 holes were drilled in the Pit 3 deposit east of Goathorn Creek, six holes in the Pit 6 deposit west of Goathorn Creek and 43 holes were completed in the Tenas Creek deposit, resulting in a significant northern extension of that zone. Samples for acid rock drainage studies were taken from core holes and 27 trenches. Piezometers were installed in surficial and bedrock bore holes to monitor groundwater flow patterns. Revised mineable reserves have not been

announced at the time of writing, but Manalta has declared its intent to produce 1.5 million tonnes of coal per year if government grants a mine development certificate.

On the **Zymo** claims 50 kilometres west of Smithers, Robin Day and Lawrence Hewitt identified anomalous copper and gold in rock and soil derived from a sericite-pyrite-altered stock.

Telkwa Gold Corporation completed helicopter-borne magnetic and EM surveys on the **Del Santo** property and **Pass** claims, located 25 kilometres east and 50 kilometres southwest of Smithers, respectively.

NORTH COAST AREA

Bishop Resources Inc. explored the **Scotia** stratabound zinc prospect in the Ecstall pendant, 40 kilometres southeast of Prince Rupert. Interlayered mafic to felsic gneiss, without distinct marker horizons, contains disseminated to massive sphalerite-galena mineralization containing 5-40% zinc over widths up to several metres. Drilling cut mineralized intercepts tens of metres wide in the core of the zone, but much narrower up and down dip, geometry previously interpreted by Texasgulf Inc. to result from tight folding. The objective of this year's drilling by Bishop Resources was to extend the zone and elucidate its structure. Based on its own and previous drilling the company announced a resource of 224 000 tonnes grading 12.2% Zn, 1.2% Pb, 0.2% Cu and 23 g/t Ag. Additional claims were staked in the Ecstall belt as a result of reconnaissance exploration.

Southwest of Prince Rupert, Porcher Island Gold Corporation cored nine holes on the **Porcher Island** gold property. Gold occurs in quartz-pyrite veins which occupy shear and dilatant structures within a quartz diorite. The aim of the program was to add to the geological resource in the AT zone, above the 1015 level adit. The company located what it interprets to be a fault offset continuation of the AT zone.

At **Surf Inlet**, 100 kilometres south of Kitimat, Rupert Resources drilled from a new crosscut on the 550 level for the down-dip extension of the Surf mine orebody. The gold-bearing quartz vein dips onto claims that were formerly held under separate ownership.

QUEEN CHARLOTTE ISLANDS

Misty Mountain Gold Ltd. continued its re-evaluation of the Specogna gold deposit on the **Harmony** property, an epithermal hot spring deposit on an offshoot of the Sandspit fault. The company announced a revised mineable resource estimate of 52.7 million tonnes

grading 1.70 g/t Au at a cutoff grade of 0.8 g/t and 1.2 waste to ore ratio. A 1700-kilogram sample was collected for column testing of biological oxidation followed by heap leach extraction of gold. The potential for "bonanza" grade gold mineralization in structural conduits 200 metres below the Specogna deposit was tested by six drill holes. Induced polarization and geochemical surveys were completed on prospective areas 5 kilometres north and 8 kilometres south of the deposit.

Okak Bay Resources Ltd. completed geological mapping, soil geochemistry and induced polarization surveys on the Southeaster epithermal gold prospect. The intent was to trace mineralized structures from volcanic rocks into a granite pluton which might sustain wider vein-filled fracture zones. The property is 25 kilometres southeast of the Specogna deposit, on a splay of the Sandspit fault.

STEWART CAMP

Teuton Resources Corp. and Minvita Enterprises Ltd. continued to drill the Clone gold-cobalt prospect situated on a nunatak 18 kilometres southeast of Stewart. As a result of the 17-hole program, the company theorizes that cross structures to the sulphide and hematite shear zones control gold-cobalt mineralization (D. Cremonese, p comm.).

On the Ashwood property, 25 kilometres south of Stewart, Golden Fortune Investments Ltd. tested a gold soil anomaly with six core holes. Several intervals 2 to 20 metres wide assayed 100 to 400 ppb gold.

Westpine Metals Ltd. carried out a Max-Min electromagnetic survey on the Golden Opportunity property located 60 kilometres north of Stewart. No conductor was detected and the company concludes that the source of gold and base metal bearing boulders is too small to be economically significant.

ISKUT CAMP

Homestake Canada Inc. continued to explore the Snip mine area for gold deposits. On the Chopin property located on Bronson Creek, gold soil geochemical anomalies led to discovery of alteration zones comparable to the Twin zone at Snip. These were tested by four core holes. Assay intercepts averaged 1 to 5 g/t gold over 0.5 to 1 metre. One exceptional intercept graded 15 g/t gold over 0.5 metre. Similarly, on the Jim claims west of Snip mine, a program of soil geochemistry and trenching identified structures and rock alteration zones parallel to the Twin vein which were tested by drilling. Results were disappointing.

International Skyline Gold Corporation acquired mineral claims covering the high wall south of its proposed Bronson Slope open-pit gold-copper mine from Prime Resources Group Inc. Six holes in the high wall area, drilled under the agreement with Prime Resources, intersected a zone of disseminated pyrite in hornfels that averages 0.58 g/t gold across 70 metres. Based on 14 800 metres of drill-hole data, International Skyline calculates a mineable resource in the Bronson Slope porphyry deposit of 76 million tonnes grading 0.44 g/t Au, 0.162% Cu, 2.7 g/t Ag and 0.007% Mo.

Whitegold Resources Corp evaluated the Brill wollastonite skarn zone on the Isk property, 14 kilometres west of Snip mine by rock trenches and core drilling. The company estimates a resource of 2 million tonnes containing 45% wollastonite and proposes to develop a quarry which would produce 50 000 tonnes annually during a three month mining season.

The Eskay Creek area was explored for precious metal enriched exhalative massive sulphide deposits. On the Corey property, Kenrich Mining Corp. did geological mapping and soil geochemical surveys in the area of four showings found last year. Prime Resources Group acquired part of the Corey property from Kenrich, including the Battlement, Bench and Cumberland zones. A previously unmapped zone of Eskay-correlative stratigraphy was discovered, comprising rhyolite overlain by mudstone and pillow basalt, which will be investigated further in 1998. A single stratigraphic hole was drilled at the south end of the Bench grid, near Sulphurets canyon. Also in the Eskay Creek area, Canamera Geological Ltd. mapped Eskay Creek hangingwall stratigraphy in the Unuk River syncline on the Afton, Calvin, Dup, Fred and Noot claims. At Treaty Creek, Teuton Resources Corporation and Global Explorations Ltd. drilled eight holes on epithermal zones containing orpiment, native sulphur and alunite.

UPPER SKEENA DISTRICT

Following release of regional silt geochemical data in the McConnell Creek map area (NTS 94D) Cyprus Canada Inc. staked claims in the Kitlangas Creek watershed, near the confluence of the Sustut and Skeena rivers, and prospected the area.

Exito Minerals Ltd. tested blind induced polarization and magnetic anomalies on the Red property 190 kilometres north of Smithers for porphyry copper mineralization in a monzonite feldspar porphyry. Eight holes were drilled.

STIKINE DISTRICT

No work was done on site at the **Red Chris** porphyry copper-gold deposit. American Bullion Minerals Ltd. considered a lower cost alternative to development of a conventional open-pit mine and mill. An economic scoping study looked at the viability of extracting rock from an open pit by means of ore and waste passes leading to an underground haulage level and thence to a mill site in the adjacent valley.

On the **Mountain** property 140 kilometres east of Eddontenajon, Waymar Resources Ltd. drilled a hole into a pyritic hornfels and skarn zone to test a gold soil anomaly. Feldspar porphyry dikes cut strongly fractured and quartz-veined rocks.

Teck Exploration Limited explored a 7 kilometre long quartz-sericite-pyrite alteration zone in Hazelton Group andesite on the **Castle** property 10 kilometres west of Eddontenajon. Rock sampling returned 1 to 3 g/t gold over widths of 2 to 5 metres.

KUTCHO - TURNAGAIN DISTRICT

Atna Resources Ltd. conducted electromagnetic surveys on its **Kutcho** property 10 kilometres west of the Kutcho Creek volcanogenic massive sulphide deposit. Core drilling targeted several conductors and a zone of silica exhalite associated with quartz-phyric felsic volcanic rocks. Narrow zones of disseminated to semimassive sulphide were intersected.

Atna Resources Ltd. also explored the **Horn** claims in the Turnagain River area by stream sediment and soil geochemical sampling, prospecting and reconnaissance geological mapping. The claims were staked after release of a stream geochemical survey by the B.C. Geological Survey in 1996. Strongly anomalous multi-element stream sediment anomalies are believed to be derived from Earn Group strata.

Bren-Mar Resources Ltd. continued its drilling program on the **Turnagain** nickel prospect 70 kilometres east of Dease Lake. Nickel occurs as a magmatic segregation near the east margin of a zoned Alaskan-type ultramafic pluton. Three of fourteen holes drilled in the past two years returned broad intercepts of nickel and cobalt; 90 to 260 metres averaging 0.24 to 0.31% Ni and 0.016% Co. Test work to determine metal recovery was begun so that the potential for a bulk-tonnage deposit can be considered.

On the **Mount Shea** claims, 60 kilometres east of Dease Lake, Loumic Resources Ltd. searched for the source of placer gold in Alice Shea Creek. Eleven holes

were drilled to test geophysical and soil geochemical targets, but no significant gold values were encountered.

On the **Nizi** property 80 kilometres northeast of Dease Lake, Madrona Mining Limited drilled five holes to evaluate epithermal mineralization in brecciated felsic volcanic rocks. The company considers the Discovery, Hill and Zinc Lake zones to be prospective for a high-grade or bulk tonnage precious metal deposit and proposes more drilling in 1998.

Nephrite jade lenses, formed at the tectonic contact between serpentinite and argillaceous sedimentary rocks, were exposed by trenching on the **Kutcho Jade** property by Jade West Resources Ltd.

KECHIKA DISTRICT

Donegal Developments Ltd. conducted lake sediment and soil sampling on the 1800-unit **Kechika** property of Tizard Explorations Inc. in the northern Kechika Trough, an area underlain by Proterozoic to Paleozoic carbonate and clastic sedimentary rocks and considered prospective for sedimentary exhalative deposits. An extensive airborne magnetic survey, undertaken to detect mineral deposits, outlined areas underlain by Tertiary-Quaternary basalt and detected structural features such as the apparent northern continuation of the Rocky Mountain trench.

Cominco Ltd. evaluated fifteen properties acquired on the basis of geological mapping and regional lake sediment geochemistry surveys by the B.C. Geological Survey. Stratiform zinc mineralization within baritic black shale on the **Term** property was exposed by trenching, but thickness and grade were considered insufficient to justify further work. Soil surveys were conducted around lakes with elevated lead, zinc and barium in sediment, despite extensive lacustrine deposits. At least one anomalous area was found which may be further evaluated by an induced polarization survey.

Fireside Minerals Inc. mined and shipped a 9800-tonne bulk sample from the Moose and Bear veins on the **Fireside** barite property 75 kilometres east of Lower Post. Barite veins from 2 to 10 metres wide, with associated mafic dikes, follow north and northeast brittle fracture and fault zones within siltstone and slate. Barite was excavated from open cuts up to 10 metres deep. The product was crushed and sorted by jigs on site, to maintain a specific density greater than 4.2, and trucked to Watson Lake for grinding and bagging.

CASSIAR CAMP

A series of zinc bearing skarn zones and related porphyry molybdenum deposits on the **Haskin-Reed**

property were re-examined by Demand Gold Ltd. The deposits, explored by a series of major and junior resource companies since 1968, occur where the early Tertiary Mt Reed and Mt Haskins biotite granite stocks intrude Lower Cambrian limestone. Work in 1997 included 14 core holes on the Brett zone from which the company calculates a "drill inferred reserve" of 450 000 tonnes grading 10% Zn. Eight holes were also completed on the A zone where Della Mines Limited previously established a "drill inferred resource" of 270 000 tonnes grading 5% Zn, 3% Pb and 34 g/t Ag. Demand Gold and associated company Cusac Gold Mines Ltd. are considering mine development with treatment of ore at the Table Mountain mill.

At the former Cassiar mine B.C. Chrysotile Corporation continued to prepare a pilot plant which will determine the feasibility of recovering chrysotile fibre from the tailings of the former operation. About 8 tonnes of fibre were produced for trial marketing and the company aims to produce 12 000 to 15 000 tonnes in 1998.

RANCHERIA CAMP

Imperial Metals Corporation conducted geological mapping, a seismic survey and diamond drilling on the **Silvertip** (formerly Midway) prospect 85 kilometres southwest of Watson Lake, with the objective of extending the Discovery and Silver Creek zinc-lead-silver manto deposits. The seismic survey holds promise of detecting the unconformable contact between the McDame Group limestone and overlying Earn Group shale and sandstone. Irregularly shaped deposits of massive silver-lead-zinc sulphides occur at or just below the unconformity. The best potential for additional reserves is interpreted to be south and southeast of the known deposits, in the direction of an interpreted intrusive source, but difficult drilling conditions prevented testing of primary targets. Drilling of a secondary target northwest of the Silver Creek deposit resulted in discovery of a 150 metre extension of the zone and was incorporated into a new resource estimate of 2,570,000 tonnes grading 325 g/t Ag, 6.4% Pb, 8.8% Zn and 0.63 g/t Au. Extraction of a 10 000 tonne bulk sample is planned by extending previous underground development.

TULSEQUAH CAMP

Canarc Resource Corporation continued its program of underground rehabilitation and detailed diamond drilling to define mineable reserves at its **New Polaris** gold property (formerly Polaris Taku mine). The Polaris level portal was re-established, the mine dewatered down

to 180 metres below the Polaris level, services were re-installed in the winze and 8 855 metres of drilling completed before work was suspended due to lack of funds. Most holes targeted vein zones within the mine workings but outside the previous resource estimate. The Serpentine and D zones, two new gold veins, were found by diamond drilling near the north end of the old workings. Canarc's best intercept, 14.4 g/t Au over an estimated true width of 18 metres, was an in-fill hole in the C zone below previous mining.

ATLIN CAMP

On the **Bennett** property, 75 kilometres northwest of Atlin, Brett Resources Inc. tested the strike extent of gold mineralization in the Skarn zone with eight drill holes, and the Plateau geophysical anomaly with two holes. The Skarn zone, a 500 by 150 metre auriferous iron gossan and carbonate alteration zone was extended 300 metres south by drilling. A drill hole at the southern end of the zone returned an intercept of 7.64 g/t Au over 3.5 metres. The cause of the Plateau geophysical anomaly was found to be graphitic fault breccia with geochemically anomalous gold.

Placer mining continues to be the economic mainstay of Atlin. The most significant mining operations in 1997 were those of Newstar Placer Inc., Daniel Johnson, on **Spruce Creek**, Ruby Gold Ltd. on **Ruby Creek**, Sisters Resources on **Wright Creek** and West Coast Paving on **McKee** and **Eldorado** creeks.

MINING AND EXPLORATION REVIEW FOR NORTHEAST-CENTRAL BRITISH COLUMBIA - 1997

By Bob Lane, P.Geo.
Regional Geologist, Prince George

HIGHLIGHTS

- The Mount Polley 18 000 tpd open-pit copper-gold mine, jointly owned by Imperial Metals and Sumitomo, officially opened on September 13, 1997.
- Construction of the \$430 million Kemess South gold-copper project, owned by Royal Oak Mines Inc., progressed rapidly and by year-end was approximately 80% complete. Start-up of the 47 700 tpd operation is scheduled for April, 1998.
- Renegotiation of a 5-year contract between the Japanese steel industry and the Bullmoose and Quintette coal mines was successfully completed.
- Development of the Babcock phase 1 pit at Quintette begun.
- Pine Valley Coal Ltd. submitted its project report on the Willow Creek coal property to the provincial Environmental Assessment Office. The company conducted two rotary drilling programs and increased clean coal reserves.
- Kinross Gold Corporation announced that the QR gold mine would close and be placed on full care and maintenance, starting March 1, 1998. An aggressive diamond drilling program at the minesite has led to several new discoveries.
- International Wayside Gold Mines Ltd. continued its underground rehabilitation and exploration program at the former Cariboo Gold Quartz mine.
- Americas Gold Corporation completed major diamond drilling programs on the JD and Al epithermal gold properties in the Toodoggone.
- The Prospectors Assistance Program awarded grants totaling \$68,242 to support nine grassroots exploration projects in the region.

EXPLORATION TRENDS

Exploration activity and expenditures in the region decreased in 1997, breaking a three-year upward trend. The estimate of 1997 exploration expenditures in the region is \$13.8 million (Figure 1), approximately 15% less than was spent in 1996. Surprisingly, the amount of exploration drilling increased significantly, to approximately 87 200 metres (Figure 2), primarily as a result of several large minesite programs.

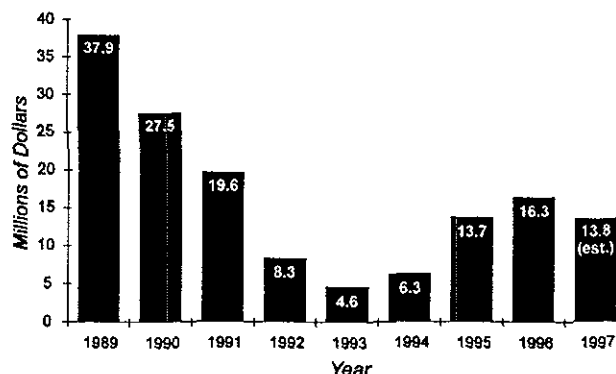


Figure 1. Annual exploration expenditures, Northeast-Central Region.

Notice of Work submittals for the year decreased marginally from 686 to 641. Although there were 25 fewer placer notices and 20 fewer mineral notices in 1997, more alarming was the number of approved projects which did not proceed from the planning stages. There were 164 mineral notices approved, representing 146 different projects, although only 91 were active.

The search for precious metal enriched porphyry deposits and auriferous vein systems accounted for well over half of the projects in the region and more than 62% of exploration dollars spent during the year (Figure 3). The recent opening of the Mount Polley and Huckleberry open-pit copper-gold mines, together with the aggressive construction of the Kemess gold-copper project, spurred exploration for precious metal enriched porphyry deposits. There was renewed interest in known porphyry

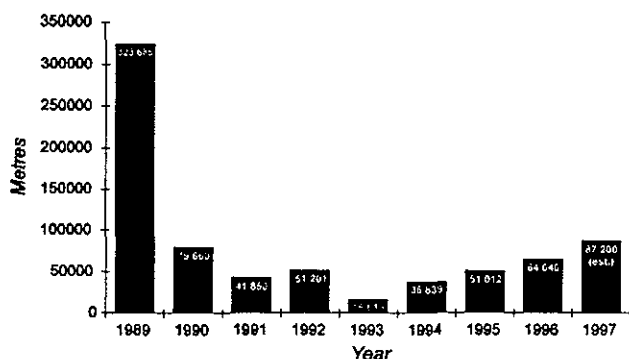


Figure 2. Annual exploration drilling, Northeast-Central Region.

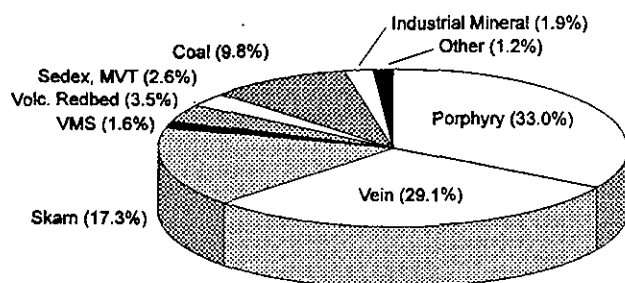


Figure 3. Exploration targets expressed as a percentage of the \$13.8 million spent in the Northeast-Central Region during 1997.

copper-gold and copper-molybdenum prospects (*i.e.*, Pine and Jean) in the northern and southern Omineca Mountains, respectively, and continued aggressive exploration in the Toodoggone district for epithermal gold deposits (*i.e.*, JD prospect). In the Cariboo (southern Quesnel Trough) exploration primarily targeted gold-enriched porphyry and related systems. One exception was the continuing re-evaluation of mesothermal gold vein and replacement mineralization at the former Cariboo Gold Quartz mine near Wells.

There were 28 major projects (those that involve mechanical disturbance and expenditures exceeding \$100,000), 17 of which took place in the Omineca Mining Division (13 in the Omineca Mountains, primarily in the northern Quesnel Trough, and 4 in the Nechako Plateau area), 4 in the Liard Mining Division (3 coal and 1 industrial mineral) and 7 in the Cariboo Mining Division. Five of the 28 major projects were on active minesites (Gibraltar, QR and Mount Polley in the Cariboo; Quintette and Bullmoose in the Northeast Coal Block), and together account for more than 22% of all exploration dollars spent in the region (Figure 4). Major exploration projects in 1997 are listed in Table 1; these and selected, smaller projects are briefly described below.

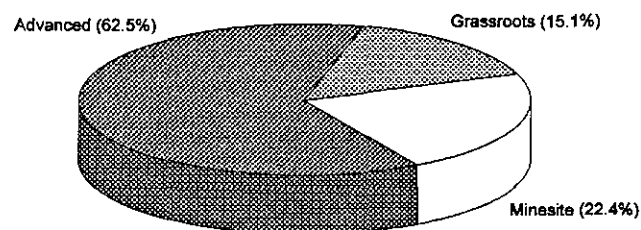


Figure 4. Exploration by category of program.

METAL MINES

In 1997, there were three operating metal mines in the region, all in the Cariboo. The **Mount Polley** copper-gold mine (Photo 1), located 56 kilometres northeast of Williams Lake, was officially commissioned on September 13th, 1997. It is the first mine to open in the region since the QR gold mine was commissioned in May, 1995. The mine is owned jointly by Imperial Metals Corporation (55%) and Sumitomo Corporation of Japan (45%). Construction was completed in June at a cost of \$115 million, approximately \$8.5 million under budget and almost five months ahead of schedule. Full production of 18 000 tonnes per day (tpd) will yield 71 500 ounces (2.22 million grams) of gold and 29 million pounds (13 200 tonnes) of copper per annum over the project's 12-year mine life. The operation has created about 170 new, full-time jobs.

The Mount Polley deposit consists of three zones, Cariboo, Bell and Springer, with combined mineable ore reserves of 82.3 million tonnes grading 0.3% Cu and 0.417 g/t Au. The deposit is contained within the Early Jurassic Polley stock, composed mainly of diorite and intrusion breccias, that cut Triassic Nicola Group volcanic rocks.

By the end of the year 2.45 million tonnes of ore from the Cariboo pit had been milled. Approximately 19 600 ounces (610 000 grams) of gold, 16 400 ounces (510 000 grams) of silver, and 8.77 million pounds (3978 tonnes) of copper were recovered. Current mining is in the north end of the Cariboo pit and will progress southward to a copper oxide rich area where gold grades are consistently over 0.5 g/t. In November, the mill processed an average of 15 700 tpd (88% of capacity).

A total of 15 diamond-drill holes and 17 percussion-drill holes tested the east and south margins of the Cariboo pit for additional ore grade mineralization. Mineralized breccias, similar to those that host the majority of the orebody, were identified but were of sub-

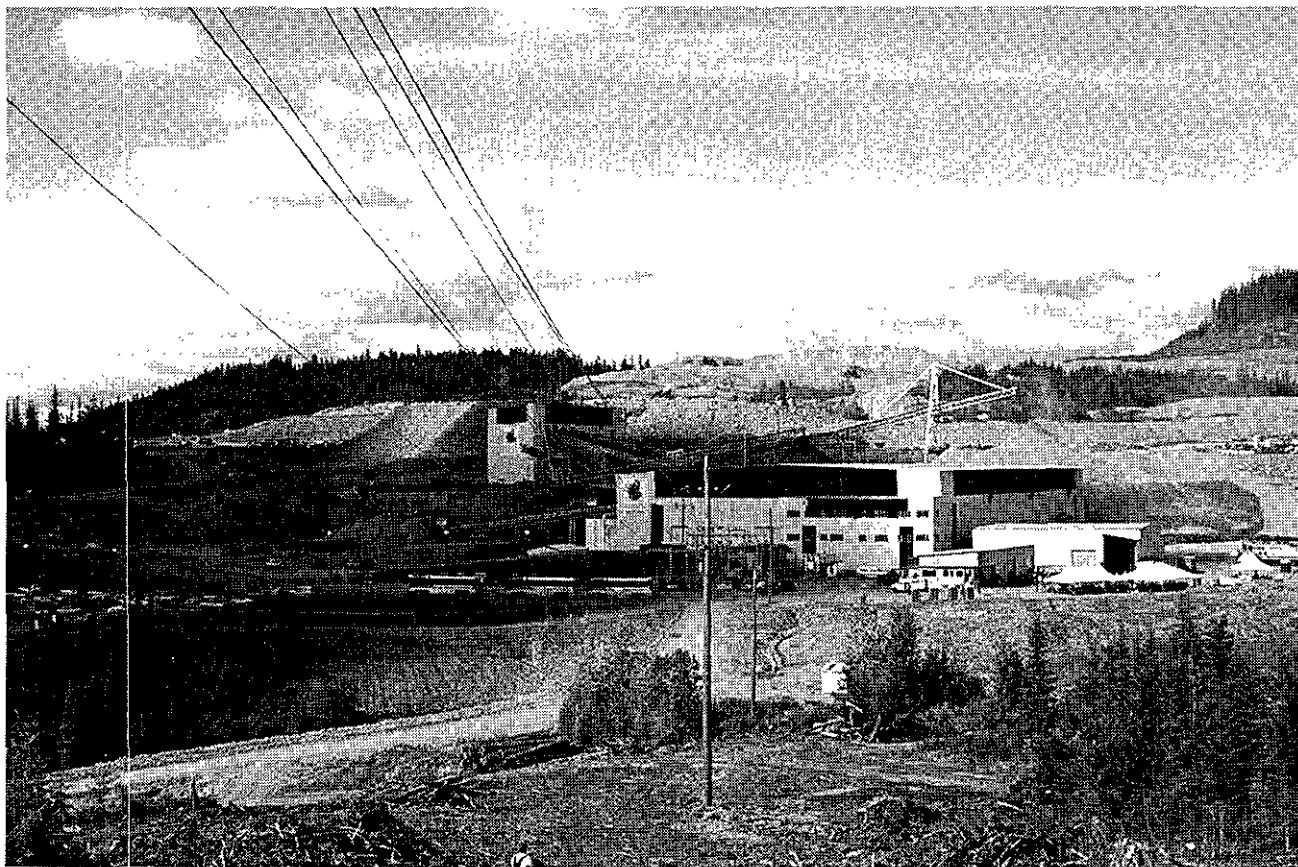


Photo 1. Looking northerly toward the Imperial Metals Mount Polley mine during the official opening (September 13th, 1997).

economic grade. However, the drilling program did prove that the mineralized system extends further south than was previously recognized. A property-wide bedrock mapping program was also initiated.

The QR gold mine, owned and operated by Kinross Gold Corporation, struggled in 1997 during its conversion from an open-pit operation to primarily an underground producer. The sobering but expected closure announcement came from the company on December 8th that, as of March 1st, 1998, the mine will be on full care and maintenance. Higher operating costs associated with underground mining, a wall failure in the Main pit that temporarily halted mining, and a weakening gold price contributed to the closure.

The QR deposit occurs in hornfelsed and propylitically altered Nicola Group volcanics within the thermal aureole of an Early Jurassic diorite intrusion (the QR stock). Three ore zones have been mined. The Main zone open pit was mined out in the fall, two small open pits were developed on the West zone, and the Midwest underground zone is currently in production.

Early in the year the mill operated well above capacity at 1400 tpd, but as the world price for gold fell, a reassessment of QR's economics resulted in the underground cutoff grade being raised from 2.5 g/t Au to 3.5 g/t Au and throughput being reduced to 600 to 800 tpd. Mill feed came primarily from the Main zone, a small open pit on the West zone (South Lobe), and low-grade stockpiles. More than 1700 metres of underground development was completed on the Midwest zone in 1997 with mining taking place on four levels. It generated about 80 000 tonnes of ore in 1997, and it will be the only active zone in 1998, prior to closure. A prestrip program on the West zone will not proceed because of the current unfavourable economic conditions.

In 1997 approximately 309 000 tonnes of ore with an average headgrade of 4.29 g/t Au were processed. Metal production for the year totaled 40 967 ounces (1 274 200 grams) of gold and 10 516 ounces (327 000 grams) of silver. Operating costs over the first nine months of the year averaged US\$391 per ounce of gold produced.

Kinross conducted an aggressive exploration program in 1997. A detailed soil geochemical survey was completed over large areas west of the Midwest zone, northwest of the West zone and south of the Quesnel River. A 169-hole, 24 500-metre diamond drilling program followed. Drilling targeted the North zone (a faulted-off extension of the Main zone) and areas outlined by gold geochemical anomalies immediately west of the Midwest zone and northwest (along strike) of the West zone. The two-drill program produced some encouraging results, but a significant amount of data has not been fully assessed.

The **Gibraltar** copper-molybdenum mine is owned and operated by Westmin Resources Ltd. In 1997 the mine produced approximately 33 200 tonnes of copper and 164 tonnes of molybdenum in concentrate, from 13.0 million tonnes of ore milled at a rate of about 35 700 tpd. An additional 2722 tonnes of cathode copper was produced from the solvent extraction-electrowinning plant (SX-EW) via acid-leach processing of low-grade ore and oxide material. The porphyry deposit occurs in the Early Triassic Granite Mountain batholith, a zoned subalkalic body that intrudes the Permian Cache Creek Group. The orebodies occur within a broad, easterly trending zone of shearing and alteration. Mining was primarily in the Gibraltar East stage 3 pit. Reserves in this pit will be exhausted late in 1998, at which time production from the Pollyanna stage 4 pit will begin. A program of stripping waste from Pollyanna began in the fall and is expected to take about 12 months to complete. Oxide material totaling 468 500 tonnes was mined from the Pollyanna - Gibraltar East Connector zone (Connector zone).

In 1997, a 34-hole, 6458-metre exploration drilling program in the Connector zone identified 44 million tonnes of sulphide ore, a reserve equivalent to 3.3 years of production. The program also outlined 13 million tonnes of oxide material that will extend the life of the SX-EW plant by 6 to 7 years. The total mineable sulphide ore reserve for the Gibraltar copper-molybdenum porphyry deposit, as of December 31, 1997, is 184.4 million tonnes grading 0.310% Cu and 0.010% Mo. The total leachable ore reserve is 16.3 million tonnes at an acid-soluble grade of 0.151% Cu.

The **Baker** gold mine, a small seasonal operation in the Toodoggone camp, is owned by Sable Resources Ltd. In 1997 the company mined and milled approximately 1600 tonnes of ore from the Multinational Vein 'B' deposit, a gold-silver-copper vein in andesites of the Upper Triassic Takla Group. This deposit is now effectively mined out. Sable also processed 544 tonnes of tailings. Total metal production was 1128 ounces

(35 800 grams) of gold, 7083 ounces (220 300 grams) of silver and 9868 pounds (4.5 tonnes) of copper.

The company conducted a limited sampling and trenching program and drilled two areas of the surrounding Chappelle property to test for additional reserves. The narrow and limited size of the vein ore shoots proved to be a difficult exploration target.

COAL MINES

There are two operating coal mines in the Northeast-Central Region. The Quintette and Bullmoose operations, both located near the town of Tumbler Ridge, produce metallurgical grade sub-bituminous coal that is exported to Japan. The two mines received good news this year when their contracts with the Japanese steel industry were renegotiated. The new 5-year deal, announced May 6th, secures markets for northeast coal until March, 2003. Commencing in 1998, Quintette will supply 3 million tonnes annually, a reduction from the previous sale of 4.35 million tonnes per annum. Bullmoose will supply 1.6 million tonnes annually beginning in 1999. Unfortunately, the reduction in coal sales will result in the permanent lay-off of 276 employees at Quintette.

The **Quintette** coal mine, operated by Teck, produced an estimated 3.8 million tonnes of clean metallurgical coal in 1997. Approximately 0.5 million tonnes were produced from the Little Windy pit at Babcock. Close to 1 million tonnes were recovered from the Shikano pit which was mined out in the fall. The remaining tonnage was mined from Mesa and Mesa Extension. Clean coal reserves, at the end of 1997, are an estimated 21 million tonnes.

Development of the Babcock deposit began early in the year. The deposit covers the top of Mount Babcock and is 11 kilometres by haul road from the wash plant. The development is expected to produce 2 million tonnes of clean coal per year over the next 5 years. The life of the deposit could extend beyond 2003 if underground mining proves to be economic. Exploration and development drilling took place within and adjacent to active pits, particularly at Babcock.

The **Bullmoose** mine, 61% owned by Teck Corporation, produced 1.85 million tonnes of clean metallurgical coal during 1997, a slight decrease over the 1996 total of 1.92 million tonnes. Production is from the South Fork pit, which as of December 31, 1997, has 13.0 million run-of-mine tonnes remaining (sufficient until 2003). A 50-hole, 3000-metre reverse-circulation drilling program began in December and by year-end was approximately 50% complete. A feasibility study of the

West Fork deposit is planned for 1998. It contains an estimated resource of 14 million tonnes.

INDUSTRIAL MINERALS OPERATIONS

The Nazko lava rock quarry (photo 2) owned and operated by Canada Pumice Corporation, is located 118 kilometres west of Quesnel. The Nazko cone rises some 170 metres above the surrounding area and is comprised of light and dark olivine basalt flows, vesicular red and black tuff breccia and air-fall tephra, that range in age from as early as 340 000 years BP to 7000 years BP. The sized red, calico and black tephra are sold for a variety of uses, including landscaping, and growing and filtration media. Mining started in early May and continued until the end of October. Production for the year was 11 900 cubic yards shipped, and an additional estimated 7500 cubic yards stockpiled at the site.

Two small limestone quarries, **Giscome** and **Dahl Lake**, produced material used principally for landscaping. The Giscome quarry, 20 kilometres northeast of Prince George, is owned and operated by Kode - Jerrat Quarries Ltd. The Dahl Lake limestone

quarry, 50 kilometres southwest of Prince George, is operated by Northrock Industries Ltd.

MINE DEVELOPMENTS

Construction of the \$430 million **Kemess** mine (Photo 2), owned and operated by Kemess Mines Inc., a wholly owned subsidiary of Royal Oak Mines Inc., is approximately 80% complete and on schedule to open in April, 1998. The project is located 300 kilometres northwest of Mackenzie and, although remote, is accessible by road. A recently constructed airstrip also services the project. Construction of the 384-kilometre, 230-kilovolt electric transmission line, to the BC Hydro Kennedy substation near Mackenzie, is scheduled for completion in February, 1998. At peak construction during the fall, an estimated 1000 workers were on site. At start-up the mine will employ approximately 310 workers. The 47 700 tpd milling operation will produce approximately 250 000 ounces of gold and 60 million pounds of copper each year over its minimum 16-year life. The mineable reserve in the Kemess South deposit is 200 million tonnes grading 0.63 g/t Au and 0.22% Cu.



Photo 2. Dry screening of volcanic material at the Canada Pumice lava rock operation at Nazko cone (October 16, 1997).



Photo 3. Looking north toward the Royal Oak Mines Kemess South mine development (September 12, 1997).

It contains 4.1 million ounces of gold and 900 million pounds of copper. The deposit is hosted by the Early Jurassic Maple Leaf intrusion, a gently inclined sheet of quartz monzodiorite. The orebody measures 1700 metres long by 650 metres wide and ranges from 100 metres to over 290 metres thick. A blanket of copper-enriched supergene ore, containing native copper, overlies hypogene ore which comprises 80% of the deposit.

The Kemess South deposit was discovered in 1983 by drilling geochemical and geophysical anomalies. Reserves were outlined by extensive diamond drilling up until 1991. Prospectors were originally drawn to the region by the prominent gossans that occur immediately to the north, and in part comprise the Kemess North deposit. It contains an estimated 1.9 million ounces of gold and more than 600 million pounds of copper.

Since late 1995, Placer Dome Inc. has continued to reevaluate components of its Mt. Milligan bulk-tonnage porphyry copper-gold deposit, located 86 kilometres

north of Fort St. James. In November 1997 the company outlined an \$800,000 pre-feasibility program that would fully review all aspects of the project's economic viability. The pre-feasibility study is targeted for completion by May, 1998, and is focused on lowering significantly the Cdn\$615 million capital cost and \$5.58/tonne operating costs of the project. Mt. Milligan's mineable reserve is 257 million tonnes grading 0.51 g/t Au and 0.24% Cu. The company's most recent evaluation and optimization of the project has indicated that processing ore at a rate of 45 000 tonnes per day would produce 200 000 ounces of gold and 31 000 tonnes of copper annually over the 16-year life of the project. To increase the project's net present value (NPV) the company has selected a proprietary hydrometallurgical treatment to process the concentrate on site. Power for the operation would be supplied by an 87-kilometre, 230-kilovolt transmission line extending westward from BC Hydro's Kennedy substation, south of Mackenzie. The mine would require a workforce of 310.

EXPLORATION HIGHLIGHTS

GATAGA/KECHIKA TROUGH

There were only a handful of exploration projects in the Gataga region this year and they proceeded, at least in part, to fulfill assessment obligations. Teck Exploration conducted large soil geochemical surveys on its Elf and Fluke sedex Zn-Pb-Ag properties. Ecstall Mining Corporation conducted modest sampling programs on its North Gataga claims, but exploration on the Akie Zn-Pb-Ag sedex deposit did not proceed in 1997 after two consecutive years of diamond drilling.

NORTHERN QUESNEL TROUGH

The northern Quesnel Trough was one of the more active areas in the region. In the Toodoggone, Americas Gold Corp. (AGC) and project partner Antares Mining and Exploration Corp. completed a major diamond-drilling program on the JD epithermal gold property. A total of 7356 metres were drilled this year in 49 holes. Most of the drilling focused on further defining the Finn zone, a 9-metre wide tabular vein and breccia body which had been traced by drilling for more than 350 metres. A total of 27 holes was drilled on the Finn zone. Six other zones were drilled, including the Creek zone, an new epithermal vein discovery 2.8 kilometres west-northwest of the Finn zone. The Creek zone has an apparent north-northwest trend and occurs within a coincident IP and multi-element geochemical anomaly 700 metres long. Seven of the eight holes drilled on the zone intersected auriferous quartz-carbonate veins and stockwork zones. Hole CZ97-08 cut 18 metres averaging 14.33 g/t Au. This interval includes a 4-metre section of semimassive to massive sulphide mineralization that averages 61.16 g/t Au, 92.3 g/t Ag, 1.34% Cu, 0.46% Pb and 11.7% Zn.

Americas Gold Corp. acquired the AI property, immediately west of JD, from Energex Minerals in 1996. In 1997 the company drilled the Thesis and Bonanza zones, two small epithermal gold deposits that were partly mined by Cheni Resources in the early 1990s. The two high-grade deposits are characterized by veins of coarse crystalline barite carrying free gold, within frothy-textured, clay-altered intermediate volcanics. The recent program tested their bulk-mineable potential.

The AGC-Antares partnership will likely carry out a similar scale program on the JD and AI properties next year and may conduct a modest diamond-drilling program on the old Lawyers mine property. A mag-EM radiometrics survey was flown over the company's extensive parcel of mineral claims, including the AI and JD properties, and may lead to new discoveries.

Stealth Mining completed a 12-hole diamond-drilling program on the Pine alkalic porphyry copper-gold system, 25 kilometres north of the Kemess mine. The prospect, optioned from Electrum Resources, was last drilled in 1993, by Romulus Resources. The property is underlain by porphyritic dacite and rhyodacite flows of the Saunders Member (Lower Jurassic Toodoggone Formation) that are intruded by an Early to middle Jurassic quartz monzonite pluton. This year's drilling program tested the Pine zone, the furthest west of three zones (the others are the Tree and Fin) that are part of a 3.5 kilometres long, northeast-trending IP chargeability high (>20 milliseconds). Propylitic alteration is widespread, but the best-looking mineralization occurs in potassically altered quartz monzonite that is cut by a network of magnetite-chalcopyrite-bornite-quartz veinlets. Assays released include encouraging copper-gold intervals in holes P97-4 (101.7 metres averaging 1.6 g/t Au and 0.15% Cu) and P97-8 (144.5 metres grading 0.49 g/t Au and 0.17 % Cu). Numerous narrow, high-grade gold intervals (1.3 metres grading 215.9 g/t Au and 3.0 metres grading 36.17 g/t Au, both in hole P97-4) were also reported. The company feels that it has increased the geological resource of the Pine deposit from 40 million tonnes grading 0.57 g/t Au and 0.15% Cu (established by Romulus Resources in 1993) to 70 million tonnes with similar or better grades. Stealth Mining plans to return to the property in 1998 to continue drilling off the gold-rich porphyry system.

Electrum Resources conducted geochemical sampling and geophysical surveys over the Pil copper-gold porphyry system located north of the Pine property. The program identified several anomalies that warrant further work. The company also investigated its Atty copper-gold porphyry and Spruce epithermal gold vein prospects.

A five-hole, 734-metre diamond-drilling program was completed by Canasil Resources Inc. on the company's Brenda porphyry copper-gold prospect, a few kilometres north of Pine. The holes were drilled in the White Pass zone, a northwesterly striking system of quartz stockworks and sericite alteration. Drilling intersected several narrow, gold-rich zones (e.g., 24 metres averaging 1.12 g/t Au and 0.13% Cu in hole 97-01 and 45.7 metres grading 1.52 g/t Au) that enhance the potential of the property.

Exito Minerals completed a seven-hole, 866-metre diamond-drilling program on the Red prospect, an alkalic porphyry copper-gold system, located 4 kilometres south of the confluence of Two Lake Creek and the Sustut River. Mineralization consists of disseminations and veins of pyrite, chalcopyrite and magnetite, and is

TABLE 1

MAJOR EXPLORATION PROJECTS, NORTHEAST-CENTRAL BRITISH COLUMBIA - 1997

Property (Operator)	Minfile Number	Mining Division	NTS	Commodity	Deposit Type	Work done
Ace (Barker Minerals)	093A 142	Cariboo	93A/14	Cu, Au, Ag, Zn	VMS, vein	11 tr, 1000 m; geochem
AI (Americas Gold Corp.)	094E 079	Omineca	94E/6W	Au	epithermal vein	26 ddh, 3224 m; IP
Baker (Sable Resources)	094E 026	Omineca	94E/6E	Au, Ag, Cu, Zn	epithermal vein	17 ddh, 1235 m; tr; geochem
Beekeeper (Wildrose Resources)	093A 155	Cariboo	93A/6W	Au, Cu	porphyry	13 ddh, 2066 m
Brenda (Canasil Resources)	094E 107	Omineca	94E/2W, 7E	Cu, Au, Ag	porphyry	5 ddh, 734 m
Bullmoose (Teck Corp.)	093P 001	Liard	93P/3	coal	sedimentary	est 40 pdh, 3200 m
Cariboo Gold Quartz (Int'l Wayside Gold Mines)	093H 019	Cariboo	93H/4E	Au	mesothermal vein	u/g rehab; est 80 ddh, 5500 m; tr
CH (Orvana Minerals)	093F 004	Omineca	93F/7E	Au, Cu, Mo	porphyry	7 ddh, 913 m
Chaco Bear (Imperial Metals)	094D 003, 033	Omineca	94D/2W	Au, Ag, Cu, Pb, Zn	porphyry-related	11 ddh, 1350 m
Fawn (Craven Ventures)	093F 043	Omineca	93F/3	Au, Ag	epithermal vein	7 ddh, 620 m; geochem
Gibraltar (Westmin Resources)	093B 012	Cariboo	93B/9W	Cu, Mo	porphyry	34 ddh, 6458 m; IP
Jajay (Lorraine, Dorothy) (Lysander Gold)	093N 002	Omineca	93N/14	Cu, Au	porphyry	6 ddh, 1144 m; geochem
JD (Americas Gold Corp.)	094E 171	Omineca	94E/6E	Au	epithermal vein	49 ddh, 7356 m; IP, airborne geophys
Jean (Continental Energy)	093N 079	Omineca	93N/2W	Cu, Mo	porphyry	11 ddh, 2280 m
Kaza (Everest Mines and Minerals)	093M 111	Omineca	93M/16W	Cu, Au	porphyry	tr; geochem; IP, mag
Laidman (Phelps Dodge)	093F 067	Omineca	93F/3	Au, Cu	porphyry-related	5 ddh, 1004 m; 2 tr, 100 m
LN - Lloyd 2, Nordik (Big Valley Resources)	093A 160	Cariboo	93A/12E	Cu, Au	porphyry	29 ddh, 5152 m
Lustdust (Teck Explorations)	093N 009	Omineca	93N/11W	Au, Ag, Pb, Zn, Cu	skarn	16 ddh, 3063 m; geochem
Mount Polley (Imperial Metals)	093A 008	Cariboo	93A/12E	Cu, Au	porphyry	15 ddh, 1210 m; 17 pdh, 1700 m
Northstar (Everest Mines and Minerals)	094D 032	Omineca	94D/1	Cu, Ag, Au	volcanic redbed	tr; geochem; IP, mag
Pine (Stealth Mining)	094E 016	Omineca	94E/2E	Cu, Au	porphyry	12 ddh, 2200 m
QR (Kinross Gold)	093A 121	Cariboo	93A/12W	Au	skarn	169 ddh, 24 495 m; geochem
Quintette (Quintette Operating Co.)	093P 019	Liard	93P/3E, 93I/14E	coal	sedimentary	86 pdh, 7287 m
Red (Exito Minerals)	094D 078	Omineca	94D/7 & 10	Cu, Au	porphyry	8 ddh, 888 m
Soup (Vital Pacific)	094D 025	Omineca	94D/8E	Au, Cu	skarn	4 ddh, 707 m
Tsacha (Teck Exploration)	093F 055	Omineca	93F/3E	Au	epithermal vein	8 ddh, 1554 m
Willow Creek (Pine Valley Coal)	093O 008	Liard	93O/9	coal	sedimentary	71 pdh, 3400 m; test pits
Wishaw (Ava Resources)	093H 131	Liard/ Cariboo	93H/16W, 93I/1W	dimension stone	metamorphic	predevelopment of quarry site

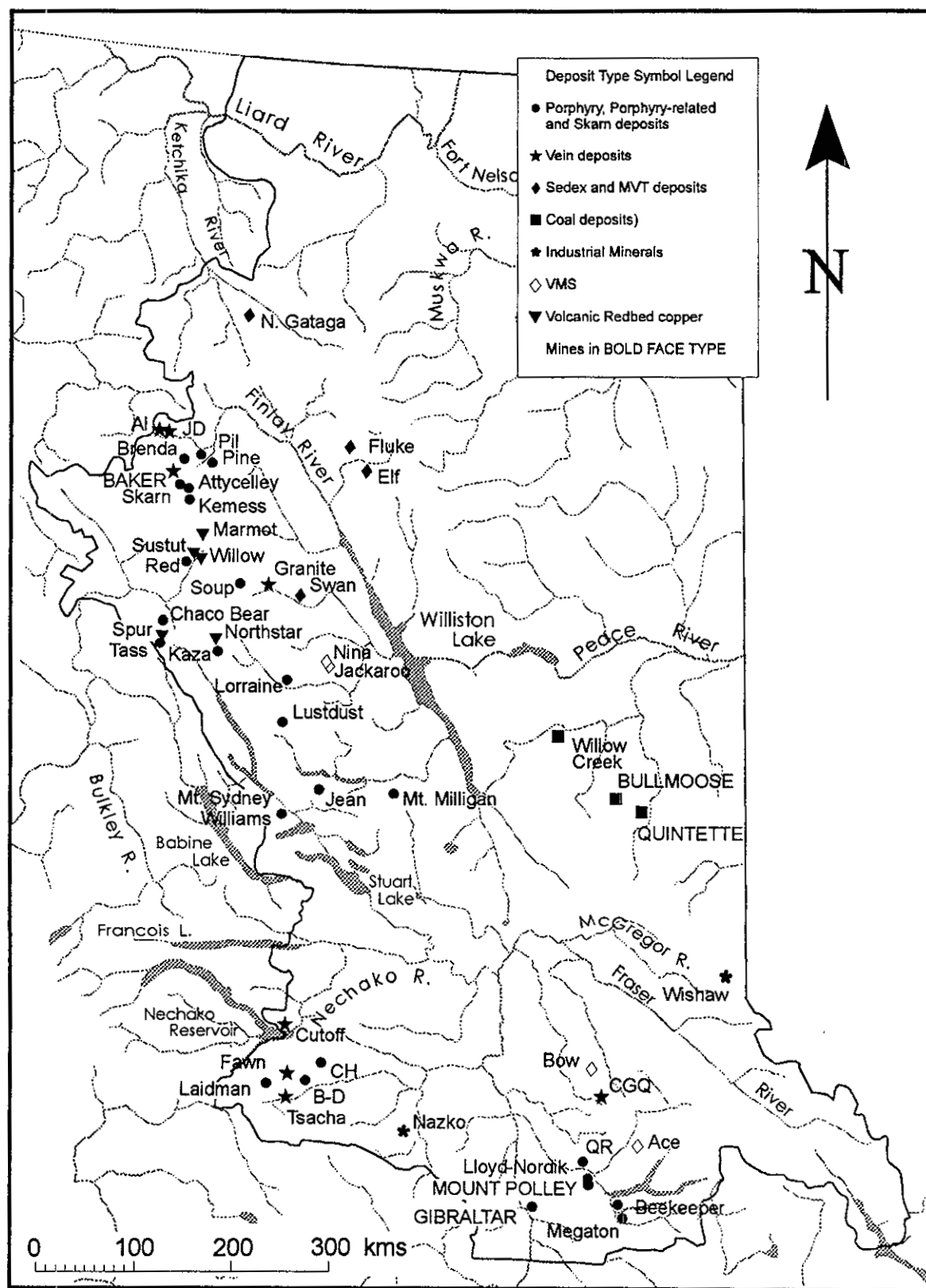


Figure 5. Operating mines and selected exploration projects, northeast-central British Columbia - 1997.

hosted by a series of feldspar porphyry dikes that cut Triassic basalts.

Preliminary examinations were made of several volcanic redbed copper occurrences in the McConnell Creek and Sustut River areas, including the **Thor-Marmot**, by San Telmo Resources, and the **Sustut Copper** and **Willow** prospects, by Cross Lake Minerals.

Vital Pacific Resources Ltd. suspended diamond drilling on the **Soup** property, 15 kilometres south of Johanson Lake, after completing only three holes. The holes were drilled from the same drill platform, 300 metres northwest of the Saddle Gulley zone, and encountered semimassive magnetite skarn. Assay results from the first two holes included 8 metres averaging 1.5 g/t Au and 0.3% Cu in hole S97-1, and 5 metres averaging 1.4 g/t Au and 0.45% Cu.

Northwest of Aiken Lake, Canasil Resources completed four diamond-drill holes on the **Granite Basin** gold prospect. The company built a new drill road upslope from past exploration efforts by Cominco (underground development in 1936-37) and Hemlo Gold Mines (diamond drilling in 1995). Gold mineralization occurs in an east-trending shear zone that dips 40 to 70° to the north, and cuts the host pyritic Takla Group volcanic-diorite sill package. Mineralized zones are bleached, intensely fractured and comprise 2-3% pyrite and traces of mariposite. A 27.25 metre intercept in hole GB97-01 assayed 0.67 g/t Au and 3.0 g/t Ag.

East of Aiken Lake in the Swannell Range, Stratabound Minerals Corp. completed an airborne mag-EM survey over its **Swan Zn-Pb-Ag** Mississippi Valley type prospect. Follow-up ground surveys were designed to delineate targets for diamond drilling in 1998.

West of Bear Lake, Imperial Metals drilled several narrow, copper and silver-rich veins on its **Chaco Bear** property. Eleven holes, totaling 1350 metres, evaluated the Bearnx, Dave/Ron, Cocola and Gossan showings. The narrow vein systems cut intermediate volcanics of the Telkwa Formation (L.-M. Jurassic Hazelton Group) and are comprised of chalcopryite, pyrite and hematite in quartz-carbonate gangue. Diamond drilling produced some good grade intercepts, but the veins did not broaden at depth. South of Chaco Bear, Lucero Resource Corp. conducted an extensive sampling and mapping program to investigate the **Spur** property for its potential to host a volcanic redbed copper deposit. Lucero also evaluated the **Tass** claims, immediately west of Spur, for porphyry copper mineralization.

Everest Mines and Minerals Ltd. completed modest trenching programs to test coincident soil geochemical and induced polarization anomalies on two properties

near Kaza Lake, 30 kilometres due north of Takla Lake. The **Kaza** copper prospect is underlain by Lower Jurassic Telkwa Formation andesitic volcanics that are intruded by felsic dikes of the Eocene Kastberg intrusions. Mineralization consists of porphyry-style fracture-controlled pyrite, chalcopryite, bornite and magnetite, and follows a 150° trend. The best trench sample averaged 1.70 g/t Au and 7958 ppm Cu over 7.5 metres. The **Northstar** property hosts several showings of volcanic redbed copper mineralization in tuffs and sediments of the Dewar Formation and bladed feldspar andesite flows of the overlying Savage Mountain Formation. Trenching exposed northerly trending massive chalcocite-bornite veins and chalcocite-bornite stockwork zones that yielded assays as high as 7.3% Cu and 46.6 g/t Ag over 5.5 metres. Late fall drilling plans did not proceed.

The large **Jajay** porphyry copper-gold property was assembled last year by Lysander Gold Corporation. It is in the Swannell Ranges, approximately 50 kilometres northwest of Germansen Landing. It is underlain by the Hogen batholith, a Late Triassic to middle Jurassic multiphase intrusion of calcalkaline to alkaline composition. In 1997, Lysander drilled two of several known prospects within the middle Jurassic Duckling Creek Syenite Complex. Three holes tested the **Dorothy** claims that are under option from Kennecott Canada Inc. Mineralization at Dorothy consists of sparsely disseminated pyrite and chalcopryite in strongly foliated diorite and migmatite. Coarse knots and stringers of pyrite, chalcopryite and pyrrhotite also occur. Zones rich in secondary biotite appear to be associated with an increase in copper mineralization. Assay results have not been released.

Three holes tested the Bishop zone on the **Lorraine** claims. The first hole was a 55-metre extension of hole 96-44 which ended in a 38-metre interval of pyroxenite, rich in coarse secondary biotite, magnetite and disseminated bornite and chalcopryite. Mineralization observed on surface at Bishop consists primarily of fracture-controlled chalcopryite in syenitic and pyroxenitic intrusive phases. Hole 97-47 cut a 64-metre section that averaged 0.58% Cu and 0.24 g/t Au.

Teck Exploration Ltd. completed a 16-hole, 3063-metre diamond-drilling program on the **Lustdust** gold-bearing polymetallic skarn-manto prospect, 36 kilometres northeast of Takla Landing. The prospect is west of the Pinchi fault, in Permian Cache Creek Group limestone and mafic tuff near the margin of the Hogen batholith. The stratigraphic sequence is cut by a series of felsic sills that are spatially related to alteration and mineralization. Feldspar megacrystic dikes and sills also cut stratigraphy

and are related to a small monzonite plug that is poorly exposed in the northwest corner of the property. Zones of hornfels, calcsilicate skarn and garnetite have developed within the thermal aureole of the stock. Mineralization ranges from proximal skarns to central mantos to distal sulphosalt veins. Drilling targeted the manto and skarn styles of mineralization that were traced by trenching in 1996. Emplacement of the massive sulphides were controlled by karsting, and in part by folding. Fold hinges are structurally thickened and are promising exploration drilling targets. The massive sulphide mineralization in the nose of a fold on the 4b zone ranges from 6.6 to 20.4 metres in true thickness. Blackjack comprises 70-80% of the massive sulphide layers, with pyrite typically averaging 5-10%.

Garnetite skarn had not been identified or evaluated before last year and is a significant exploration target. Each of the two drill holes that tested the zone intersected approximately 120 metres of garnetite and calcsilicate skarn. However the interval averaged approximately 100 ppb Au. Sulphide content of the garnetite and calc-silicate skarn is variable, but probably averages about 3%. Narrow bands of massive to semimassive sphalerite-pyrite occur within the garnetite. Drilling of skarn mineralization north of Canyon Creek, and closer to the intrusion, may proceed in 1998.

South of Takla Lake, First Point Minerals mapped and sampled an unusual nickel prospect on **Mount Sydney Williams**. The exploration target was a large tonnage, potentially leachable nickel deposit hosted by serpentized harzburgite.

Continental Energy completed an 11-hole, 2280-metre diamond drilling program on the **Jean** porphyry copper-molybdenum prospect located 10 kilometres south of Tchentlo Lake. Most of the property is underlain by Middle Triassic to Lower Jurassic Takla Group andesitic flows and pyroclastic rocks that have been intruded by the Jean Marie stock, an Early Cretaceous (130-135 Ma) granodiorite. Mineralization is primarily fracture controlled. Pyrite, chalcopyrite and molybdenite occur in hairline fractures to widely spaced 3-centimetre veinlets, with or without quartz. Mineralized fractures are typically surrounded by well-developed potassically altered envelopes. Pervasive and widespread clay alteration, primarily as a result of plagioclase destruction, gives way to propylitic alteration away from the zone. This year's drilling program tested two zones, 'N' and 'B', that correspond with IP chargeability highs within an east-trending IP anomaly 8-kilometres long. The final two holes of the program produced the most encouraging results (e.g., a 130-metre interval in hole J97-10 averaged 0.3% Cu and 0.006% Mo, and a 186-metre

interval in hole J97-11 graded 0.38% Cu and 0.009% Mo).

NECHAKO PLATEAU

Exploration in the Nechako Plateau was limited to only six projects in 1997. Three focused on epithermal gold prospects and three evaluated gold-enriched porphyry or porphyry-related deposits.

In February, 1997, Teck Exploration made public the results of a resource calculation for the **Tsacha** epithermal vein prospect in the Tommy Lakes area. The main Tommy vein has been traced along strike for 640 metres and averages 4 metres in width. The resource calculation is 478,600 tonnes grading 8.7 g/t Au and 82.3 g/t Ag (using a 3 g/t Au cutoff). Teck, as operator on behalf of joint venture partner Corona Gold, completed a gradient IP survey and drilled eight holes targeting the possible northern extension of the Tommy vein. However, drilling did not encounter any vein material. An unrecognized east-trending(?) structure may have offset the vein system. Future targets are the south extension of the vein system as well as the potential for mineralization at depth.

Phelps Dodge completed a modest diamond-drilling and trenching program on the **Laidman** gold-enriched high level porphyry prospect, 5 kilometres northwest of Laidman Lake. Medium to coarse-grained argillically and phyllically-altered quartz monzonite, part of the Early Cretaceous Capoose batholith, hosts a quartz stockwork to sheeted vein system. The quartz monzonite is cut by medium-grained diorite and biotite feldspar porphyry dikes. Local zones of advanced argillic and potassic alteration are associated with dikes and/or zones of intrusion breccia. Weak hornfels has developed locally. Pyrite, chalcopyrite and minor molybdenite occur in breccia zones, along fractures and as disseminations. Previous bedrock grab samples yielded assays up to 19.6 g/t Au. Phelps Dodge also conducted a modest diamond-drilling program on the structurally complex **Cutoff** epithermal gold property, 10 kilometres northeast of Kenney Dam. A lack of follow-up work suggests that assay results were not favourable.

Kennecott Canada Exploration Inc. continued to explore the **Blackwater-Davidson** porphyry-related polymetallic prospect near Mt. Davidson. The company expanded the existing grids and added I.P. coverage over several areas of the property. Alteration mineralogy and hornfelsing suggest proximity to a buried intrusion.

The **Fawn** epithermal gold prospect, at the east end of Entiako Spur, was revisited by Craven Ventures who drilled the Giver zone. The company also conducted

limited regional-scale sampling of the nearby Fawn 5 gold-copper skarn occurrence. Orvana Minerals Corp. drilled seven holes totaling 913 metres, on the CH porphyry copper prospect, 2 kilometres northwest of Chutanli Lake. Assay results are not yet available from either project.

CARIBOO

Gold-enriched porphyry copper and related skarn deposits continued to be the most popular exploration targets in the Cariboo. Grassroots, advanced and minesite exploration projects were undertaken along a northwest-trending belt, centred on early Jurassic alkalic intrusions, from the Horsefly area north to QR. Exploration primarily for lode gold deposits took place in a parallel trend that passes through the historic mining towns of Barkerville and Wells. There was limited grassroots exploration for volcanogenic massive sulphide (VMS) deposits in the Slide Mountain and Barkerville terranes.

International Wayside Gold Mines Ltd. continued its underground rehabilitation and exploration drilling of the **Cariboo Gold Quartz** mine, a former lode gold producer located near Wells. The 1997 program included underground rehabilitation of the 1500 level 201 x-cut, followed by percussion drilling up to the 1200 level. Surface diamond-drilling of the BC vein and Rainbow zone was completed. A modest trenching program was conducted on the "Wells trend", a northwest-trending zone that lies west of and subparallel to, the Sanders-Rainbow-Pinkerton trend. In addition to the mechanized work, a prospecting and contour soil-sampling program was completed around Cow and Richfield mountains.

All drilling completed by mid-summer, together with existing data from previous operators, was used to calculate a preliminary geological mineral inventory for the property. Using a 1.0 g/t Au cutoff, the measured, drill indicated and inferred categories total 3,108,900 tonnes grading 3.50 g/t Au.

The **Ace** property, owned by Barker Minerals Ltd., covers an area between Clair and Ishkloo creeks, 34 kilometres northeast of Likely. It is underlain by quartzite, quartz-sericite schist, greenstone, amphibolite, graphitic schist and dirty limestone of the Downey succession, part of the Paleozoic Snowshoe Group. The claims cover an 8-kilometre long, east-trending float train of gold-enriched massive sulphide and quartz-sulphide vein material. In 1996, magnetometer, VLF-EM and soil geochemical surveys were conducted over the length of the boulder train. The surveys delineated

several northwesterly trending, coincident IP chargeability high and gold geochemical anomalies. Trenching of the anomalies was conducted late in 1996 and continued in 1997. It exposed quartz-sericite and quartz-biotite schists that typically contain trace to 2-3% sulphides. Pyrrhotite is the most common sulphide mineral, but pyrite and chalcopyrite occur locally in narrow, crudely banded zones that parallel the foliation. The Ace property may represent a volcanogenic massive sulphide system (Besshi-type?) similar to the Goldstream deposit, which would be a new deposit type for the area.

Joint venture partners Wildrose Resources (formerly Eastfield Resources) and Imperial Metals conducted two diamond-drilling programs on the **Beekeeper** alkalic porphyry copper-gold prospect, 22 kilometres southeast of Mount Polley. They focused on expanding the dimensions of the "96 Zone", a mineralized stockwork that generated some encouraging drill intersections in 1996 (i.e., 30 metres grading 0.31 g/t Au and 0.20% Cu in hole B-96-1, and 22 metres grading 0.96 g/t Au and 0.70% Cu in hole B-96-30). This year's drilling extended the zone a further 200 metres. The most encouraging assay was a 36-metre interval which averaged 0.439 g/t Au.

Big Valley Resources continued to explore its vast **Lloyd-Nordik** property in the Mount Polley area of the southern Quesnel Trough. In 1997, the company drilled three of its porphyry copper-gold prospects, focusing mainly on the Lloyd zone. It is located on the northern margin of the Mount Polley stock. The zone contains a measured and indicated resource of 2.5 million tonnes averaging 0.546% Cu and 0.391g/t Au. High-grade copper and gold mineralization is concentrated in intensely K-feldspar altered zones cut by chalcopyrite and pyrite-bearing, magnetite-healed crackle breccias. Drilling in 1997 targeted the northwestern extension of the zone and was successful in extending it well to the west, although the intensity of alteration weakens together with copper and gold grades.

The other prospects drilled were the **Nordik** (923 metres in six holes), located 2 kilometres southeast of the Mount Polley mine, and **Morehead South** (635 metres in three holes), 9 kilometres west of the Lloyd zone. Geochemical sampling and/or IP surveys were completed over several areas west and northwest of Mount Polley, including BV-Premier, Jacobie West and Morehead Creek. Drilling on the Nordik property intersected weakly mineralized, pale grey plagioclase-phyric monzodiorite to diorite with sparsely disseminated pyrite and traces of chalcopyrite.

OTHER AREAS

In early October, Pine Valley Coal Ltd., operator for the BCR Ventures Inc., Falls Mountain Coal Inc. and Mitsui Matsushima Canada Ltd. joint venture, filed its Willow Creek project report with the province's Environmental Assessment Office. The company is requesting approval to build a 900 000 tonnes per year open-pit coal mine 45 kilometres west of Chetwynd. The current mineable reserve for the North and Central areas is 15.65 million tonnes of thermal and low-grade coking coal. The low-volatile coal measures are in the upper and middle members of the Gething Formation, on the northeast limb of the Coal River anticline. Capital cost of the project is an estimated \$20 million. It will require a workforce of 110 during its 15-year mine life. The period of public consultation ended in December, 1997, and the project committee is expected to make its recommendation to the Minister of Employment and Investment in early February, 1998.

Ava Resources Inc. continued its preparation of the Wishaw Lake dimension stone quarry, located 160 kilometres east of Prince George in the Kakwa Recreation Area. The deposit occurs in a valley immediately north of Wishaw Lake and is comprised of maroon to white-banded quartzite of the Lower Cambrian Mahto Formation (Gog Group). Work focused on improving road access, while little progress was made at the site. The company plans to resume operations in 1998.

LAND USE PLANNING

There are eleven planning districts within the Northeast and Central Region of the Energy and Minerals Division. Land use planning is nearing completion in the region. Planning in the southern part of the region resulted in the completion of the regional level Cariboo-Chilcotin Land Use Plan in October 1994. Subregional level Land and Resource Management Planning (LRMP) has proceeded in the remaining eight planning districts. Three LRMPs, Vanderhoof, Fort Nelson and Fort St. John have been approved by government and four others, Dawson Creek, Fort St. James, Prince George and Robson Valley are nearing completion or government approval. The Mackenzie LRMP is in mid-stage of development and will require strong representation from tenure holders to adequately represent their interests.

OUTLOOK

Exploration activity in the region is forecast to weaken in 1998. Current soft gold and copper prices support the downward trend and, if weak prices for these metals continue throughout the year, exploration will be significantly reduced and some mines may be forced to close. However, strong silver and stable zinc prices may revitalize exploration for zinc-lead-silver deposits in the Gataga district.

The search for additional reserves at the QR and Gibraltar mines did, as expected, increase in 1997. However, with the closure of QR and the successful drilling program at Gibraltar, the likelihood of large programs at these mine sites in 1998 is diminished. Major exploration programs are anticipated for JD, Al and Pine in the Toodoggone region, but even these may be scaled back because of soft metal markets. Some of the properties that were drilled in 1997 with less than encouraging results are not expected to be active in 1998.

The release of Regional Geochemical Survey (RGS) data for the Toodoggone River (94E) and McConnell Creek (94D) map sheets in July, 1997, generated only a lukewarm response. Approximately 550 claim units were staked during a one-week period following the release, mostly in NTS 94D. The BC Geological Survey Branch completed an RGS survey in the Mesilinka River (94C) map area during the summer and results will be available in mid-1998. In 1997, the GSC conducted an airborne magnetic survey (approximately 33 300 line kilometers) over part of the northern Omineca (NTS 94E and 94F/SW including part of the southern Gataga). The data package will be released in October, 1998, and may stimulate exploration the following year.

ACKNOWLEDGMENTS

This report is a compilation of information collected from property visits by the author and other Prince George Regional Operations staff. Information contributed by mine and exploration geologists working in the region are gratefully acknowledged.

EXPLORATION AND DEVELOPMENT HIGHLIGHTS IN SOUTH-CENTRAL BRITISH COLUMBIA - 1997

By Michael S. Cathro, P.Geo.
Regional Geologist, Kamloops

HIGHLIGHTS

- The **Prosperity** copper-gold project of Taseko Mines Ltd. is undergoing a feasibility study and environmental assessment.
- An expanded mineral resource of 72.1 million tonnes grading 0.31% copper has been defined at the **Getty North** deposit of Getty Copper Corp. A heap-leach SX-EW operation is contemplated.
- Encouraging drill results were released by Christopher James Gold Corp. from the **Big Kidd** alkalic porphyry/breccia gold-copper target.
- Exploration spending was about **\$17.6 million**, down from \$21 million in 1996.
- Drilling activity was about **92 000 metres**, down from 120 000 metres in 1996.

EXPLORATION TRENDS

1997 began as a relatively promising year for exploration in the South-Central region. Unfortunately, the Bre-X scandal and the drop in the price of gold led to financing difficulties for some junior companies, and several projects were canceled or scaled down in size.

Most exploration indicators showed a decline in 1997 compared to 1996. Exploration spending is estimated at about \$17.6 million, a drop of 16% relative to 1996 (Figure 1). Drilling is estimated at about 92 000 metres, a drop of 23% from 1996 (Figure 2). The number of major exploration projects (Figure 3) dropped to 26 from 28 in 1996 (a major project is defined as one with mechanical disturbance and greater than \$100 000 in spending).

As in previous years, a large proportion of exploration spending is attributable to a few very large, advanced-stage projects. Unfortunately, not much work was directed towards new or grassroots targets. Junior companies continue to be responsible for most exploration and development work; large mining companies accounted for just 6% of all spending.

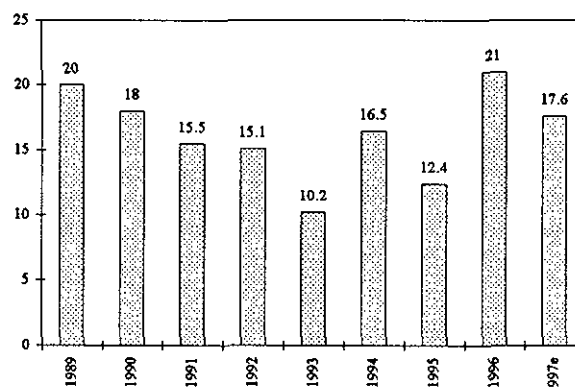


Figure 1. Annual exploration spending, in millions of dollars, South-Central Region.

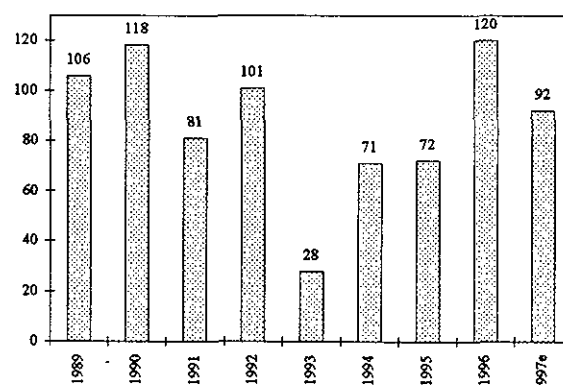


Figure 2. Annual exploration and development drilling, in thousands of metres, South-Central Region.

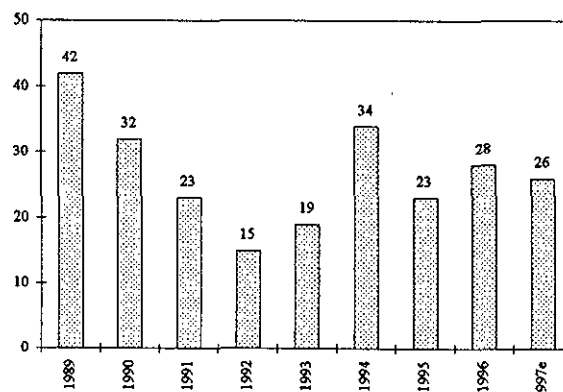


Figure 3. Number of major exploration projects per year, South-Central Region.

MINES

Two large mines and numerous small quarries were active in 1997. The locations of these operations are shown on Figure 4.

The **Highland Valley Copper** mine, a partnership between Cominco Ltd. (50%), Rio Algom Ltd. (33.6%), Teck Corp. (13.9%) and Highmont Mining Co. (2.5%), continued full scale production through 1997. One of the largest copper operations in the world in terms of mill throughput, the mine exploits calc alkalic porphyry Cu-Mo-Au-Ag deposits. Production in recent years has been mainly from the Valley pit with a small proportion coming from the Lornex pit.

In 1997 the mine produced 44.7 million tonnes grading 0.394% Cu and 0.009% Mo. Metal contained in concentrate totalled 157 162 tonnes of copper, 1968 tonnes of molybdenum, 59 967 kilograms (1.928 million ounces) of silver and 391.9 kilograms (12 600 ounces) of gold. Ore reserves remaining at the beginning of 1998 are 457.1 million tonnes grading 0.419% Cu and 0.0085% Mo, enough to continue mining until 2008 (Lorne Bond, personal communication, 1998). A potential resource of 350 million tonnes at a grade of 0.384% Cu has also been defined beneath the final Valley pit. If economic, this resource could extend the life of Highland Valley Copper by about eight years. In February 1998, the partners announced that they are evaluating the feasibility of building a hydrometallurgical smelter on site, and are pursuing lower power rates under the B.C. government's "Power for Jobs" program. These initiatives have the potential to significantly improve the profitability of the operation and to extend the mine life.

Outside of Kamloops, the **Afton-Ajax** copper-gold mine was permanently closed in June, 1997 due to the fall in copper prices and the low grade of remaining reserves. The mine was operated by Afton Operating Corp., a subsidiary of Teck Corp. The site is now being reclaimed and all equipment and buildings are to be sold. Since 1977, five different alkalic porphyry deposits have been mined; Afton, Pothook, Crescent, Ajax West and Ajax East. Several other medium to large mines in the region have recently closed and are also undergoing reclamation including **Nickel Plate** (Homestake Canada Inc.), **Goldstream** (Imperial Metals Corp.), **Brenda** (Noranda Inc.), **Samatsum** (Inmet Mining Corp.), **Hedley Tailings** (Candorado Operating Co. Ltd.) and **Boss Mountain** (Noranda Inc.).

At Princeton, the **Similco** copper-gold mine of Princeton Mining Corp. is closed pending an improvement in metal prices. The operation has been on

care and maintenance status since November, 1996. In September of this year, Princeton drilled 14 widely spaced holes to test for the depth extension of alkalic porphyry mineralization beneath Pit 2 on the Copper Mountain side of the property. Results were encouraging and a larger definition-drilling program is contemplated (Steve Blower, personal communication, 1998). The company's goal is to define a five to ten-year, low-cost reserve in the area between and beneath Pits 2 and 3. Currently, a resource of 142 million tonnes grading 0.397% Cu has been outlined.

Small industrial minerals quarries are located throughout the region (Figure 4) including **Craigmont Tailings** (M Seven Industries Ltd.; magnetite); **Harper Ranch** (Lafarge Canada Inc.; limestone), **Pavilion** (Continental Lime Ltd.; lime), **Ranchlands** (Mountain Minerals Co. Ltd.; zeolite), **Red Lake** (Western Industrial Clay Products Ltd.; diatomaceous earth), **Kingfisher** (Franz Capital Corp.; marble) and **Falkland** (Lafarge Canada Inc.; gypsum). The **Lumby** graphite-sericite project of The Quinto Mining Corp. received approval in 1997 to proceed with a 24 000 tonnes per year mine and processing plant.

At the historic **Bralorne** minesite, assembly of the 150 tonnes per day mill continued until fall, 1997. Unfortunately, the declining price of gold and financing difficulties forced the owners, Bralorne Pioneer Gold Mines Ltd. (50%) and Avino Silver and Gold Ltd. (50%), to defer their plans to re-start the mill. Early in the year, however, the partners mined and stockpiled a 2000 tonne bulk sample of arsenopyrite-rich, mesothermal quartz vein ore from a surface trench on the Peter vein. In addition, limited drilling from the 8th level of the King mine was conducted to test the Peter vein.

At the **Blackdome** gold-silver project, Claimstaker Resources Ltd. completed a feasibility study on re-opening the mine, which last operated in 1991. A new mineral inventory study increased the fully diluted mineral resource to 237 881 tonnes with an average grade of 13.1 g/t Au and 37.0 g/t Ag. Of this resource, 200 464 tonnes at an average grade of 13.9 g/t Au and 32.0 g/t Ag is accessible from existing workings. Mineralization consists of bonanza-style, epithermal veins in Tertiary volcanic rocks.

EXPLORATION PROJECTS

Most of exploration and development activity was directed to porphyry Cu-Mo-Au-Ag and vein Au-Ag targets in 1997. There was a modest, but encouraging, increase in interest in stratiform base metal targets.

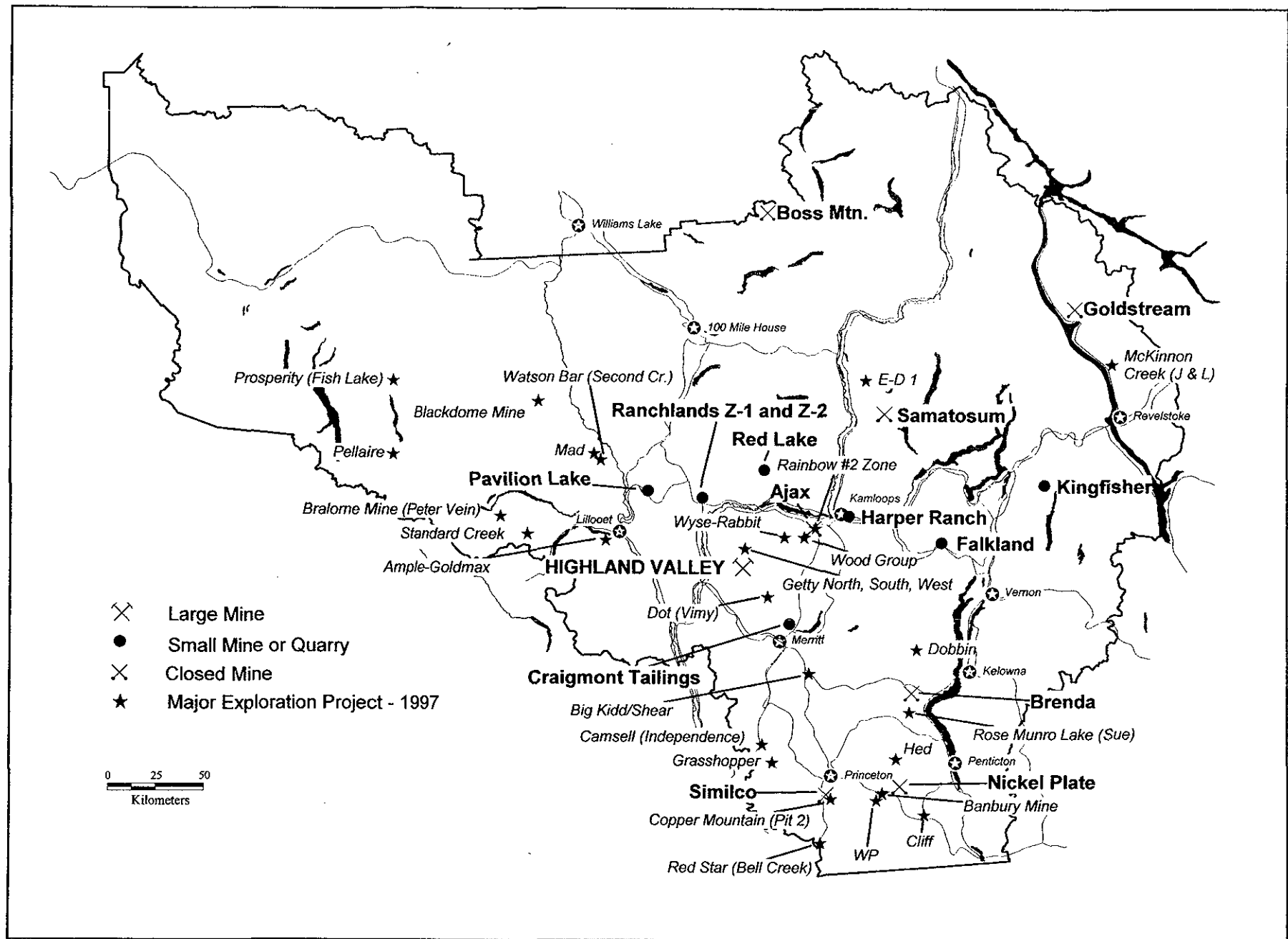


Figure 4. Operating mines and major exploration projects in the South-Central Region, 1997

TABLE 1
MAJOR EXPLORATION PROJECTS, SOUTH-CENTRAL REGION 1997

Property	Operator	MINFILE Number	Mining Division	NTS	Commodity	Deposit Type	Work Done
Ample-Goldmax	Homestake Canada Inc.	92JNE069, 084, 094	Lillooet	92J/09E	Au, Ag	Mesothermal Vein	14 ddh, 2787 m; road; geochem; geol
Banbury Mine	Teck Exploration Ltd.	92HSE046	Osoyoos	92H/08W	Au, Ag	Vein, Stockwork	5 ddh, 770 m; geochem
Big Kidd/Shear	Christopher James Gold Corp.	92HNE073-077, 181	Nicola	92H/15E	Au, Ag, Cu	Alkalic Porphyry / Breccia	10 ddh, 2073.8 m; geochem
Blackdome Mine	Claimstaker Resources Ltd.	92O 051, 52, 53	Clinton	92O/08W	Au, Ag	Epithermal Vein	U/g rehab; feasibility study
Bralorne Mine (Peter Vein)	Bralorne-Pioneer Gold Mines Ltd. / Avino Silver and Gold Ltd.	92JNE001 etc.	Lillooet	92J/15W	Au, Ag	Mesothermal Vein	3 sfc ddh; 6 u/g ddh, approx 900 m; 5 trenches
Camsell (Independence)	Nufort Resources Inc.	92HNW008	Nicola	92H/10W	Cu, Mo, Au	Porphyry	10 rcdh, 531.9 m; 7 trenches, 275 m; geophys; geochem
Cliff	Goldcliff Resource Corp.	82ESW016, 15, 14	Osoyoos	82E/04E	Au, Ag, Cu, Mo	Vein / Porphyry	7 rcdh, 600 m; 7 trenches; road; geochem
Copper Mountain (Pit 2)	Princeton Mining Corp.	92HSE001-3	Similkameen	92H/07E	Cu, Au, Ag	Alkalic Porphyry	14 ddh, 3390.7 m
Dobbin	Verdstone Gold Corp. / Molycor Gold Corp.	82LSW043	Nicola / Vernon	82L/04W	Cu, Pt, Pd, Ir, Mo	Magmatic / Porphyry?	21 ddh, approx 4725 m
Dot (Vimy)	Alhambra Resources Ltd.	92ISE023, 93	Nicola	92I/07W	Cu, Au, Ag, Mo	Porphyry / Shear zone	6 ddh, 1290.2 m; geophys
E-D 1	Foran Mining Corp.	82MSW064	Kamloops	82M/05W	Au-Cu-Zn-Pb-Ag	Manto?	3 ddh, approx 120 m; trenching; road; geol
Getty North, South, West	Getty Copper Corp.	92INE038, 40, 41, 43, 136	Kamloops	92I/10W	Cu	Porphyry	64 ddh, 18,454 m; 1500 m trenching; geophys; geochem; geol; environmental
Grasshopper	Phoenix Gold Resources Ltd.	92HNE011, 12	Similkameen	92H/10W	Pt, Pd, Au, Chromite	Podiform	9 ddh, 694.2 m; geochem
Hed	Verdstone Gold Corp. / Molycor Gold Corp.	92HNE100	Osoyoos	92H/09E	Cu, Mo, Au, Ag	Porphyry	4 ddh, 773 m; 1500 m road
Mad	First Point Minerals Corp.	92O 092	Clinton	92O/01E	Au, Ag	Epithermal Vein	7 ddh, approx 800 m; trenching; road; geochem
McKinnon Creek (J & L)	Weymin Mining Corp.	82M003, 091, 099	Revelstoke	82M/08E	Au, Ag, Zn, Pb, Cu	Volcanogenic Massive Sulphide	U/g rehab; 75 tonne bulk sample; 3 ddh, 582 m; roads; 2 trenches, 100 m; geochem
Pellaire	International Jaguar Equities Inc.	92O 045	Clinton	92O/04E	Au, Ag	Vein	U/g bulk sample; rc drilling; trenching; road; geochem
Prosperity (Fish Lake)	Taseko Mines Ltd.	92O 041	Clinton	92O/05E	Cu, Au, Ag	Porphyry	Definition and geotech drilling; environmental and metallurgical studies
Rainbow #2 Zone	Teck Exploration Ltd./Getchell Resources Inc.	92INE028	Kamloops	92I/09W	Cu, Au, Ag, Mo, Pd	Alkalic Porphyry	6 ddh, 2958.4 m
Red Star (Bell Creek)	Teck Exploration Ltd. / Redstar Resources Corp.	92HSE067, 069, 093	Similkameen	92H/02E	Cu, Zn, Pb, Ag, Au	Volcanogenic Massive Sulphide	5 ddh, 1516 m
Rose Munro Lake (Sue)	Aimaden Resources Corp.	82ENW021	Osoyoos	82E/12W	Cu, Mo, Au, Ag	Porphyry	5 ddh, 2042 m

TABLE 1 (Continued)

MAJOR EXPLORATION PROJECTS, SOUTH-CENTRAL REGION 1997

Property	Operator	MINFILE Number	Mining Division	NTS	Commodity	Deposit Type	Work Done
Standard Creek	TriBand Capital Corp.	92JNE015, 11, 13, 14, 43, 44	Lillooet	92J/10E	Au, Ag	Mesothermal Vein	4 ddh, 1800 m; airborne geophys
Watson Bar (Second Cr.)	Stirrup Creek Gold Ltd.	92O 051, 110	Clinton	92O/01E	Au, Ag	Epithermal Vein	11 ddh, 2226.5 m; trenching; geochem; geol
Wood Group	Charles Boitard		Kamloops	92I/10E	Cu, Au	Porphyry	5 ddh, 1151 m; 2 pdh, 350 m; geophys
WP	Northpoint Resources Ltd.	92HSE174	Similkameen	92H/08E	Au, Ag, Cu	Skarn / vein	10 ddh, 963 m; 15 trenches; road; geophys; geochem
Wyse-Rabbit	ProAm Explorations Corp.	92INE114, 147, 45, 130	Kamloops	92I/10E	Au, Cu	Porphyry / Vein	21 ddh, 3338 m; 1200 m road; 3 trenches; geophys; geochem

Major exploration projects are shown on Figure 4 and listed in Table 1.

PORPHYRY AND RELATED TARGETS

The **Prosperity** (Fish Lake) Cu-Au-Mo-Ag project, located southwest of Williams Lake, is the subject of an ongoing feasibility study by Taseko Mines Ltd. Since mid-1996 Taseko has conducted angle re-drilling of the Fish Lake deposit, geotechnical drilling of the proposed pit and other facilities, and metallurgical, acid rock drainage, environmental and socioeconomic studies.

A revised ore reserve and mine plan for the Prosperity project is currently being prepared from the new drilling. In 1994, reserves were estimated as 675 million tonnes grading 0.236% Cu and 0.43 g/t Au. A joint federal/provincial environmental assessment was restarted in May, 1997 and Taseko intends to submit a final project report in 1998. A key issue in the review is the impact of the mine on fish habitat in Fish Lake.

The **Getty North** (Krain) porphyry copper deposit, owned by Getty Copper Corp., was the subject of a very large, definition-drilling program during 1996-1997 (Figure 5). Located 7 kilometres north of the Highland Valley Copper mine, Getty North is a partially oxidized, Bethlehem-style deposit. As of January, 1998, it was estimated to contain a resource of approximately 72.1 million tonnes at an average grade of 0.31% Cu. Within this total are a higher grade oxide resource of 10.0 million tonnes grading 0.40% Cu, and a higher grade sulphide resource of 44.4 million tonnes grading 0.37% Cu. The company is evaluating the option of heap-leach, SX-EW processing of both oxide and sulphide zones.

During the year, Getty Copper Corp. also conducted a large-scale trenching program on the nearby **Getty South** (South Seas, Trojan) prospect, limited drilling on the **Getty West** (Transvaal) prospect, and geochemical and geophysical surveys on other targets.

On the **Dot** property, also in the Guichon Creek batholith, Alhambra Resources Ltd. drilled six diamond-drill holes to follow up on good drilling results from late 1996. The "Southeast Extension" occurs along strike from the "Northwest Zone" (Vimy) where a resource of about 6 million tonnes grading 0.5% Cu is reported. So far the Southeast Extension has been drill tested over a strike length of about 450 metres with drill intercepts up to 119.8 metres grading 0.58% Cu. Mineralization consists mainly of bornite with lesser chalcopryrite, native copper and molybdenite, hosted by potassic and phyllic-altered Bethlehem-type porphyry dikes and Guichon or Chataway granodiorite.

Near Kamloops, Teck Exploration Ltd. drilled several alkalic porphyry copper-gold targets in the Iron Mask batholith, in an attempt to define additional mill-feed for the Afton-Ajax concentrator. In a joint venture with Gatchell Resources Inc., Teck drilled six deep holes on the **Rainbow #2** zone. The holes were drilled down the steeply dipping breccia body in an attempt to define higher grade mineralization at depths greater than 300 metres. There were several good intercepts such as 159 metres grading 1.078% Cu and 0.322 g/t Au. The partners announced an in situ geological resource of 15.86 million tonnes grading 0.528% Cu using a 0.25% Cu cutoff. They concluded that, although the breccia unit is impressively mineralized, the geometry and grade distribution of the mineralization would not support



Figure 5. Getty Copper Corp. director Vic Preto (left) showing drill core from the Getty North (Krain) deposit to Bill McMillan (centre) and Tom Schroeter (right) of the B.C. Geological Survey.

either underground or open pit mining. The zone is still open below 400 metres.

Teck also drilled several holes on the **Coquihalla** zone near the Pothook pit at Aston. Here, erratic but locally high gold values occur in pyritized and altered Nicola volcanics. Copper values are low.

Near Aspen Grove, the **Big Kidd** (Shear) alkalic porphyry/breccia gold-copper prospect was drilled by Christopher James Gold Corp. late in the year. Very encouraging results were released in January and a much larger drilling program is planned for 1998. For example, Hole BK97-05, a deeper twin of a 1992 Placer Dome hole, intersected 115.96 metres grading 0.801 g/t Au and 0.124% Cu, including a higher grade section of 19.46 metres grading 3.090 g/t Au and 0.113% Cu. Mineralization is hosted by vent breccias and a monzonitic dike swarm which intrude Nicola volcanics. Alteration includes magnetite, potassium feldspar, albite and propylitic types (Ron Wells, personal communication, 1998).

At the **Wyse-Rabbit** prospect north of Logan Lake, ProAm Explorations Corp. tested for porphyry Cu-Au mineralization in the Durrand diorite and adjacent rocks.

One hole had an encouraging intersection of 10 metres grading 15.3 g/t Au in pyritic, albitized diorite.

PRECIOUS METAL VEIN TARGETS

High-grade gold-silver vein deposits were the second most popular target in the region. Near Lillooet, Homestake Canada Inc. explored the **Ample-Goldmax** property with a medium-sized drilling program, road construction and trenching, and staked a large addition to the property. The drilling tested several geochemical and geological targets along strike from the small, past-producing Golden Cache and Ample mines (Figure 6). Subsequently, Homestake returned the property to the optionees, Dave Javorsky and Gary Polischuk. Mineralization consists of arsenopyrite, lesser pyrite and rare visible gold in and adjacent to gently-dipping quartz-carbonate veins cutting sheared argillite of the Cayoosh Assemblage. The veins occur beneath, and are subparallel to the regionally important Cayoosh thrust fault.

Near Upper Taseko Lake, the **Pellaire Mine** (Lord River) property (Figure 7) was the subject of a large exploration program by International Jaguar Equities Inc. An underground bulk sample of the #4 vein was collected and will be shipped to the Trail smelter, as in 1996. In

addition, several other targets were explored by prospecting, soil sampling and trenching.

At Zone V on the **Watson Bar (Second)** property of Stirrup Creek Gold Ltd., deep drilling was successful in locating the down-dip extension of high-grade epithermal gold mineralization. Geological reserves for Zone V are estimated at 136 962 tonnes grading 14.33 g/t Au using a 6.86 g/t cutoff. Mineralization consists of brecciated quartz-sulphide veins in a gently dipping, carbonaceous thrust fault which cuts arkosic sandstones and siltstones of the Lower Cretaceous Jackass Mountain Group (Cathro *et al.*, 1998).

On the **Mad** property, 2 kilometres to the northwest, First Point Minerals Corp. drilled the Watermelon prospect, a high-angle, epithermal quartz-sulphide vein which cuts arkosic sandstone of the Jackass Mountain Group. Results were disappointing.

STRATIFORM BASE METAL TARGETS

There was an encouraging and noticeable increase in interest in stratiform Zn-Pb-Cu-Au-Ag targets in 1997. At the **McKinnon Creek (J & L)** polymetallic project north of Revelstoke, Weymin Mining Corp. completed a modest surface drilling program on the up-plunge extension of the Main and Yellowjacket zones. The Main zone is a thin, persistent massive sulphide band



Figure 6. Homestake Canada's Ample Goldmax property. Note the old workings of the Ample mine (centre-right).

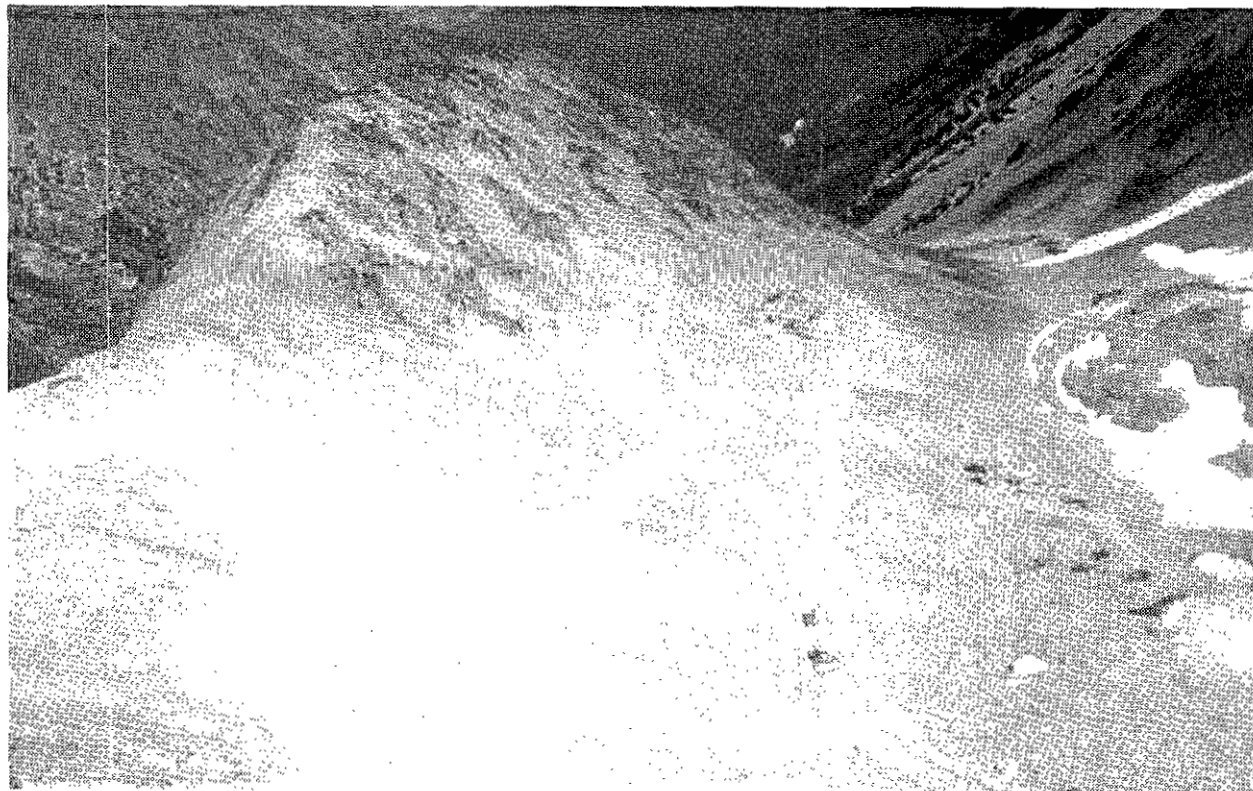


Figure 7. Aerial view, looking north, of the Pellaire Mine property of International Jaguar Equities Inc.

hosted by metasedimentary and metavolcanic rocks of the Hamill Group. It is estimated to contain 3.6 million tonnes grading 7.24 g/t Au, 81.0 g/t Ag, 3.93% Zn and 3.00% Pb. The Yellowjacket zone, hosted by silicified marble, is estimated to contain 1.0 million tonnes grading 7.09% Zn, 2.47% Pb and 52.5 g/t Ag. Weymin also collected a 75-tonne underground bulk sample from the Main zone for metallurgical testing, which will include evaluation of the potential for heavy media separation of sulphides.

Teck Exploration Ltd. drilled five holes on the **Redstar** (Bell Creek) property near Manning Park under a joint venture agreement with Redstar Resources Corp. Massive sulphides, with locally high grades of Cu, Zn, Pb, Au and Ag, are hosted by felsic volcanic rocks of uncertain age.

At the **E-D 1** property near North Barriere Lake, Foran Mining Corp. drilled three short holes and completed hand trenching to test a Cu-Zn-Au-bearing pyrrhotite body hosted by limestone beneath a black shale unit. The host-rocks are part of unit EBP (Mississippian) of the Eagle Bay Assemblage and the prospect occurs near the contact with the Baldy batholith. The mineralization also contains anomalous levels of bismuth and tungsten and is interpreted to be a manto occurrence (Trygve Höy, personal communication, 1997).

MAGMATIC TARGETS

At the **Dobbin** property, located west of Kelowna, unusual copper-platinum-palladium-iridium mineralization was the target of a large drilling program by partners Verdstone Gold Corp. and Molycor Gold Corp. The best intersection was 15 metres grading 0.54% Cu, 1.316 g/t Pt and 0.949 g/t Pd. A 9 metre composite sample from another hole assayed 0.11 g/t Ir in addition to anomalous Cu, Pt and Pd values. So far, no significant Au, Ag, Ni or Cr values have been encountered. Mineralization consists of disseminated and fracture-controlled pyrite, magnetite and chalcopyrite hosted by pyroxenite and gabbro of the multiphase Jurassic Whiterocks alkalic complex. Calcite veining and epidote-chlorite alteration are locally present, suggesting the mineralization may be, at least in part, alkalic porphyry in style.

At the **Grasshopper** property in the Tulameen ultramafic complex, dunite-hosted, platinum and palladium-bearing chromite mineralization was drilled-tested by Phoenix Gold Resources Ltd. Previous drilling by Newmont Exploration of Canada Ltd. encountered up to 9.26 g/t Pt over 3.05 metres.

INDUSTRIAL MINERALS AND GEMSTONES

Polestar Exploration Inc. officially withdrew the 75 000 tonne per year **Crystal Peak** garnet quarry proposal from the environmental review process. The company is seeking compensation from the provincial government due to the delay in permitting.

Numerous prospectors and rockhounds were actively searching for fire opal in 1997, mainly in the area between Monte Creek, Vernon and Kelowna. The opal occurs in vesicles and locally in fractures in Tertiary basalt of the Kamloops Group. Okanagan Opal Inc. continued to sort and polish specimens from its **Klinker** property near Vernon, and to manufacture and market jewelry, however no new mining was done on the property this year.

GRASSROOTS PROSPECTING

At least two interesting new gold-silver prospects were discovered this year by conventional prospecting. Near Honeymoon Bay on Adams Lake, prospector Camille Berube of Kamloops staked the **Cam-Gloria** group of 97 claim units to cover a large, rusty, auriferous quartz vein containing concentrations of pyrite, galena and chalcopyrite (Figure 8). The vein is up to 10 metres wide, at least 200 metres in strike length, and is hosted by Cretaceous monzonite of the Baldy batholith near its contact with gneissic metasediments of the Eagle Bay Assemblage. Despite being crossed by an old logging road, no record of this prospect, or any previous exploration work in the area, could be found.

The Cam-Gloria prospect was discovered by following up on two anomalous samples from the Geological Survey Branch's till geochemical survey release (Bobrowsky *et al.*, 1997). Grab samples taken by BC government geologists have assayed up to 3.754 g/t Au and 61.4 g/t Ag with anomalous Bi, Cu, Pb, As, Mo and W. Sulphide-rich samples collected by Mr. Berube have assayed up to 27.4 g/t Au. Outcropping quartz-fluorite veins and float of pyrrhotite-bearing skarn have also been found in the immediate area. Considering the metal suite, the monzonite host-rock and regional geologic setting, the Cam-Gloria prospect is interpreted to be an intrusion-related vein. It has some similarities to veins associated with Tombstone suite intrusions near Dawson, Yukon (Poulson *et al.*, 1997) and Fairbanks, Alaska (McCoy *et al.*, 1997).

At the **Kami 5** property near Monashee Pass, prospector Arnold Savjord completed trenching under a



Figure 8. Large auriferous quartz vein on the Cam-Gloria claims near Adams Lake.

grant from the Prospectors Assistance Program. The work uncovered a series of narrow, gently dipping, gold and silver-rich quartz-pyrite-galena-sphalerite veins cutting sericite-altered, foliated granodiorite of the Nelson Plutonic Suite. A 25-centimetre chip sample collected by the writer assayed 39.6 g/t Au and 1000 g/t Ag and sulphide-rich samples collected by Mr. Savjord have returned substantially higher grades. The prospect has not yet been tested by drilling or surface surveys.

ACKNOWLEDGMENTS

I would like to thank the numerous prospectors and geologists for showing me their properties and particularly, for sharing their ideas and data. Thanks are also due to Bruce Madu of the Kamloops office of the Mines Branch for his patient assistance with computer drafting.

REFERENCES

- Bobrowsky, P.T., Leboe, E.R., Dixon-Warren, A. Ledwon, A., MacDougall, D. and Sibbick, S.J. (1997): Till Geochemistry of the Adams Lake Plateau - North Barriere Lake Area (82M/4 and 5); B.C. Ministry of Employment and Investment, Open File 1997-9, 262 pages.
- Cathro, M.S., Durfeld, R.M. and Ray, G.E. (1998): Epithermal Mineralization on the Watson Bar Property (92O/01E), Clinton Mining Division, Southern B.C.; in Geological Fieldwork, 1997, B.C. Ministry of Employment and Investment, Paper 1998-1, pages 21-1-13.
- McCoy, D., Newberry, R.J., Laver, P., DiMarchi, J.J., Bakke, A., Masterman, J.S., and Minehane, D.L. (1997): Plutonic Related Gold Deposits of Interior Alaska, in Mineral Deposits of Alaska, Goldfarb, R.J. and Miller, L.D., editors, *The Society of Economic Geologists, Economic Geology Monograph 9*, pages 191-241.
- Poulson, K.H., Mortensen, J.K., and Murphy, D.C. (1997): Styles of Intrusion-Related Gold Mineralization in the Dawson-Mayo Area, Yukon Territory; in Current Research 1997-A, *Geological Survey of Canada*, pages 1-10.

EXPLORATION AND DEVELOPMENT HIGHLIGHTS KOOTENAY REGION - 1997

By H.P. Wilton, P.Eng.
Regional Geologist, Cranbrook

SUMMARY

Exploration expenditures in the Kootenay region in 1997, including those at operating mines, are estimated to have totalled \$14.7 million. This represents an increase of about 48% over the \$9.9 million expenditure estimated for 1996 and appears to be the highest total in this decade (Figure 1). Furthermore, expenditures have continued to increase annually since 1994 when only \$5.6 million was spent in the region. There were 231 projects reported (by submission of Notices of Work to the Mines Branch) in 1997, an increase of about 26% over 1996 but still lower than the 280 projects in 1995 (Figure 2). The total amount of exploration drilling in the region, both core drilling and rotary or reverse circulation drilling, was 98 664 metres, compared to 88 100 metres in 1996 (a 12% increase).

It is important to note that a combined exploration expenditure of \$4.7 million (32% of the total) and 50 000 metres of exploration drilling (51% of the total) occurred at the five producing coal mines. The coal mines have contributed approximately the same percentages of the key indicators in each of the last several years. Their total expenditure increased by 43% and their total drilling by 10% in 1997, remarkably close to the percentage increases for all exploration in the region.

A comparison of the increases in expenditure against increases in numbers of projects over the last four years, reveals that, on average, more money is being spent per project each year. This can be interpreted as an indication that more of the active projects are reaching a more mature stage of investigation (drilling) and the relative amount of "grassroots" work is decreasing, a dangerous trend which is being seen in all regions of the province. Nevertheless, in the Kootenay region at least, exploration activity is definitely on the increase and is expected to remain high in 1998.

Looking in more detail at the distribution of the major non-coal exploration activity within the region, an imbalance between the East Kootenay area (east of Kootenay Lake) and the West Kootenay-Boundary area has become quite evident for the first time. By far the

largest expenditures and most aggressive drilling activity has taken place in the Purcell anticlinorium and in the Kootenay arc where the target commodities are primarily base metals, particularly zinc and lead, and the geological targets are mainly Sullivan-style and Kootenay-arc-type sedimentary exhalative (sedex) deposits. In contrast, the area west of the Kootenay arc, most notably the Greenwood Mining Division which has traditionally been a relatively hot exploration area every year, saw significantly less activity in 1997, in large part due to depressed prices for gold and copper, the main target commodities in the western part of the region.

Approximately \$3.2 million was spent within the Purcell anticlinorium in the search for Sullivan-type sedex mineralization, with enough success to warrant an expectation of continued major spending in 1998. Kennecott Canada Exploration Inc. intersected 2.55 metres of 15.47% combined zinc and lead in a deep drill-hole at the head of Lewis Creek, and the joint venture of Miner River Resources Ltd. and Eagle Plains Resources Ltd. reported a surface discovery of massive pyrrhotite breccia with high zinc, lead and silver values on Greenland Creek west of Canal Flats. Extensive mapping and geophysical work by the joint venture of Kennecott with Sedex Mining Corp. and Abitibi Mining Corp. has identified new drill targets and new areas warranting detailed follow-up in 1998.

In the Kootenay arc, Cominco Ltd. conducted a major drilling program at its Duncan mine property on Duncan Lake and has completed extensive ground acquisition in the Salmo area by staking and by option. Sultan Minerals Inc. carried out a moderate program, including underground drilling, at the Jersey-Emerald property and has identified a number of promising new targets.

Other metal projects of note include a molybdenum-tungsten prospect drilled late in the year on Baker Creek by Barkhor Resources Inc. and Newen Enterprises Inc., a bulk-tonnage, low-grade gold prospect identified by Loumic Resources Ltd. near Trail, and Cream Minerals Ltd.'s high-grade silver prospect on Keen Creek west of Kaslo.

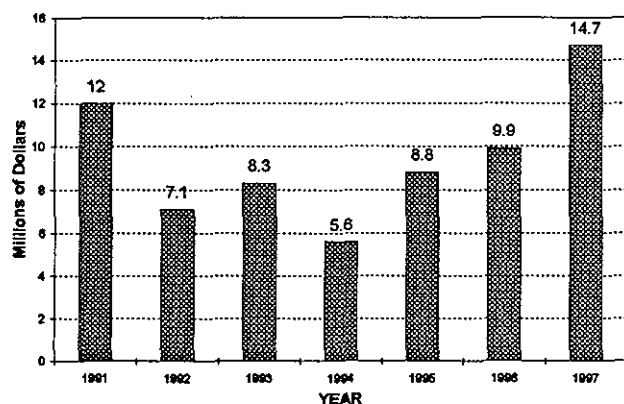


Figure 1. Exploration expenditures, Kootenay Region.

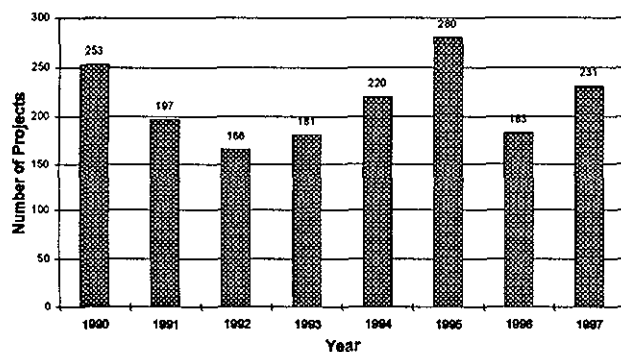


Figure 2. Exploration projects, Kootenay Region.

EXPLORATION HIGHLIGHTS

Table 1 gives details of the major metal, industrial mineral and coal projects in the region in 1997. The projects listed are those in which significant amounts of exploration drilling, bulk sampling or underground exploration work were done. A map attached to this report (Figure 3) illustrates the locations of the major projects. Many other projects with less work completed and lower expenditures were carried out and some of those may well turn out to be highlight projects in future years.

METALS

PURCELL ANTICLINORIUM

As has been the case for many years, the most important exploration target, from a regional perspective, continues to be Sullivan-style sedimentary exhalative (sedex) zinc-lead-silver mineralization in the Middle Proterozoic Aldridge Formation of the Purcell

(Belt) Supergroup. These rocks occur mainly in the core of a north-plunging anticlinorium located between the east side of Kootenay Lake and the Rocky Mountain Trench. Remaining reserves in the giant Sullivan orebody, a major contributor to the economy of the region and of the province for almost 100 years, will be depleted, and the mine will close, in the year 2001. Extensive claim staking and accelerated exploration for a successor to the Sullivan were stimulated by the release, in 1996 and in 1997, of data from a \$600,000 multi-parameter airborne geophysical survey over three of the most prospective areas in the Purcells. Prior to 1997, follow-up of the new data consisted of extensive mapping, prospecting, surface geophysics and scattered stratigraphic drilling. In 1997, this work has been rewarded with two sulphide discoveries and a number of more clearly defined target areas demanding further aggressive work in 1998. Meanwhile, work has continued on prospects outside the areas of the airborne survey, particularly near Moyie Lake.

A new feature of the enhanced exploration effort in the Purcells in 1997 was the establishment of Industrial Partnerships between some of the major industry participants and the provincial Geological Survey Branch for further mapping and regional data compilation by Derek Brown of the GSB in the Moyie River - Yahk area and in the Findlay Creek area. The companies contributed financial and logistical support for Brown's field work and shared their data. Provision of data by Cominco Ltd. from its many years of exploration in the area, and logistical support by Sedex Mining Corp. and Kennecott Canada Exploration Inc. were major contributing factors to the success of the partnership arrangements. Preliminary reports by Derek Brown and his industry collaborators have been published in Geological Fieldwork 1997, GSB Paper 1998-1.

From the beginning of the accelerated activity in the Purcell anticlinorium in 1996, the major player has been the joint venture between Kennecott Canada Exploration Inc. and the Hastings Management Group, mainly Sedex Mining Corp. and Abitibi Mining Corp. In 1997, Kennecott managed its own exploration on a part of the joint venture property package located in the upper Moyie River and Irishman Creek drainages, while Sedex and Abitibi managed exploration on the remainder of the properties throughout the Moyie River, St. Mary River and Yahk - Creston areas. Kennecott, on its Irishman/Lewis project, drilled four core holes totalling over 2500 metres and intersected 2.55 metres of massive to semimassive, coarse-grained sulphides grading 9.65% Zn, 5.82% Pb and 49.4 g/t Ag at a depth of 505 metres in the third hole. The hole is located in Panda Basin at the head of Lewis Creek, a north-flowing tributary of the

TABLE 1
MAJOR EXPLORATION PROJECTS, KOOTENAY REGION 1997

Property (Operator)	Minfile Number	Mining Division	NTS	Commodity	Deposit Type	Work Done
Albert River (Dia Met Minerals Ltd.)	N/A	Golden	82J/12E	W, Au, Cu	Vein	5ddh, 1325 m
Bismark (Cream Minerals Ltd.)	082FNW094, 095, 101	Slocan	82F/14E	Ag, Pb, Zn	Vein, replacement	5ddh, 325 m; trenching; mapping
Bull River (R. H. Stanfield & Assoc.)	082GNW002	Fort Steele	82G/11W	Cu, Au, Ag	Vein	1500 m decline; drilling; airborne geophysics
Clair West (Abitibi Mining Corp.)	N/A	Fort Steele	82F/9W	Zn, Pb, Ag	Sedex	2ddh, ~1300 m; geophysics
Duncan (Cominco Ltd.)	082KSE023	Slocan	82K/7W	Zn, Pb	Sedex, replacement	6ddh, ~ 4000 m
Elkview (Elkview Coal Corp.)	082GNE015	Fort Steele	82G/10W, 15W	Coal	Organic	46rdh, 9400 m + 7000 m in-pit drilling
Fording River (Fording Coal Ltd.)	082JSE009, 010, 012	Fort Steele	82J/2W	Coal	Organic	~ 90rdh, 23,000 m
Fors (Citation Resources Inc.)	082GSW035	Fort Steele	82G/5W	Zn, Pb, Ag	Sedex	15ddh, 12,844 m
Fortynine Creek (McMahon Resources Ltd.)	082FSW089, 090, 269	Nelson	82F/6W	Au, Cu	Vein, porphyry	8ddh, 1235 m; geochemistry
Greenhills (Fording Coal Ltd.)	082JSE007, 001, 005	Fort Steele	82J/2W	Coal	Organic	35rdh + 3ddh, 17,910 m; geophysics
Greenland Creek (Miner River Resources / Eagle Plains Resources)	082FNE107	Fort Steele	82F/16E	Zn, Pb, Ag	Sedex	7ddh, ~610 m
Irishman/Lewis (Kennecott Canada Exploration Inc.)	N/A	Fort Steele	82F/8E	Zn, Pb, Ag	Sedex	4ddh, 2523 m; mapping; geophysics
Jersey-Emerald (Sultan Minerals Inc.)	082FSW009, 010, 011, 218	Nelson	82F/3E	Au, Zn, Pb, Ag, W	Sedex, skarn, replacement	16ddh, 1204 m; trenching; mapping geochemistry;
Jodi/Sly (Barkhor Resources / Newen Enterprises Inc.)	082FNE004	Fort Steele	82F/10E	Mo, W, Zn	Porphyry, skarn, replacement	9ddh, ~ 2500 m; geochemistry
Lew (Sedex Mining Corp.)	082FSE115, 110	Fort Steele	82F/8E	Zn, Pb, Ag	Sedex	3ddh, ~1300 m
Lodgepole (Fording Coal Ltd.)	082GSE028	Fort Steele	82G/7E	Coal	Organic	9rcdh, 817 m
North 40 (Bluebird Minerals Ltd.)	082FSE097, 033	Nelson	82F/2W	Au, Ag, Pb	Vein	6ddh, 1132 m
Parson (Highwood Resources Ltd.)	082N002	Golden	82N/2E	Barite	Vein	Surface & u/g diamond drilling; trenching
Red Point (Loumic Resources Ltd.)	082FSW366	Trail Creek	82F/4E	Au	Porphyry, magmatic (?)	6ddh, 1013 m
Silvana (Treminto Resources Ltd.)	082FNW050, 051, 013	Slocan	82F/14E, W	Ag, Pb, Zn	Vein	6ddh, 590 m; test mining and milling
Strebe (Baron Gold Corp.)	082FNW255	Slocan	82F/13E	Au	Skarn, replacement	5ddh, 762 m; trenching
Summit/Bluebell (Echo Bay Mines Ltd.)	082ESE064, 062, 063	Greenwood	82E/2E	Au	Epithermal veins, skarn	23ddh, 1472 m
Sylvester K (Echo Bay Mines Ltd.)	082ESE046, 031, 013	Greenwood	82E/2E	Au	Volcanogenic(?); mass sulphide	10ddh, 1056 m
White/MRS (GEO Resources Ltd.)	082FSW086, 084	Nelson	82F/6W	Au, Cu, Ag	Vein	5ddh, ~ 1200 m; geochemistry; mapping

- 1 Fording River
- 2 Greenhills
- 3 Line Creek
- 4 Elkview
- 5 Coal Mountain
- 6 Lodgepole
- 7 Bull River
- 8 Albert River
- 9 Greenland Creek
- 10 Clair West
- 11 Lew
- 12 Irishman/Lewis
- 13 Fors
- 14 Parson
- 15 Duncan
- 16 Jodi/Sly
- 17 North 40
- 18 Silvana
- 19 Bismark
- 20 49 Creek/Miracle
- 21 White
- 22 Jersey-Emerald
- 23 Strebe
- 24 Black Crystal
- 25 Red Point
- 26 Summit/Bluebell
- 27 Sylvester K
- 28 Cranberry Ridge

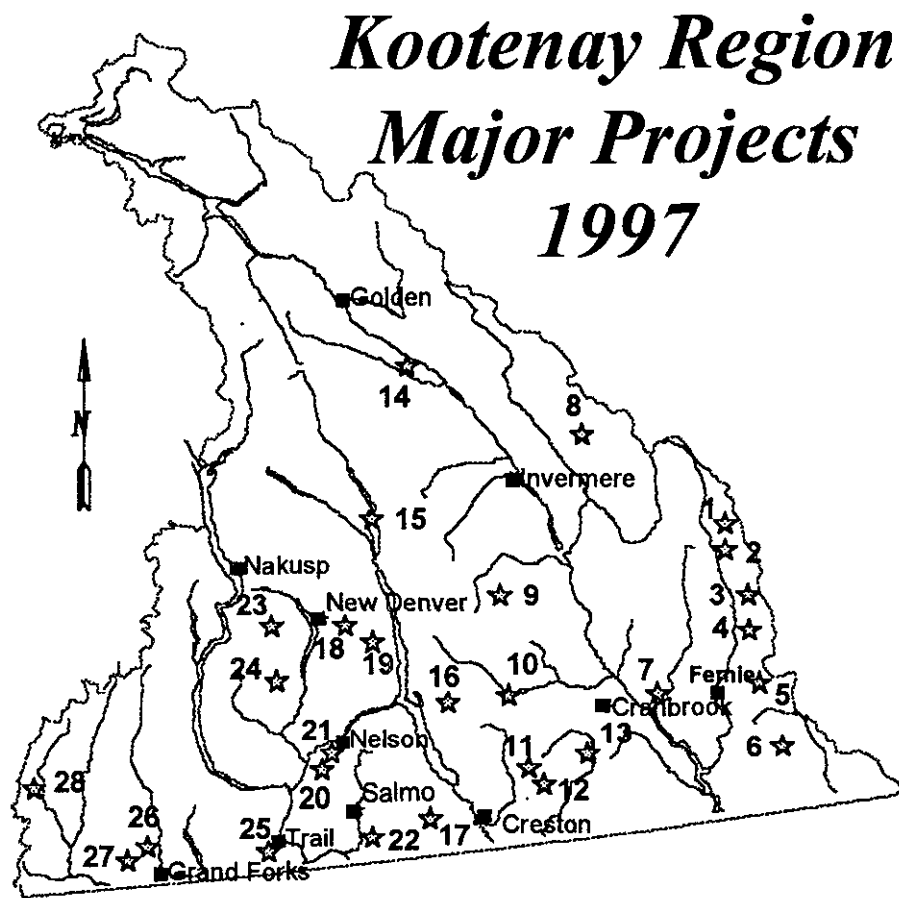


Figure 3. Major exploration projects, Kootenay Region - 1997.

upper Moyie River. The basin is located on the edge of what appears to be a hydrothermal vent indicated by the presence of extensive stratabound and discordant fragmental units and widespread albite-tourmaline-chlorite-sericite alteration of the Middle Aldridge siliciclastic rocks. It remains to be demonstrated with further drilling to what extent the sulphide interval is stratabound; it consists of sulphide bands which are both parallel to and discordant to bedding. Sedex Mining drilled approximately 1300 metres in three holes on the Lew property, north of Kennecott's Irishman/Lewis property. It is centred on the Lew "vent", a tourmalinized fragmental zone near which earlier work by Sedex had found stratiform mineralization grading better than 10% combined lead and zinc. Abitibi Mining also drilled about 1300 metres in two deep core holes at the Clair West property immediately west of St. Mary Lake where a UTEM conductor 2 kilometres long, with a coincident magnetic anomaly and lead-zinc soil anomalies, occurs on the presumed trace of the Sullivan stratigraphic horizon. Both of the latter two properties are optioned

from Cominco Ltd. and results of the programs have not yet been reported. Sedex and Abitibi also spent large portions of the budget on comprehensive mapping, prospecting and gravity surveying in other areas, including the Yahk - Creston and upper St. Mary River areas. Detailed mapping of a large area east of Yahk and south of Moyie Lake subsequent to the discovery of several previously unreported fragmental "vents" and tourmalinized zones, has identified that area as a high priority for future work.

In the Findlay and Doctor creeks area west of Canal Flats, Kennecott Canada optioned all of the extensive claim holdings of joint venture partners Miner River Resources Ltd. and Eagle River Resources Ltd. that lie north of latitude 50°. Within the optioned ground, a thick stratabound fragmental zone has been traced on surface for several kilometres and coincides with the Lower-Middle Aldridge contact (the stratigraphic position of the Sullivan deposit). Elsewhere, a conspicuous bed of tourmalinized, black meta-argillite,

anomalous in lead and zinc and containing numerous galena-rich quartz veins (Minfile 082KSE060), has been traced for at least 5 kilometres. These, and other Sullivan indicators and base metal anomalies, identify the area as having considerable potential for sedex mineralization. Kennecott completed comprehensive mapping and soil geochemistry as a first step in the evaluation of the optioned property. The Miner River/Eagle Plains joint venture meanwhile continued its own investigation of the portion of its property south of 50°, centred on Greenland Creek and the upper reaches of Skookumchuck Creek. Re-evaluation of an old sulphide showing near the head of **Greenland Creek** (Minfile 082FNE107) showed it to be a stratabound sulphide breccia layer within Lower Aldridge siltstones, with a true thickness of about 50 centimetres and traceable laterally for at least 5 metres. Rounded fragments of quartz occur in a weakly foliated (or bedded?) matrix of massive pyrrhotite with minor sphalerite, galena, chalcopyrite and arsenopyrite. Five grab samples from the showing all assayed rich in silver, lead and zinc, the best being 130.0 g/t Ag, 9.17% Pb and 6.27% Zn. A late-season, seven-hole drill test in the vicinity of the showing is reported to have encountered base metal mineralization and sedex-like alteration assemblages in every hole. Stratabound sulphide bands were intersected down-dip from the showing giving a best assay of 6.06% Zn over 0.33 metres. The upper basin of Greenland Creek contains a number of untested anomalous features, including the strongest conductor on the entire Findlay block of the 1995 airborne geophysical survey, and strong, multi element stream-sediment anomalies downstream from the discovery area. An aggressive program is planned for 1998 with a proposed budget of \$500 000.

On the **Fors** property, located immediately west and south of Moyie Lake and optioned from Chapleau Resources Ltd. and Barkhor Resources Inc., Citation Resources Inc. completed a major drilling program consisting of a total of more than 13 000 metres in 17 holes (the first two holes were completed in late 1996). A previous optionor, Consolidated Ramrod Gold Corp., had outlined a large, discordant fragmental zone which extended for more than 400 metres stratigraphically above the Sullivan horizon. This "Fors vent" is intensely altered to tourmalinite and various other assemblages, contains abundant disseminated and locally stratiform pyrrhotite with minor sphalerite, and appears to be rooted in a concordant fragmental blanket in a deep sub-basin at the presumed level of the Sullivan horizon. Citation's drilling in 1997 substantially clarified the structure and stratigraphy of the Aldridge rocks surrounding the Fors vent, but did not reveal the presence of economic

sulphide mineralization, leading Citation to terminate its option.

KOOTENAY ARC

For the first time in several years, Cominco Ltd. committed a major portion of its regional exploration spending to the Kootenay arc, highlighted by a major drilling program at its **Duncan** mine property and extensive ground acquisition in the Salmo area at the south end of the arc. This initiative was driven partly by the relatively high zinc price early in the year and by a need to confirm future local supplies of lead-zinc concentrate for the Trail smelter. The Duncan mine, located on an island close to the east shore of Duncan Lake, has never produced but is classed as a developed prospect with a long history of exploration drilling and underground development. The most recent published drill-indicated resource figure for the property is 3.7 million tonnes grading 3.1% Zn and 3.2% Pb (Hoy, 1982, CIM Bulletin v.75, no. 80, p.114). The drilling done in 1997, approximately 4000 metres in six holes, was intended to improve on and add to the known resource. Additional drilling has been proposed for 1998. The mineralization is comprised of a series of stratabound, lenticular zones occurring mainly in brecciated and silicified dolomite of the Lower Cambrian Badshot Formation. Typical of the Kootenay arc, the strata and the enclosed mineral deposits have been strongly folded and faulted. The deposits are believed to be sedimentary exhalative in origin, with considerable recrystallization and remobilization during a number of phases of deformation, resulting in a strong structural control on their present distribution.

Sultan Minerals Inc. completed a program of underground drilling consisting of a total of 1204 metres in 16 holes and one short surface hole at its **Jersey-Emerald** property south of Salmo. This large property includes both the former Jersey lead-zinc-silver mine and the former Emerald tungsten mine. The company has been exploring the property for gold associated with skarn-hosted massive sulphide zones in the Emerald and Jersey workings and, more recently, additional lead-zinc-silver ore in a lower dolomite horizon which is conformable with and roughly 60 metres stratigraphically below the original Jersey orebodies. The underground drilling in 1997 tested both targets from within the Jersey workings. It showed that gold-silver mineralization is associated with a quartz-pyrrhotite-arsenopyrite-pyrite horizon, called the Bismuth-Gold zone, which runs parallel to the east limb of the Jersey orebody. The drilling also confirmed the existence of lead-zinc mineralization in the lower dolomite but showed it to be strongly intruded by granitic rocks. Further drilling is

planned to test the belief that the mineralization will be less diluted to the south, further from the underlying Emerald stock. Later in the year the company reported that soil sampling had outlined a large, very strong, zinc-silver-copper anomaly, named the Wilson Creek zone, in an area of poor rock exposure about 2 kilometres south of the Jersey minesite. This large property still presents numerous and varied unexplored targets.

SLOCAN CAMP

Cream Minerals Ltd. has reported very promising results from a program of mapping, trenching and drilling on its **Bismark** (also called "**Kaslo Silver**") property on Keen Creek west of Kaslo. This high-grade silver-lead-zinc prospect, optioned from Eric and Jack Denny, comprises a string of former small mines and prospects stretching northeasterly for 9 kilometres along the east side of Keen Creek, including the Cork Province, Bismark and Silver Bear mines. The replacement and vein-hosted mineralization occurs in two main shear zones which appear to be wide and continuous over the full length of the property and were only exploited in a small way by the former mines. Trenching returned some very high silver values, including 371.6 g/t Ag, 4.94% Zn, 3.26% Pb over 15 metres at the Silver Bear zone and 147.5 g/t Ag, 7.01% Zn, 3.78% Pb over 7 metres at the Cork South zone. Late-season diamond drilling tested the down-dip extension of the Cork South zone with a fan of holes collared at the west end of the trench. The drilling confirmed the steep easterly dip of the zone with high-grade mineralization extending to a vertical depth of at least 25 metres. The interpreted true thickness is 6 to 7 metres with a weighted average grade of 179.52 g/t Ag, 5.12% Pb and 7.33% Zn. More drilling and continued exploration of the complete property have been proposed for 1998.

At the historic town of Sandon, east of New Denver, Tremanco Resources Ltd. resumed small-scale mining and milling of high-grade silver-lead-zinc ore from the **Silvana** and **Hinckley** deposits, and shipped the concentrate to the Trail smelter. This activity began in the early fall and was continuing at year end. A modest surface drilling program (six holes totalling 590 metres) was completed in October with the objective of locating additional ore at the Silvana mine. Results have not been announced.

GREENWOOD MINING DIVISION

Essentially every year for the past several decades, the Greenwood Mining Division, which includes the Greenwood, Rock Creek, Beaverdell and Franklin mining camps, has been a hot spot for exploration

activity. In 1997 activity slowed considerably, in contrast to increased activity levels in the eastern parts of the Kootenay region. The main cause of the reduced spending level seems to have been the difficulty in raising funds to pursue projects targeting gold and/or copper, both of which suffered from significantly reduced market prices in 1997. Most of the major activity in the area has been based on the search for those two metals.

Echo Bay Mines Ltd. optioned all of the local properties of Greenwood-based Kettle River Resources early in 1997 and took over responsibility for planning and managing all exploration work on them for a period of five years, with a first-year commitment to drill a minimum of 10 000 feet (3048 metres). The initial program undertaken by Echo Bay was the drilling of ten core holes totalling 1056 metres to explore for extensions of the **Sylvester K** gold-bearing massive sulphide occurrence, located just north of the former Phoenix mine. The Sylvester K deposit is a steep-dipping slab of massive pyrrhotite with minor pyrite and chalcopyrite, containing locally high gold values. It occurs at, and is conformable to, a stratigraphic contact between limestone and dark green volcanoclastic breccia. It most resembles a volcanogenic massive sulphide deposit but has also been interpreted as a distal skarn. It extends over 90 metres along strike but previous work had shown it to be truncated by a flat fault at a depth of about 30 metres. Echo Bay's drilling located an offset part of the zone below the fault and about 200 metres east of the surface occurrence, but it was not mineralized.

Fifteen holes totalling 967 metres were drilled by Echo Bay at the **Summit** gold prospect north of Grand Forks, in an effort to find an extension of the gold-rich epithermal quartz veins in silicified limestone discovered by Kettle River in 1996. West of Highway 3 and directly across from the Summit prospect, Echo Bay also drilled five holes totalling about 250 metres to investigate gold-bearing skarn and a small epithermal vein in the vicinity of the former **Emma** and **Oro Denoro** mines. Finally, the company drilled six holes totalling 556 metres to investigate a massive pyrrhotite occurrence in the **Attwood** Formation on the **Croesus-Johannesberg** property on Porter Creek a few kilometres south of Greenwood. Results of these latter three programs have not yet been reported.

At its **Eholt** copper-gold skarn prospect, which now combines its own Bear-Cub claim group with the adjoining Eholt property optioned from Orvana Minerals Corp., Teck Corporation completed about 3.2 kilometres of backhoe trenching to investigate ore controls and grade distribution at the **Dead Honda** zone, but no drilling was done in 1997.

St. Elias Mines Ltd. completed 590 metres of drilling in nine holes on its **Cranberry Ridge** property immediately west of Beaverdell. The target mineralization is locally very high grade gold-silver-copper-zinc in narrow quartz veins which are reported to be localized at the contacts of greenstone dikes cutting sheared granodiorite. Results of the drilling have not been reported but earlier trench assays ran as high as 93.2 g/t Au, 425 g/t Ag, and 2.2% Cu over unreported widths.

OTHER METAL PROJECTS

A project which emerged late in the year as a potentially important new prospect for the region is the **Jodi/Sly** molybdenum-tungsten-zinc project on Baker Creek just east of Gray Creek Pass. The owner/operator is the 50:50 joint venture of Barkhor Resources Inc. and Newen Enterprises Inc. It started early in the year as a low-budget investigation of stratabound zinc which had been discovered in the Mt. Nelson Formation in 1995 by Gordon Johnstone, while prospecting with a Prospector Assistance grant. By the fall, interest on the property had migrated northward and had evolved into a more aggressive investigation of a molybdenum porphyry system with good grade and size potential. The zone now being tested is an old molybdenum occurrence (Minfile 082FNE004) found and drilled by Cominco almost twenty years ago. Cominco had outlined a strong Mo-W-Zn soil anomaly which is 200 metres wide and at least 1200 metres long. The current drilling is systematically testing the area of the anomaly. By year-end a total of about 2500 metres had been completed in nine holes on the property. The last seven holes which were drilled on the anomaly all contain visible molybdenite but the only assays reported so far are from the sixth hole in which a 29.0 metre interval averaged 0.0769% Mo. The best molybdenite mineralization occurs in a stockwork of very thin quartz veins in a shattered, sericite-rich, phyllitic, white quartzite, which is interbedded with pyroxene-garnet skarn-altered dolomite containing disseminated scheelite. Aplite and quartz monzonite dikes and plugs are numerous and suggest that the altered Mt. Nelson rocks are underlain by an offshoot of the Cretaceous Bayonne batholith.

Loumic Resources Ltd. drilled a total of 1013.1 metres in six holes at its **Red Point** bulk-tonnage gold prospect on the north end of Lookout Mountain, immediately southwest of Trail. The gold is associated with pyrrhotite and pyrite (with only traces of chalcopyrite) disseminated through and coating hairline fractures in Rossland Group pyroclastics and flows which seem to range in composition from andesite to felsites. Alteration is generally weak, mainly biotitization with

more localized albitization(?). The mineralization is believed to represent a gold-rich, copper-poor, porphyry occurrence. It appears to have been deposited very early after deposition of the volcanic host because the best grades occur in fragmental rocks where higher original porosity and permeability may have played a role in channeling the mineralizing fluids. The best assay interval reported was from hole #2 in which 166 metres averaged 0.84 g/t Au. Further work will be necessary to determine whether grades of that level are sufficiently widespread to represent a mineable bulk-tonnage situation.

The **North 40** property of Bluebird Minerals Ltd. is a gold prospect located between Salmo and Creston, north of the former Bayonne mine. Drilling was focused on a large lead-gold anomaly in soils, with coincident VLF anomalies. Mineralization consists of widely spaced, shear-hosted, quartz-pyrite-galena veins in granite. The veins have envelopes of strong clay-sericite alteration up to a metre wide, but the intervening granite is relatively unaltered. Six holes were drilled totalling 1132 metres. Gold assays are reported to have ranged from 1.28 to 4.02 g/t in nine sample intervals.

On the east side of Hailstorm Ridge in the Tillicum gold camp, 28 kilometres south of Nakusp, Baron Gold Corp. completed a five-hole drilling program on the optioned **Strebe** property as an initial step toward improving on the reported inferred resource of 75 000 ounces of gold. The mineralization is structurally controlled, skarn-hosted native gold with minor pyrite, sphalerite and galena. Trench sampling prior to drilling showed the gold values to be quite erratic but locally in the multi-ounce range. Results of the drilling have not been reported but the company has indicated its intention to return in 1998.

Three drilling programs were completed in 1997 in the vicinity of Nelson. About 1200 metres of drilling was completed by GEO Resources Ltd. on the **White/MRS** property, adjacent to the former Kenville mine southeast of Nelson. The objective was to evaluate the northern extension of the mineralized shear zone at the nearby abandoned Eureka gold-silver mine, along which earlier soil sampling had returned extremely high copper and silver values, including one string of samples that ran greater than 1500 ppm Cu over a distance of 200 metres parallel to the trend of the structure. The drilling was completed in December, but no results have been reported. West of the Kenville mine, in the **Fortynine Creek** area, a private company called McMahon Resources Ltd. carried out a total of more than 1200 metres of drilling in several phases. This drilling was directed at locating an assumed siliceous shear-breccia

zone believed to be the source of coarse, high-grade gold float found in Fortynine Creek, and also to test a suspected copper-gold porphyry system near the mouth of the creek where previous drilling had returned high-grade chalcopryrite-bornite mineralization in diorite with locally strong potassic and siliceous alteration. No assays or other details of the drilling have been reported. On **Kokanee Creek**, east of Nelson, the Miner River Resources/Eagle Plains Resources joint venture completed a modest drilling program of 430 metres in five holes, to test an extensive gold-silver-zinc-lead soil anomaly associated with a pendant of metasedimentary rocks in the Nelson batholith. Assay results were erratic but locally high, including one interval that ran 26.11 g/t Au over 70 centimetres and another that assayed 10.20% Zn over 50 centimetres. Little or no veining was evident in the core and the operators consider the mineralization to be skarn-type.

At the **Bull River** mine east of Cranbrook, R.H. Stanfield and Associates continued to sink an exploration decline collared in late 1996. At year-end the it had progressed to about 915 metres from the collar, at which point drifting had begun to create drill stations. Drilling on that level is expected to start shortly and the decline will be extended to its target length of 1500 metres, at which point a bulk sample will be mined and more exploration drilling will be done. Material mined from two small open pits in the 1970s by Placid Oil, consists of gold-silver bearing chalcopryrite concentrations in at least two swarms of quartz-ferrocarbonate mesothermal veins cutting Aldridge Formation siliciclastics. Deep drilling from surface over many years is reported to have confirmed the existence of several millions of tonnes of copper-gold mineralization. The current underground development will provide an opportunity to better define the resource at depth. The operators also carried out a limited airborne geophysical survey and several small drilling programs to assess other potential targets on their extensive claim holdings.

On **Albert River**, east of Invermere, Dia Met Minerals Ltd. completed another helicopter-supported drilling program on its gold-tungsten prospect. Five holes were drilled, totalling 1325 metres, partly to determine the source of isolated anomalous gold values in surface rock samples and also to investigate a stack of thin, sub-horizontal, quartz-calcite veins which outcrop on a steep cliff directly above an accumulation of tungsten-rich vein material in talus. Nothing has yet been reported about the results of the program or future plans.

INDUSTRIAL MINERALS

In December, I.M.P. Industrial Mineral Park Mining Corp. drilled a total of 891 metres in 22 short, vertical core holes to further investigate the grade distribution of flake graphite at its **Black Crystal** property at the head of Hoder Creek, west of Slocan. The graphite is disseminated, together with biotite of about the same grain size, in otherwise clean, coarse-grained, marble beds which are interlayered with quartzofeldspathic gneisses of the Valhalla Gneissic Complex. The company has already excavated a few thousand tonnes of weathered graphitic marble for initial mill-testing and has almost completed construction of a pilot mill on Koch Creek, 31 kilometres from the deposit. Near Vallican, on the Little Slocan River, only a few kilometres from I.M.P.'s millsite, Anglo Swiss Resources Inc. collected about 160 tonnes of corundum-rich feldspar pegmatite and feldspathic gneiss from its **Blu Moon** property. The rock was transported to the former Kenville mill near Nelson, also owned by Anglo Swiss, where the corundum crystals (sapphires) were separated from the rock and shipped to California for heat-treatment tests. The company reported that heat treatment significantly improved both the colour and clarity of the sapphires. Untreated sapphires from Blu Moon and from the company's Blu Starr claim at Passmore have been successfully marketed through Nelson jewellers for several years.

At its **Parson** barite mine south of Golden, where measured reserves are available for only a few more years, Highwood Resources Ltd. carried out exploration drilling both underground and on surface in the vicinity of the mine. W.W.C. Consulting Ltd. completed a modest exploration drilling program at its former-producing **Elkhorn** barite property on Madias Creek south of Windermere.

Georgia Pacific Inc. drilled several short exploration holes, totalling approximately 500 metres, near its **Four J** gypsum quarry on Lussier River, east of Canal Flats. Markets were supplied in 1997 from gypsum stockpiled at its shipping facility in Canal Flats and some additional mining was done at the Four J quarry. Other industrial mineral producers in the region (see map, Figure 4) operated through 1997, but are not known to have conducted any exploration for new reserves. Westroc Industries Ltd. reported 1997 production of gypsum from its **Elkhorn 1** and **Elkhorn 2** quarries near Windermere of about 500 000 tonnes, up marginally from 1996. At **Mt. Brussilof**, northeast of Radium Hot Springs, Baymag Mines Co. Limited expected to ship between 180 000 and 200 000 tonnes of magnesite to its processing plant in

Kootenay Region Producing Mines and Quarries 1997

- 1 Fording River
- 2 Greenhills
- 3 Line Creek
- 4 Elkview
- 5 Coal Mountain
- 6 Moberly
- 7 Horse Creek
- 8 Parson
- 9 Mt. Brussilof
- 10 Elkhorn
- 11 Four J
- 12 Sullivan
- 13 Crawford Bay
- 14 Sirdar
- 15 Kootenay Stone
- 16 Lost Creek
- 17 Albrit
- 18 Black Gold
- 19 Rock Creek
- 20 Beaverdell

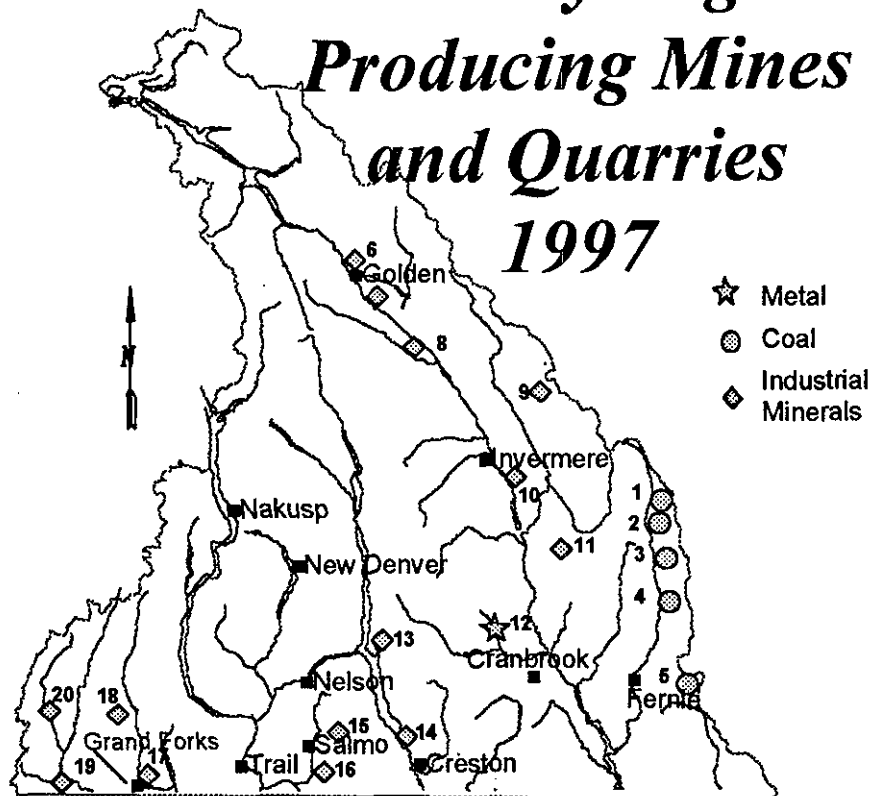


Figure 4. Producing mines and quarries, Kootenay Region 1997.

Exshaw, Alberta. In the Golden area, Highwood Resources Ltd. continues to ship about 140 000 tonnes of silica mined from its **Mt. Moberly** quarry to various markets, and Nugget Contracting Ltd. ships approximately 70 000 tonnes of silica from its **Horse Creek** operation, mostly to Wenatchee, Washington for silicon metal production. From its processing plant at **Sirdar** north of Creston, IMASCO Minerals Inc. ships dolomite and limestone mined underground at **Crawford Bay**, limestone from an intermittent operation at **Lost Creek** south of Salmo, and crushed granite mined underground adjacent to the Sirdar plant. Mighty White Dolomite Ltd. quarries and processes dolomite near **Rock Creek**. **Kootenay Stone Centre** near Salmo produces a few thousand tonnes annually of quartzite flagstone from a number of small quarries, mainly in the Porcupine Creek area. Granite dimension stone is quarried at two adjacent sites south of **Beaverdell** and San Pedro Stone Ltd. ships "black granite" to Korea from its small **Black Gold** quarry at Almond Mountain north of Grand Forks.

COAL

There was only one major coal exploration program remote from a producing mine in 1997. **Fording Coal Ltd.** drilled nine reverse circulation holes for a total of 817 metres on its recently acquired **Lodgepole** coal licenses in the Flathead River valley. The thermal coal resource at Lodgepole is seen as a long-term successor to the company's nearby **Coal Mountain** thermal coal operation. The current exploration is an initial test of the quality and geometry of the resource.

Fording projected its coal production from **Coal Mountain** at about 2.3 million tonnes in 1997, increasing to 2.5 million tonnes in 1998. In-pit exploration drilling amounted to around 4200 metres and a geophysical program was completed on the Middle Mountain coal license. At the **Fording River** mine, the company anticipated total production in 1997 to reach 8 million tonnes. Exploration drilling near the mine totalled 22 900 metres in about 90 rotary holes. At its adjacent **Greenhills** mine, **Fording Coal Ltd.** projected

1997 production at 4.3 million tonnes. Exploration drilling in and around the mine amounted to approximately 18 000 metres of mainly rotary drilling. Elkview Coal Corporation, at the Elkview mine near Sparwood, expected to produce 2.7 million tonnes of coal in 1997. It completed about 9400 metres of rotary drilling in areas adjacent to the producing pits which are scheduled for future development, and also approximately 7000 metres of in-pit exploration drilling. At its Line Creek mine, Manalta Coal Ltd. anticipated production totals for 1997 to reach 2.5 million tonnes of metallurgical coal and 700 000 tonnes of thermal coal. Exploration work was limited to in-pit drilling.

ACKNOWLEDGEMENTS

Thanks are due to the many industry managers, geologists and field staff who were willing to share their data with the author and to provide access to their exploration properties. Without their cooperation, compilations and reviews of this type would not be possible. Timely submission of Notices of Completion to the District Manager in many cases also assisted in the gathering of important statistics when direct contact with field staff was not achieved.

The author also gratefully acknowledges the assistance of his colleagues in the Kootenay regional office, in particular Valerie Smolik, Gordon MacKay and David Grieve, who helped with the preparation of the table, histograms, and maps.

A large part of the information included in the section on coal was taken directly from a compilation by Barry Ryan of the Geological Survey Branch's Coal Unit, which he graciously shared with the author.

EXPLORATION AND DEVELOPMENT HIGHLIGHTS SOUTHWESTERN BRITISH COLUMBIA - 1997

By R. H. Pinsent, P. Geo.
Regional Geologist, Vancouver

INTRODUCTION

In the spring of 1997 the Minister of Employment and Investment announced plans to create a Mineral Development Office in Vancouver by upgrading and increasing staff levels in the existing office at 865 Hornby Street. The new office will promote the province's mineral development opportunities, and provide an important geoscience centre for the Vancouver-based mineral exploration and mining sector.

HIGHLIGHTS

- Westmin Resources Limited identified a new zinc-rich massive sulphide lens as a result of a step-out drilling program at Myra Falls.
- Imperial Metals Corporation submitted a proposal to mine a bulk sample from the AM zone on the Giant Copper property southeast of Hope.
- T'Sable Coal Corporation submitted a proposal to extract a bulk sample from the T'Sable River coalfield south of Courtenay.

EXPLORATION AND PRODUCTION TRENDS

The value of the metal produced in the region rose slightly in 1997 as Westmin Resources Limited processed higher grade ore at Myra Falls. Clean coal production also increased as Quinsam Coal Corporation focused less on development and more on production at the Quinsam coal mine. The amount of limestone and of other industrial minerals and sand and gravel produced in the region remained approximately the same.

Exploration activity was down in 1997. There were fewer active projects and there was less money spent on exploration. Total investment is estimated at \$5.75 million, down from \$8.5 million in 1996. Of this, well over half was spent at the two mines. Table 1 lists fourteen "major projects" (arbitrarily defined as those likely to have had expenditures in excess of \$100 000). However, only four, in addition to the mines, are likely to have had expenditures of over \$200 000. There were

relatively well funded programs at Knob Hill, Tay and T'Sable River on Vancouver Island and at Hotspring (Quet) on the Mainland. There were also smaller programs at Debbie, Lucky/Toq, Marathon and Nitinat on Vancouver Island and at Brandywine, Margie, Ruby and Seneca on the Mainland. Table 1 also includes four properties, Galleon, Giant Copper, Monument and Quadra, that had high profiles in 1997 although they received insufficient expenditure to qualify as "major projects". The table also lists a further four projects, at Alexandria, Benson Lake, Elk/Big Andy and Nugget Queen that were completed in the late fall of 1996 and missed inclusion in last year's exploration review.

Taken together, and excluding the producing mines, the properties listed in Table 1 and shown in Figure 1, indicate a strong interest in exploration for higher grade metallic deposits, both gold and/or copper rich veins and volcanogenic massive sulphide deposits. The table also shows that there is less interest in exploring lower grade "porphyry-style" prospects than there was a few years ago. The past few years have seen a significant decrease in exploration on Vancouver Island and, conversely, a significant increase in activity on the Mainland, particularly in and around volcanic and sedimentary rock pendants in the Coast Plutonic Complex. This shift in exploration emphasis may, in part, reflect increased recognition of the importance of major vein systems, such as those at Doratha Morton and Surf Inlet, and volcanogenic massive sulphide camps, such as those at Britannia and Ecstall, to the mineral endowment of the region.

Exploration for coal and industrial minerals continued in 1997, but at a reduced level. There is only one company currently exploring for coal in the region. T'Sable River Coal Corporation is active south of Courtenay. Several companies are exploring for limestone, magnetite and other industrial minerals, but the amount of field activity this year was down because of market conditions. Dimension stone, however, remains a bright spot. Garibaldi Granite Inc. expanded its rock processing plant in Squamish and Margranite Industries increased production at its tile operation in Surrey.

TABLE 1
MAJOR EXPLORATION PROJECTS, SOUTHWESTERN REGION: 1997

Property (Owner)	MINFILE	Mining Division	NTS	Commodity	Deposit Type	Work Done
Alexandria/Enid-Julie (Norwood Resources Ltd.)	092K 028 092K 024	Vancouver	92K/6W 92K/11W	Au,Ag,Cu, Zn	Shear/vein	geol; geochem
Benson Lake (Raging River Power and Mining Inc.)	none	Nanaimo	92L/6W	Limestone		8 ddh, 595 m
Brandywine (La Rock Mining Corp.)	092JW001	Vancouver	92J/3E	Au,Ag,Pb	Shear/vein	5 ddh, 1000 m
Debbie (White Hawk Ventures Inc.)	092F 079	Alberni	92F/2E	Au,Ag,Cu	Vein	bulk sample
Elk/Big Andy (Tiberon Minerals Ltd.)	092K 122	Vancouver	92K/15W	Cu,Zn,Au, Ag	Massive sulphide	airborne geophys; geochem
Galleon (AGC America's Gold Corp.)	092C 071 092C 140	Victoria	92C/9W	Au	Vein	
Giant Copper (Imperial Metals Corp.)	092HSW001	New West.	92H/3W	Cu,Mo,Au, Ag	Porphyry/breccia	
Hotspring/Quet (Mount Hope Resources Ltd.)	092GNE038	New West.	92G/16W	Au,Ag,Pb, Zn	Vein	11 ddh, 1950 m
Knob Hill (First Choice Industries Ltd.)	102I 005	Nanaimo	102I/16E	Au,Ag,Cu	Transition/Porphyry	airborne geophys; geophys; geochem;
Lucky/Toq (Consolidated Logan Mines Inc.)	none	Alberni	92F/3W	Au,Cu	Vein	geochem
Marathon (Ambra Mining Corp.)	092C 126	Victoria	092C/16W	Au,Ag,Cu	Vein	7 ddh, 560 m
Margie (Verdstone Gold Corp.)	092HSW006	New West.	92H/6W	Cu,Ag	Vein	13 ddh, 610 m
Monument (Minestar Resources Ltd.)	092HNW054	New West.	92H11W	Au	Vein	
Myra Falls (Westmin Resources Ltd.)	092F 330 092F 073	Alberni	92F/12E	Cu,Zn,Au, Ag	Massive sulphide	23 ddh, 10 042 m; 11 w/g ddh, 6189 m;
Nitinat River (CRC Explorations Ltd.)	092C 038	Alberni Victoria	92C/15E	Au,Ag,Zn	Vein	geol; geophys; geochem
Nugget Queen (Solaia Ventures Inc.)	092L 178	Vancouver	92L/14E	Au,Ag,Pb, Zn	Vein	geol; geochem
Quadra Copper (Network One Holdings Corp.)	092K 060 092K 072	Nanaimo	092K/3W	Cu,Ag	Vein/replacement	
Quinsam (Quinsam Coal Corp.)	092F 319	Nanaimo	92F/14W	Coal		seismic geophys; 23 pdh, 2742 m
Ruby (Menika Resources Ltd.)	092GNW050	Vancouver	92G/12W	Cu,Zn,Au, Ag	Vein	5 ddh, 716 m
Seneca/Vaughan (Riverstone Resources Ltd.)	none	New West.	92G/8E 92H/5W	Cu,Zn,Pb, Ag,Au	Massive sulphide	6 ddh, 694 m
Tay (Dalmation Resources Ltd.)	092F 212 092F 150	Alberni	92F/6W	Au,Ag,Cu	Shear/vein	geophys; geochem; 8 ddh, 1274 m
T'Sable River Coal (T'Sable River Coal Corp.)	none	Nanaimo	92F/10W	Coal		seismic geophys; 4 ddh, 572 m

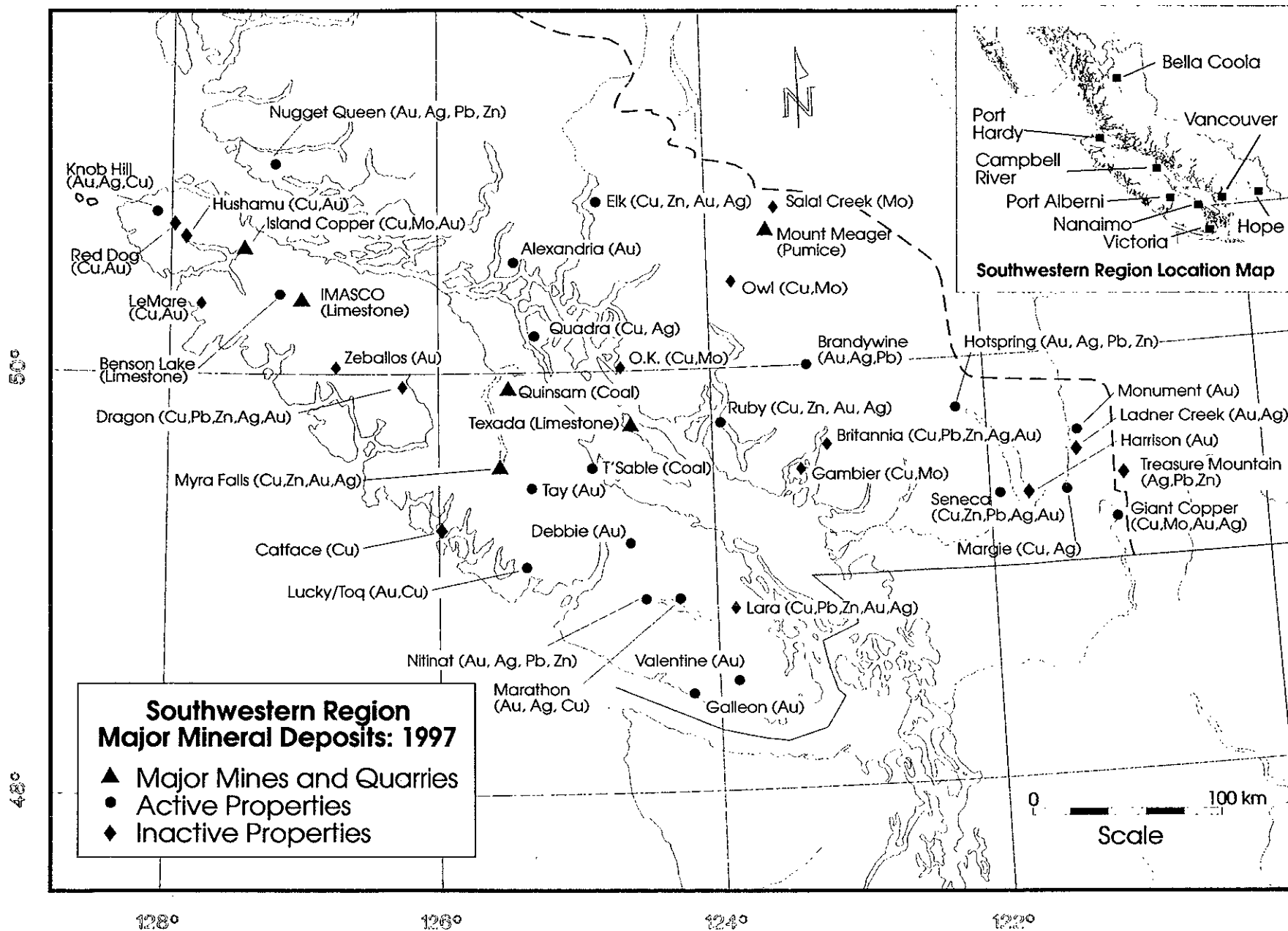


Figure 1. Southwestern Region major mineral deposits: 1997.

In January, the natural stone producers in the province organized themselves as the British Columbia Natural Stone Association. It currently has 50 members.

The following review of exploration and development activity in the region is based on information supplied by professional and other staff involved in exploration and mining in the region, and on published and unpublished reports, news releases and field visits.

PRODUCING MINES AND QUARRIES

The operating mines and quarries had a reasonably successful year and either increased or maintained production. However, commodity prices declined during the year and the outlook is uncertain. The currency crisis that affected Asia in the fall of 1997 may lead to lower prices and decreased demand for metal concentrate and coal over the next few years. It may also lead to increased production and exportation of low priced industrial minerals and dimension stone from Asia, creating increased competition for local suppliers.

MYRA FALLS OPERATION

Westmin Resources Limited operates a 3850 tonnes per day underground mining operation, employing approximately 400 people, at Myra Falls, near Campbell River. The company mines a large and geologically complex massive sulphide deposit. In 1997 it mined 1 257 045 tonnes of ore with an average grade of 1.51 % Cu, 5.35 % Zn, 0.18 % Pb, 1.56 g/t Au and 21.3 g/t Ag and produced 63 693 tonnes of copper and 113 912 tonnes of zinc concentrate and 8.266 tonnes of precious metal rich Knelson concentrate. The average headgrade at the mine has increased markedly over the past few years as the company has increased production from the relatively zinc-rich Gopher and Battle zones and reduced its reliance on lower grade ore from the H-W zone. It currently takes approximately 30% of its production from the higher grade lenses. As of December, 1997, the operation had an aggregate proven and probable mineable reserve of 8 057 756 tonnes grading 1.6 % Cu, 7.5 % Zn, 0.4 % Pb, 1.4 g/t Au and 33.5 g/t Ag.

Westmin has conducted detailed studies of the stratigraphy and structure of the Myra Falls area over the past few years and has been rewarded by success in its exploration. It discovered the high-grade Battle and Gap deposits in 1991 and the Trumpeter and Marshall zones in 1993. Recent studies include a reappraisal of the post-ore deformation of the deposit and a reassessment of the off-sets on post-mineral faults. The data provide new insight into linkages between offset portions of known

sulphide lenses. It explains why six diamond-drill holes (aggregate depth of 2684 metres), drilled from a crosscut in the Price mine, hit faults and failed to find the westward extension of the Trumpeter zone under Myra Ridge. The new interpretation suggests that the Trumpeter zone formed at approximately the same stratigraphic horizon as other H-W trend deposits but in a completely different, subparallel graben 200 to 300 metres to the northeast. It is not, as previously thought, a fault off-set of Block 43 mineralization in the H-W mine.

Based on this reinterpretation, the company stepped out approximately 1000 metres to the northeast of the Trumpeter zone and drilled two holes from surface, on Myra Ridge, (total depth of 2242 metres) looking for evidence of the postulated Trumpeter graben in an area previously considered to be too far from the main trend to warrant exploration. Both holes intersected rhyolite breccia and sediment consistent with the presence of a graben. In addition, one hole returned 4.5 metres of semimassive sulphide intermixed with rhyolite, and 1.2 metres of sub-economic massive sulphide. The discovery intercepts for the new Trumpeter West zone are below the main haulage level for the H-W shaft but they are shallow enough that the zone could be mined through the shaft. The company plans to continue to explore for the rest of the Trumpeter zone and to trace the Trumpeter West graben along strike to the northwest, where it should be up faulted above the elevation of the haulage level.

Westmin also drilled eleven core holes (aggregate depth of 5287 metres) from surface at the mine site to delineate the northwestern extension of the main H-W lens southeast of the Battle zone. The extension area had previously been drilled from underground but intercepts were poorly located for developing a reserve. The surface holes show that the H-W extension zone is far richer in zinc than had previously been thought. Its average grade is likely to be closer to that of the Gopher zone than the main H-W lens. One intercept is reported to have assayed 10.9% Zn, 2.3% Cu, 1.3% Pb, 1.0 g/t Au and 49.3 g/t Ag over 16.9 metres.

Westmin plans to drill the Marshall zone from 10 level in the Lynx mine and it has started to drive an 800-metre crosscut to provide access. The company completed the first 400 metres in 1997. It will complete the remainder and start drilling in 1998. Elsewhere on 10 level, the company completed five diamond-drill holes (aggregate depth of 3505 metres), looking for detrital sulphide in fine-grained sediment in a local palaeotopographic depression between the H-W and Ridge zones. The holes intersected sulphide, however the results were erratic and grades inconsistent.

The company continued with its stratigraphic drilling program in the Thelwood Creek valley. It drilled 2513 metres in ten core holes, five each side of the creek. Work to date shows no sign of mineralized H-W horizon stratigraphy east of Thelwood Creek. However, it is possible that the stratigraphic package is deeper than previously thought and has not been tested by the relatively shallow drilling carried out to date.

In November, 1997, Boliden Limited, a company new to Canada but with extensive mining and milling operations in Sweden, Spain and Saudi Arabia launched a successful bid for the outstanding shares of Westmin Resources Limited and acquired the company. The move provides Boliden with a producing mine and exploration arm in North America.

QUINSAM COAL MINE

Quinsam Coal Corporation operates an underground coal mine, employing approximately 180 people, near Campbell River. In 1997, it produced approximately 1.2 million tonnes of clean thermal coal for use in local cement plants and off-shore electrical generating plants. The operation has a reported mineable reserve of 36 million tonnes. It has expanded production considerably over the past few years and it is still developing the underground infrastructure required to maintain its current level of production.

Most of the exploration work carried on the property was aimed at providing stratigraphic and structural data in advance of future development and mining in the 2N and 4S production blocks. The company ran a seismic geophysical survey over a structurally disturbed part of the 2N block, looking for evidence of fault off-set of the principal coal seam. It later drilled twelve rotary-drill holes (with recovery of coal) in the 2N area, for an aggregate depth of 1549 metres. Most of the holes were sited to assist interpretation of the seismic survey results, however a few were drilled on the periphery of the known deposit to locate additional tonnage. The results indicate that the company should be able to mine in the disturbed area and should also be able to add to the 2N block reserve. Quinsam also drilled 11 rotary holes, for an aggregate depth of 1193 metres, between the currently producing 4S block and a fold and fault off-set extension known as the Lot 242 block. The company processed a bulk sample from Lot 242 in 1996 but it has yet to put it into production.

LIMESTONE QUARRIES

Holnam West Materials Limited and Ash Grove Cement Company employ 140 people at their respective

operations at Gillies Bay and Blubber Bay on Texada Island. Between them, in 1997, they produced approximately 5.0 million tonnes of cement, chemical, agricultural grade and crushed rock "aggregate" limestone, approximately the same as in the preceding year. The two companies are the principal suppliers of limestone in the coastal Pacific Northwest. They ship their product to customers in the Lower Mainland and in the Seattle area of Washington State. Imperial Limestone Corporation is a third, relatively small-scale, limestone producer on Texada. In 1997, it produced approximately 200 000 tonnes of chemical grade limestone primarily for use as industrial fillers.

Demand for cement-grade limestone has been fairly stable over the past few years. However, it should increase when Lafarge Canada Inc. completes construction of its new cement plant in Richmond in 1999. Demand for crushed rock aggregate appears to be rising and becoming less dependent on major construction projects. In 1997, there was sufficient increase in export demand from Washington State to offset the drop in demand experienced in the Lower Mainland following completion of the Roberts Bank Container Port and the expansion of Vancouver International Airport.

IMASCO Minerals Inc. owns a small limestone operation near Benson Lake on Vancouver Island. In 1997, it produced approximately 40 000 tonnes of bright, white, recrystallized limestone for specialty markets such as chips for stucco and filler for paint and putty.

OTHER INDUSTRIAL MINERALS

Clayburn Industries Limited has a fireclay operation near Abbotsford on the Lower Mainland. It produces approximately 25 000 tonnes of fireclay per year from flat-lying, Eocene, Huntington Formation shale beds on Sumas Mountain. The company produces four grades of clay for use in the manufacture of specialty refractory products, such as bricks and castings for the alumina industry, as well as face bricks of different colours for the building industry. Much of the specialty product material is shipped off-shore and around the world. The face bricks are sold throughout the Pacific Northwest. Clayburn Industries Limited, in conjunction with a joint venture partner, Sumas Clay Products Limited, also supplies shale for the local cement industry.

In 1995, Great Pacific Pumice Inc. received a mine development certificate to develop a seasonal pumice quarry on the northern slopes of Mount Meager. It is now in production. The company screens material at a temporary processing site in the Lillooet River valley and ships the product into the Lower Mainland. It hopes to

expand its market and is looking for a larger, permanent, processing site near Squamish.

Several companies are currently developing dimension stone properties and/or processing plants in the region. They include: Garibaldi Granite Inc., which has a rock-processing plant in Squamish; Margranite Industries, which has a tile plant in Surrey; Matrix Marble Corporation, which operates out of Duncan; and Granite Island Quarries Limited, which produces from a quarry on Kelly Island, near the mouth of Jervis Inlet.

In 1997, Garibaldi Granite produced approximately 3100 tonnes of dimension stone, and 4500 tonnes of small blocks for use as rip rap, from quarries at Squamish and along the Ashlu River. The company recently completed a contract to supply approximately 25 000 square feet of split-faced cut-block "Glacier White" granite from its Squamish quarry for a new hotel complex in the nearby community of Whistler. It also produced material for other, smaller contracts in Canada and the United States of America. Over the summer, Quarry Pacific Industries, an affiliate of Margranite, took a 2000-tonne bulk sample from large boulders alongside the Silverhope logging road, south of Hope, for processing into tile. In 1998, the company plans to take the Silverhope site and another on the Anderson River northeast of Hope to lease. At the same time, Granite Island Quarries Limited barged approximately 3000 tonnes of fine-grained granodiorite dimension stone blocks from Kelly Island to the Lower Mainland for sale to others for processing. Some of the stone was used in the construction of the Harbour Place residential complex on Coal Harbour in Vancouver.

EXPLORATION ACTIVITY

VANCOUVER AND INSHORE ISLANDS

There were fewer major exploration programs on Vancouver Island this year than in most recent years. However, the decrease may be temporary as several programs proposed for 1997 appear to have been postponed, rather than cancelled. In spite of the poor market conditions, there were numerous minor projects and prospecting programs directed towards a variety of targets. Some may develop into major programs in future years.

KNOB HILL

First Choice Industries Limited carried out a major program at Knob Hill, north of Holberg Inlet at the north end of Vancouver Island, looking for "porphyry" and/or "transitional/epithermal" style mineralization. The

program followed encouraging results from a limited drilling program carried out in 1996. At that time, First Choice drilled a coincident gold-arsenic soil geochemical and high-chargeability geophysical anomaly peripheral to a known porphyry copper occurrence and encountered a large area of altered, crackle brecciated and mineralized massive rhyolite and rhyolite breccia. The rock contains appreciable amounts of fracture-controlled pyrite and arsenopyrite and trace amounts of chalcopyrite, sphalerite and galena. It also contains subeconomic but geochemically interesting amounts of gold.

First Choice conducted an airborne geophysical survey before proceeding to a second, more extensive, drilling program. The company teamed up with Jordex Resources Limited, owner of the nearby Hushamu porphyry copper deposit on the neighbouring EXPO claims, and flew a 500 line-kilometre airborne electromagnetic, magnetometer and radiometric survey.

First Choice spent the summer following up on the results of the airborne survey, cutting grids and running soil geochemical and ground geophysical surveys. It began drilling in the fall. It cored 20 holes for an aggregate depth of 1905 metres. Seventeen holes were drilled in the Obling Creek area, where earlier drilling results had been encouraging. The results were generally disappointing. Some of the holes encountered similar brecciated and mineralized rhyolite and rhyolite breccia but gold values were low. Several holes cut altered andesite and identified a northeasterly trending zone of silicification and biotite alteration that appears to transect the property. The zone is enriched in copper and silver but not gold. Core from one of the holes is reported to have assayed 0.17% Cu and 0.99 g/t Ag over 67 metres. Three of the holes were drilled on other, more remote airborne geophysical targets without encountering significant mineralization.

Although the 1997 drilling program failed to define an exploration target, it confirmed the presence of a broad mineralized system in a geological environment favourable for the formation of porphyry and transitional/epithermal styles of mineralization. First Choice and Jordex Resources have staked additional ground to the south of Knob Hill.

T'SABLE RIVER COAL

T'Sable River Coal Corporation drilled the T'Sable River coalfield southeast of Courtenay in 1996 and calculated an in situ measured, indicated and inferred reserve of 39 million tonnes of high-volatile metallurgical or coking coal between 50 and 500 metres below surface. The reserve lies in a northeasterly trending sedimentary basin on the southeastern side of a

prominent palaeotopographic high, a feature that isolates the basin from the past-producing part of the T'Sable River coalfield. The coal in the basin shales out to the south, south of Cougar Smith Creek, but it remains open to the northeast, north of the T'Sable River.

Approximately 90% of the known reserve is in the lowermost, or No. 1, coal seam in an alternating sequence of siltstones, carbonaceous shales, minor sandstones and coal seams in the Cumberland Member of the Comox Formation. The remaining 10% is in the No. 3 seam higher up the section, near the base of the overlying, generally more sandy, Dunsmuir Member. The seam is comprised of two subseams, 3A and 3B, separated by a narrow interval of sandy siltstone.

In 1997, the company undertook structural, engineering and base-line studies and applied for permits to drive a decline to extract a 90 000-tonne bulk sample. It also completed 8.4 line-kilometres of shallow reflection seismic work to confirm the structural integrity of the coal within the basin. The data show that the sediments in the central part of the coalfield are relatively undisturbed and that the seams should be amenable to underground mining. However, they also show a considerable number of northwesterly dipping thrust faults cutting the northwest flank of the basin. These faults cause considerable local disruption and are likely to reduce the amount of mineable coal on the flank of the deposit. The company also drilled four core drill holes, for an aggregate depth of 572 metres, to confirm its structural interpretation and provide material for acid-base rock studies.

T'Sable River Coal proposes to drive two parallel declines into the No. 1 coal seam from a site north of Cowie Creek and to sample it using a continuous miner and conveyor system similar to that currently in operation at the Quinsam mine. The bulk sample will be trucked to the wash-plant at Quinsam for processing. The company plans to wait for a nearby section of the new Vancouver Island Highway to be completed before proceeding with the program.

BENSON LAKE LIMESTONE

There was very little industrial mineral exploration on Vancouver Island in 1997. However, Raging River Power and Mining Inc. was active in the region in the late fall of 1996. It drilled eight diamond-drill holes, for an aggregate depth of 595 metres, to assess the thickness, continuity and quality of two bands of bright, white marble in Quatsino Formation limestone a short distance to the northwest of IMASCO Mineral Limited's producing quarry at Benson Lake. The results show that

one of the bands may be suitable for use as a ground carbonate filler.

TAY

Dalmation Resources Limited explored the Tay property, west of Port Alberni. It carried out ground geophysical and geochemical programs to evaluate anomalies identified by an airborne geophysical survey conducted in 1996 and it completed eight diamond-drill holes (aggregate depth of 1274 metres) to test some of the better looking targets.

The Tay property is underlain by massive Karmutsen Formation basalt and granodiorite of the Island Plutonic Suite on the north side of a major northwesterly trending fault along the axis of the Taylor River valley west of Sproat Lake. It covers several northeasterly to easterly trending shear zones that appear to be splays off the main fault that underlies the valley. Three of the shears, Tay, Morning and Apex are strongly carbonatized and silicified. The silicious zones are locally brecciated and mineralized with pyrite, arsenopyrite, trace sphalerite, galena and free gold. The drilling program produced mixed results. Holes drilled to test a large induced polarization anomaly coincident with a gold geochemical anomaly near the top of the hill failed to account for the presence of gold in the soil. They intersected a barren vein-stockwork largely composed of graphite and calcite. One hole drilled in the Apex vein area extended its known limits. It intersected a short mineralized interval of brecciated quartz with sulphide and gold.

DEBBIE

In 1993, White Hawk Ventures Inc. leased the Debbie property, south of Port Alberni, from Westmin Resources Limited, with the intention of delineating and mining some of the higher grade, gold-bearing oreshoots. The following year, the company drove an adit into the "900 zone" west of Mineral Creek and mined, but did not mill, an 894-tonne bulk sample. In the summer of 1997, the company recovered the sample and shipped it to Greenwood for processing.

LUCKY/TOQ

Elsewhere in the Alberni District, Consolidated Logan Mines Limited conducted soil geochemical surveys over selected targets on the Lucky/Toq property, near Kennedy Lake. One of the surveys extended a soil grid in the Mount Redford area, where the company has located arsenopyrite and pyrite both in sheeted, sulphide-filled fractures in deformed granodiorite and as disseminations in an altered rhyolite dike. The soils

produced scattered, point anomalies for a variety of elements, including gold and arsenic.

MARATHON

In the Cowichan Lake area, Ambra Mining Corporation completed seven diamond drill holes (aggregate depth of 560 metres) looking for dilations and testing for continuity and gold grade in the Paula quartz vein. This is a narrow (<0.5 metre), discontinuous, vein in a shear zone in granodiorite near a contact with Sicker Group volcanic rocks. The vein contains pyrite, pyrrhotite and chalcopyrite and erratic high values for gold and silver. The drill results were inconclusive. The holes may have been poorly located.

NITINAT

C.R.C. Explorations Limited carried out a geophysical and geochemical program on the Nitinat property west of Cowichan Lake. It refurbished and added to an existing grid, mapped and conducted magnetometer, electromagnetic and induced polarization geophysical surveys. It also collected rock and soil samples in the vicinity of two discreet soil geochemical anomalies that differ in character. One is a gold anomaly and the other is for a variety of metals including silver, arsenic and molybdenum.

The gold geochemical anomaly is underlain by Bonanza Formation volcanic rocks. Based on previous work, it is probably derived from vuggy quartz-carbonate veins and breccia zones that are known to cut the volcanic rocks on the east side of a major northwesterly trending fault and from pyritic and pyrrhotitic silicified rock from within the fault itself. The polymetallic anomaly is west of the fault. It is underlain by Karmutsen volcanic rocks and intercalated limestones at the base of the Quatsino formation. The anomaly is broadly coincident with clastic limestones that contain fine disseminated pyrite and arsenopyrite. The geophysical survey identified several, possibly skarn, related targets for further exploration.

GALLEON

In the fall of 1996, Gary Pearson, a prospector, located an impressive splash of visible gold in a quartz vein in a steeply dipping fault that cuts a relatively shallow-dipping dike exposed in a rock-cut near the community of Port Renfrew. He subsequently located other gold-bearing quartz veins and staked the Galleon claims. The property is largely underlain by deformed but relatively weakly metamorphosed Leech River Group shales and siltstones that are cut by intermediate to felsic

dikes. The intrusions are emplaced along steeply dipping, northeasterly to easterly trending faults that appear to emanate from a major crustal structure, the San Juan fault. The dikes and nearby sediments are cut by white, banded and/or vuggy quartz veins of variable width and by quartz-vein stockworks. The veins contain small amounts of disseminated pyrite, traces of arsenopyrite and highly variable amounts of visible gold. AGC America's Gold Corporation took an option on the property, staked additional claims and carried out a very limited field program.

QUADRA ISLAND

Network One Holdings Corporation has acquired a large claim block over the past-producing copper belt on the west side of Quadra Island. The property includes the Copper Road deposit, east of Deepwater Bay, the Copper Cliff deposit on Discovery Passage and the Copper Bell/Pomeroy deposit-cluster north of Gowland Harbour. The copper belt was discovered in the early 1900s and has been explored intermittently. Some of the deposits have previously produced a minor amount of copper and silver and several have indicated geological reserves. The belt is comprised of numerous stratabound and epigenetic copper deposits in an undulating but relatively flatlying, faulted block of Upper Triassic Karmutsen Formation volcanic rocks.

The Copper Road deposit, in the northern half of the property, is an epigenetic deposit that produced approximately 5000 tonnes of silver-rich copper ore in the 1950s and 1960s. It is in a west to northwesterly trending, near-vertical shear zone that cuts massive, relatively unaltered basalt and andesite over a probable minimum horizontal distance of 1400 metres. The shear zone is 5 to 10 metres wide. It contains intensely deformed, sheared, chloritic volcanic rock cut by quartz and quartz-carbonate veins carrying blebs and larger masses of chalcopyrite and bornite.

The Copper Cliff deposit, at the south end of the property, is marked by a malachite stain that is visible from Discovery Passage. It is a stratabound occurrence composed of chalcocite with malachite and traces of native copper in amygdules and disseminations near the top of a gently dipping, fractured, basaltic flow. It produced a small amount of high-grade copper and silver ore in the early 1900s.

The Copper Bell/Pomeroy area contains numerous epigenetic and stratabound copper showings in relatively flat lying Karmutsen volcanic rocks close to a northwesterly trending fault that underlies Gowland Harbour and extends up Gowland Creek. Most of the showings are within a few hundred metres of the fault

and are related to it. Some of the more distant occurrences may be controlled by subsidiary structures. Stratabound showings display concentrations of chalcocite and subsidiary bornite along flow tops and in amygdules. Epigenetic showings are comprised of similar sulphide mineralization on fractures and in quartz-carbonate veinlets in faults and shears. Weathered surfaces are commonly stained with malachite, azurite and cuprite. The deposits produced a small amount of ore for the Anyox copper smelter in the mid 1910s and one is reported to have a small amount of stockpiled ore left from work in the 1960s and 1970s. Several have drill-indicated reserves.

Network One Holdings Corporation has acquired the copper belt and additional ground around the past-producing Santana deposit on the east side of Quadra Island, with the intention of exploring for additional reserves of leachable copper. It is currently reviewing its exploration options, following a change in management.

OTHER ACTIVITY

There were more limited exploration and prospecting programs on other properties on Vancouver Island. For example, IMA Resources Corporation prospected the Bacon and Cobalt Star skarn properties in the Campbell River area; SYMC Resources Limited worked on the Mactush and Dauntless shear-hosted vein deposits in the Port Alberni area; and Ecowaste Management Limited undertook road construction on the Var limestone property near Holberg Inlet, in advance of drilling.

Several prospectors took advantage of the Ministry's Prospector's Assistance Program. There were grant-assisted programs in the Bedwell Sound, Taylor River and Effingham Inlet areas on Vancouver Island and also on Quadra Island. There were also several independent programs carried out elsewhere on the Island, including Gold River and Port Renfrew.

SOUTHERN COAST

Although the number of programs in the Southern Coast was down in 1997, there is still considerable interest in the area. Companies are exploring for shear-hosted gold occurrences and for volcanogenic massive sulphide deposits in pendant rocks. The cost of exploration in the less accessible parts of the southern coast belt is high, and for funding reasons companies commonly run programs intermittently rather than on an annual basis. This may, in part, explain why only two of last year's major projects, Seneca and Ruby, were active again this year.

MONUMENT

There was no exploration on Athabaska Resources Limited's Ladner Creek (Carolyn mine) property, near Hope, in 1997 but Athabaska's success in establishing additional reserves at the mine and at the nearby McMaster deposit has renewed interest in the Coquihalla gold belt.

Minestar Resources Limited has an option on the Monument prospect, one of the best known of the thirty-odd gold showings along the 40-kilometre section of the Hozameen fault between the Fraser River and the Coquihalla Canyon. In 1997, it submitted a proposal to extract a 9000-tonne bulk sample. However, the project is currently on hold.

The Monument gold vein is near the head of Siwash Creek. It is a steeply dipping, massive, white, vuggy, quartz vein 0.3 to 3.0 metres wide hosted by deformed Ladner Group slaty argillite, siltstone and tuffaceous wacke approximately 175 metres east of the Hozameen fault. The vein, which contains minor slate partitions, has been traced for approximately 400 metres in a northerly direction subparallel to bedding and to the trace of the fault, which at this locality is marked by serpentinite. The vein is cut into four segments by a set of north to northeasterly trending, dextral crossfaults, one of which hosts a strongly carbonatized "felsic" intrusion. Trench sampling in the late 1970s showed considerable variation in grade within the vein. Gold values appear to increase from approximately 3 to 4 grams per tonne in the northern two segments to 10 to 15 grams per tonne in the southern two. Limited drilling carried out at the time of the trenching shows that the vein extends at least to shallow depth and that it is flanked by other, narrower, mineralized structures. The vein contains fine free gold, small amounts of disseminated pyrite and arsenopyrite and trace amounts of galena. The sulphide content commonly increases near wallrock contacts. There is a narrow band of arsenopyrite along a contact in one of the northern trenches.

Minestar planned to extract a bulk sample from an open-cut by trenching the southern, higher grade part of the vein system. Preliminary metallurgical work suggests that it may be able to recover approximately 80% of the gold by gravity concentration and a further 10% by flotation of the gravity concentrate tails. In this respect, the deposit is markedly different from the Ladner Creek occurrence, where the gold is weakly encapsulated in sulphide and is best recovered by flotation.

Elsewhere, Homegold Resources Limited mapped around the past-producing Emancipation mine, southeast of the Ladner Creek deposit. It identified siltstones

similar to those that host the main ore zones at Ladner Creek, in a similar structural position close to the main trace of the Hozameen fault. The company hopes to reopen the mine and explore these siltstone bands for gold-bearing alteration zones similar to those found at Ladner Creek. It also explored along the trace of the fault to the south of the Coquihalla River and identified gold in soils near Ghost Pass, north of the Cascade Recreation Area.

MARGIE

Also in the Hope area, Verdestone Gold Corporation completed 13 short diamond-drill holes (aggregate length of 610 metres), to test a linear, polymetallic, base and precious metal soil geochemical anomaly associated with a northeasterly trending, northwesterly dipping, shear-hosted quartz vein system on the Margie claims southeast of Schkam Lake. The property is adjacent to the past-producing Murphy mine which is reported to have produced a small amount of high-grade lead and silver ore in 1858. The Margie property is underlain by deformed Hozameen Group volcanic and sedimentary strata close to one of the main strands of the Fraser River fault. The rocks are intensely sheared and brecciated and difficult to drill. Five of the holes were abandoned in bad ground. The rocks are locally intensely silicified and mineralized with disseminations of pyrite, chalcopyrite and galena. One of the holes bottomed in altered feldspar porphyry, which suggests that the mineralization may be igneous in origin. The best core intercept is reported to have assayed 1.03% Cu and 20.9 g/t Ag over 7.0 metres.

GIANT COPPER

There was no field program at Giant Copper, on Silverdaisy Mountain southeast of Hope, in 1997, as Imperial Metals Corporation focused on development planning. It combined assays from drill programs carried out on the AM and Invermay zones in 1995 and 1996 with those from previous studies and reported an aggregate open-pit and underground mineral resource of 45 373 000 tonnes grading 0.47% Cu, 0.38 g/t Au and 11.19 g/t Ag.

The AM zone is an important part of the resource. It is an elliptical (350 x 150 metres), northwesterly trending, steeply dipping breccia body in sedimentary rocks adjacent to a quartz diorite to diorite stock. The breccia body is pipe like. It is composed of angular to rounded fragments of sediment that have been strongly tourmalinized and cemented by tourmaline, feldspar, quartz, calcite and blebs of sulphide. The latter are comprised of pyrite, pyrrhotite, chalcopyrite, arsenopyrite and lesser sphalerite and molybdenite. Gold content

increases with enrichment in both copper and also arsenic, although they themselves show little obvious correlation. The company estimates that the AM zone has an open-pit reserve of 1 084 250 tonnes grading 0.84% Cu, 0.55 g/t Au and 11.55 g/t Ag at a stripping ratio of 1.13:1 and an underground mineable reserve of 3 183 000 tonnes grading 1.15% Cu, 0.51 g/t Au and 20.26 g/t Ag.

In December, Imperial Metals Corporation applied for permits to extract a 10 000-tonne bulk sample for metallurgical test work. It expects to mine the sample from a surface cut in 1998. If the metallurgy is acceptable, it plans to develop a small open-pit and underground mine and process the ore off-site at the Similco mill at Princeton.

HOTSPRING

The Hotspring (Quet) property, owned by Mount Hope Resources Limited, covers a base and precious metal prospect on Sloquet Creek, west of the north end of Harrison Lake. The property was explored by Aranlee Resources Limited and Noranda Exploration Company Limited in the late 1980s. The latter flew an airborne geophysical survey, conducted various ground geophysical and geochemical sampling programs and drilled seven short holes into a large, stratabound but low-grade (<1.0 gram per tonne) gold occurrence.

The property is underlain by a relatively flat lying, southerly dipping package of Gambier Group pyritic and siliceous felsic tuffs and coarse fragmental volcanic rocks exposed along the northern flank of the whale-back ridge that separates the north from the south fork of Sloquet Creek. The rocks are near the southern margin of the Fire Lake volcanic pendant and airborne magnetic data suggest the package is underlain by plutonic rocks at relatively shallow depth. Aranlee and Noranda identified numerous mineral showings at more or less the same stratigraphic horizon over a distance of approximately 1.6 kilometres along the north slope of the ridge. Most of the showings are irregular zones of intense silicification and pyrite, galena and sphalerite enrichment in tuff near north to northwesterly trending faults and shears that cut the volcanic stratigraphy. The intensity of silicification and the amount of mineralization appears to be controlled by porosity. It drops off away from the crosscutting structures, many of which contain altered andesite dikes.

Mount Hope Resources Limited completed limited additional ground follow-up surveys and diamond drilled 11 holes along the axis of the ridge (aggregate length of 1951 metres) looking for zones of higher grade gold mineralization associated with dikes in the main

crosscutting structures. The results show that the dikes are syn to postmineral in age. They are locally intensely altered to biotite and chlorite and are also bleached, silicified and veined. Mineralized quartz veins commonly have pronounced biotite alteration envelopes. Core from one hole is reported to have assayed 1.3 g/t Au and 42.26 g/t Ag over 34.96 metres and from another 0.9 g/t Au and 16.22 g/t Ag over 24.83 metres. The company feels that the system has potential to develop a large tonnage, low-grade gold deposit.

The drilling also shows that the mineralized siliceous pyritic tuff is underlain by an intensely potassically altered, "nodular" biotitic andesite tuff unit. One hole through this unit cut 30 metres of epidote alteration and weak molybdenite mineralization that may indicate the presence of a mineralizing intrusion at depth.

NUGGET QUEEN

In late December, 1996, Solaia Ventures Inc. explored a cluster of gold-bearing quartz-sulphide veins on the Nugget Queen property, near McKinnon Lagoon, south of Seymour Inlet. The veins are in a roof pendant close to a granodiorite intrusion. Most are in a band of slaty argillite 200 metres wide that is interbedded with basalt and andesite. The veins are discontinuous. They pinch and swell and reach a maximum width of approximately 2 metres. Most follow the regional, northwesterly trend displayed by the argillite band but a few are strongly discordant. The "main" vein strikes in an easterly direction and dips steeply to the north. The veins are filled with milky white quartz containing angular fragments of country rock and variable amounts of disseminated to semimassive galena, sphalerite, chalcopryrite, pyrite and/or pyrrhotite. Trench samples return erratic but locally high gold values.

Solaia established a grid on the property in 1995 and completed a soil geochemical survey that showed good correlation between base and precious metal anomalies and underlying veins. In 1996, it returned to extend the survey and hand trench some of the anomalies. The results are encouraging. The company has extended some of the known veins and located a new one. It revisited the property in 1997 but little work was done.

ALEXANDRIA

Also in the fall of 1996, Norwood Resources Limited examined the Alexandria and Enid-Julie gold mines in the Pembroke Range north of Phillips Arm. The mines are two of several small past-producing occurrences in the Doratha Morton gold camp. They are located along a

complex, discontinuous and faulted, shear-hosted quartz-vein system on or near the contact of a Gambier Group roof pendant. The vein system is known to extend for a minimum distance of 6.5 kilometres and it is dotted with showings along its length. The showings have been explored intermittently since the late 1880s. The Alexandria mine, at the south end of the system, was developed through five adits. It produced 22 239 grams of gold, 40 590 grams of silver and 1761 kilograms of copper in 1939/40. The Enid-Julie mine, further north, produced a token amount of gold and silver in 1933.

The Alexandria deposit comprises several subparallel, northwesterly trending, en echelon ribbon-banded quartz veins that range in width up to approximately 1.0 metre and contain erratic but commonly high values of gold, together with minor pyrite and chalcopryrite. The deposit appears to be truncated to the north by a northeasterly trending normal fault. The Enid-Julie showings comprise a number of small adits and shafts driven into similar, but less obviously ribboned, quartz veins approximately 2 kilometres to the north of the Alexandria workings. They appear to be located on a second structure that strikes to the northwest, off the Alexandria property, towards the past-producing Doratha Morton mine.

Norwood Resources established grids over both areas, collected soil samples and ran electromagnetic geophysical surveys. The data suggest the presence of untested quartz veins both near the Alexandria adits and northwest of the Enid-Julie occurrence. The gold in soil anomaly associated with the Enid-Julie vein system projects towards the Empress shaft and adit and from there it extends toward the southern boundary of the Doratha Morton property.

In the fall of 1997, the company returned to the property to evaluate the gold anomalies around the Empress showings. The gold appears to be derived from en echelon, tensional quartz veins that contain shoots enriched in pyrite and fine-grained tellurides.

RUBY

Menika Resources Limited is exploring for northeasterly trending, pyrite and/or marcasite-rich, quartz-sulphide veins and breccias that crosscut pendant contacts on the old Chalice property, at Ruby Lake, near Egmont at the north end of the Sechelt Peninsula. It diamond drilled five holes, for an aggregate depth of 716 metres, to test geological and geophysical targets. The results were disappointing. The holes intersected granodiorite and crosscutting andesite and feldspar porphyry dikes that are altered but not significantly mineralized.

BRANDYWINE

La Rock Mining Corporation continued to explore the Brandywine property, near Whistler. It completed five diamond drill holes (aggregate depth of 1000 metres) to test geophysical conductors in volcanic rocks in a Gambier Group roof pendant. It is looking for both volcanogenic massive sulphide and structurally controlled gold mineralization. One hole, collared near an occurrence of what is probably deformed lead, zinc, silver-rich volcanogenic massive sulphide mineralization in the Tedi pit area, cored a thick section of rhyolite. Another, drilled to test a structure under Martial Lake, intersected a 0.5-metre interval of deformed and altered greenstone that contains fuchsite and is cut by a quartz vein stockwork. The rock contains disseminated pyrite, sphalerite, galena and traces of gold. The company also drilled two holes near the gold occurrence at Dave's Pond. One of these, collared to the south of the pond, intersected a quartz vein 3 metres wide, that contains a small amount of pyrite.

SENECA

Riverstone Resources Inc. has an option on the Seneca volcanogenic massive sulphide property north of Harrison Mills. In 1997, it drilled six core holes (aggregate depth of 693 metres) in a 3.0-kilometre step-out to the northwest of the known mineralization at Fleetwood. The holes were drilled from roads, in an area of thick cover, to test strong chargeability anomalies for flat-lying, volcanogenic massive sulphide zones.

The holes intersected intermixed and poorly correlatable felsic and intermediate breccias, flows, tuffs and mafic dikes of the Harrison Lake Formation. One also cut a short section of haematitic chert. The fragmental rocks are locally moderately to intensely silicified and all are strongly pyritized. Pyrite occurs as blebs and disseminations, as replacements of mafic minerals, as veins with minor quartz and as rare fragments in felsic tuffs. Although strongly pyritic, the rocks are barren and the company will probably refocus its attention closer to the Fleetwood showing.

ELK

Further north, Tiberon Minerals Limited returned to its Elk property, near the head of Bute Inlet, in the fall of 1996, to explore a volcanogenic massive sulphide occurrence in a large, Gambier Group roof pendant. It resumed exploration around the Big Andy showing where trench sampling in the early 1990s reportedly produced a weighted average grade of 1.8% Cu, 0.3% Zn, 31.59 g/t Ag and 578 ppb Au across a true width of

1.10 metres of deformed and recrystallized semimassive sulphide. The showing is composed of pyrite, chalcopyrite, pyrrhotite, sphalerite and galena in a gangue of quartz, carbonate, clay, chlorite and rare barite. It is enclosed within phyllite and meta-argillite that is structurally and possibly stratigraphically above a thick succession of schistose, weakly pyritic, felsic volcanic rocks.

The company cut an in fill grid over the main showing and increased soil sample density to one sample every 50 metres. The results show that the Big Andy zone is open along strike and that mineralization may extend for a considerable distance to the west.

The company subsequently flew a 180 line-kilometre airborne electromagnetic and magnetometer survey that located several conductors, including one coincident with an area of anomalous soil geochemistry west of the Big Andy zone. It is planning a grid geophysical survey to locate the anomaly on the ground.

OTHER ACTIVITY

In other activity Thurlow Resources Limited sampled the Hy/Lo molybdenum property north of the Doratha Morton mine, Canquest Resources Limited mapped part of the O.K. porphyry copper property near Powell River and Minvita Enterprises Limited worked on the Tex claims near the past-producing Giant Mascot mine, near Hope. In addition, there were prospecting programs in the Powell River and Pemberton areas and elsewhere. One of the latter, north of Pemberton, was carried out as part of the Prospector's Assistance Program.

ACKNOWLEDGMENTS

The author acknowledges the contribution of numerous public and private sector geologists and other professionals to this report. Without their reports and information, exploration reviews would not be possible.

PART B

MINERAL ASSESSMENT REPORTS

REVIEW OF OPERATIONS

1947 - 1997

By A. F. Wilcox, P.Geo.

SUMMARY

The assessment report system was introduced in 1947 by the Government of British Columbia to archive information collected by the mineral exploration industry so that it could be used later by prospectors and exploration companies to facilitate the discovery of new mines. This geoscientific data not only is useful to the mineral industry, it also plays a role in mineral resource assessments by the government.

Results of mineral and placer exploration and development programs are submitted to the Ministry in compliance with the *Mineral Tenure Act* and Regulations.

The assessment report library contains over 25,400 reports describing exploration work worth over \$825 million. Since 1980, an average of 942 reports have been submitted annually. The number of assessment reports submitted in 1997 totalled 536, with declared costs of \$56,780,342, a 7.5% increase in expenditures over 1996. Drilling accounted for 67% of the expenditures, with the remainder of work consisting of geochemical sampling, geophysical surveys, geological mapping, physical work and prospecting.

Assessment work, which is required for the maintenance of mineral claim tenure, comprises only a portion of the overall mineral exploration in the province. It has been estimated that only about 40% of the total exploration expenditures is submitted in assessment reports and 25% is applied to claims.

INTRODUCTION

In compliance with the *Mineral Tenure Act* Regulations, results of mineral exploration programs conducted on mineral claims in British Columbia are submitted to the Ministry of Energy and Mines. These assessment reports contain information on geology, geophysics, geochemistry, drilling, prospecting and physical work. This information is valuable for mineral exploration, research studies, land use planning and resource management. The British Columbia Geological Survey Branch manages and maintains a library of over

25,400 mineral Assessment Reports, dating from 1947, that describe exploration work worth over \$825 million. Reports can be viewed at provincial government offices or purchased (on microfiche or paper) after the expiration of the confidential period (at least one year). An outline of the history of the administration of the assessment report system is presented in Table 1.

During the 1959-60 period about 7000 individuals and 300 companies held Free Miners Certificates (FMC) annually. In the late 1960s and 1970s and subsequent years the number of FMC increased to about 10 000 and 1000 respectively. In any one year 200 to 400 companies and individuals have submitted assessment reports.

Over 100 visitors per month view exploration data in the Vancouver regional office. Exact viewing statistics for other offices are not kept or easily assembled. Before the start of the field season each year the Resource Centre in Victoria is heavily utilized by the staff geologists preparing for the field. Over 400 hundred requests for information have been received by the assessment report geologist since the beginning of this fiscal year. A significant number of requests are also handled by the Mineral Titles staff in Vancouver.

In 1983, out of approximately 1700 questionnaires mailed to explorationists, 650 were completed and returned, about 80% to 85% of the returns overlapped assessment reports already submitted and the remaining contained new information, although without substantiation of a technical report.

Some of the earlier statistics and subsequent changes to our publications were based on about 50 responses to 300 questionnaires soliciting opinions from explorationists regarding government publications.

The statistics used in this report cover assessment reports approved during the time frame November 1st to October 31st the following year and may actually reflect work carried out in the previous year.

TABLE 1

HISTORY OF MINERAL INDUSTRY ASSESSMENT REPORTS IN BRITISH COLUMBIA

1947	Assessment Report (AR) system introduced; technical content only checked and processed by examining geologist; all administration conducted by Mineral Titles staff.
1958	Minister of Mines Annual Report (MMAR) includes a rudimentary index of assessment reports.
1966	MMAR includes tabulated results from a questionnaire mailed to mining companies to obtain additional information on exploration activity in the Province.
1969	Traditional MMAR split into two volumes. <i>Geology, Exploration and Mining</i> (GEM) and Minister of Mines and Petroleum Resources Annual Report; Assessment Report Index published as separate brochure.
1975	GEM split into three volumes due to increasing amount of data; the Exploration volume was based entirely on assessment reports and questionnaires compiled solely by the Resource Data and Analysis Section of the Department.
1977	Revised Mineral Act Regulations proclaimed, including a section on reporting assessment work and portable assessment credit (PAC).
1981	Assessment Report Index computer file developed on IBM mainframe (programming in Mark IV).
1983	First attempt at computer assisted production of Exploration 1981 volume (an enhanced AR Index).
1984	AR Index downloaded from IBM mainframe to NTS 585 minicomputer (programming in COBOL).
1985	Steps taken to overcome the backlog of data processing and distribution: <ul style="list-style-type: none"> • the questionnaire discontinued as inefficient way to assemble data. • a Title Page and Summary form for authors introduced for assessment reports, to overcome chronic omissions of required data, and provide up-front summaries for the Exploration volume.¹ • 1980 to be the last manually produced volume, and last to include data from questionnaires; 1985 volume to be organized in Part A, exploration overview, Part B, description of selected properties; and Part C, summaries of assessment reports. • data processing and compilation of assessment report summaries developed on VAX 780 (programming in MANTIS).
1987	New assessment reports and previously filmed aperture cards microfilmed and microfiche distributed to 19 mining division and 6 geological survey offices throughout the Province, to facilitate access by industry and public.
1988	Computerized operations of the Assessment Report Indexing System (ARIS) began in February, 1988. Revised Mineral Tenure Act proclaimed, specifying assessment report requirements ² ; Part C of the old Mineral Act Regulations governing assessment reports not changed.
1989	Summaries of assessment reports in Exploration Part C discontinued (in favour of Assessment Report Index), due to large volume of data, rising operating costs, and duplication of the Assessment Report Index.
1990	Approved 20 000 th Assessment Report in June.
1996	Transpose the ARIS environment from the VAX to a personal computer-based LAN system. New ARIS operational in May saving \$20,000 per year in operating costs.

¹ Previously, cover sheets were completed by the assessment report examining geologist.

² The previous Mineral Act was vague on the subject of assessment reports.

PORTABLE ASSESSMENT CREDIT (PAC)

The PAC accounting system was started in 1977 to allow free miners and companies to bank the excess expenditures as credits to be applied in future exploration programs. Approved value in excess of that required to be applied to the claims, will be credited in a PAC account to the registered owner/operator as designated on the Statement of Work. If desired by the owner or operator, PAC credits may be used for assessment report credit. Upon submission of an assessment report, up to 30 per cent of the value approved may be withdrawn from the owner's or operator's PAC account and added to the work value to make up the total value of work requested. During the first year of operation, 101 companies had 275 transactions for a credit of almost 2.5 million dollars. Today there are 660 active companies and 1657 inactive companies (no transactions within the last five years). Over 300 million dollars has been credited to PAC and only 68.5 million dollars has been removed from PAC to extend title. Four million dollars has been removed from PAC to extend title on claims that have had active exploration programs for over 10 years.

EXPLORATION EXPENDITURES AND ASSESSMENT REPORT COSTS

The total exploration expenditures always exceed the cost of work claimed in assessment reports because British Columbia does not require complete disclosure of all exploration work performed. For the last twenty years, typically about 40 per cent of the total expenditures have been filed as assessment credit (see Table 2).

"Grassroots" exploration includes geological, geophysical, geochemical, drilling, prospecting surveys, surface cuts and some underground work but does not include work done at operating mine sites.

It is interesting to note that only a portion of exploration expenditures are credited to extension of claim tenure. Cash paid in lieu of work credits is minimal, usually less than 5% of the lode and placer work credits. Since 1974, more value was credited to assessment reports than applied to claims. This may possibly be attributed to the establishment of the Portable Assessment Credit accounts.

The annual expenditures spent on grassroots exploration shown in Table 2 and Figure 1 are derived from replies by industry to annual questionnaires on exploration for metallic and industrial minerals on undeclared and declared mines and in recent years from statistics gathered by the Geological Survey Branch. The

value applied to claims; reported in Table 2 is taken from column K of the Statement of Work. Value submitted and approved in assessment reports and direct revenue generated by value applied to claims is reported on column M of the Statement of Work.

Prior to 1988 recording fees were set at 5% of the value applied to the claims. When the Mineral Tenure Act was proclaimed in 1988 the filing fees for a claim were changed to \$10 per unit per year. Accurate statistics have not been recorded by the Geological Survey Branch. However, the filing fee column shown in Table 2 has been calculated at 5 % prior to 1998 and 8 % after. Further revenue is generated by free miners licenses and costs associated with staking additional claim units.

Direct revenue to the Province is substantial. A significant part of the total exploration expenditures (\$100 million) goes directly to communities as suppliers of secondary industry products such as expediting services and sub-contractors of goods and services. As well, in the last 10 years over 16.5 million dollars has been paid in recording fees

Figure 1 illustrates the exploration expenditures and the value of the exploration programs as recorded in the assessment reports. The graph indicates the amount applied in assessment reports follows the same trend as the total amount expended on exploration programs.

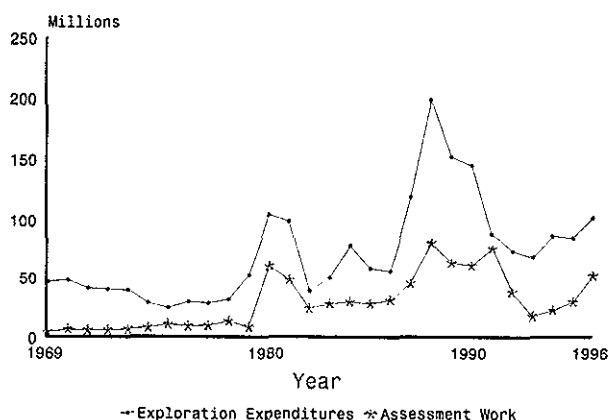


Figure 1. British Columbia Expenditures and Assessment Work

VALUE OF ASSESSMENT REPORTS

Over 25,400 assessment reports have been approved since 1947. These assessment reports have a cumulative value of over \$825 million as shown in Table 3. The figures for 1996-97 are incomplete and represent only a portion of the work and value submitted. Not all assessment reports for those

years have been received or processed. Industry has up to a full year to submit an assessment report.

Assessment Reports were first mentioned in the 1958 Minister of Mines Annual Report, where the number (247) of assessment reports received between 1947 and 1958 was presented in a rudimentary index format. Since 1959, the number of reports approved has been published annually. The annually approved value of reports statistics began in 1969; prior to that there was

only an estimate of total value of the assessment reports submitted.

SUMMARY OF 1997 STATISTICS

In recent years (1980-1997) an average of 942 reports are submitted annually (see Figure 2). The number of assessment reports submitted in 1997 totalled 536 with declared costs of \$56,780,342, a 7.5% increase in expenditures over year 1996. Drilling accounted for 67% of the expenditures (see Figure 3).

TABLE 2
ANNUAL EXPLORATION EXPENDITURES AND ASSESSMENT REPORT CLAIMS

Year	Grassroots Expenditures (million \$)	Value applied to Claims (million \$)	Value of Assessment reports (million \$)	Filing Fees (000 \$)
1969	44.4	8.9	2.1	445
1970	46.0	11.9	4.4	595
1971	39.1	10.7	3.8	535
1972	38.2	9.8	4.1	490
1973	37.3	12.9	4.6	645
1974	21.4	4.8	5.9	240
1975	19.2	3.9	8.5	195
1976	29.0	3.8	7.1	190
1977	22.5	4.0	7.6	200
1978	29.6	6.6	11.1	330
1979	49.8	7.6	8.6	380
1980	102.6	14.1	58.2	705
1981	97.3	24.8	45.8	1240
1982	36.4	23.0	21.4	1150
1983	47.7	17.5	25.5	875
1984	76.7	27.9	27.2	1395
1985	55.9	38.0	25.7	1900
1986	53.6	21.4	28.7	1070
1987	116.8	32.5	42.9	1625
1988	196.8	36.7	79.0	2936
1989	150.0	35.7	60.9	2856
1990	143.0	35.0	58.4	2800
1991	87.0	35.0	74.4	2800
1992	72.0	20.6	35.6	1648
1993	66.0	9.4	15.0	752
1994	85.0	11.8	19.9	944
1995	83.0	11.4	27.1	912
1996	100.0	12.6	49.3	1008
Totals:	1946.3	492.3	762.8	30861

TABLE 3

VALUE OF ASSESSMENT REPORTS

Year	Number of Assessment Reports	Cumulative Value (millions \$)
1947/58	247	.
1959	43	.
1960	40	.
1961	53	.
1962	78	.
1963	70	.
1964	49	.
1965	114	.
1966	153	.
1967	289	N/A
1968	288	5.0 (est.)
1969	569	7.1
1970	622	11.5
1971	583	15.3
1972	637	19.4
1973	698	24.0
1974	456	29.9
1975	416	38.4
1976	439	45.5
1977	427	53.1
1978	522	64.2
1979	592	72.8
1980	1420	131.0
1981	1162	176.8
1982	725	198.2
1983	1231	223.7
1984	957	250.9
1985	905	276.6
1986	1011	305.3
1987	1181	348.2
1988	1403	427.2
1989	1233	488.1
1990	1199	546.5
1991	1304	620.9
1992	616	656.5
1993	478	671.5
1994	490	691.4
1995	540	718.5
1996	577*	771.0
1997	536*	827.8
Total:	24,434	827.8

* incomplete statistic

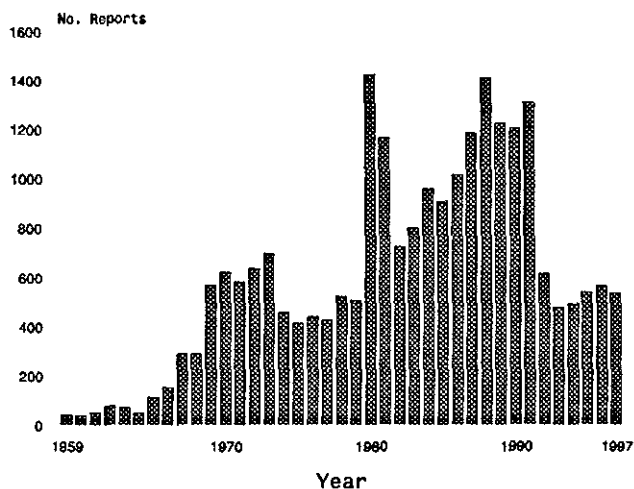


Figure 2. Number of Reports Approved Annually

From 1959 to 1990 the number of assessment reports received and approved shows a steady growth. This growth peaked in 1991 and since that time has dropped to a steady rate of about 550 reports being received annually. This is the same levels as in the mid 1970s. The peak that occurred in 1980 and 1981 is due to a change in the way the assessment report statistics were gathered. The number of reports filed in 1980 and 1981 will be lower but still more than 1979 or 1982 values.

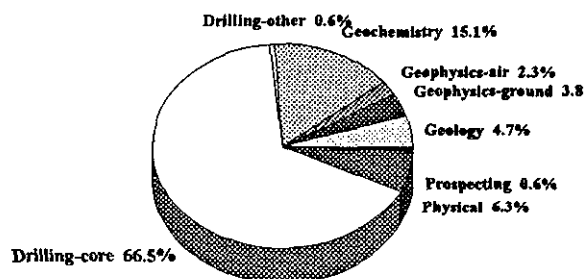


Figure 3. Value of Exploration by Work Type

Average exploration project costs (Table 4) are based on reports with clearly apportioned cost statements including labour and consulting, room and board, transport, instrument and equipment rentals, camp supplies, analyses, report preparation, and direct administration and management of the project. These figures are to be used as a guideline only and may vary depending upon working conditions and accessibility to the exploration project.

The costs for 1997 are similar to 1996 (Table 4), although some costs went down which might reflect the nature of the exploration projects in that particular year or a more competitive business climate.

TABLE 4
AVERAGE EXPLORATION PROJECT COSTS, FOR
1996 AND 1997 (\$ PER UNIT OF WORK)

TYPE OF WORK	1997	1996
Geological mapping	13/ha	15/ha
Mag./E.M. airborne	36/km	36/km
Magnetic, ground	319/km	302/km
EM, ground	521/km	357/km
Induced Polarization	1 247/km	1 327/km
Self potential	525/km	760/km
Soils	34/sample	39/sample
Stream sediments	92/sample	86/sample
Rock chips	64/sample	74/sample
Sampling-assaying	27/sample	30/sample
Drilling, core	121/m	123/m
Drilling, non-core	85/m	91/m
Prospecting	12/ha	12/ha
Line cutting, grid	538/km	523/km
Trenching	63/m	57/m

The main exploration survey costs are compared with various 1:250,000 NTS (National Topographic System) mapsheets in Table 5. It is clear that the assessment costs are spent in all areas of the province and no one area clearly dominates. A wide variety of types of work were completed, although only limited distances of tunnelling and road construction were completed and claimed for assessment credit.

PRODUCTS

In compliance with the *Mineral Tenure Act* Regulations, results of mineral exploration programs conducted on mineral claims in British Columbia are submitted to the Ministry of Energy and Mines. These assessment reports contain information on geology, geophysics, geochemistry, drilling, prospecting and physical work. This information is valuable for mineral exploration, research studies, land use planning and resource management. The British Columbia Geological Survey Branch manages and maintains a library of over 25,400 mineral Assessment Reports dating from 1947.

Reports can be viewed at provincial government offices or purchased (on microfiche or paper) after the expiration of the confidential period (at least one year).

The Assessment Report Indexing System (ARIS) was designed to assist the Geological Survey Branch in the administration of Assessment Reports and also provides the Assessment Report Index to clients. Assessment reports are sorted by National Topographic System (NTS) mapsheet. For each approved, non-confidential assessment report, the Index includes latitude, longitude, Universal Transverse Mercator (UTM) coordinates, claim names, operator, author, type of work report and report year. In digital format the Index also includes the following information: commodities searched for, detailed work data, and keywords.

The Assessment Report Index is published in hard copy and digital format. The digital data is organized as a series of flat ASCII files. A program, called ARISTRAN, converts the data to .dbf format (dBASE) and adds QuikMap parameters for plotting. The digital files can also be used with a variety of commercial software programs.

All mineral assessment report products are available through our agent:

British Columbia & Yukon Chamber of Mines
840 West Hastings Street,
Vancouver, B.C. V6C 1C8
Phone: (604) 689-5271, Local 105
Fax: (604) 681-2363
E-Mail: chamber@bc-mining-house.com
Web: <http://www.bc-mining-house.com/chamber>

The ARIS home page on the Geological Survey Branch's web page (<http://www.ei.gov.bc.ca/geology/>) contains some of the above listed products which can be downloaded for free. The completed data on diskettes is available from the download free data section. The complete assessment report index maps are on-line and a monthly update of new assessment reports that are off-confidential (assessment report index) is posted regularly.

TABLE 5
SUMMARY OF ASSESSMENT WORK, 1997

NTS	No. of Assessment Reports	Value \$	Geological (ha)	Geophysical		Geochem. No. of Samples	Drilling		Prospecting (ha)	Trenching (m)	Access Roads (km)	Line/grid (km)	Tunnelling (m)
				Airborne (km)	Ground (km)		Core (m)	Non-core (m)					
82/83	168	6 302 480	55 880	2 088	1 142	31 530	27 947	1 500	7 210	1 844	17	450	--
92/102	146	16 815 983	38 880	4 394	1 070	127 286	98 385	4 418	9 390	3 651	17	687	308
93	98	9 781 598	30 985	3 492	2 478	41 240	40 425	1 688	12 650	9 932	3	739	--
94	33	4 067 587	10 378	491	117	5 958	9 886	--	855	800	9	49	--
103	31	13 227 906	17 850	4 796	618	32 411	68 722	--	1 450	1 638	--	66	103
104/114	74	6 604 788	44 750	5 733	2 197	13 968	21 324	815	5 025	923	--	187	--

REFERENCES

- Kalnins, T. E. and Wilcox, A. F. (1989): Assessment Reports - A Source of Valuable Information; in Exploration in British Columbia 1989, *British Columbia Ministry of Energy, Mines and Petroleum Resources*, pages 237-240.
- Kalnins, T. E. and Wilcox, A. F. (1990): Assessment Reports a Source of Valuable Current & Historic Mineral Exploration Data; in Exploration in British Columbia 1990, *British Columbia Ministry of Energy, Mines and Petroleum Resources*, pages 175-178.
- Kalnins, T. E. and Wilcox, A. F. (1991): Assessment Reports a Source of Valuable Current & Historic Mineral Exploration Data; in Exploration in British Columbia 1991, *British Columbia Ministry of Energy, Mines and Petroleum Resources*, pages 149-152.
- Kalnins, T. E. and Wilcox, A. F. (1992): Assessment Reports a Source of Valuable Current & Historic Mineral Exploration Data; in Exploration in British Columbia 1992, *British Columbia Ministry of Energy, Mines and Petroleum Resources*, pages 133-136.
- Kalnins, T. E. and Wilcox, A. F. (1993): Assessment Reports a Source of Valuable Current & Historic Mineral Exploration Data; in Exploration in British Columbia 1993, *British Columbia Ministry of Energy, Mines and Petroleum Resources*, pages 61-64.
- Kalnins, T. E. and Wilcox, A. F. (1994): Assessment Reports a Source of Valuable Current & Historic Mineral Exploration Data; in Exploration in British Columbia 1994, *British Columbia Ministry of Energy, Mines and Petroleum Resources*, pages 73-75.
- Kalnins, T. E., Wilcox, A. F. et al. (1994): ARIS - A Mineral Assessment Report Database for the Public; in Proceedings of the 4th International Conference on Geoscience Information GEOINFO IV Ottawa, Canada June 24-29, 1990, *Geological Survey of Canada*, Open File 2315 volume II, pages 268-276.
- Schroeter, T. G. (1997) British Columbia Mining, Development and Exploration Review 1996 Overview; *British Columbia Ministry of Employment and Investment*, Information Circular 1997-1
- Wilcox, A. F. and Kalnins, T. E. (1995): Assessment Reports a Source of Valuable Current & Historic Mineral Exploration Data; in Exploration in British Columbia 1995, *British Columbia Ministry of Energy, Mines and Petroleum Resources*, pages 83-85.