

# THOMPSON-OKANAGAN REGION

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## SUMMARY AND TRENDS

Exploration activity increased sharply in 2004 throughout the Thompson-Okanagan region, formerly called the South-Central region. Exploration spending is estimated at about \$21 million, up from \$7.5 million in 2003 (Figure 4-1). This is the highest spending level since 1996, and is approaching the exploration activity levels of the late 1980s and early 1990s. Drilling activity was also up sharply to about 110 000 metres, versus 45 000 metres in 2003 (Figure 4-2). The number of major projects, *i.e.*, those with drilling or trenching and over \$100 000 in spending, is estimated at 29, compared with 17 in 2003 (Figures 4-3 and 4-4). These indicators highlight a strong resurgence in exploration and mine development, brought on by increased commodity prices, improved profitability for mining, a better climate for junior company financing, and an overall strengthening of the BC economy.

New exploration activity continues to be led by junior companies which were responsible for over 90% of the investment. These companies are primarily targeting bulk-mineable copper-gold and copper-molybdenum porphyry deposits, high-grade gold-silver veins, and stratiform polymetallic massive sulphide deposits. More than sixty percent of the work comprises detailed drilling, bulk sampling, and engineering and metallurgical studies, as part of feasibility or resource definition programs on advanced-stage projects such as **Afton**, **Bralorne**, **Elk**, **Brett**, **McKinnon Creek** and **Ruddock Creek**. A lesser, but still significant amount of work, can be considered grassroots exploration, such as at the **North Valley**, **Ann North**, **Barnes Creek**, **Rain**, **Murphy Lake**, and **Friendly Lake** projects. In addition, early stage prospecting and claim staking appears to be picking up, particularly for porphyry copper-gold deposits in the Cariboo, gold-silver vein deposits in the Merritt area, and polymetallic deposits in the Goldstream area north of Revelstoke.

High metal prices provide an opportunity for custom milling or mine re-openings at several dormant mine-mill complexes in the region. Many of these “brownfield” sites have existing permits and substantial infrastructure, including tailings ponds, power and water supplies, camp and office buildings, loading facilities and intact or partially intact mills. The first to re-open may be the **Goldstream** copper-zinc mill north of Revelstoke. Orphan Boy Resources Inc is studying the feasibility of

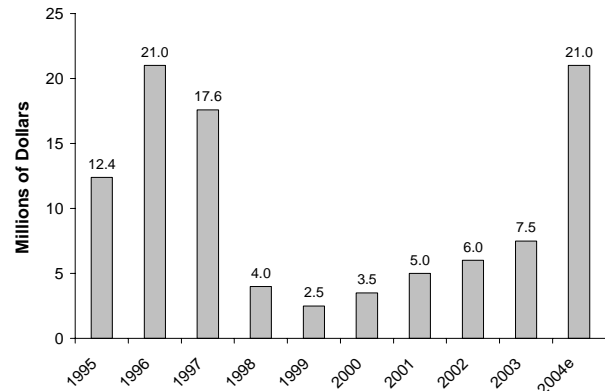


Figure 4-1. Annual exploration spending, in millions of dollars, Thompson-Okanagan region.

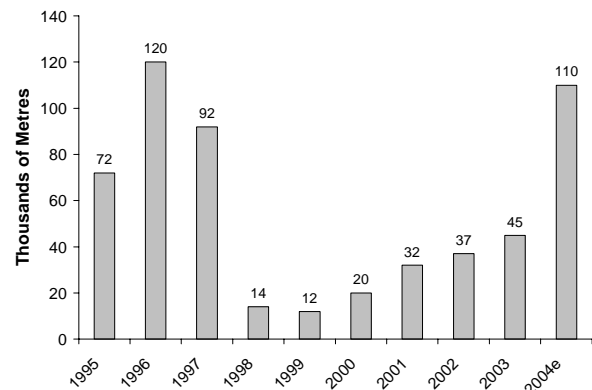


Figure 4-2. Annual exploration and development drilling, in thousands of metres, Thompson-Okanagan region.

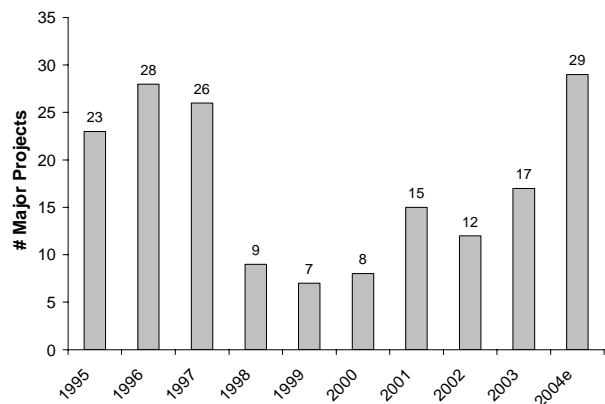


Figure 4-3. Number of major exploration projects per year, Thompson-Okanagan region.

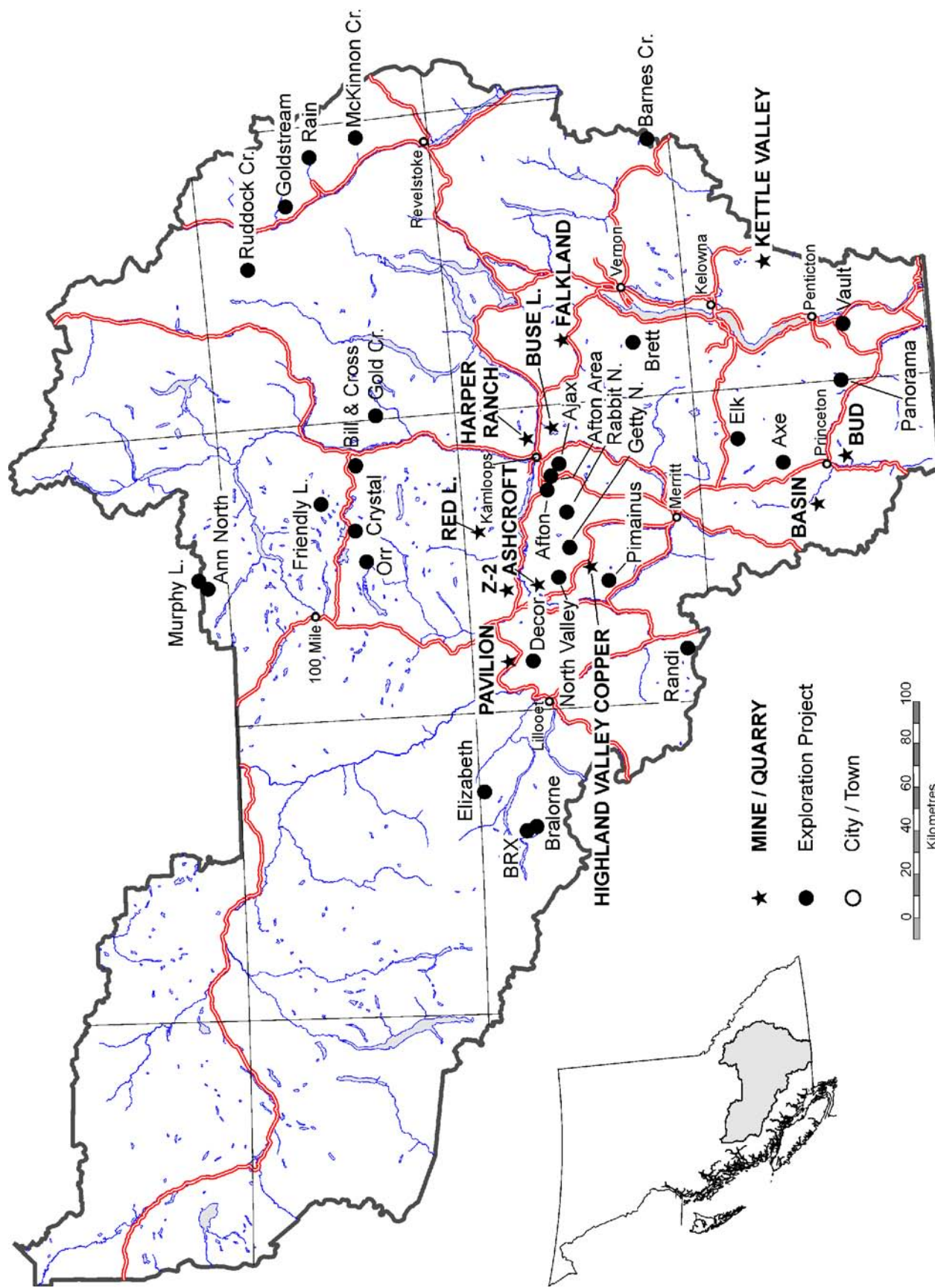


Figure 4-4. Mines, quarries and major exploration projects, Thompson-Okanagan region, 2004.

starting the mill in 2005 to treat copper-gold ore from the Willa project, located near New Denver. Other dormant sites include **Afton**, **Blackdome** and **Similco**.

Two small industrial minerals projects and a coal mine moved closer to commercial production. Construction began on a micronizing mill at Princeton, which will process zeolite from the **Zeo** quarry of Zeo-Tech Enviro Corp. An application for a small mine permit was filed for the **Decor** quarry of Pacific Bentonite Ltd, following successful test mining and marketing over the last two years. The mine is located at Hat Creek, near Cache Creek, and will produce burnt shale for cement-making and for landscaping uses. Production more than doubled at the small **Basin coal** mine near Princeton. The wash plant is being moved to the mine site and the company is evaluating the feasibility of a 50 megawatt wood-waste and coal-fired generating station.

Finally, the huge **Highland Valley Copper** mine was highly profitable during the year due to higher copper and molybdenum prices. The mine is currently slated to close in 2009; however, the possibility of extending the mine life to 2013 is being studied.

All of the operating mines in the region are listed in Table 4-1 and shown on the map (Figure 4-4). In addition, the major exploration projects are listed in Table 4-2.

## MINES AND QUARRIES

### METALS

**Highland Valley Copper** (HVC; Figure 4-5), Canada's largest metal mine, is on track for an exceptionally profitable year due to higher metal prices. Located southwest of Kamloops, the mine employs about 890 people and is owned by a partnership of Teck Cominco Ltd (97.5%) and Highmont Mining Company (2.5%). Average daily mill throughput has averaged about 135 000 tonnes per day (or 50 million tonnes per year) in

recent years. The mine is developed on calc-alkalic porphyry copper-molybdenum deposits within the Early Jurassic Guichon Creek batholith. Most ore comes from the Valley pit, augmented by a small amount from the Lornex pit.

Production at HVC in 2004 is forecast at about 170 000 tonnes of copper, 5000 tonnes of molybdenum and minor by-product gold and silver. Copper production in 2004 is expected to be slightly lower than in recent years due to lower head grades. However, molybdenum production and sales will be up strongly due to higher grades and improved recoveries. Teck Cominco reported that their share of operating profit was \$125 million in the third quarter ending September 30<sup>th</sup>, of which molybdenum sales contributed \$69 million.

Proven and probable ore reserves at the beginning of 2004 were 252.3 million tonnes grading 0.42% copper. Although the mine is scheduled to close in mid-2009, the partners are studying the possibility of deepening the Valley pit, which would extend the mine-life to 2013. A decision is not expected until 2006.

In terms of exploration, HVC had a relatively busy year, exploring numerous targets. A joint venture with Getty Cooper Inc enabled HVC to conduct a large, induced polarization survey and to drill test several grassroots targets on the **North Valley** property, located north and northwest of the Valley pit. In addition, the company drilled three holes on induced polarization targets, south of the mine in the **Pimainus** area.

Several other mine-mill complexes remain on care-and-maintenance status. Many of these have been closed since the mid-1990s, awaiting higher metal prices and/or discovery of additional ore. They have permits and substantial infrastructure in place and represent excellent opportunities for renewed mining or custom milling. Orphan Boy Resources Inc owns the **Goldstream** copper-zinc mine-mill complex north of Revelstoke. In 2004 the company conducted an aggressive exploration project on their extensive "Big Bend" property holdings, and continued to study the feasibility of using the 1360 tonne-per-day Goldstream mill to process copper-gold ore

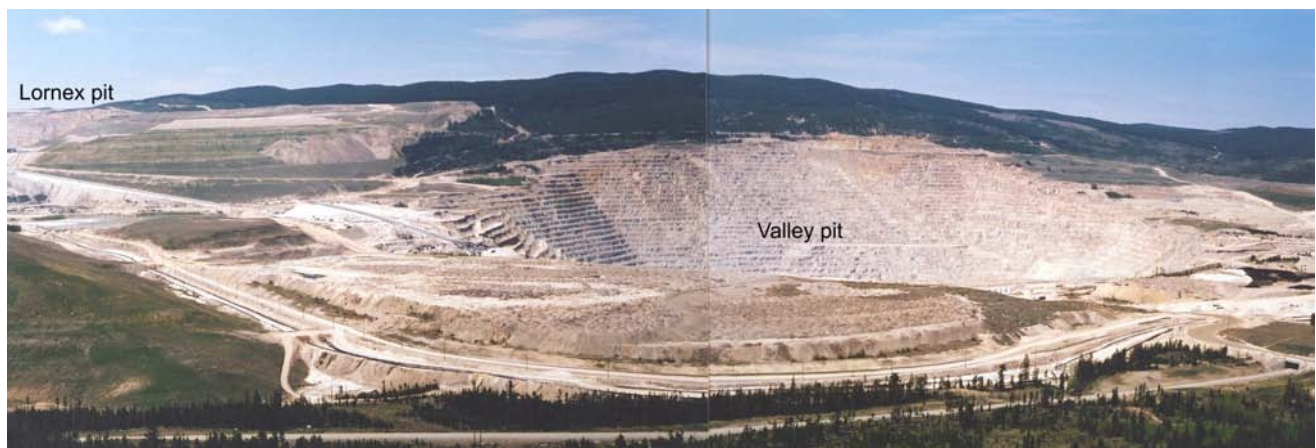


Figure 4-5. View looking southwesterly over the Valley pit, **Highland Valley Copper**. Lornex pit is in the upper left.

**TABLE 4-1 – THOMPSON-OKANAGAN FORECAST MINE PRODUCTION 2004.**

<b>Mine</b>	<b>Operator</b>	<b>Deposit Type / Commodity</b>	<b>Forecast Production in 2004 (tonnes or kilograms)</b>	<b>Number of Employees</b>	<b>Proven and Probable Reserves (at Jan. 1, 2004)</b>
<b>Metals</b>					
Highland Valley Copper	Teck Cominco Ltd / Highmont Mining Company Ltd	Calc-alkalic porphyry Cu-Mo	170 000 t Cu, 5000 t Mo, 500 kg Au, 70 000 kg Ag	890	252,300,000 t at 0.42 % Cu
<b>Coal</b>					
Basin (Tulameen)	Compliance Energy Corp / Sojitz Coal Development Ltd	Thermal coal	40,000 t	~8	
<b>Industrial Minerals</b>					
Ashcroft	IG Machine and Fiber Ltd (IKO Industries Ltd)	Basalt (roofing granules)		55 (plant & quarry)	
Bud	Western Industrial Clay Products Ltd	Bentonite		see Red Lake	
Buse Lake	Lafarge Canada Inc	Volcanic ash (alumina-silica)		see Harper Ranch	
Craigmont	Craigmont Mines Joint Venture	Magnetite tailings		~30 (plant; seasonal)	
Falkland	Lafarge Canada Inc	Gypsum		see Harper Ranch	
Harper Ranch	Lafarge Canada Inc	Limestone		32 (plant & 3 quarries)	
Kettle Valley quarries	Kettle Valley Stone Company	Ashlar, flagstone, thin veneer		~40 (plant & quarries)	
Pavilion	Graymont Western Canada Inc	Limestone		~40 (plant & quarry)	
Red Lake	Western Industrial Clay Products Ltd	Diatomaceous earth, leonardite		45 (plant & 3 quarries)	
Z-2	Industrial Minerals Processors	Zeolite		~3 (plant and quarry; intermittent)	

**TABLE 4-2. MAJOR EXPLORATION PROJECTS, THOMPSON-OKANAGAN REGION, 2004.**

<b>Property</b>	<b>Operator</b>	<b>Minfile (NTS)</b>	<b>Commodity</b>	<b>Deposit Type</b>	<b>Work Program</b>
Afton	DRC Resources Corp	92INE023	Cu, Au, Pd, Ag	Alkalic Porphyry	UG; FS; DD (~2000 m)
Afton Area	Abacus Mining and Exploration Corp	92INE028, 030, 026	Cu, Au, Ag, Pd	Alkalic Porphyry	IP; DD (~27,500 m)
Ajax	DRC Resources Corp	92INE012, 013	Cu, Au	Alkalic Porphyry	DD (2,015 m)
Ann North	GWR Resources Inc	92P 002, 115, 034	Cu, Au, Ag	Alkalic Porphyry	TR; DD (~3000 m)
Axe (Adit Zone)	Bearclaw Capital Corp	92HNE143, 040, 142	Cu, Au	Alkalic Porphyry	IP; DD & PD (~900 m)
Barnes Creek	Columbia Yukon Explorations Inc	82L/01W	Au	Vein?	TR; G; DD (~300 m)
Bill & Cross	New Cantech Ventures Inc / Providence Diamond Corp	92P 169	Cu, Au, Mo, Pb	Veins? Porphyry?	TR; A; DD (1421 m)
Bralorne	Bralorne Gold Mines Ltd	92JNE164, 001	Au-Ag	Mesothermal Vein	BU; MS; UG; DD (~3000 m)

**TABLE 4-2. CONTINUED**

<b>Property</b>	<b>Operator</b>	<b>Minfile (NTS)</b>	<b>Commodity</b>	<b>Deposit Type</b>	<b>Work Program</b>
Brett	Mosquito Cons Gold Mines Ltd	82LSW110, 131, 084, 047, 132, 130	Au, Ag	Epithermal Vein	TR; GC; G; A; DD (2776 m)
BRX	Mill Bay Ventures Inc / Levon Resources Ltd	092JNE020	Au, Ag	Mesothermal Vein	UG-BU
Crystal	Amarc Resources Ltd	92P/07W	Cu, Au	Alkalic Porphyry	IP; DD (~400 m)
Decor Pit (Hat Creek)	Pacific Bentonite Ltd	92INW047, 084	Burnt shale (alumina rock and landscape rock)	Industrial Mineral	BU (~7000 t)
Elizabeth	J-Pacific Gold Inc	92O 012	Au, Ag	Mesothermal Vein	TR; G; GC; UG; DD (~3000 m)
Elk (Siwash North)	Almaden Minerals Ltd	92HNE096	Au, Ag	Mesothermal Vein	EN; DD (10,265 m)
Friendly Lake	Lithic Resources Ltd	92P 134, 006, 007	Cu, Mo, Pb, Zn, Au, Ag, Pd, Pt	Alkalic Porphyry; Vein	AB-MG; IP; G; DD (~2400 m)
Getty North	Getty Copper Inc	92INE038	Cu	Calc-alkalic Porphyry	BU; MS; IP; DD (~5000 m)
Gold Creek (Enargite)	Navasota Resources Ltd	82M 065	Au, Ag, Pb, Zn	Vein	GC; G; DD (~1000 m)
Goldstream (Spire & Boutwell)	Orphan Boy Resources Inc	82M 278	Cu, Zn, Au, Ag	VMS (Besshi)	FS; GP; G; GC; TR; DD (1952 m)
Iron Lake	Argent Resources Ltd / Eastfield Resources Ltd	92P 132	Cu, Au, Pd, Pt	Alkalic Porphyry	GP-AB; DD (~300 m)
McKinnon Creek (J&L)	BacTech Mining Corp	82M 003	Au, Ag, Cu, Zn, Pb	Stratiform; Mesothermal vein	PF; EN; MS; UG-BS (5 t); UG-DD (~2300 m)
Murphy Lake	Candorado Operating Co Ltd	93A 044, 073, 113, 063, 92P 004	Cu, Au	Alkalic Porphyry	G; TR; DD (1604 m)
North Valley	Highland Valley Copper	092INW040, 011, 030, 029, 053, 085, 005	Cu, Mo, Au, Ag	Calc-alkalic Porphyry	IP; DD (~6500 m)
Orr	Amarc Resources Ltd	92P/07W	Cu, Au	Alkalic Porphyry	IP; DD (~600 m)
Pimainus	Highland Valley Copper	92ISW046	Cu, Mo	Porphyry	DD (802 m)
Panorama Ridge	Goldcliff Resources Corp	82ESW052, 259	Au	Skarn	TR; GC; G; DD (2277 m)
Rabbit North & South	Ballad Gold and Silver Ltd / Auterra Ventures Inc	92INE147, 045, 130, 114, 071	Cu, Au	Alkalic Porphyry, Vein	DD (811 m)
Rain (Sorcerer)	Orphan Boy Resources Inc	82M 156	Cu, Zn, Pb, Au, Ag, Mo, W	VMS; Skarn; Porphyry; Vein	GC; G; TR; DD (~2500 m)
Randi	Locke Goldsmith	092ISW054	Au, Ag, Cu	Mesothermal Vein	DD (~10,000 m)
Ruddock Creek	Cross Lake Minerals Ltd	82M 082, 83	Zn, Pb, Ag	Stratiform	AB-GP; DD (1839 m)
Vault	Ecstall Mining Corp	82ESW173	Au, Ag	Epithermal Vein	G; DD (1310 m)

**Work program abbreviations:**

A = access; trail, road construction on claims; AB-EM = airborne electromagnetics; AB-MG = airborne magnetics; AB-RD = airborne radiometrics; BU (X tonnes) = bulk sample (weight in tonnes if known); CD = condemnation drilling; CQ = coal quality testing; CT = carbonization test (coal); DD (Xm) = diamond drilling totaling X metres; EN = environmental baseline studies/monitoring, remediation work; FS = feasibility studies; G = geology, mapping, etc; GC = geochemical sampling (rock, soil, silt, etc); GD = geotech drilling; GP = geophysics (general); IP = Induced Polarization; 3D-IP; MG = magnetics; MK = marketing-primarily for industrial mineral products; MS = metallurgical studies; OB = overburden drilling; OP-BU = open-pit bulk sample; P = prospecting; PD = percussion drilling; PF = pre-feasibility studies; R = reclamation; RC = reverse circulation drilling; TR = trenching, UG (X m) = X metres of underground development; UG-BU = underground bulk sample; UT = UTEM; VLF; WT = washability test (coal)



from the Willa property, located 230 kilometres south near the town of Silverton. The company hopes to begin shipping Willa ore to Goldstream in mid-2005.

Exploration near the Goldstream mine included the **Spire** and **Boutwell** Besshi-type massive sulphide copper-zinc targets. At Spire, massive and semi-massive sulphide horizons are interpreted to be at or near the Goldstream “mine horizon”. Trenching and drilling has encountered copper-zinc-lead massive sulphide mineralization with grades and thicknesses approaching those at the mine. The **Rain** property, located about 50 kilometres by road southeast of Goldstream, was the subject of extensive surface work and drilling. The property has a wide variety of mineralization styles, including Besshi or Goldstream-style massive pyrrhotite with traces of zinc and copper, skarn and stockwork or porphyry molybdenum-tungsten (Ruger or Sorcerer Creek prospect, MINFILE 82M 156), and polymetallic veins, manto and skarn mineralization hosted by marble. The latter include the **Alfie** and **Lynes** showings discovered late in the year. Orphan Boy also has several other promising base-metal prospects in the Big Bend area, including the stratiform, **Rift** zinc-lead-copper deposit.

The dormant **Blackdome** gold-silver mine and mill of J-Pacific Gold Inc located northwest of Clinton also remains on care and maintenance. This is an underground mine that operated in the 1980s and again briefly from October 1998 to May 1999. Mineralization consists of narrow, high-grade epithermal quartz veins. The 200 tonne-per-day mill is intact and the property has an inferred mineral resource of 124 120 tonnes grading 12.8 g/t gold and 33.7 g/t silver. In 2004, J-Pacific commissioned a structural geology study of the mine area and conducted drilling at the **Elizabeth** property (Figure 4-6) located 32 kilometres to the south. If sufficient high-grade ore can be defined, it would not be technically difficult to connect existing roads to allow trucking to the Blackdome mill. Narrow, high-grade mesothermal gold-quartz veins are the principal target at Elizabeth. Free gold and spectacular grades have been found by surface trenching and drilling in 2003 and 2004. Interesting intrusion-hosted, stockwork mineralization with copper, molybdenum and gold values was also encountered in several drill holes. This new discovery is called the “Porphyry zone”.

The **Similco** (Copper Mountain-Ingerbelle) copper-gold mine at Princeton remains on care and maintenance. When it shut down in 1996, the Similco mine was reported to have a resource of 142 million tonnes grading 0.397% copper (plus unreported gold) in the area of Pits 2 and 3 on the Copper Mountain side of the property. The property was sold in 2002 to Envirogreen Technologies Ltd, a company involved in the remediation of special wastes, which has set up a plant on a small portion the mine site. Compliance Energy Corp has also been using a small portion of the minesite for its coal wash plant (Figure 4-7), and has an option to purchase part of the site from Envirogreen, including the mill building.

Compliance is studying the feasibility of building a coal and wood-waste fired generating station on the site.

## COAL

At the **Basin** coal mine, production of clean thermal coal more than doubled in 2004 to about 40 000 tonnes. Located near the town of Coalmont, the operation is a joint venture of Compliance Energy Corp (65%) and Sojitz Coal Development Ltd (35%). The Basin project has measured and indicated resources of 19 million tonnes and a permit for up to 250 000 tonnes of annual coal production. The high volatile, bituminous B and C rank coal is sold mainly to cement plants and small greenhouse growers in southern BC.

Since opening in 2003, raw coal has been trucked about 45 kilometres, on a seasonal basis, to a wash plant at the Similco site near Princeton (Figure 4-7). Late in 2004 the partners began moving the wash plant to the minesite and purchased a fleet of mining equipment in preparation for a January, 2005 restart. A thickener tank will be added to the plant and power will be supplied by generators. Production is forecast to be 150 000 tonnes of



Figure 4-6. Rob Montgomery and Warner Gruenwald, consultants to J-Pacific Gold Inc, and BC Geological Survey geologist Tom Schroeter examine drill core at the **Elizabeth** property.



Figure 4-7. Coal wash plant of Compliance Energy Corp, located on the site of the dormant **Similco** copper-gold mine near Princeton.

clean coal in 2005. The Similco site will continue as a load-out for highway trucks, and could become the location for a proposed \$125 million, 50-megawatt coal and wood-fired generating station, currently undergoing feasibility studies.

## INDUSTRIAL MINERALS

Over 250 people are employed at industrial minerals quarries and processing plants in the region. These operations are important providers of stable employment in smaller communities such as Cache Creek, Ashcroft, Princeton and Merritt. Of note were two small operations, **Decor** and **Zeo**, which were under development during the year. They should enter commercial production in the near future. There are very good opportunities for additional growth in this sector due to the wide variety of rock types and deposits in the region, excellent transportation infrastructure, proximity to growing markets in western North America, and the relative ease of permitting.

The **Kamloops** cement plant and **Harper Ranch** limestone quarry of Lafarge Canada Inc, with an annual capacity of about 220 000 tonnes of cement, benefited from an improving economy and busier construction industry in western Canada. The plant operated at about 70% capacity in 2004 and should be at this level, or higher, in 2005. Lafarge also draws materials from the **Falkland** and **Buse Lake** quarries, which provide gypsum and alumina-silica rock respectively. There are 24 permanent positions at the plant, with another eight contractors working in the quarries.

Lafarge also purchased about 7000 tonnes of alumina-rich burnt shale from Pacific Bentonite Ltd for use in cement-making. The material was mined under a bulk sample permit at the **Decor** pit (Figure 4-8; formerly called Ben or Hat Creek), located near Cache Creek. Late in 2004, Pacific Bentonite applied for a mine lease and a 35 000 to 50 000 tonne per year quarry permit, and



Figure 4-8. **Decor** pit of Pacific Bentonite Ltd (courtesy John Dormer).

expects that larger quantities can be supplied to Lafarge in the coming years. Once the quarry permit is in place, the company intends to further develop landscaping and decorative markets for the shale. In addition, the property hosts a large bentonite deposit which is being investigated for municipal engineering and tile manufacture applications.

Also near Cache Creek, Graymont Western Canada Inc operates the **Pavilion** limestone quarry and lime plant on the Pavilion Indian Reserve (Figure 4-9). Employing more than 35 people, mainly First Nations, the operation produces lime used in pulp mills, mines and other industrial processes. The plant has rated capacity of 180 000 tonnes of lime per year. Graymont has been studying the feasibility of a change in the surface mining system that could incorporate a raise and glory hole.

East of Ashcroft, IG Machine and Fiber Ltd, a subsidiary of IKO Industries Ltd, operates the **Ashcroft** basalt quarry and roofing granule plant. The plant produces about 250 000 tonnes of roofing granules in ten distinct colours. The granules are shipped by rail and truck to IKO asphalt shingle plants in Calgary, Alberta; Sumas, Washington; Chicago, Illinois and elsewhere in North America. About 55 people are employed.

Farther along the Thompson River to the northeast, the **McAbee** and **Walhachin** quarries supply railroad ballast for the Canadian National and Canadian Pacific railways, respectively. The railroads also have several other quarries in the region.

Craigmont Mines Ltd operates the **Craigmont** magnetite tailings operation located near Merritt. Tailings from the old Craigmont copper mine are processed to recover up to 70 000 tonnes of magnetite annually. The plant operates on a seasonal basis (March to December), employing about 30 people. The magnetite is used in all coal washing plants in western Canada, plus the Centralia mine in Washington State. The company is investigating the feasibility of adding a new mill circuit to recover hematite, which could be used in steel or cement manufacturing. In 2004, an option agreement was signed with Christopher James Gold Corp to purchase 50% of





Figure 4-9. Graymont's *Pavilion* limestone quarry and lime plant, located near Cache Creek.

the operation for \$3.5 million. Christopher James Gold is also interested in exploring for base and precious-metal deposits in and around the underground and open-pit Craigmont copper mine, which closed in 1982.

At its plant in Kamloops, Western Industrial Clay Products Ltd manufactures cat litter, barn deodorizer, industrial absorbents, and carriers for agricultural products. These are prepared from diatomaceous earth mined from the **Red Lake** quarry northwest of Kamloops, and bentonite mined from the **Bud** quarry at Princeton. About 45 people are employed at the company's various sites.

The **Z1** (Ranchlands) zeolite quarry near Cache Creek was dormant in 2004. It is a small-scale, intermittent producer owned by the Mineral Products Division of Dynatec Corporation. The company continues to market agricultural and absorbent products, produced from stockpiled zeolite at its plant in Lethbridge, Alberta.

Zeolite was mined from the nearby **Z2** quarry for processing at a plant in Ashcroft. The quarry and plant are owned by Industrial Mineral Processors, a private company based in Calgary. The plant produces industrial absorbents for oil field clean-up, soil conditioner, barn deodorizers, feed binders, and cat litter.

At Princeton, Zeo-Tech Enviro Corp owns the **Zeo** (Bromley Vale) zeolite quarry where a 4000 tonne bulk sample was blasted in 2002. The deposit is reported to have a measured resource of 350 218 tonnes, an indicated resource of 214 310 tonnes, and an inferred resource of 297 000 tonnes. In 2003, Zeo-Tech and partner C2C Zeolite Corp formed an operating company, United Zeolite Products Ltd, which in turn signed a five-year, five million-dollar supply contract with Halliburton Energy Services Inc. The zeolite will be used to produce lightweight cement for oil and gas wells. United began construction in 2004 of a zeolite micronizing plant at Princeton. Late in 2004, Zeo-Tech conducted crushing and stockpiling of zeolite to provide material for mill start-up and trucking to Halliburton over the winter.

Okanagan Opal Inc produces attractive fire opal gemstones and jewelry from the **Klinker** property, located west of Vernon. Opal occurs as fracture and vesicle-fillings in andesitic to basaltic laharic breccia of the basal Kamloops Group (Eocene). Small-scale mining took place in 2004 to meet growing demand. Presently the gemstone jewelry is marketed from a retail store in Vernon (Figure 4-10) and is aimed at the BC tourist market; however, the company aims to develop other North American markets.

Decorative rock and dimension stone are produced at numerous small quarries throughout the region. The best known producer is the **Kettle Valley Stone Company** of Kelowna which sells flagstone, ashlar, facing stone and landscape rock mined from the **Nipple Mountain**, **Kettle Valley**, **Canyon** and **Gemini** quarries. Kettle Valley's workforce has grown to about 40 people year round, mainly employed in the Kelowna processing facility (Figure 4-11). The products include dacite ash, gneiss and basalt, and are mainly used in high-end residential and commercial developments in the western U.S.A. and in the Vancouver-Whistler area.

South of Revelstoke, D.G. Olsson produces, by hand, small amounts of micaceous-quartzite flagstone and facing stone at the **Begbie** quarry. Other small, hand-operated flagstone quarries exploit micaceous quartzite in the North Thompson area.



Figure 4-10. Retail store of Okanagan Opal Inc at Vernon.





Figure 4-11. Facing stone and flagstone at the production facility of **Kettle Valley Stone** at Kelowna.

BBF Resources Inc continued marketing studies on a 180 tonne bulk sample of perlite collected from the past producing **Frenier** quarry located west of Clinton. The material is being tested for use in horticulture and building materials. A resource of 375 000 tonnes is reported from previous drilling.

## EXPLORATION HIGHLIGHTS

### **KAMLOOPS-HIGHLAND VALLEY**

The Iron Mask batholith near Kamloops enjoyed its best year for exploration in a long time, with about \$6 million in expenditures by two operators, and substantially more work is expected in 2005. The **Afton** alkalic porphyry copper-gold-silver-palladium project of DRC Resources Corp is the subject of a 13-month, \$18 million feasibility study that began in fall 2004. A recent, advanced scoping study indicated favourable economics, moderate capital requirements and low environmental concerns for a 9000 tonne-per-day underground panel (block) caving operation, with a mine life of nearly 18 years. The advanced scoping study proposed a mine plan that would exploit a resource of 51.5 million tonnes grading 1.72% copper equivalent (1.13 % copper, 0.85 g/t gold, 2.55 g/t silver and 0.11 g/t palladium), producing about 522 000 tonnes copper (1.15 billion pounds) and 39 200 kilograms gold (1.26 million ounces) over the mine life. This is part of an overall measured and indicated resource totaling 68 700 000 tonnes grading 1.68% copper equivalent (1.08% copper, 0.85 g/t gold, 2.62 g/t silver and 0.12 g/t palladium), using a cutoff of 0.7% copper equivalent. An additional 7.45 million tonnes is inferred to exist at a slightly lower grade.

The Afton-Ajax complex was operated by a subsidiary of Teck Cominco Ltd between 1977 and 1997, with the Afton pit in operation from 1977 to 1987 (Figure

4-12). DRC is exploring the extension of the Afton deposit beneath and to the southwest of the Afton pit. Mineralization has been found at least 500 metres below the elevation of the pit-bottom and the zone is open to depth and along strike. The current development work will include a 2000 metre-long decline, 20 000 metres of underground drilling, bulk sampling, and metallurgical and engineering studies. Procon Mining and Tunnelling Ltd has been contracted to do the underground work.

Despite encouraging results in 2003, no work was done by DRC on the **Pothook gold zone** located south of the Pothook pit. Several 2003 drillholes cut bulk tonnage-type gold mineralization such as 156 metres grading 0.72 g/t gold, and drilling nearby by Teck, in 1996, encountered up to 35 g/t gold and 0.12% copper over 6 metres. Additional exploration is expected on this encouraging zone, which may be an extension of the **Coquihalla** zone, drilled by Abacus Mining and Exploration Corp late in 2004.

DRC also owns claims between the **Ajax** East and West pits, which provided mill-feed to the Afton concentrator prior to closure in 1997. The pits are located about 10 kilometres southeast of the Afton site. Three of five drill holes encountered encouraging mineralization



Figure 4-12. Aerial view of the **Afton** mine complex with the Afton pit in the centre with mill/office buildings to the east (right) and the Pothook pit to the southeast. The Afton main zone extends in a southwesterly direction from the bottom of the pit towards the tailings pond in the lower left. The Trans-Canada Highway curves around the north side of the pit. (Courtesy DRC Resources Corp)

between the two pits. Abacus Mining has an option from Teck Cominco Ltd for the main claims covering the Ajax pits; however, they have not done any drilling in this area.

Abacus Mining conducted a very aggressive exploration program on their large **Afton area** property, optioned from Teck Cominco Ltd. Work included a large 3-D induced polarization survey and more than 27 000 metres of drilling, split between the **Rainbow** deposit, the **DM-Audra-Crescent** area, and the Coquihalla zone.

At **Rainbow**, a resource of 15 900 000 tonnes grading 0.528% copper with undefined gold, silver, molybdenum and palladium values was reported from previous Teck work. The 2004 drilling attempted to extend the higher grade mineralization in the Rainbow #2 and #22 zones to depth.

Previous drilling on the **DM** zone, located three kilometres east of the Afton pit, had defined a resource of 2.685 million tonnes grading 0.38% copper and 0.27 g/t gold (MINFILE). Abacus' work in this area had several encouraging drillholes including 308.9 metres grading 0.42% copper and 0.20 g/t gold in a hole through the DM deposit, and 98 metres grading 0.45% copper and 0.60 g/t gold in a hole at **Audra**. The latter is located between the DM deposit and the Crescent pit, where Teck mined a small amount of ore in 1988-89. Mineralization at DM and Audra contains abundant bornite and chalcopyrite in a strongly potassic-altered breccia.

Farther southwest, midway between the Afton and Highland Valley Copper mines, Auterra Ventures Inc and Ballad Gold and Silver Ltd drilled seven holes on the **Rabbit North** property. The holes encountered porphyry copper-gold on the edge of a large induced polarization anomaly, and gold-bearing quartz-pyrite mineralization. North of Kamloops, Zappa Resources Ltd acquired the **Heff** (Mesabi) copper-gold skarn prospect near Heffley Lake, and were considering a small drill program at year end.

In the Highland Valley, Getty Copper Inc drilled several geophysical targets in the vicinity of the **Getty North** porphyry copper deposit. Previous work at Getty North defined a drill indicated and inferred resource of 72.1 million tonnes grading 0.31% copper, including 10.0 million tonnes of oxide grading 0.40%. Getty also collected bulk samples for metallurgical studies. The ELSA metal continuous vat leaching process is being considered for treatment of the Getty North oxides.

Finally, on the **Stump Lake** property, 38 kilometres south of Kamloops, Maximum Ventures Inc conducted trenching and sampling in the search for gold-silver vein mineralization.

## **SOUTHERN CARIBOO-CHILCOTIN**

Afton or Mt. Polley-style bulk-mineable porphyry copper-gold-silver-palladium deposits were the target of several significant exploration projects in the southern

Cariboo. These projects primarily targeted known showings and grassroots geophysical or geochemical anomalies within the Late Triassic-Early Jurassic "Quesnel Trough". The deposits are associated with magnetic alkaline diorite-syenite intrusions into the co-magmatic Nicola Group volcanic arc.

Lithic Resources' **Friendly Lake** property, located northwest of Little Fort, was the subject of a comprehensive program of airborne and surface geophysics, geochemistry, geological mapping, prospecting and drilling. The work defined broad copper, gold, silver and lead-in-soil anomalies, partly coincident with geophysical anomalies within an area underlain by Nicola Group volcanic, sedimentary and intrusive rocks. Closer to Little Fort, New Cantech Ventures Inc drilled the **Bill** (gold-copper) and **Cross** (copper-gold) prospects with disappointing results. Near Bridge Lake, Amarc Resources Ltd staked the **Crystal** and **Orr** properties to cover grassroots porphyry targets in the Nicola rocks, and conducted induced polarization surveys and drilling.

The **Ann North** porphyry copper-gold property, located northeast of Lac La Hache, was the subject of several waves of drilling and trenching by GWR Resources Inc. Positive results were reported from several drillholes in a strongly potassic-altered quartz monzonite intrusion. The best hole was #04-19 which cut 26 metres grading 0.50% copper and 1.23 g/t gold at shallow depths, and 107.3 metres grading 0.29% copper and 0.33 g/t gold deeper down in the hole. GWR Resources also optioned some of their property holdings to Candorado Operating Company Ltd which staked additional claims to the north. Candorado completed surface surveys and drilled several holes on the **Murphy Lake** copper prospect where previous drilling returned up to 1.14% copper over 9.3 metres.

An airborne magnetic-electromagnetic survey was flown over Argent Resources' **Iron Lake** property located northeast of 100 Mile House. This grassroots property has a large soil anomaly, and float sampling has returned encouraging values in copper, gold and platinum group metals in an area underlain by pyroxenite.

The largest potential development in the region is the **Prosperity** porphyry gold-copper deposit of Taseko Mines Ltd, located southwest of Williams Lake. The project is on-hold but the most recent information from the company gives an estimated measured and indicated resource of 491 million tonnes grading 0.22% copper and 0.43 g/t gold.

## **GOLD BRIDGE**

Mesothermal gold-quartz veins were the subject of several significant exploration projects in the famous Gold Bridge camp, British Columbia's most prolific gold district with over 4.1 million ounces produced historically. The most advanced project is the **Bralorne mine** of Bralorne Gold Mines Ltd which operated from

1987 to 1971. A Mine Development Certificate was issued for a new mine in 1995, however, since then low gold prices have delayed development. Resource calculations reported at that time gave 406 584 tonnes at a grade of 10.6 g/t gold above the 800 level in the Bralorne mine, and 26 115 tonnes grading 9.6 g/t gold for the Upper Peter vein on the Loco property.

In 2004 Bralorne completed construction of a tailings pond to allow five years of production, and began test milling using a small (~100 tonne-per-day) gravity/flotation pilot plant. As of mid-August more than 10 000 tonnes had been processed through the plant, producing about 141 dry tonnes of concentrate. Most of the material processed was from low-grade stockpiles with some additional material coming from the Upper Peter vein (4230 adit) on the Loco (or Cosmopolitan) property. At small amount of dore gold was produced on-site, and about 20 tonnes of flotation concentrate was shipped to the Jerritt Canyon mine in Nevada for further processing.

Bralorne also did underground development to prepare a stope on the Peter vein on the 800 level of the King mine workings, and drove a decline from the 4230 level to access a new level 30 metres deeper. Surface drilling returned encouraging results from the 51B vein in the gap between the Bralorne and Pioneer mine workings, and a new 180-metre long adit is being driven to access this area.

On the nearby **BRX** property, Mill Bay Ventures Inc drove a cross-cut to access the California vein for grade determination and extraction of a bulk sample. Menika Mining's **Reliance** property, to the east, was tested by three drillholes with encouraging results, such as 33.5 metres grading 7.54 g/t gold. Avino Silver and Gold Mines Ltd drilled several holes on mesothermal gold targets on the **Olympic** property, five kilometres northeast of Gold Bridge.

## **OKANAGAN**

Exploration work in the Okanagan focused almost exclusively on epithermal and mesothermal gold-quartz veins in 2004.

A resource calculation was released in May 2004 for the **Elk** project of Almaden Minerals Ltd, located 45 kilometres southeast of Merritt, and just 2 kilometres south of Highway 97. This project produced 1609.6 kilograms gold (51 750 ounces) from 16 700 tonnes of direct-shipping ore from open-pit and underground operations between 1992 and 1995. Grades were consistently high, averaging about 96 g/t gold.

The new resource was calculated using drill data for the Siwash B and WD veins, just two of eight known mesothermal vein structures on the property. Global (bulk-tonnage and underground mineable) measured and indicated resources were reported to total 668 300 tonnes

grading 9.66 g/t gold (207 600 ounces) plus an additional 1,317,200 tonnes grading 4.91 g/t gold (207 800 ounces) in the inferred category. Included in the global figures is a higher grade, underground-mineable resource totaling 164 000 tonnes grading 33.69 g/t gold in the measured and indicated category, plus another 195 200 tonnes grading 16.38 g/t gold in the inferred category.

Almaden followed up with an aggressive drilling campaign in summer and fall 2004 to further increase resources. More than 10 000 metres of drilling in 44 holes was directed at the Siwash B, WD and Bullion Creek veins. The company also conducted some environmental monitoring work in preparation for possible permitting of a small mine and mill in the future. Last year the company purchased a 110 tonne-per-day, modular, gravity-flotation mill in Alaska and moved it to a site near the property for storage.

Directly south of the Elk property, International Tower Hill Mines Ltd drilled its **Siwash** gold property, a porphyry and vein-style gold-silver-copper target.

Ecstall Mining's **Vault** and **Dusty Mac** mine properties near Okanagan Falls host low-sulphidation, epithermal gold-silver vein and breccia deposits in Tertiary volcanic rocks; a geological setting similar to the productive Republic and Curlew districts in Washington State. The **Vault Main** zone is reported to have a resource of 1.55 million tonnes grading 2.49 g/t gold. Ecstall drill-tested the western end of this structure in early 2004, encountering good gold values at shallow depths (e.g. 9 metres grading 2 g/t gold). The Vault property also contains the **Vault North** vein, a narrow quartz-carbonate-adularia vein with an indicated resource of 152 000 tonnes grading 14 g/t gold. The nearby Dusty Mac gold-silver mine produced 93 372 tonnes of quartz breccia ore from a small open pit in 1975 and 1976. The average recovered grade was 6.49 g/t gold and 113 g/t silver. Ecstall will conduct a seismic reflection survey in 2005 to help locate a postulated underlying feeder vein.

Southwest of Vernon, the **Brett** epithermal gold-silver property was acquired and explored by Mosquito Consolidated Gold Mines Ltd and Running Fox Resources Corp. This property was extensively explored in the 1980s and early 1990s but has been relatively dormant since 1996 because of litigation. The property is underlain by Tertiary volcanic rocks and gold mineralization occurs in north-northwest-trending, steeply dipping shear zones, quartz veins, and altered, flat-lying tuffaceous horizons. The Bonanza area of the Main Shear has been the focus of most of the previous work including over 10 000 metres of diamond drilling, 2800 metres of reverse circulation drilling and 459 metres of underground development. The property boasts one spectacular intersection in a 1988 reverse circulation hole drilled down-dip on the Main Shear, which returned 69.6 g/t gold over 71.65 metres. A small amount of surface mining was done in 1995 and 1996, resulting in a 291 tonne shipment to the Trail smelter in 1996, with an



average recovered grade of 27.74 g/t gold and 63.7 g/t silver.

The 2004 work included soil surveys, trenching, geological mapping, prospecting, re-sampling of old core, and 17 drillholes. This work resulted in discovery of several new soil anomalies and mineralized zones. The most exciting new area appears to be the Bonanza East zone located about 50 metres east of the Main Shear, where a hole intersected 1.31 metres grading 162 g/t gold (176.3 g/t by check metallic fire assay), plus two lower grade sections hosted by tuff.

Solomon Resources Ltd controls the **Bouleau** property, located north and east of Brett, where narrow, high-grade quartz-gold veins are hosted by intrusive rocks.

Columbia Yukon Explorations Inc conducted a small amount of drilling on the **Barnes Creek** grassroots gold target, located in the Monashee Pass area east of Vernon. Late in 2003 the company completed excavator trenching and discovered several new showings comprising narrow, gold-bearing quartz veins in black shale. Several creeks in the area carry placer gold and the company also outlined several large gold and arsenic-in-soil anomalies. Prospecting within these anomalies led to the discovery of quartz-pyrite float boulders with promising gold-silver assays in late 2004.

## **FRASER RIVER-MERRITT**

Locke B. Goldsmith explored the **Randi** property, northwest of Boston Bar, with major drilling campaigns in both in 2003 and 2004. The target is mesothermal gold veins, however, results are not available.

The **Duke** (Copper Canyon) porphyry copper-gold-silver prospect southwest of Merritt was expected to be drilled in late 2004 or early 2005 by partners Southern Rio Resources Ltd and Freegold Ventures Ltd. Drilling in 1963 returned encouraging copper values (*e.g.* 0.63% copper over 57.9 metres). However, gold was not included in the assay work at that time and little work has taken place since. Recent surface grab sampling by Southern Rio has shown gold values in the range of 0.21 to 0.48 g/t gold.

To the south and east of Duke, Almaden Minerals Ltd and joint venture partner Consolidated Spire Ventures Ltd continued grassroots prospecting for low sulphidation epithermal gold-silver-arsenic-antimony-mercury-molybdenum mineralization in intermediate volcanic rocks of the Cretaceous Spences Bridge Group. Spire optioned the **PV** and **NIC** claims from Almaden in early 2004, staked a large number of additional claims, and defined four new gold and pathfinder element stream sediment anomalies to the north of PV. Previous Almaden work at PV had discovered numerous float boulders of quartz grading up to 43.34 g/t gold and 130.7 g/t silver. On the **NIC** claims on the eastern side of the large

property, Almaden discovered a bedrock showing of brecciated quartz veins in late 2003. Chip samples returned values such as 9.24 g/t gold over 0.5 metres and 2.26 g/t gold over 1.4 metres, with silver values in grab samples as high as 209.1 g/t. Spire followed up with a soil survey that outlined several gold-in-soil anomalies.

Farther west, near the town of Spences Bridge, Almaden conducted grassroots work on the **SAM** claims where an epithermal gold discovery was made in late 2003. Twenty-two grab samples of quartz averaged 0.82 g/t gold. 2004 work comprised soils, prospecting and hand trenching.

Epithermal gold-silver mineralization is also the target on the **Blustry Mountain** (Rand) project of Wyn Developments Ltd. Located west of Cache Creek, the property is underlain by volcanics of the Spences Bridge Group which host a large alteration zone with a coincident polymetallic soil anomaly. Wyn conducted induced polarization surveys and prospecting in 2004.

South of the town of **Merritt**, Forum Development Corp plan to drill a 455-metre hole in late 2004 or early 2005 to test coal and coalbed methane potential in the Middlesboro collieries area.

## **REVELSTOKE**

The **McKinnon Creek (J & L)** polymetallic deposit, located 45 kilometres north of Revelstoke, was acquired by BacTech Mining Corp in late 2003. The J & L Main zone comprises an arsenopyrite-bearing massive sulphide body with a reported potential resource of 3.6 million tonnes grading 7.24 g/t gold, 81 g/t silver, 3.0% lead and 3.83% zinc. In 2004 the company began a \$1.6 million pre-feasibility study involving underground drilling, collection of a 5-tonne bulk sample from underground, and metallurgical and environmental studies. The overall goal is to advance the project towards a production decision. The conceptual plan is for underground mining with production of lead and zinc flotation concentrates for smelting, and a separate gold-silver flotation concentrate for bioleaching. BacTech may try to submit an environmental assessment report in 2005, and to complete project approvals in 2006.

The **Ruddock Creek** sedimentary exhalative zinc-lead deposit was optioned by Cross Lake Minerals Ltd from Doublestar Resources Ltd. The deposit is located about 100 kilometres north of Revelstoke and was explored previously by Falconbridge Ltd and Cominco Ltd, who reported an inferred mineral resource of 1.5 million tonnes grading 8.4% zinc and 1.6% lead within the "E zone". Cross Lake drilled 11 holes in 2004 (Figure 4-13) to expand the E zone to the west and north. Mineralization is hosted within siliceous calc-silicate and quartzite in a westerly-plunging fold-nose. Cross Lake also owns the **LJ**, **Kneb** and **Ghost** stratiform base-metal massive sulphide prospects in the Goldstream region.



Figure 4-13. Drilling on the **Ruddock Creek E zone** zinc-lead deposit. (Courtesy Cross Lake Minerals Ltd)

### **SHUSWAP-NORTH THOMPSON**

Metallurgical studies continued on the **Fir** carbonatite-hosted tantalum-niobium property north of Blue River. Owner Commerce Resources Corp reported on testwork conducted by SGS Lakefield Research Ltd which showed that gravity and flotation separation can produce a high-grade concentrate (58-59%  $Ta_2O_5$  +  $Nb_2O_5$ ) with minimal losses. The Fir deposit is reported to contain an indicated resource of 5.65 million tonnes grading 203 g/t  $Ta_2O_5$  and 1074 g/t  $Nb_2O_5$  with an additional inferred resource of 6.74 million tonnes at the same grade. Commerce also owns the **Verity** deposit, located a few kilometres to the north, which is reported to have a resource of 3.06 million tonnes grading 196 g/t  $Ta_2O_5$ , 646 g/t  $Nb_2O_5$  and 3.2%  $P_2O_5$ .

North of Barriere, Molycor Gold Corp drilled three holes and did a small induced polarization survey on the **Windpass mine** property. Between 1916 and 1944, the Windpass mine produced 93 435 tonnes of quartz-magnetite-sulphide vein material with a recovered grade of 11.47 g/t gold, along with minor silver and copper values. Drilling was also done on the **Gold Creek** property, northeast of Barriere, by Navasota Resources Ltd late in the year. The company was targeting gold-in-soil anomalies near the Enargite polymetallic vein prospect.

Several stratiform base-metal properties in the Shuswap-Adams Lake area changed hands recently. Argent Resources Ltd acquired the western side of the **Harper Creek** disseminated sulphide deposit, located south of Vavenby. The Harper Creek deposit has a historical geological resource of 96 million tonnes grading 0.41% copper. Yale Resources Ltd acquired the **Adams Plateau** copper-zinc-lead-silver project in the Nikwikwai Lake, area east of Adams Lake. The Extra High property, which includes the **Kamad 7** deposit was optioned by Lucky 1 Enterprises Inc. Kamad 7 is a Kuroko-type massive sulphide deposit, is located near the

past-producing Homestake and Samatosum mines, and has an estimated resource of 375 000 tonnes grading 4.0 g/t gold, 6.1% zinc, 4.8% lead, 0.5% copper and 55 g/t silver.

### **ASPEN GROVE-PRINCETON-KEROMEOS**

Following up on promising results, a substantial program of trenching and 22 drillholes was completed in 2004 on the **Panorama Ridge** gold skarn project of Goldcliff Resources Corp. Located a few kilometres east of the historic Nickel Plate gold mine, the property has numerous targets. At the York-Viking area, trenching exposed 77 metres grading 1.129 g/t gold, and mineralization has been found over an area of 300 by 300 metres. Drilling of the York prospect in late 2003 intersected of 77.02 metres grading 0.93 g/t gold in hole 23003.

The nearby **Bradshaw Hill** (Yuniman Ridge) project of Firestone Ventures Inc hosts high-grade gold veins and shear zones. Two new mineralized zones were identified in 2004 with grab samples reported to run up to 6.35 and 0.265 g/t tonne gold.

North of Princeton, Bearclaw Capital Corp drilled several holes on the **Axe** porphyry copper-gold deposit to confirm old results and study the oxide copper potential. Previous drilling, totaling about 14 000 metres in 185 drill holes, is reported to have defined four mineralized zones with an aggregate indicated resource of 39 100 000 tonnes grading 0.39% copper (at a 0.25% copper cut-off), along with an inferred resource of 32 000 000 tonnes at similar grade. The overall resource is said to include an inferred oxide resource of 8 500 000 tonnes grading 0.54% copper. The gold content has not been determined.

A resource calculation was released for the **Big Kidd** porphyry copper-gold property located at Aspen Grove, southeast of Merritt. Christopher James Gold Corp reported that the property contains a combined indicated and inferred resource of 122.4 million tonnes grading 0.33 g/t gold and 0.15% copper.

### **ACKNOWLEDGMENTS**

This paper has benefited from the input of numerous company geologists, consultants and individual prospectors. They are thanked for their hospitality in the field and free sharing of ideas and results. The manuscript was improved by the editorial comments of Brian Grant.