British Columbia Geological Survey
Geological Fieldwork 1997

GEOCHEMICAL PATHFINDERS FOR MASSIVE SULPHIDE DEPOSITS IN THE SOUTHERN KOOTENAY TERRANE

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KEYWORDS: Kootenay Terrane, geochemistry, sulphide deposits, pathfinder elements, soil, till.

INTRODUCTION

A variety of geochemical methods have proved effective exploration tools for base metal massive sulphide deposits. The most extensive geochemical expression from massive sulphide mineralization is characteristically shown by those elements most mobile in the near surface environment (e.g. copper, zinc, sulphate). These elements combined with changes in surface water pH may be detected by regional stream sediment, stream water or lake sediment surveys. However, massive sulphide bodies are small compared to many other styles of mineralization and are difficult to locate especially where bedrock is covered by glacial deposits. Soil and till geochemical geochemical surveys commonly use the ore-related elements (e.g. gold, copper, lead, silver, zinc) to detect mineralization. Hydromorphic dispersion of the geochemically immobile elements (e.g. gold, lead) is limited compared to more mobile elements (e.g. copper). Immobile element soil anomalies can be the most direct indicator to the location of a concealed base metal sulphides or mineralized material in till (Cameron, 1977). However, element patterns in soil and till are typically small and therefore difficult to detect without a detailed survey. Anomaly size can be increased and the character of the sulphide mineral source better established by using pathfinder elements commonly found associated with the sulphide ore. Typical pathfinders are arsenic for gold and mercury for copper-lead-zinc sulphides.

A regional stream water survey, detailed geochemical studies, a regional till geochemical survey, surficial mapping and mineral deposit studies were carried out by the Geological Survey Branch in 1996. These projects were part of an integrated study of the Eagle Bay Assemblage within NTS sheets 82M 4 and 5 (Dixon-Warren *et al.*, 1997; Bobrowsky *et al.*, 1997; Sibbick *et al.*, 1997; Höy, 1997). Surficial mapping, mineral deposit studies and the geochemical surveys covered two 1:50,000 scale map sheets (82M 4 and 5). Strong arsenic, copper, cobalt, gold, lead and zinc geochemical dispersal plumes were revealed in till samples collected down-ice from a number of massive sulphide deposits within these map sheets. More subdued copper, zinc, sulphate hydrogeochemical anomalies were detected by the stream water survey.

Studies of the Southern Kootenay Terrane continued during the summer of 1997. Geochemical studies included a regional till survey of the western half of two 1:50,000 NTS sheets, 92P1 and 8 (Paulen *et al.*, 1998) and detailed geochemical sampling within NTS 82M4 and 5 outlined in Figure 1.

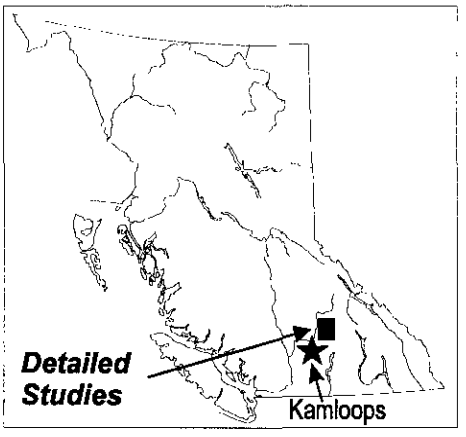

Figure 1. Location of the project area.

The aims of the detailed sampling were:

- To establish the geochemical expression in soil and till near different sulphide occurrences.
- To discriminate between different mineral sources within down-ice dispersal plumes.

Preliminary results of detailed geochemistry for three occurrences are described in this paper.

TOPOGRAPHY AND GEOLOGY

Detailed geochemical studies were carried out at several locations on the Adams Plateau and near North Barriere Lake. The moderate to high relief of the region is typical of the Shuswap highlands. West of Adams Lake the undulating land surface is dissected by several major east-trending valleys, such as those occupied by Simax Creek and the North Barriere River. Valley sides are often steep and have extensive talus below cliff sections. A varying thickness of till, deposited by an ice advance from the northwest, covers bedrock on the more subdued plateau topography. Vegetation ranges from cottonwood stands in

valley bottoms to a western hemlock, red cedar and Douglas fir canopy on the plateau. (Rowe, 1972). Organic and gleysolic soils are common in poorly drained areas whereas luvisolic and regosolic soils are typically developed on hill slope and plateau regimes. The predominant surficial deposits are basal till, ablation till, glaciofluvial sediment, glaciolacustine sediment, fluvial sediment, organic accumulations and colluvium (Bobrowsky *et al.*, 1997). Till, colluvium and glaciofluvial sediments are most common on the rolling plateau and hill slopes. Fluvial, glaciofluvial and glaciolacustrine deposits mantle the valley floors.

The Adams Plateau-North Barriere Lake area is underlain by Paleozoic rocks of the Eagle Bay Assemblage and Fennell Formation. The western part of the area is dominated by the Fennell Formation, a Devonian to Permian sequence of oceanic bedded cherts, gabbro, diabase, pillow basalt, sandstone, quartz-porphyry rhyolite and conglomerate. The Fennell Formation forms part of the Slide Mountain Terrane and has a thrust contact with the Cambrian to Mississippian Eagle Bay Assemblage to the east. The Eagle Bay Assemblage is part of the Kootenay Terrane that was originally deposited along the ancestral margin of North America. Older Eagle Bay rocks range from quartzites, quartz-rich schists and limestone. These are overlain by grit, phyllite and quartz mica schist and coarse grained clastic metasediments interbedded with felsic volcanic rocks. Above the metasedimentary rocks are limestone and calcareous phyllite, calcsilicate schist and skarn, pillowed greenstone and chlorite-sericite-quartz schist of felsic origin. At the top of the sequence are slates and siltstone. The Eagle Bay Assemblage has been intruded by quartz monzonite of the Cretaceous Baldy and Raft batholiths (Schiarriza and Preto, 1987).

MINERAL DEPOSITS

A variety of massive sulphide deposits occur within rocks of the Eagle Bay Assemblage and Fennell Formation (Nelson *et al.*, 1997; Höy, 1991, 1996; Schiarriza and Preto, 1987). The deposits have been a source of base and precious metals in the past and continue to be an attractive exploration target. Among the more significant sulphide deposits and occurrences are:

- Kuroko-type volcanogenic massive sulphide gold-copper-lead-zinc-barite deposits hosted by felsic volcanic rocks of the Eagle Bay Assemblage. Typical of this type are the Homestake (MINFILE 82M025), Rea Gold (MINFILE 82M191), Samatosum (MINFILE 82M244) and Harper (MINFILE 82M60).
- Besshi-type volcanogenic massive sulphide copper-zinc deposits hosted predominantly by metasediments of the Eagle Bay Assemblage. The Mount Amour occurrence (MINFILE 92P050) is most likely an example of this type of deposit.
- Cyprus-type volcanogenic massive sulphide copper-zinc deposits in mafic volcanic rocks. The Chu Chua deposit (MINFILE 92P140) hosted by mafic flows and tuffs of the Fennell Formation is an example of this type.
- SEDEX-type lead-zinc-silver sulphide deposits hosted by metasedimentary rocks of the Eagle Bay Assemblage. An example of this type is the Spar occurrence (MINFILE 82M017).

DETAILED GEOCHEMICAL STUDIES

Detailed geochemical orientation studies were conducted at nine locations (Figure 2). The locations were selected to include sulphide mineralization typical of the Kootenay Terrane and to include examples of gold, arsenic and copper glacial dispersal trains. The metal association of each occurrence and the types of sample collected are listed in Table 1.

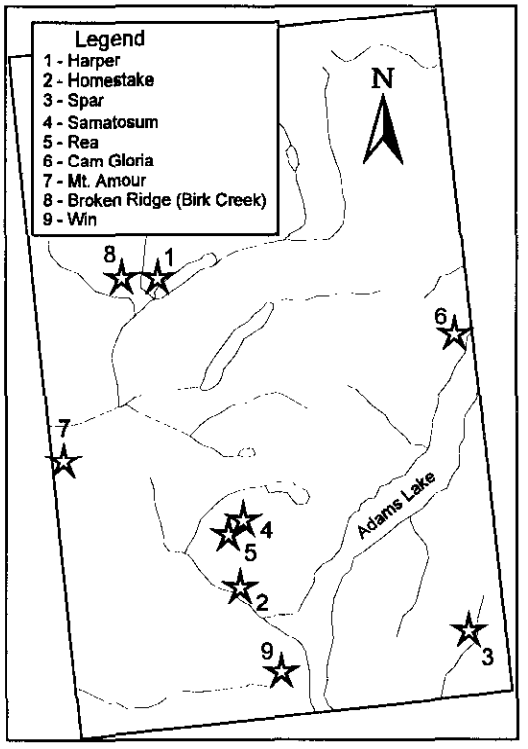

Fig 2. Location of the orientation studies.

Objectives of the orientation studies were to determine the effectiveness of various geochemical sampling media and pathfinder elements for detecting sulphide mineralization. Soil, till and bedrock samples were collected from pits or profiles excavated at intervals on lines that traversed the deposits. Vegetation samples were also collected at the Harper, Homestake and Spar deposits. The vegetation types included tree bark from Lodgepole

pine (*Pinus contorta*) and Douglas fir (*Pseudotsuga glauca*) and twigs from Subalpine fir (*Abies lasiocarpa*).

Table 1. Mineralization and Sample Types for Study Areas

Area	Mineralization	Sample Type
Broken Ridge	Cu-Pb-Zn-Ag	Soil, Till, Rock,
Cam-Gloria	Au-Ag-Bi-Pb	Soil, Till, Rock
Harper	Cu-Pb-Zn-Ag-Au	Soil, Till, Rock, Tree Bark
Homestake	Au-Cu-Pb-Zn-Ba	Soil, Till, Rock, Tree Bark
Mt Amour	Cu-Pb-Zn	Soil, Till, Rock
Samatosum -Rea	Au-Ag-Cu-Pb-Zn	Soil, Till, Rock
Spar	Au-Ag-Pb-Zn-Cu	Soil, Till, Rock, Tree Bark
Win	Cu-Pb-Zn	Soil, Till, Rock

Soil samples (minus 63 micron fraction) were analysed for 50 elements including gold, arsenic, barium, cobalt, copper, molybdenum, nickel, mercury and zinc by thermal neutron activation at Activation Laboratories, Ancaster Ltd., Ontario and by aqua regia digestion-inductively coupled plasma emission spectroscopy (ICP) at Acme Analytical Laboratories Ltd., Vancouver. Tree bark, leaf and twig samples were macerated and part of the sample compressed into a briquette. A second portion of the macerated material was ashed at 480°C and the ash analysed for 30 elements by aqua regia digestion-ICP at Activation Laboratories Ltd. Selected soil and till samples were analysis for up to 70 trace metals by enzyme leach-inductively coupled mass spectroscopy at Activation Laboratories Ltd. Rock samples collected in 1997 were prepared and analysed for gold by fire assay and trace metals by aqua regia digestion-ICP at Eco-Tech Laboratories Ltd., Kamloops.

Soil, till and rock samples were also analysed for molybdenum, copper, lead, zinc, silver, arsenic, cadmium, antimony, bismuth, thallium, tellurium, mercury, selenium and gallium by aqua regia digestion-solvent extraction and ultrasonic nebulizer-inductively coupled plasma emission spectroscopy at Acme Analytical. Detection limits for direct ICP and ultrasonic nebulizer ICP are compared in Table 2.

RESULTS

Preliminary results for soil, till and rock samples from the Harper, Broken Ridge (Birk Creek) and Cam-Gloria occurrences are shown here to illustrate the typical geochemical response to base and precious metal mineralization.

1. Harper Property (MINFILE 82M60)

At the Harper property two northwest trending lenses of pyrrhotite, pyrite, chalcopyrite, sphalerite and galena occur in phyllite and schist of the Eagle Bay Assemblage. The lenses are up to 8 metres wide and can be traced for up 210 metres along strike. The contact between the batholith and felsic metalvolcanic rocks of the Eagle Bay Assemblage lies approximately 500 metres north of the main sulphide occurrence. Bedrock is covered by a thin (1-2 metres) veneer of a light brown to grey sandy till. The overburden texture and the abundance of monzonite clasts in the till suggests that the source is mainly the Baldy batholith.

Table 2. Detection limits (DL) for elements by aqua-regia-ultrasonic nebulizer-ICP (UICP)and direct ICP

Element		DL-UICP	DL-ICP
Aluminium	Al	0.01%	0.01%
Antimony	Sb	2 ppm	0.2 ppm
Arsenic	As	2 ppm	0.5 ppm
Barium	Ba	1 ppm	1 ppm
Bismuth	Bi	2 ppm	0.1 ppm
Boron	B	3 ppm	3 ppm
Cadmium	Cd	0.2 ppm	10 ppb
Calcium	Ca	0.01%	0.01%
Chromium	Cr	1 ppm	1 ppm
Cobalt	Co	1 ppm	1 ppm
Copper	Cu	0.2 ppm	1 ppm
Gallium	Ga	-	0.5 ppm
Gold	Au	3 ppm	100 ppb
Iron	Fe	0.01%	0.01%
Lanthanum	La	1 ppm	1 ppm
Lead	Pb	3 ppm	0.3 ppm
Magnesium	Mg	0.01%	0.01%
Manganese	Mn	1 ppm	1 ppm
Mercury	Hg	-	10 ppb
Molybdenum	Mo	1 ppm	0.1 ppm
Nickel	Ni	1 ppm	1 ppm
Selenium	Se	-	0.4 ppm
Silver	Ag	0.3 ppm	30 ppb
Sodium	Na	0.01%	0.01%
Tellurium	Te	-	0.2 ppm
Titanium	Ti	0.01%	0.01%
Thorium	Th	2 ppm	2 ppm
Tungsten	W	2 ppm	2 ppm
Strontium	Sr	1 ppm	1 ppm
Thallium	Tl	5 ppm	0.2 ppm
Uranium	U	5 ppm	5 ppm
Vanadium	V	1 ppm	1 ppm
Zinc	Zn	1 ppm	1 ppm

A predominantly luvisolic soil has developed on a gentle, south facing slope. Lodgepole pine (*Pinus contorta*), Douglas fir (*Pseudotsuga glauca*), and paper Birch (*Betula papyrifera*) are the main canopy species

growing in the area. The hill side has been disturbed by trenching, excavation of a short adit and the construction of logging roads (now largely overgrown).

The rock samples were collected to help establish background element concentrations in the soil and till. Sample 97RL17R is a dark grey schist containing magnetite and pyrrhotite. Sample 97RL18R is a very rusty weathered, siliceous, light grey phyllite containing pyrite. Both taken 97RL17R and 97RL18R were taken close to the adit. Sample 97RL19R from a trench 250 metres east of the adit is a dark grey-green siliceous schist with banded pyrite and minor chalcopyrite. Element concentrations in these samples and in an oxidized till samples collected within 10 metres of 97RL17R are shown in Table 3. The highest gold detected in rock is 20 ppb whereas the till contains 179 ppb gold. Bismuth, mercury, lead and selenium are also higher in the till. The enhancement of gold and other elements in the till relative to bedrock may reflect glacial dispersal of sulphides from an up-ice source rather than the geochemistry of the underlying bedrock.

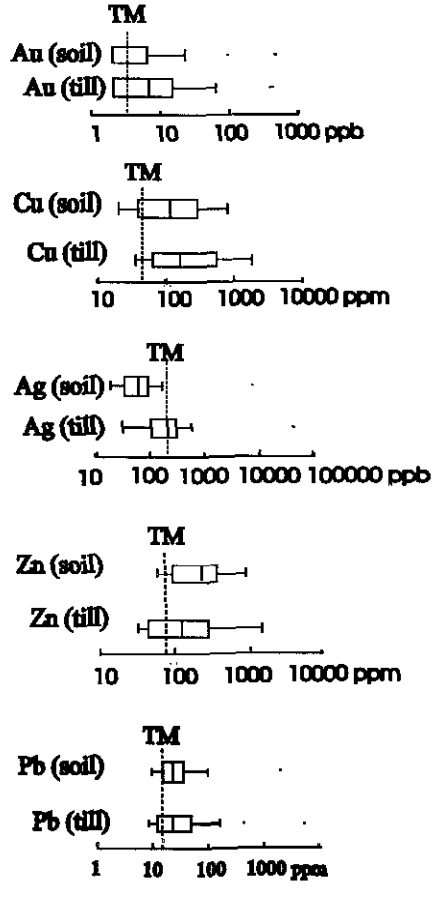

Figure 3. Median and range values for gold, silver, copper, lead and zinc in combined Harper-Broken Ridge soil and till samples. TM indicates median value for 1996 regional till survey.

Median and range gold, silver, copper, lead, zinc, arsenic, mercury, bismuth, selenium and antimony values in soil and till samples from the Harper and Birk Creek Broken Ridge (Birk Creek) occurrences are compared by box and whisker plots shown in Figures 3 and 4. Geochemical data for samples from these areas has been combined because the occurrences are less than 5 kilometres apart and occur in a similar host rock. Also shown in Figure 3 for comparison are median copper, silver, gold, zinc and lead values for the 1996 regional till survey.

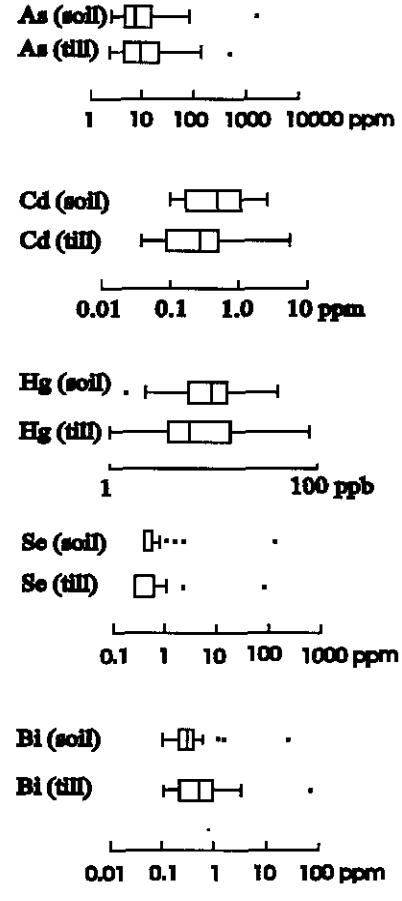

Figure 4. Median and range values for pathfinder elements in combined Harper-Broken Ridge soil and till samples.

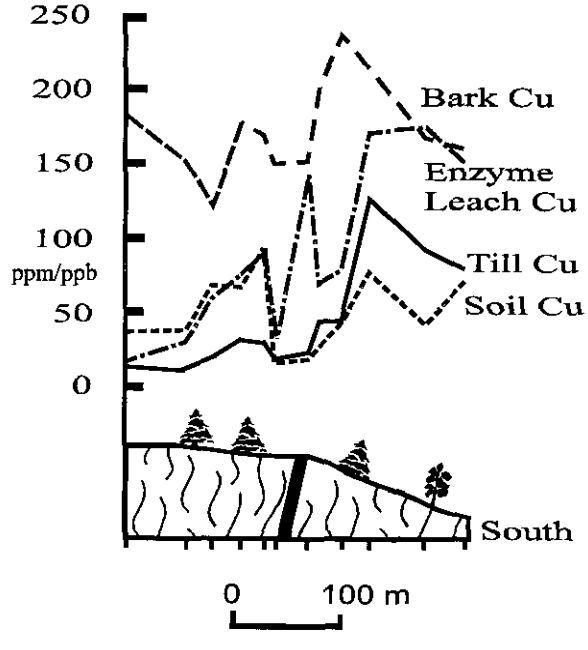

Figure 5. Copper in soil, till and tree bark, Harper occurrence.

Table 3. Geochemistry of Harper area samples. Gold by INA. Other elements by aqua regia-ICP

Element	Till978111	R97RL17	R97RL18	R97RL19
Au ppb	179	20	10	18
Ag ppb	3170	596	633	1779
As ppm	5.9	2.2	35	2.5
Bi ppm	41.7	17.5	1.6	3.4
Cd ppm	0.1	1.24	0.18	0.19
Co ppm	0.3	<1	4	37
Cu ppm	286	870	282	1869
Fe %	18.9	21.4	5.56	13.45
Ga ppm	15.4	19	6.7	8.4
Hg ppb	33	10	25	<10
Mn ppm	708	1042	462	1849
Mo ppm	2.6	1.4	4.7	2.3
Ni ppm	3	17	5	16
Pb ppm	117	36	35	14
Sb ppm	<0.2	<0.2	0.2	<0.2
Se ppm	21	7.1	3.2	7.0
Te ppm	0.7	0.9	<0.2	<0.2
Tl ppm	<0.3	<0.2	<0.2	<0.2
V ppm	94	66	35	20
Zn ppm	199	341	125	50

Table 4. Geochemistry of Broken Ridge samples Gold by INA. Other elements by aqua regia-ICP.Col.-Colluvium

Element	Soil978065	Col.978066	Rock 97RL3	Rock 97RL5
Au ppb	10	23	1	5
Ag ppb	481	568	133	3229
As ppm	39.6	139	1.8	1005.6
Bi ppm	1.2	0.4	0.6	3.7
Cd ppm	2.04	3.0	0.34	0.48
Co ppm	22	63	23	16
Cu ppm	252	1083	254	2243
Fe %	4.37	10.82	11.29	20.6
Ga ppm	11.8	15.4	21.6	3.6
Hg ppb	24	53	10	17
Mn ppm	740	2062	1013	214
Mo ppm	1.1	3.5	3.2	4.3
Ni ppm	66	128	120	43
Pb ppm	234	117	3.9	131.7
Sb ppm	0.3	0.5	<0.2	3.2
Se ppm	<0.3	1.2	0.5	10.7
Te ppm	0.2	0.8	<0.2	1.4
Tl ppm	0.3	0.8	0.2	0.2
V ppm	59	104	195	15
Zn ppm	852	957	279	76

The distribution of copper in soil, till and tree bark along a north-south traverse crossing the strike of the most easterly sulphide lens is shown in Figure 5. Also shown in Figure 5 is the copper extracted from soil using an enzyme leach. The decrease of copper directly over the mineralization could reflect increasing mobility in the more acid soil due the weathering of the sulphides. Increased copper down-slope from the mineralization in soil and till can be most likely explained by the transition from till to colluvium that contains a larger amount of locally derived mineralized bedrock.

2. Broken Ridge (MINFILE 82M130)

The Broken Ridge occurrence, located north of the confluence between Birk and Harper Creeks, was selected as a detailed study area because a regional till sample collected in 1996 near the occurrence contained 3653 ppm copper. Mineralization consists of banded pyrite, pyrrhotite, chalcopyrite, minor sphalerite and galena in dark green actinolite schist of the Eagle Bay Assemblage. In Table 4 geochemical results for rock, soil and till samples taken from close to the occurrence are shown. The rock samples are respectively a banded sulphide (97RL3R) and a grey-green gneiss (97RL5R). Bedrock is partly covered by basal till and, locally, by colluvium on the steeper parts of the east facing hill slope above Harper Creek. Variation of elements down a soil-till profile close to the occurrence is illustrated by samples 978065 and 978066 in Table 4. The distribution of gold, copper, silver, arsenic, bismuth and mercury in till and colluvium is shown in Figures 6-11.

The highest gold, silver, arsenic, and selenium values occur in oxidized colluvium 50 metres to the south of the occurrence. Increased iron, copper, lead, bismuth, thallium and tellurium are also found in the colluvium at this site. Most element levels decrease to the southeast of the anomalous sample although high copper levels persist beyond the limit of the sampling. The decreased values to the southeast of the highly anomalous site can be explained by down-slope transport and dilution of mineralized rock in the colluvium.

The most anomalous copper occurs in a weakly oxidized till 800 metres to the west of the Broken Ridge occurrence. This anomaly is close to the site of a 1996 regional till sample containing over 3000 ppm copper. Other 1996 till samples collected 1 kilometres northwest and up-ice from the peak anomaly have less than 50 ppm copper. However, a till sample 400 metres southeast (down-ice) has 550 ppm copper indicating glacial dispersal of copper-mineralized rock can be up to 2 kilometres from the source.

Only weakly anomalous mercury levels were found in soil and till close to the Broken Ridge occurrence. The highest mercury (93 ppb) with enhanced bismuth occurs in basal till 1.5 kilometres southwest and this weak anomaly has no apparent sulphide source. Interpretation of soil and till geochemical patterns is complicated by the existence of other small base-metal sulphide bodies in the Birk Creek area similar to the Broken Ridge occurrence.

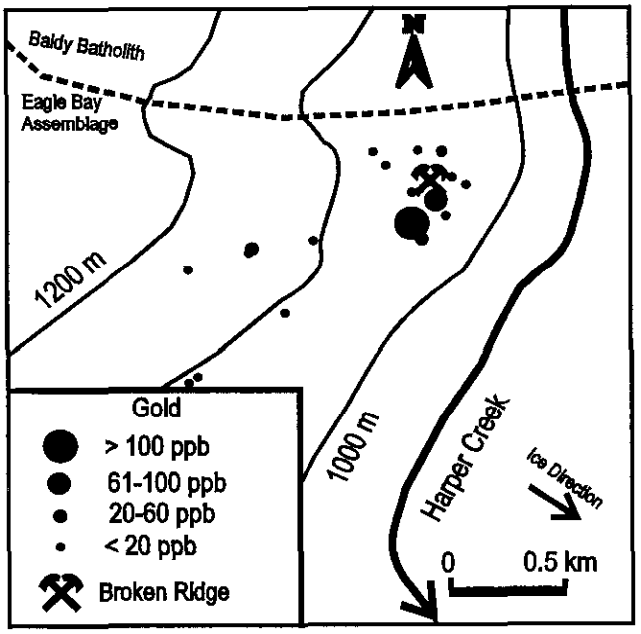

Figure 6. Gold in Till Samples, Broken Ridge Area.

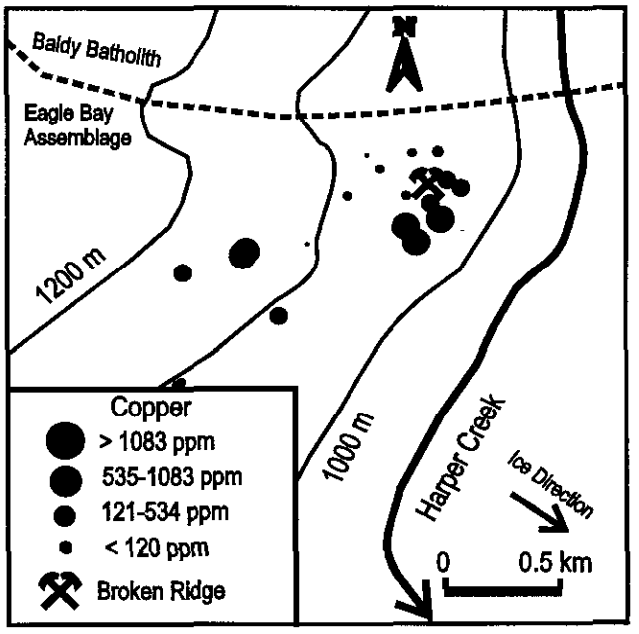

Figure 8. Copper in Till Samples, Broken Ridge Area.

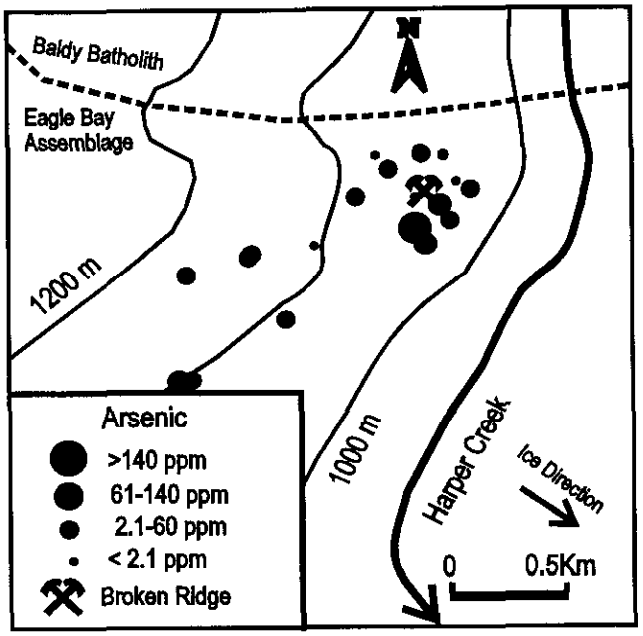

Figure 7. Arsenic in Till Samples, Broken Ridge Area.

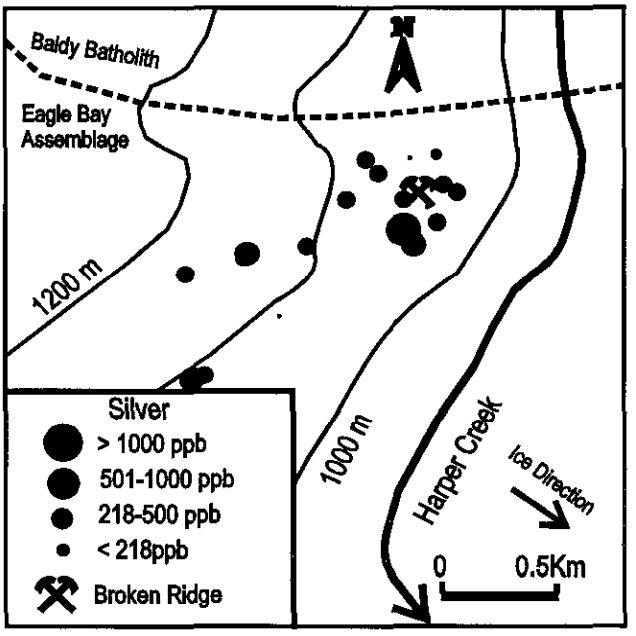

Figure 9. Silver in Till Samples, Broken Ridge Area.

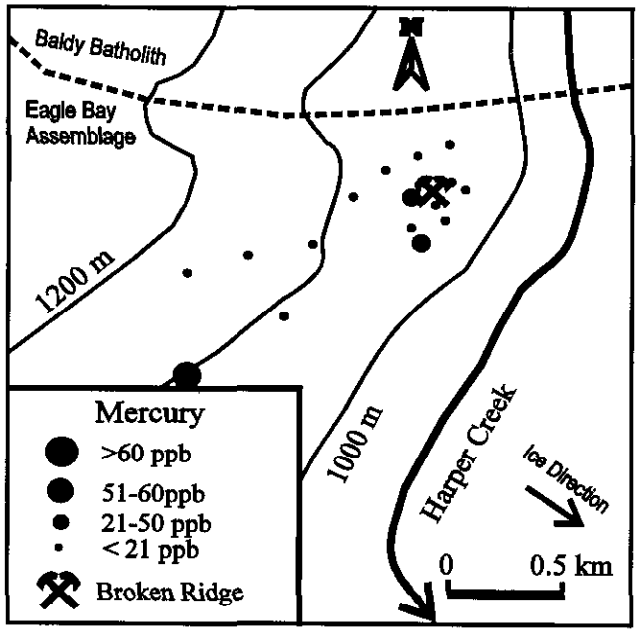

Figure 10. Mercury in Till Samples, Broken Ridge Area.

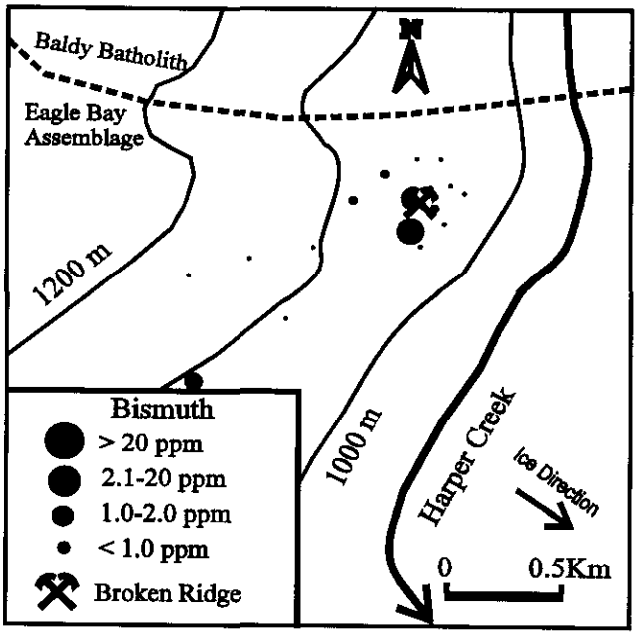

Figure 11. Bismuth in Till Samples, Broken Ridge Area.

Cam-Gloria Property

Several new mineral occurrences have been discovered near Honeymoon Bay on Adams Lake by prospector Camille Berube through follow up of two till samples from the 1997 till release (Bobrowsky *et. al.*, 1997). The till samples were strongly anomalous in gold (215 and 43 ppb), and very weakly anomalous in silver (0.6 ppm), bismuth (5 ppm), arsenic (15 ppm), molybdenum (11 ppm) and tungsten (6 ppm). Prior to Berube's work there were no MINFILE occurrences or records of previous work in this area.

The Honeymoon area is underlain by biotite quartz monzonite of the Cretaceous Baldy batholith which intrude amphibolite grade micaceous quartzite, quartz-mica schist and rare calcareous schist of the Eagle Bay Assemblage, and Devonian granitic orthogneiss (Schiarizza and Preto, 1987).

A large, rusty auriferous quartz vein (Honeymoon or "012" vein, Cam-Gloria claims) is the most interesting new mineral occurrence. It is located at about the 7 kilometre point on the north fork of the Grizzly Forest Service road, approximately 3 kilometres west of the Honeymoon Bay campsite on Adams Lake. The vein strikes at 050° and dips steeply northwest. The main body of quartz is up to 10 metres wide and approximately 200 metres in length. Other quartz outcrops and float have been found over an additional 150 metres of strike length. Concentrations of sulphide minerals occur within the vein, particularly on its southeast side and include pyrite, galena and minor chalcopyrite. Grab samples of this sulphide-rich material have returned values as high as 27.4 ppm gold, 28.4 ppm silver, 120 ppm bismuth, 534 ppm lead, 427 ppm copper, 35 ppm arsenic, and 26 ppm molybdenum (Camille Berube, personal communication, 1997).

A random grab sample (97RL33R) from the whole quartz vein outcrop was taken during the detailed geochemical studies in July, 1997. The grab sample contained 1.38 ppm gold, 7.8 ppm silver, 55 ppm bismuth, 430 ppm lead, 118 ppm copper and 21 ppm molybdenum. Results for this and a second grab sample of vuggy quartz vein (CAM 1) collected by Trygve Höy are shown in Table 5. Also shown in Table 5 are results for till and soil samples collected within 2 metres from the vein. Element concentrations in a till sample (978219) reflect the rock geochemistry, but there is no increase of gold or other pathfinder metals in the B soil horizon (978220). A horizontal profile of gold, arsenic, bismuth, antimony, lead and zinc in till samples down-ice from the vein (Figure 12) reveals that most elements can be detected up to 1 kilometer to the southeast.

Approximately 1000 metres to the northeast, at the five kilometre mark on the road one of the authors (M.S. Cathro) tentatively identified pyrrhotite-bearing garnet-pyroxene skarn in float. This skarn may originate from the contact between Eagle Bay metasediments and monzonite to the northwest. In addition, roadcuts between the two areas expose several narrow (<4 centimetres wide) monzonite-hosted quartz-fluorite veins (strike 290°; dip70°S) and a 30 centimetre wide quartz-pyrite-pyrrhotite vein (strike 015° ; dip90 °).

The Honeymoon prospect has broad similarities with intrusion-related mesothermal gold deposits such as those near Fairbanks, Alaska (McCoy *et al.*, 1997) and those associated with Tombstone suite intrusions in the Dawson-Mayo area of Yukon Territory (Poulsen *et al.*, 1997). The most important similarities are the gold-bismuth-

molybdenum association, the nearby occurrence of pyrrhotite-bearing skarn and fluorite-bearing veins, and the hostrock of Cretaceous monzonite intruding metamorphosed, carbonate-bearing pericratonic rocks. Honeymoon Bay appears to differ, however, in its lack of sheeted veins and its relatively low content of arsenic and antimony. Few of the Honeymoon Bay rocks have been analysed for metals such as tellurium and selenium. These elements are known to be present in the northern Cordillera deposits.

A possible analogue for the Honeymoon Bay vein may be the poorly described, but potentially economically significant, Pogo (Stoneboy) deposit near Fairbanks which is currently being explored by Sumitomo Metal Mining Arizona Inc. and Teck Corporation. There, a large, flat lying, high temperature quartz vein system is reported to be hosted by a mixed package of gneiss and Cretaceous monzonite over an 8 kilometre strike length. It carries very high gold values associated with pyrite, pyrrhotite and minor chalcopyrite, bismuthinite, arsenopyrite and stibnite (Tom Schroeter, personal communication, 1997).

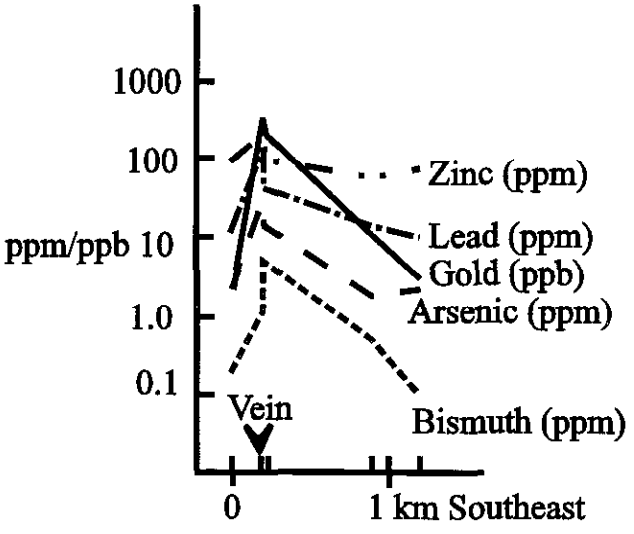

Figure 12. Geochemical Profiles for Elements in Till, Cam-Gloria Property.

CONCLUSIONS

Element concentrations are typically higher in till and colluvium compared to levels in the B soil horizon. Comparison of geochemical patterns surrounding the Broken Ridge copper-lead-zinc-silver sulphide occurrence reveals a close spatial relationship between anomalous gold, silver, arsenic, copper and bismuth levels in till samples. The gold, silver and arsenic dispersal pattern are relatively short and most likely reflect down-slope transport of mineralized material in colluvium from the Broken Ridge occurrence. However, anomalous copper values can be detected for up to 2 kilometres indicating a more extensive dispersal of copper mineralized bedrock in basal till. Selenium and arsenic in soil and till are geochemical pathfinders for precious-base metal mineralization typical of massive sulphide deposits in the Kootenay Terrane. However, mercury does not appear to be an effective pathfinder.

Copper anomaly contrast is not increased using tree bark as a sample type or by enzyme leach analysis.

Table 5. Cam-Gloria geochemistry. Gold by INA. Other elements by aqua regia-ICP.ND=Not Determined.

Element	Soil97220	Till97219	Rock 97RL33	CAM-1
Au ppb	3	326	1112	3746
Ag ppm	0.4	1.0	8.6	61.0
As ppm	39.62	28.4	27.4	87
Bi ppm	0.2	1.1	55	56
Cd ppm	0.19	0.76	0.14	<0.4
Co ppm	4	7	3	<2
Cu ppm	8.5	24.2	113	17
Fe %	1.38	3.51	10.78	1.68
Ga ppm	6.5	5.1	3.5	ND
Hg ppb	32	24	29	ND
Mn ppm	468	784	72	40
Mo ppm	0.9	0.5	11.6	<2.0
Ni ppm	10	8	5	<2.0
Pb ppm	10.4	127	420	191
Sb ppm	<0.2	0.6	3.7	<5.0
Se ppm	<0.3	<0.3	<0..3	ND
Te ppm	<0.2	<0.3	3.5	ND
Tl ppm	0.2	0.3	0.7	ND
V ppm	22	34	7	<2
Zn ppm	135	202	27.1	18

Gold, bismuth, lead, arsenic and antimony can be detected in till up to 2 kilometres down-ice from the quartz-vein gold mineralization on the Cam-Gloria claims close the Honeymoon Bay on Adams Lake. However, element levels in the corresponding B-soil horizon of the till were lower or could not be detected. Anomalous bismuth also occurs in surficial material at the Broken Ridge and at the Harper Occurrence. The presence of anomalous bismuth could indicate reflect another mineralized source such as a skarn or vein associated with the Baldy batholith-Eagle Bay contact

Interpretation of data for the other study areas is in progress to identify additional geochemical pathfinders for mineralization and to compare the geochemistry of different grain size fractions of soil and till.

ACKNOWLEDGMENTS

The authors would like to thank Steve Sibbick, now with Norecol, Dames and Moore, Inc.,Vancouver, for

initiating this project and preliminary studies of the Harper, Homestake and Spar occurrences in 1996. Camille Berube is thanked for sharing his data and knowledge of the Cam-Gloria Claims. Dave Lefebure very kindly and promptly edited the first draft of this paper and his constructive suggestions are very much appreciated. The authors would also like to thank Trygve Höy for his comments on geology and mineralization of the Kootenay Terrane; Wayne Jackaman and Steve Cook for their very constructive comments on the paper.

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