GEOFILE 2005-11

BEDROCK GEOCHEMISTRY OF THE BARRIERE LAKES - ADAMS PLATEAU AREA (82L/13E; 82M/3W, 4, 5, 12S; 92P/1E, 8E)

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keywords: Eagle Bay, Slide Mountain, Adams Plateau, Adams Lake, Barriere, bedrock geochemistry

INTRODUCTION

During the late 1970s and early 1980s, the British Columbia Geological Survey Branch conducted several years of mapping the bedrock geology of the Adams Plateau region (Figure 1). The net result of this work included a detailed map (Schiarizza and Preto 1984) and report describing the bedrock structure and geology (Schiarizza and Preto 1987). The region was revisited by the Geological Survey Branch in the late 1990s to conduct regional till geochemistry surveys and complete the mapping of the surficial geology (Dixon et al. 1997; Leboe et al. 1997; Paulen et al. 1998a, b) to stimulate further mineral exploration in the region. Over 1500 till samples were collected and analysed for trace element and whole rock (major oxides) geochemistry and released as open files (Bobrowsky et al. 1997, 1998; Paulen et al. 2000a, b).

The impetus for the earlier projects were to stimulate mineral exploration centred on Devono-Mississippian rocks of the Eagle Bay Assemblage and Permian to Devonian rocks of the Fennell Formation. Volcanogenic massive sulphide deposits hosted in the Fennell Formation, volcanogenic sulphide-barite deposits hosted in the Eagle Bay Formation, tombstone-style gold prospects hosted in the Baldy Batholith and the highly mineralized package of Nicola Group volcanic, sedimentary and associated intrusive rocks all suggest that the region has considerable mineral potential.

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In order to further aid in the interpretation of the till geochemistry, rock samples that were collected during the Geological Survey Branch's original bedrock mapping programs were selected from each lithological map unit and subjected to the same trace element and whole rock geochemical analyses that the till samples had undergone. This bedrock geochemistry, combined with the overlying till geochemistry will provide a unique dataset to the region where geochemical exploration can be used to compare the tills to their erosional source, namely the bedrock which outcrops and/or subcrops up-ice. Spatial analysis of both datasets is now possible and this may shed some light on some of the unexplained elevated trace element and major oxide concentrations observed in the tills (Bobrowsky et al. 1997, 1998; Paulen et al. 2000a, b). By ruling out some of the inherent bedrock chemistry, the till data can now provide some indication of possible blind bedrock lithologies and/or mineralization that likely occur under a blanket of glacial sediment (>5 m thick) and were unaccessible to the geologists who mapped the bedrock of this region.

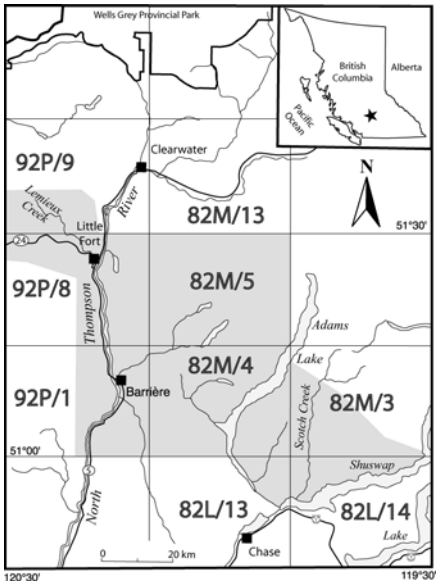

Figure 1. Location of the study area in south central British Columbia. Coverage from the Eagle Bay (1996-1998) till geochemistry surveys is indicated by the shaded region.

PREVIOUS WORK

Many geochemical investigations have focused on the various polymetallic precious and base metal massive suphides occurrences hosted by the felsic to intermediate metavolcanic rocks of the Eagle Bay Assemblage (e.g Goutier 1986; Höy 1987, 1999) and on the massive suphides hosted in oceanic basalts of the Fennell Formation (e.g. Aggarwal and Nesbitt 1984; Stoynov 2003). A modest amount work has been conducted on the regional bedrock geochemistry. Geochemical analyses on Fennell Formation rocks were reported by Hall-Beyer (1976), Aggarwal et al. (1984) and Schiarizza and Preto (1987). Jung (1986) discussed the geochemistry of the Thuya, Takomkane, Raft and Baldy Batholiths. Recent research has provided some insight on the Eagle Bay Assemblage rock geochemistry (Bailey et al. 2001; Bailey 2002).

BACKGROUND AND SETTING

Located in south-central British Columbia, the Barriere Lakes - Adams Plateau area area lies in the southwestern part of the Shuswap Highland and the northeastern part of the Thompson Plateau within the Interior Plateau (Holland, 1976; Mathews 1986). This region is characterized by moderate to high relief, and glaciated and fluvially dissected topography. Elevations range from 360 to 2380 m above sea level. Most of the area is covered by unconsolidated sediments of mixed genesis and of variable thickness, but rarely exceeding a few tens of metres. Till (of various facies) dominates the landscape, followed in turn by colluvial, glaciofluvial, fluvial, glaciolacustrine sediments and organic sediments.

REGIONAL BEDROCK GEOLOGY

The Barriere Lakes - Adams Plateau area lies within a belt of structurally complex low-grade metamorphic rocks which occurs along the western margin of the Omineca Belt (Figure 2). This belt is flanked by high grade metamorphic rocks of the Shuswap Complex to the east and by rocks of the Intermontane Belt to the west (Okulitch 1979; Schiarrizza and Preto, 1987). Lower Paleozoic to Mississippian rocks of the Eagle Bay Assemblage (Kootenay Terrane) underlie a majority of area. The Eagle Bay Assemblage consists of a complex succession of metasedimentary and metavolcanic rocks that are intruded by Late Devonian orthogneiss (Okulitch 1979, 1989; Schiarizza and Preto 1987) and Jurassic-Cretaceous granodiorite and quartz monzonite of the Raft and Baldy batholiths Rocks of the Eagle Bay assemblage are contained within four west directed thrust slices that collectively contain a succession of Cambrian (and possibly Late Proterozoic) quartzites, grits and quartz mica schists (Units EBH and EBQ), mafic metavolcanic rocks and Tshinakin limestone (EBG). These lithologies are overlain by undated phyllite, carbonate, and metavolcanics (Unit EGS), metamorphosed basalt, chert and quartzite (Unit EBM), and carbonaceous phyllite and limestone (Unit EBL). The upper part of the Eagle Bay Assemblage consists of felsic to intermediate metavolcanic and metasedimentary rocks (Units EBA and EBP; Schiarizza and Preto 1987).

Volcanic and clastic sedimentary rocks comprising the Devonian to Permian Fennell Formation of the oceanic Slide Mountain Terrane structurally overlie the Eagle Bay Formation. These rocks consist of bedded cherts, gabbro, diabase, pillowed basalt and volcanogenic metasediments. A major north-south fault paralleling in the North Thompson River valley separates the Kootenay and Slide Mountain terranes from the younger Quesnel terrane that occurs to the northwest. Eocene breccias occur sporatically along the western edge of the Thompson River valley.

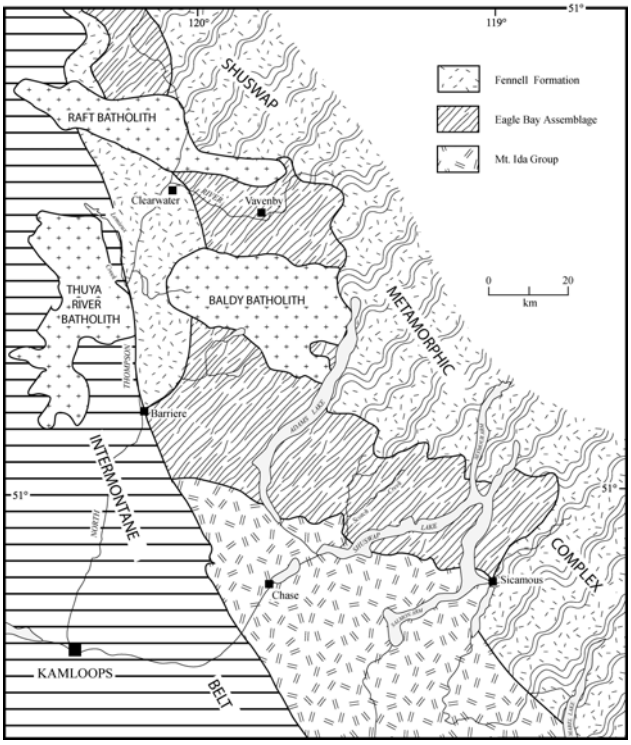

Figure 2. Figure 2. Geologic setting of the Adams Plateau - Clearwater - Vavenby area, modified after Schiarrizza and Preto (1987) and Campbell and Tipper (1971). Not shown are Tertiary volcanics and numerous granitic plutons.

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METHODS

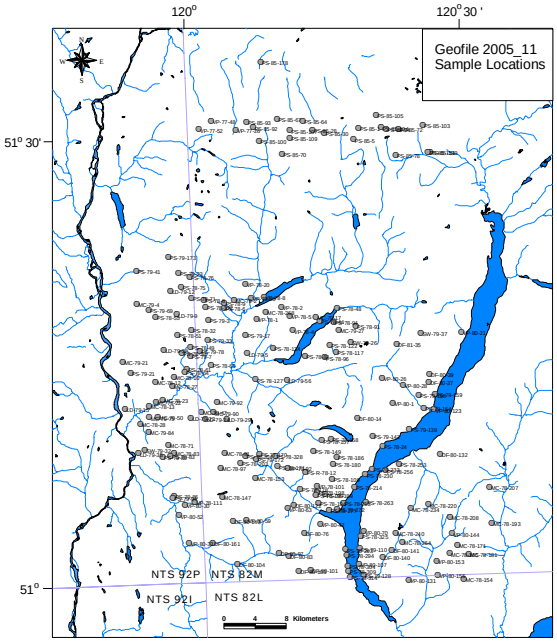

Figure 3. Rock sample locations in the Barriere Lakes – Adams Plateau area

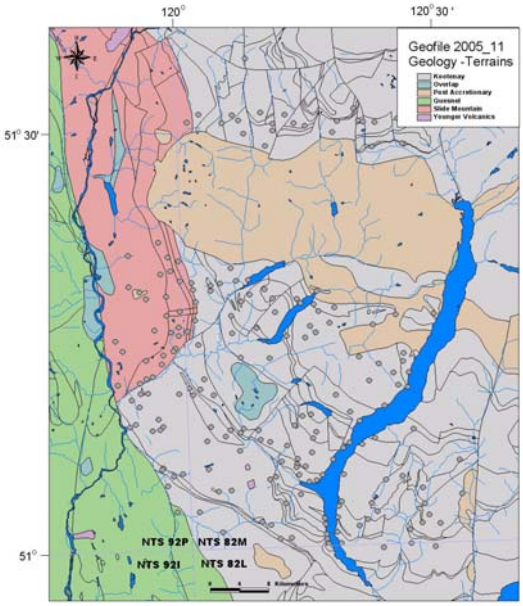

Figure 4. Bedrock sample locations from Kootenay and Slide Mountain terranes within the Barriere Lakes – Adams Plateau area

Samples originally collected from the regional bedrock mapping in the study area (Preto 1979, 1981; Preto et al. 1980; Schriarizza 1981, 1982, 1986) were retrieved from Geological Survey Branch archives. A total of 221 rocks were selected from various lithologies of the Kootenay and Slide Mountain terranes (Figures 3 and 4).

Selected rock samples were jaw crushed and ground in a steel mill to - 150 mesh (< 0.075 mm). A pulp split was analysed at Acme Analytical, Vancouver, BC for trace by aqua regia digestion and inductively coupled plasma emission spectroscopy (ICPES), for major oxides (e.g. SiO_2) and Ba, Ni, Sr, Zr, Y, Nb, Sc by lithium metaborate fusion, loss on ignition (GRAV) at 1100°C and carbon and sulphur by Leco combustion (LECO).

A second split of the milled sample was analysed at Activation Laboratories Ltd. Ancaster, Ontario for 32 additional elements by thermal neutron activation (INAA). Detection limits and methods are listed in Table 2. The major oxides SiO_2, Al_2O_3, Fe_2O_3, MgO, CaO, Na_2O, K_2O, TiO_2, P_2O_5, MnO and Cr_2O_3 were all determined to 0.01 per cent. All of the analytical results with location coordinates (UTM NAD 27 and 83) and sample descriptions are listed in Appendix A.

TABLE 2. METHODS AND DETECTION LIMITS

Element	Detection	Units	Method
Aluminum	0.01	%	ICPES
Antimony	3/0.1	ppm	ICPES / INAA
Arsenic	0.5/0.5	ppm	ICPES / INAA
Barium	5/250	ppm	ICPES / INAA
Boron 3	ppm	icpes	
Bismuth	3	ppm	ICPES
Bromine	0.5	ppm	INAA
Cadmium	0.2	ppm	ICPES
Calcium	0.01/1	%	ICPES / INAA
Cerium	5	ppm	INAA
Cesium	0.5	ppm	INAA
Carbon	0.01	%	Leco
Chromium	1/2	ppm	ICPES / INAA
Cobalt	1/5	ppm	ICPES / INAA
Copper	1	ppm	ICPES
Europium	1	ppm	INAA
Gold	2000/2	ppb	ICPES / INAA
Hafnium	1	ppm	INAA
Iron 0.01/0.2	%	ICPES / INAA	
Lanthanum	1/2	ppm	ICPES / INAA
Lead 3	ppm	ICPES	
Loi	0.01	%	GRAV
Lutetium	0.2	ppm	INAA
Magnesium	0.01	%	ICPES
Manganese	1	ppm	ICPES
Molybdenum	1	ppm	ICPES
Niobium	10	ppm	ICPES
Nickel 1	ppm	ICPES	
Phosphorus	0.001	%	ICPES
Potassium	0.01	%	ICPES
Rubidium	15	ppm	INAA
Samarium	0.1	ppm	INAA
Scandium	1/0.1	ppm	ICPES/INAA
Selenium	3	ppm	INAA
Silver	0.3/5	ppb	ICPES/INAA
Sulphur	0.01	%	Leco
Sodium	0.001/0.02	%	ICPES / INAA
Strontium	3/500	ppm	ICPES/INAA
Tantalum	0.5	ppm	INAA
Terbium	0.5	ppm	INAA
Thorium	2/0.2	ppm	ICPES / INAA
Titanium	0.001	%	ICPES
Tungsten	2/1	ppm	ICPES / INAA
Uranium	8/0.2	ppm	ICPES / INAA
Vanadium	2	ppm	ICPES
Ytterbium	2	ppm	INAA
Yttrium	10	ppm	ICPES
Zirconium	10	ppm	ICPES
Zinc	1/50	ppm	ICPES / INAA

QUALITY CONTROL

Precision and accuracy was measured from the results of a replicate CANMET reference standard SY4 and from duplicate pulp samples analysed with the rock samples. The identity of the quality control standards is shown in Table 3 and the results of the standard and replicate sample analyses are listed in Appendix B. For most elements in the replicate sample the percent difference (mean of duplicate pair/difference between pair) is less that 25 percent. The percent relative standard deviation (RSD) for trace element replicate analyses of SY4 is often larger than 50 percent due to element values close to detection limits. Major oxides, however, generally show RSD values better than 5 percent. The mean values for Na_2O in SY4 demonstrate an apparent drift during the analyses from above 0.7 percent to below 0.7 percent. RSD values have not been calculated for the INAA determined elements because only two analyses are available. Moreover, the second on the analyses is clearly much lower than the first. The reason for this disparity is unknown.

TABLE 3 INSERTED STANDARDS

Q/CLabNumber	ICP & Oxide Standards
RP-78-122	CANMET SY-4
RP-78-131	CANMET SY-4
RP-78-154	CANMET SY-4
RP-78-53	CANMET SY-4
RP-79-155	CANMET SY-4
RP-79-18	CANMET SY-4
RP-79-32	CANMET SY-4
RP-79-64	CANMET SY-4

RESULTS

A total of 196 bedrock samples were analyzed for trace element and whole rock geochemistry (Table 4). Of the 196 samples, 151 or 77% represent Kootenay Terrane (Eagle Bay Assemblage) bedrock lithologies. Slide Mountain Terrane (Fennell Formation) rocks account for 32 or 16% of the samples. Other rocks collectively account for 13 or 7% of the samples and include eight samples of Devonian orthogneiss, four samples of Kootenay Terrane diorite and a single sample of Cretaceous granodiorite from the Baldy Batholith.

These data will provide regional geochemical information on the bedrock geology for the Eagle Bay Assemblage and Fennell Formation lithologies. This bedrock data also augments the till geochemistry data for the region and will make available a unique comparative dataset for future spatial analysis to ultimately improve the understanding of the complex geology buried under a blanket of glacial sediment and aid future drift prospecting in the region (cf. Paulen et al. 1999; Paulen 2001).

TABLE 4. LIST OF BEDROCK SAMPLES ANALYZED FOR TRACE ELEMENT AND WHOLE ROCK GEOCHEMISTRY. BEDROCK UNIT NAMES FROM SCHIARRIZZA AND PRETO (1987).

Terrain/Age	Rock Unit	Total
Cretaceous	Kg	1
Late Devonian	Dgn	8
Slide Mountain	uFb	9
Slide Mountain	IFc	3
Slide Mountain	IFb	7
Slide Mountain	IFg	7
Slide Mountain	IFs	3
Slide Mountain	IFcg	3
Kootenay	EBP	9
Kootenay	EBF	13
Kootenay	EBA	29
Kootenay	EBM	8
Kootenay	EBK	3
Kootenay	EBL	1
Kootenay	EBS	21
Kootenay	EBQ	22
Kootenay	EBG	43
Kootenay	EBH	2
Paleozoic (?)	di	4

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