HARPER CREEK: A VOLCANOGENIC SULPHIDE DEPOSIT WITHIN THE EAGLE BAY ASSEMBLAGE, KOOTENAY TERRANE, SOUTHERN BRITISH COLUMBIA (82M/12)

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KEYWORDS: Volcanogenic disseminated sulphide deposit, volcanogenic massive sulphide deposit, Devonian, Kootenay Terrane.

INTRODUCTION

Harper Creek is a volcanogenic sulphide deposit within highly deformed Late Devonian metavolcanic rocks of the Eagle Bay Assemblage (Figure 1). As well as disseminated chalcopyrite, it includes a number of massive to semimassive magnetite-sulphide or sulphide layers.

The deposit is located near the headwaters of Harper Creek, 10 km southwest of Vavenby and approximately 100 kilometres north of Kamloops in south-central British Columbia. The area is in heavily wooded mountainous terrain within the Shuswap Highlands, at elevations ranging from approximately 1400 to 1700 metres (Plates 1 and 2). Overburden in the immediate deposit area is extensive and exposures are mainly restricted to trenches and logging or exploration road cuts. A large part of the deposit area has been recently logged.

Access to the property is provided by the Lost Creek road south from Vavenby, then the Jones Creek (11.1 km) and Barriere Lake (2 km) logging roads.

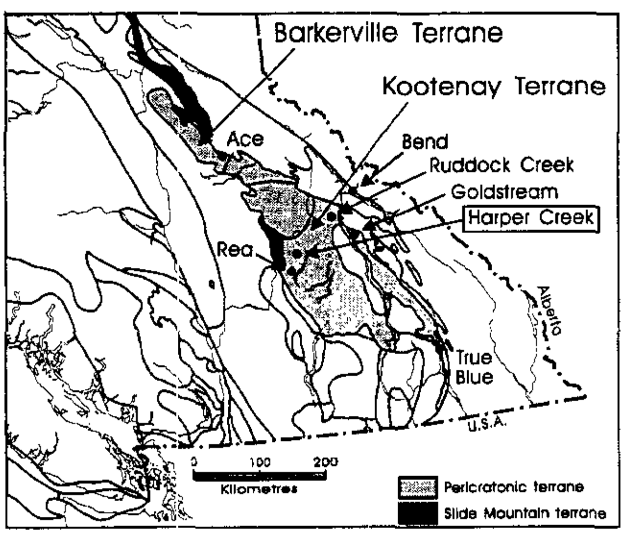


Figure 1: Terrane map showing location of selected massive sulphide deposits in the Kootenay terrane, southern British Columbia.

This paper is part of a regional study of massive sulphide deposits and mineral potential of the Kootenay Terrane of southern British Columbia and the correlative Yukon-Tanana Terrane in the northern part of the province and Yukon Territory. It summarizes four days of detailed trench and road mapping in late September, 1996; results of exploration drilling, just commenced, are not included.

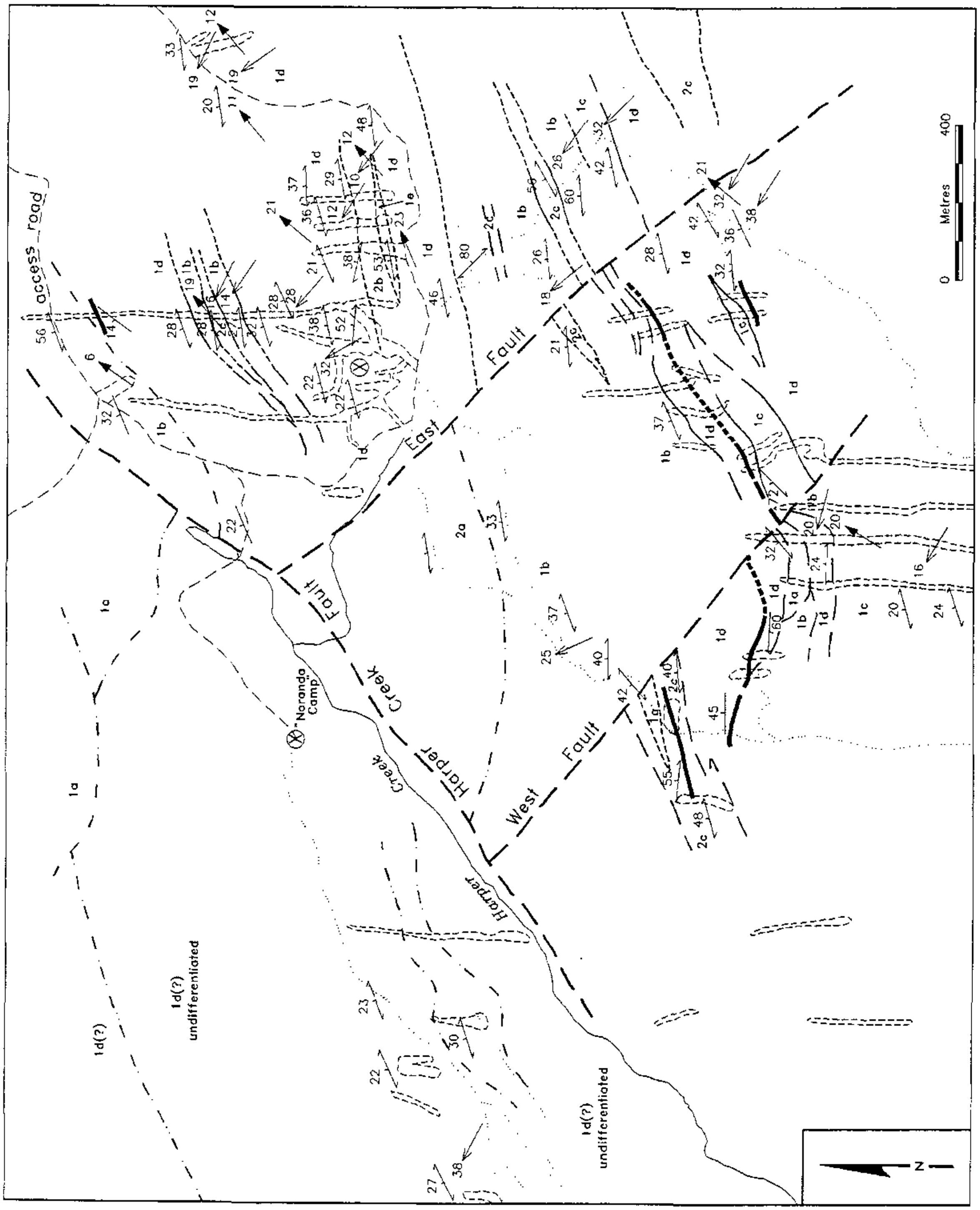
EXPLORATION HISTORY

Noranda Exploration Company Ltd. staked the Sue and Goof claims in 1966 as a result of a reconnaissance geochemical survey, followed immediately by staking of the Hail claims to the east and south by Quebec Cartier Mining Company. Exploration of the two properties was carried out independently until 1970, followed by a joint venture under Noranda's supervision. This exploration included soil geochemistry, geophysical surveys, trenching, geological mapping, and more than 25 800 m of diamond drilling in 163 drill holes. Two adjacent mineralized zones were defined, the East Zone on Quebec Cartier property and the West Zone on the Noranda property (Figure 2) with combined reserves of 85.5 m tonnes containing 0.388 percent copper (Kraft, 1974).

Based in part on recognition of volcanogenic massive sulphide potential and precious metal content, Aurun Mines Ltd. acquired the Hail claims in 1986 and continued trenching, geological mapping and sampling. Phillips Barratt Kaiser Engineering Ltd., in a pre-feasibility study, calculated total "mineable reserves of 65.3 million tonnes grading 0.36 percent copper, 0.040 g/tonne gold and 2.2 g/tonne silver". The Noranda and Quebec Cartier properties, collectively referred to as the Harper Creek deposit, have been inactive until work this past fall by American Comstock Explorations Ltd. of Vancouver.

Initial work proposed by American Comstock includes a UTEM geophysical survey, base line environmental studies, metallurgical studies and diamond drilling. Diamond drilling commenced in late September, 1996 to determine the northeastern extent and grade of mineralization.

Figure 2: Geological map of the Harper Creek deposit.



REGIONAL GEOLOGY

The Eagle Bay Assemblage is within the Kootenay terrane, a succession of variably metamorphosed and deformed clastic sediments, subordinate volcanics and limestones that range in age from Proterozoic to Triassic. Lower Paleozoic rocks of the terrane appear to be in stratigraphic contact with North American rocks (Fyles and Eastwood, 1962; Colpron and Price, 1992; 1995). Mafic volcanic rocks of the Slide Mountain terrane occur as fault-bounded slices along the western edge of the Kootenay terrane; they are interpreted to record remnants of a Mississippian-Permian marginal basin or ocean (Nelson, 1993). To the west are dominantly volcanic arc rocks of the Quesnell terrane.

The Eagle Bay Assemblage comprises Lower Cambrian to Mississippian metasedimentary and metavolcanic rocks that are intruded by Late Devonian orthogneiss (Schiarizza and Preto, 1987). Okulitch (1977) correlated the assemblage with the Lardeau Group of the Kootenay arc, essentially confirmed by discovery of archeocyathid fossils just northwest of Vavenby within the Lower Cambrian Tshinakin limestone (Schiarizza and Preto, *op.cit.*); Struik (1986) correlated the Eagle Bay with rocks of the Barkerville terrane in the Cariboo Mountains.

Paleozoic 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 limestone (EBG), and overlying schistose sandstones and grits (EBS) with minor calcareous and mafic volcanic units. These are overlain by a "...Devono-Mississippian succession of mafic to intermediate metavolcanic rocks (Units EBA and EBF) intercalated with and overlain by dark grey phyllite, sandstone and grit (EBP)" (Schiarizza and Preto, 1987). Unit EBA hosts many of the sulphide occurrences in the Eagle Bay assemblage, including the Harper Creek deposit (Schiarizza, 1986a; 1986b; Schiarizza and Preto, *op. cit.*).

Unit EBA comprises dominantly light grey to pale green sericite-quartz phyllite, less chlorite phyllite and up to 10 percent metasedimentary intervals of dark grey phyllite, siltstone and limestone. In the Vavenby area, it thins to the east, from several hundred to several tens of metres. Just south of the Harper Creek deposit, Unit EBA is structurally underlain by greenstones, chloritic phyllites, quartzitic units and orthogneiss of EBG, and north of the deposit, by dominantly metasedimentary rocks of EBP (Schiarizza, 1986a; Schiarizza and Preto, *op. cit.*).

LEGEND

Contact (after Belik, 1973)
Geological Contact
Fault (inferred)
Trench
Exposure
Sulphide – magnetite lens

Early foliation; schistosity 20
Bedding 14
L_1 (mineral) lineation
2 crenulation lineation

Road, 4-wheel drive
cat trail

Devonian – Eagle Bay Formation (Eba)

Sulphide layers

3b massive magnetite, pyrite, pyrrhotite, chalcopyrite
3a massive to semimassive pyrite, minor chalcopyrite

Metasedimentary units (minor metavolcanic)

2c carbonaceous phyllite, calcareous phyllite, minor dolomite, grey limestone
2b grey, pale green or tan sericite phyllite, quartzitic phyllite
2a quartzite, sericitic quarzite; minor sericitic and chloritic phyllite

Metavolcanic units (minor metasedimentary)

1e quartz-eye phyllite, schist; quartz-sericite phyllite
1d quartz-sericite phyllite, minor schist; tan to silver grey; minor chloritic phyllite
1c sericite phyllite; chlorite-sericite phyllite; minor quartz-sericite phyllite
1b chlorite phyllite; chlorite-sericite phyllite; minor quartz-sericite phyllite
1a greenstone; foliated, locally fragmental; chlorite phyllite

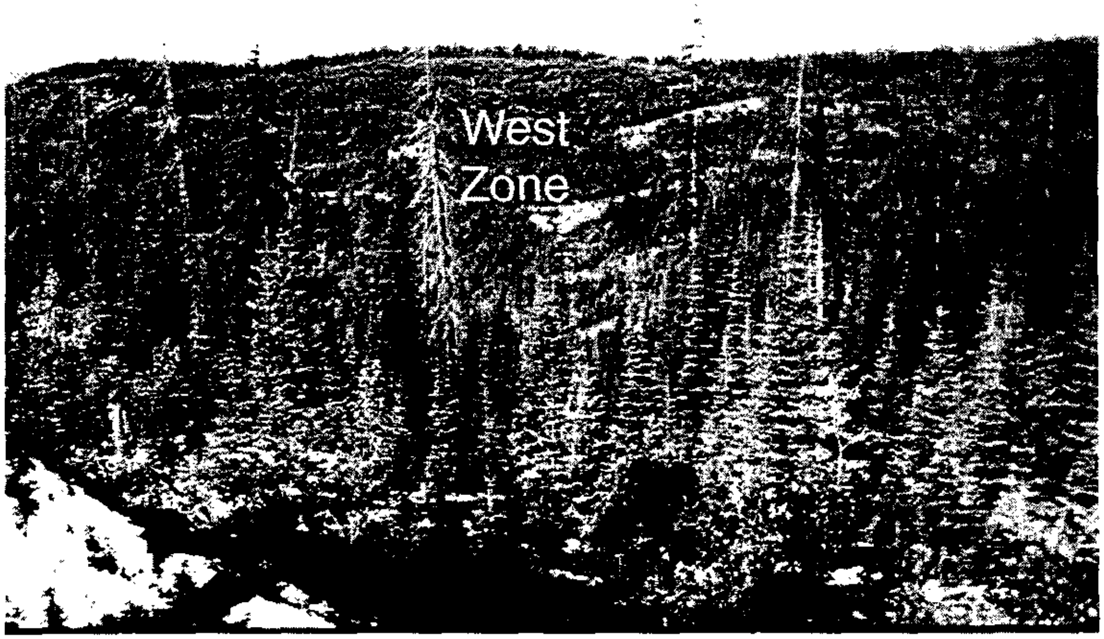


Photo 1: View looking northwest towards the West Zone of the Harper Creek Deposit.

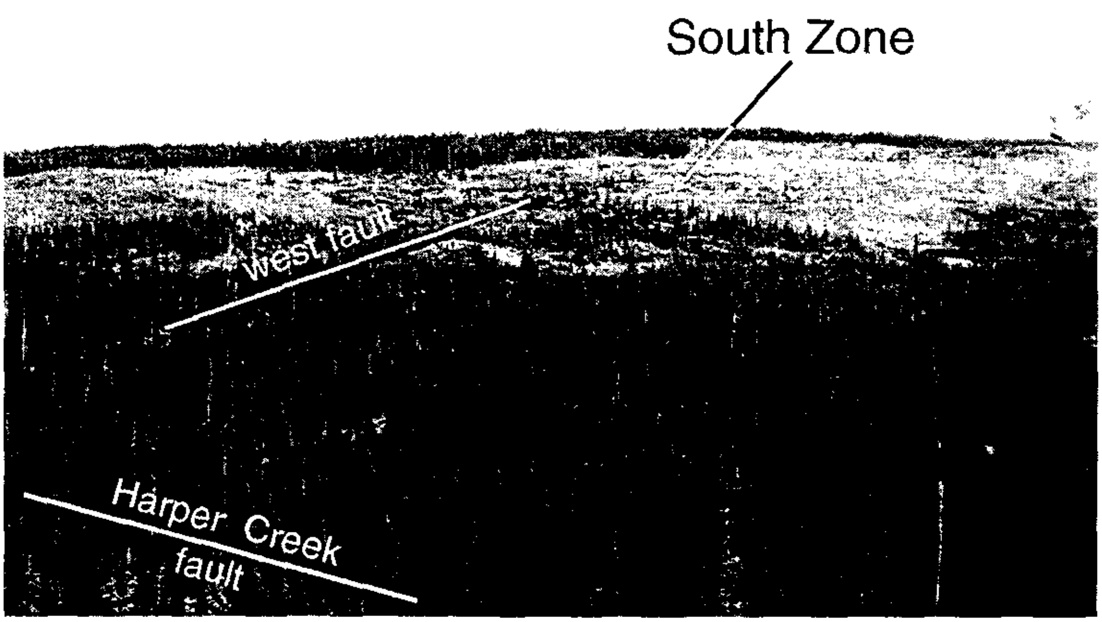


Photo 2: View looking southeast towards the South Zone of the Harper Creek Deposit.

HARPER CREEK DEPOSIT

INTRODUCTION

The geology of the Harper Creek deposit has been studied by Preto (1971) and Belik (1973) and described in a number of company assessment reports (Lammle, 1986; 1987; Phillips Barratt Kaiser Engineering Ltd., 1988) . This report draws considerably from these previous works.

STRATIGRAPHY

The area has undergone intense deformation, with development of a penetrative foliation that largely masks bedding. Units, including the massive sulphide layers, are not repeated and all recognized bedding/cleavage intersections indicate that the north-facing stratigraphic succession is on the upper limb of a tight anticlinal structure that closes to the south. Hence, it is interpreted that the structurally lowest units in the south are also the oldest.

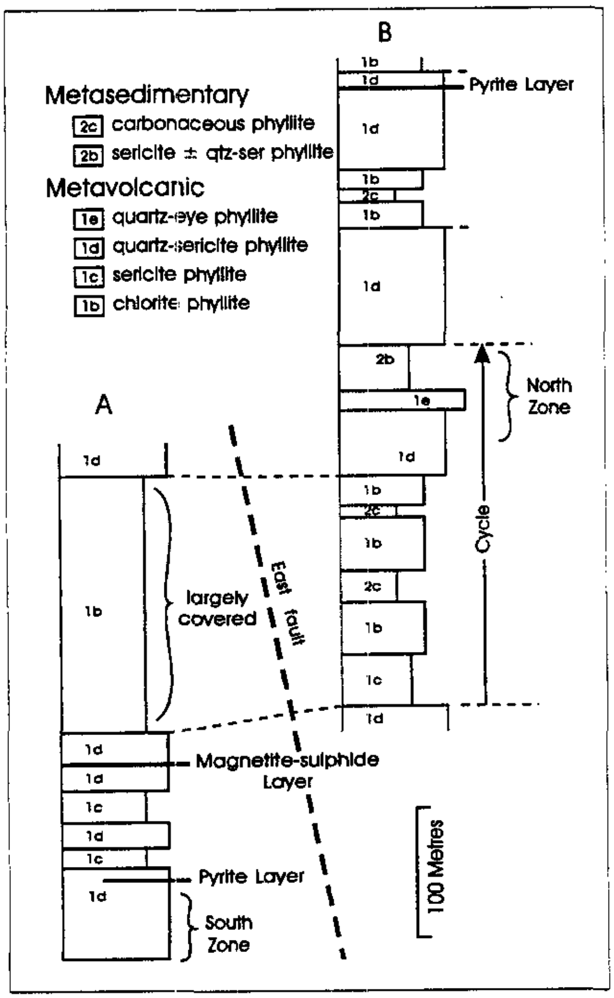


Figure 3. Schematic sections of Unit EBA, Harper Creek: (A) west of the East fault; (B) east of the East fault.

Units are divided into either dominantly metavolcanic or metasedimentary rocks. However, intense alteration, particularly sericite development, as well as the penetrative foliation, commonly makes interpretation of the protolith difficult. Figure 3 shows composite sections in the area, and assumes there are no structural repetitions.

METAVOLCANIC UNITS

Unit 1a is foliated, massive to fragmental greenstone, with less chlorite phyllite, that outcrops in the northern part of the area (Belik, 1973) It is medium to dark green, with locally angular to subrounded amphibolite or greenstone fragments up to several centimetres across. The matrix comprises fine-grained, foliated actinolite, clinozoisite, feldspar, chlorite, sphene, carbonate and quartz. Unit 1a is interpreted to be a mafic ash and lapilli tuff (Belik, *op. cit.*).

Unit 1b is dominated by chlorite phyllite, with minor sericite or quartz-sericite phyllite. It occurs throughout the central part of the area (Figure 2) and in thin lenses within quartz-sericite schists of Unit 1d. A number of dark grey, carbonaceous phyllite layers, assumed to be argillaceous intervals, occur within it. The chlorite phyllite consists of foliated chlorite, with variable carbonate, feldspar, quartz, sphene and minor sericite and clinozoisite. Rusty-weathering siderite? typically forms thin discontinuous laminae, and occasionally occurs as disseminated euhedral grains. Disseminated pyrite is common, and intense sericite alteration locally produces soft, pale green coloured exposures. Abundant chlorite and common sphene suggest that the protolith of Unit 1b is a mafic ash tuff.

Unit 1c is a pale green to grey-green sericite phyllite that commonly contains minor amounts of chlorite. It occurs in the southern part of the area, stratigraphically below the magnetite-sulphide layer (Unit 3b). Siderite, as disseminated grains or irregular laminae, is common throughout, and quartz may occur as fine discontinuous segregations. Disseminated and vein sulphides are also locally common, with malachite staining on foliation planes and in cross-fractures. The fine felted nature of the sericite, local abundance of sulphides and variable chlorite and quartz content suggests that sericite of Unit 1c is an alteration mineral related to introduction of potassium. Siderite content, little visible quartz and variable amounts of chlorite suggest that the dominant protolith is a mafic tuff, with perhaps minor intermediate tuffs or sediments. The occurrence of Unit 1c beneath the most prominent sulphide layer further suggests that it may be the highly sheared and foliated remnants of a footwall alteration zone.

Unit 1d is the most abundant and conspicuous unit throughout the map area (Figure 2). It comprises dominantly lustrous, silvery-grey to tan coloured quartz-sericite phyllite, with quartz occurring interstitial to sericite, in thin foliation parallel laminae and as prominent quartz "eyes". Accessory minerals include variable amounts of chlorite, albite and dolomite. Locally it is coarser grained, and is referred to as a quartz-feldspar-sericite schist. It hosts the disseminated chalcopyrite of the northeastern Quebec Cartier showing, and may be the host of two of the sulphide lenses. The protoliths of sericite schists that contain quartz eyes are interpreted to be felsic tuffs. Others, lacking these quartz eyes, may be felsic tuffs or siliceous metasediments.

Unit 1e is a prominent quartz-eye phyllite with abundant elliptical to subrounded quartz eyes up to a centimetre in length. With decreasing size and abundance of quartz eyes it grades into Unit 1d. It may be a more felsic volcanic tuff, with a rhyolitic or dacitic composition.

METASEDIMENTARY UNITS

Quartzites of Unit 2a, interbedded with quartzitic phyllites, occur south and southwest of the Noranda camp. They form white to light green, resistant orthoquartzite, sericite quartzite and albite-sericite quartzite outcrops (Belik, 1973). Belik (*op.cit.*) differentiated a carbonaceous quartzite unit within Unit 2a. Mineralization southwest of the Noranda camp occurs in quartzitic units that have been assigned to 2a, as well as in carbonaceous phyllites and quartz-sericite phyllites. Unit 2a is dominantly a siliceous metasedimentary unit; however, more phyllitic units within it may be felsic to intermediate tuffs.

Unit 2b consists of sericite, quartz-sericite and chlorite-sericite phyllites that appear similar to "intermediate" tuffs of Unit 1c. However, rapid lithological changes in layer stratigraphy, and the common association with carbonaceous phyllites, suggest that they may be metasediments or possibly metamorphosed tuffaceous sediments. They occur interlayered with quartz-eye phyllites stratigraphically above Unit 1e (Figure 2) and as interbeds in units 1b and 1d. These latter occurrences are not differentiated on the map.

Unit 2c includes dark grey to black carbonaceous phyllite, pale grey calcareous phyllite, grey limestone and minor tan dolomite. It occurs as scattered, discontinuous lenses throughout the area, most commonly in chlorite phyllites of Unit 1b. It hosts copper mineralization of the Noranda camp, and a semi-massive pyrite layer, associated with massive dolomite, in a trench on the southern slopes of Harper Creek. Many exposures of Unit 2c contain euhedral phenocrysts of pyrite, locally up to a centimetre across.

DISCUSSION

Stratigraphic sections of Unit EBA in the Harper Creek deposit area are illustrated in Figure 3. Essentially, the succession comprises two sequences of felsic to intermediate tuffs, separated by mafic tuffs and interbedded fine-grained clastic sedimentary units (units 1b and 2c). The massive magnetite-sulphide layer occurs near the top of the stratigraphically lowest felsic unit; the pyritic lens to the northwest (Figure 2), within metasediments that record a hiatus in volcanism prior to onset of deposition of mafic tuffs of Unit 1b.

The overlying succession of mafic tuffs (1b), intermediate to felsic tuffs (1d) and quartz-eye phyllites (1e) may record a volcanic cycle that is capped by metasediments of Unit 2b. Disseminated mineralization near the Quebec Cartier camp occurs at the top of this volcanic succession and in the transition to overlying mixed intermediate and mafic tuffs. The upper pyrite layer in section B (Figure 3) is also near the top of a more felsic volcanic package, overlain by mafic volcanics of Unit 1b.

STRUCTURE

Regional structures of the Vavenby area are described by Schiarizza (1986a). He recognizes two early phases of intense deformation, associated with Jurassic regional metamorphism, and three phases of post-metamorphic folding. The most conspicuous post-metamorphic deformation is east-west trending folds that are probably related to intrusion of the Baldy batholith. North-trending faults, commonly filled by Tertiary dikes, cut east-trending folds and are interpreted to be related to the final phase of deformation (Schiarizza, *op. cit.*)

Two phases of folding are clearly recognized in the Harper Creek deposit area. An intense penetrative foliation (Phase 2 of Schiarizza, 1986a) strikes easterly and dips variably to the north (Figure 2). It generally obliterates bedding or transposes it parallel to foliation. Where bedding/foliation angles are preserved, bedding dips are less steep. This is clearly displayed in the most northern trench (Figure 2) where a sub-horizontal to shallow north-dipping semi-massive pyrite layer is cut

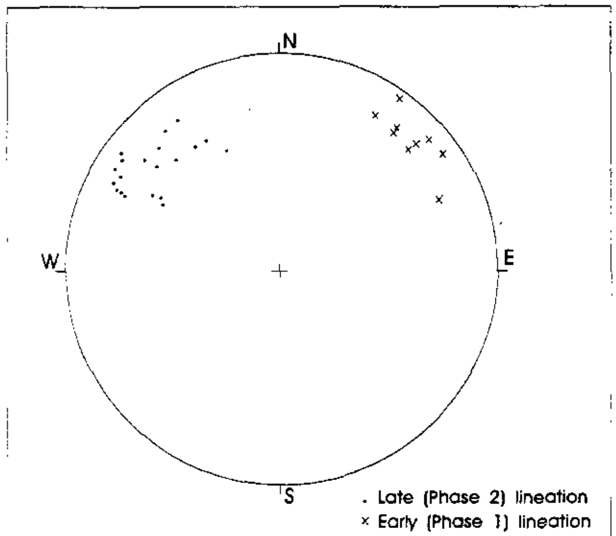


Figure 4. Stereoplot of early mineral lineations and late crenulation cleavage lineations.

Plate 3. Thin pyrite layer from the most northern trench (see Figure 5) showing the angle between layering and more steeply dipping foliation.

by more steeply dipping foliation (Plate 3). These relations define an antiformal closure to the south, with the Harper Creek succession on the upper limb of the antiform, and hence right-way-up. Mineral lineations related to these early folds plunge at low angles to the northeast (Preto, 1971); (Figure 4).

A prominent, steeply dipping to vertical crenulation cleavage trends northwest throughout the area (Figure 4). Macroscopic folds related to these structures were not recognized.

Northeast and northwest-trending late faults are inferred in the deposit area. A northeast- trending fault is mapped by Belik (1973) in the Harper Creek valley (Figure 2). Displacement on this fault is not known as lithologies cannot be correlated readily across it. Schiarizza (1986b) defines a more northerly trending, steeply dipping fault in the Harper Creek valley; maximum inferred west-side up displacement is a few hundred metres.

Two steeply dipping, northwest-trending faults are interpreted to cut the Harper Creek succession south of Harper Creek (Figure 2). Both follow airphoto lineaments, are interpreted to have steep dips, and have west-side up displacements of a few tens of metres. The more western fault appears to offset the massive magnetite-sulphide lens and truncates Unit 2c farther northwest. The eastern fault appears to truncate (or offset?) more quartzitic members of Unit 2a and may truncate the magnetite-sulphide layer (Figure 2).

MINERALIZATION

Mineralization on the Harper Creek prospect includes disseminated sulphides, vein and fracture controlled sulphides and massive to semimassive sulphide and sulphide-magnetite layers (Preto, 1971; Belik, 1973). The disseminated sulphide zones are considered to have the most economic potential (Phillips Barratt Kaiser Engineering Ltd., 1988; M. Sanguinetti, personal communication, 1996). They form discontinuous zones that approximately parallel the trends of bedding and foliation.

DISSEMINATED SULPHIDE ZONES

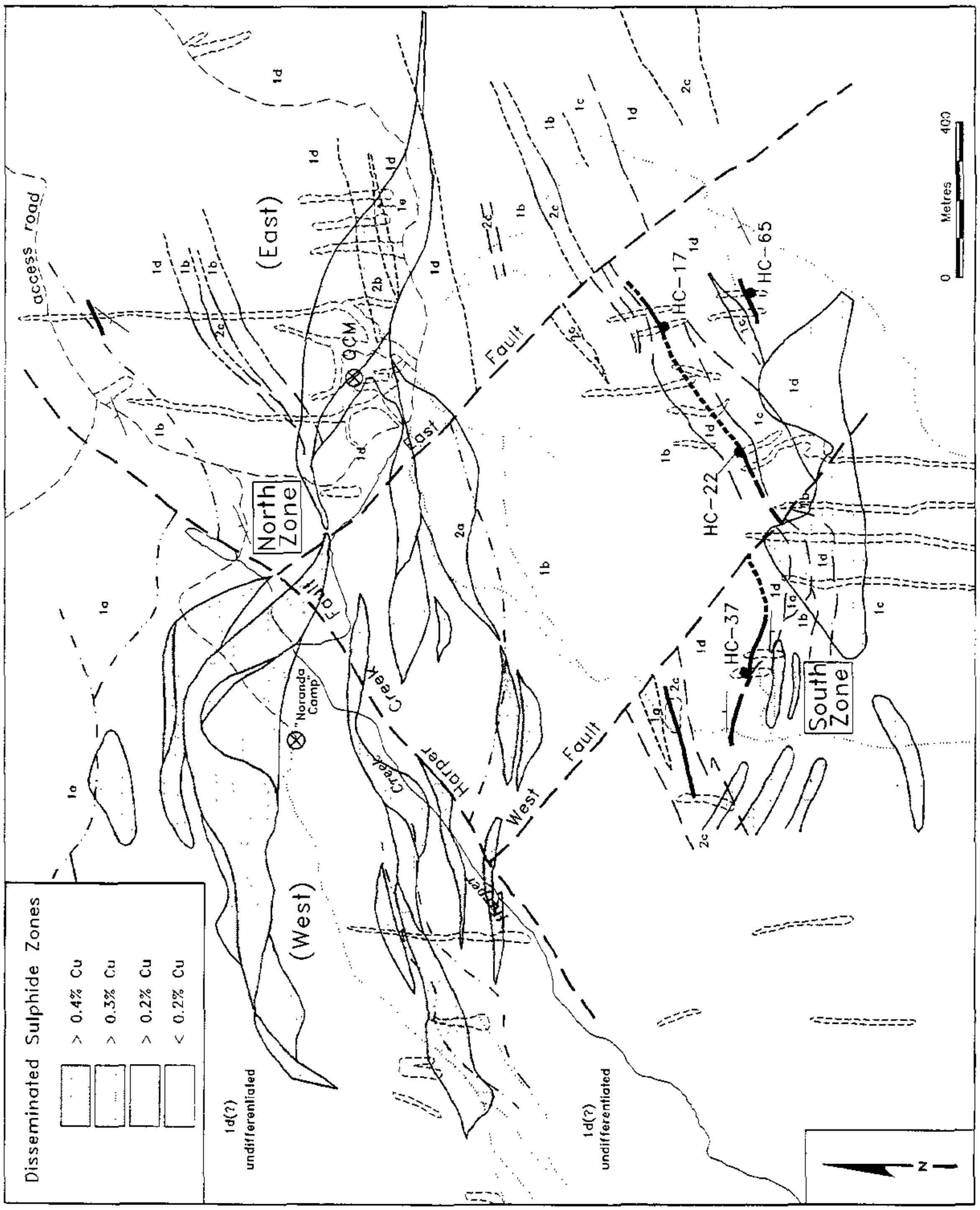
The dominant sulphide minerals in the disseminated sulphide zones are, in decreasing order of abundance, pyrite, pyrrhotite and chalcopyrite. Disseminated pyrite content ranges up to 10 percent; disseminated chalcopyrite is restricted to pyritic zones and generally does not exceed 2 percent (Belik, 1973). Minor disseminated sphalerite and locally, arsenopyrite also occur within the pyritic zones (Preto, 1971; Belik, *op. cit.*). The disseminated sulphides occur as finely dispersed grains on foliation planes. Chalcopyrite also occurs commonly in fine, north-trending hairline fractures, and with quartz and calcite in north trending veins or tension gashes. Pyrite is also found outside the disseminated sulphide zones.

Two large irregular zones of disseminated sulphide mineralization, defined by surface and diamond drill core assays, are recognized. Although the zones trend easterly and dip at a shallow angles to the north, essentially parallel to foliation trends, they clearly crosscut layering. Geological reserves, described below, are from Phillips Barratt Kaiser Engineering Ltd. (1988). The zones are schematically shown on Figure 5. The more northern extends from east of the Quebec Cartier camp, west across Harper Creek to the Noranda camp area. It splays to the west resulting in two higher grade zones separated by less mineralized rock, and as well increases in surface extent and grade to the west (Figure 5). The eastern zone increases in grade and thickness in the subsurface to the north, with grades more comparable to those exposed at surface to the west, supporting a model of west-side up movement on the Harper Creek fault. Copper grades range from less than 0.2 percent to greater than 0.4 percent. Total geological reserves east of Harper Creek are 42.5 million tonnes grading 0.37 percent copper, 0.043 g/t gold and 2.4 g/t silver; reserves west of Harper Creek are 53.5 million tonnes grading 0.42 percent copper, 0.047 g/t gold and 2.6 g/t silver.

The north zone comprises disseminated and fracture controlled chalcopyrite and malachite with in dominantly quartz-sericite phyllites. Pyrite is ubiquitous, sericite alteration is locally intense, and silicification in the form of quartz veinlets and "sweats" is common.

The southern zone is less well defined, smaller and generally of lower grade. It comprises disseminated chalcopyrite and malachite within a zone of intense sericite and dolomite alteration, in probable mafic to intermediate tuffs. It is underlain by sericite-altered tuffaceous sediments and overlain by more siliceous tuffs that contain the sulphide layer. The zone is between 100 and 200 metres in width, with calculated geological reserves of of 20.5 million tonnes containing 0.3 percent copper. The south zone appears to be offset by the western northwest trending fault (Figure 5) and increases in grade to the west.

Figure 5: Geological map of the Harper Creek deposit, showing locations of disseminated sulphide zones and sulphide layers (after A. Soregaroli, 1972, unpublished Noranda Explorarations Co. Ltd. report; Phillips Barratt Kaiser Engineering Ltd., 1988).



SULPHIDE-MAGNETITE LAYER (UNIT 3b)

A sulphide-magnetite layer that ranges in thickness from a few tens of centimetres to several metres has been traced intermittently for a strike length of approximately 600 metres. It varies from massive magnetite with dispersed pyrite to dominantly pyrite in a magnetite matrix. Chalcopyrite content ranges up to approximately 4 percent. The sulphides and magnetite locally produce a crude banding in the layer. Copper values grade from 0.9 percent to less than 0.1 percent; lead, zinc and arsenic values are low (Table 1), silver content is generally less than 10 ppm, and maximum gold content in analyzed samples, less than 250 ppb. A magnetite-rich grab sample assayed 0.01 oz Au/ton; (M. Sanguinetti, personal communication, 1996).

Unit 3b is dominantly within quartz-sericite phyllites that may originally have been felsic tuffs. However, it is possible that quartz laminae and veinlets within this unit record silicification associated with sulphide deposition. The layer and siliceous envelope is underlain by intense sericite alteration and disseminated sulphides of the south sulphide zone. Fine-grained, massive to foliated, brown weathering dolomite, locally with abundant quartz, commonly occurs adjacent to the layer.

PYRITIC LAYERS (UNIT 3a)

A number of other thin, discontinuous massive to semimassive sulphide layers occur throughout the area (Figure 2). They are less than a metre thick and can only be traced a few tens of metres, perhaps due to limited surface exposure. They comprise pyrite with minor pyrrhotite, magnetite and chalcopyrite in a chlorite-quartz-sericite gangue. The most southern pyrite layer is a few tens of centimetres thick and can be traced across two trenches. It is within a siliceous quartz-eye sericite schist. A sulphide layer northwest of the sulphide-magnetite layer is within carbonaceous phyllite and grey limestone of Unit 2c. Massive, fine-grained dolomite, cut by quartz veins that carry sphalerite and pyrite, occurs along its margin.

Thin pyritic layers also occur within quartz-eye phyllite in the most northern trench (Plate 3). The pyrite is medium grained within a dark quartzitic matrix.

ALTERATION MINERALOGY

Distinction between alteration minerals associated with sulphide deposition and metamorphic minerals is difficult, particularly as metamorphism has overprinted alteration assemblages. Hydrothermal alteration minerals recognized in the field include intense sericite development, brown-weathering dolomite, calcite and quartz, and possibly chlorite.

TABLE 1. SELECTED ASSAYS OF TWO SULPHIDE LAYERS, HARPER CREEK DEPOSIT (FROM THIS STUDY).

Sample	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	As ppm	Au ppb
HC-17	4746	47	284	3.6	89	288	880	11	232
HC-22	1196	21	43	<.3	55	103	448	2	23
HC-37	1931	58	121	1.3	20	279	131	85	34
HC-65	7678	36	179	10.1	69	248	342	129	73

Sericite, of assumed hydrothermal origin, produces a soft, pale greyish-green rock in which all primary bedding features are obliterated. It contrasts with coarser grained sericite that is abundant in more siliceous units, does not appear to be as texture destructive and is assumed to be of metamorphic origin. Sericite alteration is most intensely developed in the trenches in the south of the map area (Unit 1c, Figure 2); the protolith of this unit is assumed to include mafic tuffs, with minor intermediate tuffs or sediments. Sericite alteration is also common at the south end of trenches near the Quebec Cartier camp. These alteration zones are in the footwall of the most intense sulphide mineralization, beneath both the massive sulphide-magnetite layer and the disseminated sulphide zones. Hence, it is assumed that they reflect potassium metasomatism associated with sulphide deposition.

Dolomite and siderite are common in all chloritic units, commonly producing rusty-weathering outcrops. Carbonate occurs as disseminated grains and in thin, very rusty-weathering laminae within more chloritic phyllites. Total carbonate content varies considerably; within the mineralized zones it is estimated to average 12 percent (Phillips Barratt Kaiser Engineering Ltd., 1988). Dolomite and siderite also occur in thick, cross-cutting massive veins, with quartz, pyrite, chalcopyrite and sphalerite. These are conspicuous in the carbonate and carbonaceous phyllite units (2c) at the southwest end of the map area (Figure 2). Massive, fine-grained dolomite, with quartz, also occurs adjacent to the sulphide-magnetite layer. The foliated nature of much of the dolomite indicates that it is a pre- or synmetamorphic mineral and its association with both disseminated and layered sulphides suggests, at least in part, a hydrothermal origin.

Quartz occurs as discontinuous laminae within sericite phyllites, and in cross-cutting quartz-calcite sulphide veins and tension gashes. These modes of occurrences may reflect silicification or, possibly, remobilization of original silica during metamorphism. Rounded quartz eyes in sericite phyllite are interpreted to be original volcanic quartz.

Chlorite is abundant in many of the units, and generally is interpreted to record metamorphism of a mafic to intermediate volcanic unit. However, dispersed chlorite in siliceous sericitic units that are interpreted to be originally felsic tuffs, may be related to Mg alteration. Commonly, dispersed and veinlet sulphides are associated with chlorite.

SUMMARY AND DISCUSSION

Harper Creek is interpreted to be a volcanogenic sulphide deposit within Late Devonian bimodal calcalkaline volcanics of the Eagle Bay Assemblage. It consists of a number of thin sulphide or sulphide-magnetite layers, as well as several large zones of disseminated chalcopyrite and pyrite that approximately parallel the dominant foliation and layering trends in the upper limb of an overturned anticline. Remobilized sulphides also occur in late hairline fractures, quartz veins and tension gashes.

The southern disseminated sulphide zone is within intensely sericitized tuffaceous sediments in the footwall of the sulphide-magnetite layer. This suggests that it may be part of a widespread footwall alteration zone related to massive sulphide deposition. Its conformable nature may reflect an original semiconformable zone or may possibly reflect transposition of a cross-cutting zone into foliation.

The northern zone of disseminated sulphides is within felsic tuffs that are interpreted to be at the top of a volcanic cycle. It is underlain by mafic chlorite tuffs and overlain by metasedimentary phyllites. Its similarity to the south zone, stratigraphic position and semiconformable nature suggest that it also records continued sulphide deposition during volcanism.

A number of other disseminated sulphide deposits in the Eagle Bay Assemblage are described by Schiarizza and Preto (1987). EBL, located between the northeast ends of North and East Barriere Lakes, comprises disseminated pyrite, pyrrhotite and lesser chalcopyrite in dominantly chlorite schists of Unit EBQ. Lydia, 12 km west of Harper Creek, also consists of disseminated pyrite, pyrrhotite and chalcopyrite in chlorite phyllite, calcareous phyllite and quartzofeldspathic schist of EBQ. Associated semimassive sulphides suggest a further similarity with Harper Creek. Other similar occurrences include VM and VAV (Schiarizza and Preto, 1987). A common feature of all these occurrences is the close spatial association with quartz-feldspar orthogneiss units interpreted to be subvolcanic intrusions. This raises the possibility that these are deformed and metamorphosed porphyry copper deposits (Schiarizza, personal communication, 1996).

However, I suggest that these disseminated sulphide deposits may be similar to large semiconformable alteration zones that have been described beneath some massive sulphide deposits (Morton and Franklin, 1987). These alteration zones can have strike lengths of several kilometres and thicknesses of tens to hundreds of metres. In particular, Mattabi-type massive sulphide deposits can have large, well-defined semiconformable alteration zones, characterized by sericite, quartz, dolomite and sulphides, that may extend up to the ore horizon and merge with more typical alteration pipes (Morton and Franklin, *op.cit.*). The thin sulphide lenses at Harper Creek may record seafloor venting of sulphides while disseminated sulphides and associated alteration were deposited in the footwall.

The term "volcanogenic disseminated sulphide deposit" (VDS) has been applied to the Harper Creek deposit (K. Daughtry, personal communication, 1996). Further work is required to determine if Harper Creek is a new deposit type that is distinct from either a porphyry deposit or the semiconformable alteration zones and associated mineralization recognized in the footwalls of some massive sulphide deposits.

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