1993 GEOLOGICAL AND GEOCHEMICAL REPORT
OF THE CREELMAN #2 PROPERTY

Revelstoke Mining Division, British Columbia
NTS 082M/1E and 082M/8E
Latitude 51° 14' N
Longitude 118° 12' W

Prepared By
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800-900 West Hastings Street
Vancouver, B.C.
V6C 1E5

July 10, 1994
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1.0 INTRODUCTION

1.1 Location and Access

The Creelman #2 property is located 31 kilometres north of Revelstoke B.C., one kilometre east of Highway 23 and the Columbia River and one kilometre north of La Forme Creek. The claim straddles map sheets 082M/1E and 082M/8E, and is centred upon latitude 51° 14' north, and longitude 118° 12' west (Figure 1).

Access to the property is by truck north along Highway 23 to 1.3 kilometres past La Forme Creek. An unmaintained logging road extends east from the highway to an elevation of 950 metres (3140 feet) on the southwest corner of the property (Figure 2). Access by truck up the logging road is not possible past approximately 1.5 kilometres.

1.2 Physiography and Climate

Topographical relief on the Creelman #2 claim (Figure 2) ranges from the location of the LCP in the Columbia River valley in the west at 730 metres (2400 feet), to the northeastern corner of the property at 1830 metres (6000 feet). Topography on the property slopes moderately to steeply west and southwest. Some rocky cliffs are exposed around the 1200 metre (4000 foot) elevation, and many of the creeks occupy very steep and precipitous gullies. The creeks are small and very steep, yet many have a small continuous flow of water throughout the summer.

The claim is heavily forested up to the scattered high alpine meadows at 1830 metres (6000 feet) with a mixture of hemlock, spruce, cedar, balsam fir and alder. Much of the forest is second growth after logging and/or fire, and some small cut blocks exist at lower elevations. The logging road that provides access to the claim was completed in the fall of 1992 by Pope and Talbott, making future logging an obvious probability.

The climate is relatively wet year-round. Heavy snow falls occur above the 1000 metre (3500 foot) elevation from late November to April. The spring and fall are rainy, and summers vary from hot and dry to wet.

1.3 Property Status and Ownership

The Creelman #2 claim is in the Revelstoke Mining Division (Figure 3).

<table>
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<th>Name</th>
<th>Record No.</th>
<th>No. of Units</th>
<th>Record Date</th>
<th>Expiry Date</th>
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<td>Creelman #2</td>
<td>317126</td>
<td>20 Units</td>
<td>April 22, 1993</td>
<td>April 22, 1995</td>
</tr>
</tbody>
</table>

The claim is owned by the author, David W. Tupper. The new expiry date
Figure 1. Location map.
The Goldstream slice of the Selkirk allochthon (Read, 1981) is a fault isolated belt of Proterozoic to Lower Paleozoic metasedimentary and metavolcanic rocks which hosts a variety of mineral deposits (Figure 4). The Goldstream slice extends west from the Columbia River to Downie Creek, and south from the Goldstream River to La Forme Creek.

Mineral exploration in the area of the Goldstream slice dates back to before the turn of the century when gold placer mining was undertaken in the French Creek, McCulloch Creek and Carnes Creek drainages in 1865. Early lode mineral exploration work began with the discoveries of the metasedimentary hosted Standard and Montgomery copper deposits in 1895, and the J&L gold deposit in 1896. Today the J&L deposit is held by Equinox Resources Ltd. and hosts a proven and probable reserve of 808,200 tonnes grading 7.2 grams/tonne gold, 66 grams/tonne silver, 5.2% zinc, 2.6% lead and 4.7% arsenic (Codilleran Round-up Snapshot Review, 1990). Small carbonate replacement massive zinc-lead-copper deposits like the Mastodon just north of La Forme Creek were explored and mined on a limited scale beginning in 1926. The most important discovery in the area to date was the Goldstream deposit in 1972. Noranda first began operating the Goldstream mine in 1983, but was forced to halt operations in 1984 because of low metal prices. The mine was reopened in 1991 by Bethlehem Resources Corporation and Goldnev Resources Incorporated and is presently being operated based on reserves of 1.436 million tonnes grading 4.48% copper and 3.03% zinc (News release, Vancouver Stock Watch, May 13, 1993). South of La Forme Creek in high grade metamorphic rocks correlative to the Proterozoic, is the Thanksgiving tungsten occurrence.

The Creelman #2 claim was staked to include the Copper Queen copper-zinc occurrence. The original discovery of the Copper Queen occurrence is not known, however it has been staked off and on since the 1950’s. Work completed to date on the Copper Queen includes a three hole diamond drilling program completed in 1968 by Coldwater Mines Ltd. Reported results include an intersection of 6.1 metres grading 0.85% copper. In 1976, Kerr Addison Mines Limited completed an extensive soil and stream geochemical sampling survey that outlined a 600 metre by 150 metre coincident copper-zinc-lead soil anomaly. Chip sampling returned grades of up to 2.01% copper, 0.56% zinc and 18.9 g/t silver across 2.34 metres. Drilling was recommended but never followed up. No gold assays were reported.

The Geological Survey of Canada conducted a Regional Geochemical Survey in the area in 1977.
The work completed in 1993 that is the subject of this report included: the collection of five soil samples (confirming the soil anomaly outlined by Kerr Addison), five silt samples and two rock grab samples, and; two days of geological mapping.

2.0 GEOLOGY

The regional tectonic setting of the Goldstream area is best described by Logan (1994) as follows (Figure 4):

The Northern Selkirk Mountains area is a complexly deformed and metamorphosed region situated between the Foreland fold and thrust belt of the southern Canadian Rockies on the east, and the Shushwap Metamorphic Complex in the west. The Goldstream area is underlain by strongly deformed Late Proterozoic to early Paleozoic metasedimentary and metavolcanic rocks of the Selkirk allochthon, as well as numerous large plutonic bodies, all part of the pericratonic Kootenay Terrane. The Selkirk allochthon consists of at least three tectonic slices. The Goldstream and Clanhncudainn slices form the hangingwall of the Monashee decollement north of Revelstoke. The overlying Illecillewaet slice is the largest . . . making up the eastern most part of the allochthon.

2.1 Regional Geology

The regional geology (Figure 4) of the Goldstream slice of the Selkirk allochthon is largely comprised of Lower Paleozoic Lardeau Group metasedimentary and metavolcanic rocks. The stratigraphy of the area also includes however, the Upper Proterozoic Horsethief Creek Group, the Eocambrian Hamill Group and the Cambrian Badshot Formation (Figure 5) (Wheeler, 1965; Brown, 1978 - cited in Logan, 1994). Logan (1994) notes that these stratigraphic divisions “. . . are broadly similar, and form the miogeoclinal wedge of the ancestral North America, with rocks of the Lardeau Group as a more distal and possible marginal basin sequence to the wedge.” Stratigraphic nomenclature and identification in the belt have yet to be firmly established however due to a range of problems limiting definitive correlations of the stratigraphy.

The Horsethief Creek Group has been mapped northeast of the Goldstream River (Brown, 1976; Lane, 1977; Hoy, 1979: - cited in Logan, 1994; Wheeler, 1965). The Horsethief Creek Group consists of phyllitic and slatey pelites, interbedded sandstones, conglomerate and minor carbonate rocks.

The Hamill Group consists of feldspathic and quartzose arenites and metavolcanic rocks unconformably overlying the Horsethief Creek Group rocks. Rocks of the Hamill Group were mapped in the areas northeast (Brown, 1976;
Hoy further subdivided the stratigraphy to the northeast to include metavolcanic-phyllites of the Mohican Formation of the upper part of the Hamill Group. The Hamill Group has also been mapped extending along the eastern half of the Goldstream slice of the Selkirk allochthon north from Carnes Creek to the Goldstream River (Hoy, 1979; Brown and Lane, 1988; Gibson, 1989; Brown, 1991: - cited in Logan, 1994). Gibson subdivided the Hamill between Downie Creek and the Goldstream River into its Marsh Adams and Mohican Formations. The upper part of the Hamill Group is host to the J&L gold-silver-lead-zinc-arsenic deposit located on Carnes Creek.

The Badshot formation consists of Archeocyathid-bearing limestones that conformably overlie the Hamill Group and is to be found north and east of the Goldstream River, and along the east of the belt from La Forme Creek to the Goldstream River (Brown, 1976; Lane, 1977; Hoy, 1979; Brown and Lane, 1988; Gibson, 1989; Brown, 1991: - cited in Logan, 1994; Wheeler, 1965; Gibson and Hoy, 1985). The Badshot hosts the Mastodon carbonate replacement massive zinc-lead-copper deposit located north of La Forme Creek.

The Lardreau Group conformably overlies the Badshot Formation in the Illecillewaet synclinorium (Colpron, 1992; - cited in Logan, 1994); but they are in uncertain, possibly reverse order in the Trout Lake area (Smith, 1992a; - cited in Logan, 1994). The Lardreau was subdivided by Fyles and Eastwood (cited in Logan, 1994) into six formations in the Ferguson area. The Index Formation is divided into the grey phyllite and minor basal conglomerate of the Lower Index, and basic flows and tuffs of the Upper Index. The Upper Index has been mapped by Brown (1983) along the core of the Goldstream slice from La Forme Creek to north of Carnes Creek. The Goldstream copper-zinc Mine and the Montgomery copper-zinc occurrence occur in rocks of the lower part of the Index Formation. Descriptions of the Rain copper-zinc occurrence on Downie Creek suggest it too is hosted by the Lower Index Formation. The Standard copper-zinc occurrence is considered to be hosted in rocks of the upper part of the Index Formation. Above the Index Formation, are grey to black siliceous argillites of the Triune Formation, followed by grey quartz arenites and limy concretions of the Ajax Formation and dark grey siliceous argillite of the Sharon Creek Formation. None of the Triune, Ajax or Sharon Creek Formations have been recognised in the Goldstream slice area (Logan, 1994). The Jowett Formation is comprised of tholeiitic, pillowed and breccia flows, tuff and lesser limestone and phyllite, and outcrops along Highway 23 at Carnes creek (Brown, 1983). The Copper Queen occurrence is possibly hosted by the Jowett Formation (Gibson, personal communication). The Broadview Formation occurs at the top of the Lardreau Group and consists of grey quartz feldspar grit, foliated micaceous quartzite and phyllite. The Broadview Formation is known to outcrop south of the Goldstream River along the western margin of the belt.
2.2 Property Geology

The Creelman #2 property covers early Paleozoic Lardeau Group rocks at the southwestern margin of the Holdich structural domain (Brown, 1983), one of several fault bounded domains identified within the northwesterly trending, northeasterly dipping Goldstream slice of the Selkirk allochthon. Brown (1983) completed a geological section across the Holdich domain 8 kilometres northwest of the property. He interprets the geology, beginning in the west along the Columbia River Fault, to consist of a moderate to shallow east dipping succession of dark green tuffaceous volcanic rocks with thin white dolomitic limestone interbeds typical of the Jowett Formation, and green siliceous phyllite and phyllitic quartzites of the upper Index Formation. This general interpretation is thought to continue south to the Creelman #2 property area.

The geology of the Creelman #2 property was mapped in detail by Kerr Addison Mines Ltd. in 1976. The geology of the property includes sericite schist, quartz sericite schist, quartzite, amphibolite, limestone (marble), chlorite schist, biotite schist, gneiss and quartz monzonite. The area of the Copper Queen showings are described as follows:

[The Copper Queen showing area] is underlain by a sequence of metamorphic rocks that include a lower sericitic quartz-feldspathic rock that is only slightly schistose. This is overlain by a succession of metamorphic volcanic rocks that include amphibolite, chlorite schist with interbedded thin beds of limestone. Overlying the metavolcanic sequence are quartz-sericite schist, sericite schist and quartzite. Intruding the metamorphic rocks about 50 metres north west of the [Copper Queen] showings is a small plug of porphyritic biotite-hornblende quartz monzonite.

The Kerr Addison mapping was confirmed in part by the author and G. Gibson in 1993. Gibson suggests that the chlorite schist unit with thin interbeds of dolomite found in the showing area, in core from the 1968 drilling and described by Hajek above resembles the Jowett Formation outcrops described by Brown (1983) on Highway 23 at Carnes Creek. The predominant schistosity in the showing area strikes 160° to 180° and dips 28° to 35° to the east.

2.3 Mineralization

At the Copper Queen showing, bands of disseminated chalcopyrite, sphalerite pyrite, pyrrhotite and trace galena occur in limy metavolcanic chlorite schist near its contact with overlying quartz sericite schist. The mineralized horizon is conformable with schistosity and is highlighted by local malachite staining.
Mineralization is traceable across 300 metres of strike. The Copper Queen horizon strikes 160° to 180° and dips 28° to 35° to the northeast.

3.0 1993 WORK PROGRAM

The 1993 work program was limited in its scope to examine the geology of the showings area and verify the geochemical anomaly in soil and silt samples.

3.1 Geological Mapping

Petrographic thin section analysis was done on two hand samples collected by Gibson. The first was a core sample of the limestone interbedded chlorite schist unit. The specimen was concluded to be a meta-andesite metamorphosed to a moderately well foliated schist. The predominant mineral composition is of plagioclase and actinolite, with less abundant biotite/chlorite and calcite. The 0.2-0.5 mm carbonate lenses paralleling foliation are of ankerite. Patches of sulphides include up to 1.3% pyrrhotite, pyrite, minor marcasite and trace chalcopyrite. The second sample was collected from the southern exposures of mineralization in a creek. The thin section reveals it to be a meta-andesite with relic plagioclase phenocrysts. Chalcopyrite and sphalerite form coarse patches, and chalcopyrite also occurs as abundant fine disseminated grains. Kink folds were noted in the foliated chloritic groundmass.

Below the showings, a 5 to 10 metre bluff forming limestone (marble) unit extends across the property from the south at approximately 730 metres elevation to the north at 975 metres elevation (Figure 5). Along the north property boundary, this unit strikes more 020° and appears considerably thickened, forming a very deep gorge in the creek there. This requires further mapping to determine if this is the result of folding.

3.2 Geochemistry

A total of two rock grab, five B horizon soils and five silt samples were collected on the property (Figure 6).

The rock samples were collected along the logging access road just east of the LCP. Both samples were of minor rusty pyritic quartz veins and were only assayed for gold and silver. Only sample 93TC-R001 was anomalous assaying 39.1 ppm Ag.

The soil samples collected by Gibson served to substantiate the anomaly outlined by Kerr Addison. The samples were collected along a north-south line originating above the anomaly area and slowly descending towards the logging access road. The three most northerly samples (CR-1 3820, CR-2 3720 and CR-3 3650) were all anomalous in zinc and copper. None were anomalous in lead.
There were five silt samples collect along the western boundary of the property extending north from the LCP. Moderate copper anomalies ranging up to 80 ppm and moderate zinc anomalies ranging up to 111 ppm highlight the last four creeks.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The work reported here substantiates the Copper Queen showings and the 600 metre by 150 metre coincident Cu-Zn anomaly outlined by Kerr Addison in 1976, giving rise to the potential for a Goldstream-type volcanogenic massive sulphide deposit on the claim.

Recommendations for further work include:
- extension of the soil grid to the south;
- electromagnetic and magnetometer geophysical surveys of the property;
- extensive prospecting;
- detailed geological mapping.

Respectfully,

David W. Tupper, B.Sc., P.Geol.
5.0 REFERENCES


APPENDIX I

Statement of Qualifications
STATEMENT OF QUALIFICATIONS

I, DAVID W. TUPPER, of 1048 Aubeneau Crescent, West Vancouver, British Columbia, do hereby certify that:

1. I am a consulting geologist with offices at 800-900 West Hastings Street, Vancouver, B.C., V6C 1E5;

2. I worked on the Creelman #2 property from October 28 to October 30, 1993.

3. I am a graduate of the University of British Columbia (1985) with a Bachelor of Science degree;

4. I have practised my profession continuously since graduation, largely on a contractual basis;

5. I have been employed in the mining industry since 1979;

6. I am the author of the present report;

7. I have been a Registered Professional Geologist in the province of British Columbia since 1993.

Dated at Vancouver, British Columbia this 5th day of July, 1994.

Respectfully Submitted,

David W. Tupper, B.Sc., P.Geol.
APPENDIX II

Statement of Expenditures
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<th>Category</th>
<th>Description</th>
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<td><strong>Field Program</strong></td>
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<tr>
<td>Personnel</td>
<td>G. Gibson (1 day @ $350/day)</td>
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<td></td>
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<td><strong>Post Field</strong></td>
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APPENDIX III

Statement of Analytical Procedures
ANALYTICAL PROCEDURES

The samples submitted by Gibson were sent to VanGeochem Lab Limited in Vancouver. Samples submitted by Tupper were sent to Min-En Laboratories in North Vancouver.

All soil and silt samples were kiln dried and sieved to -80 mesh. Rock samples were crushed, split and pulverized. A 1.5 gram sample is then digested with 5 millilitres aqua regia for 25 element (VanGeochem) or 31 (Min-En) ICP analysis. The samples submitted by Tupper were analyzed for gold and silver by 10 gram sample fire assay with atomic absorption finish.
APPENDIX IV

Communication from G. Gibson
Dear Dave,

Re: COPPER QUEEN Property Exam—Nov. 01/93.

Here are the I.C.A.P. results for the reconnaissance soil samples I took on Nov. 01/93.

Samples were taken at about 200m intervals along a descending path as I worked my way out southeastward, toward the logging road. Sample CQ-1 3820 was immediately below the helicopter pad (and at least one drill set-up), sample CQ-5 3140 was at the 2nd-last switchback on the road. Samples numbers refer to elevations in feet.

There are at least 30 boxes of NQ and 10 boxes of B-standard(?) drill core stored near the helicopter pad. Naturally, the core boxes are in poor condition. Mineralized intersections seem to have been removed. The main unit cut by the drilling is fairly massive dark green chlorite-actinolite schist (volcanic greenstone) with intercalated dolomite layers. Superficially, this unit resembles the “Jowett Fm.” outcrops on Route 23 at Carnes Creek about 8km to the northwest.

Dave—I have samples from the core if you want to see them.

Best regards,

Gordon Gibson

/encl.
APPENDIX V

Rock, Silt and Soil Sample Descriptions
SOIL SAMPLES

PROJECT: CREELMAN#2 PROPERTY: 

<table>
<thead>
<tr>
<th>Sample</th>
<th>Coordinates N.S. E.W.</th>
<th>Horizon</th>
<th>Depth</th>
<th>Color</th>
<th>% Org.</th>
<th>Slope</th>
<th>Date</th>
<th>Zn (ppm)</th>
<th>Pb (ppm)</th>
<th>Ag (ppm)</th>
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<td>CR-1 3920'</td>
<td>0 m S</td>
<td>B</td>
<td>0.1m</td>
<td>Brown</td>
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<td>Steep</td>
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<td>132</td>
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<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>Med.</td>
<td>&quot; 3720'</td>
<td>160</td>
<td>196</td>
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<td>CR-3 3850'</td>
<td>400m N-S</td>
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<td>0.3m</td>
<td>&quot;</td>
<td>10-2%</td>
<td>Steep</td>
<td>&quot; 3650'</td>
<td>79</td>
<td>119</td>
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<tr>
<td>CR-4 3830'</td>
<td>600m N-S</td>
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<td>0.1m</td>
<td>&quot;</td>
<td>5-7%</td>
<td>&quot;</td>
<td>&quot; 3530'</td>
<td>79</td>
<td>72</td>
<td>&lt;2</td>
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<tr>
<td>CR-5 3140'</td>
<td>Dead End</td>
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<td>10-7%</td>
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<td>&quot; 3170'</td>
<td>79</td>
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SILT SAMPLES (Date: Oct 29/93)

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<th>Depth</th>
<th>Color</th>
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<th>Pb (ppm)</th>
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<td>9372-1001</td>
<td>550m N-S</td>
<td>Silty</td>
<td>Fine</td>
<td>Clays</td>
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<td>Elev. 2720'</td>
<td>24</td>
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<td>9372-1002</td>
<td>740m N</td>
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<td>Elev. 2800</td>
<td>49</td>
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<td>9372-1003</td>
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<td>10%</td>
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<td>Elev. 2620/Main Creek</td>
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<td>9376-R001</td>
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<td>Ct. Ve.</td>
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<td>9376-R002</td>
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APPENDIX VI

Rock, Silt and Soil Sample Results
Geochemical Analysis Certificate

Company: DAVID TUPPER  
Project: CREELMAN  
Analyst: DAVID TUPPER

Date: 11-07-93  
Copy 1: DAVID TUPPER, VANACOUVER, B.C.

We hereby certify the following Geochemical Analysis of 5 SILT samples:

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<th>Sample Number</th>
<th>AU-FIRE PPB</th>
<th>AG PPM</th>
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<td>.7</td>
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</table>

Certified by

MIN-EN LABORATORIES
**Geochemical Analysis Certificate**

<table>
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<tr>
<th>Sample Number</th>
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<th>AG</th>
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<td>93TC-R001</td>
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<tr>
<td>93TC-R002</td>
<td>16</td>
<td>.8</td>
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</tbody>
</table>

*We hereby certify the following Geochemical Analysis of 2 ROCK samples*

Certified by [Signature]

MIN-EN LABORATORIES
**MIN-EN LABS — ICP REPORT**

705 WEST 15TH ST., NORTH VANCOUVER, B.C. V7M 1T2

FILE NO: 3V-0168-LJ1

DATE: 93/11/07

FILE: SILT  (ACT:F31)

| SAMPLE NUMBER | AG PPM | AL PPM | AS PPM | B PPM | BA PPM | BE PPM | BI PPM | CA PPM | CD PPM | CO PPM | CU PPM | FE PPM | K PPM | LI PPM | Mg PPM | Mn PPM | Mo PPM | Na PPM | Ni PPM | P PPM | PB PPM | SB PPM | SR PPM | Ti PPM | V PPM | Zn PPM | Ga PPM | Sn PPM | W PPM | Cr PPM |
|---------------|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--------|--------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|
| 931C-L001     | .1     | .97    | 1      | 2     | 106    | .5     | 6      | .78    | .1     | 14     | 24     | 2.45  | .14   | 13    | .78   | 393    | 1     | .01   | 41    | 1190   | 18    | 2     | 18    | 4     | 884   | 47.8  | 40    | 4     | 1     | 4     | 50    |
| 931C-L002     | .1     | 1.51   | 2      | 4     | 287    | .9     | 6      | 1.16   | .1     | 19     | 49     | 3.26  | .19   | 18    | 1.01  | 723    | 2     | .01   | 82    | 1810   | 22    | 3     | 26    | 4     | 848   | 56.9  | 80    | 4     | 1     | 6     | 84    |
| 931C-L003     | .1     | 1.81   | 1      | 6     | 276    | .9     | 9      | 1.22   | .1     | 22     | 59     | 4.07  | .25   | 25    | 1.44  | 592    | 2     | .03   | 67    | 2010   | 21    | 5     | 32    | 6     | 1704  | 82.5  | 111   | 6     | 1     | 7     | 82    |
| 931C-L004     | .1     | 1.47   | 8      | 5     | 257    | .6     | 7      | 1.04   | .1     | 18     | 55     | 3.09  | .21   | 17    | 1.21  | 470    | 3     | .02   | 63    | 1510   | 24    | 4     | 26    | 6     | 1077  | 56.8  | 111   | 6     | 1     | 6     | 74    |
| 931C-L005     | .1     | 1.58   | 1      | 6     | 381    | .7     | 10     | .86    | .1     | 23     | 80     | 3.92  | .28   | 18    | 1.31  | 513    | 1     | .02   | 65    | 1760   | 13    | 3     | 23    | 8     | 1440  | 70.9  | 86    | 6     | 1     | 7     | 78    |
APPENDIX VII

Petrographic Report
Report # 940193 for:

David Tupper,
800 - 900 West Hastings Street
Vancouver, B.C., V6C 1E5

April 1994

Property: Copper Queen (Cu-occurrence)

Samples: Core, Hand

Summary:

Samples are of metamorphosed andesite (probably slightly porphyritic flows with plagioclase phenocrysts). Alteration assemblages are plagioclase-amphibole-(biotite/chlorite) with minor ilmenite and accessory to trace epidote and apatite.

Sulfides occur as disseminated patches and lenses (commonly parallel to foliation). In the hand sample these are mainly chalcopyrite and sphalerite with minor pyrite. In the core sample these are mainly pyrrhotite with minor pyrite and marcasite and trace chalcopyrite.

Hand Sample: This is a meta-andesite containing relic phenocrysts of plagioclase in a well foliated groundmass dominated by chlorite with less abundant tremolite/actinolite and minor ilmenite. Chalcopyrite and sphalerite are concentrated strongly in a few coarse patches; chalcopyrite also forms abundant, much finer, disseminated grains. Foliation and some ilmenite grains are warped slightly about small kink folds. Sulfide patches do not show deformation textures, suggesting that they were recrystallized after the weak kink deformation.

Core Sample: This is a meta-andesite which was metamorphosed to a moderately well foliated schist dominated by plagioclase and actinolite with less abundant biotite/chlorite and calcite. Ankerite forms lenses/veins parallel to foliation. Sulfides include pyrrhotite and minor pyrite and marcasite and trace chalcopyrite.

John G. Payne, PhD.,
Tel: (604)-986-2928
Fax: (604)-983-3318
Hand Sample: Meta-Andesite: Chlorite-Plagioclase-Actinolite-Quartz Schist with lenses and patches of Chalcopyrite-Sphalerite

The sample contains relic phenocrysts of plagioclase in a well foliated groundmass dominated by chlorite with less abundant tremolite/actinolite and minor ilmenite. Chalcopyrite and sphalerite are concentrated strongly in a few coarse patches; chalcopyrite also forms abundant, much finer, disseminated grains. Foliation and some ilmenite grains are warped slightly about small kink folds. Sulfide patches do not show deformation textures, suggesting that they were recrystallized after the weak kink deformation.

| Phenocrysts | Groundmass | Chlorite | Tremolite/Actinolite | Plagioclase | Quartz | Ilmenite | Chalcopyrite | Sphalerite | Epidote | Apatite | Pyrite | Galena |
|-------------|------------|----------|---------------------|-------------|--------|---------|-------------|------------|---------|---------|--------|--------|--------|
| Plagioclase | 7-10%      | 50-55    | 15-20               | 5-7         | 1-2    | 1-2     | 2           | 0.5        | 0.2     | 0.1%    | trace  | trace  |

Plagioclase forms subhedral, equant relic phenocrysts or porphyroblasts averaging 0.5-0.8 mm in size and locally up to 1.5 mm. Some contain moderately abundant inclusions of ragged, prismatic tremolite/actinolite grains. Plagioclase also forms patches of anhedral, slightly to moderately interlocking aggregates of grains averaging 0.05-0.15 mm in size.

Chlorite is concentrated in chlorite-rich bands up to 2 mm wide parallel to foliation, in which it forms flakes averaging 0.1-0.4 mm long. Pleochroism is from very pale to light green. Tremolite/actinolite is concentrated in clusters averaging 1-1.5 mm in size and bands parallel to foliation as ragged prismatic grains averaging 0.1-0.2 mm in length. It also forms scattered grains and clusters of grains averaging 0.5-1 mm long and a few clusters of fibrous, subradiating grains averaging 0.05 mm in size. Pleochroism is mainly from very pale to pale/light green. A few prismatic grains up to 0.5 mm long of actinolite are pleochroic from light to medium green.

Quartz is concentrated in one band up to 2 mm wide in which it forms grains averaging 0.3-0.7 mm in size in part intergrown intimately with tremolite/actinolite and in part interstitial to sulfides.

Ilmenite forms tabular grains averaging 0.1-0.2 mm long and locally up to 0.5 mm long; many are intergrown with chlorite flakes parallel to foliation.

Epidote forms disseminated, anhedral to subhedral, prismatic grains averaging 0.05-0.15 mm in size in chlorite-rich patches.

Apatite forms subhedral, prismatic grains averaging 0.12-0.2 mm long and 0.1-0.15 mm across.

(continued)
Chalcopyrite forms irregular patches up to 2.5 mm in size concentrated in one actinolite-quartz-rich band parallel to foliation. Bordering these patches and elsewhere in the groundmass, chalcopyrite forms disseminated grains averaging 0.01-0.1 mm in size intergrown intimately with clusters of actinolite.

Sphalerite forms anhedral grains averaging 0.15-0.5 mm in size and a few up to 1 mm long, commonly associated with coarse patches of chalcopyrite. It is medium orange in colour and contains minor exsolution blebs of chalcopyrite averaging 3-5 microns in size.

Pyrite forms subhedral, equant grains averaging 0.1-0.25 mm in size, mainly in cores of sulfide patches.

Galena forms one anhedral patch 0.04 mm across associated with a small patch of sphalerite.
Core Sample: Meta-Andesite: Plagioclase-Hornblende-Biotite-Ankerite-Calcite Schist

The sample is a moderately well foliated schist dominated by plagioclase and actinolite with less abundant biotite/chlorite and calcite. Ankerite forms lenses/veins parallel to foliation. Sulfides include pyrrhotite and minor pyrite and marcasite and trace chalcopyrite.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Plagioclase</td>
<td>35-40%</td>
</tr>
<tr>
<td>Actinolite</td>
<td>30-35</td>
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<tr>
<td>Biotite-Chlorite</td>
<td>10-12</td>
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<tr>
<td>Calcite</td>
<td>8-10</td>
</tr>
<tr>
<td>Ilmenite/Ti-oxide</td>
<td>1-2</td>
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<tr>
<td>Pyrrhotite</td>
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<tr>
<td>Pyrite</td>
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<td>Epidote</td>
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<tr>
<td>Marcasite</td>
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</tr>
<tr>
<td>Chalcopyrite</td>
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<td>Veinlets/Lenses</td>
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<td>Ankerite</td>
<td>5-7</td>
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<td>Plagioclase-(Calcite)</td>
<td>Trace</td>
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Plagioclase forms a few anhedral relic phenocrysts or porphyroblasts averaging 0.5-0.7 mm in size. Alteration is slight to sericite and chlorite. In the groundmass, plagioclase forms aggregates of equant grains averaging 0.03-0.07 mm in size; this plagioclase is more sodic than the coarser grains and is relatively fresh.

Actinolite forms ragged prismatic grains averaging 0.2-0.7 mm long. Pleochroism is form light to medium green. A few clusters are of ragged prismatic to fibrous grains averaging 0.05-0.25 mm long. It is concentrated moderately in a few lenses up to 1.5 mm wide parallel to foliation.

Biotite forms flakes averaging 0.3-0.5 mm long and locally up to 1 mm long. Pleochroism is from pale to medium reddish brown. Some of the biotite grains are replaced completely by pseudomorphic, pale green chlorite.

Calcite forms disseminated grains averaging 0.1-0.2 mm in size. It is concentrated moderately in lenses up to a few mm long and 0.5 mm wide parallel to foliation as grains averaging 0.3-0.7 mm in size.

Ankerite/siderite is concentrated in seams or veinlets parallel to foliation averaging 0.2-0.5 mm wide as very fine to extremely fine grained aggregates. Alteration is slight to limonite which gives the mineral a light orange colour and high apparent relief. Intergrown with ankerite/siderite in some lenses are flakes of chlorite.

Ilmenite forms equant grains and clusters averaging 0.05-0.12 mm in size and subhedral tabular grains averaging 0.15-0.25 mm long. Alteration is common to leucoxene, mainly in irregular patches along grain margins.

Epidote forms anhedral grains averaging 0.1-0.2 mm in size intergrown with actinolite.

Apatite forms equant grains averaging 0.1-0.15 mm in size and a few up to 0.3 mm across.

(continued)
Core Sample

Pyrrhotite forms equant grains averaging 0.05-0.2 mm in size and a few lenses up to 1 mm long. Several of the latter are altered with dusty non-reflective grains which give the patch a moderately lower reflectivity than normal. A few grains are recrystallized to extremely fine grained (?)marcasite/pyrite along their margins.

Pyrite forms a few clusters up to 1 mm long of subhedral, cubic grains averaging 0.1-0.2 mm in size and locally up to 0.5 mm long; some contain several irregular inclusions averaging 0.01-0.025 mm in size of chalcopyrite and/or pyrrhotite. A few patches up to 0.5 mm in size contain cores of subhedral pyrite grains averaging 0.1-0.15 mm in size, and rims up to 0.06 mm wide of very fine grained marcasite.

Chalcopyrite forms anhedral grains averaging 0.03-0.07 mm in size associated with pyrrhotite lenses and inclusions in pyrite.

A few wispy veinlets up to 0.03 mm wide are of very fine grained plagioclase and minor chlorite.