ROCK GEOCHEMISTRY, ASSAYS
PETROGRAPHIC AND MINERALOGIC REPORT
ON THE
JOE ANNE GROUP OF MINERAL CLAIMS

Nanaimo Mining Division
Latitude 49°44'N; Longitude 125°22'W
NTS 92F/11W, 14W

Report For
IRON RIVER RESOURCES LTD.
1910 Galerno Road
Campbell River, B.C.
V9W 1K6

GEOLOGICAL BRANCH
ASSESSMENT REPORT

15.116

by
K.E. NORTHCOTE AND ASSOCIATES LTD.
Alassis, P.E.

September 6, 1986
K.E. Northcote Ph.D., P.Eng.
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ROCK GEOCHEMISTRY, ASSAYS
PETROGRAPHIC AND MINERALOGIC REPORT
ON THE
JOE ANNE GROUP OF MINERAL CLAIMS

SUMMARY

The property, consisting of 5 JOE ANNE claims of 20 units each and 12 two-post PICK UP claims, is located approximately 29 kilometres southwest of Campbell River, B.C. in the Nanaimo Mining Division, NTS 92F/11W and 14W. A logging road system provides access to both sides of the property.

Samples from 18 sites were sent for Au and Ag geochemical analysis, ICP analysis for 27 elements, and 2 for Au assay. Petrographic and mineralogic analyses were completed on 34 thin sections, 2 polished thin sections and 6 polished sections. Photomicrographs show mineralogic and textural relationships. All of this work was completed in the period June 15 to July 15, 1986.

Assay and geochemical analyses produced 2 samples with values greater than 1000 ppb Au and 5 samples with values greater than 15 ppm Ag. Samples 86 JA-4 and 5 gave 1350 and 1250 ppb Au respectively and when fire assayed gave significantly higher values of 0.072 and 0.069 oz Au/ton.

Initial surveys on the JOE ANNE claims have resulted in the discovery of a Tertiary pluton-polyphase intrusion-hydrothermal breccia complex bounded on the north by a hornfelsed halo within Nanaimo Group sediments. Karmutsen volcanics, which unconformably underlie the Nanaimo Group sediments, are also intruded by the plutonic members.

Later, metal-bearing, hydrothermal solutions have permeated intrusion breccias, brecciated metasediments and initially permeable metasediments.
Geochemical analyses and assays have shown that this complex hydrothermal system contains significant gold-bearing zones.

This geologic environment has high potential for discovery of base and precious metal-bearing epithermal vein-breccia-shear-gouge systems, massive replacement and disseminated deposits such as those at Mt. Washington, Faith and Gem Lakes areas. Although this environment of high mineral potential extends into Strathcona Park a large portion of greatest potential underlies the JOE ANNE claims.
INTRODUCTION

TERMS OF REFERENCE

K.E. Northcote and Associates Ltd. was contracted by Iron River Resources Ltd. to prepare a petrographic and mineralographic report supported by rock geochemistry analyses and assays on a suite of specimens from the JOE ANNE claims. The collection of samples, preparation of thin sections petrographic and mineralographic examination, geochemical analyses and assays were completed in the period June 15 to July 11, 1986.

LOCATION AND ACCESS

The JOE ANNE property is located approximately 29 kilometres southwest of Campbell River and 24 kilometres northwest of Courtenay on Vancouver Island Latitude 49°44'N, Longitude 125°121'W, NTS 92F/11W and 14W. See Figures 1 and 2. The claims are located between the southwesterly and southeasterly branching headwaters of Piggott Creek, cover Rossiter and Divers Lakes and extend to the Strathcona Park boundary. Elevations range from 1380 metres on the north end of Mount Brooks to 720 metres in the southeast branch of Piggott Creek. A logging road following the southeast branch of Piggott Creek provides access to Rossiter Lake, the common corner of JOE ANNE II and 5 claims. Another road system following the southwest branch of Piggott
Creek provides access to the west sides of JOE ANNE III and IV claims. Road distance from Campbell River is approximately 40 kilometres in each case.

MINERAL CLAIMS

The JOE ANNE claims are comprised of 5 claims of 20 units each, shown on Figure 2. JOE ANNE II, IV and 5 extend into Strathcona Park. The units or portions of units which lie within the park are excluded from the claims. No claim lines were flagged, blazed or claim posts set within park boundaries. A group of 12 two post claims, the PICK UP 1 to 12 claims were recently staked by Iron River Resources Ltd. These claims replace the former WAT 1 to 12 claims, owned by D.Dylan Watt, thus eliminating any area not owned by Iron River Resources Ltd. within the JOE ANNE claims. Table 1 lists these claims and indicates their present status.

### TABLE 1

<table>
<thead>
<tr>
<th>CLAIM NAME</th>
<th>UNITS</th>
<th>RECORD NO.</th>
<th>ANNIVERSARY DATE</th>
<th>EXPIRY DATE</th>
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<td>JOE ANNE I</td>
<td>20</td>
<td>1838 (8)</td>
<td>Aug.8/84</td>
<td>1987</td>
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<td>JOE ANNE II</td>
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<td>1987</td>
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<tr>
<td>JOE ANNE III</td>
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<td>1840 (8)</td>
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<td>1986</td>
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<td>JOE ANNE IV</td>
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<td>1986</td>
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<td>JOE ANNE 5</td>
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<td>1939 (10)</td>
<td>Oct.30/84</td>
<td>1987</td>
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<td>PICK UP CLAIMS</td>
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</tr>
<tr>
<td>PICK UP 1</td>
<td>1</td>
<td>2-post</td>
<td>2343 (5)</td>
<td>May 12/86</td>
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<tr>
<td>PICK UP 2</td>
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<td>&quot;</td>
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<tr>
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<tr>
<td>PICK UP 12</td>
<td></td>
<td>&quot;</td>
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</table>
The legal corner posts and location posts for claims comprising the JOE ANNE property were not examined to determine that they were set in accordance with the Mineral Act. It is noted, however, that those posts which were observed during property examinations appeared to be legally set and the location lines are well marked. Legality and maintenance of the claims by carrying out assessment work and filing acceptable assessment reports is the responsibility of Iron River Resources Ltd.

Because these groups of claims lie within the E & N Land Grant, there was some question regarding ownership of base metal rights and iron. Iron River Resources has copies of correspondence on file from the Attorney General's Department suggesting ownership of these rights in their favour.

GEOLoGY

The property is underlain by block faulted, gently dipping Karmutsen volcanic flows, pillow lavas and breccias with minor intercalated tuffaceous interbeds. These volcanic rocks are unconformably overlain by Nanaimo Group comprised of near flat-lying conglomerates and sandstones with interbedded siltstone and shale. In the southern part of the property this succession is intruded by Tertiary plutons, and cut by intrusion and hydrothermal breccias.

The presence of Tertiary plutons and diatremes indicates a high structural level intrusive environment which provides high potential for precious and base metal deposits as mineralized vein-breccia-shear-gouge systems, stockworks and massive replacement of certain beds within the Nanaimo Group and Karmutsen Formation.

PREVIOUS WORK DONE

The area of the JOE ANNE mineral claims was prospected by L.V. and D.P. Berkshire and R. Hunter during the 1984 and 1985 field seasons. As

Selco Division-B.P. Resources Canada Limited, carried out a geological and soil geochemical program late in the 1985 season. Emphasis was placed on soil geochemistry because snow covered most of the significant outcrops at higher elevations leaving lower drift-covered areas open.

Initial sampling of rocks and soils has produced significantly anomalous gold values. Geochemical analyses of three samples of breccia sent for assay by Northcote gave values up to 10,000 ppm Cu, 12.5 ppm Ag, and 190 ppb Au. Grab samples of breccia assayed by Selco-B.P. yielded up to 1.4 g/t Au, 9.4 g/t Ag, and 0.38% As. Results of their soil geochemistry program indicates anomalous quantities of these metals over an area approximately 1000 m by 500 m.

WORK DONE FOR THIS REPORT

Samples from 13 sites were collected June 16 and 17, 1986. From these sites 19 samples were submitted for geochemical analyses for Au and Ag. 2 for Au assay and 19 for ICP analyses for 27 elements. In addition 1 sample collected by R. Hunter and 4 samples collected during 1985 were geochemically analysed for Au and Ag, and by ICP for 27 elements. The geochemical, assay and ICP laboratory sheets are included in Appendix "B". Sample sites are indicated on Figure 3, scale 1:5000.
Petrographic and mineralogic analyses were completed on 34 thin sections, 2 polished thin sections and 6 polished sections. Photomicrographs show mineralogic and textural relationships. All of this work was completed in the period June 15 to July 15, 1986.

RESULTS

Table 2 summarizes the lithology and geochemical and assay values for Au and Ag. ICP analyses are not listed on this table but all analyses are included in Appendix "B" and their significance is discussed below.

**TABLE 2**

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>Ag(ppm)</th>
<th>Au(ppb)</th>
<th>LITHOLOGY</th>
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<tr>
<td>PLUTONS</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2+00S 4+60W</td>
<td>3.7</td>
<td>5</td>
<td>Granodiorite/quartz diorite</td>
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<tr>
<td>7+00S 2+00E</td>
<td>1.7</td>
<td>12</td>
<td>Quartz diorite</td>
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<tr>
<td>86 JA-13</td>
<td>0.4</td>
<td>10</td>
<td>Quartz diorite</td>
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<tr>
<td>86 EL-6</td>
<td>0.8</td>
<td>8</td>
<td>Feldspar porphyry</td>
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<tr>
<td>1+75S 2+00W</td>
<td>6.2</td>
<td>39</td>
<td>Quartz impregnated pluton</td>
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<tr>
<td>BRECCIAS</td>
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<tr>
<td>5+25S 6+75W</td>
<td>1.8</td>
<td>10</td>
<td>Intrusive breccia</td>
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<tr>
<td>3+00S 7+00W (A&amp;B)</td>
<td>1.2</td>
<td>1</td>
<td>Intrusive breccia</td>
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<tr>
<td>2+00S 5+90W</td>
<td>1.5</td>
<td>2</td>
<td>Amphibole hornfels breccia</td>
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<tr>
<td>5+25S 2+00W</td>
<td>0.4</td>
<td>10</td>
<td>Hydrothermal breccia</td>
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<tr>
<td>4+25S 2+00W</td>
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<td>8</td>
<td>Diatreme breccia</td>
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<td>1</td>
<td>Hydrothermal breccia</td>
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<tr>
<td>86 JA-3(Float)</td>
<td>1.5</td>
<td>2</td>
<td>Hydrothermal, intrusive breccia</td>
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</table>
Assays and geochemical analyses produced 2 samples with values greater than 1000 ppb Au and 5 samples with values greater than 15 ppm Ag. The 2 samples from sites 86 JA-4 and 5, giving 1350 and 1250 ppb Au respectively, when fire assayed, gave significantly higher values of 0.072 and 0.069 oz Au/ton.
It is noted in ICP analyses that highest gold and silver values correspond to generally higher but not necessarily the highest As, Bi, Cd, Pr, Sr and Zn values. More samples are required for meaningful statistical analysis.

Site 86 JA-4 is an iron-stained, weathered zone in hydrothermally altered intrusion breccia with most of the sulphides weathered out. See Figure 3.

Site 86 JA-5 is sulphide mineralized, quartz-sericite altered open space quartz veined intrusion and hydrothermal intrusion breccia which appears in abundance in talus below a northerly trending structure cutting at a low angle into the cliffs above. The mineralized material appears to have been derived from within this structure.

PETROGRAPHY AND MINERALOGY

Petrographic studies to date confirm a high level intrusive plutonic environment accompanied by disrupted, open-space, chloritic brecciation of both the plutonic and sedimentary units with intense hydrothermal alteration and siliceous veining in close proximity to the plutons. Outside of this intensely brecciated zone an envelope of less fractured static metamorphosed hornfelsed Nanaimo Group impure sandstone, shales and conglomerates extends for a least 500 metres out from the plutons.

Hydrothermal silicification and sericitization commonly accompanied by sulphide mineralization permeates the intrusion breccias and brecciated metasediments over broad areas. Degree of alteration ranges from complete replacement of original material leaving ghost-like outlines of former intrusion breccia fragments and conglomerate clasts to partial which shows incomplete permeation and alteration of these materials. Drusy quartz crystals lining open cavities accompanied by sulphide mineralization are common in breccias and conglomerates. Late fracture systems superimposed on the above may be totally or partially filled by quartz, lesser sericite
and are commonly accompanied by sulphide mineralization.

Mineralization of several varieties are noted.

Static mineralization of hornfels, disseminated to massive.

(a) pyrrhotite-pyrite
(b) magnetite

Silicification, sericitization, vugs

(a) chalcopyrite-hematite (with silver values)
(b) pyrite-arsenopyrite-hematite (with gold values)

Composite quartz veins (with gold values)

(a) arsenopyrite-pyrite-chalcopyrite-sphalerite-pyrrhotite-galena-hematite.

Segregation of specific sulphides was noted in polished sections of composite veins suggesting separate pulses of mineralization.

CONCLUSIONS

Initial surveys on the JOE ANNE claims have resulted in the discovery of a Tertiary pluton-polyphase intrusion-hydrothermal breccia complex bounded on the north by a hornfelsed halo with Nanaimo Group sediments. Karmutsen volcanics, which unconformably underlie the Nanaimo Group sediments, are also intruded by the plutonic members.

Later, metal-bearing, hydrothermal solutions have permeated intrusion breccias, brecciated metasediments and initially permeable metasediments.

Geochemical analyses and assays have shown that this complex hydrothermal system contains significant gold-bearing zones.
This geologic environment has high potential for discovery of base and precious metal-bearing epithermal vein-breccia-shear-gouge systems, massive replacement and disseminated deposits such as those at Mt. Washington, Faith and Gem Lakes area. Although this environment of high mineral potential extends into Strathcona Park a large portion of greatest potential underlies the JOE ANNE claims.
CERTIFICATE

I, Kenneth E. Northcote of 2346 Ashton Road, R.R. # 1, Agassiz, B.C. do hereby certify that:

1] I have been practising as a professional geologist for a period of approximately 25 years for petroleum exploration companies, mining exploration and consulting companies, federal and provincial agencies.

2] I obtained a Ph.D. in geology from U.B.C. in 1968 and qualified for registration with the Association of Professional Engineers of B.C. in 1967.

3] This Petrographic and Mineralogic Report is a result of work done personally on the JOE ANNE claims.

4] I have no interest in the properties or securities of Iron River Resources Ltd., nor do I expect to receive any.

5] I consent to the use of this report in, or in connection with, a prospectus relating to the raising of funds.

Dated at Agassiz B.C. this 6th day of September, 1986.

[Signature]

K.E. Northcote, P.Eng.
REPORTS PERTAINING TO THE JOE ANNE PROPERTY


**Project 86-1**

Iron River Resources Ltd.
1910 Galerno Road
Campbell River, B.C.

Invoice No. 1119
June 15 to July 15, 1986

**PROFESSIONAL FEES (Reduced rate 250/day[field] 200/day[office])**

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<td>June 16</td>
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<td>June 17</td>
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<td>1/2 day consultation &amp; travel n/c</td>
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<td>June 22</td>
<td>1/2 day sample prep. for assay, petrographic sections $100.</td>
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**B.K. Northcote**

June 16 | 1 day @ 75/day | $75 |

**FOOD AND LODGINE**

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**TRAVEL**

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<td>June 18</td>
<td>Kilometerage Campbell River Agassiz 200 Km x .25</td>
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<td>June 15</td>
<td>Ferry n/c (split)</td>
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**VANCOUVER PETROGRAPHICS**

Thin sections, polished sections, polished thin sections and stained slabs
Note: 15 thin sections and stained slabs prepared and paid for earlier

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**Total**

$600.00

$187.50

$251.47

$93.00

$320.50
ASSAY MIN-EN LABORATORIES
June 25  5 x 11.50  57.50
July  5          361.00
    7          37.50
    7          15.00

PETROGRAPHY/MINERALOGY
35 thin sections @ 45.00  1 575.00
  2 polished ts @ 90.00  180.00
  6 polished sec. @ 45.00  270.00
  Total 2 025.00  Less 15%

MISCELLANEOUS
Shipping and handling charges
Samples to V.P. 10 x 2  20.00
Samples to M-E. 10 x 3  30.00
Telephone n/c
Sample bags n/c

REPORT PREPARATION
K.E.N. Prep. of Manuscript 2 days @ 200  640.00
P. Stoeckly draughting 4 hours  40
Typing and compilation  150
Xeroxing/reproduction(6 copies)  50

PHOTOMICROGRAPHS AND PHOTOGRAPHS
Photographs 16 x 5.00(dup. 16x5x1.00)  $160.00
Photomicrographs 32 x 5.(dup. 32x5x1.00)  320.00

Total  $4 612.22

Sub total  $1,452.47

471.00

1,518.75

50.00

640.00

480.00

$4,612.22
APPENDIX "A"

PETROGRAPHIC AND MINERALOGIC DESCRIPTIONS
PLUTONIC ROCKS
Sample 2+00S 4+60W
Granodiorite/quartz diorite

MACROSCOPIC
Granodiorite, fine grained seriate, leucocratic, altered bleached mafics, conspicuous interstitial quartz.

Disseminated pyrite.
Stained slab; shows a narrow quartz-K-spar veinlet cutting through section and weak (5%) interstitial K-spar in rock matrix.

MICROSCOPIC  Percentages and grain sizes are visual estimates
Plagioclase 40% anhedral grains, sericitic alteration some remnant polysynthetic twinning.
Orthoclase 5% not positively identified in thin section
Quartz 30% anhedral interlocking, crushed appearance
Amphibole? -5%; shredded grain remnants associated with chlorite
Chlorite; -10%; clusters of grains interstitial to quartz and plagioclase, amphibole remnants and disseminated grains
Sericite? Bladed radiating high birefringent material, sericite? parallel extinction.
Veins-
Epidote
Quartz
K-spar
Opaque, -1% disseminated pyrite
Iron staining, hematite
Sample 7+00S 2+00E
Quartz diorite

MACROSCOPIC
Granitic, fine/medium grained, leuco/mesocratic, quartz distinct interstitial, mafic 10%, blotchy appearance by clusters of fine grains, hornblende more abundant than biotite.
Stained slab—possible traces K-spar

MICROSCOPIC
Percentages and grain sizes are visual estimates
Plagioclase; 70% -0.1 (to 2.5mm) laths, normal/weak oscillatory zoning An27 to 40.
K-spar; not detected in thin section
Quartz -10% (-0.1 to 1.0mm), anhedral, interstitial irregular
Mafic; +15%
(a) hornblende -10% (-0.01 to 1.0mm) irregular ragged grains, sieve texture, partial alteration to chlorite, interstitial clusters of fine grains.
(b) biotite +5% -0.01 (to 0.3mm) aggregates of shredded ragged grains
(c) chloritic -5% alteration, weak alteration of hornblende and chlorite.
Opaque; -5% irregular grains (-0.01 to 0.1mm) associated with mafics

Texture
Granitic, hypidiomorphic granular seriate.
Sample 86-JA-13
Quartz diorite

MACROSCOPIC
Quartz diorite, fine/medium grained, mesocratic with hornblende more abundant than biotite. Quartz is fairly conspicuous as interstitial clusters of small to medium grains
Stained slab, shows less than 5% interstitial clusters of fine K-spar

MICROSCOPIC  Percentages and grain sizes are visual estimates
Minerals Present
Plagioclase; 70%, subhedral laths (to 1.5mm) unaltered, oscillatory zoning An$_{28}$ to An$_{38}$
Orthoclase; not confirmed in section but present in stained slab.
Hornblende; 15%, anhedral, irregular (to 2.0mm) green, pleochroic contains irregular zones remnant augite within hornblende crystals.
Biotite; -5%, irregular laths (to 1.5mm) some alteration to chlorite, locally shredded appearance
Quartz; -10%, anhedral grains (to 0.5mm) interstitial, generally aggregates of grains
Apatite; trace, euhedral crystals (-0.1mm)
Chlorite; traces, alteration of biotite
Epidote; traces, anhedral, irregular grains (to 0.3mm) associated with mafic hornblende
Opaque; -1%, irregular grains to 0.3mm.
Quartz diorite; plagioclase, quartz, hornblende, chlorite

As above
Sample 85-EL-6
Feldspar porphyry
MACROSCOPIC
Fine grained feldspar porphyry, 40% phenocrysts, plagioclase and hornblende, no conspicuous quartz.
Stained slab shows diffuse K-spar impregnation outwards from veinlets

MICROSCOPIC Percentages and grain sizes are visual estimates
Phenocrysts 40%
Plagioclase; 25% (-0.1 to 1.5mm) subhedral laths, weak sericitic alteration, fine oscillatory zoning An_{42} to 32
Chlorite/biotite; 5% (to 0.5mm) green color, shredded appearance, chloritic alteration of amphibole
Hornblende/actinolite, 10% (to 1.0mm) pleochroic green color, bladed appearance. Note different varieties represented by intense pleochroism, vivid birefringence but showing characteristic amphibole cleavage.
Groundmass 60%
Fine feldspathic groundmass, 60%, (-0.01 to 0.1mm) as irregular grains with scattered small subhedral laths producing an overall granular texture
Quartz; -5% A few small anhedral grains scattered in matrix
Opaque; -5% occurs as a fine dusting scattered throughout matrix with a tendency to form concentrations around margins of some feldspar grains

Texture
Porphyritic, subhedral plagioclase and shredded hornblende/actinolite altered to green biotite and chlorite.

Veins
(a) Prehnite(?) moderate to high birefringence, biaxial, 2V about 60°, high (+) relief
(b) Quartz
Specimen 1+75S 2+00W

Quartz impregnated, sericite-carbonate-chlorite altered, hematite-stained plutonic rock.

MACROSCOPIC

Fine-grained feldspathic, siliceous impregnated rock, containing irregular masses of chlorite in clusters of fine grains and as weak irregular veinlets. Strong pinkish overprint of hematite stain. Disseminated irregular grains of pyrite.
Stained slab; no evidence of K-spar.

MICROSCOPIC

Percentages and grain sizes visual estimates using calibrated analyzer lenses.

Minerals Present

Plagioclase; 25%, ghost-like outline (0.2 to +1.5mm) strong sericite and carbonate alteration.
Sericite; 25% radiating aggregates of small fibrous crystals pseudomorphous after plagioclase.
Carbonate; -10%, large irregular sieved masses to 2mm in optical continuity. Fine anhedral grains (-0.01 to 1.5mm) associated with sericite replacing plagioclase.
Quartz; 30%, (0.05 to 1.0mm) anhedral interstitial impregnations and as veinlets.
Chlorite; 10%, interstitial large patches to 2mm composed of clusters of radiating anhedral blade-like crystals (0.1mm), probably replacing former mafic minerals, and in discontinuous irregular veinlets.
Hematite; -5% in discontinuous fractures and irregular random disseminated flecks (-0.01 to 0.1mm)

Texture

The plates of former plagioclase crystals are sieved and almost completely replaced by irregular grains of sericite and carbonate forming near-continuous masses pseudomorphous after plagioclase.
Quartz impregnated, sericite-carbonate, chlorite altered, hematite-stained, pluton.

As above
Specimen 1+75S 2+00W

Texture (Continued)

These irregular grains have been brecciated and impregnated by quartz. Overprint of reddish brown hematite flecks. Late fracture crackles filled by quartz.
BRECCIAS
Sample 5+25S 6+75W
Intrusive breccia

MACROSCOPIC

Compact intrusive breccia composed of plutonic mesocratic fine/medium grained, quartz diorite fragments a fraction of a cm to several metres in diameter with scattered but abundant generally smaller aplite/felsite and pinpoint vuggy siliceous fragments. Scattered vuggy zones with quartz crystals growing inwards. High fragment to matrix ratio. Matrix, mafic-rich, chlorite. Traces of disseminated pyrite. Iron-stained fracture surfaces
Stained slab shows no evidence of K-spar.

MICROSCOPIC Percentages and grain sizes are visual estimates.

Fragments
Quartz diorite; composed of sericitic plagioclase, quartz and chloritized mafic.
Quartz aggregates; aggregates of anhedral quartz grains

Matrix
Quartz grains/fragments, 30%, (-0.05 to 1.0mm), subangular
Sericitized plagioclase grains/fragments, 40%, (-0.05 to 1.0mm)
Chlorite; 30%, interstitial between quartz and sericitized plagioclase fragments.

Texture
Close packed quartz diorite and quartz aggregate fragments in a dense fine cataclastic textured groundmass of quartz and sericitic plagioclase grains/fragments in a chlorite-rich matrix.

Note: Because of the coarse fragmental nature of this breccia a large number of thin sections of clasts would be required to illustrate compositional differences. This section was prepared to show the characteristics of the matrix.
86 P III-17  Sample No 5+25S  6+75W

Compact intrusion breccia, high fragment to matrix ratio, sericitic quartz diorite fragments in a fine chlorite-rich matrix. Iron-staining.

86 PMG IV -8  Sample No 5+25S  6+75W  Scale  0.1mm

Intrusion breccia, sericitic quartz diorite fragments in fine chlorite-rich matrix.
Intrusion breccia showing quartz diorite and felsite breccia fragments in a finer quartz, sericitic feldspar and chlorite-rich matrix.

Intrusion breccia similar to 5+25S 6+75W, but with porphyritic felsite fragments and locally rich in epidote.
Specimen 3+00S 7+00W (A)
Intrusive Breccia

MACROSCOPIC
Breccia of very fine grained feldspathic felsic (?) fragments, lesser coarser plutonic quartz diorite fragments. Fine epidote-rich matrix among breccia fragments with fine lithic fragments, quartz and feldspar crystal fragments. Traces of disseminated pyrite. Stained slab; no K-spar evident, felsic fragments etch producing a fine powder.

MICROSCOPIC Percentages and grain sizes are visual estimates using calibrated analyzer lenses.

Minerals Present
Felsite fragments-60% grain size (-0.01 to 0.04mm)
  Feldspar 50%
  Quartz 15%
  Sericite 15%
  Chlorite -10%
  Epidote -5%
Texture very fine grained (-0.01 to 0.04mm) anhedral quartz feldspar, abundant sericite lesser chlorite grains. Has appearance of mylonitized rock crushed to very fine grain-size and reindurated
Plutonic fragments 5% with grain size (-0.01 to 0.3mm)
  Feldspar, plagioclase, twinned laths to 0.3mm
  Quartz; 10%, anhedral interstitial
  Chlorite; -5%, anhedral clots
Texture; fine/medium grained, hypidiomorphic granular
Matrix 35%
  Quartz and feldspar fragments (-0.01 to 0.2mm) with small lithic fragments as above in an epidote-rich chloritic groundmass (to 25%)
Chloritic matrix, felsitic fragments.
Specimen 3+00S 7+00W (A)

**Texture**

Dislocation and crackle breccia composed of lithic felsite and lesser fine-grained plutonic fragments in an epidote-rich matrix with fine quartz and feldspar crystal fragments.

Specimen 3+00S 7+00W (B)

Intrusive Breccia, similar to 3+00S 7+00W (A)

**MACROSCOPIC**

Breccia fragments of fine-grained felsite, porphyritic or pseudoporphyritic leucocratic feldspathic fragments with lesser coarser plutonic (quartz diorite) fragments in a chlorite-rich matrix containing smaller lithic, and quartz, and feldspar fragments. Traces of disseminated pyrite. Stained slab indicates no K-spar present.

**MICROSCOPIC** Percentages and grain sizes are visual estimates

Lithic fragments

(a) Very fine granular felsite/cataclasites

(b) Pseudoporphyritic felsites/cataclasites

(c) Quartz diorite

Matrix

Chlorite with small lithic, quartz and feldspar crystal fragments.
Sample 2+00S 5+90W
Amphibole hornfels breccia

MACROSCOPIC
Dark grey to black, generally very fine grained mottled by scattered indistinct coarser grains and ghost-like outlines of possible lithic clasts, well indurated, dense.
Strong disseminated pyrite magnetite and pyrrhotite generally very fine grains with scattered coarser. Magnetic Stained slab, no evidence of K-spar

MICROSCOPIC Percentages and grain sizes are visual estimates
Ghost-like fragments
Feldspathic material, 60% (-0.01 to +1mm) former plagioclase crystals altered to granular texture, pseudomorphic outline; indistinct grain boundaries
Quartz; 10% scattered anhedral and clusters of grains (-0.01 to 1.5mm), crackled, mottled extinction
Amphibole 15% shredded prismatic crystals
Biotite -5% traces, irregular shredded appearance veins
Epidote trace.
Opaque 10% pyrite, pyrrhotite, magnetite (-0.01 to 0.1mm) anhedral irregular (pyrrhotite & pyrite) and euhedral (pyrite)

Texture
In thin section the rock appears as indistinct aggregates of feldspathic material forming ghost-like lithic fragment outlines. Randomly disseminated anhedral and clusters of anhedral quartz grains and disrupted veinlets. Broken coarse grained feldspar and quartz crystals. Strong disseminated pyrite, pyrrhotite and magnetite. Weak crackle quartz veining.
Amphibole hornfels breccia; ghost-like lithic fragments of aggregates of feldspathic material. Randomly disseminated anhedral quartz grains, clusters of grains and disrupted veinlets. Strong disseminated pyrite, pyrrhotite and magnetite.

As above
Sample 5+25S 2+00W
Quartz sericite hydrothermal breccia

MACROSCOPIC
Groundmass of sugary vitreous quartz grains surrounded by white sericite. Numerous vugs and druses lined by quartz crystals. Vugs contain iron stained leached residue. Breccia nature clearly discernable in outcrop and hand specimen.
Note- This breccia appears to be only weakly mineralized but requires careful mapping, sampling and assaying.
Stained slab; no evidence of K-spar.

MICROSCOPIC Percentages and grain sizes are visual estimates
Breccia Fragments
Quartz; 85%, (-0.01 to +1.0mm) anhedral interlocking quartz grains
Sericite; 15% aggregates of very fine grains interstitial to quartz grains. Some scattered coarser muscovite.
Opaques; traces scattered grains associated with hematite.
Hematite; widely scattered clusters of hematite grains and associated iron staining in open space vugs and coating some quartz grains.
Biotite; iron stained-as clusters of grains in druses and vugs

Texture.
Quartz sericite breccia with open space quartz crystal lined druses, brecciated nature not obvious in thin section.

As above, with cavity appearing dark through x-nicols.
Specimen 4+25S 2+00W

Diatreme Breccia

**MACROSCOPIC**
Diatreme breccia, high fragment low matrix ratio. Fragments in specimens to several centimetres, composed of felsite, granular drusy quartz and quartz crystals. Some iron-staining in matrix following fractures.
Stained slab; no evidence of K-spar staining

**MICROSCOPIC** Percentages and grain sizes are visual estimates

**Fragments**
(a) Quartz fragments, broken fragments 5mm in optical continuity, mottled extinction as a result of fracturing.
(b) Granular quartz, anhedral, (0.2 to 1.0mm) irregular interlocking "picture puzzle" texture
(c) Felsite(?), very fine granular (-0.01 to 0.02mm) quartz, feldspar(?), sericite, compact. Sericite forms an irregular, discontinuous network; in some fragments intense, masking former textures

**Matrix**
Fine fragmental (-0.01 to 0.7mm)
Quartz
Chlorite and green mica
Sericite
Feldspar
Zircon (trace)
Opaque very fine irregular grains
Iron staining and hematite
Diatreme breccia, high fragment to matrix ratio, fragments felsite, granular drusy quartz and quartz crystals in a very fine chlorite-sericite-rich matrix
Quartz, granular quartz and felsite(?) fragments in a fine fragmental quartz, sericite, chlorite, feldspar-rich matrix. Iron-staining in fractures.

As above
Sample 5+50S 6+75W  Float

Intrusive breccia

MACROSCOPIC

Block of float 30x15 cm. Abundantly iron-stained, weathered with siliceous and altered feldspar-rich fragments to 10 cm. Open space drusy cavities between fragments with quartz crystals growing inwards. Veined by quartz.

Cut surface shows a fine fragmental texture with pervasive quartz matrix, pinpoint druses.

Stained slab; no evidence of K-spar

MICROSCOPIC Percentages and grain-sizes are estimated.

Fragments and Matrix

Seritized pseudomorphs after subhedral feldspar crystals, 40%, (-0.05 to 1.5 + mm). Sericitized feldspar-rich fragments and aggregates of grains. Some remnant twinning visible.

Aggregates of anhedral quartz grains, 30%, (to 1.5+ mm), impregnation? and late veining.

Sphene; traces, (to 0.2mm), anhedral

Veins and Cavity Fillings

Quartz; 15%, euhedral quartz crystals (to several mm) in veins and fracture fillings.

Sericite; -10%, in clusters of radiating grains

Amphibole (?)-5%, fibrous radiating, green pleochroic, high birefringence

Chlorite; -5%, in clusters of granular structured grains with internal radiating texture

Iron staining pervasive throughout

Texture

Thin section composed of fragments of quartz aggregates and completely sericitized feldspar in a matrix of drusy quartz with clusters of radiating grains of sericite and chlorite. Veining by late quartz.

Pervasive iron-staining.
Sample 86JA-1  A & B (two sections)
Hydrothermal breccia

MACROSCOPIC
Polymictic breccia, metasedimentary, siliceous and plutonic fragments. Strongly chloritic very fine fragmental matrix. Fragments range in size from a fraction of a centimetre to several metres in diameter. Moderate clast to matrix ratio. Large open space cavities visible in outcrop; weakly drusy in handspecimen lined by quartz crystals, traces of chalcopyrite. Iron stained.
Stained slab; no evidence of K-spar.

MICROSCOPIC  Percentages and grain sizes are visual estimates

Fragments
Metasedimentary hornfels; (a) very fine-grained quartz, 35%; sericitic 40% (altered feldspar?) aggregates, interstitial chlorite, 25%
(b) very fine-grained, highly siliceous, 85%; chlorite, 15%
Quartz aggregates; anhedral grains (to +1.0mm) forming angular siliceous breccia fragments

Matrix
Minute lithic fragments of those described above with a chloritic matrix.

Veins
Veined and impregnated by quartz. Crackle fractures filled with chlorite.

Vugs, partial filling
(a) Quartz; euhedral crystals
(b) Chlorite; fibrous radiating
(c) Sphene; traces
(d) Zircon; trace
(e) Sericite/green biotite/amphibole; fibrous, radiating high birefringence, shredded.
(f) (?), high/moderate (+) relief, low birefringence, subhedral
Sample 86-J-1

Polymictic hydrothermal breccia; metasedimentary, siliceous and plutonic fragments in strong chloritic matrix. Open cavities. Chalcopyrite mineralization.

Sample 86-JA-2

Silicified polymictic intrusion breccia, leucocratic intrusive, siliceous and minor metasedimentary angular breccia fragments in a fine fragmental chlorite-rich matrix.
hexagonal like apatite but appears to be biaxial (-),
angular extinction no obvious cleavage, weak?
Iron staining in vugs and fractures.

Sample 86 JA-2
Silicified intrusive breccia

MACROSCOPIC
Lithic fragments in outcrop range from a fraction of centimetre to several metres. Moderate fragment to matrix ratio.
Stained slab; no evidence of K-spar

MICROSCOPIC Percentages and grain sizes are visual estimates

Fragments
Leucocratic plutonic; composed of:
Quartz grains; 30%, anhedral (to 1.0mm)
Plagioclase laths; 60%, (to 1.0mm) moderate to strong sericite weak to moderate carbonate alteration
Chlorite; -10%, irregular interstitial
Note: some of the more quartz-rich fragments thought to be plutonic in origin may in fact be metasandstone.
Sericitized porphyry (?)
Altered metasediments; (1)subangular to subrounded quartz grains in an interlocking feldspathic, weakly altered matrix;
(2) chlorite-rich very fine grained metasediments.
Quartz; fragments composed of aggregates of anhedral quartz grains to 2.0 mm. May represent brecciated early stage veining.
Matrix
Small composite lithic fragments of the above
Quartz
Feldspar; weak to moderate sericite, carbonatized
Sphene; trace, anhedral grains
Chlorite; interstitial
Carbonate; associated with sericitized feldspar
Opaque; -1%, small anhedral/irregular grains to 0.1mm associated with chlorite or with hematite in cavities

Cavity fillings
Quartz; suspect that some potion of quartz content is a result of silicification (impregnation) accompanying cavity filling
Sericite
Chlorite
Hematite
Veining
Brecciated veins

Sample 86 JA-3  Float below iron-stained zone in cliff face
Hydrothermal altered intrusive breccia
MACROSCOPIC
Intrusive breccia consisting of leucocratic/mesocratic plutonic fragments, conspicuous quartz, with open drusy quartz-lined cavities and quartz veining. Quartz crystals in vugs to several mm; traces of chalcopyrite. Pervasive iron-staining.
Stained slab; no evidence of K-spar
MICROSCOPIC  Grain size and percentages are visual estimates
Fragments; not conspicuous in thin section
Plutonic fragments; interlocking intergrowth of sericitized plagioclase laths and quartz
Hydrothermal altered, veined intrusive breccia. Float from below iron-stained zone in cliff face.

Gold bearing, hydrothermal altered, weathered intrusive (?) breccia.
Quartz; 35%, anhedral grains (to 1.0 mm) some of this quartz may be a result of impregnation accompanying quartz veining. Feldspar; 60%, strongly sericitized lath-shaped pseudomorphs (to 1.0 mm) Small amount of remnant twinning visible An\textsubscript{35}. Forms irregular masses to several mm. Discontinuous net-like structure.

Opaque; -5%, irregular iron-stained interstitial patches

Note: Some fragments tentatively classified as altered plutonic may be metasandstone. Plutonic fragments would be expected to have euhedral/subhedral plagioclase laths, interstitial quartz grains, with overprint of hydrothermal quartz. Otherwise generally lower quartz content. Few conspicuous chert grains.

Veining and Vug Infilling
Quartz; anhedral/euhedral (to 1 or 2 mm)

Sericite; radiating bladed, shredded appearance (to 0.2 mm) in aggregates of several mm.

Opaque; irregular iron-stained interstitial patches

Trace apatite?

Texture

Brecciated nature not readily visible in thin section. Plutonic fragments. Interlocking grains and aggregates of abundantly sericitized plagioclase and quartz grains. Quartz-filled veinlets and quartz and sericite-lined cavities between grains. Iron-staining pervasive throughout, associated with hematite and irregular aggregates of very fine granular opaques.

Sample 86 JA-4 (Similar to 86JA-3 but from a gold-bearing zone)

Hydrothermal altered, weathered, intrusive breccia

MACROSCOPIC

Intrusive breccia consisting of altered, weathered iron-stained plutonic fragments, conspicuous quartz, intense sericitic alteration. Open drusy quartz and sericite-lined cavities. Strong iron-staining.
Silicified, sericitic, iron-stained hydrothermal gold-bearing breccia. See 86 P-III-12

As above.
Brecciated texture, conspicuous on cut surfaces.
Stained slab; no evidence of K-spar.

**MICROSCOPIC**  Grain sizes and percentages are visual estimates

**Fragments**
- Plutonic fragments; interlocking intergrowth of sericitized plagioclase laths and quartz.
- Quartz; 35%, anhedral grains (to 1.0mm) Much of this quartz is a result of impregnation accompanying quartz veining.
- Feldspar; 50%, strongly sericitized lath-shaped pseudomorphs (to 1.5mm). Some remnant twinning confirms plagioclase. An$_{30}$
- Sericitization forms a discontinuous diffuse network.
- Opaque accompanied by iron staining, 15%, irregular interstitial patches and in vugs

**Veining and Vug Infilling**
- Quartz; anhedral/euhedral (to 2mm)
- Sericite; radiating, bladed, shredded appearance (to 0.2mm) in aggregates of several mm.
- Opaque; irregular iron-stained interstitial patches

**Texture**
- Brecciated nature not readily visible in thin section. Plutonic fragments. Interlocking grains and aggregates of abundantly sericitized plagioclase and quartz grains. Quartz-filled veinlets and quartz and sericite-lined cavities between grains. Pervasive iron-staining throughout.
Sample 2+00S 1+25W Polished Thin Section
Siliceous hydrothermal breccia

MACROSCOPIC

Large siliceous fragments to several cms showing an internal mottled appearance and by iron staining suggesting incipient brecciation or earlier healed brecciation. Vuggyness evident in some siliceous fragments. Scattered fragments with plutonic texture. Matrix between fragments chlorite rich containing pods of sulphides mainly chalcopyrite.
Stained slab shows no evidence of K-spar

MICROSCOPIC  Percentages and grain sizes are visual estimates

Transmitted light
Quartz; 65% fragments of large crystals and aggregates of grains
Evidence of fractures in quartz healed by later quartz.
Sericite -10%, as clusters of grains in cavities
Unknown; -1% moderate (+) relief, low birefringence
Chlorite; 10%, in matrix strong iron staining, green, weakly pleochroic, fibrous/bladed, radiating
Sphene (?) -1%, high (+) relief and birefringence, in cavities associated with chlorite granular texture, striated clear grains parallel extinction
Hematite; 5%, associated with opaques and iron staining
Opaques; -10%, see reflected light section

Reflected light
Opaque minerals present 15%, forming composite veins
(a) Chalcopyrite; 8%, as irregular isolated grains and irregular elongate masses (to several mm)
(b) Sphalerite 1%, as small exsolution (~0.01mm) blebs and small irregular (0.1mm) masses in chalcopyrite
(i) isolated grains, very light grey
(ii) intergrowth with chalcopyrite
Sample No 2+00S  1+25W
Cut surface of mineralized siliceous hydrothermal breccia mineralized by chalcopyrite, sphalerite with lesser pyrite, pyrrhotite, hematite, pyrite, covellite, argentite (?)
86 PMG-III-21  Sample 2+00S 1+25W  Scale 0.1mm  R.L. X100

(a) Chalcopyrite, (b) covellite, (c) pyrrhotite, (d) sphalerite

86 PMG III-22  Sample 2+00S 1+25W  Scale 0.1mm  R.L. X400

(a) Chalcopyrite, (b) pyrite, (c) covellite, (d) exsolved sphalerite, (e) argentite (?)
(c) Covellite; -1% reddish orange internal reflection
(d) Hematite; +5%, irregular interstitial masses locally associated with covellite
(e) Pyrite; trace, anhedral 0.2mm
(f) Pyrrhotite; traces, small (-0.05mm) in blebs in chalcopyrite and irregular isolated grains to 0.2mm
(g) Unknown; traces, argentite, (?) medium grey, poor polish, strong anisotropic medium grey to dark grey anhedral/prismatic (.03 to .04mm) 2 extinctions for each rotation of stage

Opaque minerals predominantly chalcopyrite occurring as irregular isolated grains and forming discontinuous irregular elongate masses in composite veins.

Sample: 86 JA-5A Polished Section

MACROSCOPIC
Silicified, sericitic, chloritic, iron-stained, hydrothermal breccia showing chloritic mafic pseudomorphs. Irregularly and diffusely veined and impregnated by quartz and sulphides. Vein contains 15 to 20% sulphides and oxides in irregular elongate aggregates of grains and to a lesser extent (<5%), disseminated in more richly impregnated wall rock.

MICROSCOPIC
Reflected light Opaque minerals represent 20% of section
Arsenopyrite 8%, euhedral/subhedral grains forming elongate irregular masses of aggregates of crystals to 0.5cm in length.
Pyrite; 2%, irregular grains generally (-0.1mm)
Hematite, +5%, irregular and diffuse interstitial masses to several mm commonly associated with pyrrhotite remnants.
Chalcopyrite; -1%, anhedral aggregates of grains and blebs exsolved from sphalerite.
Sphalerite; +2%, anhedral aggregates of grains and irregular masses (to +1.0mm), exsolution blebs of chalcopyrite
Pyrrhotite; +2%, minute blebs in sphalerite, remnant blebs and ribs in hematite, isolated irregular grains to 0.3mm in gangue

Sample 86 JA-5B Polished Section

MACROSCOPIC
Silicified, sericitic, chloritic, iron-stained, hydrothermal breccia showing chloritic mafic pseudomorphs. Irregularly and diffusely veined and impregnated by quartz and sulphides. Veins contains 15 to 20% sulphides and oxides in irregular elongate aggregates of grains and to lesser extent, -5%, disseminated in more richly quartz impregnated wall rock.

MICROSCOPIC
Reflected light Opaque minerals represent 15% of section
Minerals Present
Arsenopyrite; 8%, subhedral/euhedral crystals forming aggregates (to 2mm)
Pyrite; 5%, subhedral/euhedral crystals forming aggregates (to 3mm)
Chalcopyrite; 2%, irregular grains (to 0.3mm) interstitial to pyrite and arsenopyrite. Isolated grains in gangue (from -0.01 to 0.1mm)
Sphalerite; -1%, irregular grains (to 0.3mm) associated with chalcopyrite and galena and as isolated grains
Galena; -1%, anhedral (0.2mm) takes a poor polish, associated with sphalerite and chalcopyrite
Unidentified; very pale yellow-cream, very fine filigree intergrowth with sphalerite and extends outwards in minute fractures into gangue. Requires SEM confirmation
Sample 86 JA-5B

Unknown; cream-white color filigree texture in sphalerite(?) and gangue. Requires SEM identification.
Sample 86 JA-5B  Thin section
Hydrothermal, vuggy intrusive breccia

MACROSCOPIC

Hydrothermally altered intrusion breccia, angular altered intrusive fragments showing quartz and sericite alteration within a chlorite-rich fine fragmental matrix. Low plutonic fragment to matrix ratio. Open space quartz crystals lining vugs and cavities. Sulphides and sericite infilling among quartz crystals. Stained slab; no evidence of K-spar.

MICROSCOPIC  Percentages and grain sizes are visual estimates.

Fragments

Altered plutonic fragments consisting of:
Quartz; 55%, anhedral grains, (to 0.4mm) in interlocking arrangement with aggregates of:
Sericite; 40%, pseudomorphous after plagioclase, lath-like outlines, forming a discontinuous network.
Locally fine granular sericitic feldspar and quartz-rich lithic fragments.
Chlorite; -5%, clusters of grains

Hydrothermal Infilling, solid and open space.
Quartz, anhedral grains, (to 1.0mm), forming veins and as impregnations, open space, euhedral crystals to +2.0mm
Sericite; fibrous, radiating
Chlorite; irregular clusters of grains with fibrous radiating texture growing inwards from walls of cavities and fractures.

Texture

Low fragment to matrix ratio breccia, hydrothermally altered sericite and siliceous plutonic (much lesser matasedimentary (?) fragments in a hydrothermal siliceous-sericite matrix. Discontinuous late fracture filling by chlorite. Cavities filled or partly filled with quartz, sericite, chlorite and lesser opaques (sulphides)
Sample 86 JA-5C

Vuggy, crackle, intrusion breccia, chlorite-rich fracture fillings.

Sample 86 JA-5B

Hydrothermal, vuggy, intrusion breccia. Quartz and sericite altered intrusive fragments in a chlorite-rich fine fragmental matrix.
Sample 86 JA-5 C

Hydrothermal altered intrusive breccia

MACROSCOPIC

Cut surface indicates plutonic breccia hydrothermally altered by sericite, quartz and chlorite. High fragment to matrix ratio. Drusy cavities between fragments lined by quartz with pyrite crystals. Strong iron staining on fracture surfaces and in particular in drusy cavities masks lithology and texture.

Stained slab; no evidence of K-spar

MICROSCOPIC Percentages and grain sizes are visual estimates

Fragments

Plutonic; interlocking grains of:
Quartz; 35%, anhedral (to 0.6mm)
Sericite; plagioclase, 60% Very strong replacement of plagioclase showing pseudomorphous lath outlines (to 1.5mm)
Opaque; 5%, euhedral/subhedral pyrite grains (to 0.2mm)
Trace zircon
Traces apatite, associated with sericite/chlorite altered plagioclase

Metasediments; few small fragments fine quartz-sericite-rich

Matrix

Smaller lithic fragments forming composite grains
Sericite/feldspar
Quartz
Chlorite; fine interfragmental network and forming scattered clots of coarser grains
Opaque; very fine interstitial dusting
Cavity filling
Quartz; crystals to 2mm (+)
Hematite
Pyrite; aggregates of crystals to several mm.
Sample 86-JA-5-1
Hydrothermal breccia

MACROSCOPIC
Hydrothermal breccia, diffuse fragmental appearance mottled cream and light grey, diffuse irregular elongate fine granular masses of quartz and sericite in a fine granular quartz-rich matrix. Vuggy, drusy with quartz crystals projecting inwards from walls of vugs. Disseminated grains and irregular clusters of grains of pyrite and arsenopyrite in siliceous matrix.

MICROSCOPIC
Reflected light Opaque minerals represent 20% of section
Minerals Present
Arsenopyrite; 8%, euhedral crystals (-0.01 to 0.5mm) as individual disseminated crystals and aggregates (to 1+mm) and as inclusions in pyrite
Pyrite; 6%, euhedral crystals (-0.01 to 0.6mm) as individual disseminated crystals and aggregates of crystals (to 1.0+mm)
Sphalerite; -2%, anhedral crystals, irregular outline, (-0.1 to 0.2mm)
Chalcopyrite; -1%, anhedral grains (0.1mm) interstitial to arsenopyrite and pyrite
Pyrrhotite; -1%, anhedral grains (to 0.1mm) in gangue
Hematite; 2%, in vugs interstitial to euhedral quartz

Sample 86 JA-5-2
Hydrothermal breccia

MACROSCOPIC
Silicified, sericitized wall rock mottled light grey and light brown with a fine fragmental appearance. Cut and impregnated by diffuse multibranched quartz vein, composite, containing irregular masses to lcm of arsenopyrite and pyrite grains. Lesser disseminated sulphides in altered wall rock. Sulphides total about 25% of the polished section.
MICROSCOPIC

Reflected light  Opaque minerals represent about 25% of the polished section.

Pyrite; 15%, euhedral/subhedral crystals (-0.01 to 1.0mm) as individual grains and clusters of grains forming irregular masses (to several mm). Locally has very fine granular texture.

Arsenopyrite; 8%, euhedral/subhedral crystals (-0.01 to 0.5mm) as individual grains and clusters of grains bordering and cutting and intergrown with pyrite. Forms beaded veinlets of small euhedral crystals in small fractures in gangue.

Pyrrhotite; 2%, anhedral irregular grains (to 0.5mm) rimmed and cut by hematite alteration. Forms discontinuous diffuse pyrrhotite-rich veinlets

Chalcopyrite; -1%, anhedral grains (0.1mm) interstitial to pyrite and arsenopyrite

Sphalerite; -1%, small anhedral grains (0.1mm) widely scattered in gangue

Hematite; -1%, alteration of pyrrhotite.

Sample 86-JA-5-3 Polished Thin Section
Hydrothermal breccia

MACROSCOPIC

Silicified, sericitized wall rock mottled light grey and light brown with a fine fragmental appearance. Cut and impregnated by diffuse quartz veining showing open space drusynes. Siliceous zones and vein material contains aggregates of sulphide grains

Stained slab; no evidence of K-spar.

MICROSCOPIC  Percentages and grain sizes are visual estimates

Transmitted light

Minerals Present

Sericite, 45%
Feldspar remnants 10%±
Quartz; 40%
Opaque; 5%
Gangue consists of irregular masses of sericite (to several mm) composed of aggregates of grains (0.01 to 0.10 mm). Some remnants of feldspar grains were noted. Veined and impregnated by quartz grains (-0.01 to 1.0 mm) forming a discontinuous network. Best developed veins contain coarsest quartz crystals. Vugs lined by quartz crystals with opaque minerals associated with hematite.

Reflected light
Opaque minerals present Approximately 5% of section
Pyrite; 2%, subhedral/euhedral (to 0.5 mm) as isolated grains and clusters of grains to several mm.
Arsenopyrite; 2%, subhedral/euhedral (to 0.4 mm) as isolated grains and clusters of grains to several mm.
Chalcopyrite; -1%, anhedral irregular (-0.01 to 0.1 mm) and as minute exsolved blebs in sphalerite.
Sphalerite; -1%, anhedral (-0.01 to 1.0 mm) interstitial to pyrite, contains traces of exsolved chalcopyrite. Isolated grains in gangue. Two varieties
(a) pale grey, creamy internal reflection
(b) light grey, yellowish brown/reddish internal reflection
Covellite; traces, bright blue pleochroic, reddish brown anisotropism
Pyrrhotite; -1%, irregular grains (to 1.0 mm), associated with hematite, arsenopyrite
Galena; trace, anhedral grains (to 0.4 mm) isolated grains or clusters of grains in gangue
Hematite; -1%, irregular filigree textured grains scattered throughout gangue and in drusy cavities.

Composite veining, sulphides show some tendency for segregation into layers of predominatly one variety of sulphide.
Composite vein (a) arsenopyrite (b) pyrite (c) sphalerite (d) chalcopryrite

(a) pyrrhotite, (b) sphalerite, (c) chalcopryrite, (d) arsenopyrite
Galena in quartz gangue; pyrite bleb
Sample 85-JA-5-4 Polished Section

MACROSCOPIC

Silicified; sericitized wall rock, mottled light grey and light brown with a fine fragmental appearance. Cut and impregnated by diffuse quartz veining showing drusy vugs with euhedral quartz crystals projecting inwards from walls of cavities. Sulphides mainly pyrite, arsenopyrite tend to be segregated into diffuse layers of predominantly one type of sulphide; producing composite veins and veinlets.

MICROSCOPIC

Reflected light Opaque minerals comprise approximately 10% of section

Minerals Present

Arsenopyrite; 3%, subhedral/euhedral (-0.01 to 0.5mm) as individual grains or aggregates of grains forming irregular elongate masses (several mm). Mainly in quartz veins but also as smaller disseminated grains in quartz-sericite matrix.

Pyrite; 4%, subhedral/euhedral (0.01 to 0.5mm) as individual grains or aggregates of grains forming irregular elongate masses (several mm). Most abundant in quartz veins but also as smaller disseminated grains in quartz-sericite matrix.

Chalcopyrite; 1%, small anhedral grains (0.01 to 0.1mm) as individual grains or associated with other sulphides in quartz veinlets and in sericitic matrix

Pyrrhotite; 1%, small anhedral grains, (-0.01 to 0.2mm) clusters of grains (to 0.5mm) In quartz veinlets and in quartz-sericite gangue.

Sphalerite; -1%, small anhedral grains (-0.01 to 0.1mm) disseminated in sericitic matrix and associated with other sulphides

Hematite; associated with pyrrhotite.
Sample 86-JA-5-5  Polished Section

MACROSCOPIC
Silicified, sericitized wall rock, mottled light grey and light brown with a fine fragmental texture. Cut and impregnated by diffuse quartz veining showing drusy vugs with euhedral quartz crystals projecting inwards from walls of cavities. Sulphides, mainly pyrite and arsenopyrite tend to be segregated into diffuse layers of predominantly one type of sulphide; producing composite veins and veinlets.

MICROSCOPIC
Reflected light; Opaque minerals approximately 10% of section
Minerals Present
Arsenopyrite; 2%, subhedral/euhedral (-0.01 to 0.5mm) as individual grains or aggregates of grains forming irregular elongate masses (to several mm) Most abundant associated with quartz veins.
Pyrite; 5%, subhedral/euhedral (-0.01 to 0.5mm) as individual grains or aggregates of grains forming irregular elongate masses (to several mm) Most abundant associated with quartz veins.
Chalcopyrite; 1%, anhedral grains (-0.01 to 0.2mm) associated with other sulphides, exsolved from chalcopyrite and as isolated grains
Pyrrhotite; 1%, (-0.01 to 0.2mm) anhedral grains cut by arsenopyrite
Galena; traces, (- 0.1 to 0.3mm) light grey, poor polish, isotropic, cleavage pits.
Sphalerite; -1%, anhedral grains(-0.01 to 1.0mm) reddish internal reflection.
Hematite; associated with pyrrhotite.
Unknown (a) & (b) Intergrowth of light blue grey isotropic with cream white anisotropic. As diffuse remnants in dark grey alteration.
Argentite; trace associated with covellite
Covellite; trace with chalcopyrite
Unknown (a) and (b); intergrowth of light blue grey isotropic with cream white anisotropic. In dark grey altered groundmass
C

METASEDIMENTARY AND SEDIMENTARY ROCKS
86 JA 6 (A & B) Two sections
Hydrothermal breccia of metasedimentary conglomerate

Hand specimens contain rounded, subrounded subangular to angular polymictic clasts and fragments generally a few cms to a fraction of a cm diameter. Clasts and fragments include metasandstone and pebble conglomerate containing grains and pebbles of quartz, sericitic feldspar, and chert. The breccia shows low to moderate clast to matrix ratio. Vuggy spaces between breccia clasts are lined by quartz crystals 2 to 3 mm with iron staining and, locally, aggregates of chalcopyrite grains. Stained slabs show no evidence of K-spar.

MICROSCOPIC Grain sizes and percentages are visual estimates
Clasts and Fragments
Metasediments
Quartz and quartz grain aggregates, chert clasts, in a matrix of iron-stained sericitized, plagioclase (?) grains, quartz and chert granules
Vugs
Quartz; euhedral crystals growing inwards from the edges of the vugs (to 3+ mm)
Chlorite, aggregates of grains radiating texture, iron staining
Sericite; coarser bladed radiating aggregates of grains
Iron staining

Sample 86 JA-7
Hydrothermally altered quartz, volcanic and plutonic, cobble-chert pebble conglomerate
MACROSCOPIC
Quartz and plutonic/volcanic cobbles and chert pebbles in an altered sandy textured matrix. Cut surfaces show pinpoint vuggyness lined by quartz crystals. Large specimen cut by quartz veins. Stained slab; no evidence of K-spar.
Sample 86 JA-6

Siliceous hydrothermally altered, brecciated conglomerate. Iron stained

Matrix of above consisting of grains of chert, quartz, iron stained-sericite feldspar (?)
Veined conglomerate, approximately 1/2 scale

Conglomerate composed of volcanic, chert, quartz, and plutonic pebbles. Weak quartz veining.
MICROSCOPIC Grain sizes and percentages are visual estimates
Thin section shows quartz and chert cobbles in a sandy textured matrix.
Hydrothermal alteration by sericitic alteration of plagioclase (?) and silicification with euhedral quartz crystals projecting inwards from cavity walls with associated chlorite/sericite and iron-staining.

Matrix
Quartz grains; 30%, anhedral (to 0.4mm)
Chert grains; ~10%, very fine pavement texture of anhedral quartz
Composite sericite/quartz/plagioclase(?) grains; 30% (to 0.4mm) over all fine granular texture
Sericite/chlorite; 30%, fibrous radiating clusters of grains forming an iron-stained groundmass between grains. High birefringence present but masked by iron-staining.
Cavities
Euhedral quartz crystals to several mm have grown inwards from cavity wall
Chlorite/sericite; birefringence masked by iron-staining, interstitial to quartz crystals.
Opaque; associated with iron staining

Sample 86 JA-7A
Chalcedony, quartz intergrowth with pyrite from conglomerate zone.

MACROSCOPIC
Layered orbicular intergrowth of chalcedony with coarse open space drusy quartz between chalcedony lobes
Pyrite crystals and aggregates of grains in vugs and in quartz matrix
Iron stained
Stained slab; no evidence of K-spar
Sample 86 JA-7A

Drusy quartz, chalcedony intergrowth with pyrite in conglomerate zone
MICROSCOPIC
Obicular chalcedony containing minor calcite. Some intergrowth of coarser quartz into cavities between lobes of chalcedony. Quartz crystals to several mm.
Pyrite grains and crystals with hematite and iron-staining associated with coarser quartz crystals.

Sample 86 JA-7B
Meta volcanic/sedimentary/plutonic cobble conglomerate.
MACROSCOPIC
Plutonic/volcanic/sedimentary cobbles to a few cms diameter in a well indurated finer siliceous/feldspathic/hornblende-rich pseudogranitic textured matrix.
Rock has thermal metamorphosed baked appearance, dense indurated with widely disseminated coarse pyrite and clusters of grains.
Stained slab; no evidence of K-spar

MICROSCOPIC  Percentages and grain sizes are visual estimates.
Clasts
Volcanic origin
(a) Fine felted feldspathic weakly porphyritic flow
   Plagioclase crystallites form a felted groundmass with small clusters of radiating coarser plagioclase laths (to 0.3mm). Fine disseminated interstitial amphibole in a felted matrix with few scattered clusters of coarser grains associated with the coarser plagioclase.
(b) Coarser felted feldspathic, weakly porphyritic flow similar to (a) but groundmass of plagioclase and hornblende coarser grained to (0.2 to 0.3mm)
(c) Basaltic flow, weakly porphyritic, composition as above, coarser grain size with phenocrysts (+1.0mm)
Plutonic/hydrothermal origin
(a) Quartz clasts
(b) Quartz diorite clasts (not represented in thin section but observed in hand specimens)

Metasedimentary origin
Hornfels metasandstone/argillite; fine quartz and feldspar (?) fragments in a very fine amphibole-rich (hornblende) matrix.
Ranges from meta-argillite to metasandstone and may show layering and size gradation in the same clast.

Chert

Matrix
Quartz grains; subrounded, (to +1.0mm)
Hornblende-rich grains
Feldspar (plagioclase grains)

Lithic grains; same composition as coarser rounded clasts.
Material surrounding quartz grains shows pervasive iron-staining ranging from a brown dusting to a more uniform, continuous bright red-brown color.

Opaques; disseminated aggregates of fine opaque grains and clusters of coarser grains to 0.5+ mm in matrix and within lithic clasts.
Sample 86-JA-8
Sandstone interbedded with conglomerate

MACROSCOPIC
Light brown groundmass speckled by white grains. Fine to medium-grained quartz and altered, sericitic, feldspar grains in a sericitic matrix.
Stained slab; no evidence of K-spar.

MICROSCOPIC Percentages and grain sizes are visual estimates. It should be noted that sandstone similar to this might constitute material designated as plutonic clasts in some of the hydrothermally altered intrusion breccias described earlier.

Grains
Quartz; 45%, generally subangular grains (to 1.5 mm)
Feldspar; 20%, anhedral grains (to 1.0 mm) irregular shapes, diffuse margins, sericitic with carbonate patches. Some remnant twinning visible
Chert; ~5%, subrounded granules (to 1.0 mm) showing internal siliceous pavement-like structure
Pyrite; trace euhedral crystals
Sphene; traces, rounded grains
Hematite; trace
Matrix; 30%
Finer fragments of material forming the grains described above with chlorite as bladed radiating aggregates of grains

Close-packed, dense with no visible pore space.

Sample 86-JA-9
Silicified polycrystal conglomerate

MACROSCOPIC
Well rounded and angular polycrystal pebbles and cobbles consisting
Indurated, hydrothermally altered conglomerate. Crackled with some open space quartz veinlets.

Brecciated hydrothermally altered conglomerate showing open space cavities.
of a variety of chert, metasedimentary, plutonic and volcanic(?) clasts in a fine sandy textured matrix. The rock is well indurated and silicified. Matrix fine grained with moderate chlorite content. Generally low clast to matrix ratio. Cut by very narrow open space quartz veinlets.

Iron staining
Stained slab; no indication of K-spar

MICROSCOPIC Percentages and grain sizes are visual estimates

Cobbles and Pebbles
Chert; very fine siliceous pavement
Metasedimentary; shale, very fine granular quartz in a felted sericite groundmass, probably replacing plagioclase
Plutonic
Matrix
Quartz grains
Chert grains
Sericitized feldspar grains
Chlorite, bladed, radiating, fibrous
Vugs
Quartz
Chlorite/sericite, both appear to be present although birefringence is masked by iron staining. Bladed radiating

Veining
Diffuse veining by quartz

Sample 86-JA-10
Metasedimentary hydrothermal breccia

MACROSCOPIC
Breccia composed of fragments of metasedimentary hornfelsed impure sandstone. High fragment to matrix ratio with abundant open spaces partially filled with inward projecting quartz crystals and chlorite.
Iron staining in cavities and fractures
Stained slab; no evidence of K-spar
MICROSCOPIC Percentages and grain sizes are visual estimates

Fragments
Metasedimentary sericitic hornfels
Hornfelsed meta sandstone/siltstone; containing:
Quartz; 15 to 20%, anhedral to angular grains (to 0.15mm)
Feldspar; 30%, sericite altered ghost-like fragments (to 0.15mm)
Chert (?) 10%
These grains are in a finer matrix, 40%, of quartz, sericite, remnant feldspar.
Randomly disseminated irregular opaque grains and aggregates (to 0.10mm) with associated iron staining.

Vugs and Cavities
Minor quartz crystals (to 1mm) projecting inwards from cavity walls
Abundant chlorite as aggregates of fibrous radiating grains
Minor sericite showing high birefringence, colorless
Associated iron-staining

Sample 86-JA-11
Biotite hornfels; metasandstone/siltstone

MACROSCOPIC
Biotite hornfels; metasandstone/siltstone, fine-grained sandy texture, siliceous grains, brownish color as a result of secondary interstitial biotite, massive. Widely disseminated pyrite and pyrrhotite grains.
Stained slab; no evidence of K-spar.

MICROSCOPIC Percentages and grain sizes are visual estimates
Biotite hornfels
Grains
Quartz; 40%, subangular fragments generally 0.4mm but up to 1.0mm
Biotite hornfels

As Above
Plagioclase 30%, subangular fragments, weak sericitic alteration, twinning evident
Lithic grains; -5%, composite grains of flattened silty argillite
Opaque; -5%, anhedral irregular (to 0.2mm) disseminated grains and aggregates of grains
Zircon; trace subhedral (0.1mm)

Matrix
Biotite; 25%, aggregates of fine grains, forming interstitial grainy textured masses. Clusters of scattered coarser blades to 0.2mm

Sample 86-JA-12
Argillaceous sandstone
MACROSCOPIC
Argillaceous sandstone, quartz, feldspar and lesser mafic grains with scattered irregular diffuse shaly partings and masses possibly including carbonaceous material. Well cemented, slightly friable.
Band of iron staining about 1.5 cm in from surface leaving a bleached weathered surface layer.
Stained slab; indicates approximately 5 to 10% K-spar grains present

MICROSCOPIC Percentages and grain sizes are visual estimates
Minerals present
Quartz; 40%, subhedral/angular (generally up to about 0.4mm scattered to 0.8mm)
Plagioclase; 30%, subangular/angular (about 0.4mm) weak sericitic alteration, twinning visible
K-spar; -10%, subangular grains (about 0.4mm) confirmed by stained slab
Biotite; 15%, anhedral grains, (to 0.5mm) shredded, bent grains
Opaque; -5%, dusting, aggregates of fine irregular grains and anhedral grains (to 0.2mm) associated with hematite and iron staining masking presence of biotite grains.
Argillaceous sandstone, note detrital (?) biotite and high sericitic feldspar content.
Sample 85-EL-4
Metasandstone biotite hornfels

MACROSCOPIC
Fine quartz and feldspar and lithic grains in a pervasive secondary biotite-rich groundmass. Numerous scattered small irregular shale and feldspar-rich lithic clasts. Weak to moderately magnetic. Stained slab shows no evidence of K-spar.

MICROSCOPIC Size and percentages are visual estimates

Clasts
Quartz; 25%, (-0.01 to 1.0mm) angular to subangular grains
Feldspar; 20%, (-0.01 to 1.0mm) angular to subangular grains clouded by fine alteration.
Biotite; 5%, (to 0.5mm) shredded fragments representing larger grains of secondary biotite in matrix
Sericite; -1%, (to 0.5mm) irregular shredded fragments
Opaque; pyrrhotite, 2% (-0.01 to 0.3mm) irregular grains randomly scattered throughout matrix
Lithic Clasts -5%
(a) Metasediment; shale, biotitic hornfels
(b) Feldspar-rich lithic clasts
Matrix
Biotite; 40%, (-0.01 to 0.05mm)
Sericite; -5%, (to 0.05mm)
Quartz and feldspar; very fine grains of the same material forming larger clasts
Texture
Angular to subangular clasts of quartz, feldspar, metasedimentary shale and feldspar-rich matrix. High matrix to clast ratio. Biotite, and probably pyrrhotite result from thermal metamorphism of argillaceous sandstone.
Sample 85 EL-5
Metasandstone hornfels

MACROSCOPIC
Fine quartz and feldspathic fragments with minor pyrrhotite in a mica-rich matrix. Low matrix to fragment ratio. Stained slab shows high K-spar content in feldspar grains.

MICROSCOPIC Percentages and grains sizes are visual estimates

Grains
Quartz; 30%, (-0.05 to 0.6mm), angular to subangular grains, clear, uniform extinction.
Feldspar; 55%, (-0.05 to 0.6mm), angular to subangular, clouded by sericite alteration. Stained slab indicates high K-spar or potassium content.
Opaque; -5%, pyrrhotite (-0.01 to 0.5mm), irregular to subhedral grains
Lithic clasts; -10%
Scattered small clasts of altered argillaceous siltstone
Matrix; -10%, not readily distinguishable from altered feldspathic clasts but appears to be a very low percentage of total rock. Composed of the same material as the detrital grains. Biotite not conspicuous more sericitic.

Texture
Fine-grained angular to subangular quartz and sericite altered feldspar grains with high potassium content. Close packed showing low matrix content. Randomly disseminated pyrrhotite.
Sample 2+00S 6+00W

Amphibole Hornfels similar to 200S 5+90W

MACROSCOPIC

Mottled dark grey to black, generally very fine grained with scattered indistinct coarser grains and ghost-like outlines of possible lithic clasts, well indurated, dense. Strong disseminated pyrite, pyrrhotite magnetite Magnetic Stained slab; no evidence of K-spar.

MICROSCOPIC

Percentages and grain sizes are visual estimates

Feldspar 40% ghost-like outlines (0.05 to 1.0mm) altered to fine granular texture, weak sericitic alteration.

Quartz; 15% (-0.01 to 1.0mm) scattered large anhedral grains, aggregates of fine anhedral grains. Forms discontinuous veinlets.

Some concave and convex rounded margins suggests resorption.

Biotite; -10%, (-0.01 to 0.1mm) disseminated small shredded laths, as aggregates and in veins

Amphibole; -10% (-0.01 to 0.2mm) disseminated shredded prismatic crystals

Chlorite; 20% disseminated aggregates of crystals and in veinlets

Sericite; 5% alteration of feldspar, aggregates of minute grains and blades associated with feldspar.

Opaque; -5% (-.01 to 0.3mm) pyrite and pyrrhotite, anhedral grains and aggregates of grains. Some pyrite euhedral crystals.

Texture

In thin section the rock appears as indistinct aggregates of feldspathic material as grains, aggregates of grains and forming ghost-like lithic fragment outlines.

Randomly disseminated anhedral and clusters of anhedral quartz grains and as disrupted veinlets. Broken coarse grained feldspar and quartz crystals or grains some appear well rounded and partly resorbed.

Strong disseminated pyrite, pyrrhotite and magnetite.
Sample 5+40S 4+00E
Sericitic Hornfels

MACROSCOPIC
Dark grey to black with randomly disseminated subrounded coarse light grey quartz grains and diffuse rounded altered feldspar grains. Weakly magnetic
Stained slab; no evidence of K-spar

MICROSCOPIC  Percentages and grain sizes are visual estimates
Quartz; 25%, (.02 to 0.3mm) angular/subangular
Feldspar; 25%, anhedral grains, strongly altered into fine granular texture with strong disseminated sericite, some clouding by chlorite
Sericite; to 0.2mm as shredded grains widely scattered through finer sericitic matrix.
Matrix 50%
Finer grained quartz and feldspar fragments as above with abundant sericite to 30%, very fine grained irregular aggregates permeating throughout matrix.
Opaque-5%, (-/01 to 0.1mm) anhedral disseminated magnetite.
Trace pyrite.
Texture
Composed of former detritial grains of subrounded/subangular quartz, altered sericitic feldspar in a strong sericitic matrix containing much finer grains of quartz and feldspar.
Sericitic hornfels, detrital grains of subrounded/subangular quartz, sericitic feldspar in a strongly sericitic matrix of quartz and feldspar. Disseminated fine grains pyrite, pyrrhotite, magnetite.
Sample 2+00S 5+25W

Hornfels

MACROSCOPIC


MICROSCOPIC

Percentages and grain sizes are visual estimates

Minerals Present

Quartz; 25% subangular, (-0.01 to 0.2mm)
Feldspar, 25% sericitized, subangular, indistinct grains as a result of alteration (-0.01 to 0.2mm)
Sericite 35% alteration of feldspar (?) and as interstitial discontinuous network, individual grains (-0.01 to 0.1mm)
Biotite; 10% (0.01 to 0.1mm) light brown, interstitial, discontinuous network.
Chlorite; traces
Opaques; -5% (-0.01 to 0.15mm) small subangular to euhedral grains pyrite, pyrrhotite.

Texture

Composed of former detrital grains, subangular quartz, feldspar which has undergone strong alteration to sericite. Interstitial secondary biotite product of metamorphism.
Result of contact metamorphism during emplacement of Tertiary plutons, diatremes, hydrothermal breccias into Nanaimo Group sediments.
Specimen 1+25N 2+00W

Biotite Hornfels

MACROSCOPIC

Very fine grained, dark grey, with distinct medium brown tint as a result of secondary biotite. Contains small clasts composed of very fine/minute grains of the same material. Disseminated pyrite. Stained slab; traces of K-spar grains widely disseminated through the matrix.

MICROSCOPIC

Percentages and grain-sizes are visual estimates using calibrated analyzer lenses.

Minerals Present

Quartz; 30%, (-0.01 to 0.3mm) angular to subangular detrital grains
Plagioclase, 35%, (-0.01 to 0.7mm) angular to subangular, some twinning, An35. sericitic alteration.
K-spar; -5%, as indicated by stained slab
Biotite; 25%, (-0.01 to 0.05mm) interstitial clusters of very fine bladed crystals forming masses to 0.2mm and larger discontinuous interstitial networks. Some wisps of coarser biotite to 0.3mm with bent, shredded aspect.
Chlorite; trace, alteration of biotite
Zircon; trace of broken crystals
Epidote; trace
Opaque; 3% pyrite, irregular grains (0.01 to 0.2mm) and aggregates forming clots to 1.0mm.

Texture

Composed of former detrital grains subangular quartz, feldspar which has undergone weak alteration to sericite. Interstitial secondary biotite; product of metamorphism.
Result of contact metamorphism during emplacement of Tertiary plutons, diatremes and hydrothermal breccias into Nanaimo Group sediments.
APPENDIX "B"

ASSAY, GEOCHEMISTRY AND ICP LABORATORY SHEETS.
ANALYTICAL REPORT

Project: IR(5) NS(1)  Date of report: June 20, 1986.
File No.: 6-350  Date samples received: June 16, 1986.

Samples submitted by:
Company: K.E. Northcote
Report on: 6 & rocks assay prep Geochem samples

Assay samples

Copies sent to:
1. K.E. Northcote, Agassiz, B.C.
2. 
3. 

Samples: Sieved to mesh Ground to mesh -100
Prepared samples stored  discarded
rejects stored  discarded

Methods of analysis: Ag-nitric, perchloric digestion. AA, Au-fire.

Remarks:

SPECIALISTS IN MINERAL ENVIRONMENTS
GEOCHEMICAL ANALYSIS CERTIFICATE

COMPANY: K.E. NORTHCOTE
PROJECT: IR(5) NS(1)
ATTENTION: K.E. NORTHCOTE

FILE: 6-350
DATE: JUNE 20/86.
TYPE: ROCK GEOCHEM

I hereby certify that the following are the results of the geochemical analysis made on 6 samples submitted.

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Certified by [Signature]

[MIN-EN Laboratories Ltd.]
705 West 15th Street North Vancouver, B.C. Canada V7M 1T2
PHONE: (604) 980-5314 OR (604) 988-4524
TELEX: 04-352238
ANALYTICAL REPORT

Project: IR(5) NS(1)  Date of report: June 30, 1986.
File No.: 6-350R  Date samples received: June 27, 1986.
Samples submitted by: K.E. Northcote
Company: K.E. Northcote
Report on: 5 pulps Geochem samples

Assay samples

Copies sent to:
1. K.E. Northcote, Agassiz, B.C.
2. 
3. 

Samples: Sieved to mesh Ground to mesh

Prepared samples stored □ discarded □
rejets stored □ discarded □

Methods of analysis: 27 element trace ICP.

Remarks:

SPECIALISTS IN MINERAL ENVIRONMENTS
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## ANALYTICAL REPORT

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**Samples submitted by:**

**Company:** K.E. Northcote

**Report on:** Geochem samples

| 2 pulp | Assay samples |

**Copies sent to:**

1. K.E. Northcote, Agassiz, BC.

2. 

3. 

**Samples:** Sieved to mesh

Ground to mesh

**Prepared samples**

- stored □
- discarded □

**Rejects**

- stored □
- discarded □

**Methods of analysis:** Au-fire

**Remarks:**

---

SPECIALISTS IN MINERAL ENVIRONMENTS
Certificate of ASSAY

Company: K.E. NORTH COTE
Project: IRR-86
Attention: K.E. NORTH COTE

We hereby certify the following results for samples submitted.

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Certified by

MIN-EN LABORATORIES LTD.
ANALYTICAL REPORT

Project: IRR-86  Date of report: July 1, 1986.

File No.: 6-385  Date samples received: June 24, 1986.

Samples submitted by: K.E. Northcote

Company: K.E. Northcote  Geochem samples

Report on: 19 rocks assay prep  Assay samples

Copies sent to:
1. KE Northcote, Agassiz, B.C.
2. 
3. 

Samples: Sieved to mesh  Ground to mesh: -100

Prepared samples: stored [X]  discarded [ ]

rejects: stored [X]  discarded [ ]

Methods of analysis: Ag-nitric, perchloric digestion. A.A.  Au-fire.

27 element trace ICP.

Remarks:

SPECIALISTS IN MINERAL ENVIRONMENTS
GEOCHEMICAL RESULTS CERTIFICATE

COMPANY: K.E. NORTHCOSE
PROJECT: IRR-86
ATTENTION: K.E. NORTHCOSE
FILE: 5-185
DATE: JULY 1/86
TYPE: ROCK GEOCHEM

We hereby certify the following results for sample submitted.

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Certified by [Signature]

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