FIN CLAIMS

(Pearson Option)

Geology and Geochemistry

Omineca Mining Division, B.C.

N.T.S. 94 E 2

February, 1980

L. Haynes D. Knight

7750

FIN CLAIMS
(Pearson Option)
Geology and Geochemistry
Omineca Mining Division, B.C.
N.T.S. 94 E 2
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CLAIMS		RECORD #	EXPIRY DATE
Fin 1	(20 units)	1437 (9)	27 Sept. 1979
Fin 2	(20 units)	1438 (9)	27 Sept. 1979
Fin 3	(1 unit)	1439 (9)	27 Sept. 1979
Fin 4	(20 units)	1864 (7)	3 July 1980
Fin 5	(8 units)	1865 (7)	3 July 1980
Fin 6	(6 units)	1946 (8)	3 Aug. 1980

Location: $57^{\circ}14'$N, $126^{\circ}41'$W
Owner: Bradford D. Pearson
Operator: Rio Tinto Canadian Exploration Ltd.
Work Performed: June 6 to August 16, 1979

FIN CLAIMS

(Pearson Option)

Geology and Geochemistry

Omineca Mining Division, B.C.

N.T.S. 94 E 2

February, 1980

SUMMARY

The Fin claims cover a porphyry copper prospect located in the Thutade Lake - Finlay River area of British Columbia. During the 1979 field season geological mapping, soil and stream geochemical sampling, prospecting and line cutting were carried out over the property.

The property was found to overlie Jurassic to Triassic volcanics that have been intruded by younger Jurassic granodiorites. Weak copper mineralization was found in four locations on the property and several zones of intense prophylitic and phyllic alteration were mapped. The results of soil sampling outline five zones of anomalous metals. Two of these are believed to be transported anomalies. The remaining three may represent porphyry copper mineralization.

Diamond drilling is recommended to test the known mineralization and altered zones for their porphyry copper potential. Detailed mapping of the altered zones, the geochemical anomalies and the areas of mineralization is also recommended.

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FIN CLAIMS

(Pearson Option)

Omineca Mining District, B.C.

Geology and Geochemistry

1. INTRODUCTION

The Pearson Option is a porphyry copper prospect located in the Finlay River area of British Columbia. From June 6 to August 16, 1979, field work entailing geological mapping, soil and stream sediment geochemical sampling and prospecting was carried out over the property.

Field work was carried out by a seven man crew under the direction of David Knight and was supervised by Larry Haynes, a permanent staff member with Rio Tinto Canadian Exploration Ltd.

Results of the programme are discussed in the following report.

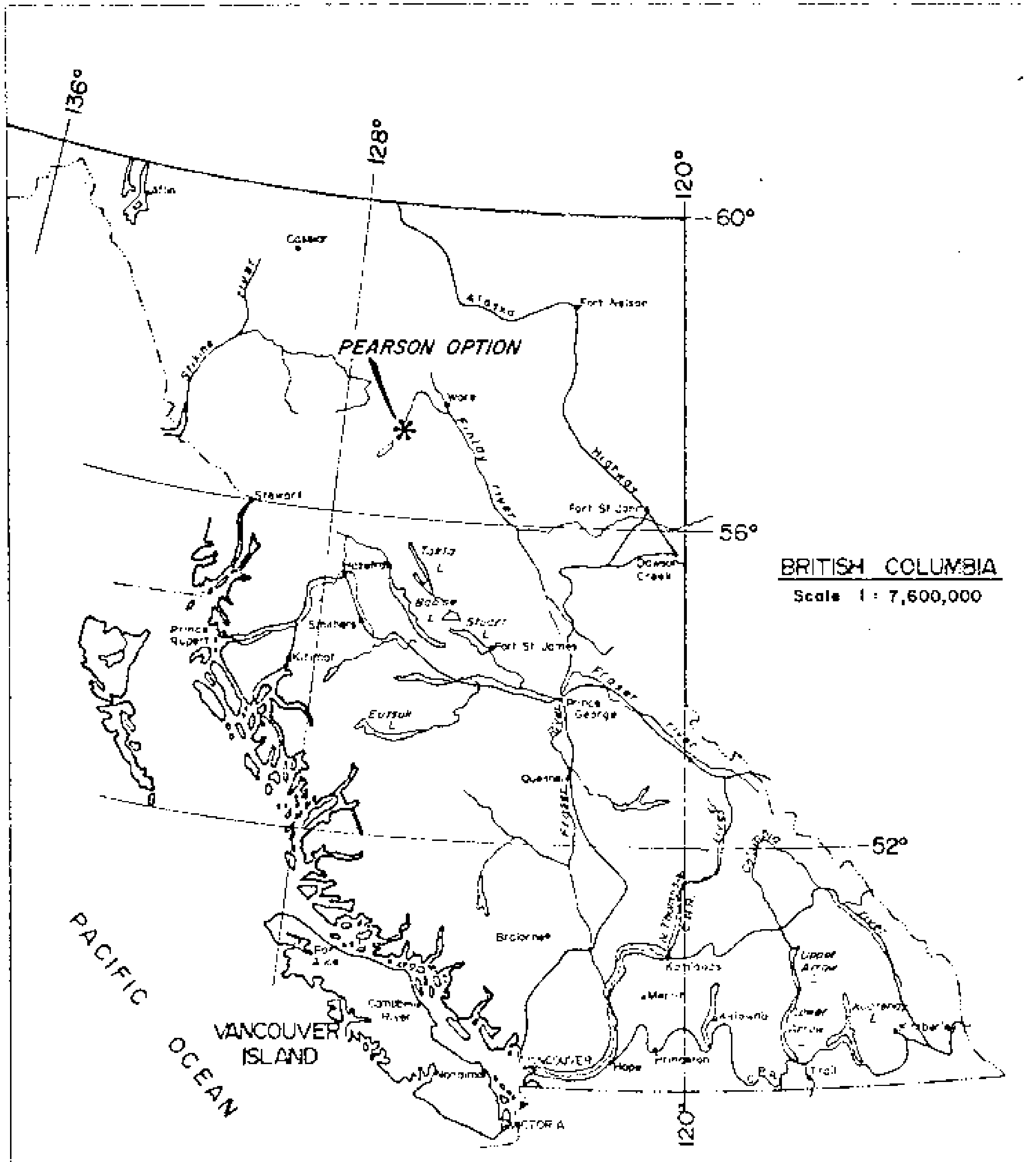
1.1 Location and Access

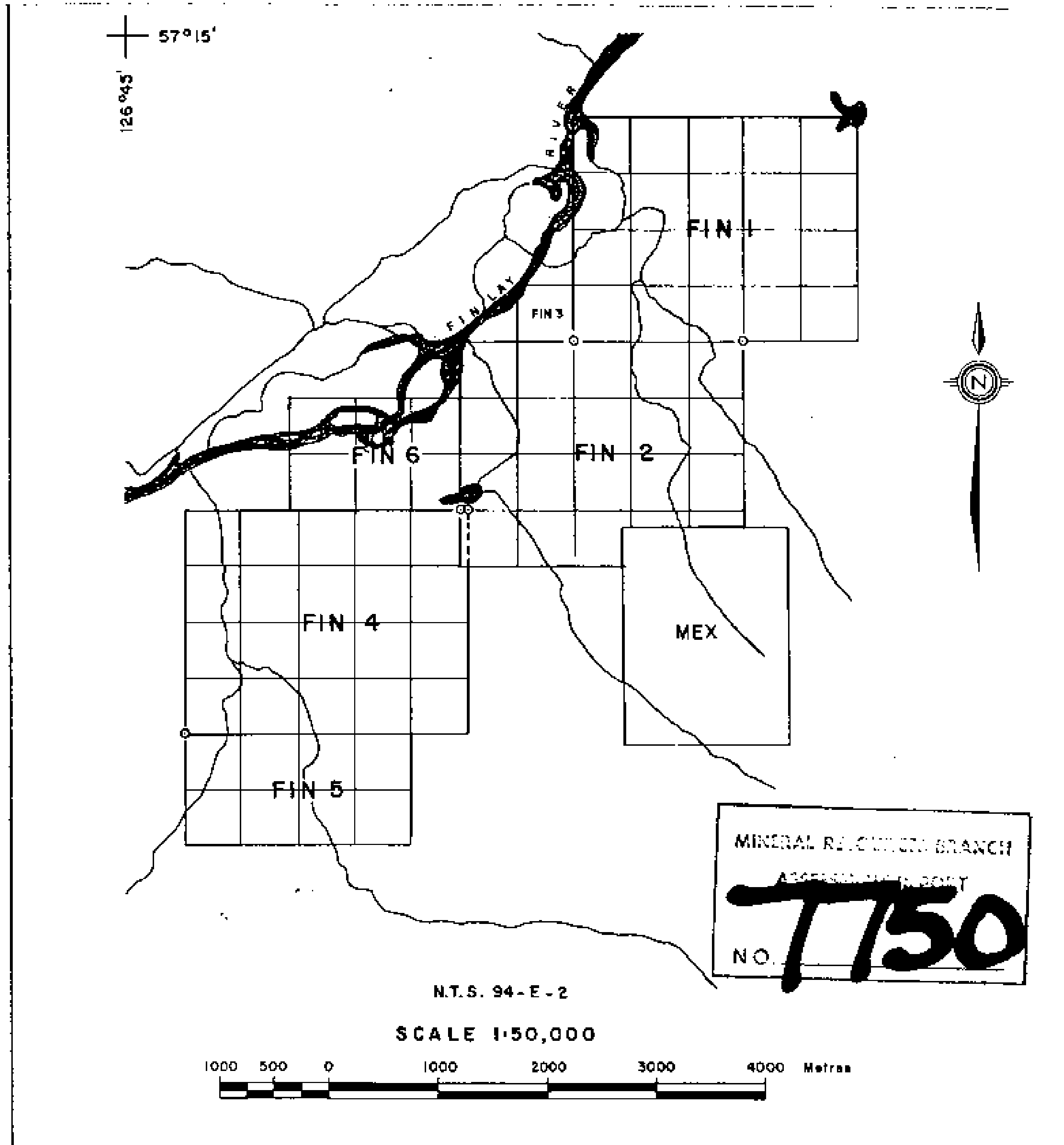
The Pearson Option (Fin Claims) is located in the Omineca Mining District, B.C., approximately 20 km northeast of the northern end of Thutade Lake and 1 km south of the Finlay River. The claims encompass an area of approximately 19 km^2 centering on Latitude 57°14'N and Longitude 126°41'W.

Access to the property is by helicopter. The summer field programme was mobilized from Smithers, B.C. Men, equipment and supplies were moved by fixed wing aircraft to the Sturdee River airstrip approximately 27 km west of the property , then by helicopter.

1.2 Topography

The Fin Claims encompass some 19 km^2 of relatively flat terrain on old terraces of the Finlay River. At this point the Finlay River flows northeast along a broad (5 km wide) valley through the Swannel Ranges. Elevations range from 1000 m to 1200 m above sea level.





RIO TINTO CANADIAN EXPLORATION LTD.

PEARSON OPTION B.C.

LOCATION MAP

JAN. 1980	L.H./y.m.	DWG. L-6608

1.3 Property and Claim Status

The Pearson Option currently consists of six mutually contiguous mineral claims totalling 75 units. The claims, their record numbers and anniversary dates are given in the table below. Map C-7545 shows the location of the soil sample grid relative to the claim boundaries.

TABLE I
Claim Status

Claim Name	Record Number	Anniversary Date
FIN 1 (20 units)	1437 (9)	27 Sept. 1979
FIN 2 (20 units)	1438 (9)	27 Sept. 1979
FIN 3 (1 unit)	1439 (9)	27 Sept. 1979
FIN 4 (20 units)	1864 (7)	3 July 1980
FIN 5 (8 units)	1865 (7)	3 July 1980
FIN 6 (6 units)	1946 (8)	3 Aug. 1980

1.4 History and Previous Work

The Fin Claims were optioned by Riocanex from Bradford D. Pearson in October 1978. Pearson staked these claims during September 1978 to cover a porphyry copper-molybdenum prospect that he had identified through reviewing B.C. Ministry of Mines Assessment Reports.

The Fin Claims cover portions of an area that was worked by Kennco Exploration (Western) Ltd. during the period June 1968 to April 1973. Kennco's work included soil and silt sample surveys, ground and airborne magnetometer surveys, reconnaissance I.P. and geological mapping. Details of this work is documented in B.C. Dept. of Mines Assessment Reports 1846, 1886, 1983, 2035, 2326, 2380, 3031, 3120, 3266 and 4396.

1.5 Work by Riocanex in 1979

Field work commenced on June 6, 1979 and continued until August 16, 1976. During this period the following work was completed.

(1) A base line totalling 6.9 km was cut.
(2) The property was mapped at a scale of 1:5000 with emphasis given to defining the major rock units and alteration assemblages.
(3) Soil and silt sampling was carried out over most of the property.
(4) Three additional claims, FIN 4, FIN 5 and FIN 6 were staked.

2. GEOLOGY

2.1 General Geology

The Fin Claims are underlain by a series of upper Triassic to lower Jurassic volcanic flows that have been intruded by a granodiorite of Jurassic age. The volcanics consist mainly of pink porphyritic dacite flows, with minor andesite and basalt. The granodiorite has several phases, ranging in texture from inequigranular to porphyritic.

The volcanics and intrusives have been hydrothermally altered and show several propylitic and phyllic zones. The alteration is most intense within the centre of the property. The phyllic zones occur in several locations near the centre of the property and are surrounded by propylitic alteration. The propylitic alteration is most intense near the phyllic zones.

2.2 Procedure and Presentation of Data

David Knight, currently a graduate student at University of Manitoba co-ordinated the geological mapping and assisted with the preparation of this section of the report. Mapping was carried out by pace and compass traverse using the soil sample grid for control. Geology was plotted directly on a 1:5000 scale base map, contoured at 10 m intervals.

The detailed geology of the property is shown on two accompanying drawings, G-8708-1 and G-8708-2. Discussion and description of the map units follows in the section entitled 'Local Geology'.

2.3 Local Geology

The local geology is divided into four units: overburden, altered rocks, intrusives and volcanic. Thin section descriptions of the altered rocks, intrusives and volcanics are included as Appendix A in this report. Reference to these descriptions is made in discussions of the various rock units.

2.3.1 Overburden

Some 85% of the property is covered by overburden including bog, swamp material or unconsolidated glacial debris.

The unconsolidated glacial debris includes till, moraine and kames. Near the Finlay River these deposits are up to 30 metres in thickness. Elsewhere on the property the thickness of overburden represented by bog, swamp or unconsolidated glacial deposits is assumed to be a thin veneer, not more than 10 metres thick. Glacial features suggest a southwest to northeast ice direction.

A weakly consolidated mixture of glacial till with angular and rounded boulders of volcanic and intrusive rocks has been mapped as Unit 5. This rock is a glacial derived paraconglomerate which varies in thickness from two to five metres. For purposes of reporting this unit has been included with overburden.

2.3.2 Altered Rocks

At several locations on the property the rocks are so intensely altered that their primary textures have been destroyed. The classification of these rock units is based on mineral assemblage only.

Unit 4a is a highly fractured, silicified, and sericitized rock with primary quartz eyes and 1% to 5% pyrite. Remnant feldspars approximately 1 mm square, may be present. Unit 4a is best exposed in the major northwest-southeast creek canyons that cut the property, however, it is not restricted to these canyons.

Unit 4b is a highly fractured and pyritized rock with intense propylitic alteration that is represented by epidote. The groundmass is aphanitic and either a light grey or dirty cream white in colour. No other distinctive macroscopic characteristics can be observed. Unit 4b is best seen in the two northwest-southeast trending creek canyons that expose unit 4a.

Thin section description of unit 4a (sample #508) and unit 4b (sample #510) describe these rocks as altered dacite porphyry or possibly a quartz-feldspar porphyry.

Unit 4c, a highly fractured and iron stained rock, has only been mapped at one location on the property. The rock is strongly leached and altered to clay minerals (kalonite (?) and sericite). As with units 4a and 4b no primary textures are visible.

Unit 4d is a medium to dark grey, aphanitic to very fine grained rock. The rock is moderately fractured and is characterized by its high magnetite content, approximately five percent. This unit has only been mapped in one area near the northeastern boundary of the property.

2.3.3 Intrusives

At least five different types of intrusive rocks are readily recognized on the property. These units are identified according to differences in texture, grain size and mineral composition. Other intrusive rocks having slight variations from these four units have not been differentiated.

Unit 3a is a fine to coarse grained light pink-orange granodiorite (see thin section description - sample #513) concentrated in the northeastern half of the property. The granodiorite is usually unaltered, massive, and poorly fractured with a composition of approximately 65-75% feldspar, 10-15% quartz as quartz eyes, 5-10% biotite, 0-5% amphiboles and 1% magnetite or less. Secondary minerals are iron oxide, epidote and chlorite altering ferramagnesian and some manganese oxide.

Units 3b, 3c and 3d form mapable but isolated outcrops. Unit 3b is a cream white, medium to coarse grained, equigranular rock with subhedral to euhedral grains. Mineral composition is 65-75% feldspar, 15-20% amphibole, 0-5% biotite, 0-10% interstital quartz and occasional fine grained xenoliths up to five centimetres in diameter.

Unit 3c is a pink-orange, fine to medium grained, inequigranular rock with anhedral to euhedral crystals. Mineral composition is 75% feldspars, 20% ferromagnesian (biotite?) and 2% magnetite. This unit shows chlorite and epidote alteration near quartz-pyrite veins.

Unit 3d is a light pink aphanitic felsite dike with very fine grained phenocrysts of feldspar (5-10%) and quartz eyes (0-5%).

Unit 2a, a porphyritic granodiorite (see thin section description - sample #507) outcrops throughout the property. However, the best exposures are in the southwestern half of the property. These rocks have a pink-orange to grey aphanitic to very fine grain groundmass with coarse grain phenocyrsts. The rock usually consists of 40 to 60% groundmass, 30-40% feldspars, 10-15% ferromagnesian (amphiboles and or minor biotite), 0-5% quartz, 0-2% magnetite and minor pyrite. In places ferromagnesian minerals show a preferred orientation.

No contacts between the different intrusives have been mapped. There is weak evidence to suggest that unit 2a may be subvolcanic, possibly older than the unit 3 intrusives.

2.3.4 Volcanics

Volcanic rocks on the property have compositions that range from felsic-rhyodacites to mafic andesites or basalts. The volcanics cover much of the southwestern corner of the property and where overburden is not so extensive a repetition of units from felsic to mafic can be seen. For the most part these rocks are porphyritic with an aphanitic groundmass. Some units are completely aphanitic or very fine grained. The volcanics have been divided into units according to colour of groundmass,texture, percent and coarseness of phenocrysts.

Unit 1a is a porphyritic orange-pink rock with an aphanitic groundmass usually with fine to medium grain phenocrysts. The unit is porphyritic and probably of rhyodacite or dacite composition. (See thin section description - sample #512). The rock is usually unaltered, massive and may show alignment of amphibole phenocrysts. Phenocrysts range from 0 to 25 percent of the rock. Their composition and abundance are: feldspars 0-15%, biotite 0-4%, amphiboles 0-4%, quartz 0-1%, and magnetite 0-1%.

Later investigators have called unit 1a a dike rock instead of a volcanic. While there is a possibility that some of unit 1a is intrusive, in this report it will be called volcanic since it covers such a large area.

Unit 1b is a dark bluish green-grey porphyritic rock with an aphanitic to very fine grain groundmass. Phenocyrsts range from 50 to 75 percent of the rock. Their composition and abundance are: feldspar 20-40%, ferromagnesian (biotite and amphiboles) 10-15%, magnetite 0-2% and minor pyrite. The mafics are usually completely altered to chlorite or epidote. Thin section description of this volcanic (sample #511) suggests a dacitic composition of tuffaceous origin.

Unit 1c is a purple porphyritic andesite with an aphanitic groundmass and medium to coarse grain feldspar (20-25%) and ferromagnesian (5%) phenocrysts.

Unit 1d is a light green-grey rock composed of crystals, crystal fragments, and rock fragments within an aphanitic groundmass. The phenocrysts are feldspars (20%) and amphiboles (5%) with minor rock fragments. This unit has been mapped as a dacite crystal tuff.

2.4 Alteration and Mineral Zoning

The alteration types recognized on the Fin claims are predominantly propylitic and phyllic with minor argillic zones. Results of the alteration mapping are shown on geology maps (G-8708-1 and G-8708-2). A discussion of mapping techniques, types of alteration and possible interpretation follows.

2.4.1 Alteration Mapping

Mapping of the alteration was based on a qualitative measurement of type, intensity, and pervasiveness of alteration by hand sample examination. The types of alteration are represented by a capital letter P for propylitic, A for argillic, S for phyllic, and K for potassic alteration. The intensity of alteration is an estimate of the degree of alteration of an average altered grain and is measured by the numbers 1 to 10. 1 means that the average grain is 10% altered, 10 means the average grain is 100% altered to a different mineral. Pervasiveness is the extent to which the whole rock is altered and is estimated from hand sample or outcrop by the numbers 1 to 10. 1 means 10% of the rock is altered and 10 means that 100% of the rock is altered.

e.g. P56 means propylitic alteration with an intensity of 50% and pervasiveness of 60%.

2.4.2 Propylitic Alteration

Propylitic alteration extends over most of the property. Towards the property boundaries it becomes weak or missing and when present is represented by a few epidote veinlets and slight chloritization of the ferromagnesian minerals. Towards the centre of the property propylitic alteration generally increases; epidote veinlets increase in size and density, epidote begins to replace ferromagnesians, chloritization is more intense and both the magnetite and pyrite content increase. The proximity of propylitic zones to phyllic zones near the center of the property indicate the alteration is due to hydrothermal activity and not regional metamorphism.

2.4.3 Phyllic Alteration

Phyllic alteration is located near the center of the property. These zones which may be up to 250 metres in diameter are so altered that no primary textures are seen. The phyllic zones are characterized by a mineral assemblage of quartz, sericite and pyrite. Quartz is present as primary (?) quartz eyes or an alteration product. Pyrite occurs mainly as disseminations and ranges from 1% to 5% of the rock.

Phyllic alteration was first thought to be due to syngenetic alteration of felsic volcanics. However, the very large vertical and planar extent of the alteration, presence of pyrite and quartz veinlets, intense fracturing, and proximity of intrusives suggest hydrothermal alteration. The zone that illustrates this relationship best is at 25 + 50W, 5 + 00N. Here, granodiorite intrudes a series of felsic volcanics. The volcanics have been altered to the same extent and intensity as unit 4a.

2.4.4 Argillic Alteration

Argillic alteration is present in one or two locales and is indicated on the geology map. These zones show clouding of the feldspars to a dull white with only a few sericite flakes and may be a less intensely altered phyllic zone. The areas are small and do not seem to have any great importance.

2.4.5 Magnetite and Pyrite Halos

Magnetite and pyrite show a spatial distribution around intensely altered zones and copper mineralization.

Magnetite forms halos within the propylitic and surrounding the phyllic zones. The magnetite content increases from $\ll$1% at the periphery of the propylitic to 1-3% near the inner edge of the prophylitic zone. Normally there is no magnetite in the phyllic zones, however, isolated occurrences of magnetite content may reach 1%.

Pyrite also forms halos, with most of the pyrite occurring in the phyllic zone. Pyrite increases (at the expense of magnetite) from 1% at the edges of the phyllic zone to 2-5% of the rock in the centre of the phyllic zone. Both pyrite and magnetite content increase where copper mineralization is found.

2.5 Structure

Due to the small amount of outcrop in the area, little can be said about structure.

Intrusion of the grandiorite must have been passive as there is little or no fracturing near intrusive-volcanic boundaries. Where contacts between intrusive and volcanic were observed, the volcanics were moderately fractured (fractures ever 9 cm). Some xenoliths of volcanics are found within the intrusive.

Several areas of intense fracturing are exposed along northwest-southeast trending creek canyons. These areas were initially interrupted as fault zones which had hydrothermal solutions passing through them. However, no evidence for large faults has been found.

3. GEOCHEMISTRY

3.1 Sampling, Sample Preparation and Analytical Procedure

Soil samples were collected over most of the property from a grid established by chain and compass. A N45^{O}E base line was cut for control.

Soil sample lines were run perpendicular to the base line and spaced every 150 metres. Soil sample sites were selected every 75 metres and the sample site was marked on flagging tape. Soil samples were collected from the 'B' horizon wherever possible. The only exceptions occurred where the 'Ah'(humus) horizon was the only accessible horizon. Samples were normally collected with a light mattock from 30 to 50 cm deep. Silt samples were collected wherever a stream intersected a soil sample line. A total of 1312 soil samples and 134 silt samples were collected.

All samples were placed in Kraft paper envelopes and shipped to the Riocanex Laboratory in North Vancouver. Here the samples were oven dried at 60^{O}C. The dried sample was sieved through 80 mesh stainless steel screen and the over size material discarded. Analyses was carried out on the minus 80 mesh fraction after digestion with a 2:1 mixture of hot concentrated nitric and hydrochloric acid. Results in ppm for the elements Cu, Mo, Pb, Zn and Ag were obtained by the company analyst, Mr. E.F. Paski, Jr.

3.2 Presentation and Discussion of Results

Soil and stream results are showing in drawings GC-8710-1 to GC-8713-2 inclusive at a scale of 1:5000. A summary of statistical data for all five elements analyzed is contained in Table II. The results for Cu, Mo, and Ag have been contoured at threshold and highly anomalous levels using a log normal distribution.

Discussion of results for each element follows.

TABLE II

SIGNIFICANT STATISTICAL LEVELS

For metal values in soil samples from the Fin Claims

(LOG NORMAL DISTRIBUTION)

METAL	MEAN	S	MEAN + 2 S*	MEAN + 3 S+
Cu	30 ppm	3.44 ppm	355 ppm	1220 ppm
Mo	3.5 ppm	3.26 ppm	37 ppm	120 ppm
Ag	0.20 ppm	3.25 ppm	2.2 ppm	6.5 ppm
Pb	22 ppm	2.46 ppm	133 ppm	770 ppm
Zn	138 ppm	2.36 ppm	770 ppm	1880 ppm

(NORMAL DISTRIBUTION)

METAL	MEAN	S	MEAN + 2 S*	MEAN + 3 S+
Cu	90 ppm	330 ppm	750 ppm	1080 ppm
Mo	8 ppm	18 ppm	44 ppm	62 ppm
Ag	0.45 ppm	0.85 ppm	2.15 ppm	3.0 ppm
Pb	38 ppm	89 ppm	216 ppm	940 ppm
Zn	218 ppm	360 ppm	940 ppm	1220 ppm

*threshold

+ highly anomalous

3.2.1 Copper

High copper in soils is found over most of the property but is concentrated in the northeastern portion. To make interpretation of the results simpler only anomalous (threshold) and highly anomalous copper values have been contoured. As well, no single sample anomalies have been contoured. The contouring highlights four areas of interest.

Area 1 is a small soil anomaly associated with mineralization near 25+50W, 6+75N ('A' showing). It is believed that the anomaly represents a broad mineralized area. The size of the soil anomaly is controlled by the thickness of overburden, with anomaly disappearing in areas of thick overburden.

Area 2 centres around 4 + 50E, 4 + 50N and is the largest soil anomaly, most likely associated with unit 4a, a zone of intense alteration with pyrite, sericite and quartz. At this time the relationship between these altered rocks and mineralization is uncertain, however, it is believed that mineralization accompanied the alteration and is represented by the anomalous soil samples.

Area 3 near 0+00E, 12+00N and Area 4 near 12+00E, 0+00N are best explained in terms of glacial transport. The apparent source of these anomalies is from the Mex claims which adjoin the property to the south. Here, copper mineralization occurs in a large gossan approximately 1000 by 500 metres. A major creek with its headwaters on the Mex claims cuts across the Fin claims and shows a well developed dispersion anomaly. Silt samples from this creek range from 8000 ppm at the property boundaries to 1300 ppm near the creeks confluence with the Finlay River.

3.2.2 Molybdenum

High molybdenum values are essentially coincident with the anomalous copper and have the same interpreted source.

3.2.3 Silver

Anomalous silver values are closely associated with copper and molybdenum. Silver outlines a fifth area of anomalous metal near 13+00 W, 3+00 N. This anomaly is similar to Area 2 in that it occurs over highly altered rocks and has associated higher copper and molybdenum values.

3.2.4 Lead and Zinc

Lead and zinc values have not been contoured. Both show an erratic distribution, although lead does show several high values near the 'A' showing.

4. MINERALIZATION

Copper mineralization in the form of copper carbonates was found in four areas on the property. These locations are indicated on the geology map. The largest and most interesting mineralization covers in an area 40 metres by 10 metres. The second largest mineralized zone occurs in a 7 by 5 metre area. The two remaining showings are only spot occurrences. Secondary copper minerals seen were malachite with minor amounts of azurite and chrysocolla. All the mineralization is accompanied by pyrite.

The largest area of copper mineralization, 'A' showing, is found 100 metres south of 25 + 50W, 6 + 75N. Here a highly altered unit 2a grandiorite intrudes unit 3a, a series of porphyritic dacite flows. Both the volcanics and intrusive are cut by a porphyritic felsite dike, unit 1d. The mineralization occurs as copper carbonates coating fractures in an area of quartz stockwork with veinlets ranging in width from 0.5 to 1.5 cm. The stockwork is found in the altered intrusive and not in the surrounding volcanics. Mineralization is confined to a high pyrite (1-5%) and high magnetite (1-3%) area and is surrounded by a highly fractured, phyllicly altered and iron stained zone.

The second copper occurrence, 'B' showing, is located about 25 metres west of 6 + 00W, 2 + 25N. Minor chalcopyrite and malachite occur in an area of about 7 by 5 metres as disseminations and within widely spaced quartz veinlets. This showing is similar to the 'A' showing in that the mineralization is: (1) in an intensely fractured and altered rock (unit 2a - porphyritic granodiorite) and (2) the mineralized area contains up to 1-3% pyrite and magnetite.

The third ('C' showing) and fourth ('D' showing) areas of mineralization occur in less than a meter square area. The 'C' showing in a few metres north of the base line at 4 + 00W and is within a single quartz veinlet in unit 2a - porphyritic granodiorite. The 'D' showing is a malachite stained fracture in a propylitically altered unit - 1a granodiorite. The showing is located about 10 metres south of the base line at 5 + 20E.

5. CONCLUSIONS

The results of the present programme lead to the following conclusions.

(1) Geological mapping of the property suggests the presence of a porphyry copper system. Evidence for this includes several phases of intrusive, strong zones of propylitic and phyllic alteration, weak copper mineralization in a quartz stockwork and the apparent zoning of magnetite and pyrite.

(2) Soil geochemistry outlines several anomalous areas that fall into three categories. The first category includes anomalous areas related to mineralized float from outside the property. The second category includes anomalies that show a weak correlation to highly altered zones. The final category are areas related to known mineralization as demonstrated at the 'A' showing. It is believed that the last two categories are related to porphyry copper mineralization.

(3) Copper mineralization is erratic and occurs mainly as copper carbonates (malachite and azurite). Rocks containing mineralization are badly weathered and it is believed that any primary copper has been leached out. Mineralization at the 'A' showing is most likely related to a porphyry copper system.

6. RECOMMENDATIONS

It is recommended that:

1) Several diamond drill holes be drilled in the vicinity of the 'A' showing. Purpose of this drilling is two-fold, first to test the known mineralization and secondly to aid in the geological mapping and interpretation.

2) The large amount of overburden has made geological mapping of the property difficult. Areas surrounding highly altered rocks, known mineralization and soil anomalies should be mapped in detail.

3) Soil anomalies that have been interpreted as transported anomalies should be investigated further to ensure that this is the case.

4) Consideration should be given to possible induced polarization and ground magnetometer surveys. At present there is an apparent relationship between alteration, mineralization, and pyrite-magnetic halos. Both pyrite and magnetite contents increase in known areas of alteration and mineralization.

Respectively submitted

RIO TINTO CANADIAN EXPLORATION LIMITED

L. Haynes

Larry Haynes, B.Sc.

STATEMENT OF QUALIFICATIONS

L. HAYNES

ACADEMIC

1972	B.Sc. Geology	University of British Columbia

PRACTICAL

1972-1980	Rio Tinto Canadian Exploration Ltd. Vancouver, B.C.	Geologist involved in all aspects of mineral exploration in B.C., Yukon and N.W.T. Emphasis has been on the geological and geochemical appraisal of porphyry prospects at both regional and property levels.
1969-1972 (summers)	Rio Tinto Canadian Exploration Ltd. Vancouver, B.C.	Student assistant on regional and property geochemical surveys of porphyry copper prospects in South-Central B.C.

STATEMENT OF QUALIFICATIONS

D. KNIGHT

ACADEMIC

1978	B.Sc. Geology	University of Arizona
1978	M.Sc. Program-Geology	University of Manitoba
1978-79	Teaching Assistant Economic Geology and Mineralogy-Petrology	University of Manitoba

PRACTICAL

1979 (summer)	Riocanex	Geologist-Party Chief Exploration in Central B.C.
1978 (summer)	Whyoming Minerals Corp.	Associate Geologist. Setting up Drills & Mapping.
1977 (summer)	B & B Mining (Noranda)	-Geologist Assistant-Scintillometer Surveys & some Mapping. Globe, Arizona area.
1976-74 (summer)	American Selco Inc.	Technical Duties claim staking, transit work, gridding, soil sampling, and Geophysics: VLF, Magnetometer & EM. Through out Central & Northern Arizona.

APPENDIX

A

THIN SECTION DESCRIPTION

Vancouver Petrographics Ltd.

JAMES VINNELL, Manager
JOHN G. PAYNE, Ph.D. Geologist

P.O. BOX 39
8887 NASH STREET
FORT LANGLEY, B.C.
V0X 1J0

PHONE (604) 888-1323

Report for: David Knight,
Riocanex - Pearson Camp,
c/o Dennis Macks,
Box 607,
MACKENZIE, B.C., V0J 2C0

Invoice 1662

Samples: 505-508, 510-513

The samples are grouped as follows:

1) Porphyritic Volcanic Rocks (Dacitic)
abundant plagioclase phenocrysts, sparse quartz phenocrysts, variable mafic phenocrysts

a) coarse groundmass (0.05-0.1 mm)	512
b) medium groundmass (0.05 mm)	508
c) fine, variable groundmass (0.005-0.05 mm)	506, 510, 511
d) original texture destroyed	505

2) Plutonic Rocks (Granodiorite)

a) uniform grain size	513
b) coarse plagioclase with finer groundmass	507

Alteration

1) Plagioclase
most plagioclase is altered to sericite; intensity ranges from weak to strong, with plagioclase completely destroyed in 505. In some samples plagioclase is partly replaced by epidote. Chlorite is a minor alteration in some rocks.

a) sericite i) weak to moderate : 512, 506, 508, 507,
ii) moderate to strong: 510, 511, 513
iii) texture destroyed : 505
sericite-quartz alteration
b) epidote i) weak : 513
ii) strong: 511, 510
c) chlorite i) very weak : 506, 511

2) Mafic Minerals
hornblende is completely destroyed, and biotite is partly destroyed; alteration products are mainly chlorite, calcite, epidote, Ti-oxide, and magnetite. In some samples none of these minerals are present; textures suggest that original mafic minerals may be altered to sericite with or without Ti-oxide

a) Chlorite-epidote-Ti-oxide: 512 original hornblende
513 original biotite
b) Biotite partly altered to chlorite : 507
c) Sericite(muscovite)-Ti-oxide: 510 original hornblende
511 original biotite
505 texture destroyed
508 ?

3) Replacement Patches

Two main assemblages form alteration patches. They are grouped as follows (not all minerals need be present in a given rock)

a) Epidote-chlorite-magnetite-quartz: 506, 507, 510, 511, 513

b) Quartz-sericite(muscovite)-pyrite: 505, 508

4) Veins

Several samples are cut by veins, probably related in origin to the alteration assemblages. Most veins have no alteration halos; these are noted where present.

a) Epidote-bearing veins	
i) epidote-quartz-pyrite-apatite (with sericite halo)	506
ii) epidote-quartz-(chlorite)*	507, 513
iii) quartz-biotite-(epidote)	505
* only one vein shows a K-feldspar halo, others have no halo	
b) Quartz-chlorite-opaque	506
c) Quartz-(calcite) veins and veinlets (possibly early)	
i) quartz (early)	505
ii) quartz-calcite	512
d) Magnetite veins	505
e) Limonite veins, late, produced during weathering	most samples

Scheelite is tentatively identified in sample 510. A similar smaller grain occurs in sample 505. Distinction from zircon is on the basis of lower birefringence, as seen in the interference figure, and less diagnostically the rougher surface of scheelite.

Calcite occurs only in sample 512, both in veins and in alteration of hornblende? phenocrysts.

Magnetite occurs in three samples: 505, 506, and 512; it may be of secondary origin in all three.

John Payne

John Payne,
June, 1979

Sample 505 Quartz-Sericite-Magnetite Altered Dacite Porphyry or Porphyritic Dacite

phenocrysts		
quartz	10%	
groundmass		
quartz	65	
sericite	20	
magnetite	4	
biotite	minor	
Ti-oxide	minor	
zircon	trace	scheelite? one grain

veins
magnetite
early quartz
late quartz-biotite-epidote
late limonite

The rock is strongly altered and recrystallized. The only original texture is shown by quartz phenocrysts. These are rounded grains from 0.3 to 1.5 mm in size. A few patches of sericite-rich rock in the groundmass may represent original plagioclase phenocrysts, but if these were present in the original rock, they have been totally destroyed.

The groundmass varies widely in texture; the following varieties are distinguished, although contacts between them are gradational.

1) patches containing abundant rounded quartz grains 0.05-0.15 mm in size, with interstitial sericite. These grade in texture into the early quartz veins (20-25% of groundmass)
2) patches contain irregular grained quartz up to 1 mm in size; this quartz contains dusty to very fine grained sericite (and semiopaque?); sericite is interstitial to quartz (20-25% of groundmass in large patches)
3) sericite-rich zones, possibly relict plagioclase phenocrysts; these contain medium grained (0.15-0.3 mm) irregular sericite grains and patches of very fine grained (0.005-0.01 mm) pale brown sericite with minor quartz. Some have outlines approximating plagioclase phenocrysts, others are irregular in outline. (5% of groundmass)
4) very fine to fine grained intergrown quartz and sericite (50% of groundmass).

Other groundmass minerals occur in all zones except variety 3. Magnetite forms grains from 0.05 to 0.1 mm in size, commonly concentrated in patches with interstitial quartz and sericite. Locally hematite occurs as individual grains with magnetite. Biotite forms scattered pale green-brown grains averaging 0.1-0.2 mm in size. Ti-oxide forms a few patches up to 0.2 mm across composed of fine grained aggregates, partly intergrown with quartz and sericite. Zircon forms scattered euhedral prismatic grains up to 0.15 mm long.

veins:

1) Early veins consist of quartz mosaics averaging 0.1 mm in grain size; these grade into variety 1 of the groundmass.
2) Magnetite forms veins with grain size 0.05-0.1 mm. They do not intersect the early quartz veins in the sample.
3) A late vein with sharp borders consists of quartz with scattered patches of biotite in radiating clusters, minor epidote with biotite, and common limonite. Grain size is 0.1-0.2 mm.
4) Late veins consist of limonite; these are formed during weathering.

Sample 506 Dacite Porphyry

phenocrysts

plagioclase	35-40%	
quartz	5- 7	
magnetite	2- 3	(possibly of secondary origin)
apatite	1- 2	

groundmass 40-45
quartz-feldspar-chlorite

replacement patches? 5- 7
magnetite-chlorite

veins
1) quartz, minor chlorite, opaque
2) pyrite, epidote, chlorite, quartz, plagioclase(?) with sericite halos
3) limonite

Plagioclase phenocrysts are from 0.5 to 2 mm in size, and rounded to subhedral prismatic in outline. Alteration is slight to moderate to sericite and minor chlorite; most sericite is very fine grained, but locally flakes are up to 0.05 mm across.

Quartz forms rounded grains 0.5 to 1.5 mm in size; a few are slightly resorbed by the groundmass. Where cut by quartz veins, the phenocryst appears recrystallized to a fine grained (0.05 mm) mosaic.

Magnetite forms rounded grains from 0.3 to 1 mm across; many are fractured, and most are surrounded by fine grained chlorite. These may be of secondary origin, replacing the groundmass in patches.

Apatite forms grains 0.05-0.1 mm in size, with a few up to 0.2 mm long; most are equant and irregular in outline, while coarser grains are subhedral subby prisms. It is common with magnetite-chlorite patches.

The groundmass is mainly siliceous with a variable groundmass. Coarser grained groundmass (0.05 mm) consist of interlocking quartz with much lesser feldspar (both plagioclase and K-feldspar). Finer grained groundmass (0.005-0.02 mm) consists of feldspars, quartz, and chlorite with minor sericite. Grains are mainly equant, and form irregular interlocking mosaics.

Early veins are composed mainly of quartz, with grain size 0.03 to 0.2 mm. Some of these have patches of chlorite and limonite along their centerlines. These veins are offset by later pyrite-rich veins; offset on three major pyrite-rich veins totals 3 to 4 mm.

Pyrite-rich veins form a parallel set. These are up to 0.5 mm across, and very variable in thickness and grain size. Pyrite grains are up to 1 mm long. Epidote and chlorite are common, and a few coarse grains of apatite are present. Quartz and plagioclase occur locally in fine grained aggregates with epidote and chlorite. The veins have halos up to 2 mm across in which feldspars are strongly altered to sericite.

Late discontinuous veinlets consist of limonite; these are most probably formed along fractures by iron released from pyrite during weathering. They cut early veins, but in section are not in contact with later pyrite-rich veins.

Sample 507   Granodiorite with fine-medium grained groundmass

"phenocrysts"	
plagioclase	45-50%
groundmass	
quartz	15
K-feldspar	10-15
plagioclase	7
biotite	7
chlorite	2- 3
opaque	2
epidote	2
veins and patches	3
epidote, chlorite, quartz	
inclusion	3

The sample contains a few late limonite veinlets, the product of weathering.

The rock contains coarse partly interlocking plagioclase grains from 1 to 3 mm enclosed in interstitial quartz-K-feldspar-plagioclase-biotite of average grain size 0.2-0.5 mm. The texture indicates partial crystallization at a slow rate to produce the plagioclase megacrysts, and then more rapid cooling of the residual magma to form the interstitial assemblage.

Plagioclase "phenocrysts" are equant to slightly elongate, anhedral to subhedral grains, with weak to moderate alteration to sericite. In hand sample they have a pink to reddish color. A poor composition determination gives An_9.

Quartz forms anhedral grains from 0.2 to 1.5 mm in size, with local finer grains. Most of these contain inclusions of fine grained feldspar either as subhedral to anhedral grains or irregular intergrowths (of K-feldspar).

K-feldspar forms grains from 0.2-0.5 mm in size, with a few coarser grains up to 1.5 mm. Some are intergrown with quartz as described above, and some contain irregular patches of plagioclase, possibly of perthitic exsolution origin or possibly plagioclase grains are strongly replaced by K-feldspar. Much K-feldspar has a dusty semiopaque alteration.

Plagioclase occurs in the groundmass as grains from 0.15 to 0.5 mm in size, with similar alteration as the coarse plagioclase.

Biotite forms grains from 0.1 to 0.5 mm in size; many are ragged, elongate laths, and commonly these form in irregular clusters. Pleochroism is moderate from very pale straw to light brown. In part, biotite is altered to chlorite; alteration is controlled by cleavage planes in biotite.

Opaque forms scattered grains and clusters from 0.1 to 0.4 mm in size. Grains are altered from 50 to 100% to hematite, with alteration proceeding inwards in concentric zones.

Epidote forms patches of grains 0.1-0.2 mm in size with chlorite and biotite. These are probably related in origin to later veinlets and patches of epidote-chlorite-quartz.

Late epidote-chlorite-quartz forms irregular veins and patches; quartz grain size is 0.2 to 1 mm, other minerals are finer grained. Quartz commonly occurs in the centerline of veins. The rock bordering veins contains irregular patches of epidote-chlorite, probably as alteration of biotite.

The inclusion contains very abundant epidote from 0.005 to 0.05 mm in grain size, enclosing angular fragments? of quartz and feldspar from 0.05 to 0.2 mm in size. At one end epidote alteration is complete, and the patch grades? into the epidote-quartz vein.

Sample 508 Dacite Porphyry (Quartz-Muscovite-Pyrite Alteration)

phenocrysts			
plagioclase	40%		
groundmass	45-50		
rock fragment	2		
alteration patches	10		
quartz-muscovite		7	(muscovite=sericite)
muscovite-pyrite		3	

Plagioclase phenocrysts are subhedral to euhedral prisms up to 1.5 mm long, and irregular smaller grains from 0.2 to 0.5 mm. They are slightly to moderately altered to sericite and very minor chlorite.

The groundmass consists mainly of irregular, interlocking, slightly lathy plagioclase grains averaging 0.05 mm long. Interstitial sericite and Ti-oxide are generally minor. The groundmass has a slight flow foliation parallel to elongation of plagioclase laths. Ti-oxide forms local concentrations of very fine grains.

The sample contains a few rounded fragments up to 2.5 mm across of other rock types. These are similar to the host in that they are dacite porphyries to porphyritic dacites, but they contain much more sericite (30%) and quartz (15-20%). They must have been partly altered prior to their inclusion in the host, or else, for some unknown reason, were more susceptible to alteration by the solutions related to the later intrusion.

Alteration patches are of two types. The first are large (up to 2.5 mm) and consist of medium grained (0.1-0.2 mm, locally up to 0.5 mm) irregular quartz intergrown with laths of muscovite-sericite of similar grain size. Minor opaque and Ti-oxide are present.

The second type consists of subhedral to anhedral pyrite grains averaging 0.1-0.2 mm intergrown with muscovite flakes of similar size.

The rock is cut by several limonite veins.

Sample 510 Epidote-Altered Dacite Porphyry

phenocrysts	25-30%	
plagioclase	20-25	
quartz	3- 5	
muscovite	0.5-1	
scheelite?	one grain	
amphibole?	one grain	
groundmass	50%	
quartz, feldspar, sericite, Ti-oxide		
alteration		
epidote	20-25%	(mainly of plagioclase)
opaque	2- 3	(with minor chlorite)

Plagioclase phenocrysts are from 0.5 to 1 mm in size with anhedral to subhedral outlines. Most are moderately altered to fine grained patches of sericite and more commonly epidote. Many are strongly to completely altered to epidote. No original composition was determined.

Quartz forms rounded to subhedral, partly resorbed phenocrysts from 0.5 to 1.5 mm in size.

Muscovite forms ragged grains up to 0.5 mm long; these may be secondary after original biotite.

One grain of scheelite is present. It has the following properties: 0.2 mm across, euhedral with 2 tetragonal prisms (100, 110), no cleavage, colorless, very high relief, low birefringence (0.015), uniaxial positive.

One grain of altered amphibole is present. It is 0.5 mm across with subhedral to euhedral outlines. It is completely altered to a fine grained aggregate of sericite (65%) and Ti-oxide (35%).

The groundmass is very variable in composition and texture. Grain size ranges from 0.005 to 0.02, with a few coarser zones from 0.02 to 0.03 mm. Quartz and plagioclase are difficult to distinguish, and form most of the groundmass in much of the rock. Minor components are sericite and Ti-oxide. Several patches up to 10 mm long contain very abundant sericite in the groundmass enclosing scattered plagioclase and/or opaque grains. Some of the sericite-rich zones also contain scattered fine grained (0.05 mm) quartz and plagioclase. These patches may be inclusions of a second rock type or may just have formed during alteration.

Epidote forms coarse to medium grained crystals and aggregates, many of which contain subhedral to euhedral grains up to 1.5 mm across. Color ranges from pale to bright yellow, and interference colors are fairly high. Much of the epidote is a replacement of plagioclase phenocrysts, but some may be replacement of the groundmass. Opaque forms fine to coarse grains (up to 1 mm), generally surrounded by epidote and/or chlorite.

Sample 511 Epidote-Altered, Chloritic Dacite Porphyry Crystal Tuff

This sample is similar to sample 510 but with much more chlorite in the groundmass.

phenocrysts	35-40%	
plagioclase	25-30	
quartz	7-10	
opaque	1- 2	(may be of alteration origin)
muscovite	1	(after biotite)
groundmass	45-50%	
quartz-plagioclase	30-35	
chlorite	10-15	
Ti-oxide	2- 3	
alteration		
epidote	15-20%	(lesser quartz, chlorite, opaque)

Plagioclase forms irregular phenocrysts from 0.2 to 1.0 mm in size; many are crystal fragments. Some are replaced by patches of sericite, others by fine chlorite, and many by epidote, either partly or completely.

Quartz forms phenocrysts up to 1.5 mm in size. Some coarser ones are strongly resorbed by the groundmass, and some grains are angular crystal fragments.

Opaque forms grains of a wide size range from 0.25 to 2.5 mm. Some are rimmed by hematite, others are associated with patches of quartz and lesser chlorite. Some are probably of replacement origin.

Muscovite forms ragged grains after biotite, and commonly containing Ti-oxide. Most are 0.5 mm long, with two coarser skeletal grains up to 1.2 mm in size.

The groundmass consists of very fine to fine (0.005-0.05 mm) intergrown quartz and plagioclase in variable textures, with interstitial to intergrown very fine grained chlorite and scattered Ti-oxide patches and grains.

The most prominent alteration is patches of very variable size and grain size of epidote, with lesser quartz and chlorite in some. Patches are probably after plagioclase phenocrysts, and much less commonly after groundmass. Opaque may be partly of replacement origin.

The variable texture of the groundmass and the fragmental nature of some quartz and plagioclase phenocrysts suggests that the rock is of tuffaceous origin.

Sample 512   Porphyritic Dacite (coarse groundmass)

phenocrysts			
plagioclase		30-35%	
altered mafic		7-10	(chlorite-(calcite)-Ti-oxide-opaque-epidote)
quartz		5	
biotite		3	
magnetite(opaque)		3	
apatite		1	
groundmass		45-50	
plagioclase	23		
K-feldspar	12		
quartz	10		
chlorite	3		
biotite	1		
apatite	minor		
opaque	minor		
sphene	trace		
epidote	trace		
veinlets			
quartz-calcite			

Plagioclase phenocrysts are subhedral equant to elongate prismatic grains from 0.5 to 2 mm in size. A poor composition determination is An_{10}, but other grains suggest a composition closer to An_{15}. Grains are slightly altered to sericite, with a few grains showing moderate alteration, and a few showing strong alteration. The last group appear yellow in the stained block, with sericite producing the stain.

Altered mafic phenocrysts are elongate laths with sharp borders, grain size is mainly 0.5 to 1 mm, with a few up to 2 mm long. A few clusters of more poorly formed grains are present, the largest is 3 mm across. Alteration minerals in all grains include chlorite with lesser Ti-oxide and opaque. About half the grains contain abundant calcite as coarse grains, and a few contain epidote. The original mineral may have been hornblende or biotite; hornblende is preferred because of the ragged nature of biotite phenocrysts, which are described below.

Quartz forms several rounded phenocrysts from 0.5 to 2 mm in size. One smaller phenocryst has strongly resorbed borders.

Biotite forms very ragged laths from 0.3 to 1 mm long. Pleochroism ranges from pale straw to light brown. Most appear to be partly bleached and altered; this produces a color variation within grains. One very coarse (3 mm) grain is strongly contorted and contains abundant bands of Ti-oxide.

Magnetite forms rounded grains 0.1 to 0.3 mm in size, with a few up to 0.5 mm. It is abundant as well with chlorite and calcite in altered hornblende? phenocrysts.

Apatite forms a few prismatic grains up to 0.2 mm long, and a few acicular grains up to 0.3 mm long; most are euhedral.

The groundmass averages 0.05 to 0.1 mm in size, and consists of an equigranular irregular intergrowth in the proportions described above. Locally patches contain abundant very fine grained chlorite. Apatite grains are anhedral to euhedral. Sphene forms two grains up to 0.5 mm long. Calcite forms a few patches up to 0.2 mm across; these probably are related in origin to calcite in veinlets.

Veinlets are abundant, and from 0.02 to 0.1 mm in width; most are one mineral grain wide. Quartz is more abundant than calcite; the two minerals are seldom intergrown, but occur in different parts of the same veins.

Sample 513 Granodiorite

plagioclase	55-60%
K-feldspar	15-20
quartz	10-15
chlorite	5- 7
epidote	2- 3
opaque	1- 1½ (including hematite after opaque)
apatite	minor
muscovite	minor

veinlets and veins

epidote, minor quartz

Plagioclase forms subhedral to anhedral equant to slightly elongate prismatic grains from 0.5 to 1.5 mm. Alteration is moderate, to dusty to very fine grained sericite. Fine to coarse patches of epidote occur in some grains, especially near late epidote veins. Composition by Michel-Levy method is An_{6-7} (R.I. less than quartz).

K-feldspar forms anhedral, partly interstitial grains up to 1.5 mm across. Some are slightly perthitic with tiny parallel lenses of plagioclase. All have abundant dusty alteration to semi-opaque.

Quartz forms rounded to irregular grains from 0.3 to 1.5 mm in size; some are interstitial to feldspars, locally occupying narrow interstitial zones between plagioclase crystals.

Chlorite with epidote and Ti-oxide form alteration of biotite: chlorite is pseudomorphic after biotite, Ti-oxide forms lenses parallel to cleavage, and epidote forms medium to coarse grained patches. Some chlorite-epidote appears to be replacing the rock as a fine to coarse aggregate.

Epidote forms as described above, and also forms some coarse patches in the rock, probably after plagioclase.

Opaque forms clusters of grains 0.1 to 0.15 mm in size, generally surrounded by chlorite and minor epidote. Locally it is partly to completely altered to bright red hematite; alteration forms concentric zones about cores of opaque (non-magnetic).

Apatite forms a few grains 0.05 to 0.1 mm long, associated with clusters of opaque, chlorite, and epidote.

Muscovite occurs with epidote and quartz in one patch as a few grains up to 0.25 mm across.

Veins and veinlets consist mainly of epidote, with locally minor quartz. Grain size ranges from very fine to coarse; some veins are uniform in grain size; one wide vein has a core of very fine grained irregular epidote grading sharply outwards to coarse grained epidote patches. A halo about 0.5 to 1 mm wide contains moderately abundant epidote patches as alteration of plagioclase. One vein has a vague halo of K-feldspar which is more prominent in the stained block than in thin section.

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Samples: 7907220, 7907221

7907220: Crystal Lithic Tuff (Ignimbrite?) of Dacitic Composition

fragments of quartz and plagioclase phenocrysts, numerous mainly siliceous rocks in tuffaceous groundmass

alteration to the stable assemblage

quartz-kaolinite-sericite-limonite-(Ti oxide)

7907221: Porphyritic Dacite

quartz and plagioclase phenocrysts in a siliceous-sericitic groundmass

alteration to the stable assemblage

quartz-sericite-Ti oxide-pyrite-(limonite)

John Payne

John Payne,
September, 1979

7907220 Crystal-Lithic Tuff (Ignimbrite?)

fragments

quartz phenocrysts and fragments	15%	
plagioclase phenocrysts	15-20	(completely altered to kaolinite, limonite)
rock fragments	10-15	
i) cherty quartz		
ii) irregular dacite		
iii) quartz-opaque aggregate		
iv) hematite patch		
groundmass	50	
sericite-kaolinite		
zircon	trace	
secondary minerals		
opaque	1- 2	
actinolite aggregates	2- 3	
late veins (breccia veins)	3- 5	
limonite		

The rock consists of very abundant fragments of rocks of several types, and phenocrysts of quartz and plagioclase and broken fragments of these, in a very fine grained groundmass. The stable alteration assemblage is quartz-kaolinite-sericite-limonite

Quartz forms rounded to very angular phenocrysts and fragments from 0.05 to 1 mm in size, with several much coarser grains up to 5 mm.

Plagioclase phenocrysts are mainly from 0.2 to 1 mm in size; they have been completely altered to kaolinite and iron oxides, but are recognized by their common subhedral to euhedral outlines.

Rock fragments are generally rounded, and consist of mainly siliceous types. They range in size from 0.2 to 1.5 mm. The most common variety is a cherty rhyolite? with fine grained (0.005-0.05 mm) irregular intergrown aggregates of quartz. The dacite contains a very fine grained groundmass of cherty quartz with scattered coarser quartz grains and patches of sericite. The quartz-opaque aggregate is coarser grained (averaging 0.05-0.1 mm) and consists of an irregular mosaic of quartz and lesser opaque.

A patch of hematite 0.7 mm across appears to be a fragment rather than a replacement patch.

The groundmass consists of very fine grained (0.005-0.01 mm) kaolinite and sericite, probably in about equal amounts. One stubby zircon grain 0.08 mm long is present.

Opaque forms irregular to subhedral cubic aggregates of grains ranging in size from 0.1-0.3 mm. Many occur with altered plagioclase, and clusters are present in the dacite rock fragment and a few other fragments.

Actinolite forms fan-shaped aggregates up to 0.2 mm in size. These are scattered in the rock, and occur with a wide variety of mineral assemblages, e.g., in altered plagioclase, with opaque.

The rock is cut by numerous breccia veins, with angular fragments of various resistant rocks and minerals enclosed in a limonite groundmass. Fragment size is mainly 0.05 mm.

7907221 Porphyritic Dacite, Altered to Quartz-Sericite-Pyrite

phenocrysts		
quartz	15%	
plagioclase	15	(completely altered to sericite)
mafic?	1	(completely altered to sericite, opaque)
groundmass		
quartz	30-40	
sericite	20-30	
Ti-oxide	2- 3	
pyrite	1- 1½	
limonite	1- 1½	
zircon	trace	

The rock has been altered to the stable assemblage quartz-sericite-pyrite-Ti oxide; later alteration produced limonite veins and patches, probably from breakdown of pyrite.

Quartz phenocrysts are from 0.2 to 1.5 mm in size. Most are rounded and consist of single grains with sharp borders against the groundmass. One cluster 1.5 mm across consists of several quartz grains ranging from 0.2 to 1 mm in size.

Plagioclase phenocrysts are up to 1.5 mm in size; they are completely altered to sericite which ranges widely in grain size from 0.005 to 0.1 mm. Grain borders are very diffuse, and only locally do sericite patches retain the original subhedral to euhedral plagioclase outlines.

A few patches consist of unoriented intergrowths of sericite and opaque; these patches average 0.5-1 mm across, and may originally have been biotite phenocrysts.

The groundmass is dominated by quartz and sericite. Quartz forms a mosaic texture, with different grain sizes in different parts of the section. Most quartz averages 0.02-0.05 mm in size, but patches here and there have grain sizes 0.05-0.1 mm and 0.1-0.15 mm. Sericite forms scattered grains in quartz mosaics, and elsewhere is much more abundant in the groundmass, forming the majority of it. Grain size ranges from 0.005 to 0.05 mm.

Ti-oxide forms irregular grains averaging 0.01-0.02 mm in grain size; patches are mainly 0.1 mm across, but a few are up to 0.5 mm. A few opaque grains, generally skeletal in outline, are rimmed by Ti-oxide; this suggests that they may be ilmenite.

Pyrite forms scattered irregular to subhedral cubic grains.

Zircon forms a few grains up to 0.15 mm long; the largest is a doubly terminated euhedral prism.

Limonite forms late veins and patches, producing a yellow brown stain, particularly in sericite.

PETROGRAPHIC REPORTS

PEARSON PROJECT

By

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Fox Geological Consultants Ltd
Vancouver, B.C.

For

Riocanex
Vancouver, B.C.

January 7, 1980

FOX GEOLOGICAL CONSULTANTS LTD

PETROGRAPHIC REPORT

Spec. No. ..508..............

Date ....12-31-79.............

CLASSIFICATION

Quartz-feldspar porphyry

MEGASCOPIC DESCRIPTION

Grey, fine grained quartz-feldspar porphyry. 20% subhedral quartz phenocrysts, closely packed feldspar phenocrysts (lmm) enclosed by fine grained matrix, 5% disseminated pyrite.

MICROSCOPIC DESCRIPTION

Texture

Porphyritic: tabular feldspar (albite) phenocrysts (lmm) and anhedral aggregates of quartz enclosed by fine grained matrix of quartz, feldspar, sericite flakes and pyrite granules. Sericite common throughout - fine grained subradiating bundles. Feldspar phenocrysts weakly altered to sericite. Books of pale green chlorite probably pseudomorphs after biotite.

Minerals & Habits

Albite (60%)	Tabular phenocrysts, subaligned, lmm. Weakly altered to sericite. Anhedral matrix grains.
Quartz (10%)	Anhedral aggregates.
Sericite (10%)	Anhedral bundles and radiating aggregates
Chlorite (10%)	Anhedral plates, after biotite(?)
Pyrite (5%)	Anhedral grains
Zircon	
Flourite	
Apatite	

COMMENTS

Weak phyllic alteration. Chlorite forms pseudomorphs after biotite.

Flet.

FOX GEOLOGICAL CONSULTANTS LTD

PETROGRAPHIC REPORT

Spec. No. 510

Date 12-31-79

CLASSIFICATION

Quartz-feldspar porphyry.

MEGASCOPIC DESCRIPTION

Pale green, subporphyritic quartz-feldspar porphyry consisting of angular quartz phenocrysts, tabular feldspar (1mm), 10% disseminated epidote, 5% pyrite.

MICROSCOPIC DESCRIPTION

Texture

Porphyritic: 20% subhedral quartz phenocrysts (1mm), 30% subhedral albite phenocrysts (1mm) enclosed by a fine grained matrix composed of a granoblastic aggregate of quartz, feldspar, sericite and granules of euhedral epidote. Coarse aggregates of euhedral epidote common throughout. Feldspar phenocrysts weakly altered to sericite. Disseminated pyrite common. Ragged books of chlorite after biotite(?).

Minerals & Habits

Quartz (20%)	Phenocrysts and matrix grains
Albite (25%)	Phenocrysts, weakly altered to sericite. Anhedral grains in matrix.
Epidote (20%)	Euhedral aggregates and granules.
Sericite (25%)	Fine grained aggregates in matrix.
Pyrite (5%)	Disseminated grains.
Chlorite (5%)	
Sphene	
Apatite	

COMMENTS

Moderate phyllic alteration: sericite and small amounts of secondary quartz. Epidote appears to be a late stage mineral along with chlorite (late stage "overprint").

Fly.

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PETROGRAPHIC REPORT

Spec. No. 790-7220

Date 12-31-79

CLASSIFICATION

Quartz porphyry - altered tuff(?)

MEGASCOPIC DESCRIPTION

Pale grey, intensely altered quartz porphyry. 20% quartz "eyes", 30% chalky feldspar phenocrysts, 5% disseminated pyrite enclosed by a fine grained quartzo-feldspathic matrix.

MICROSCOPIC DESCRIPTION

Texture

Porphyritic: angular quartz phenocrysts (2mm) and intensely altered tabular feldspar phenocrysts enclosed by a fine grained granoblastic matrix of sericite and secondary quartz. Feldspar phenocrysts consist entirely of fine grained sericite. 10% rounded lithic fragments (2mm) - volcanic rock particles. Weak, subparallel alignment of phenocrysts and sericite folia. Accessory, radiating bundles of stilbite common (.1mm), generally filling cavaties.

Minerals & Habits

Quartz (30%)	Angular phenocrysts, fine grained aggregates.
Feldspar pseudomorphs (40%)	Remnant grains, entirely altered to sericite.
Sericite (20%)	Fine grained streaks and aggregates in matrix.
Stilbite (5%)	Radiating, felted masses filling minute cavaties.
Apatite, Zircon	

COMMENTS

Intensely altered to sericite, minor secondary quartz, stilbite fills small cavaties. Rock fragments are common - although intensely altered - and along with angular quartz grains suggests an altered tuff or volcanic sediment.

FOX GEOLOGICAL CONSULTANTS LTD

PETROGRAPHIC REPORT

Spec. No. ...790-7221...

Date .....12-31-79.....

CLASSIFICATION

Altered quartz porphyry

MEGASCOPIC DESCRIPTION

Pale grey, intensely altered porphyry(?). Rounded quartz grains (1mm) enclosed by aphanitic, dense groundmass.
5% disseminated pyrite. Iron oxide stain in fractures.

MICROSCOPIC DESCRIPTION

Texture

Irregular quartz grains (1mm) - probably phenocrysts, enclosed by a fine grained, felted mass of sericite and granoblastic aggregates of secondary quartz.

Minerals & Habits

Quartz (50%)	Anhedral grains up to 1mm and masses of interlocking quartz up to .1mm forming matrix.
Sericite (45%)	Fine grained subradiating masses intergrown with quartz.
Pyrite (5%)	Disseminated grains.

COMMENTS

Intensely altered porphyry. Typical phyllic alteration assemblage: quartz and sericite.

JLY.

APPENDIX

B

COST STATEMENT

COST STATEMENT

B.C. PEARSON OPTION

GEOLOGY, GEOCHEMISTRY, LINE CUTTING, AND STAKING
29 MAY TO 2 SEPTEMBER 1979

GENERAL COSTS

Food & Accommodation

17 persons, 29 May-2 Sep, 361 man days @ $17		6137

Riocanex Equipment

361 man days @ $3.00		1083

Helicopters

Highland, 206B, 13 Jul, 3 hrs @ $341	1024	
Viking, 500D, 1 Jun-19 Aug, 61.7 hrs @ $285	17585	18609

Fixed Wing

N.T. Air, otter, 4 May-29 Aug, 6 trips @ $489	2934	
Smithers, otter, 21 Jun-13 Aug, 2 trips @ $515	1030	
Universal Travel, 29 May-27 Aug, 13 trips @ $66	862	4826

Rental Equipment

Traeger, SSB50C, 16 May-17 Jul, 62 days @ $6	372	
Chain-saw rentals, Generator, 16 May-17 Jul, 62 days @ $5	310	
Longyear Canada, diamond saw, 8 Jun-17 Jul, 39 days @ $1	39	
Bowmac Trucks:		
2 3/4 ton 4WD PU, 4 Jun-7 Jun, Jul 19, 6 days @ $45	269	
Tilden, May 31-Jun 1, 10-13, 4 days @ $25	100	1090

Supplies	5961
Expediting Services	
D. Macks	500
Report Preparation	1500
TOTAL GENERAL COSTS	39706

GEOLOGY

General Costs

116/361 x $39.706	$ 12759

Salaries & Wages

17 persons, 1 Jun-2 Sep, 116 man days @ $45	5220
Benefits @ 25% of salaries & Wages	1305
GEOLOGY TOTAL	$ 19284

LINE CUTTING

General Costs

79/361 x $39.706	$ 8689

Salaries & Wages

17 persons, 17 Jun-17 Jul, 79 man days @ $45	3555
Benefits @ 25% of salaries & wages	889
LINE CUTTING TOTAL	$ 13133

GEOCHEMISTRY

General Costs

151/361 x $39,706 (TOTAL GENERAL COSTS)			16608

Salaries and Wages

17 persons, 10 Jul-15 Jul, 151 man days @ $45			6795
Benefits @ 25% of salaries			1699

Analysis

Riocanex lab, Jun-Aug		
1446 soil sample for Ag, Cu, Mo, Pb, Zn @ $4.90	$ 7085.40	
17 soil samples for Ag, Cu, Mo, Pb, Zn, Sb @ $5.55	94.35	
6 soil samples for Sb @ $0.65	3.90	
5 soil samples for As @ $2.50	12.50	
Geochem supplies	225.00	
Bondar-Clegg lab, Jul 20,30		
6 rock assays for Au, Ag @ $8.50	51.00	
6 rock assays for Cu @ $5.00	30.00	
6 rock assays for Mo @ $6.00	36.00	
6 rock assays for Pb @ $5.50	33.00	
6 rock assays for Zn @ $5.50	33.00	7604

GEOCHEMISTRY TOTAL	32706

STAKING

General Costs	
15/361 x $39,706	$ 1650
Salaries & Wages	
17 persons, 17 Jun-15 Jul, 15 man days @ $45	675
Benefits @ 25% of salaries & wages	169
STAKING TOTAL	$ 2494
GRAND TOTAL	$67617

172 / 144 . . . ppm Pb (Silt) / Zn (Silt)

12 / 144 . . . ppm Pb (Soil) / Zn (Soil)

A Cu . . . . Copper Occurence and Showing Name

1
2

N.T.S. 94-E-2

SCALE 1:5000

100 50 0 100 200 300 400 Metres

RIO TINTO CANADIAN EXPLORATION LIMITED

PEARSON OPTION

PPM Pb - Zn

SEPT. 1979	L.H. / y.m.	DWG GC-8713-1


AREA 1
AREA 5
AREA 3
ppm Pb (Silt) Zn (Silt)
ppm Pb (Soil) Zn (Soil)
Copper Occurence and Showing Name
N.T.S. 94-E-2
MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 7750
RIO TINTO CANADIAN EXPLORATION LIMITED
PEARSON OPTION
PPM Pb - Zn
SEPT. 1979
L.H. / y.m.
DWG. GC - 8713 - 2

LEGEND

■ . . . Legal Corner Post

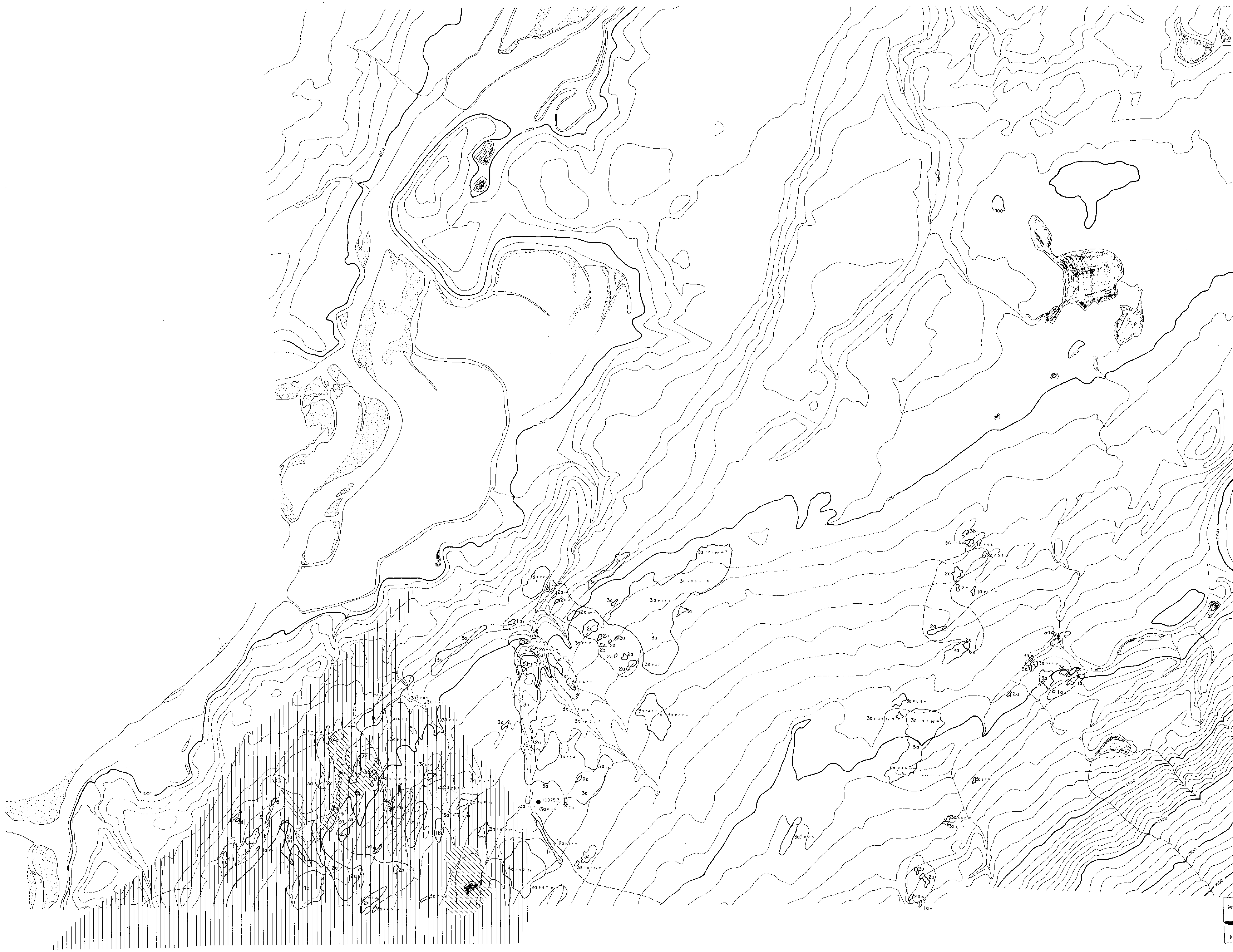
All Claim Posts Established by Pace and Compass Survey

N.T.S. 94 E / 2

SCALE 1:10,000

200 100 0 200 400 600 800 Metres

RIO TINTO CANADIAN EXPLORATION LIMITED		
PEARSON OPTION		
CLAIM MAP		
FEB. 1980	L.R.H. / y.m.	DWG. C-7545



LEGEND

RECENT

[5] Poorly cemented glacial till

JURASSIC (?)

[4] Highly altered rock with no primary textures visible ; 4a, light grey, intensely fractured aphanitic rock characterized by a quartz - sericite - pyrite alteration assemblage ; 4b, light grey to cream white, intensely fractured, aphanitic rock characterized by a quartz - epidote - pyrite alteration assemblage ; 4c, dark grey aphanitic rock with up to 5% magnetite

[3] Intrusive, 3a, fine to coarse grained, light pink - orange granodiorite, 3b, medium to coarse grained, cream white diorite, 3c, fine to medium grained, pink - orange diorite, 3d, pink felsite dike

[2] Intrusive, 2a, pink - orange, porphyritic granodiorite.

JURASSIC - TRIASSIC (?)

[1] Volcanic, 1c, orange pink porphyritic dacite, 1b, blue - grey porphyritic dacite, 1c, purple porphyritic andesite, 1d, light grey - green dacite crystal tuff

- 2a Outcrop
- Geological boundary (defined, assumed)
- Cu Copper occurrence and showing name
- ● 7907513 Sample for thin section description
- Propylitic alteration
- Phyllic alteration

1
2

N.T.S. 94-E-2

SCALE 1 : 5000

100 50 0 100 200 300 400 Metres

RIO TINTO CANADIAN EXPLORATION LIMITED		
PEARSON OPTION		
GEOLOGY		
FEB. 1980	L.R.H. / y.m.	DWG. G- 8708 - 1

LEGEND

RECENT

5 Poorly cemented glacial till

JURASSIC (?)

4 Highly altered rock with no primary textures visible ; 4a, light grey, intensely fractured aphanitic rock characterized by a quartz - sericite - pyrite alteration assemblage ; 4b, light grey to cream white, intensely fractured, aphanitic rock characterized by a quartz - epidote - pyrite alteration assemblage, 4c, dark grey aphanitic rock with up to 5% magnetite

3 Intrusive ; 3a, fine to coarse grained, light pink - orange granodiorite, 3b, medium to coarse grained, cream white diorite; 3c, fine to medium grained, pink - orange diorite; 3d, pink felsite dike

2 Intrusive; 2a, pink - orange, porphyritic granodiorite.

JURASSIC - TRIASSIC (?)

1 Volcanic; 1a, orange - pink porphyritic dacite; 1b, blue - grey porphyritic dacite, 1c, purple porphyritic andesite, 1d, light grey - green dacite crystal tuff

2a Outcrop

Geological boundary (defined, assumed)

Cu Copper occurrence and showing name

● 7907513 Sample for thin section description

Propylitic alteration

Phyllic alteration

N T S 94-E-2

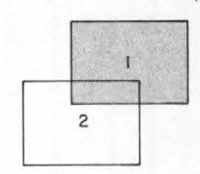
SCALE 1:5000

100 50 0 100 200 300 400 Metres

RIO TINTO CANADIAN EXPLORATION LIMITED		
PEARSON OPTION		
GEOLOGY		
FEB. 1980	L.R.H. / y. m.	DWG. G-8708-2

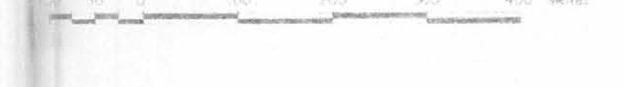
7909158 ···· Silt Sample Location and Number

7909115 ···· Soil Sample Location and Number



N.T.S. 94-E-2

SCALE 1:5000



RIO TINTO CANADIAN EXPLORATION LIMITED

PEARSON OPTION

SAMPLE LOCATION

SEPT. 1979	L.H./y.m.	DWG GC-8709-1

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 7750

N.T.S. 94-E-2

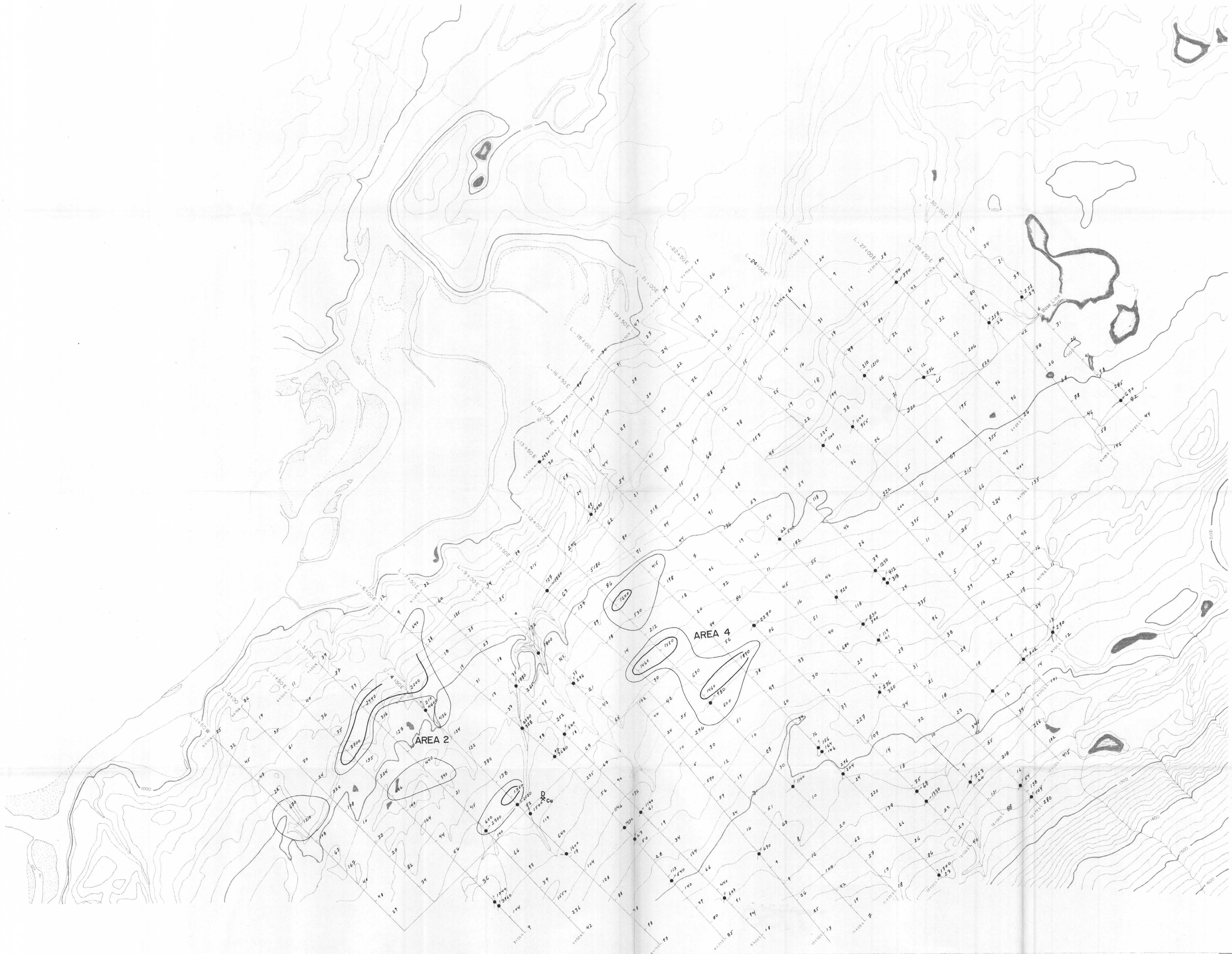
SCALE 1:5000

RIO TINTO CANADIAN EXPLORATION LIMITED

PEARSON OPTION

SAMPLE LOCATION

SEPT. 1979 | L.H./y.m. | GC-8709-2



MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 7750

Contour Interval

— 1220 — .... Highly Anomalous

— 355 — .... Threshold

540 .... ppm Cu (Silt)

12 .... ppm Cu (Soil)

A Cu .... Copper Occurence and Showing Name

N.T.S. 94-E-2

SCALE 1:5000

100 50 0 100 200 300 400 Metres

RIO TINTO CANADIAN EXPLORATION LIMITED		
PEARSON OPTION		
PPM Cu		
SEPT. 1979	L.H./y.m.	DWG GC-8710-1

Contour Interval

— 1220 — .... Highly Anomalous

— 355 — .... Threshold

132 .... ppm Cu (Silt)

12 .... ppm Cu (Soil)

A Cu .... Copper Occurence and Showing Name

N.T.S. 94-E-2

SCALE 1 : 5000

100 50 0 100 200 300 400 Metres

RIO TINTO CANADIAN EXPLORATION LIMITED		
PEARSON OPTION		
PPM Cu		
SEPT. 1979	L.H./y.m.	DWG GC-8710-2

Contour Interval

— 120 — .... Highly Anomalous

— 37 — .... Threshold

4 .... ppm Mo (Silt)

4 .... ppm Mo (Soil)

Cu .... Copper Occurence and Showing Name

N.T.S. 94-E-2

SCALE 1:5000

100 50 0 100 200 300 400 Metres

RIO TINTO CANADIAN EXPLORATION LIMITED

PEARSON OPTION

PPM Mo

SEPT. 1979	L.H./y.m.	DWG GC-8711-1

MINERAL RESOURCES BRANCH ASSESSMENT REPORT NO. 7750

RIO TINTO CANADIAN EXPLORATION LIMITED

PEARSON OPTION

PPM Mo

SEPT. 1979 | L.H./y.m. | GC - 8711 - 2

Contour Interval

— 6.5 — .... Highly Anomalous

— 2 — .... Threshold

0.6 .... ppm Ag (Silt)

0.2 .... ppm Ag (Soil)

A Cu .... Copper Occurence and Showing Name

N.T.S. 94-E-2

SCALE 1:5000

100 50 0 100 200 300 400 Metres

RIO TINTO CANADIAN EXPLORATION LIMITED

PEARSON OPTION

PPM Ag

SEPT. 1979	L.H./y.m.	DWG GC - 8712 - 1

Contour Interval

— 6.5 — .... Highly Anomalous

— 2 — .... Threshold

0.7 .... ppm Ag (Silt)

0.2 .... ppm Ag (Soil)

A Cu .... Copper Occurence and Showing Name

N.T.S. 94-E-2

SCALE 1:5000

100 50 0 100 200 300 400 Metres

RIO TINTO CANADIAN EXPLORATION LIMITED

PEARSON OPTION

PPM Ag

SEPT. 1979	L.H./y.m.	GC - 8712 - 2