ECSTALL

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SUMMARY

Geological mapping has shown that the Ecstall massive sulphide deposit occurs in a volcanic-volcaniclastic sequence close to a felsic volcanic centre. Therefore, the deposit is considered volcanogenic and the volcanogenic model should be used to guide exploration for new sulphide deposits in the area.

A zone of strong massive sulphide-type hydrothermal alteration including chloritization, sericitization, and silicification has been discovered 1.5 km southwest of the Ecstall Deposit. Strong alteration with disseminated and stringer sulphide mineralization occurs in mafic and felsic volcanic-volcaniclastic rocks over an area of 2.7 km^2 known as the Thirteen Creek-West Grid Alteration Zone. A 30 cm wide chert bed in this area contains pods of massive sulphides with up to 8.06% Cu, 0.53% Zn, 350 g/tonne Ag and 2,400 ppb Au. This zone is the prime exploration target for 1987.

Soil geochemical surveys over portions of the property did not detect any major base metals anomalies although they were successful in detecting weakly mineralized felsic horizons.

Electromagnetic ground and airborne geophysical surveys located many conductors most of which appear to be formational. Five widely scattered diamond drill holes tested some of the stronger conductors. Most of the conductors that were tested are graphitic argillite or weakly mineralized quartz-sericite schist.

CONCLUSIONS AND RECOMMENDATIONS

Geological investigations of the Ecstall Deposit indicate it is volcanogenic and located proximal to a felsic volcanic centre. Therefore, further exploration should concentrate on identifying other felsic volcanic centres as well as hydrothermal alteration zones and stringer and massive sulphide-bearing areas. The Thirteen Creek Cirque-West Grid Alteration Zone is highly prospective for massive sulphide deposits. Favourable indicators are the presence of: stringer-type sulphides, strong chlorite alteration associated with sulphide mineralization and a massive chalcopyrite-pyrite bearing exhalitive horizon with significant gold values.

Quartz-sericite schist beds host all massive sulphide deposits in the area, including the Ecstall Deposit. Most quartz-sericite schist units are strongly altered and contain disseminated to massive pyrite and anomalous amounts of base metals. They are therefore the most prospective horizons for base metal accumulations and particular attention should be paid to them.

Ground geophysical surveys were limited to parts of the property covered by cut grid lines and did not cover the Thirteen Creek Cirque-West Grid Alteration Zone. The surveys were successful in detecting and evaluating conductors in the grid areas. Most conductors have long linear trends and appear to be formational. Portions of a few conductors were drill tested and found to be graphitic argillite or weakly mineralized quartz-sericite schist.

Metal content of soil and silts is not sufficiently high to indicate the presence of any subcropping polymetallic massive sulphide deposit within the areas sampled. However, the technique is sensitive and detected weakly mineralized quartz-sericite schist units. Several anomaly areas require detailed prospecting and sampling.

The following work is recommended for 1987:

1) Cut a grid over the Thirteen Creek Cirque-West Grid Alteration Zone. The lines should be spaced at 150 m intervals. This will require approximately 25 horizontal line km of cutting

2) Map the zone at a scale of 1:2,000.

3) Conduct H.L.E.M. and magnetic surveys over the zone.

4) Conduct a soil sampling survey over the zone. The following elements should be analyzed for: Cu, Zn, Pb, Ag, and Au.

5) Sample and hand trench in the vicinity of the strong multi element soil anomalies and Max Min conductors on lines 8800 N, 8950 N, 9100 N east of baseline 3700 E.

INTRODUCTION

Location, Access and Terrain

Claims comprising the Ecstall Project area are within the Skeena Mining District, in NTS 103H/13E and 14W (Figs 1 and 2). The claims lie north and south of the Ecstall River, centered at approximately 53°52'N, 129°30'W (Fig. 2). Camp for area operations is within crown-granted claims north of the river. Area supply centers are Prince Rupert and Terrace, 72 kilometres northwest and 94 kilometres northeast of camp respectively.

During 1986, fuel, drill and other equipment were barged from Prince Rupert and up the Ecstall River to approximately 8 kilometres from camp; final positioning was by helicopter. Personnel and supplies were brought from Prince Rupert to Johnston Lake by fixed-wing aircraft; transport to camp from Johnston lake, or alternatively directly from Terrace, was by helicopter. Major suppliers used in 1986 are listed in Appendix I.

The property is on rugged forested slopes and low ridges of the Coast Range Mountains; elevations range from 10 to more than 1300 metres above mean sea level. Most of the property below treeline (at approximately 700 metres) is covered by mature conifers and underbrush; small grassy or swampy areas on some benches and ridges provide landing sites for helicopters. Outcrop exists in small creek beds, on steep cliffs and locally on some benches and ridges. Access is easier and bedrock is better exposed above the treeline.

History

The area has been explored intermittently since the discovery of the Ecstall deposit (massive pyrite +/- chalcopyrite and sphalerite) in Red Gulch during the late 1890's. This deposit is owned by Kidd Creek Mines Ltd. and has been explored by surface and underground drilling and scuts (Bacon, 1952). Reserves are estimated at 6.9 million tonnes ding 0.6% copper, 2.5% zinc, 42.3% iron and 48.4% sulphur (Dolmage et 1961). Drill core, from the North lens and from only the upper part the South lens, was analysed for precious metal content; nearly 65% the reserves are estimated to contain an average of 0.5 g/tonne gold d 20 g/tonne silver.

RESERVES

The claims within the Ecstall project were staked to cover the "Mine ries" metavolcanics which hosts the Ecstall deposit.

Summary of Work in 1985 and 1986

Exploration for polymetallic massive sulphide deposits was performed n lands owned or under option to Kidd Creek Mines Ltd., a division of alconbridge Limited. Work in 1985 and 1986 was performed by personnel of Falconbridge (operator) and of various contractors (Appendix I).

1985 Exploration:

An airborne electromagnetic (INPUT)/magnetic survey was flown by Questor Surveys Ltd. in December, 1985. The survey covered approximately 36 square kilometres in the Ecstall Project area. Various airborne geophysical anomalies were selected for follow-up during the summer of 1986 by ground electromagnetic and magnetic surveys, described below.

1986 Exploration:

Orthophoto base maps of the Ecstall River Project area were prepared at 1:5,000 and 1:10,000 scales by Delta Aerial Surveys Ltd. Contour intervals are 20 metres.

Grid lines are usually 150 metres apart and oriented east-west, across the regional trend of lithologies and airborne geophysical atures. Cliffs, steep slopes and swamps caused problems in providing overage over parts of some airborne conductor axes, however coverage as generally adequate. A total of 47.1 kilometres of crosslines and .4 kilometres of baseline was cut by Martinson Linecutting & Staking td. Falconbridge personnel cut an additional 2.4 kilometres of line and ccurately slope-chained all lines (Figs. 3, 4 and 5); pickets were laced 20 metres apart. Slopes were surveyed using hand-held nclinometers and ground profiles were prepared to allow proper rientation of electromagnetic coils.

Geological mapping and lithogeochemical sampling were performed to re-evaluate the Ecstall massive sulphide deposit, previously classified as replacement type, in light of the volcanogenic massive sulphide model and to locate new exploration targets. The property was geologically mapped at 1:5,000 scale. Position was determined by reference to the grid or to topographic features and elevations indicated by aneroid altimeter. Lithogeochemical analyses were used to determine the protoliths of the various schistose rocks present and to indicate the degree and distribution of alteration.

Ground geophysics included: two-frequency horizontal loop electromagnetic (Max Min), VLF-EM, and magnetometer surveys performed by Delta Geoscience Ltd. Most crosslines were surveyed. Bedrock conductors and magnetic anomalies were located.

Geochemical surveys consisted of sampling 1081 soil sites and collecting 69 silt samples, which were analysed for copper, zinc, lead and silver. Sampling was concentrated in areas underlain by quartz-sericite schist units and/or by EM conductors. Several anomalous areas were detected.

Five holes, totalling 915.9 metres were diamond drilled to test EM conductors, prospective geology and areas of anomalous geochemical samples. None of the holes intersected economic mineralization, however

GEOLOGY

REGIONAL GEOLOGY

The property covers a portion of the north-northwest trending Ecstall Pendant, a metasedimentary-metavolcanic belt within the Central Gneiss Complex. The belt is 4 to 15 km wide and at least 60 km long (Fig. 4). It consists mainly of hornblende-plagioclase amphibolite schists with lesser amounts of quartzite, marble, migmatite and granitoid rocks of late Paleozoic or early Mesozoic age (Roddick, 1970). The rocks north of Big Falls Creek have been metamorphosed to amphibolite facies while to the south they vary from middle greenschist to lower amphibolite facies. The contact between the Coast Range Intrusive Complex and the Ecstall Pendant is sharp in some places (e.g. along the western edge of the Ecstall Property) and in other places it is a complex migmatitic zone up to 4 km wide (Unit 1 of Fig. 4).

The belt hosts 3 subeconomic massive sulphide deposits; the Ecstall, Packsack and Scotia deposits. The Ecstall Deposit lies within the property covered by this report. It was discovered in the late 1800's. The deposit consists of 2 lenses of massive sulphide containing 6.3 million tonnes of drill-indicated reserves grading: 0.6% Cu, 2.5% Zn, 42.3% S. The North Lens and upper part of the South Lens were assayed for precious metals and contain 20 g/tonne Ag and 0.5 g/tonne Au (Dolmage et al, 1961). The Packsack Deposit , located 12 km southwest of the Ecstall Deposit, was discovered in 1958 by Texas Gulf Sulphur. The deposit contains approximately 2.7 million tonnes of reserves grading: 0.5% Cu, 0.2% Zn, 0.01% Pb, 34 g/tonne Ag, 0.3 g/tonne Au (Graf, 1981) and is presently controlled by Noranda Inc. The Scotia Deposit, located 25 km northwest of the Ecstall property, was discovered by Texas Gulf Sulphur in 1958 and is now owned by Kidd Creek Mines Ltd. Drilling has so far outlined 187,000 tonnes grading: 11.8% Zn, 1.3% Pb and 20.6 g/tonne Ag (Meyers and Moreton, 1981). The Ecstall and Packsack deposits occur in similiar geological settings and both are hosted by quartz-sericite schist. The Scotia Deposit occurs in rocks of higher metamorphic grade and is hosted by a sericitic felsic gneiss (Delancey, 1977).

PROPERTY GEOLOGY

General

The property is underlain by metamorphosed sedimentary, volcanic, volcaniclastic and related mafic and felsic intrusive rocks of the Ecstall Pendant and granodiorite of the Coast Range Intrusive Complex. The Ecstall Pendant is approximately 8 km wide in the vicinity of the property and trends 170°. The contact between the Coast Range Intrusives and the Ecstall Pendant is sharp and the Pendant rocks are strongly deformed and metamorphosed for up to 150 m from the contact. The rocks of the Ecstall Pendant have been moderately to strongly deformed and metamorphosed to the middle greenschist facies obliterating most volcanic and sedimentary textures.

Figure 5 summarizes of the property geology at a scale of 1:50,000. The geology of the property at 1:5,000 scale is presented in Figures 6 to 8. Rocks of volcanic affinity occur in a north northwest trending belt 4 km wide which passes through the centre of the property The belt is flanked by sediments to the east and sediments and Coast Range Intrusive rock to the west. The rocks of the volcanic belt strike 160° to 180° and dip 80° to 90° to the east. The sediments in the southwest corner of the property are highly deformed and many tight folds with steeply plunging axes striking 160° to 180° are present. A foliation subparallel to the regional strike has been imposed on all rocks of the Ecstall Pendant

Lithologies

General:

Table II is a list of mappable rock units which occur on the property. Each of these units is discussed in detail below.

Chlorite Schist (map unit 1):

In most cases Chlorite Schist occurs as a well foliated, fine-grained, medium to dark green coloured rock composed mainly of chlorite with lesser amounts of biotite and sometimes hornblende depending on metamorphic grade. If appreciable amounts of biotite or hornblende occur, their presence is noted on the map. In a few locations relict volcanic and volcaniclastic textures are visible suggesting that most of these rocks are volcanic in origin.

Pillows are clearly recognizable in two locations. The first is along an 80 m stretch of Red Gulch Creek, immediately north of the Third Outcrop, where there are pillows up to 40 cm wide and 60 cm long with selvages 2 cm thick . The second is on Allaire Ridge, immediately south of Thirteen Creek Cirque. Here, pillows are exposed in a 3 metre-wide section of a 120 metre-thick unit of chlorite schist. These pillows are 30 cm long and 10 cm wide with selvages 1 to 2 cm thick. A mafic fragmental rock consisting of stretched angular mafic fragments 5 to 15 cm in length supported by a black, fine-grained matrix outcrops about two metres east of the pillows. Similiar fragmental rocks occur in beds up to 2.0 metres-thick along the eastern edge of Thirteen Creek Cirque (see Photo 1) and in creeks along the east bank of Red Gulch.

Quartz-Chlorite Schist (map unit 2):

Quartz-Chlorite Schist is a fine-grained, medium green coloured rock of mafic to intermediate composition consisting of quartz and chlorite

TABLE II

LITHOLOGIES

Map Unit	
	COAST RANGE INTRUSIVE COMPLEX
13	GRANODIORITE
12	MAFIC DYKE (UNDEFORMED)
	ECSTALL PENDANT METAMORPHIC ROCKS
11	MAFIC INTRUSION (DEFORMED)
10	CHERT
9	MARBLE
8	CLASTIC METASEDIMENTS Argillite Greywacke Quartzite Conglomerate
7	QUARTZ-BIOTITE SCHIST
6	QUARTZ-SERICITE SCHIST
5	QUARTZ-BIOTITE GNEISS
4	FELSIC VOLCANIC BRECCIA
3	QUARTZ-CHLORITE-BIOTITE SCHIST
2	QUARTZ-CHOLRITE SCHIST
1	CHLORITE SCHIST

(N.B. this is not a stratigraphic column) with minor amounts of biotite. In some cases Quartz-Chlorite Schist may be a silicified equivalent of Chlorite Schist. For example, nearly massive quartz-chlorite schist occurs in Red Gulch Creek in the vicinity of Ecstall Deposit and is definitely silicified. In other places it occurs in beds 0.10 to 10 m thick indicating that it may have been deposited as a mafic tuff. Fragmental quartz-chlorite schist, similiar in appearance to fragmental chlorite schist, occurs in Water Line Creek 100 m east of camp.

Quartz-Chlorite-Biotite Schist (map unit 3):

Quartz-Chlorite-Biotite Schist is mafic to intermediate in composition and fine- to medium-grained. The ratio of biotite to chlorite in the rock is extremely variable and is probably a function of metamorphic grade. In some locations it contains up to 5 % garnet as porphyroblasts less than 0.5 cm wide. In many places the schist has a bedded appearance. The beds average about 1.0 m in thickness.

This unit is likely derived from mafic volcaniclastic and reworked volcanic rocks.

Quartz-Biotite Gneiss (map unit 4):

This is a fine- to medium-grained felsic rock composed primarily of quartz and biotite with variable amounts of chlorite and plagioclase. It occurs in a 300 m stretch of Red Gulch Creek south of the Third Outcrop and is in sharp contact with a felsic volcanic breccia to the east. It strikes due north weakly crosscutting the local stratigraphy. The gneiss thickens rapidly to the north reaching a maximum thickness of 150 m in the vicinity of the Third Outcrop. No trace of the gneiss could be found on Red Gulch Ridge 1.4 km north of the Third Outcrop.

Quartz-biotite gneiss also outcrops a few metres north of the Ecstall Deposit in a 20 m stretch of Red Gulch Creek. Its contacts are sharp at 007°. According to Douglas (1952), Quartz-biotite gneiss occurs close to the eastern wall of the Ecstall Deposit.

The discordant nature of its contacts and its cross sectional outline suggest that the quartz-biotite gneiss is an intrusive igneous rock. The fact that its foliation is parallel to the foliation in the surrounding rocks of the Ecstall Pendant, that it is quite different in appearance from the Coast Range Intrusives in the area and that it is associated with a fragmental rock of similiar composition (see Felsic Volcanic Breccia) indicate that it was emplaced contemporaneously with the rocks of the Ecstall Pendant as a subvolcanic intrusion or dome.

A massive quartz-biotite rock occurs in Red Gulch 450 m's south of the Ecstall Deposit. The rock is finer grained than the gneiss to the north and may be an extrusive phase of the quartz-biotite gneiss or a massive quartzite. It is also mapped as quartz-biotite gneiss.

Felsic Volcanic Breccia (map unit 5):

Felsic Volcanic Breccia is exposed in small sections along the east side of Red Gulch Creek 600 to 700 m north of the Ecstall Deposit. It is in contact with quartz-biotite gneiss to the east. It consists of angular felsic fragments, similiar in composition to the quartz-biotite gneiss, 2 to 20 cm in length, supported by a dark fine-grained chloritic matrix (see Photo 2). The fragments are stretched parallel to foliation with length to width ratios of about 1:4 and comprise roughly 20 to 50 % of the rock. The thickness and extent of this unit is unknown due to paucity of outcrop.

Quartz-Sericite Schist (map unit 6):

Quartz-Sericite Schist hosts all major occurrences of massive sulphide on the property including the Ecstall Deposit and the Third Outcrop Showing. It is a strongly sheared, buff coloured felsic rock composed of quartz and sericite with trace to 5 % pyrite and variable amounts of chlorite, biotite and mariposite. It occurs in beds up to 120 m thick which can be traced for up to 5 km and is often interbedded with argillite.

Quartz-Sericite Schist is probably derived from accumulations of tuffs and sediments deposited during periods of felsic volcanism. Beds of relatively well preserved lapilli tuff occur within quartz-sericite schist in two places. The first is on Red Bluff, 250 m northwest of camp, where the lapilli are graded and fine to the east. The second is on the ridge south of Balan Creek, where the tuff has a strong lithic component.

Quartz-Biotite Schist (map unit 7):

Quartz-Biotite Schist, composed of quartz and biotite with minor amounts of chlorite and sometimes garnet, occur as beds <5 m thick in chloritic schists. The generally aluminous composition and thinly bedded nature of this unit indicate that it is dominantly sedimentary in origin, with a variable volcaniclastic component.

Clastic Metasediments (map unit 8):

Clastic metasedimentary rocks occur on Red Gulch Ridge, the East Plateau and at the south end of the property in the vicinity of the Balan Creek Cirque.

The sediments on Red Gulch Ridge consist mainly of greywacke composed of approximately equal amounts of quartz and biotite. A conglomeritic rock occurs at the east end of the ridge. It consists of rounded matrix supported epidotized clasts 1 to 10 cm long stretched parallel to foliation in a silty matrix of quartz and biotite.

The sediments on the East Plateau and in the southwest corner of the property consist of quartzites in beds up to 10 cm wide composed essentially of quartz with minor sericite and black aphanitic argillite in beds less than 2 cm wide. Massive quartzites are also common.

Quartzite beds 10 cm to 1.0 m thick occasionally occur in chloritic schist units. Argillite units up to 30 m thick often occur along the margins of quartz-sericite schist beds. The argillites usually contain trace amounts of pyrite giving them a rusty weathered surface. Most argillite beds are weakly graphitic.

Marble (map unit 9):

Marble occurs in beds up to 5 m thick which have been traced for up to 800 m. It is usually massive, crystalline and grey in colour and consists almost entirely of calcite. The marble that runs along the east bank of Red Gulch Creek is thinly laminated and in places contains thin beds of chloritic and argillaceous material. A thin discontinuous bed of marble less than 10 cm thick occurs along the northeastern contact of the North Lens of the Ecstall Deposit and was likely deposited as a chemical sediment.

Chert (map unit 10):

A 0.5 m thick chert bed with disseminated pyrite occurs in Red Gulch Creek immediately east of the quartz-sericite schist which hosts the Third Outcrop Showing. Another chert horizon, 30 to 50 cm wide, has been traced for approximately 100 m along the western side of the Thirteen Creek Cirque. This horizon contains semi-massive to massive pyrite-chalcopyrite; one grab sample assayed 8.06% Cu, 0.53% Zn, 350 g/tonne Ag and 2400 ppb Au.

Mafic Intrusive, Deformed (map unit 11):

Medium- to coarse-grained, dark green, massive mafic intrusive rock composed of hornblende, quartz and plagioclase occurs as dykes up to 100 m wide on the East Plateau and Allaire Ridge. A large medium-grained magnetite-bearing body occurs just west of Mariposite Lake A similiar body occurs 2 km south and an irregularly shaped mafic intrusion 300 m's in diameter outcrops on the ridge south of Balan Creek.

All these rocks have a foliation parallel to that of the surrounding Pendant rocks, which indicates that they were emplaced prior to the Coast Range Intrusive event, perhaps penecontemporaneously with other igneous rocks of the Pendant.

Mafic Intrusive, Undeformed (map unit 12):

Several massive, fine-grained, medium grey mafic dykes up to 1.5 m wide were observed in creeks along the east bank of Red Gulch Creek. The dykes trend 45° to 90° and cut stratigraphy and all quartz veins. They were likely emplaced after or during the late stages of the Coast Range Intrusive event.

Granodiorite (map unit 13):

Granodiorite of the Coast Range Intrusive Complex outcrops along the western edge of the property. The rock is medium- to coarse-grained and has a granitic texture. Its contact with Pendant rocks is sharp and irregular. Epidote is a common accessory mineral and the Pendant rocks near the intrusion are often weakly to moderately epidotized.

Alteration

General:

Two hundred and forty three whole rock analyses were made of grab samples taken during the survey to detect zones of hydrothermal alteration and provide a quantitative measurement of the intensity of alteration. The following geochemical alteration indexes were used:

1. SODIUM (Na) DEPLETION:

Na depletion is common in most volcanogenic massive sulphide related alteration zones. A rock with <1.00% Na_2O is considered Na depleted and a rock with <0.50% Na_2O is strongly depleted.

2. STRONTIUM (Sr) DEPLETION:

Sr behaves like Na and is also depleted in hydrothermal alteration zones. A sample with less than 100 ppm Sr is considered depleted and with less than 50 ppm strongly depleted.

3. MAGNESIUM (Mg) ENRICHMENT IN CHLORITE SCHIST:

Mg enrichment is a feature of most massive sulphide forming hydrothermal alteration zones. Mg content varies with rock type. The initial Mg content of each of the rock units at the Ecstall is unknown and so it is not possible to measure the degree of Mg enrichment in all the samples. However, some chlorite schist samples contain extremely high amounts of MgO and are definitely Mg enriched. An average chlorite schist contains 8.10% MgO. A chlorite schist with more than 9.50% MgO is arbitrarily considered Mg enriched.

4. ISHIKAWA ALTERATION INDEX (Ishikawa et al,1976):

The Ishikawa Index measures the relative amount of Na and Ca depletion and Mg and K enrichment in a rock. The index is defined as;

$$100X(K_2O+MgO)/(K_2O+Na_2O+CaO+MgO)$$

It increases with increasing intensity of alteration. A sample with an index greater than 50 is considered altered and a rock with an index above 80 is strongly altered.

5. CHROMIUM (Cr) ENRICHMENT IN FELSIC ROCKS:

Cr enrichment is not a typical feature of massive sulphide forming hydrothermal systems. But it does occur in many of the quartz-sericite schists on the property and may be related to syn-volcanic hydrothermal activity. The Cr occurs in the mineral mariposite. Mariposite is a green chromium bearing variety of muscovite in which Cr substitutes for octahedral Al in the crystal lattice (Deer et al, 1962). It is a hydrothermal alteration product similiar to fuchsite but with less Cr. Fuchsite contains >0.6% Cr while mariposite generally has <0.1% Cr. The source of the Cr is probably the relatively primitive tholeiitic mafic volcanic rocks which occur on the property (see Lithogeochemistry section).

A felsic rock with more than 800 ppm Cr is considered Cr enriched.

The results of this sampling are presented in Figures 9 and 10. Hydrothermal alteration including chloritization, silicification and sericitization occurs in the following areas; Red Gulch Ridge, the Third Outcrop, the Ecstall Deposit, the Thirteen Creek Cirque - West Grid Alteration Zone and in all the Quartz-Sericite Schist units. These areas are discussed in detail below.

Red Gulch Ridge:

Strong pervasive silicification, sericitization, chloritization and occasional pyrite stringers 0.5 to 1.0 cm wide and 2 to 4 cm long occur in an outcrop of chlorite schist and quartz-sericite schist 5 m wide by 20 m long. The outcrop is located on Red Gulch Ridge, north of the Red 1 claims, 1.5 km along strike of the Third Outcrop Showing. It is a good example of the type of alteration associated with massive sulphides in the Ecstall Area. Chlorite schist accounts for 90% of the outcrop. It contains many quartz veinlets, knots of coarse chlorite and 1 to 5% pyrite as cubes up to 0.5 cm in diameter. AB20813, a sample of chlorite schist, contains 13.40% MgO. Quartz-sericite schist occurs on the western edge of the outcrop and a sample of it, AB20814, contains 0.57 % Na_2O, <10 ppm Sr and has an Ishikawa Index of 88.

Third Outcrop Showing:

The Third Outcrop massive sulphides are hosted by a moderately silicified quartz-sericite schist bed about 5 m wide. A sample of the quartz-sericite schist (AB20755) contains 0.24% Na2O, <10 ppm Sr and has a Ishikawa Index of 90. Immediately east of the quartz-sericite schist is a chert bed <1.0 m wide and further east is a moderately chloritized and carbonatized chlorite schist. A sample of this chlorite schist, AB20773, contains 9.62% MgO and a strongly carbonatized one, AB20779 contains 11.90% CaO and had a 6.70 % loss on ignition. The chlorite schist immediately west of the Third Outcrop quartz-sericite schist bed is also moderately chloritized. The quartz-biotite gneiss 20 m to the west is only weakly chloritized.

The Ecstall Deposit:

While the deposit is well exposed its alteration zone is not because of steep topography and thick vegetation. The deposit is hosted by quartz-sericite schist with trace amounts of mariposite. Immediately west of the quartz-sericite schist are chloritic schists which are not strongly altered. Although a thin, discontinuous, strongly chloritized zone does occur along the contact between the quartz-sericite schist and the chloritic schists. In places the chloritic schists are weakly carbonatized and silicified. The quartz-biotite gneiss which occurs a few metres east of the deposit is only weakly chloritized.

Twelve whole rock samples were taken in the vicinity of the Ecstall Deposit. Sample locations and partial results are presented in Figure 11. Complete analyses are listed in Appendix II. All samples of quartz-sericite schist are strongly Na and Sr depleted and have Ishikawa Indexes greater than 80. Only 1 of 4 samples of chloritic schist is Na depleted. AB20748 was taken 1 m east of the South Lens and contains 0.86% Na_2O.

The quartz-sericite schist bed which hosts the Ecstall Deposit can be traced north of the deposit for 900m. Two samples, AB20781 and AB20782, were taken along this bed (Fig. 9). Both are chloritized and have Ishikawa Indexes over 80.

Thirteen Creek Cirque - West Grid Alteration Zone:

Strong chloritization, sericitization and silicification associated with disseminated and stringer pyrite-chalcopyrite mineralization in metavolcanic rocks occurs over an area of 2.7 km^2. This area is known as the Thirteen Creek Cirque-West Grid Alteration Zone (Figs 9 and 10). It is a prime target for future exploration on the Ecstall Property.

Spectacular examples of chloritization and sericitization are exposed in Thirteen Creek Cirque. The cirque lies along strike of a belt of strongly silicified quartz-sericite schist which is up to 150 m wide and runs just west of the West Grid 1 km north of the cirque. It is known as the West Grid Quartz-Sericite Schist. A 10 m wide bed of weakly chloritized, strongly sericitized and intensely silicified kyanite-bearing quartz-sericite schist occurs at the southwest corner of the cirque, along strike of the West Grid Quartz-Sericite Schist. The bed contains several pyrite stringers <0.5 cm wide and 2 to 3 cm long and up to 30% kyanite as porphyroblasts up to 1.0 cm long (Photo 3). It pinches out to the east into quartz-chlorite-biotite schist. Medium-grained quartz-chlorite-biotite schist with trace to 5% disseminated pyrite-chalcopyrite underlies most of the cirque. Pyrite often occurs as cubes up to 0.5 cm in diameter associated with chlorite. Chlorite occurs as as large flakes and knots up to 0.5 cm in length. Several chloritic pyrite stringers 10 to 30 cm long and 0.5 to 1.5 cm wide were observed in the quartz-chlorite-biotite schist in the cirque (Photo 4). Sulphide stringers also occur in chlorite schist exposed in Elaine Creek just west of the West Grid Quartz-Sericite Schist (Fig. 7).

Eight whole rock samples were taken in Thirteen Creek Cirque.

Samples of quartz-sericite schist have Ishikawa Indexes of up to 73 and less than 30 ppm Sr but all have more than 1.00% Na_2O. The quartz-chlorite-biotite schists have Ishikawa Indexes of 60 to 70 and are rarely Na or Sr depleted. Three samples of the West Grid Quartz-Sericite Schist were taken, AB20750, AB20805 and AB20973. None are Na or Sr depleted. Their Ishikawa Indexes are between 55 and 71.

Quartz-Sericite Schist Beds:

All Quartz-Sericite Schists are altered to some degree. Of the 84 Quartz-Sericite Schist samples taken, more than half contain less than 1.00% Na20 and have Ishikawa Indexes greater than 80 (Figs. 9 and 10).

Particularly strong silicification with locally abundant mariposite occurs in the Mariposite Quartz-Sericite Schist Belt north of Allaire Creek. Intense mariposite alteration in the vicinity of Mariposite Lake may be related to the poorly exposed magnetite-bearing mafic intrusive body which lies just west of the lake.

Mineralization

General:

The property hosts a large massive sulphide deposit known as the Ecstall Deposit, a partially tested massive pyrite showing called the "Third Outcrop", a 10 cm wide bed of massive sulphide exposed in a small trench refered to as the "Trench Showing" and a 5 cm wide bed of massive pyrite exposed on Red Bluff. These occurences were investigated by Holyck (1952) and were briefly examined during the course of this year's survey. This summer's work concentrated on the following areas of significant mineralization: 1) The Thirteen Creek Cirque-West Grid Alteration Zone, 2) The Mariposite Quartz-Sericite Schist Belt 3) The East Plateau Zn Showing and 3) The South Grid East Quartz-Sericite

Schist Belt. Each of these areas are discussed in detail in the sections below.

A total of 244 rock samples were analyzed for Cu, Pb, Zn, Ag, Au and Ba. The results of this work are presented in figures 12 and 13; complete analytical results are listed in Appendices II and III.

The Ecstall Deposit:

Previous workers (Holyck, 1952 and Douglas, 1952) have mapped, sampled and described the Ecstall deposit. They concluded that it occurs in a sedimentary rock sequence and classified it as a replacement type deposit. This survey has shown that the deposit occurs in a volcanic/volcaniclastic sequence, close to a felsic volcanic centre and that hydrothermal alteration has occurred in the vicinity. It is therefore considered to be volcanogenic.

The Ecstall Deposit consists of two lenticular bodies of massive pyrite referred to as the North and South Lenses. These strike north-south, dip steeply east and plunge steeply south. They occur en echelon and in places are less than 10 m apart. The North Lens is 290 m long, has a maximum width of 30 m and extends 230 m beneath Red Gulch. It contains 3.1 million tonnes of massive sulphide grading 0.80% Cu, 2.0% Zn, 43.5% Fe, 49.5% S, 17.1 g/tonne Ag and 0.5 g/tonne Au (Dolmage et al, 1961). The South Lens is 400m long, less than 15 m wide and extends at least 340 m below Red Gulch. It contains over 3.8 million tonnes of sulphide grading approximately 0.5% Cu, 3.0% Zn, 41.3% Fe, 47.6% S; only material from the upper 1.3 million tonnes was assayed for precious metals and this contains 20.2 g/tonne Ag and 0.5 g/tonne Au (Dolmage et al, 1961). Drilling by Northern Pyrites Ltd. in 1941 outlined 250,000 tonnes of sulphide grading 2 % Cu along the west wall of the South Lens above an elevation of 20m.

Both lenses outcrop in Red Gulch Creek (Photo 5). The pyrite occurs as fine, closely packed cubes separated by thin layers of gangue. This gives the sulphide a friable texture and is likely the result of deformation.

Figure 14 is a geological sketch of the deposit based on detailed surface and underground mapping by Hugh Douglas in 1952 with several modifications based on brief surface examinations in 1986. These modifications are noted on the sketch. The major new findings are: 1) that the North Lens has the outline of a steeply south plunging antiformal structure, and 2) that a thin discontinuous bed of marble occurs along the northeastern margin of the North Lens. The first observation supports Douglas's suspicion that the Ecstall Deposit is folded. The second suggests that some, if not all, of the marble on the property was deposited as a chemical sediment.

Thirteen samples were taken from the vicinity of the deposit and analyzed for Cu, Pb, Zn, Ag, Au and Ba among others. Sample locations and selected results are shown in Figure 14, complete results are listed in Appendices II and III. The results show that the host rocks of the deposit have anomalous amounts of Cu, Pb, Zn, Ag, Au and Ba. These elements may be useful in identifying favourable horizons in other parts of the property.

Third Outcrop Showing:

The Third Outcrop Showing is located on a steep slope about 50 m east of Red Gulch Creek 750 m north of the Ecstall Deposit. A bed of massive pyrite 1.5 to 2.0 m wide, hosted by quartz-sericite schist, outcrops over a distance of 30 m. The pyrite bed can be traced north into Red Gulch where it is 10 cm thick and the quartz-sericite schist which hosts it can be traced further north to the top of Red Gulch Ridge. A 30 cm thick bed of chert lies immediately east of the Third Outcrop Quartz-Sericite Schist exposed in Red Gulch Creek.

The Third Outcrop was tested by 13 X-ray drill holes in 1952 which indicated that the mineralization is spotty. However, Douglas, 1952 pointed out that the drilling only tested the showing to a depth of 300 m above sea level while the Ecstall Deposit extends at least 300 m below sea level. The best intersection was 5.18 m of massive sulphide grading 0.63% Cu and 2.30% Zn.

Trench Showing:

A 10 cm wide bed of massive pyrite hosted by quartz-sericite schist is exposed in a trench located 200 m northeast of camp. Sample AB20730 from the trench contains 330 ppm Cu, 1200 ppm Zn, 46 ppm Pb, 4.50 ppm Ag and 70 ppb Au. This bed is intersected by the Texas Gulf adit 80 m below the trench.

Red Bluff Showing:

A 10 cm wide bed of massive pyrite occurs in a 10 m wide bed of quartz-sericite schist exposed on Red Bluff 300 m northwest of camp. A sample of massive sulphide, AB20730, contains only 2 ppm Cu, 51 ppm Zn and 40 ppb Au. The massive sulphide cannot be traced on surface for any appreciable distance.

Thirteen Creek-West Grid Alteration Zone:

A 30 cm wide chert bed with pods of massive pyrite-chalcopyrite mineralization has been traced for 100 m at the south end of Thirteen Creek Cirque (Fig. 7). A grab sample of massive sulphide assayed 8.06% Cu, 0.53% Zn, 350 g/tonne Ag and 2400 ppb Au. Several pyrite + chlorite stringers <1.5 cm wide and <25 cm long occur in the cirque (Photo 4). A boulder 25 cm across of semi-massive pyrrhotite-pyrite with 5 % chalcopyrite was found in the centre of the cirque at an elevation of 490 m. Another boulder 2.0 m in diameter with abundant pyrrhotite-pyrite stringers (>20% sulphides overall) was found at the 510 m elevation on the east side of the cirque and a 15 cm wide boulder with approximately 10 % galena was found in a creek on the southeast wall of the cirque. ~~A sample of~~ the galena-bearing float assayed 0.02% Cu, 7.80% Pb, <0.01% Zn, 6.24 oz/t Ag and 55 ppb Au.

Disseminated chalcopyrite and malachite is common in the West Grid Quartz-Sericite Schist which lies 800 m to the north, along strike of the cirque (Fig. 7). Most samples taken from this quartz-sericite schist belt contain anomalous amounts of Cu (up to 1.5%) and Au (up to 310 ppb). Twelve samples were taken along a 900 m stretch of this belt and contain an average of 2671 ppm Cu and 81 ppb Au. Occasional stringers of pyrite were observed in chlorite schist exposed in Elaine Creek just west of the West Grid Quartz-Sericite Schist Belt. A sample of these stringers, AB20770, contains 8700 ppm Cu.

The presence of a massive sulphide-bearing exhalitive horizon, stringer mineralization, anomalous Cu and Au values, massive sulphide-bearing float and strong hydrothermal alteration (see Alteration Section) indicate this area may host important massive sulphide mineralization.

Mariposite Quartz-Sericite Schist Belt:

The "Mariposite Quartz-Sericite Schist Belt" contains 1 to 5% pyrite on average and in places north of Mariposite Lake up to 50 % pyrite (Fig. 7). Fourteen samples were taken along the belt north of Allaire Creek. Many of these samples are anomalous in Zn and weakly anomalous in Au and Cu. A particularly heavily mineralized sample from the north end of the belt, 1.2 km north of Mariposite Lake contains 0.22 % Zn.

The combination of anomalous amounts of base and precious metals, considerable sulphide mineralization and strong hydrothermal alteration make this belt worthy of further exploration, particularly the area north of Mariposite Lake where the quartz-sericite schist package thickens considerably and pyrite mineralization appears to be the heaviest.

East Plateau Zn Showing:

A heavily pyritized, sericitic shear zone 1.0 m wide, hosted by chlorite schist occurs in a creek on the East Plateau. The zone contains trace amounts of sphalerite. A sample from this zone, AB20738, contains 1840 ppm Zn and 320 ppm Cu. The shear zone strikes 175° and dips 85° west. It could not be traced north or south of the creek.

South Grid East Quartz-Sericite Schist Belt:

A 3 m wide pyritic shear zone occurs in the "South Grid East Quartz-Sericite Schist Belt" located in the southeast corner of Mariposite 2. The zone strikes 172° and dips 85° east. Sample AB20860 from this zone contains 1200 ppm Cu and 240 ppm Zn.

Structural Geology

The chloritic and sericitic schists of the central part of the property strike 170° to 180° and dip 80° to 90° to the east. Except near the Coast Range Intrusions where they strike roughly parallel to the irregular margins of the intrusions. The sediments on the East Plateau strike 150° to 180° and dip near vertically east and west. The sedimentary rocks in the Balan Creek Area are highly deformed and there are many tight folds up to 1 m in amplitude. Most fold axes strike north-northwest to north and dip steeply east to vertical. Minor folds with axial planes striking northwest to north-northeast and plunging moderately to steeply north and south are occasionally seen on the rest of the property suggesting that a similiar style of major folding may have occurred.

There is strong evidence that the North and South Lenses of the Ecstall Deposit occur on the same horizon which has been tightly folded about a vertical, north trending, steeply south plunging axis. Evidence for this is the antiformal outline of the deposit on surface (Fig. 14) and the presence of many tight folds in thin quartz-sericite schist beds within the deposit (Douglas, 1952).

Stratigraphic top indicators are rare due to destruction of most primary features during regional metamorphism, however a few examples were observed. An extremely tentative top-to-the-east determination was made on an outcrop of pillowed mafic volcanics on Allaire Ridge immediately south of Thirteen Creek Cirque. A graded bed of felsic lapilli tuff on Red Bluff fines to the east. In drill hole 86MAR-2, at a depth of 164.7 metres, rip-up clasts of argillite in a bed of quartz-sericite-mariposite schist indicates tops are to the east. In Red Gulch Creek felsic volcanic breccia, which appears to be an extrusive phase of quartz-biotite gneiss, occurs immediately east of the gneiss and also suggests tops are to the east.

Most rocks of the Ecstall Pendant have a foliation striking 170° to 180° and dipping 80 to 85° to the east. All fragmental rocks appear to have been stretched by 2 to 3 times in the horizontal direction parallel to foliation. There has also been considerable vertical deformation. Mafic fragments on Allaire Ridge have been vertically stretched by more than 3 times.

Lithogeochemistry

General:

The volcanism on the property appears to be bimodal. Only mafic (chlorite schist) and felsic (quartz-sericite schist and quartz-biotite gneiss) metamorphic rocks were positively identified as being volcanic in origin. No intermediate volcanic rocks were recognized.

The volcanic rocks were classified chemically along the lines suggested by Irvine and Baragar (1971). Major oxide data indicates that the mafic volcanics belong to the tholeiitic rock series while the felsic volcanics belong to the calc-alkaline series. Some samples were also analyzed for selected rare earth elements (REE). The REE data support the conclusions made from the major oxide data.

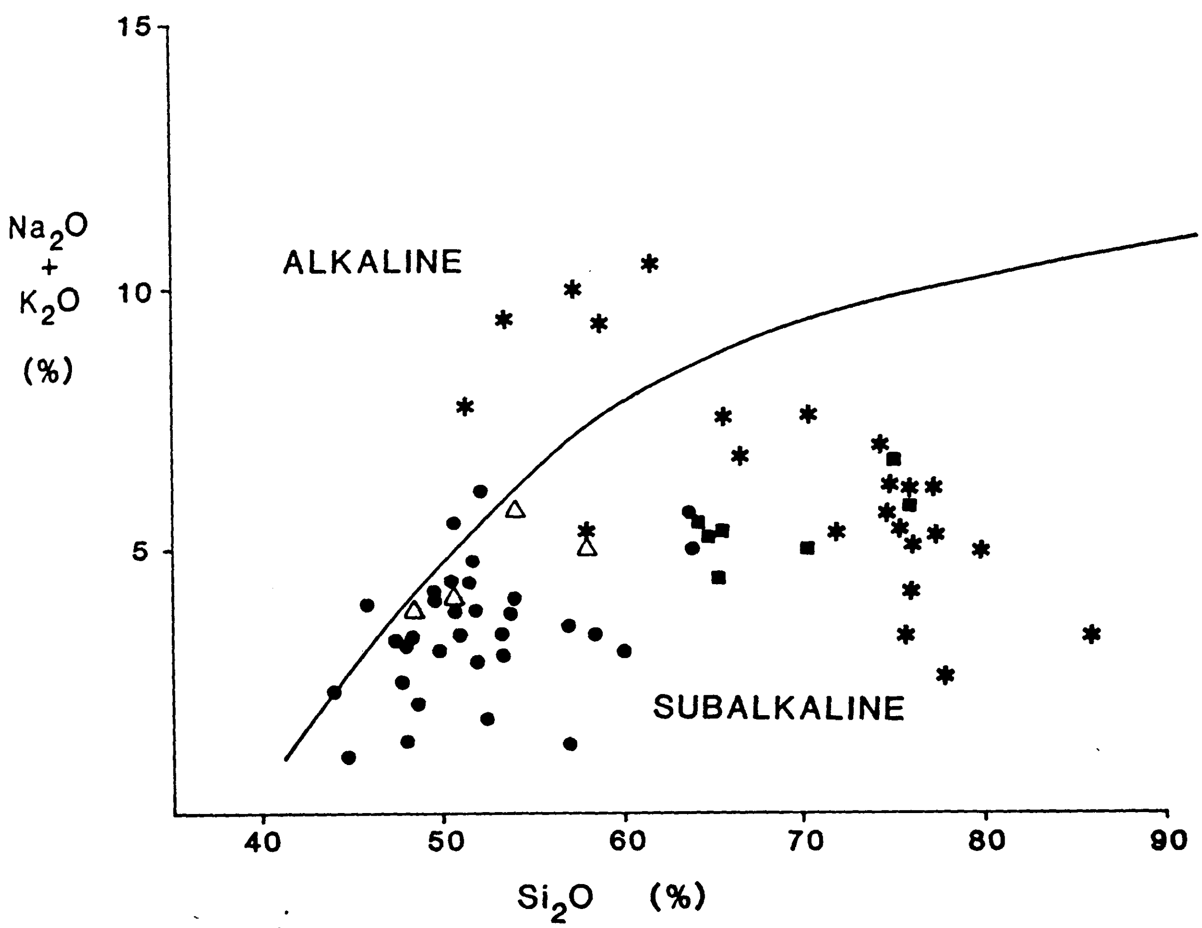
Mafic Volcanics (Chlorite Schists):

Thirty-three samples of chlorite schist, four from outcrops displaying pillow structures, were analyzed for the major oxides and plotted on an alkali-silica plot (Fig. 15). Thirty of these samples plot in the subalkaline field as defined by Irvine and Baragar (1971). These samples were then plotted on a Jensen Cation Plot (Jensen, 1976) which is designed to subdivide subalkaline rocks into the tholeiitic, calc-alkaline and komatiitic suites (Fig. 16). Twenty-four samples plot in the tholeiitic field, 2 intensely chloritized samples plot in the komatiite field and the rest plot in the calc-alkaline field.

Twenty-three chlorite schist samples were analyzed for the 7 rare earth elements (REE) LA, Ce, Nd, Sm, Eu, Yb and Lu. Thirteen of these display smooth chondrite-normalized REE distributions (Fig. 17). The distributions are flat with overall REE abundances of 15 to 30 times chondrite.

Although the data is by no means conclusive it does indicate that most if not all the mafic volcanic rocks on the property belong to the tholeiitic series.

The chlorite schists are relatively rich in nickel (Ni) and chromium (Cr) (see table III). Nickel and chromium are strongly partitioned into olivine in the early stages of fractionation. The relatively high concentrations of these two elements indicates that the mafic volcanics are relatively primitive tholeiites.



- • chlorite schist
- △ pillowed mafic volcanics
- * quartz-sericite schist
- ■ quartz-biotite-chlorite gneiss

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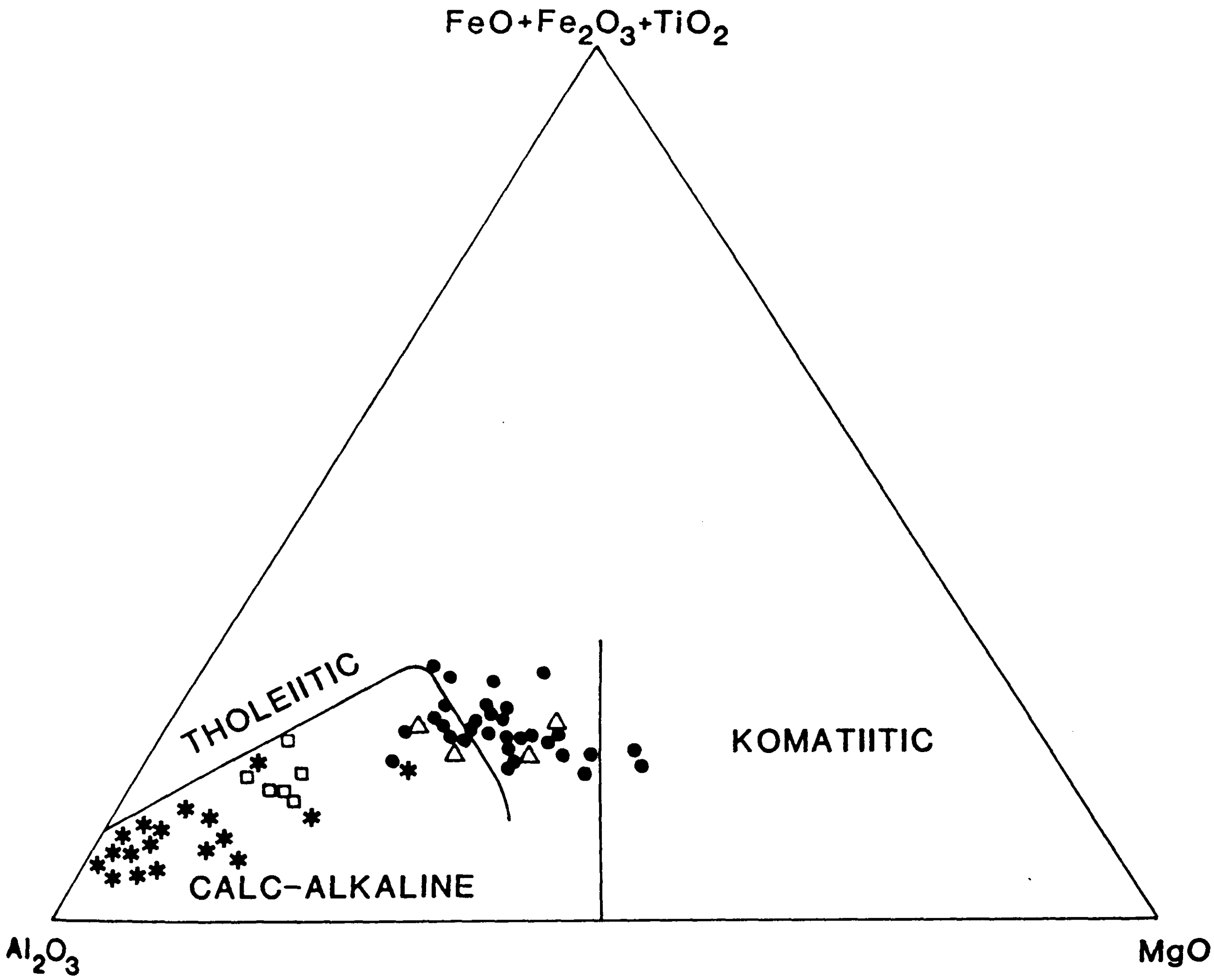
ALKALI vs. SILICA

Ecstall Volcanics

Work by: FH,JP,LU | Figure 15

after Irvine and Baragar (1971)



• chlorite schist

△ pillowed mafic volcanics

✱ quartz-sericite schist

□ quartz-biotite gneiss

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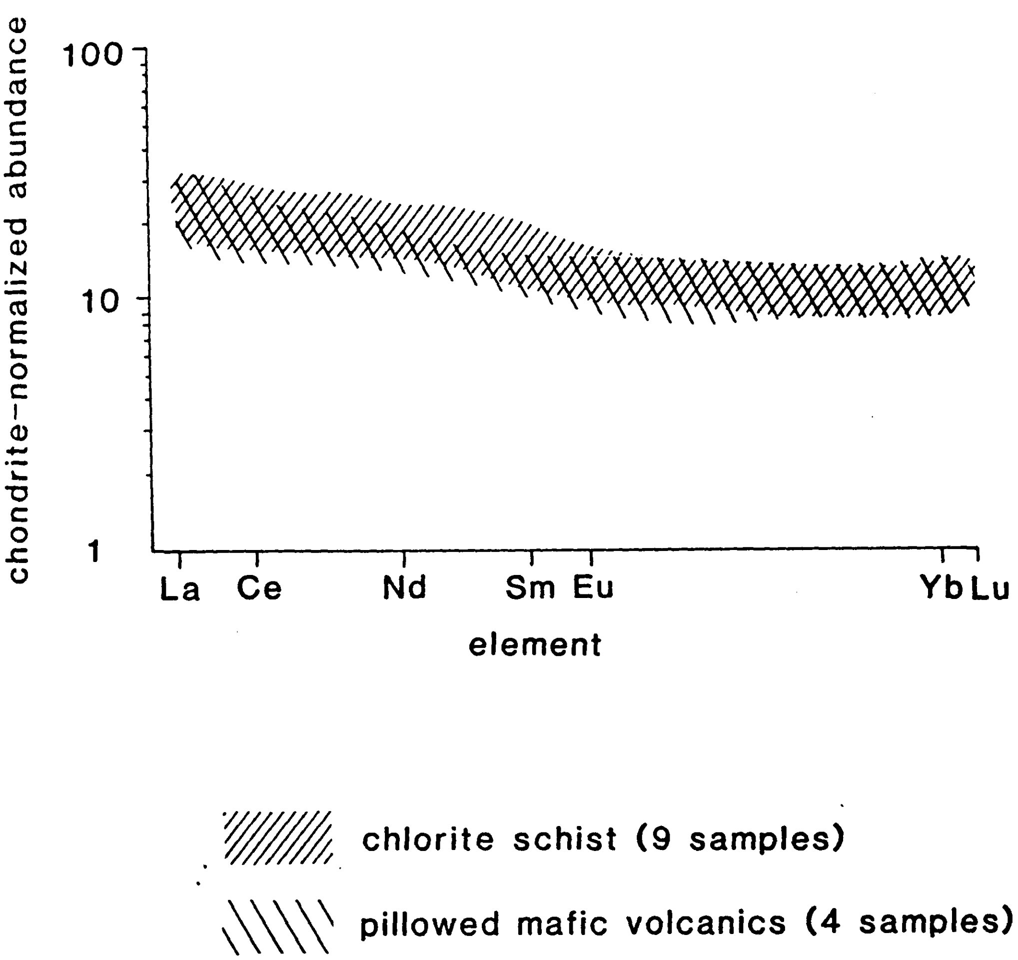
Jensen Cation Plot

Ecstall Volcanics

Work by: FH,JP,LU | Figure 16



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Rare Earth Elements Plot
Mafic Volcanics

Work by: FH,JP,LU | Figure 17

TABLE III

NICKEL AND CHROMIUM IN MAFIC VOLCANICS

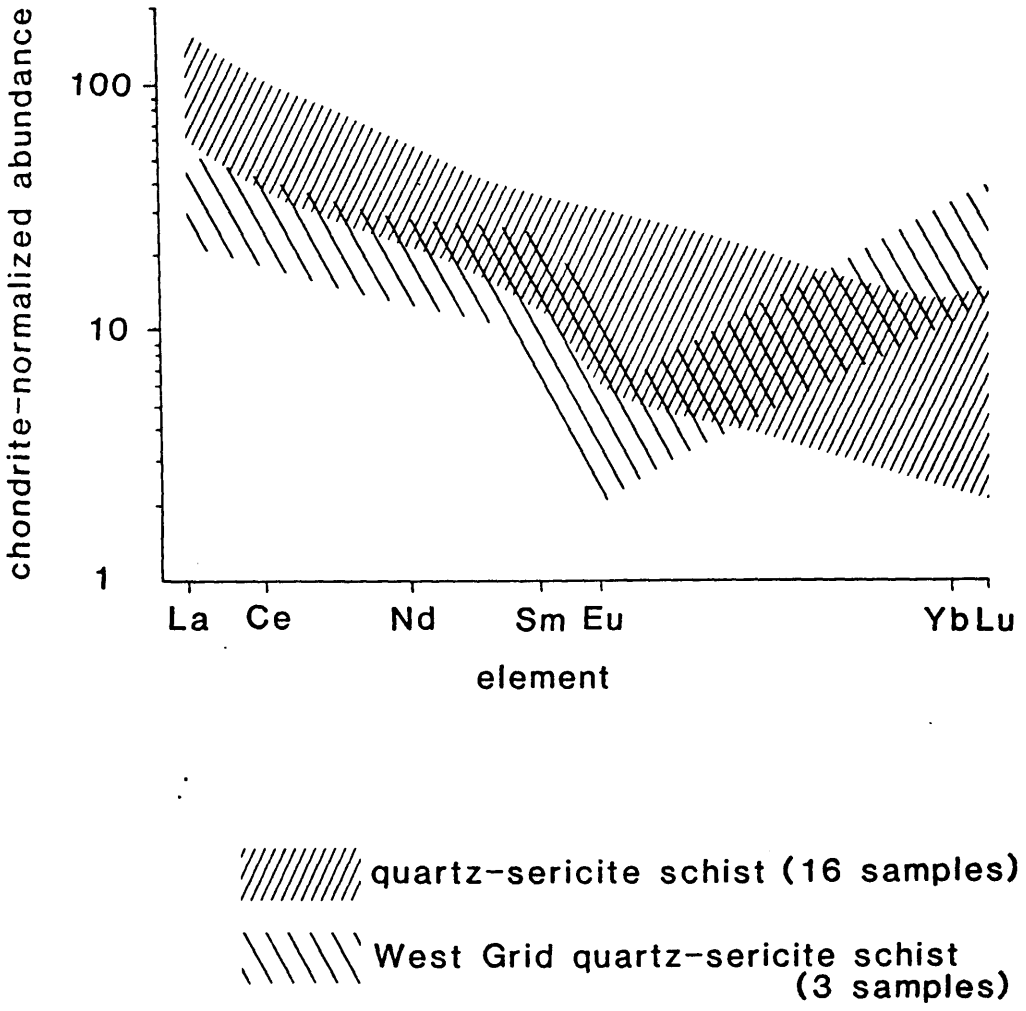
ELEMENT	AVERAGE CHLORITE SCHIST ON THE ECSTALL PROPERTY	AVERAGE BASALT (Pinz, 1967)	AVERAGE OCEANIC THOLEIITIC BASALT (Engel et al., 1965)	AVERAGE ISLAND ARC THOLEIITIC BASALT (Jakes and White, 1972)	AVERAGE CALC-ALKALINE BASALT (Jakes and White, 1972)
Ni (ppm)	138	90	97	30	25
Cr (ppm)	332	168	297	50	40

Felsic Volcanics (Quartz-Sericite Schists & Quartz-Biotite Gneisses):

As previously mentioned, virtually all quartz-sericite schist samples are altered to some degree and this alteration has affected the major element chemistry of most of these rocks. Eighty-four quartz-sericite schist and 7 quartz-biotite gneiss samples were analyzed for the major oxides. The results were screened in order to remove strongly altered and mineralized samples. Samples with <1% Na_2O, or <100 ppm Sr, or Ishikawa Index >50, or more than trace ammounts of sulphide were removed from the data set. The remaining 25 quartz-sericite schist and all quartz-biotite gneiss samples were plotted on an alkali-silca plot (Fig. 15). Twenty-one quartz-sericite schist and all quartz-biotite gneiss samples plot in the subalkaline field as defined by Irvine and Baragar, 1971. The samples were then plotted on a Jensen Cation Plot and all plotted in the calc-alkaline field (Fig. 16).

Nineteen of the unaltered quartz-sericite schist samples were analyzed for the REE and 14 of these displayed smooth chondrite normalized REE distributions (Fig. 18). Two distinct patterns emerged. The first is displayed by all samples except those from the West Grid Quartz-Sericite Schist Belt. It is a steeply sloping pattern, typical of calc-alkaline rocks with [La]n:[Yb]n ratios of 14 to 24 and an average [Yb]n value of 9 times chondrite (Fig. 19). The second type is displayed by 3 samples taken along the West Grid Quartz-Sericite Schist Belt. These samples have [La]n/[Yb]n values of 1.5 to 2.3 and pronounced negative Eu anomalies. This anomalous REE pattern may be a primary geochemical feature of the West Grid Quartz-Sericite Schist Belt or it may be the result of alteration. Further sampling and detailed mapping would be needed to resolve this.

All 7 quartz-biotite gneiss samples were analyzed for REE. The samples have moderately sloping REE distributions characteristic of calc-alkaline rocks (Fig. 20).



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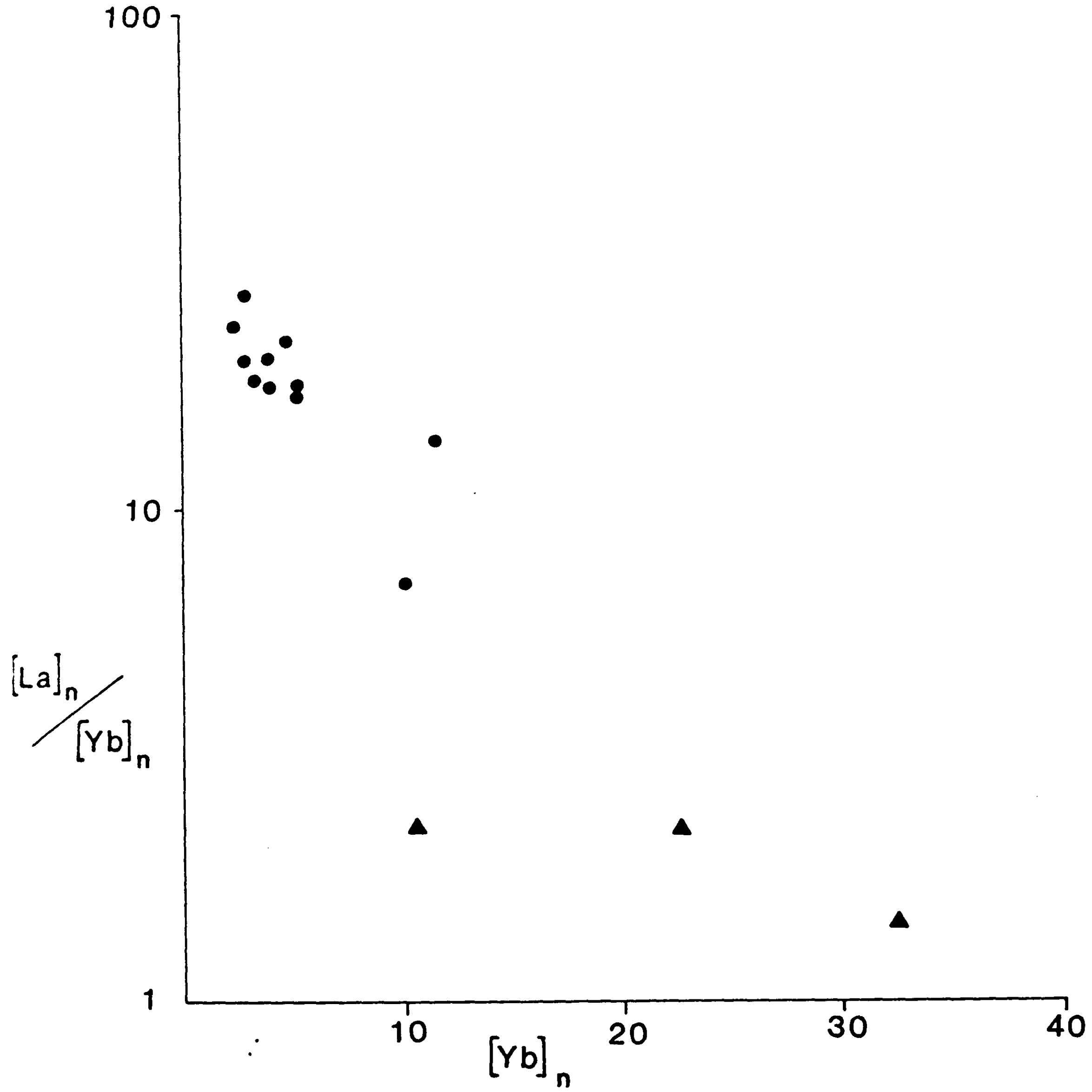
Rare Earth Elements Plot
quartz-sericite schist

Work by: FH,JP,LU — Figure 18



● quartz-sericite schist
▲ West Grid quartz-sericite schist
n chondrite normalized

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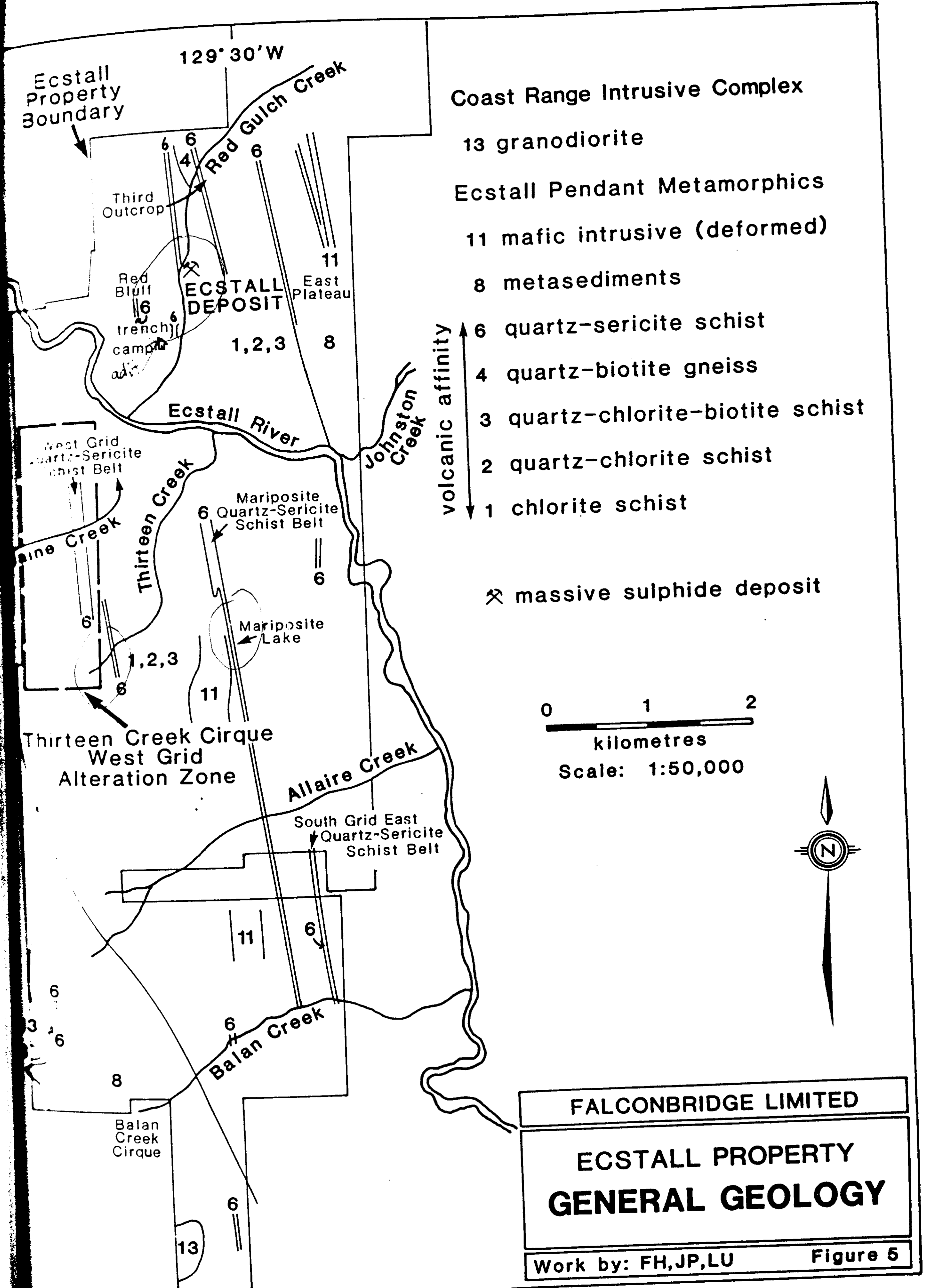
La/Yb vs. Yb Plot

quartz-sericite schist

Work by: FH,JP,LU **Figure 19**


129°30'W
Ecstall Property Boundary
Red Gulch Creek
Third Outcrop
Red Bluff
trench
camp
ECSTALL DEPOSIT
East Plateau
1,2,3
8
11
6
4
Ecstall River
Johnston Creek
West Grid Quartz-Sericite Schist Belt
Thirteen Creek
Mariposite Quartz-Sericite Schist Belt
Mariposite Lake
Thirteen Creek Cirque West Grid Alteration Zone
Allaire Creek
South Grid East Quartz-Sericite Schist Belt
Balan Creek
Balan Creek Cirque
13
Coast Range Intrusive Complex
13 granodiorite
Ecstall Pendant Metamorphics
11 mafic intrusive (deformed)
8 metasediments
6 quartz-sericite schist
4 quartz-biotite gneiss
3 quartz-chlorite-biotite schist
2 quartz-chlorite schist
1 chlorite schist
volcanic affinity
massive sulphide deposit
0 1 2
kilometres
Scale: 1:50,000
N
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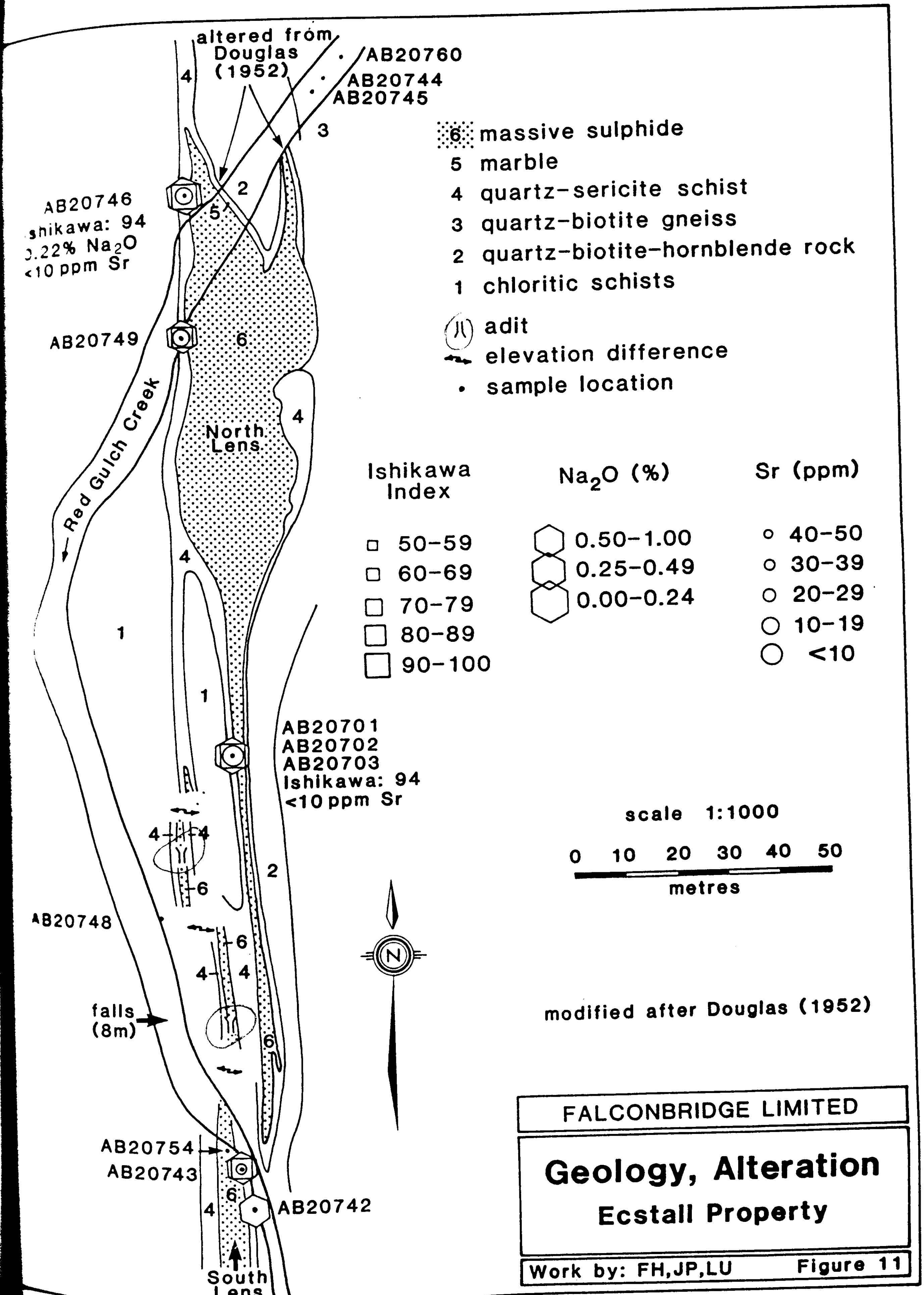
ECSTALL PROPERTY
GENERAL GEOLOGY
Work by: FH,JP,LU
Figure 5



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Geology, Alteration

Ecstall Property

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Figure 11