

GEOLOGICAL REPORT

EIK PROPERTY

Northern Vancouver Island, Nanaimo M.D.

July, 1972

P. Folk, B.A.Sc.

861204

G E O L O G I C A L R E P O R T

ELK PROPERTY

located on

NORTHERN VANCOUVER ISLAND,
IN THE NANAIMO MINING DIVISION

July, 1972

P. Folk, B.A. Sc.

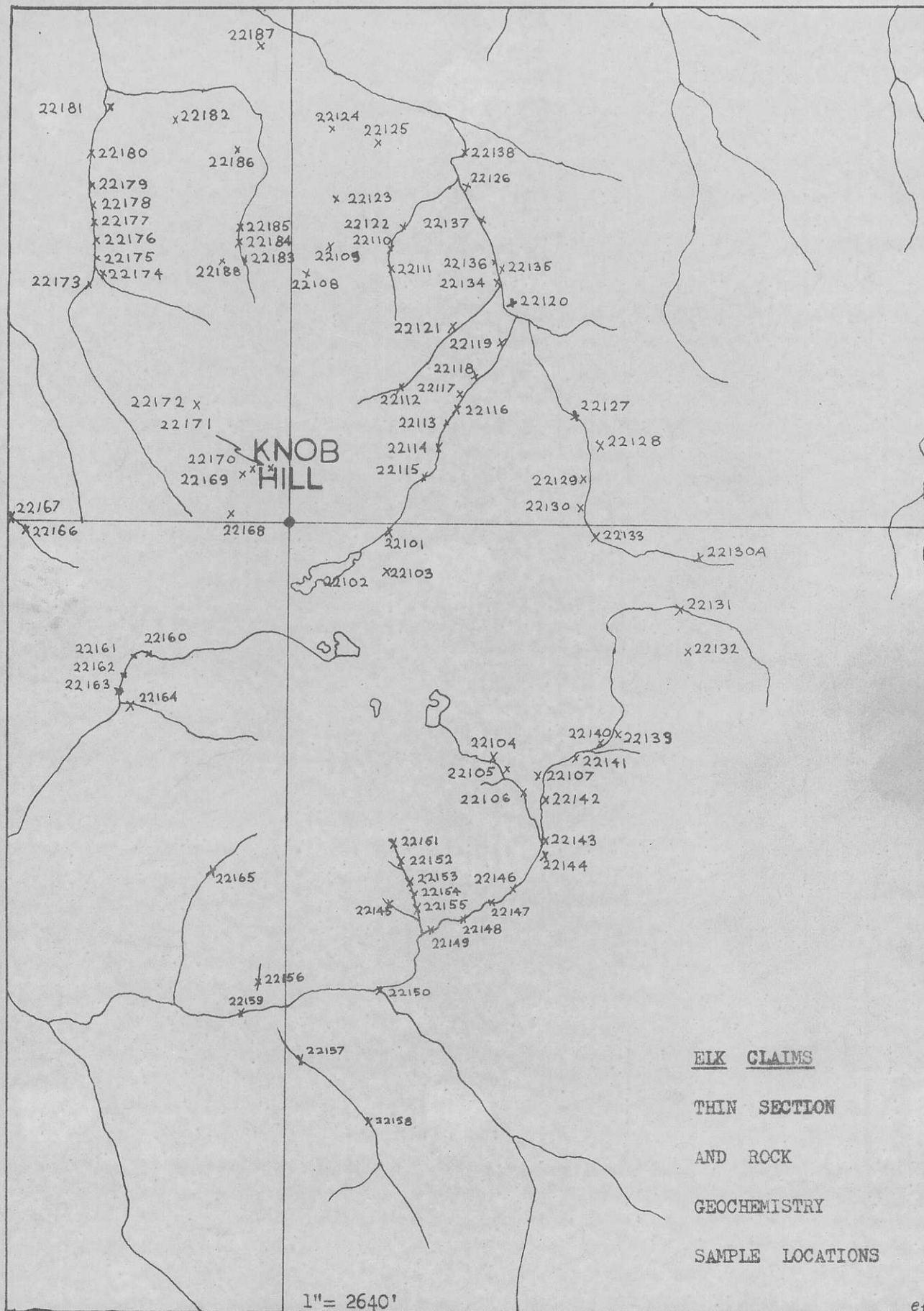


FIG. 2

ef

T A B L E O F C O N T E N T S

	Page
Summary.....	1
Introduction.....	2
Location and Access.....	2
Topography and Vegetation.....	3
Regional Geology.....	3
Geology of the Elk Property.....	4
Introduction.....	4
Stratigraphy and Structure.....	4
Description of Rock Units.....	7
Alteration.....	15
Origin of Alteration.....	16
Mineral Occurrences.....	17
Discussion.....	17
Conclusion.....	18

MAPS, FIGURES & TABLES

Geology

enclosed

Fig. 1 Location Map

after Page 2

Table of Rock Units

Page 6

Fig. 2 Thin Section and Rock Geochemistry
Sample Locations

after Page 7

APPENDIX

Petrographic Descriptions.....after Page 19

SUMMARY

1. On the Knob Hill Elk claims there are at least two foci of intense hornfelsic alteration which are associated with distinct magnetic anomalies. The Knob Hill area also is the focus of the rock geochemistry, and is the culmination of a distinctly domal topographic form.

2. A large magnetometer anomaly, similar to the Knob Hill anomaly occurs in the east part of the property at one mile east - 1800 feet south. No rock outcroppings can be found within this anomaly.

3. Hydrothermal action has altered most of the rocks in the Bonanza strata. Sericite, clay, calcite, silica, chlorite, epidote and pyrite are common alteration products.

4. The most intense argillic type alteration occurs in fractured areas and fault zones. It is not necessarily associated with the visible plutonic rocks.

5. No significant mineralization was found.

INTRODUCTION

The Elk claim group, comprising 170 full size, contiguous mineral claims was staked during February and April 1972 by West Coast Mining and Exploration. During the latter part of May and the early half of June 1972 magnetometer, rock geochemical, and geological surveys were carried out over a large part of the claim group.

The rock geochemical survey, field mapping, and petrographic (thin section) examinations were carried out by P. Folk under the supervision and with the assistance of H. Veerman and W. Botel of West Coast Mining and Exploration. This report deals with the geological mapping and petrographic examinations.

For information regarding the other aspects of the work see the "Progress Report" by H. Veerman, P. Eng., dated July 1972.

LOCATION AND ACCESS

The property (Fig. 1), is located about fifteen miles north of Holberg, northern Vancouver Island and encompasses most of the area known as KNOB HILL. Good logging roads, originating at Port Hardy, about 30 miles away, pass within four miles of the claim group center. It is an easy walk along a flagged trail from the road's end to the camp. Alternately, helicopter service is available at the Port Hardy airport.

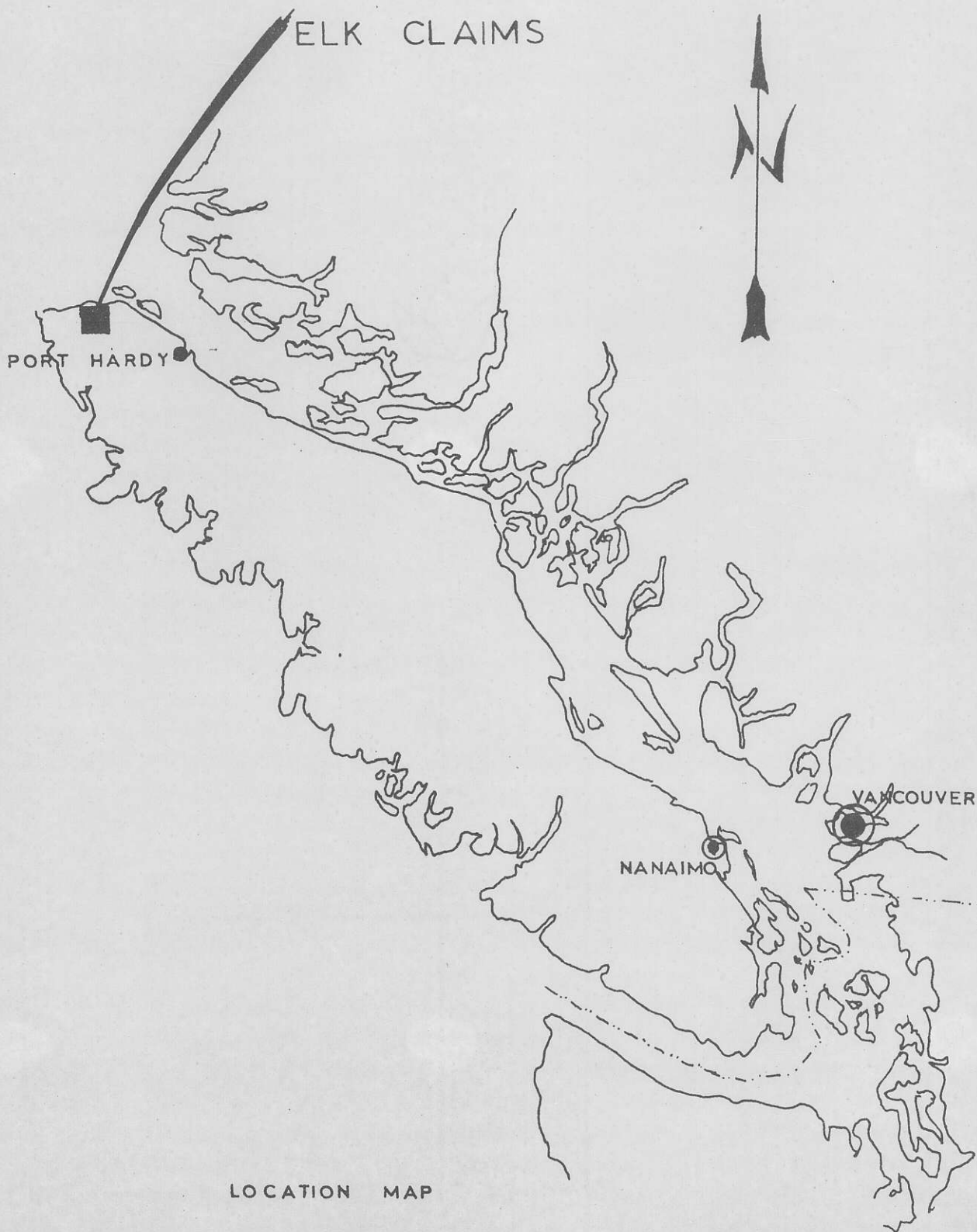


FIG. 1

1"=40 MILES

TOPOGRAPHY AND VEGETATION

The topography and vegetation of the area is distinctly different than most other parts of Northern Vancouver Island. Vegetation is generally sparse! Trees are few and stunted with little undergrowth. These are large, open, swampy, poorly drained areas containing moss and coarse grass with myriad small ponds and puddles. Rain forest, typical of most of northern Vancouver Island is evident in the valleys of large creeks and rivers.

The topography is gentle and hilly. The Elk claims cover a roughly circular, domal form culminating in Knob Hill, a distinctive land mark.

REGIONAL GEOLOGY

The Elk claims are situated across a northwest trending band of Bonanza (lower Jurassic) tuffs and volcanics. To the south west this band of Bonanza strata is overlain by Lower Cretaceous sediments. To the north east they are cut by (middle and upper Jurassic) crystalline rocks of the "Island Intrusions". Just west of the property the Bonanza group overlay a band of Quatsino limestone (upper Triassic) and Karmutsen (upper Triassic and older) andesites and basalts.

Two producing mines and several prospects are associated with the Bonanza strata.

GEOLOGY OF THE ELK PROPERTY

Introduction

Geological mapping of the property was completed by using pace and compass methods tied into the magnetometer grid lines whenever they were encountered. At the same time, rock chip samples were taken for geochemical analysis and for the manufacture of thin sections. There are very large areas with no outcrop in which no geological (or geochemical) information is available.

The accompanying geological map shows the geology as seen in the field and later confirmed by the examination of thin sections.

Sixteen different classifications of rocks were recognized and mapped. The basis for distinguishing the rocks is in part lithologic and in part determined by the degree of alteration. In other words, the rocks have been divided into rock types such as Andest¹ie, Quartz, Diorite, etc. and further classified as to degree of alteration, for example Tuffs and Highly Altered Tuffs.

STRATIGRAPHY AND STRUCTURE

The lack of outcrop, marker horizons, and bedding attitudes prevented correlation between different areas and hence the stratigraphy of the Bonanza rocks remains unclear.

Similarly, the structural picture remains unclear. An examination of air photos reveals an obvious radial drainage. Creeks radiate from the Knob Hill area to join two large creeks which form a roughly circular arrangement around the Knob Hill area. The resulting "domal" structure culminates

at Knob Hill. Unfortunately, domal uplift can be neither proven nor disproven due to a lack of stratigraphic horizons, bedding attitudes and outcrops in general.

The dominant structural trends are north west - south-east. The Bonanza-Cretaceous and Bonanza-Island Intrusive contacts trend in this direction as does a rhyodacitic group of rocks in the Bonanza strata. Otherwise, there is an east-west trend in dykes and fractures to the north of Knob Hill. The major structural trends show up on the magnetometer map of the area.

Faults in many directions cut the area, some are parallel to the drainage and others cut across it. It is suspected that the intrusive contact is in part a faulted one.

TABLE OF ROCK UNITS

CRETACEOUS

Conglomerate and Sandstone

LOWER JURASSIC (Bonanza Group)

Hard, Dark Volcanics, Hornfels

Light Grey Lithic Tuff

Light Green Unaltered Tuffs

Light Green Altered Tuffs and Volcanics

Light, Grey, Highly Altered Tuffs and Volcanics

Rhyodacite

Black Conglomerate

Weakly Altered Andesites and Basalts (Karmutsen Group)

Limestone and Banded Calcareous Tuffs

GRANITIC ROCKS

Coarse Grained Biotite Granodiorite

Medium Grained Granodiorite

Medium Grained Quartz Diorite

Contact Phase

Various small bodies, Felsite, Diorite, Feldspar Porphyry

DYKES

Andesite Dykes, some porphyritic

DESCRIPTION OF ROCK UNITS

Introduction

The following are descriptions of the rock types seen in the field and mapped. Pertinent information gathered in the petrographic examinations are included here. Individual thin sections are described in the appendix. Figure two is an index map showing the rock sample locations.

Note that the order of the rock descriptions is not meant to infer stratigraphic or time sequence.

CONGLOMERATE AND SANDSTONE (Lower Cretaceous)

Unconformably overlying the Bonanza strata are lower cretaceous, unaltered, boulder conglomerates and brown sandstones, generally dipping steeply to the west. A thin section from near the contact with the Bonanza group shows that the sandstone is composed of rounded volcanic particles, feldspar and quartz grains.

HARD, DARK VOLCANICS, HORNFELS

Rocks of this type are found outcropping in two different areas:

- (1) Knob Hill
- (2) Near coordinates one mile east, one mile south, or at the corner between sections 13, 18, 7 and 12. For reference purposes this shall be called area number two.

The rocks at Knob Hill are distinct from any seen elsewhere. They are light to dark grey, pyritized with traces of Pyrrhotite, fragmental, very tough rocks. Some of the rocks have a peculiar luster similar to that of argillite.

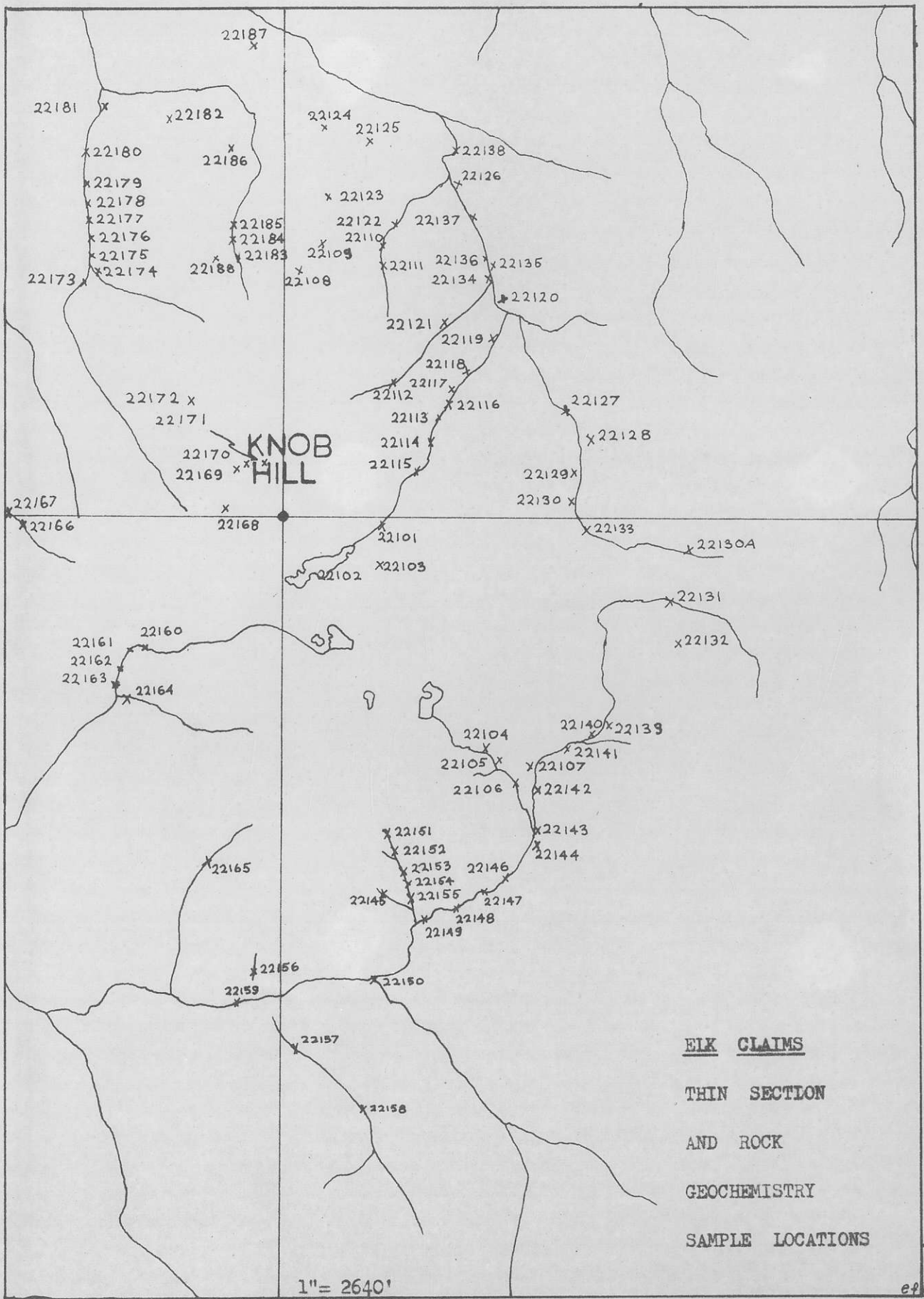


FIG. 2

In thin section (numbers 22168 to 22172) the rocks take on a variety of aspects. Two of the slides show a high percentage of opaques, probably pyrite, and silica enrichment in what appears to be a volcanic rock. Two other slides contain small secondary biotite grains with abundant fine brown clay. Number 22168 contains about twenty percent andalusite as small crystals in mosaic ground mass of quartz, sericite and traces of biotite. The texture and mineralogy is that of a hornfels. Thin section number 22171 from Knob Hill has the texture of an ignimbrite but the main constituents have been completely altered to a uniform "film" of very fine opaque dust, clay and sericite. It is this very fine uniform argillic material which gives the hand specimen its "argillite" appearance. The volcanic glass in the rock has been completely altered to a black opaque material.

In area number two are some rocks which are not as dark or as fragmental as the Knob Hill group but appear to have been similarly altered. These rocks are fine grained, grey and hard. One of the thin sections from the area (No. 22143) contained secondary biotite and about twenty percent of very fine opaque, possibly carbonaceous matter in a fine mosaic of quartz and feldspar. The original texture, now obliterated may have been clastic or porphyritic. Other rocks in this area are fairly well pyritized, sericitized, calcified and altered to clay.

LIGHT GREY LITHIC TUFF

There is a fairly distinctive group of medium to coarse grained lithic tuffs directly to the north and to the south west of Knob Hill. In general terms these rocks are light grey in colour with fragments visible

to the unaided eye. Thin sections show that they are mostly only weakly altered and locally the fragments of quartz, feldspar and lithic particles are rounded and compact. Slide number 22185 in this group has the texture of a poorly sorted sandstone.

In the rocks of the grey lithic tuff classification to the south west of Knob Hill there is a small area in which the rocks are quite highly altered, probably a structural effect. These rocks have been included in the "Light Grey Highly Altered" classification. Pyrite and a few specks of chalcopyrite and molybdenite were found here.

LIGHT GREEN UNALTERED TUFFS

Outcrops of this group occurs in the southern part of the mapped area. They are finely to coarsely clastic in texture and in general have minor pyrite, chlorite, carbonate with some epidote. These are characteristic minerals or propylitic type hydrothermal alteration.

Hand specimens are light green, locally fragmental in appearance, only slightly pyritized and sometimes have carbonates in fractures.

LIGHT GREEN ALTERED TUFFS AND VOLCANICS

Most of the outcrops in the creek to the east of Knob Hill and in the large creek of "area two" are included in this classification. These andesite and tuffs are more or less altered to sericite and clay with calcite. Pyrite and sericite are usually present. In the field they are light grey to green, and have an indistinct clastic appearance with light coloured alteration sometimes surrounding various grains.

Thin sections show varying amounts of argillic type alteration with sericite, pyrite and clay. Feldspars, andesine in composition, are usually sericitized and/or partly altered to clay. Epidote and calcite alteration (Saussurite) is also common.

LIGHT GREY HIGHLY ALTERED TUFFS AND VOLCANICS

These are somewhat similar to the above, but are more strongly altered. The division between Altered and Highly Altered is in fact somewhat arbitrary.

Rocks of this classification are pervasively altered to sericite and clay. Silicification and pyritization are common. In hand specimen, these rocks are light grey and pyritized, fragmental or fine grained and massive. They have limonitic weathered surfaces and are commonly associated with faults and fractures.

Thin section examinations show relict clastic and prophyritic textures with the feldspathic components completely altered to sericite, clay (kaolinite) and sometimes to calcite. Silicification is sometimes intense.

This group also includes some altered acid volcanics or tuffs in the vicinity of line 4800 east at 6000 south. These rocks are massive, light grey to green, pyritized, highly siliceous and fine grained with no visible phenocrysts or fragments. They are cut by large, dark green porphyritic andesite and smaller andesite dykes. The same intense sericitization, etc. as described above was found in the thin sections. Original textures were largely obliterated by the alteration products.

RHYODACITE

A group of very hard, banded, light coloured, pyritized, fine grained rhyodacites occur in a north west - south east trending belt north east of Knob Hill.

Thin sections show that these are fine grained, quartzo-feldspathic rocks with bands containing quartz and feldspar in a fine mosaic. Some bands also have large percentages of very fine plagioclase laths, while others contain minute granules of epidote. There has been some quartz-sericite-epidote veining, but relatively little alteration in general. This lack of alteration is not surprising in such a dense, impermeable, and siliceous rock.

There are some fine grained quartzo-feldspathic tuffs included in this unit, (samples numbered 22130A and 22131). These exhibit moderate alteration to sericite and clay.

BLACK CONGLOMERATE

The creek bed upstream from area number two (about 6000 east, 3600 south) contains a black conglomerate. Various angular to sub-round fragments up to 1½ inches in diameter rest in a fine grained black argillaceous matrix. The strata trends in a northerly direction.

WEAKLY ALTERED ANDESITES AND BASALTS

Massive, relatively unaltered andesties and basalts outcrop to the north west of Knob Hill. These are dark grey to green, east-west trending partly amygdaloidal volcanics. These are distinct from other rocks in the area and could very well be a block of Karmutsen group volcanics which have somehow been faulted into the area.

Thin sections indicate that the andesites are sericitized and calcified more than the basalts, but alteration is generally not strong. Subophitic and amygdaloidal textures are common.

LIMESTONE AND BANDED CALCAREOUS TUFFS

Thin bands up to 15 feet wide of limestone and light green calcareous tuffs are found in a few places in the cretaceous and Bonanza rocks. The attitude of these sometimes contorted bands is irregular.

GRANITIC ROCKS

The Island Intrusives in the claim area are composed of three main phases. Going away from the contact, the rocks grade from a light colored hornblende-chlorite, medium grained quartz diorite through light pink medium grained granodiorite with greater than 10% K-spar, into brown colored coarser grained granodiorite with greater than 10% K-spar but with clots of mafic minerals, notably biotite.

Included in the last category are a few outcrops of brown hornblende medium grained basic diorite. This phase shows up as a magnetometer high in the south east quadrant of section 25.

Most of the granitic rocks show little alteration. Thin sections of medium grained granodiorite and quartz diorite show minor deuteric alteration of hornblende to chlorite, epidote and opaques. There is normal zoning of feldspars. Feldspar cores vary from labradorite to andesite in composition with more alkalic rims. In faulted and fractured areas, sericite and calcite in particular indicate weak hydrothermal alteration. Quartz grains are broken, indicating strain. In some hand specimens, minute fractures in the granitic rocks exhibit a pink, K-spar alteration.

CONTACT PHASE

The granitic phases just described are crystalline rocks which are easily identified and distinct from "contact phase" rocks. The contact phase is a heterogeneous group which outcrops near the crystalline rocks described above. They are leucocratic or dark, massive or banded, and do not show a definite crystalline texture in hand specimens. There is some evidence of granitization. Light colored crystalline rocks are interlayered with bands of darker, altered volcanics.

The thin sections from areas near the contact are variously described as leucocratic quartz diorite, porphyritic hornblende quartz diorite, chlorite quartz diorite, altered rock, amphibolite, and pseudo-poikilitic pyroxene quartz diorite. They also show various stages of alteration. Some of the darker rocks have been recrystallized into fine amphibolites. Some of the leucocratic rocks are granitic in texture and have up to 40% quartz. Other rocks can only be described as altered, having been hydrothermally altered to sericite, clay, and calcite, presumably from reactions associated with the intrusive mass.

Thin section number 22173, from a sample taken about three quarters of a mile north west of Knob Hill is particularly interesting. It contains roughly 45% quartz, some, obviously the result of silica enrichment and secondary biotite. The appearance of biotite suggests that the alteration is similar to that at Knob Hill, and thus may be related to the Knob Hill alteration zone.

The contact phase rocks are found at various distances from the crystalline intrusives. In some places, notably at the intrusive-andesite and basalt contact, no contact phase exists. This is probably a faulted contact.

Various leucocratic dykes of various compositions are found cutting through the area. Small felsitic, diorite and feldspar porphyry dykes outcrop in the creek near "area two". These are generally associated with pyritization but are not heavily pyritized themselves. A thin section of a felsite dyke showed considerable sericitization but no pyrite. Rock near the dyke is heavily pyritized. Either the sericitization of the dyke is deuteric and the fluids associated with the dyke are partly responsible for the alteration of the surrounding rocks, or the alteration occurred after the dyke was intruded and the impermeability of the dyke rock prevented it from being pyritized. The former is more plausible. However, the relationship of these small bodies to the alteration is not clear. One small diorite dyke, in fact cuts the unaltered Cretaceous sandstones. A thin section of the dyke shows sericitization and calcification. The alteration must be deuteric.

DYKES

Andesite dykes from a few inches to 60 feet wide are found throughout the area. They cut all strata except the cretaceous and hence are probably upper Jurassic in age. They are generally only slightly if at all altered. The larger dykes are prophyritic and can sometimes be traced over long distances.

ALTERATION

The bulk of the Bonanza strata has been hydrothermally altered to some extent. Propylitic alteration with calcite, chlorite, epidote and pyrite occurs in the "light green unaltered tuffs" and "light grey lithic tuffs". Argillic alteration characterized by sericite, clay minerals, epidote, calcite, quartz and pyrite is found in most other Bonanza group outcrops. The rock classification used here divides the argillic type alteration into altered and highly altered. In the highly altered type, the rocks are composed almost entirely of the characteristic minerals listed above. The altered rocks are only partly altered and some original minerals persist. Faulting and fracturing are associated with concentrations of pyrite and highly altered strata; in other words, intense argillic alteration is structurally controlled.

Thin section studies show that the rhyodacites, some of the contact phase rocks, and quartz diorites of the Island Intrusives are somewhat argillicly altered. Alteration of the intrusives occurs mainly in fault and fracture zones.

The rhyodacites are relatively unaltered, since they are dense and impermeable; however, sericite, calcite, epidote, quartz and pyrite were found.

The strongest alteration is a hornfelsic type characterized by dark, resistant, tough rocks. Biotite is found in some of the specimens and there is generally a high percentage of finely divided opaque material. One rock sample from the Knob Hill area contains about 20% andalusite with sericite

and traces of biotite in a fine quartzo-feldspathic groundmass. This composition and texture are characteristic of hornfels alteration.

ORIGIN OF ALTERATION

Hornfelsic alteration does not result directly from the contact with the main body of the Island Intrusives. This is obvious since relatively unaltered rocks occur between the two areas of intense alteration and the quartz diorites and granodiorites. Also, no biotite or hornfelsic alteration was seen in the contact zone. Another source of heat must be postulated.

In the creek in "area two", there are a few diorite dykes and a small outcrop of hornfelsic material. Although these very small bodies are not sufficiently large to produce such intense alteration, they may be indications that larger hidden intrusive bodies exist, possibly at depth.

No granitic outcrops were found in the Knob Hill vicinity, but there are only five small outcrops within a 1500 foot radius of the hill top. The source of alteration is hidden.

Argillic alteration extends from the quartz diorite in the north to the south end of the claims. Part of the alteration may be the result of emanations from the intrusive, but generally speaking the intense argillic type alteration is related to faulting and fracturing at a distance from the granitic rocks.

In proximity to the hornfelsic alteration in "area two" there is a great deal of argillic alteration and pyritization. Unfortunately, the lack

of outcrop near Knob Hill prevents any definitive statement regarding the distribution of argillic alteration in the immediate area.

MINERAL OCCURRENCES

Very small occurrences of chalcopyrite, sphalerite, and molybdenite mineralization are scattered over the property. There is a small (five feet by two feet) skarn chalcopyrite-sphalerite deposit just outside the property to the north east of Knob Hill and a few scattered traces of mineralization within two hundred feet of the main outcrop. Economically the showing is insignificant. There is a twelve inch wide sphalerite bearing quartz vein about a mile north of Knob Hill. Pyrite and traces of chalcopyrite can be found in most of the rock types.

Near one mile east, 600 feet south, overlying the east magnetic anomaly, a piece of float mineralization was found with 0.2% copper as chalcopyrite associated with pyrrhotite. A thin section of the rock (number X) reveals secondary biotite alteration.

DISCUSSION

The geological and petrographic studies point to the two areas of intense alteration already mentioned. The magnetic survey shows three distinct anomalies in the Bonanza strata. Two of these are associated with the above areas of alteration. Another large anomaly similar to the one over Knob Hill is situated in the area where the float (number X) mineralized rock with biotite alteration was found. Unfortunately, there is no outcrop within 1000 feet of the area to determine the geological features, but the possibility exists that another Knob Hill type situation exists below the overburden.

The geochemistry (see report by H. Veerman) indicates a zonal arrangement focusing on Knob Hill. There are anomalous values in area two, but they are quite erratic. Other high values may be fault controlled.

The other areas of the property do not have a high economic potential. The main body of the Island Intrusives shows some areas of hydro-thermal activity and the odd speck of mineralization. In the north east corner of section 24, there is a small amount of magnetite in a fault zone and some specks of chalcopyrite away from the fault. This is the area of fairly high magnetic values associated with a basic diorite type of rock. The significance of this area is that it shows a small "plug" of different composition within the intrusive mass. If another of these "plugs" were to intrude into the overlying strata, it might alter them in the way that the Knob Hill rocks have been altered. A later or different intrusive episode might also be responsible for the alteration. This is the situation at the Red Dog property about six miles to the south east.

In one of their assessment reports, Stokes Exploration Management Company Limited, for Quintana Minerals Corporation reported a questionable intrusion about 12,000 feet south west of Knob Hill.

CONCLUSION

The area contains a geological environment favourable for the formation of "porphyry" type copper deposits. Geological information, although scanty, points to Knob Hill as a center of alteration. A large magnetometer anomaly to the east may result from a duplication of the Knob Hill geology.

Area two (to the southeast), has similar alteration to that found at Knob Hill, but the magnetic anomaly is small in comparison.

Present information suggests that the Knob Hill area is a prime target for further exploration.

The only way to find out the source of:

- (a) the rock geochemistry anomaly;
- (b) the magnetic anomaly;
- (c) the cause of the intense alteration

is to drill.

P. Folk B.A. Sc.

July 25, 1972

A P P E N D I X

PETROGRAPHIC DESCRIPTIONS

No. 22101

Hand Specimen:

Coarse grained clastic texture. Large particles greater than 10 mm. diameter occur in a groundmass of fine grained feldspar and other fragments. The rock is highly pyritized with an overall grey-green color.

Thin Section:

Texture: Coarse grained clastic. Large rounded fragments of volcanic material and broken plagioclase fragments occur in a groundmass of green almost isotropic chloritic material and clay containing microcrystalline quartz and feldspar. Some of the fragments consist of a fine mosaic of minute interlocking grains, mostly silica. The feldspar grains are andesine.

Epidote occurs in clusters with small quartz grains (in the groundmass). Sericite-chlorite veinlets cut the sample.

Quartz - 10%
Pyrite - 2%

Alteration: Silicification with pyrite and epidote. Minor sericite in fractures. Minor clay in the groundmass.

Name: Altered coarse grained lithic tuff.

No. 22102

Hand Specimen:

Medium grained clastic texture. Green-grey color. Fragments up to 3 mm. in diameter of light green, altered rock and feldspar fragments in a fine grained dark grey-green groundmass. Heavily pyritized.

Thin Section:

Medium grained clastic texture. Altered feldspar (Plagioclase) grains, some euhedral, some broken, up to 1.5 mm. in diameter are in a dirty brown, fine grained groundmass of fine altered feldspars, clay, chlorite and a very fine granular epidote (?). There is about 5% epidote, in coarse aggregates with quartz. Light green Pleochroic, fine prismatic crystals of actinolite are common.

Quartz - 1%
Pyrite - 2%

Alteration: Minor silicification (Veinlets of quartz) and pyritization. Feldspars are altered to brown clay minerals and some epidote. Actinolite results from the alteration of mafic constituents.

Name: Altered tuff or volcanic.

No. 22104

Hand Specimen:

Fine grained, green-grey rock with some dark green particles and feldspar grains up to 2 mm. in diameter.

Thin Section:

Pisolitic texture. Round pisolites of light brown devitrified glass, glass shards, rounded vacuoles of chlorite, fragments of feldspar, and irregular fillings of microcrystalline quartz are in a groundmass of dark grey glassy material and small laths of plagioclase. The glass is partly altered to chlorite and minor calcite. Calcite also occurs in small veinlets.

Epidote - 5% associated with calcite
Quartz - 5%

Alteration: Feldspars are cloudy and partly altered to calcite and epidote. Saussuritization. Weak propylitic alteration.

Name: Tuff.

No. 22105

Hand Specimen:

Grey-green, highly pyritized, rock with a porphyritic or finely clastic texture. Chlorite, epidote, and fine points of white alteration are distributed throughout the specimen.

Thin Section:

Texture: Medium grained clastic texture. Highly altered anhedral to subhedral feldspar grains up to 1 mm. in diameter occur in a fine grained brown (clay) groundmass. Irregular portions of the groundmass are composed of finely granular dark grey mineral with points of yellowish pleochroism - probably an epidote mineral. Chlorite in small irregular shard-like grains forms part of the matrix. The feldspars have been completely altered to fine grained calcite and sericite. Pyrite grains up to 0.5 mm. are disseminated throughout.

Pyrite - 5%
Quartz - negligible

Alteration: Sericitization, some alteration to clay, calcite and epidote. Probably argillic facies alteration.

Name: Altered tuff.

No. 22106

Hand Specimen:

Light grey finely clastic or porphyritic highly pyritized rock. Small feldspar grains and 10% quartz grains all less than 2 mm. in diameter, are in a fine grained groundmass of similar composition.

Thin Section:

Texture: Original texture partly obliterated. What remains is in part a sub-trachytic arrangement of altered feldspars up to 1 mm. in diameter with smaller lath-like phenocrysts in sub-parallel arrangement. Otherwise the slide shows irregular patches of clay or sericite with fine mosaic quartz.

Mineralogy:

Plagioclase - 70% Less than 0.1 mm. to 1 mm. diameter $\overline{0.2}$ mm.

Large phenocrysts are andesine, small, sub-parallel phenocrysts are too small to have their composition determined.

Quartz - 5 - 10% up to 1 mm. diameter, grains of mosaic quartz.

Calcite - 5% as small patches less than 0.1 mm. in diameter in the center of quartz grains and distributed throughout the rock.

Sericite - 10% very fine sericite formed from the alteration of feldspar.

Pyrite - 5% anhedral grains less than 0.1 mm. in diameter found throughout, but not in the quartz grains.

Alteration: Pyritization and sericitization.

Name: Altered andesite.

No. 22107

Hand Specimen:

Dark grey fine grained volcanic. Round, indistinct, green, fine grained grains with white dots of white alteration in a groundmass of similar but slightly purplish aphanitic material.

Thin Section:

Texture: Porphyro-trachytic. Phenocrysts of plagioclase (Labradorite-An 58) from 0.5 mm. to 2 mm. in diameter (average about 1 mm.) are in a fluidal groundmass

of sub-parallel Andesine crystallites, iron ore and greenish glassy material. Calcite occurs as an alteration of the matrix. Chlorite occurs in cracks in the phenocrysts and is also associated with calcite. There is also a very slight sericitic alteration of the phenocrysts.

Opagues - 10% as fine dust in the groundmass and a few pyrite cubes.

Name: Porphyritic Andesite (possibly a dyke rock).

No. 22108

Hand Specimen:

Medium grained clastic texture, grey in color. Feldspar, chlorite and epidotized fragments up to 2 mm. in diameter occur in a finely particulate pyritized groundmass.

Thin Section:

Texture: Fine grained clastic texture. Quartz, feldspar and some lithic particles all less than 1 mm. in diameter are in a dusty brown finely particulate clay-feldspar-chlorite matrix.

Mineralogy:

Quartz - 8% less than 1 mm. to 5 mm. in diameter
Feldspar - 70% An 60, Labradorite
Chlorite - 10%
Epidote - 3%
Pyrite - 2%

Quartz occurs as sub-round composite sutured grains and single slightly fractured grains with straight extinction. These are randomly distributed throughout the groundmass. There are also a few lithic particles of minute interlocking grains (chert).

Chlorite occurs as irregular patches associated with quartz. Epidote is in discrete grains partly associated with quartz.

Alteration: Very minor silification with Epidote and chlorite.

Name: Fine grained lithic tuff.

No. 22109

Hand Specimen:

Light green clastic textured rock. Feldspar crystals and some light green grains less than 2 mm. in diameter occur in a fine grained, green groundmass. Epidote and some Pyrrhotite.

Thin Section:

Texture: Clastic. The particles consist of: 1) sub-round fragments of sericitized feldspar (less than 1 mm. in diameter), 2) fine grained andesite fragments less than 1 mm. in diameter, 3) an irregular light green glass fragment with included plagioclase microlites, feldspar phenocrysts and pyrite.

The groundmass is a dark brown chloritic, crypto-crystalline material containing minute quartz and feldspar grains.

Epidote - 2%
Opaques - 2% pyrrhotite in part

Alteration: Slight sericite alteration of feldspars.

Name: Lithic Tuff.

Note: The round nature of the fragments suggest that they have been water worn. In other words this may be a poorly sorted volcanic sediment.

No. 22110

Hand Specimen:

This is a light coloured, fine grained, banded, highly siliceous rock. An acid volcanic.

Thin Section:

Texture: Fine grained; banded. The various bands of different widths exhibit compositional differences. Most of the rock is composed of a dense fine grained quartz, K-spar, and plagioclase mosaic. Some bands are composed mostly of feldspar, one in particular consists of densely packed plagioclase with a few small fibrous actinolite crystals.

Epidote occurs along fractures with pyrite and quartz. It is also distributed throughout the rock in minute granules.

Pyrite - 5%

Alteration: Pyritization with minor silica and Epidote. Silification is not readily apparent since a large percentage of the rock is composed of finely divided silica. Actinolite is from the alteration of a mafic minerals.

Name: Acid volcanic-Rhyodacite (?).

No. 22111

Hand Specimen:

Texture: Medium grained Alotriomorphic granular.

Mineralogy:

Quartz - 15%
Feldspar - 60%
Mafics - 20%
Pyrite - 5%

A few feldspar phenocrysts up to 2 mm. in diameter and dark grey mafic patches up to 3 mm. occur with anhedral light grey quartz. The texture is not the usual crystalline texture of the granite rocks in the area. This is probably a contact phase.

Thin Section:

Fine to medium grained Hypidiomorphic granular.

Mineralogy:

Quartz - 10%, 0.2-0.8 mm.; $\overline{0.5}$ mm. ___
Plagioclase (An 45) 80%, .2-2 mm.; 1 mm.
Chlorite - 10%
Opagues-Pyrite - 1%
Sericite

The plagioclase is zoned, with calcic cores (An 45) and more sodic rims. Phenocrysts are subhedral, sericitized, with corroded edges. Quartz occurs as cracked, anhedral grains between the feldspars. The chlorite is light brown to green, anhedral, and is associated with sericite and opaques.

Alteration: Sericitization, mafics altered to chlorite.

Name: Chlorite quartz diorite.

No. 22112

Hand Specimen:

Grey-green medium grained Porphyritic. Highly epidotized lithic fragments and feldspar grains in a fine grained groundmass.

Thin Section:

Texture: Porphyritic. Altered feldspar (Andesine) phenocrysts up to 2 mm. in diameter are in a fine mosaic of minute feldspars, chloritic material and some quartz. The feldspars are moderately sericitized.

Epidote, about 2% of the rock, occurs as groups of crystals and granular aggregates irregularly distributed throughout. Quartz, about 2% of the rock, occurs as anhedral grains about .5 mm. in diameter. Chlorite is interstitial in the matrix (very fine grained) and is also associated with epidote in irregular patches.

Alteration: Moderate to high sericitization of feldspars.

Name: Porphyritic Andesite.

No. 22113

Hand Specimen:

Light green feldspars up to 2 mm. in diameter and dark green chlorite blebs in a fine grained dark green groundmass. Pinpoints of light coloured alteration throughout.

Thin Section:

Texture: Pilotaxitic texture. Phenocrysts of plagioclase and altered Hornblende in a groundmass of fine plagioclase laths, green chloritic material and opaque specks.

Hornblende - 5% averaging about 1 mm. in diameter more or less altered to chlorite and calcite.

Epidote - 2% as small granules

Alteration: Light alteration.

Name: Andesite - possibly a dyke rock.

No. 22114

Hand Specimen:

Pyritized, Epidotized light green clastic (?) rock similar to 22102.

Thin Section:

Texture: Fine grained clastic (?) texture. Irregular fragments of feldspar and quartz mostly less than 1 mm. in diameter are in a random, close packed, more or less interlocking relationship. Feldspars (Andesine) have slightly corroded edges and are cloudy from clay alteration.

Epidote - 5% in granular aggregates

Quartz - 10% less than 0.1 mm. in diameter, interlocking grains probably the result of silification. Also in small quartz-Epidote veinlets.

Pyrite - 5%

Alteration: Pyritization, silification, clay alteration of feldspars.

Name: Fine grained crystal tuff.

No. 22115

Hand Specimen:

Pyritized light grey medium grained rock. Clastic texture similar to 22114 and 22116.

Thin Section:

Texture: Clastic medium grained. Altered feldspar grains (up to 1 mm. in diameter) some broken, all with rounded, corroded edges in a groundmass of finely divided chlorite or clay, fine opaques, minute feldspar and small quartz grains. There are some large chlorite grains. One, probably devitrified glass, is irregularly shaped and arcuate. Another grain 2 mm. long and 1 mm. wide has a rectangular form after Biotite or possibly Hornblende.

Feldspars are altered to epidote and greenish finely divided chlorite or clay (saussuritization).

Quartz - epidote - sericite veins at the rock.

Alteration: Moderate silification - Pyritization. Saussuritization of feldspars.

Name: Medium grained altered tuff.

No. 22116

Hand Specimen:

Heavily Pyritized light grey medium grained clastic (?) rock.

Feldspar and chlorite fragments less than 2 mm. in diameter occur in a grey matrix composed of similar material but fine grained.

Thin Section:

Texture: Coarse grained relic clastic texture. Ghosts of large felsitic fragments up to 5 mm. in diameter with a light brown groundmass composed mostly of a fine mosaic of minute brown altered feldspars (less than 0.1 mm. in diameter) and brownish clay. The large "ghost" fragments consist of irregular masses of fibrous chlorite, Pyrite, brownish clay and fine, sutured grains of quartz. (no sericite).

Quartz - 2% as fine mosaic quartz in the groundmass. Associated with pyrite and fine chlorite, it is probably the result of silification.

Alteration: Pyritization and argillic alteration with minor silification.

Name: Altered tuff.

No. 22117

Hand Specimen:

Fine to medium grained highly pyritized siliceous rock. Py - 7%.

Thin Section:

Texture: Granular Mosaic texture.

Mineralogy:

Pyrite - 10%

Sericite - 10%

Quartz - 80%

Interstitial Pyrite and sericite between interlocking, unstrained, clear quartz grains which range in size from less than 0.1 mm. to 1 mm. in diameter.

Alteration: Intense silification with Pyrite and sericite.

Name: Quartz - sericite-pyrite rock.

No. 22118

Hand Specimen:

Fine grained siliceous light grey rock.

Thin Section:

Texture: Very fine grained mosaic. This rock consists of a few anhedral grains of quartz and a few of plagioclase in a matrix of very fine grained silica (less than 0.1 mm. in diameter). There are small veinlets of quartz-epidotes, about 8% Pyrite, and a few specks of sericite. This rock is similar to No. 22110.

Name: Rhyodacite.

No. 22119

Hand Specimen:

Fine grained, thinly banded, grey siliceous rock.

Thin Section:

Texture: Very fine grained, thinly banded. Similar to 22118 and 22110 but banded with layers of extremely fine granular epidote (?) which is almost opaque.

One band of the section contains small feldspar laths up to 0.1 mm. in groundmass of a similar material. There are epidote granules surrounding the microphenocrysts. Minute quartz-epidote-sericite veinlets.

Name: Rhyodacite.

No. 22120

Hand Specimen:

Medium grained, crystalline, fresh, hypidiomorphic granular quartz diorite.

Thin Section:

Texture: Medium grained, hypidiomorphic granular

Mineralogy:

Quartz - 10%, 0.5 to 2 mm., $\bar{1}$ mm. in diameter
Hornblende - 15%, 0.5 to 2 mm., $\bar{1}$ mm. in diameter
Plagioclase - 75%, 1 to 3 mm., $\bar{2}$ mm. in diameter
Pyrite, Epidote, Sericite

Subhedral Plagioclase is strongly zoned with Labradorite (An 56) cores and more sodic rims. The cores are sericitized. About half of the Hornblende is altered to chlorite.

Alteration: Chlorite, epidote, and minor sericite from deuteric alteration.

Name: Quartz Diorite.

No. 22121

Almost identical to 22119.

5% sericite in veinlets and finely divided throughout

Pyrite - 5%

Name: Rhyodacite.

No. 22122

Almost identical to 22119 and 22121

The thin section shows many thin bands with a great deal of epidote and some calcite along veinlets.

Name Rhyodacite.

No. 22123

Hand Specimen:

Dark green medium grained Porphyritic rock. Feldspar phenocrysts up to 2 mm. in diameter in a grey-green groundmass. Weathered surface pitted after feldspar.

Thin Section: sub-porphyritic.

Altered plagioclase phenocrysts up to 2 mm. in diameter in a groundmass of fine grained quartz and feldspar. 0.1 mm. and less.

Large plagioclase phenocrysts account for about 50% of the rock. These have andesitic cores and more sodic rims. The groundmass contains about 80% small, dusty (altered) plagioclase phenocrysts, 10% quartz as anhedral interlocking grains and 10% Hornblende in small euhedral crystals partly altered to chlorite (0.1 mm. to 2 mm., 0.2 mm.). Epidote occurs as granular aggregates with chlorite up to 1 mm. in diameter, and as fine grained aggregates formed at the expense of feldspar.

One subhedral grain of Pigeonite altered to Hornblende and chlorite, one small red garnet.

Pyrite - 2%
Epidote - 2%

Name: Hornblende quartz diorite (porphyritic contact phase).

No. 22124

Hand Specimen:

Medium grained, fresh granitic texture

Plagioclase - 60%
K-spar - 5% (pink)
Quartz - 10%
Hornblende - 25%

Thin Section:

Texture: Medium grained Hypidiomorphic granular.
Mode: Plagioclase (Labradorite-An 56) - 60%, 0.1 mm to 1 mm., 0.5 mm.

K-spar - 10% up to 2 mm. in diameter
Quartz - 10% up to 1 mm. in diameter
Hornblende - 20%, 0.5 mm. to 2 mm., 1 mm. in diameter
Chlorite, Epidote, Opaques

The plagioclase is relatively fresh and strongly zoned with An 56 (Labradorite) cores and more sodic rims. K-spar which is pink in hand specimen occurs in anhedral grains with slight dusty alteration. Hornblende is partly altered to chlorite, epidote, and opaques.

Alteration: Deuteric alteration (chlorite-epidote)

Name: Hornblende granodiorite.

No. 22125

Hand Specimen:

Porphyric dyke rocks. Light greenish feldspar phenocrysts up to 3 mm. in diameter in a fine grained grey groundmass. Small mafic grains distributed throughout.

Thin Section:

Texture: Porphyritic

Phenocrysts: Large feldspar phenocrysts up to 2 mm. in diameter, somewhat zoned and altered account for about 40% of the slide.

Hornblende-chlorite phenocrysts from less than 0.1 mm. to about 2 mm. in diameter account for about 10% of the slide.

Groundmass: The groundmass is a dense mass of about 85% anhedral feldspars, 10% fine grained green subhedral Horn blende-chlorite crystals and 5% fine grained quartz.

There are a few crystals of Enstatite and pigeonite (?), some altered to chlorite.

Alteration: Sausseritization of feldspars, deuteric chlorite and epidote alteration. Generally weak alteration.

Name: Andesite Porphyry.

No. 22126

Hand Specimen:

As in 22124, medium grained pink granitic rock.

Thin Section:

Texture: Medium grained Hypidiomorphic granular.

Mode: Plagioclase - 70%, 1.3 mm., $\bar{2}$ mm. in diameter

K-spar - 5-10%, 1.3 mm., $\bar{2}$ mm. in diameter

Quartz - 10%

Calcite - 5%

Opaques - 2%

Epidote

The plagioclase crystals are highly zoned with sodic Andesine (An 34 approximately) cores and more Alkalic rims. Cores of the feldspars are highly sericitized and somewhat sausseritized (calcite and epidote) in places. The rims show a less intense, dusty alteration. Horn blende is partly altered to chlorite and some opaque mineral.

Alteration: minor hydrothermal alteration

Name: Quartz diorite.

No. 22127

Hand Specimen:

Light green, fine grained allotriomorphic granular, pyritized rock. Looks like a dioritized contact rock.

Mafics - 20%
Quartz - 10%
Feldspar - 70%

Thin Section:

This thin section has a medium grained hypidiomorphic granular texture, the feldspars have been completely altered to calcite, sericite, clay (kaolinite) and some chlorite. Quartz occurs in anhedral grains between the feldspars and mafics.

Quartz - 10%, 0.5 to 2 mm. in diameter
Feldspar - (altered) - 80%, 0.5 to 2 mm. in diameter
Chlorite - 7%, after Horn blende
Opaques - 3% pyrite associated with chlorite. Traces of epidote.

This appears to be an altered contact rock near the edge of the main pluton.

Alteration: Sericitization, pyritization, etc., hydrothermal alteration.

Name: Quartz diorite.

No. 22128

Hand Specimen:

Pyritized, fine grained, light grey green rock with a few small altered feldspars less than 1 mm. in diameter.

Thin Section:

Texture: The original texture, possibly clastic or porphyritic, has been obliterated. A few feldspar grains entirely altered to calcite and sericite occur in a groundmass showing an odd patchy extinction. The groundmass is fairly uniform throughout the slide. Most of the rock has been sericitized and altered to kaolinite. Minor quartz occurs as small grains less than 0.1 mm. in diameter.

Pyrite and limonite - 8%

Alteration: Pyritization, sericitization and clay alteration are pervasive. Intense hydrothermal alteration of the argillic type. Note: silification is not evident.

Name: Altered rock.

No. 22129

Hand Specimen:

Medium grained light grey-green rock. Dary grey round grains up to 2 mm. in diameter are in a light grey, fine grained, patchy groundmass. No feldspar grains are apparent.

Thin Section: Porphyritic texture.

Corroded Euhedral crystals of a light green amphibole up to 2 mm. in diameter in a fine grained dark grey groundmass composed mainly of fine needle like fibres of what appears to be the same Amphibolite material, some altered to chlorite and brown clay, minor epidote and silica alteration.

This unique rock is the result of the recrystallization of a basic rock, possibly a dyke.

Name: Fine grained amphibolite.

No. 22130

Hand Specimen:

Light grey, coarsely clastic heavily Pyritized and Epidotized, hard siliceous fractured rock.

Thin Section:

Texture: Fractured, fine grained felsophyric. The rock is entirely composed of fine grained anhedral felsitic material much less than 0.1 mm. in grain size, with a few small plagioclase laths and small quartz grains. This material has been fractured and the fractures filled with similar but even finer grained material.

Pyrite - 20%
Epidote as clusters of crystals.

Name: Rhyodacite.

No. 22130A

Hand Specimen:

Fine grained, slightly banded, clastic texture. Rock is light coloured, hard and somewhat brecciated.

Thin Section:

Texture: Fine grained, faintly banded, clastic texture. Angular feldspar a few quartz fragments less than 0.1 mm. in diameter, and what appear to be

round altered glass shard occur in a dark grey groundmass of clay and granular epidote-actinolite. The fragments and clay (montmorillonite?) after glass are in a compact mass with little matrix between them. Some of the glassy material contains what appear to be small crystallites of feldspar. Silification is evident in veinlets.

Name: Fine grained tuff.

No. 22131

Hand Speciman:

Light grey-green siliceous, coarse, pyritized breccia. Fine grained fragments are in a light green groundmass of similar material.

Thin Section:

Texture: Brecciated, coarse grained clastic texture. One large, fine, grained, quartzo-feldspatic fragment and feldspar phenocrysts are in a fine grained groundmass made up of small anhedral quartz and feldspar grains in a clayey matrix. The highly fractured groundmass has pyrite, sericite and some calcite in the fractures. Feldspars are sericitized, the grains near fractures are more highly altered than others. The matrix appears to be fairly unaltered.

Pyrite - 7%

Alteration: Sericitization-intense along fractures

Name: Brecciated acid tuff.

No. 22132

Hand Specimen:

Fine grained grey siliceous rock with pyrite pyrrhotite and epidote.

Thin Section:

Texture: Fine grained mosaic. Calcite-epidote knots associated with mosaic quartz are in a fine grained mosaic of anhedral plagioclase phenocrysts, anhedral quartz and dusty feldspars. All these grains are less than 0.1 mm. in diameter.

Quartz - 10%

Epidote - 5%

Calcite - 5%

Opagues - 2% pyrite and pyrrhotite

Limonite staining

The dusty brown clay alteration of the feldspar gives the slide a dusty brown colouration.

Alteration: Silification and fine clay alteration of feldspar.

Name: Rhyodacite

No. 22133

Hand Specimen:

Fine grained light green massive highly siliceous pyritized rock with a few specks of chlorite.

Thin Section:

Similar to 22130 except for the following:

- 1) unbrecciated.
- 2) 5% actinolite as finely radiating aggregates of crystals.
- 3) quartz - 3% as small interlocking grains with epidote, i.e. some silification.

Name: Rhyodacite

No. 22135

Hand Specimen:

Slightly pyritized medium grained quartz diorite.

Thin Section:

Texture: Medium grained hypidiomorphic granular.

Mode: Plagioclase (andesine) - 70%, 1 to 4 mm. $\bar{2}$ mm. in diameter
Quartz - 10% anhedral grains, 1 to 2 mm. in diameter
Chlorite - 5%
Epidote - 5%
K-spar - 5%

The plagioclase is sericitized, the K-spar is cloudy with incipient alteration.

Name: Quartz diorite.

No. 22136

Hand Specimen:

Lightly pyritized, gray-green, fine grained rock with small grains of light green material. Large irregular patches of quartz feldspar.

Thin Section:

Texture: Pseudo-poikilitic. Large interlocking quartz and calcil feldspar crystals contain many small separate subhedral phenocrysts or augite in what looks like a poikilitic texture.

Mode: Plagioclase (Anorthite) - 20%, 0.2-1.5 mm., $\bar{1}$ mm.
Pyroxene (Augite) - 40% up to 3 mm. in diameter

Since this sample was taken in contact area, the rock must be a very odd contact phenomenon.
Name: Quartz diorite-contact rock.

No. 22137

Hand Specimen:

Fine grained light green highly siliceous rock with a few feldspar phenocrysts.

Thin Section:

Texture: Porphyritic. The rock is composed of 30% euhedral plagioclase (Labradorite) 1 mm. to 3 mm., 2 mm. in diameter in a groundmass of microcrystalline mosaic quartz. There is 5% finely granular epidote associated with the coarser quartz crystals. The feldspars show signs of saussuritization.

Quartz - 60% (mosaic quartz)
Pyrite - 1%

This rock has been quite heavily silicified.

Name: Altered porphyry.

No. 22138

Hand Specimen:

Light green fine to medium grained granitic rock with large blebs of chlorite.

Thin Section:

Texture: Medium grained hypidiomorphic granular.

Mode: Quartz - 8 - 10%
Plagioclase (andesine) - 65%
Chlorite and Calcite - 25% after Horn blende
Opagues - traces

Alteration: Chlorite and calcite after Horn blende. Sericite and calcite after Plagioclase. Quartz grains are slightly cloudy and broken, indicating slight deformation. Minerals indicate mild hydrothermal alteration.

Name: Quartz diorite.

No. 22139

Hand Specimen:

Light grey coarse grained lithic fragments are in a fine feldspathic matrix. The rock seems to be quite porous, there is some clay alteration on the weathered surface.

Thin Section:

Texture: Clastic. Particles up to 3 mm. in diameter of Rhyodacite and andesite rest in a highly silicified and sericitized fine grained matrix. The boundary between the fragments and groundmass is indistinct due to the alteration. Veinlets of fine grained quartz are common and sericitization is pervasive. (continued...)

Quartz - 15%
Opagues - trace

Alteration: Intense silicification and sericitization

Name: Altered lithic tuff.

No. 22140

Hand Specimen:

Fine grained, grey-green, fractured, finely clastic rock with small dark grey and light green particles. Pyrite, Epidote and Chlorite throughout.

Thin Section:

Texture: Clastic. Fragments of altered feldspar up to 2 mm. in diameter are in a dark groundmass of small feldspar crystals, iron ore, chlorite (after glass) and dark grey clay. The cores of the feldspars consist of dark clay, chlorite and calcite, while the rims appear to be relatively unaltered. Sericite is present in small amounts, as are quartz-calcite veinlets.

Alteration: Moderate argillic alteration.

Name: Crystal tuff.

No. 22141

Hand Specimen:

Light yellow-green fine grained felsitic rock. No sulfides. This is a dyke rock

Thin Section:

Texture: Mosaic texture. The rock consists of fine grained anhedral feldspar less than 0.2 mm. in diameter and a few anhedral quartz grains in a compact interlocking mosaic. There is a high degree of sericitization with light yellow-green, fibrous, radiating aggregates of an unidentified mineral, possibly stilpnomelane. No opaque minerals present.

Name: Felsite.

No. 22142

No Hand Specimen

Thin Section:

Texture Clastic texture. Round particles up to 0.5 mm. in diameter of fine grained mosaic quartz with isotropic greenish glass, and round particles from 3 to 4 mm. in diameter which have been completely altered to calcite occur in a groundmass composed of fine feldspars, mosaic quartz and clay (montmorillonite?). The feldspars (Labradorite, An 58 approximately) are altered to calcite with some clay.

Opagues - 5% pyrite

Name: Altered tuff.

No. 22143

Hand Specimen:

Very dark, fine grained, pyritized, hard rock which has been brecciated.

Thin Section:

Texture: The original texture may have been clastic or porphyritic. This rock is composed mostly of an extremely fine mosaic of quartzo-feldspathic material with a sprinkling of highly pleochroic brownish red, fine biotite grains. Extremely fine opaque (carbonaceous) material occurs after feldspar and throughout the slide as a fine dust. There is also a sprinkling of very fine, clear, prismatic crystals with high relief, like apatite but with inclined extinction.

Opagues - 20%, some pyrite

Biotite - 1%

Alteration: The appearance of biotite indicates a higher degree of alteration than noted so far. The fine abundant opaque material may be a significant alteration product.

Name: Hornfels.

No. 22144

Hand Specimen:

Dark grey coarse grained clastic rock. Large volcanic fragments in a light grey fine grained matrix. Highly pyritized, limonite on the weathered surface.

Thin Section:

Texture: Relict clastic texture. "Ghosts" of particles up to 3 mm. in diameter composed of sericite, calcite and minor epidote occur in a groundmass composed mainly of clay and finely disseminated pyrite. The forms of a few glass shards are still visible.

Pyrite - 10%

Epidote - 3%

Quartz - 2%

Alteration: Abundant pyritization and sericitization with clay alteration.

Name: Highly altered tuff.

No. 22145

Hand Specimen:

Grey-green porphyritic rock: Feldspar phenocrysts up to 2 mm. in diameter and chlorite patches in a light green fine grained pyritized groundmass.

Thin Section:

Texture: Original texture largely obliterated, probably porphyritic.

Feldspars of all sizes from less than 0.1 mm. to 2 mm. in diameter, have been altered to sericite, calcite, chlorite and clay. These highly altered phenocrysts are contained in a fine groundmass (less than 0.1 mm. in diameter) of quartz, feldspar and chlorite. Chlorite occurs as irregular fibrous patches and as extremely fine material between the feldspar crystals.

Quartz - 5% in the groundmass

Alteration: Silification, alteration of feldspars to sericite, calcite, chlorite and clay

Name: Altered volcanic rock.

No. 22146

Hand Specimen:

Fine grained, dark green, finely particulate pyritized rock with epidote and quartz stringers.

Thin Section:

Very similar to 22140 with the addition of calcite - epidote veinlets.

Name: Moderately altered crystal tuff.

No. 22147

Hand Specimen:

Clastic texture. Large sub-angular fragments in a grey fine grained matrix with small feldspar grains. Highly pyritized with epidote.

Thin Section:

Texture: Coarse grained clastic. Volcanic fragments, some with greater than 6 mm. in diameter are found in a greenish brown groundmass of small feldspar fragments and crystals, fine pyrite, epidote and clay minerals. (continued....)

Pyrite - 10%
Epidote - 3%
Quartz - 1%
Chlorite - 2%

Chlorite is an alteration of glass (a few shards visible). The quartz occurs in small round composite grains and as a filling for irregular cavities. One large cavity about 2 mm. in diameter has been filled with quartz and chalcedony. Others contain quartz and epidote. Pyrite is distributed throughout the slide except in the feldspar fragments.

Alteration: Weak alteration, propylitic. Pyritization.

Name: Lithic tuff.

No. 22148

Hand Specimen:

Slightly pyritized grey-green finely particulate groundmass with one large volcanic fragment.

Thin Section:

Texture: Coarse Clastic. The thin section consists mainly of two large fragments of volcanic rock separated by a groundmass of tuffaceous material and an epidote veinlet. The tuffaceous material consists mostly of feldspar fragments up to 1 mm. in diameter, chlorite and small particles of volcanic rock.

Feldspars are moderately altered to cloudy clay minerals, sericite, and traces of calcite and epidote.

Pyrite - 2%
Traces of Hematite

Alteration: Weak alteration mostly to clay-sericite.

Name: Coarse grained altered Lithic tuff.

No. 22149

Hand Specimen:

Clastic texture. Light grey lithic fragments up to 2 mm. in diameter in a light grey, altered, fine grained groundmass. Heavily pyritized.

Thin Section:

Texture: Medium grained clastic texture. Ghosts of fragments up to 4 mm. in diameter are in an extremely fine grained groundmass. Fragments have been altered to clay or sericite or both. The groundmass is composed of finely mosaic kaolinite (?) and minor quartz. Some of the fragments have fairly coarse sericite rims and fine

(continued...)

quartz mosaic cores. There are also a few simple, clear, unstrained quartz fragments up to 0.5 mm. in diameter.

Pyrite - 10%
Quartz - 5%

Alteration: Kaolinization-sericitization with abundant pyrite. Some silicification.

Name: Altered tuff.

No. 22150

Hand Specimen:

Medium grained light green, slightly pyritized epidotized, quartz and feldspar rich clastic rock.

Thin Section:

Texture: Coarse clastic. Large volcanic fragments up to 5 mm. in diameter with feldspar fragments up to 2 mm. in diameter, rest in a matrix of brownish green clay material and small feldspar and quartz crystals. Feldspars are partly altered to sericite and clay.

Quartz - 2% as fine grained mosaic aggregates
Epidote - 1% as small grains
Pyrite - traces
Calcite - in veinlets

Alteration: Moderate to weak sericitization and alteration, minor silicification.

Name: Coarse lithic tuff.

No. 22151

Hand Specimen:

Rock contains two large volcanic particles set in a dark fine grained highly pyritized groundmass.

Thin Section:

Texture: The original texture has been largely obliterated, possibly coarse clastic texture. Large masses of fine sericite and calcite probably the result of feldspar alteration occur in a groundmass of small altered feldspars, mosaic quartz and chloritic material. Chlorite also occurs as cavity fillings with quartz, calcite and opaques. It also has replaced two large mafic (biotite?) grains.

Pyrite - 5%
Quartz - 2%

Alteration: Pervasive sericite and calcite alteration. Also chloritic alteration.

Name: Altered tuff.

No. 22152

Hand Specimen:

Dark grey, fine grained, slightly pyritized rock with a porphyritic aspect. Small feldspar and some darker grains are in a groundmass of fine grained material.

Thin Section:

Texture: Clastic. Broken fragments of quartz feldspar and lithic fragments (rhyodacite) of all sizes up to 2 mm. in diameter are in a groundmass of small feldspar crystals, various small fragments and interstitial chloritic material. There is some alteration of feldspars to calcite and sericite, however some feldspars have been left unaltered.

Name: Weakly altered, medium grained tuff.

No. 22153

Hand Specimen:

Light grey fine grained massive pyritized rock. It appears to consist of mostly feldspar. No fragments or crystals are visible.

Thin Section:

Texture: Mosaic texture, fine grained, massive. This rock is entirely composed of a fine mosaic of quartz, sericite and clay (kaolinite). Quartz accounts for about 50% of the slide in an interlocking mosaic of grains, none of which exceed 0.1 mm. in diameter. The clay and sericite occur between the quartz grains and as aggregates, indistinct in outline. Some (10%) of the quartz is the result of silicification since it forms in vein-like masses throughout the rock. The clay and sericite are probably altered feldspars, so the original rock was a fine grained quartzo-feldspathic mosaic rock, possibly an acid volcanic.

Alteration: High degree of sericite, clay (kaolin) and silica alteration.

Name: Altered acid volcanic or tuff.

No. 22154

Hand Specimen:

Green, medium grained porphyritic texture. Sub-round feldspar and chloritic grains less than 2 mm. in diameter in a fine grained green pyritized groundmass.

Thin Section:

Texture: Original texture largely obliterated, the rock has a porphyritic aspect. The groundmass consists almost entirely of fine quartz in a mosaic similar to that
(continued....)

described in 22153. Clay, chlorite and epidote in the groundmass are from the alteration of feldspathic material.

The phenocrysts, about 40% of the rock are from 0.3 mm. to 1 mm. in diameter and are completely altered to sericite with some calcite and clay. Some grains from .5 mm. to 3 mm. in diameter are composed of epidote and chlorite with calcite and pyrite. Some chlorite appears to be after biotite.

Alteration: Pervasive sericitization, some epidote-chlorite-calcite, alteration, minor silicification.

Name: Altered acid volcanic or tuff.

No. 22155

Hand Specimen:

Light grey, fine grained, felsitic material. A few small feldspar grains in a grey felsitic groundmass.

Thin Section:

Texture: Original texture obliterated. The rock has a porphyritic aspect. The thin section shows a mass of fine grained quartz, clay and sericite. Round "ghost" fragments of slightly coarser material occur in a matrix of finer grained quartz, sericite and clay.

There are a few rounded patches composed of sericite and clay. These may represent original feldspar crystals. A few small radiating, acicular crystals of an unidentified mineral are found associated with quartz grains.

Alteration: Pervasive sericitization and clay alteration.

Name: Altered acid volcanic or tuff.

No. 22156

Hand Specimen:

Dark grey, medium grained clastic rock, composed of rounded volcanic, feldspar and quartz fragments in a greenish brown fine grained matrix. Appears unaltered.

Thin Section:

Texture: Clastic. Volcanic particles, plagioclase and quartz particles, round to sub-angular, up to 1.5 mm. in diameter are in a fine grained clay matrix. Minor chlorite.

Alteration: Virtually none.

Name: Volcanic sandstone.

No. 22157

Hand Specimen:

Green fine to medium grained sub porphyritic rock. Feldspars and mafic fragments up to 2 mm. in diameter are in a fine grained green groundmass.

Thin Section:

Texture: Sub-porphyritic. Subhedral feldspar crystals and some rounded grains occur in a fine grained groundmass of mottled green glass, small crystallites of feldspar and opaque dust.

There are small calcite veinlets and irregular patches of calcite alteration. Feldspars have been slightly altered to carbonate, clay and chlorite. A few cavities have been filled with chlorite, zeolite and clay.

Alteration: Low grade alteration, propylitic.

Name: Altered andesite.

No. 22158

Hand Specimen:

Medium grained, grey-green, porphyritic, relatively fresh rock. The sample contains small cavities filled with feldspar and lined with chlorite.

Thin Section:

Texture: Porphyritic. Feldspar phenocrysts up to 2 mm. in diameter, averaging 0.3 mm., rest in a matrix of colourless, randomly oriented, microcrystalline feldspar, chlorite, and fine opaque dust.

The feldspars are andesine in composition and have been weakly altered to calcite and sericite. There are a few small anhedral grains of quartz associated with chlorite.

Name: Slightly altered andesite.

No. 22159

Hand Specimen:

Grey-brown fine grained rock with clastic fragments. Feldspar fragments up to 2 mm. in diameter and smaller round particles in a fine grained matrix. Some hematite specks.

Thin Section:

Texture: Clastic texture. Round feldspar grains up to 6 mm. in diameter, averaging 1 mm., and round grains of chlorite rest in a matrix of light brown

(continued...)

clay, plagioclase microlites, altered feldspar grains, and fine opaque dust in random orientation.

The cores of the feldspars are fresh, the rims are cloudy. A few quartz fragments and round particles of chlorite with minor epidote and hypersthene are distributed throughout.

Name: Unaltered tuff.

No. 22160

Hand Specimen:

Light brown-green, medium to coarse grained chloritic and epidotized clastic rock with sub-round to sub-angular fragments.

Thin Section:

Texture: Medium to coarse grained clastic. Large round particles up to 5 mm. in diameter rest in a matrix of minute feldspar particles of roughly the same composition. There is some chlorite in the shape of shards, limonite staining and chlorite after pyroxene. There is one chlorite-epidote veinlet.

Quartz - 1%
Epidote - 5%

Feldspars have been saussuritized.

Name: Lithic tuff.

No. 22161

Hand Specimen:

Light greenish grey clastic rock contains lithic fragments up to 10 mm. in diameter, and smaller fragments in a light grey, fine grained groundmass. There is some epidote.

Thin Section:

Similar to 22160. Volcanic particles up to 5 mm. in diameter are in a matrix of similar material only fine grained. There is slight chlorite alteration and pyrite.

Name: Lithic tuff.

No. 22162

Hand Specimen:

Light brown, fine to medium grained sugary textured rock.

Thin Section:

Texture: Obliterated. The rock is composed of altered feldspar "ghosts" in a fine grained mosaic of quartz, altered feldspar and finely granular epidote. Feldspars have been completely altered to clay, sericite and epidote. There are a few round, clear quartz grains.

Quartz - 8%
Epidote - 5% - finely granular
Pyrite - 5%

Pyrite is scattered throughout the rock.

Name: Highly altered rock.

No. 22163

Hand Specimen:

Medium grained clastic, light green, pyritized rock. Quartz and feldspar grains up to 3 mm. in diameter are in a light green, fine grained matrix.

Thin Section:

Texture: Medium grained clastic. Feldspar fragments rest in a dark brown clay matrix with light green glassy material, crystallites and small fragments. There are a few round chlorite blebs with fine grained pyrite rims. Minor sericitization and cloudy saussuritization.

Quartz - 5%
Pyrite - 2%

Name: Crystal tuff.

No. 22164

Hand Specimen:

Medium to coarse grained light green chloritized clastic rock. One large fragment of light green aphanitic siliceous rock and many feldspar grains rest in a light green fine grained groundmass.

Thin Section: As in 22163 with the addition of a lithic fragment in one corner of the slide.

Name: Crystal-lithic tuff.

No. 22165

Hand Specimen:

Dyke rock. Fine to medium grained light coloured, porphyritic rock. Horn blende - 10%. Most of the grains are anhedral.

Thin Section:

Texture: Sub-porphyritic. Altered plagioclase phenocrysts up to 1 mm. in diameter occur in a fine grained (less than 0.1 mm.) matrix of plagioclase and small quartz grains.

Plagioclase - 85%

Quartz - 5%

Chlorite - 10%

Chlorite occurs in the matrix as fine grains and as altered mafic phenocrysts. The larger feldspars are sericitized and calcified. No pyrite.

Name: Quartz diorite. Dyke.

No. 22166

Hand Specimen:

Dark grey medium grained fragments in a volcanic material of slightly lighter colour. Pyritized.

Thin Section:

Texture: Coarse grained clastic. Coarse fragments are set in a light brown groundmass of feldspar microlites, dusty iron ore, light green chlorite, in the shape of glass shards and light brown clay.

Name: Coarse grained lithic tuff.

No. 22167

Hand Specimen:

Light grey, coarse grained, clastic, pyritized rock. A brown volcanic sub-round fragment and various feldspar grains occur in a green-grey fine grained matrix.

Thin Section:

Texture: Coarse clastic. Lithic fragments (volcanic) up to 5 mm. in diameter, altered feldspar grains and a few quartz fragments rest in a groundmass of brown clay, crystallites of feldspar and chlorite.

Chlorite - 3% occurs in irregular shaped patches

Epidote - 5% occurs in crystal aggregates throughout the rock. Some of the

(continued...)

aggregates have chlorite cores.
Quartz - 5% as fragments and mosaic grains.

Feldspars have been thoroughly saussuritized to epidote and calcite.

Name: Coarse grained lithic tuff.

No. 22168

Hand Specimen:

Fine grained, light grey heavily pyritized rock. Feldspar fragments appear to be in sub-parallel alignments.

Thin Section:

Texture: Original texture completely obliterated. Patchy, mosaic texture remains. The rock consists of irregular, slightly elongated masses of very fine sericite (about 50%) and masses of finely mosaic quartz with andalusite and a sprinkling of sericite. Opaque minerals (5%) with some limonite staining are scattered throughout. There are traces only of biotite.

Alteration: High temperature alteration to form biotite and andalusite.

Name: Hornfels.

* recheck by D. Cooke indicates that this is alkali feldspar.

No. 22169 and 22170

Hand Specimen:

Light grey, fine grained, pyritized rock with a limonitic, pitted, weathered surface. Feldspar phenocrysts are visible, but are anhedral with unclear outlines.

Thin Section:

Texture: Interstitial volcanic texture. Angular plagioclase phenocrysts (Labradorite, An 65) up to 1 mm. in diameter are in a groundmass of plagioclase and quartz grains in a fine mosaic.

Alteration: There is a cloudy (saussurite) alteration of the feldspars. There has been a high degree of silicification, the rock contains interlocking quartz along fractures and in small grains about 0.1 mm. in diameter. Pyritization. There is also some sericite.

Opagues (pyrite) - 15%
Quartz - 15%

Name: Altered volcanic.

No. 22171

Hand Specimen:

Dark grey, pyritized clastic textured fine grained rock. Particles up to 4 mm. in diameter, sub-angular and dark coloured are in a fine grained matrix which seems to flow around the particles. The fresh surface resembles argillite. The weathered surface is limonitic.

Thin Section:

The texture is that of an ignimbrite. Arcuate elongate shards of black opaque material up to 5 mm. in diameter, altered slightly elongate feldspathic grains and at least one round lithic fragment are in sub-parallel arrangement in a very fine grained uniform, clay groundmass well dusted with fine opaques. The groundmass flows around the round lithic fragment (rhyodacite or chert). The feldspathic grains, many of which appear elongated parallel to the shards are completely altered to clay and very fine sericite. Included in some of the larger opaque shards are these same clay-sericite fragments as well as altered feldspar microlites. One corner of the slide contains a slightly different rock type. In this, the matrix consists of clay and fine opaques, while the fragments are clay-sericite and nearly isotropic green chloritic material in sub-parallel arrangement. This second material intrudes the former along a fracture.

Alteration: The rock is almost entirely altered to fine, uniform clay, no distinct crystals of any kind are visible even under the highest magnification.

Name: Altered welded tuff.

No. 22172

Hand Specimen:

Light to dark grey fine grained, hard siliceous rock.

Thin Section:

Texture: Patchy texture, original texture obliterated. One lithic fragment of fine grained chert exists in the slide. Otherwise the rock is composed of irregular patches of three different kinds of material. One is composed mostly of sericite with some grey clay. Another is composed of grey clay with some sericite, the third consists of biotite, clay, sericite, opaques and traces of quartz. Sericite veinlets cut the rock.

Alteration: The appearance of secondary biotite in the rocks indicates high temperature, hornfelsic alteration.

Name: Highly altered rock-Hornfels.

No. 22173

Hand Specimen:

Grey, medium grained, slightly pyritized quartz diorite.

Thin Section:

Texture: Medium grained hypidiomorphic granular.

Mode: Quartz - 45%, 0.1-1 mm., $\overline{0.5}$ mm. in diameter
Epidote
Pyrite
Biotite - secondary

Plagioclase is partly altered to brown clay or sericite. The quartz, partly the result of silicification occurs as fractured and sutured interlocking grains.

Alteration: Secondary biotite indicates high temperature alteration. High degree of silicification.

Name: Quartz diorite.

No. 22174

Hand Specimen:

Light coloured medium grained granitic texture. Feldspar crystals up to 3 mm. in diameter and anhedral grey mafics in a light grey rich sugary matrix.

Thin Section:

Texture: Medium grained, hypidiomorphic granular.

Mode: Plagioclase - 60%, 0.5 mm. to 4 mm., $\overline{1.5}$ mm. in diameter
Quartz - 40%, 0.1 mm. to 1 mm.
Chlorite
Calcite

The quartz exists as anhedral broken grains between the feldspars. This rock is very similar to 22173 without the biotite and with less and finer grained quartz.

Name: Quartz diorite.

No. 22175

Hand Specimen:

Fine grained grey volcanic with epidote filled fractures and large knots of quartz-epidote-pyrite. (continued...)

Thin Section:

Texture: Sub-ophitic texture. Corroded and altered feldspar laths are in a sub-ophitic arrangement with brown-green horn blende-chlorite, probably after pyroxene. Pyritized veinlets of calcite, epidote and actinolite.

Alteration: Saussuritization of feldspars and alteration of pyroxene to hornblende-chlorite.

Name: Altered basalt.

No. 22176

Hand Specimen:

Light green-grey, pyritized, fine grained rock. Feldspar crystals and some fragments are visible but appear to be highly altered.

Thin Section:

Texture: Largely obliterated, the original texture was probably porphyritic.

Large feldspar crystals up to 5 mm. in diameter completely altered to sericite-calcite, and a few small grains of quartz, are in a dense fine grained mosaic of quartz, feldspars, with some sericite and calcite.

Alteration: Highly sericitized, calcified.

Name: Altered intermediate or acid volcanic or tuff.

No. 22177

Hand Specimen:

Light green porphyritic rock with a fine grained groundmass. Light brown pitted (after feldspar) weathered surface. Pinpricks of white alteration.

Thin Section:

Texture: Sub-porphyritic. Altered plagioclase phenocrysts up to 4 mm. in diameter are in a fine felsitic mosaic with some quartz (grains less than 0.1 mm. in diameter). There are masses of chlorite, calcite and granular epidote along fractures. Hornblende, about 5% of the rock, is more or less altered to calcite, chlorite and epidote. Feldspars are moderately altered to epidote-calcite (saussuritization). Traces of pyrite.

Name: Porphyritic andesite.

No. 22178

Hand Specimen:

Fine grained crystalline dark grey volcanic. Small plagioclase laths are visible.

Thin Section:

Texture: Sub-ophitic, porphyritic. Fresh zoned plagioclase up to 4 mm. in diameter occur in a groundmass consisting of plagioclase in sub-ophitic arrangements with augite which has been altered to horn blende and fibrous green chlorite. The feldspars are calcic, An 80 (bytownite) in composition.

Opaques - 5%

Alteration: Minor alteration of pyroxene.

Name: Porphyritic basalt.

No. 22179

Hand Specimen:

Fine grained light grey slightly porphyritic, pyrrhotitized volcanic. Epidote visible.

Thin Section:

Texture: Sub-porphyritic. Plagioclase phenocrysts up to 1 mm. wide and 2 mm. long are in a fine grained compact feldspathic groundmass with small plagioclase laths in a mosaic of feldspars with some quartz. All feldspars exhibit a dusty alteration with epidote grains. There are some stringers of quartz-actinolite and pyrite.

Alteration: Minor alteration of feldspars, minor silicification.

Name: Andesite.

No. 22180

Hand Specimen:

Dark grey finely crystalline pyritized volcanic.

Thin Section:

Texture: Intersertal texture.

Mode: Plagioclase - 50%
Horn blende - 30%
Pyrite - 20%

(continued...)

Anhedral green chlorite and pyrite occupy the spaces between feldspar laths (up to 1 mm. long). Fine grained chlorite-biotite and an unidentified finely granular mineral with extreme relief occur in cavities.

Alteration: Minor dusty alteration of feldspars with corrosion of the phenocrysts.

Name: Basalt.

No. 22181

Hand Specimen:

Dark grey fine grained heavily pyritized volcanic with many blebs or amygdules of darker material.

Thin Section:

Texture: Amygdaloidal. Round amygdules with rims consisting of green hornblende and chlorite. The groundmass is composed of fine grained feldspars, green anhedral hornblende and opaque minerals.

Mode: Hornblende-chlorite - 50%
Feldspar - 30% less than .1 mm. in diameter
Opakes - 20%
Epidote, feldspar, quartz, chlorite veinlets.

Name: Basalt.

No. 22183

Hand Specimen:

Light grey, coarse clastic rock. Lithic fragments up to 4 mm. in diameter, with quartz and feldspar grains in a light green fine grained groundmass.

Thin Section:

Texture: Coarse clastic. Large sub-round fragments of porphyritic volcanic 6 mm. in diameter occur in a groundmass composed of feldspar fragments up to 1 mm. in diameter, a few quartz fragments, and irregular shaped chlorite grains up to 1 mm. in diameter in a green-brown clay, opaque dusty matrix. Epidote grains (2%) are throughout the rock. Minor sericite and clay alteration of feldspars.

Name: Coarse lithic tuff.

No. 22184

Hand Specimen:

Light grey medium grained clastic rock. Rounded lithic fragments and feldspar grains are in a light green-grey, fine grained groundmass, epidote is visible.

Thin Section:

Texture: Medium grained clastic. Volcanic particles up to 4 mm. in diameter, anhedral feldspars and a few quartz grains comprise most of the fragments. The matrix, about 25% of the rock, is mostly brown clay with 5% chlorite as irregular shaped grains which may be altered glass shards. Epidote (3%) grains are distributed throughout the rock.

Alteration: Slight-minor sericite and epidote. Traces of pyrite.

Name: Lithic tuff.

No. 22185

Hand Specimen: As in 22184

Thin Section:

The components are the same as in 22184. However, the fragments are sub-round to round and occur in a compact mass with only about 10% matrix. This compact nature and roundness of fragments suggest that this has been weather transported., i.e., this is a poorly sorted sandstone.

Name: Tuffaceous sandstone.

No. 22188

Hand Specimen:

Light grey-green coarsely clastic rock with a characteristic knobby weathered surface.

Thin Section:

Medium grained clastic. Altered feldspar fragments from 0.1 mm. to 1 mm. in diameter, chlorite particles, and lithic fragments up to 4 mm. in diameter rest in a dirty brown groundmass of clay and small feldspar grains. The chlorite particles, common as round and angular grains up to 1 mm. in diameter show some internal banded texture after glass, arcuate form and sometimes fine quartz mosaic rims. Epidote is commonly associated with chlorite and larger feldspar crystals. Feldspars have been partly altered to clay with minor epidote. There are traces of sericite and a few rhyodacite fragments.

Name: Lithic tuff.

No. X

Hand Specimen:

Dark grey rock with large fragments in a fine grained groundmass. Pyrrhotite and chalcopyrite mineralization. This is a specimen of float material.

Thin Section:

Texture: Coarse clastic texture. Large volcanic fragments up to 5 mm. in diameter and plagioclase crystals up to 1 mm. in diameter are in a fine mosaic groundmass of feldspar, fine opaques and quartz.

Quartz - 5% occurs as mosaic grains associated with the opaques.

Biotite - 10% occurs as finely divided crystals throughout the groundmass and fragments. Secondary biotite.

Some feldspars are completely unaltered, most are cloudy.

This is a very interesting rock. It has copper mineralization, also it has undergone a high degree of alteration resulting in secondary biotite, but the feldspars are relatively unaltered.

Name: Highly biotite altered lithic tuff.