SUBJECT: MONTHLY REPORT- JANUARY

Green Mountain Project in Oregon was completed. Geochem and recon geology indicated a syngenetic (volcanic) source for the copper anomaly in this area. Average background Cu. is about 100 ppm for this area as compared to 40-50 for the Cascades in general. This roughly 2x background and the syngenetic source is the most logical. Negative data support this:

1) No hydrothermal alteration.
2) No structural development- ie.- fracturing.
3) No visible sulfides.
4) Incipient zeolitic alteration.

The source for the Cu. is most likely related to the ashfall tuffs in the area. These units are very irregular in size and distribution and do not offer a potentially economic target. As a result no further work is recommended.

An attempt was made to examine prospect in the Pansey Basin of the North Santiam District. Snow cover ranging from one foot to three feet prevented an actual examination of the rocks; however, communication with people staying in the old mining camp may result in a major mapping and geochem program this summer. It turns out that several freaks have been keeping up the assessment in order to live on the property. George-- is the grandson of the fellow that put the district together and knows much of the history of the district.

As this district was picked for having potential for a tourmaline breccia it was confirmed that this is probably the case. George accompanied a geologist last season and said that a major tourmaline breccia was recognized. It was recommended for option, but evidently it was a small company without funds and no followups were made. I was shown a few samples and it appeared to be similar to the Margaret. Follow-up work this spring- recon mapping will indicate the size potential and follow-up geochem- mapping and possible option could result. The property is for sale as the original owner died in December of 1970. An Oregon State senator inherited the property and wants to sell. The claim block includes 170 contiguous claims and several buildings and the mining equipment. Follow-up is to be held-up until snow conditions are right to make a proper exam.

Mark-
If you have not done so already, we should have a file on this district including a literature survey & a copy of the topo of the area of the Bx. You could have stumbled onto something worth while, and we should be prepared for follow-up next spring. Do you want a topo blow-up of the area in preparation for mapping?

Pomsey

37-24-2

Geology

rocks - diorite - and - porphyry - Most abundant - sheared & fractured -
Tbx - (Qtz porphyry)

Structure -

NW shears - dominant N

fractures - NW - dominant -
NE + minor -
possible - E-W all major veins -
- some fractures -

Alteration -

Epidote - chl - Qtz - - propylitic
Py - Qtz - ser - smaller - restricted -
Tourmaline - 2-4% in - large - pervasive - in Tbx
hematite - magnetite
Silicification - generally wk
sericite - strong -

Mineralization

cpy - Py -
covellite - Tr -
Zn - Pb

Py - dissem & in fractures - 1-5% - 2-3 average -
Tbx - complete leaching.

FORM 158

DUVAL CORPORATION

INTER-OFFICE MEMORANDUM

FROM M. Dearborn DATE February 15, 1971.

TO V. F. Hollister ATTENTION

SUBJECT: PANSEY BASIN - MARION COUNTY, OREGON

A two step program evaluating the mineral potential of the Pansey Basin, Marion County, Oregon is planned for this spring and summer. The first step is a brief reconnoissance examination of two known mineral occurences to evaluate size potential of reported tourmaline breccia pipes. If these prospects warrant further work then the second step will be initiated in early June.

Silt sample analysis of all drainages in the district, roughly 100 square miles, reconnoissance mapping--1,000 scale and follow-up investigation of any highs will probably take four men plus the geochem lab 4 - 5 weeks. This will also include soil sampling across the two indicated tourmaline breccias. Magnetometer work across the breccia should also be anticipated.

The reconnoissance geologic work limiting the two breccia pipes should be completed by the end of April. If this work is positive ten definite plans involving the geochem trailer and additional men can be finalized.

Mark Dearborn
M. Dearborn

MD:cg

Battle Ax - Mill City Quad -
Pansey Basin

Zn - 3x BKg
Cu - 2x BKg
Pb - 2x BKg

These samples represent fringe vein type deposits and are very significant in this case.

- Attempted traverse but didnot obtain access as tron bar across road -
  - commune in old mining shacks.
  - Dick Bowen describes as most interesting in Oregon Cascades -
    - some fairly large altered zones
- Bulletin - typical zonation - related to Plutton at depth -
  - workings in area described as vein type - but thats okay - may be much more important.

- Just not certain of distrabution but requires much more work -
  - sampling drainages around the area -
  - recon mapping - 1000 scale if possible -
    - property situation may be difficult.

FORM 158

DUVAL CORPORATION

INTER-OFFICE MEMORANDUM

FROM: M. Dearborn DATE: June 15, 1971

TO: V. F. Hollister ATTENTION:

SUBJECT: PANSEY BASIN

The time period June 2nd to 10th was spent with Terry Rollerson doing 500 scale reconnaissance mapping in the Pansey Basin, Oregon. George Atiyeh and Larry McDougal spent three days showing us the workings in the Amalgamated mines claim group. The purpose of our trip was to find and map the tourmaline breccia described by Callaghan and Buddington.

Initially large zones of pyritization were found in the Stoney Creek area and Gold Creek. Andesite cut by diorite and andesite shows wide spread propylitization--chlorite, epidote, weak quartz and pyrite.

Pyritization and silicification over 6,000 feet in the Stoney Creek area encouraged prospecting and trenching 30-40 years ago. Follow up investigation of the prospector's early lead led to the discovery of a major tourmaline breccia. Minimum dimensions of the leached breccia are roughly 1,000 x 1,500 feet; but incomplete mapping left the area open on two sides. Quartz-tourmaline-sericite-sulfides make up the breccia near the centre, in the margin of the breccia, tourmaline surrounds large fragments of andesite with weak sericite and sulfides.

Structural control outside the breccia is a strong set of NW fractures and shears. Fracture set orientations are N30W, N60E and E-W. A major E-W structure is indicated by the E-W valley of the North Santiam and also a major E-W fracture set. Several major NW shears are present and the strong NW fracture set indicates a major NW structure.

Mineralization, regionally, fits the classic zoning picture suggested for most porphyry centres. Pb-Zn at the Ruth, three miles to the east has proven reserves of 300,000 tons 8% Zn. Gold-Silver-pyrite veins in Gold Creek two miles to the NW has major workings but no definite reserves established. The mineralization near the centre is also zoned with an outer pyrite-Epidote-cholorite zone with sulfides dominately in the fractures. Copper mineralization is restricted to major shears surrounding the tourmaline breccia. Complete leaching within the breccia zone indicates equal volumes of sulfides as fracture fillings and disseminations. Original sulfide content is estimated at 5-8% with possibly 1/3 to 1/2 being copper bearing sulfides. Also, the association of strong sericite-Quartz-tourmaline within the breccia indicates a good association for Cu sulfides.

FORM 158

DUVAL CORPORATION

INTER-OFFICE MEMORANDUM

FROM M. Dearborn DATE June 15, 1971

TO V. F. Hollister ATTENTION

SUBJECT: PANSEY BASIN

This district is a good exploration bet and detailed, 500 scale, mapping followed by establishment of a good grid for geochem and mag are justified at this time.

Mark Dearborn

Mark Dearborn

MD:cmg

DATA SHEET - PANSEY BASIN

	TBX	OUTER STRINGER
Geology	Tour. Qtz Porphyry	diorite andesite
Major Structure	Breccia	N30W + EW
Stringers	Breccia	NW + N60E + EW

Alteration minerals

Tourmaline	5-40%	Tr-1%
Orthoclase	possible leached	none
biotite	not detected	none
silicification	strong	moderate
sericite	strong	wk
clay	mod	wk
chlorite	weak	wk--strong
epidote	wk	strong
magnetite	none	wk-
size	+1000-open 2 sides	+6000 feet
pyrite-dissemination	2-4%	1%

Mineralization

Sulfide % in stringer	2-3%	1% - 2%
Quartz	strong	moderate
Calcite	none	erratic- (fracture)
Copper	(mal. in bx-rare) leached +.4%?	fractured-shears
Mo	not detected	not detected
Gold	.01	tr-.2-Gold Creek
Silver	.05	2.5 oz.
Zn-Pb	wk	veins-8%- 300,000 tons power
Zoning	definite	definite

FORM 159

DUVAL CORPORATION

INTER-OFFICE MEMORANDUM

FROM Vancouver

DATE June 16, 1971

TO Tucson

ATTENTION F. H. Howell

SUBJECT: PANSEY BASIN, MARION CO., OREGON

Attached is a preliminary memo on Mark Dearborn's latest discovery in Oregon. Mark is now putting together an interesting picture in Pansey Basin that adds up to a porphyry copper in a zoned district. The outcrop is hard to find and requires time to map, but once the picture is complete, we will be in a position to act.

I have talked with a few claim holders in the area and property will not be easy.

Mark again has selected a target suggested by the literature and checked it out in the field. He has done an excellent piece of work.

V. F. Hollister

VFH:cmg

cc: A. J. Schmidt
Mark Dearborn

FORM 159

DUVAL CORPORATION

INTER-OFFICE MEMORANDUM

FROM VANCOUVER

DATE SEPTEMBER 3, 1971

TO TUCSON

ATTENTION F. H. HOWELL

SUBJECT: PANSEY BASIN, MARION COUNTY, OREGON

Attached is Mark Dearborns final geologic report on the Pansey Basin in Oregon. Considering the difficult traversing he was faced with, Mark put together a rather competent and coherent picture. The ground is worth acquiring, but only if it is obtained under easy terms. The nature of the geologic gamble is such that front money is not justified in large committments. A further report dealing specifically with property will come in later.

Attachment: Report by Mark Dearborn

[redacted]

VFH:cmt

cc: Mark Dearborn
A. J. Schmidt

FORM 159

DUVAL CORPORATION

INTER-OFFICE MEMORANDUM

FROM Mark Dearborn DATE August 31, 1971

TO V. F. Hollister ATTENTION

SUBJECT: PANSEY BASIN

INTRODUCTION:

The Pansey Basin is located in the North Central Cascades of Oregon, 40 miles east of Salem and 25 miles east of Mehama on the Little North Fork Santiam River. Access is by highway 22 from Salem to Mehama then from Mehama up the Little North Fork of the Santiam.

Topography is youthful with plus 3,000 feet of relief. Precipitation is moderately heavy with 70 - 80 inches per year plus four to ten feet of snow. Vegetation is dense making outcrop difficult to find.

Mining activity began in the 1860's with limited placer activity in Gold Creek. Staking and exploration of the lode claims began in the early 1900's. Exploration and promotion reached a peak in the 30's as J. P. Hewitt assembled most of the claims in the area and raised money to develop the Ruth. Prospecting continued for 15 years with trenching and tunneling being carried out on most claims. Principal exploration has been for Zn-Ag and Au, with little or no emphasis on the copper potential of the area.

REGIONAL GEOLOGY:

Miocene volcanics (Sardine Fm) are the dominant rock types. Composition ranges from andesite to rhyolite with intercalated sediments being common. Dioritic stocks cut the volcanic pile and in most cases are weakly mineralized. Large zones (+ 200 mi^2) of propolytically altered volcanics in belts paralleling the Cascades indicate a major batholithic complex at depth. The Pansey Basin makes up one propolytic zone with chlorite, epidote and weak pyrite being pervasive.

GEOLOGY:

Miocene Sardine andesites and rhyolites are the oldest and most prevalent rocks present. Propolytic mineralization is common as epidote-quartz fracture fillings and a general chloritization of the rock is pervasive. The volcanics are cut by three intrusive units. Quartz Diorite ranging from medium grained hypidromorphic to porphyritic appear to be closely related to the mineralization. Quartz porphyry strongly tourmalinized cuts andesite and diorite near the contact. Post mineral andesite dikes cut all rock units.

ALTERATION:

Chlorite, epidote, weak quartz and pyrite is pervasive throughout this area. Only in the more intensely altered Quartz porphyry is the propolytic suite apparently lacking. The brecciated Quartz porphyry is moderately to strongly silicified, sericitized, pyritized, and tourmalinized.

Pyritization is the most conspicuous alteration product. A zone of +6,000 x 10,000 feet is erratically pyritized with the content ranging from 2% to plus 5%. Associated with the pyrite is argillic alteration which also is erratic in distribution.

Pervasive silicification surrounds the Quartz porphyry especially on the north side.

STRUCTURE:

A major E-W structure is supported by the drainage system of the Little North Fork Santiam and a E-W fracture set. NW fracture sets and zones of pyritization as well as drainage systems indicates a major NW control for the Cascades in general.

Pre-mineral brecciation is developed in and surrounding the Quartz porphyry. Tourmaline, Quartz, and sulfides form the cement. Post mineral brecciation may be developed, but lack of outcrop prevents an adequate interpretation.

Quartz-sulphide stringers of moderate density surround the Quartz porphyry. The width of the stringers is generally less than ½ inch and spacing is not dense.

MINERALIZATION:

District zonation fits the porphyry concept with Zn and Au surrounding the copper center. Three miles NE 300,000 tons 8% Zinc are proven at the Ruth. Extensive workings in the Gold Creek area indicate moderate amounts of Au-Cu-Ag in major vein systems.

Total sulfide content within the Quartz porphyry is 5%, with roughly one-half in the fractures and one-half as disseminations. Moderate leaching has taken place, but appears to be insufficient to develop an attractive secondary blanket.

Copper mineralization is visible surrounding the Quartz porphyry in stringers, and is generally associated with tourmaline. The widespacing and low grade of the mineralized stringers excludes this area from the target of interest.

Geochemistry supported field interpretations on both a regional and local nature. Regionally the district is two times background in Cu-Zn-Pb for the Cascades. Locally silt sampling across the Quartz porphyry shows the target area to be plus 10 times background for the Cascades.

CONCLUSION:

As a near surface target the Pansey is small with a maximum potential of 25,000,000 tons +0.5 Cu. However, the major target is deep. The concept of porphyry development shows emplacement to be at a depth of 4 - 8,000 feet. The youthful nature of the Oregon Cascades plus the large propolytic alterzones suggests major batholiths at depth. Assuming the Quartz porphyry makes this target worth following up, providing a reasonable property picture can be assembled.

Attachments: Index Map 1"= 4 Mi.
Regional Geology 1:500,000
Local Geology 1"=500'
Struct & AH 1"=500'
Geochem 1"=500'

Mark Dearborn
Mark Dearborn

MD:cmg

FORM 159

DUVAL CORPORATION

INTER-OFFICE MEMORANDUM

FROM VANCOUVER DATE August 20, 1971

TO HOUSTON ATTENTION M. F. Owen

SUBJECT: PANSEY BASIN - PROPERTY

Mark Dearborns' investigations into the Pansy Basin of Marion Co., Oregon, have disclosed a small porphyry target, with speculative possibilities for a larger target not visible in outcrop. Pending approval by Mr. Howell, I would like to suggest that we now stake that part of the Basin that we deem critical to our interest and use the next few years in an attempt to complete the ownership package on as inexpensive a basis as possible.

GEOLOGY: Mr. Dearborn has submitted several reports in the past detailing investigations as they have been made, and he will submit a complete, final report on his investigations when he has time. It is clear now, however, that in inexpensive attempt at a property position is justified.

PROPERTY: Investigations by Mr. Dearborn and myself have shown that part of Pansey Basin to be of interest to be burdened by a number of unpatented mining claims with at least five separate ownerships involved. Should we start negotiations with any or all of them, without the open ground being staked, then we run the risk of others staking and complicating the already complicated picture. It would appear best for us to have the critical open ground covered as inconspicuously as possible prior to negotiations. Therefore I would suggest that the claims be staked in your own name or of someone else in Houston (not Tucson) not in the exploration department, and the actual staking be done under contract with a reliable survey group. With our past experience with McIlhanney at the Margaret for staking as satisfactory as it has been, I would suggest using them. Twenty claims are believed adequate for staking at this time since we believe the remaining ground has been staked in some fashion.

Attached to Mr. Howells copy of this memo is an ER that should cover the cost of staking and also costs of negotiating for additional property. It comes to $5,000, and should be adequate to cover costs for this year. Mr. Dearborn is preparing a map showing where the claims should be staked, but we can do nothing until the ER is approved.

[redacted]

VFH:cmg

cc: Mark Dearborn
F. H. Howell/ER

FORM 159

DUVAL CORPORATION

INTER-OFFICE MEMORANDUM

FROM R. L. Moore — DATE May 14, 1978

TO V. F. Hollister — ATTENTION

SUBJECT: Pansey Basin, Marion Co., Oregon.

J. R. Huspeni and I spent four days on the Shiny Rock Mining Corp. claims, northeast of Gates, Oregon. Our main objective was to investigate the tourmaline breccia zones and to determine if there is a concentric pattern to the fractures. While working in the area, we met with George Atiyeh, President of Shiny Rock Corp., and had the opportunity to look at the Freeport drill core.

Freeport Exploration Company currently holds the lease options on the Shiny Rock claims. They have done both geologic and alteration mapping throughout the mineralized area. Their geologic map appears to be accurate, but the alteration map seems to be off.

The tourmaline alteration is located within the phyllic zone and is confined to the Spokane Creek area. The tourmaline is located along fractures and as vein fillings. The veins show N10W to N35W trends with the major tourmaline zone being elongated in this direction. Tourmaline within the veins is typically associated with quartz and carries between 5 and 8% sulfides and/or limonite. The dominant sulfide is pyrite with zones of high chalcopyrite. The sulfides occur on veins, but the majority are disseminated through the rock. There are four zones of tourmaline alteration, with no continuity between these zones. Located to the southwest of the tourmaline veins is a NW-SE trending breccia pipe. The pipe is approximately 150 feet by 300 feet and consists of volcanic breccia fragments within a tourmaline, clay and sulfide matrix.

The major fracture trend varies between N15W and N35W. There is also a subordinate trend ranging between N10E and N30E. This trend is less developed and typically carries no sulfides or tourmaline.

We did not spend enough time at Pansey Basin to do detailed alteration mapping, but we were able to spotcheck Freeport's work. The Freeport map shows the center of alteration running along the Little North Fork of the Santiam River. Our investigation shows that this zone contains phyllic-propylitic transition alteration with chlorite being the dominant mineral followed by sericite and epidote. Our investigation showed the potassic zone to be smaller than the one Freeport mapped, and

.../...

shifted slightly to the south. The alteration along the river is phyllic-potassic and rapidly changes to propylitic to the north. To the south of the North Fork, there is a large zone of strong phyllic alteration with a high percentage of limonites and disseminated tourmaline stars.

NS-1, Freeport's first diamond drill hole, is located NW of Spokane Creek near the tourmaline zones. The hole was drilled at 60° along a bearing of due south. This hole had only one zone of ore grade copper (.355% Cu) at a depth of 1940-2040 feet. Within this zone, copper occurs as disseminated chalcopyrite with minor pyrite. The cp/py ratio is about 4:1 suggesting potassic alteration. The rock is a creamy diorite to quartz diorite with a high percentage of sericite (40%). Calcite occurs in large euhedral to subhedral crystals as well as small crystals at the plagioclase sites and makes up from 10-20% of the rock mass. There is minor secondary biotite and K-spar as well. The hole was drilled to a total depth of 2113 feet with the bottom 50 feet in strong phyllic alteration. NS-1 showed phyllic alteration at the very top and bottom of the hole with potassic alteration between.

NS-2 was drilled just north of the Little North Fork. It was drilled at 60° bearing S45°W. Freeport's interpretation of NS-2 was that the entire hole was drilled in potassicly altered rock. When the core was investigated, the top of NS-2 showed weak potassic alteration which quickly changed to phyllic at a depth of about 200 feet. There is a short ore zone containing 0.32% Cu at 830-880 feet. This is located in phyllic-propylitic alteration. The hole was terminated at 2005 feet in strong propylitic alteration, and not potassic as was suggested by Freeport.

From our investigation, the Pansey Basin property appears to have excellent potential as a porphyry copper deposit. We discussed possible lease arrangements with George Atiyeh during our visit. He was aware of the poor copper market and thought that lower payments than those which Freeport is now paying could be arranged. He suggested the possibility of placing a moratorium on payments untill copper prices come up. With this possibility, it is believed that Pansey Basin deserves further investigation. Before any decision is made, however, the alteration should be remapped and the Freeport core relogged.

THE UNIVERSITY OF BRITISH COLUMBIA

INTERDEPARTMENTAL MEMORANDUM

TO Vic

FROM RLA

DATE

Here's another date from the K-Ar lab. Seems reasonable for that part of the world... the most recent detail is in GSA guidebook for Corvallis mtg - Oregon Bull 101.

(NTS ____________)

K-Ar

Sample Number(s) and Reference(s)

Lab No: *Pansey Basin.*

Ref: *V. Hollister*
R. Armstrong

Record No:

Suite No:

Sample Name:

decay constants:

- ☐ 4.72/.584/1.19
- ☐ 4.72/.584/1.18
- ■ 4.96/.581/1.167
- ☐ not reported

material	Date	1σ error
(*Whole Rx*)	*11.0*	± *0.4* Ma
( )		± Ma
( )		± Ma
( )		± Ma

Latitude: Longitude: (X° Y' Z" or X° Y.Y')

(° ' " N , ° ' " W (±);

UTM Zone ___ ______E ______N; Province ______

Sec.____, T.______, R.______; ____________Co., State__________.

(NTS________) ____________________Map Area, Scale__________

Location:

Source Type:

Rock:

Geologic Unit:

Geologic Age:

Material Analyzed: *Whole rock, quality very fine.*

Analytical Data: (list duplicate analyses or indicate n = 2, n = 3, etc.)

K = *1.56 1.56* %; (Ar^{40*} = *0.6712* $x10^{-6}$ cc/gm)
K_2O= % *0.2995* $x10^{-10}$ mol/gm) ; (*42.2* $\%\Sigma Ar^{40}$)

K = %; (Ar^{40*} = $x10^{-6}$ cc/gm)
K_2O= % $x10^{-10}$ mol/gm) ; ($\%\Sigma Ar^{40}$)

K = %; (Ar^{40*} = $x10^{-6}$ cc/gm)
K_2O= % $x10^{-10}$ mol/gm) ; ($\%\Sigma Ar^{40}$)

K = %; (Ar^{40*} = $x10^{-6}$ cc/gm)
K_2O= % $x10^{-10}$ mol/gm) ; ($\%\Sigma Ar^{40}$)

Comment on Analyses:

Interpretation:

Collected by:

Dated by: *J.E. Harakal*

Date: *03.18.80*

NORTH SANTIAM PORPHYRY COPPER PROSPECT

MARION COUNTY, OREGON

SUMMARY REPORT

DONALD J. DECKER

Consulting Geologist

MICHAEL B. JONES

Freeport Exploration Company

August 1977

LITTLE NORTH SANTIAM RIVER FROM NEAR STACK CREEK,
GOLD CREEK BASIN IN CENTER BACKGROUND

WHETSTONE MOUNTAIN FROM JAWBONE FLAT

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LITTLE NORTH SANTIAM PORPHYRY COPPER PROSPECT

ABSTRACT

The Little North Santiam porphyry copper prospect in the central Cascades of Oregon has appropriate size, strength, and coherent alteration-metallization zoning patterns to warrant continued evaluation by Freeport. Outside diameter of the phyllic (1 to 5% pyrite) zone is approximately three miles. The central potassic (biotite + magnetite ± K-feldspar ± chalcopyrite) core is at least two miles in diameter, including the portion of the stock on AMOCO claims. Best copper mineralization (0.7% Cu) as presently defined in two 2000 foot diamond drill holes is in biotite + magnetite altered diorite. The sulfide system has ample room for an undiscovered 200 million tons of primary ore.

In the area of the prospect, a diorite stock intrudes Miocene Sardine Formation andesitic volcanic rocks. The stock is composite with at least two phases: pyritiferous medium grained porphyritic diorite; and fine grained equigranular diorite. Quartz porphyry dikes intrude both the volcanics and the stock and contain up to 0.14% Cu. A tourmalinized intrusive breccia pipe is anomalous in Cu, Mo, and Au. Airborne magnetic high anomalies correspond to the central copper anomalous potassic alteration and to the intrusive breccia pipe.

SUMMARY AND CONCLUSIONS

To date, a large (3 x 5 miles) porphyry copper-molybdenum system with peripheral zinc-lead mineralization has been identified. The central copper zone is in potassic (biotite, magnetite) alteration which is surrounded by zones of phyllic, argillic, and propylitic alteration. Within the potassic zone, 0.35% copper is intersected in two diamond drill holes, and 0.1% copper is exposed on the surface in untested areas. One tourmaline intrusive breccia pipe with surface dimensions of 150 x 300 feet contains anomalous Mo, Au, and Cu values.

Drill Targets

The extended geologic and alteration mapping and geochemical sampling during 1977 defined four new areas with potential for economic grade copper mineralization. These areas (Plate 9) warrant testing by at least one drill hole each. An initial program of four drill holes and a contingent program of three additional holes are discussed below:

Area 1 - Mill Creek (see Plate 9):

The largest copper anomaly, 1000 x 2000 feet is along Mill Creek and the Little North Santiam River. Features favorable for copper mineralization are:

(a) copper anomaly (250 to 1400 ppm) - 1000 x 2000 feet
(b) copper/zinc anomaly (> 3) - 1200 x 1500 feet
(c) potassic alteration
(d) Mill Creek aeromagnetic-high
(e) quartz stockwork "crackle breccia" within the copper and Cu/Zn anomalies
(f) intrusion of copper anomalous dacite and rhyolite quartz porphyry dikes into diorite with anomalous copper
(g) alluvial cover over approximately 90% of target area caused by the highly altered and incompetent nature of the mineralized rock

One 1500 foot drill hole (No. 3) is recommended for this area based on the above factors with another hole (No. 7) planned if the results of No. 3 are encouraging. It is anticipated the best mineralization would be intersected within 800 feet of the surface (see Plate 5D). The mutual association of crackle breccia, copper, potassic alteration, magnetic high, and intrusive rhyolite quartz porphyry make this area a prime drill target.

Area 2 - Tourmaline Intrusive Breccia Pipe (Plate 9):

The breccia pipe located in the SE corner, Section 30, should be tested at depth for copper mineralization. The favorable characteristics of the pipe are:

(a) tourmalinized breccia pipe
(b) anomalous copper (>250 ppm) and Cu/Zn ratio (> 3)
(c) large surface Mo (>6 ppm) and Au (>0.1 ppm) anomaly
(d) +0.7% Cu near the end of drill hole NS-1 which bottomed 1300 feet east of the projected bottom of the breccia pipe
(e) Spokane Creek aeromagnetic high
(f) 14 million tons of +1% Cu drilled in a similar tourmalinized breccia in southwest Washington

To adequately test this breccia pipe for mineralization, one drill hole (No. 4) is proposed at -60° to a depth of 2500 feet. This hole would cut the pipe at 2000 feet below its outcrop and at the same relative elevation as the +0.7% Cu mineralization in drill hole NS-1. Drilling a second inclined hole (No. 8) to a depth of 1500 feet to cut the pipe at 1000 feet below its outcrop is contingent upon hole No. 4 intersecting encouraging mineralization.

Area 3 - Camp Creek:

One 2000 foot hole (No. 5) is proposed for this area based on the following criteria:

(a) gold anomaly (> 0.19 ppm) - 2000 x 5000 feet
(b) Mo anomaly (> 2.5 ppm) - 1500 x 6000 feet
(c) quartz porphyry intrusive
(d) porphyritic diorite with miarolitic cavities and abundant pyrite
(e) phyllic alteration in diorite

In the Panguna deposit on Bougainsville Island in Papua, New Guinea (Fountain, 1972, p. 1054), miarolitic cavities are found locally in the mineralizing intrusive phase. Gold was an important guide to copper mineralization in the initial exploration stages.

Area 4 - Spokane Creek:

Drill hole No. 6, 300 feet NE of NS-1, would test anomalous copper and tourmaline-copper fractures north of the projection of NS-1. The proposed depth of 2000 feet vertical would reach into the potassic alteration zone and to a depth sufficient to test the northern extension of mineralization intersected in NS-1.

Proposed drill hole No.9 (1500 feet deep) is near the mouth of Stony Creek. This hole would test a 1000 foot long gold anomaly (> 0.25 ppm) superimposed on the southeast end of the central potassic zone. The Lure 4 discovery pit in this area contains anomalous copper (800 ppm) in potassic alteration. This hole is contingent upon encouraging results from hole No. 6, 1200 feet to the WSW.

Costs:

The proposed drilling will be carried out in two phases, with the second contingent upon significant mineralization in the first.

Proposed Hole No. Priority	Contingent	Depth (feet)	Target
3		1500	Crackle breccia, potassic zone, Cu anomaly, quartz porphyry, magnetic anomaly
4		2500	Tourmaline breccia pipe, NS-1, magnetic anomaly
5		2000	Au, Mo anomaly, phyllic alteration
6		2000	Cu anomaly, tourmaline, NS-1
	7	1500	Same as 3
	8	1500	Same as 4
	9	2000	Au anomaly, potassic alteration

The estimated costs for the drilling are:

Initial phase (proposed holes Nos. 3-6):
8000 feet x $20.00 per foot = $160,000.00

Contingent phase (proposed holes Nos. 7-9):
5000 feet x $20.00 per foot = $100,000.00

Expenditures to date:

Property Maintenance	$ 25,000
Geophysics	$ 19,000
Geochemistry	$ 18,000
Geology	$ 40,000
Drilling and Access	$123,000
TOTAL	$225,000

INTRODUCTION

Location

The Little North Santiam prospect is a porphyry copper sulfide system in the Cascade Range 50 miles east of Salem, Oregon (Battle Ax and Mill City 15' quadrangles, T 8 S, R 5 E; see Figure 1). Mehama, a town of 200 people, lies 25 miles southwest of the project area and 23 miles east of Salem on Oregon Highway 22. The property is reached via Highway 22 east from Salem for 23 miles then north on North Fork Santiam road which meets Highway 22 one mile east of Mehama. This road is paved for about 14 miles and continues as Forest Service Roads 80 eight miles to Shiny Rock Mining Corporation's gate on the western edge of the property. Jawbone Flat, the project campsite, is 3.3 miles east of the gate and consists of several cabins that are maintained by Shiny Rock Mining Corporation (SRMC).

Topography in the project area is steep with occasional cliffs. The geologic mapping and sampling covers an area of approximately 20 square miles where the elevation ranges from 1800 feet to 4969 feet above sea level. Most of the area is heavily forested with virgin Douglas Fir and Western Hemlock, as well as abundant deciduous vegetation and moss. Precipitation is approximately 80 inches per year, with two to eight feet of winter snow pack. Mean temperature is 48.7°F.

Property

The mining property owned by Shiny Rock Mining Corporation consists of 246 unpatented lode, 3 unpatented millsite, and 7 patented lode mining claims. R. J. Callju (1976) researched the titles of the claim block (Appendix 1). SRMC excluded 6 unpatented, 4 patented claims, and the 3 millsites from the option agreement with Freeport. These claims cover the Ruth zinc mine.

Option Terms

Freeport has a mineral lease agreement with Shiny Rock Mining Corporation of Mehama, Oregon, covering approximately seven square miles of patented and unpatented mining claims located on the Little North Santiam River. Freeport is responsible for all phases of exploration and development, excluding the Ruth zinc mine which is located on a small vein structure in the eastern part of the lease area. The agreement requires rental payments totaling $40,000 during the first three years of the lease. Starting in year four, annual advance royalty payments of $175,000 increasing to $250,000 in year eight are due to the owner if the property is not in production. Delay rental payments of $250,000 per year are payable thereafter until a production decision is made. Production is subject to a royalty of 2.75% of revenue which is defined as net smelter return plus concentrate transportation costs.

History and Production

The district was discovered about 1877 (Brooks and Ramp, 1960, p. 286), and production has been intermittent to the present. Earliest work in the district was in search of free gold, most of which was apparently produced from the Ogle Mountain Mine seven miles northwest of Jawbone Flat. From 1923 to 1941, zinc ore was produced from the Ruth Mine at Jawbone Flat and copper ore from the Santiam Copper Mine (Santiam No. 1) two miles west of Jawbone Flat. Other mines in the vicinity were also worked for copper, lead, and zinc during this period.

In 1929, Mr. J. P. Hewitt acquired the Ruth Mine, the principal mine in the project area, and retained control of it until his death in December 1970. During his control, Mr. Hewitt added many other claims to his holdings. Shiny Rock Mining Corporation obtained the property in September 1971 from Hewitt's family. Since 1975, SRMC has reopened the Ruth vein and constructed a pilot mill to determine the viability of a full-scale lead-zinc-silver mining operation.

The district was recognized as having porphyry copper characteristics and potential in the early 1970's. During the ensuing years, several major mining firms visited the area and conducted various reconniassance surveys. In September 1975, AMOCO Minerals Company located the Frog group of 68 mining claims along the southern border of SRMC's ground.

Freeport Minerals Company optioned the SRMC claims in July 1976 and immediately began a program of geochemical rock chip sampling and reconnaissance geologic mapping. This initial work was followed in November 1976 with a diamond drill program of 4118 feet in two holes. Both drill holes intersected significant mineralization to 0.75% Cu. In February 1977, Freeport contracted an aeromagnetic survey to aid interpretation of the district. In the early summer of 1977, detailed mapping of geology and hydrothermal alteration features at a scale of 1 inch = 1000 feet and additional rock chip sampling refined the geologic target concepts and the distribution of copper anomalies.

AREAL GEOLOGY

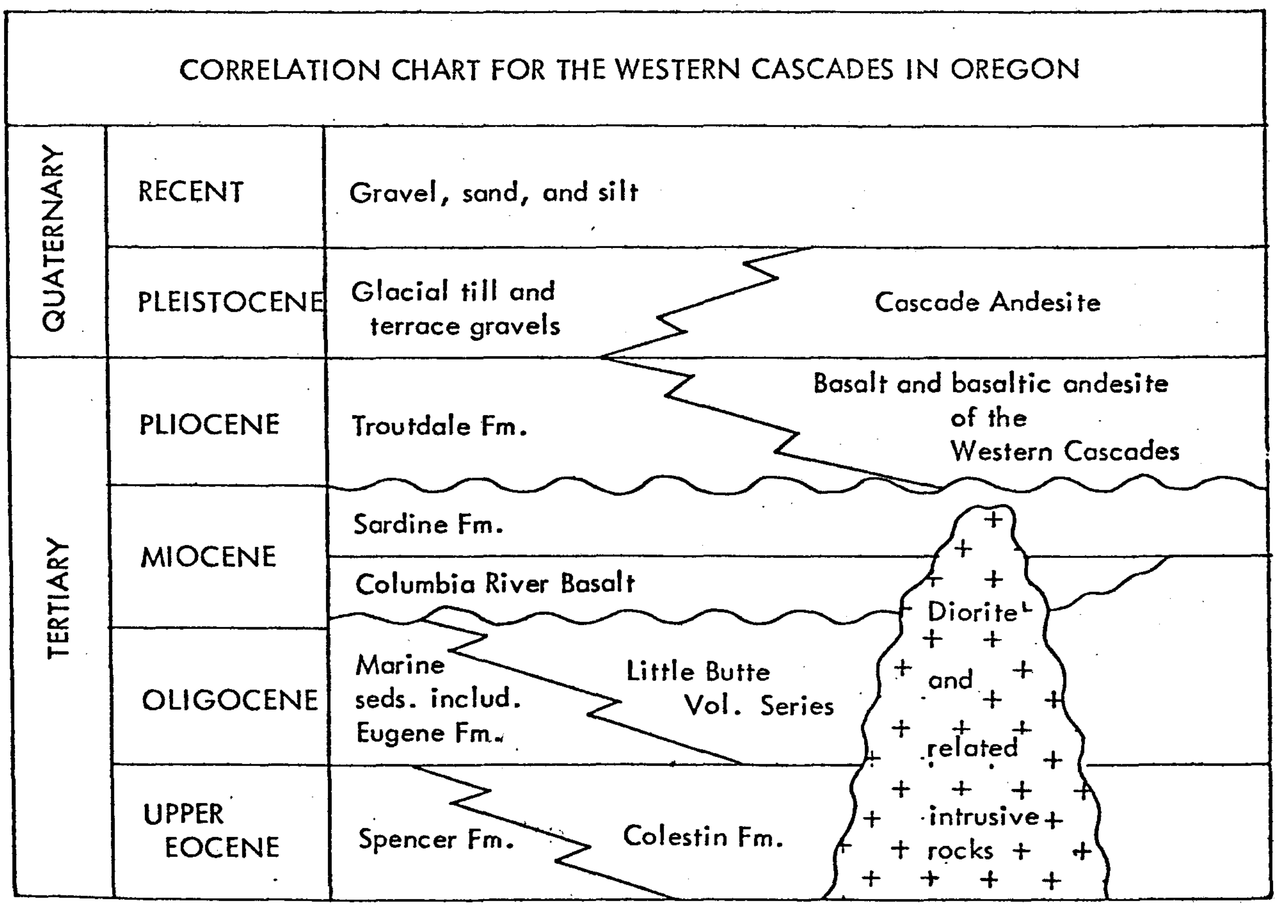
Peck, et al, (1964) have compiled the most complete description of the Cascade Range. Peck assigns the rocks in the district to the Late Miocene volcanic Sardine Formation (Figure 2). The Sardine Formation dips to the west at about 10^{o}. The formation is thickest in the vicinity of the property (Peck, et al, 1964, p. 30) which may be due to proximity to volcanic vent areas.

Several anomalous circular topographic features around the north and west edges of the prospect are definable on aerial photos (see Plate 4D). These circular features may represent caldera or vent-related structures. Mineralization is associated with one of these features in the Gold Creek basin in the northwest part of the claim block.

Several masses of diorite intrude the volcanic rocks at and near Jawbone Flat (Peck, et al, 1964, p. 39). A large diorite intrusion exposed at Detroit Dam, ten miles south of Jawbone Flat has been described by Pungrassame (1970). Callaghan and Buddington (1936, 1938) describe several other intrusives in the central Oregon Cascades. Most of the dioritic intrusions have associated hydrothermal alteration.

FIGURE 3 STRATIGRAPHY

From Brooks and Ramp, 1968, p. 283



PROJECT GEOLOGY

Sardine Formation

The Sardine Formation of late Miocene age is the dominant unit exposed in the area of study. The formation consists of several mapable units divided from bottom to top as lahar, lapilli tuff, tuff, flow breccias, flows, and welded tuff (as shown on Plate 5A).

Lahar: The lahar is the lowest unit exposed in the mapped area and crops out from Gold Creek to the east edge of the prospect (Plate 5). The upper contact dips west at 10^{o}, and approximately 1000 feet of section are exposed. The lahar consists of angular to rounded pebble to boulder (up to three feet) size andesitic volcanic fragments set in a tuffaceous matrix. No welding is evident in the unit.

Lapilli Tuff: Overlying the lahar is an extensive lapilli tuff unit consisting of tuffaceous rock with 10-50% lapilli size fragments (4 mm to 5 cm). This tuff is generally 200-500 feet thick; but in the Gold Creek basin, it may be as much as 1500 feet thick. In the Gold Creek basin, the lapilli tuff may represent a caldera fill unit.

Tuff: The lapilli tuff grades upward into a tuff unit in which the fragment size is predominately less than 4 mm. The tuff ranges up to 300 feet thick.

Flows and Flow Breccias: Andesitic to rhyodacitic flows and their related breccias overlie and are interbedded with the tuff. The flows and flow breccias are best exposed in the western part of the map area. The flow breccias consist of angular andesitic fragments up to one foot across set in a groundmass of similar composition. Most breccia units are 50 feet thick. The breccias grade up into flow units which in turn may grade up into lapilli tuffs. These relations are best séen along Cedar Creek in the southwest part of Plate 5.

Welded Tuff: The uppermost unit mapped is a welded tuff best exposed on Stony Ridge in Section 31. This unit may be up to 300 feet thick. Dyhrman (1976) described the Hugh Creek Ignimbrite immediately north of Whetstone Mountain, which is probably a correlative unit. The welded tuff contains pumice and lithic fragments up to six inches in diameter set in a plagioclase groundmass. Some fragments appear very similar to the quartz porphyritic rhyolite dikes found near the Ruth Mine.

Undifferentiated Volcanics: The undifferentiated unit shown on Plate 5A contains all volcanic appearing rocks which could not be positively identified primarily because of hydrothermal alteration effects.

Intrusive Rocks

Five map units of the Jawbone stock were differentiated in the field mapping as shown on Plate 5A. The most extensive units are the microdiorite and Hewitt diorite. These two units have similar distributions, and the microdiorite may be a border phase or early mafic phase of the stock.

Microdiorite: The earliest phase of the Jawbone stock is the microdiorite. This rock is characterized by fine (2 mm) uniform grain size and is generally dark gray. Where the rock is altered by potassic alteration, it is difficult to distinguish from altered volcanic rocks.

Hewitt Diorite: The Hewitt diorite is both gradational into the microdiorite and cuts it in dikes. The diorite is a medium-grained, porphyritic rock which usaully carries up to 4% pyrite by volume. The diorite is also altered by potassic alteration and in some places is difficult to distinguish from altered volcanics or microdiorite.

Quartz Porphyry: Three later phases of the stock form small masses and dikes of limited distribution. Their relative ages are not well defined. Rhyolite quartz porphyry is found predominantely in the vicinity of the Ruth Mine and west to Mill Creek. Quartz porphyry float occurs in the NW ¼, Section 29. Fragments of the porphyry are found in the welded tuff in Section 31 and in the tourmaline breccia pipe in the SE corner of Section 30. The quartz porphyry may be genetically related to the Sardine Formation welded tuff, and the Hugh Creek Ignimbrite of Dyhrman (1976) as descirbed above.

Trachyte: Trachyte occurs in Sections 24 and 30 (west edge of Plate 5A). Intrusive breccia (?) may border the eastern margin of the body in Section 30. Trachyte bodies are locally pyritiferous but do not appear to be related to copper mineralization.

Late Dikes: Late dikes of minor extent vary in composition from andesite to dacite. They have very minor alteration in or associated with them.

HYDROTHERMAL ALTERATION

The sulfide system is in part concentrically zoned and has appreciable size and strength. The center of the system, as presently understood, is a zone of potassic alteration at least one mile in diameter. Partly surrounding the potassic zone is phyllic alteration with 1 to 5% pyrite at least three miles in diameter. Phyllic alteration grades to an outer halo of propylitic assemblages.

Six hydrothermal alteration assemblages were mapped as displayed on Plate 5B. These assemblages are identified as potassic, phyllic, argillic, propylitic, tourmaline, and quartz veining.

Potassic

The potassic zone is best exposed near the mouth of Stony Creek in Section 29 and extends 5000 feet northwest along the river. The potassic alteration in this area is characterized by fine secondary biotite and magnetite replacing plagioclase and actinolite phenocrysts and as a major constituent of the groundmass. Biotite and quartz ± K-feldspar occur as minor veinlets (Kemp, 1976). The highest grade mineralization found to date is within the potassic alteration zone in drill hole NS-1.

Along Mill Creek, at the northwest end of the potassic zone, chalcopyrite and possibly bornite form a high copper, low total sulfide ($< 1\%$) assemblage, with anomalous copper (> 250 ppm) and copper/zinc (> 3) ratios. At the mouth of Dolores Creek (west of Mill Creek), the potassic zone crops out with extensive quartz and orthoclase veining and anomalous copper.

Weak potassic alteration in both east and west Gold Creek drainages surrounds small intrusives of porphyritic Hewitt diorite. The only anomalous copper in this area is confined to vein structures.

Phyllic

The most extensive alteration assemblage is the phyllic zone consisting of chlorite, sericite, and pyrite. This assemblage is roughly coincident with the intrusive mass of Hewitt diorite exposed from the Little North Santiam River southwest over Stony Ridge to Cedar Creek. The assemblage is strongest where it joins the potassic zone in Sections 29 and 30. Here, pyrite ranges up to 10% and copper values are up to 400 ppm. Along the river in Section 29, the phyllic alteration forms bleached zones and veinlets in biotite alteration.

Argillic

Argillic alteration has a spotty and discontinuous distribution within and peripheral to phyllic alteration. The assemblage is characterized by the clay-silica alteration products and generally does not carry anomalous copper.

Propylitic

The propylitic alteration is very extensive and is denoted by the mineral assemblage of epidote-chlorite-pyrite $\pm$ calcite $\pm$ hematite. Many Pb-Zn and Cu-Pb-Zn vein structures are in the propylitic zone. They may carry high metal values but are of limited economic importance.

Quartz Veins

Quartz veins form a limited stockwork exposed along the Little North Santiam River for 300 feet east and west from the mouth of Dolores Creek. This veining is in potassic alteration which has been partly destroyed by retrograde phyllic alteration and envelopes to the quartz veins. Quartz veining also occurs along Mill Creek, approximately 600 feet NE of the mouth of Dolores Creek, in an area of potassic alteration with low total sulfides and anomalous copper (up to 0.14%).

Tourmaline

Tourmaline alteration is abundant along Spokane Creek and forms vein fillings, massive replacements and replacements in intrusive breccia. In the vicinity of hole NS-1, tourmaline cuts phyllic alteration in vertical veinlets up to a few inches wide. A zone of strong veinlet-controlled tourmaline was the target of NS-1 and was intersected about 500 feet below the surface. The fracture controlled tourmaline usually carries chalcopyrite (200 ppm to 0.2% Cu).

Massive tourmaline replaces volcanic rocks in a zone 100 feet wide at 2600 feet elevation in Spokane Creek. This zone is not anomalous in metal values.

Other areas of limited extent are also tourmalinized. Weak fracture-controlled tourmaline in the SW ¼, Section 31, near Cedar Creek is not anomalous in copper. Fracture-controlled tourmaline at the mouth of Spokane Creek is in an area of potassic-phyllic alteration. Disseminated tourmaline in an argillized dacite intrusive at the forks of Mill Creek is in a low total sulfide area with disseminated chalcopyrite (238 ppm Cu). Tourmaline-quartz-chalcopyrite veins also occur for one-half mile along the main river west of Dolores Creek. These veins trend N 15° W to N 40° W and are only a few inches wide. The wallrock of these veins is propylitically altered.

Tourmalinized Intrusive Breccia: A tourmalinized intrusive breccia pipe cuts through diorite at 2800 feet elevation on the ridge west of Spokane Creek. The breccia pipe is at least 150 feet wide and 300 feet long NW-SE. This pipe contains anomalous Cu (+300 ppm), Au (0.1 ppm), and Cu/Zn (> 3) ratios. Grant (1977, p. 24) documents the common association of breccia pipes with porphyry copper systems in the Cascades. The pipes are usually within intrusive rocks and extend to several thousand feet in depth.

CROWN MINE

A second copper sulfide system may be present at the Crown Mine approximately four miles west of the main area of interest (Plate 2). Mineralization at the Crown Mine is partly defined by distinct metal and alteration zoning. The central anomalous copper area, although accompanied by generally low (less than 100 ppm) copper values, is associated with diorite in a tourmalinized and potassically altered area. The potassic alteration extends at least one mile northwest of the Crown Mine and is coincident with Cu/Zn ratios greater than 3.

Partly surrounding the central copper-potassic zone is lead-zinc mineralization in Henline Creek, about 1.5 miles to the north, and near the mouth of Elkhorn Creek, about 2 miles to the southwest.

STRUCTURE

The central copper zone (E ½ Section 30 and W ½ Section 29) is localized at the structural intersection of northwest and northeast trends along the Little North Santiam River. The dominant structural trend of veins, fracturing, and tourmalinized structures is N 15° W to N 40° W. The main intrusive mass of Hewitt porphyritic diorite, as well as stockwork quartz veining near the mouth of Mill and Dolores Creeks, trend N 50° E. These structural trends intersect in the vicinity of the largest copper anomaly just northeast of DDH NS-2. Grant (1969 and 1977) points out the importance of northwest-northeast structural intersections to copper mineralization in the Cascades of Washington.

GEOCHEMISTRY

Geochemical sampling over approximately 20 square miles was concentrated on the SRMC property as shown on Plate 5C. Most samples are rock chips of outcrop. One thousand rock chip samples were analyzed for Cu, Mo, Pb, Zn, Au, and Ag. These values were plotted and contoured at a scale of 1 inch = 1000 feet as follows:

Metal	Contours (ppm)	Plate No.
Cu	100-160-250	5C-1
Mo	2.5-7.5	5C-2
Pb	50-100-150	5C-3
Zn	100-150-200	5C-4
Au	0.1-0.19	5C-5
Ag	0.2-0.5-1.0	5C-6

Figure 6 shows the histogram distribution of values for Cu, Pb, and Zn.

Well-developed trace element geochemical patterns in the Little North Santiam sulfide system are consistent with the patterns of hydrothermal alteration. The central copper zone superimposed on potassic alteration grades outward to pyrite-phyllic alteration which in turn is surrounded by peripheral Pb-Zn veins in propylitic alteration.

Copper

The central copper-rich part of the system contains two anomalies ($>$ 250 ppm Cu) defined by the rock chip sampling (Plate 5C). One, the Spokane Creek area, is associated with vertical fracture-controlled tourmalinization in an area of strong phyllic alteration. Tourmaline is controlled by N 40° W to E-W fractures, which appear to postdate the surrounding phyllic alteration. Both the tourmaline fractures and the wallrock are anomalous in copper. The Spokane vein is found in this area and strikes N 50° E.

The second (and larger) anomaly is along Mill Creek and southwest to Dolores Creek. The anomaly is 1200 feet long in a NE-SW direction and at least 1000 feet wide. Exposure of the anomaly is minimal; about 90% of the area is covered with stream alluvium.

Within the Mill Creek anomaly is a highly anomalous area 400 feet in diameter with +0.1% Cu that also corresponds to a molybdenum anomaly ($>$ 6 ppm Mo). The highest copper value (0.14%) is found in a quartz porphyry outcrop, with slightly lower values in dacite and potassically altered wallrocks of microdiorite.

At the edge of the Mill Creek anomaly near the mouth of Dolores Creek, a quartz-vein-rich area of crackle breccia (?) contains anomalous copper (250 to 700 ppm) for at least 600 feet along the riverbed.

Additional copper anomalies are present NW from Dolores Creek. These are vein occurrences in tourmaline-quartz-chalcopyrite and quartz-chalcopyrite veins. In the west end of the central copper zone, in the vicinity of Gold Creek, are several strong veins with tourmaline-quartz-chalcopyrite. Mineralogy of the veins changes to chalcopyrite-galena-sphalerite in the periphery of the sulfide system in upper Gold Creek and the Black Eagle Mine.

Molybdenum

Two extensive areas are characterized by molybdenum anomalies (greater than 6 ppm). The largest area includes portions of both Dolores and Babe Creeks and extends toward Spokane Creek. This anomaly includes the tourmaline intrusive breccia pipe and is within phyllic alteration for the most part. The second anomaly is in an argillized structure in the upper reaches of Babe and Spokane Creeks. A three-sample anomaly corresponds to the +0.1% Cu anomaly along Mill Creek. Several other anomalous molybdenum occurrences are restricted to veins.

Zinc

Zinc anomalies (+200 ppm) surround the central area of mineralization. The peripheral anomalies coincide well with the base metal veining found near the Ruth vein, upper Stony Creek and the Gold Creek-Black Eagle area.

Lead

Lead anomalies (+50 ppm) have roughly the same distribution as zinc. The Ruth vein area, as well as Stony Creek, have local anomalies. Scattered anomalies in the Spokane and Babe Creek drainages are from local vein structures within generally more copper-rich areas.

Silver

The silver values (+0.5 ppm) are widely scattered in both base metal veins and copper-rich zones. There is a general correlation with the molybdenum-rich areas.

Gold

Gold in detectable quantities (0.1 ppm) is found from the Ruth Mine west to Gold Creek. A concentration of gold values roughly corresponds to the molybdenum high in the phyllic alteration zone in Spokane, Babe, Dolores, and Camp Creeks.

Cu/Zn Ratio

Anomalous copper values are associated with areas of Cu/Zn ratios >3. The Cu/Zn ratio of three outlines the copper-rich core area in most detail. The highest grade mineralization cut in the drill holes has a Cu/Zn ratio of 200.

The largest anomalous Cu/Zn ratio area is 500 by 3000 feet, trending NW-SE, and corresponds to the copper-rich core from west of Mill Creek southeast into the Spokane Creek drainage. Another area is around the tourmalinized intrusive breccia pipe. A third area is the south central part of Section 31.

The Cu/Zn ratio progressively decreases toward the fringes of the sulfide system. Within the lead-zinc anomalies, the ratio is generally less than 0.5.

MAGNETICS

Freeport contracted an aeromagnetic survey of the Little North Santiam area through Northway Survey Corporation, Ltd., of Toronto in February, 1977. Northway used a helicopter to fly a draped survey at 500 foot ground clearance with a Gulf Mark III total field fluxgate magnetometer. The survey area covered approximately 23 square miles and extended from Stony Ridge on the south, 3 1/2 miles north to the Marion-Clackamas county lines and from Stack Creek on the west, 6 1/2 miles east to 1 1/2 miles east of the Ruth mine. Approximately 95 line miles were flown on E-W lines about 1/4 mile apart and 6 1/2 miles long. The aeromagnetic data were plotted and contoured on a base map at a scale of 1 inch = 1000 feet (Plate 7).

Magnetic Features

Three distinct magnetic patterns are displayed on the aeromagnetic map within the area of geologic and geochemical interest. These are magnetic linears, areas of flat magnetic response, and two magnetic highs.

Magnetic linears: Linear magnetic trends follow the Little North Santiam River, Battle Ax Creek, and possibly Opal Creek. The Little North Santiam-Opal Creek trend in N 50° W. Geologic features that parallel this trend are dikes, some quartz veining, and post-mineral faults. The Battle Ax Creek trend is N 60° E. A fault breccia near the mouth of Camp Creek is on this trend. Both linears may correspond to faults. The location of the central potassic alteration zone near the junction of the Little North Santiam and Battle Creek linears may be controlled by the intersection of structures represented by these linears.

Flat magnetic response: The drainages of Gold Creek and Camp Creek are areas of low magnetic relief. This magnetic signature may be due to homogenization of remanent magnetism in the volcanic rocks by intrusion of the Jawbone stock (Dave Stevens, personal communication, 1977). Hewitt porphyritic diorite crops out in both drainages. Additionally, the Gold Creek drainage contains a thick sequence of lapilli tuff at least 1500 feet thick that may mask underlying magnetic contrasts.

Magnetic highs: The Little North Santiam magnetic linear separates two magnetic highs, the Mill Creek anomaly to the north and the Spokane Creek anomaly to the south. Adjacent sides of these anomalies have the same size and shape and appear to be faulted apart.

The Mill Creek magnetic high has a relief of 400 gammas. The anomaly is approximately 5000 feet long NW and 4000 feet wide. Its shape is concave eastward into the area of low magnetic relief around Camp Creek. The southern flank of the Mill Creek anomaly corresponds to the copper anomalous central potassic alteration zone. Magnetic potassic alteration may continue to the north and underlie at depths of 800 to 1000 feet the northern three-quarters of the anomaly that corresponds to surface exposures of propylitic alteration. Scattered quartz veins within this propylitic alteration also hint at more favorable alteration at depth.

The Spokane Creek anomaly has a relief of at least 200 gammas; this anomaly is not closed to the south. The long axis of the anomaly trends approximately N 40° W and is at least 4000 feet long. The tourmalinized intrusive breccia pipe and extensive molybdenum and gold anomalous areas are superimposed on the northwest end of the Spokane Creek magnetic anomaly. The surface projection of the bottom of diamond drill hole NS-1 terminates near the northern edge of the anomaly. Inspection of the alteration log for DDH NS-1 (Figure 4) indicates qualitatively a moderate amount of magnetite in the rock near the bottom of the hole.

DIAMOND DRILLING

Diamond drilling followed the initial geologic mapping and geochemical sampling. Two angle holes each over 2000 feet long were drilled and significant copper mineralization (> 0.35%) was intersected in both drill holes.

Hole NS-1 (2113 feet; see Plate 5 and Figure 4) drilled through approximately 900 feet of phyllic alteration and into potassic alteration to 2080 feet. The hole bottoms in argillically altered porphyritic diorite. The entire potassic zone is anomalous in copper as chalcopyrite (> 300 ppm Cu) and a 110 foot zone at 1940-2050 feet averages 0.356% Cu. Within this zone, a 60 foot section averages 0.45% Cu with a high value of 0.775%. At the phyllic-potassic boundary, a 280 foot interval (920-1100 feet) averages 0.12% Cu.

Drill hole NS-1 was directed toward a surface zone of fracture-controlled tourmaline veins with associated anomalous copper. This zone was intersected at the projected depth of 500 feet and continues in the core to about 1200 feet. The lower part of this tourmaline zone includes the phyllic-potassic boundary that averages 0.12% Cu.

Drill hole NS-2 was drilled 2005 feet in mixed phyllic and potassic alteration with weak pyrite and chalcopyrite throughout the hole. One 50 foot zone at 830-880 feet depth averaged 0.32% Cu. This hole ended in potassic alteration. At the main phyllic-potassic boundary (830-1110 feet), 280 feet averaged 0.14% Cu in a quartz flooded rock with low total sulfides (see Frame 5).

TARGET CONCEPT

The Little North Santiam porphyry copper system was generated by intrusion of a composite dioritic stock into consanguinous Miocene volcanic rocks. Classic, partly concentric potassic, phyllic and propylitic hydrothermal alteration patterns are centered on the diorite stock. The quartz porphyry which crops out in the central potassic zone may be the mineralizer phase of the stock. Copper (+250 ppm), molybdenum (+6 ppm), and gold (+0.2 ppm) anomalies are coincident with the central potassic zone and a tourmalinized intrusive breccia. Peripheral lead-zinc anomalies coincide with the propylitic alteration.

Erosion has dissected the system to the top of the potassic zone. Vertical zonation is indicated by (1) an AMOCO drill hole on the south side of Stony Ridge that was collared in phyllic alteration and reportedly drilled into 0.5% Cu in potassic alteration; (2) exposures of potassic alteration in the topographic lows of the Little North Santiam River and Gold Creek with phyllic and propylitic alteration exposed at higher elevations; and (3) transition from phyllic to potassic alteration with depth in DDH NS-1.

Ore grade copper mineralization in porphyry systems generally coincides with potassic alteration. The area potentially underlain by potassic alteration is large and extends from the Gold Creek drainage three miles south to Stony Ridge. Magnetite is closely associated with +0.25% Cu mineralization in potassic alteration at Panguna (Figure 7). Aeromagnetic highs coincide with exposed potassic alteration near Mill Creek and relatively abundant magnetite is associated with +0.1% Cu in biotitized rock in holes NS-1 and NS-2 (Figures 4 and 5). Additionally, in andesitic or island arc porphyry copper systems, anomalous gold has been shown to be a good indicator of mineralized porphyry centers. The gold is probably derived from leaching of weathered pyrite and its chemical and relative mechanical immobility insure that the gold anomalies are not transported and that they, therefore, correspond to or overlie sources of mineralization.

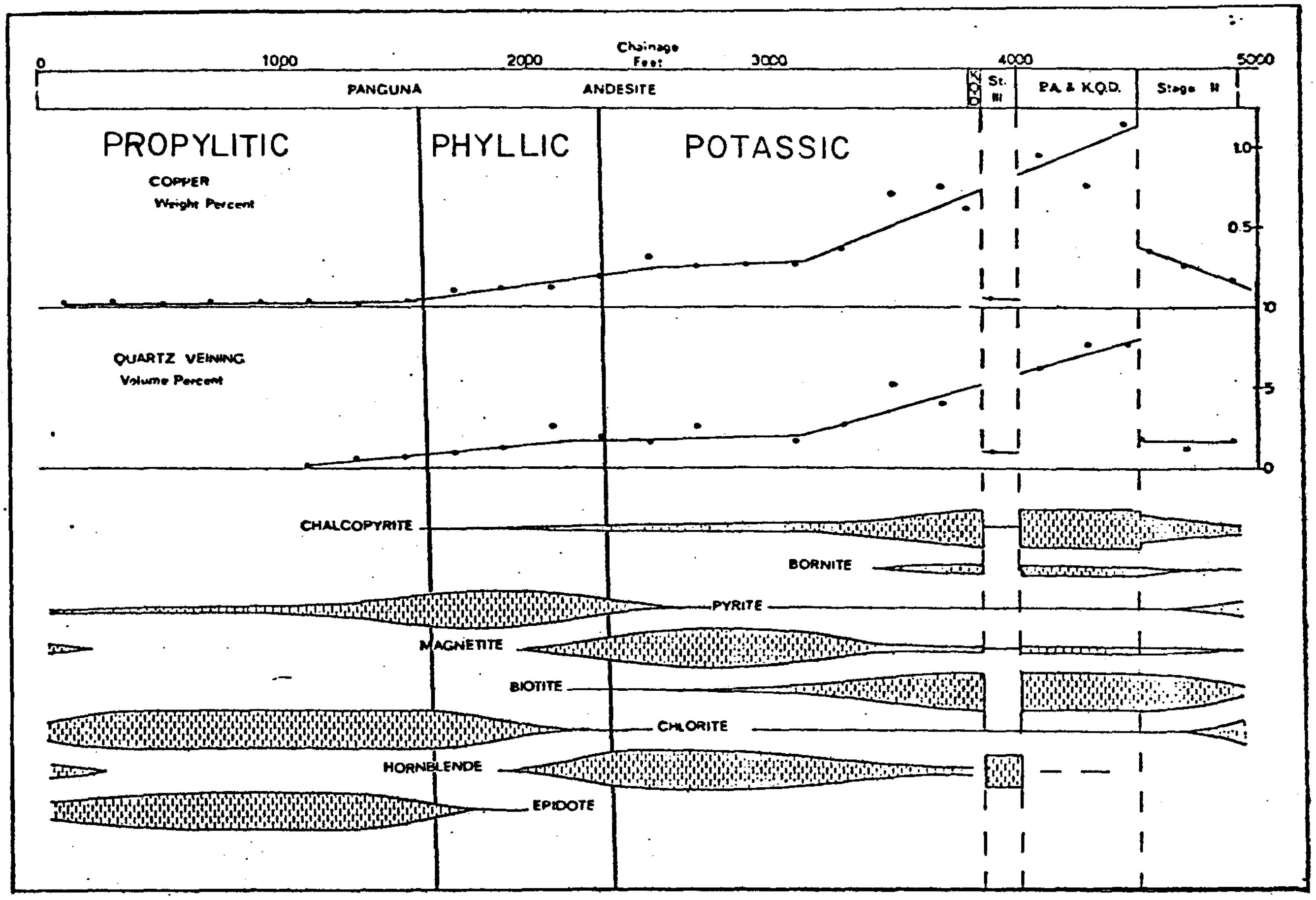
Similar Deposits

The Little North Santiam system has characteristics similar to the Panguna porphyry copper deposit on Bougainville Island (Fountain, 1972). The ore deposit at Panguna contains 900 million tons of 0.48% Cu and 0.02 oz/ton Au. Mineralization is associated with a Pliocene diorite-granodiorite intrusion in Tertiary volcanic rocks. Copper metallization occurs in biotite and magnetite altered stock and volcanics adjacent to a mass of late stage mineralizing quartz-feldspar porphyry. The alteration patterns at Panguna are very similar to those in DDH NS-1 (compare Figure 7 with Figure 4).

Two Teritary porphyry copper systems in the southern Cascades of Washington have recently been drilled. The Miner's Queen deposit drilled by AMOCO contains 14 million tons of +1% Cu in a tourmalinized breccia. Duval's Ryan Lake deposit contains 200 million tons of 0.6% Cu and has associated tourmaline breccia.

Ore Controls

Continued drill evaluation of the Little North Santiam sulfide system should probe untested ore control targets These are:



Geologic log of the western adit main drive, showing distribution of copper mineralization, quartz veining and principal alteration minerals.

(from Fountain, 1972)

FIGURE 7. ALTERATION PATTERNS AT PANGUNA, BOUGAINVILLE ISLAND

(1) Tourmalinized breccia pipes and fracture zones.

(2) Central potassic alteration zone, especially in and near aeromagnetic highs.

(3) Potassic-phyllic alteration zone boundary.

The tourmalinized intrusive breccia pipe located in the SE corner, Section 30, is a prime target for copper mineralization. At the present exposure level, it contains weak copper in a silicified breccia matrix. One tourmalinized fracture zone along Spokane Creek contains anomalous copper which was drilled by NS-1.

The central potassic alteration zone contains the highest grade copper mineralization discovered to date. Strong biotite-magnetite alteration from 1940-2050 feet in drill hole NS-1 averages 0.35% Cu for 120 feet. This is a low total sulfide area, chalcopyrite being the dominant metallic mineral present.

The third ore localization environment is at the boundary of potassic and phyllic alteration zones. This environment was intersected in both drill holes and is characterized by a quartz-rich zone with copper in the 0.12%-0.15% range. This environment is also found at the mouth of Dolores Creek where strong quartz veining represents a crackle breccia. The phyllic alteration in these areas may be retrograde after potassic alteration.

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APPENDIX 1 - PROPERTY

The title search by Callju is included in this appendix and Plate 2 summarizes that information. One area of concern is the overlap of SRMC and AMOCO claims (Plate 5). The SRMC claims are prior to the AMOCO Frog group in Section 31. Following the AMOCO staking of the Frog group, SRMC staked the New Hope group in Section 32 and overlapped the Frog claims. No serious conflict is anticipated in this area, but the actual boundary lines should be established on the ground to avoid any open fractions. Open fractions do exist within the SRMC claim block which should be staked.

Section 36, T 8 S, R 4 E is privately owned land presently being clear-cut. This section should be considered for purchase in the event a mill or tailings site is anticipated.

THIN SECTION DESCRIPTIONS - LITTLE NORTH SANTIAM PROJECT

Introduction and Summary

Twenty-six thin sections were examined petrographically to determine rock type and alteration. In addition 14 of the samples were examined by X-ray diffraction for more accurate mineral identification. All of the samples are volcanic rocks or subvolcanic intrusive units, and all have undergone at least weak propylitic alteration.

In the following descriptions alteration types are classified according to the mineral assemblage and intensity of replacement. Propylitic alteration is characterized by the presence of calcite, epidote(clinozoisite), and/or actinolite. Sericite and chlorite are usually present. Sericitic or phyllic alteration is characterized by sericite with or without chlorite. In one sample kaolinite is present. Potassic alteration is typified by the development of secondary biotite and/or potassium feldspar again with or without sericite and chlorite. Relative intensity of alteration ranges from weak (0 to 30% replacement) through moderate (30 to 70%) to strong (70 to 100% replacement). Grain sizes are expressed in relative terms applicable only on a microscopic scale. Coarse grains exceed 0.75mm, medium grains range between 0.25 and 0.75mm, and fine grains have diameters less than 0.25mm. Very fine and extremely fine are relative terms with no precise size limits. Percentages listed for individual minerals within the thin sections are visually estimated modal compositions and are by no means necessarily accurate or representative of the rock sample.

In general the rocks are fine-grained and many of the alteration products are extremely fine-grained. Sericite, chlorite, and clay are used in a general sense for these alteration products as even X-ray diffraction study of the whole rock plug failed to more positively identify some of the alteration phases. All of the rocks are at least weakly propylitized and several have undergone weak and sporadic potassic alteration. Of the twenty-six samples examined, 15 display propylitic alteration, 7 belong to the sericitic alteration facies, and 4 samples contain secondary biotite. Alteration is pervassive throughout the slides with little or no microstructural control. Veinlets are minor, and in only one case was a weak alteration selvage noted (3069).

Chlorite is the most abundant alteration phase occurring in coarse patches as well as in the groundmass. Sericite is the next most common alteration product usually in coarse patches in association with chlorite, as replacements of plagioclase, and as a groundmass phase. Calcite, epidote(clinozoisite), and actinolite are minor propylitic minerals associated with chlorite, replacing plagioclase, or occurring within the groundmass. Secondary biotite as replacements of the groundmass and plagioclase phenocrysts is sporadically developed in four samples (RC2223, RC2225, 3070, 3071), however it is volumetrically minor and may not be a product of true potassic alteration in the magmatic sense as seen in granitoidal intrusives associated with porphyry copper mineralization. The biotite may be an incipient contact metamorphic effect. It appears to be stable with respect to chlorite. No obvious paragenesis or superposition of alteration zones was noted. In all cases sericite and chlorite appear in textural equilibrium. Sericite and/or chlorite are pervassively developed in every section. Tourmaline occurs in 7 sections (S16,3038,3040,3043,3044, RC2127,RC2128), but it is only abundant in two (3043,3044). The tourmaline is dravite, a magnesium-rich tourmaline, but it also contains some iron. It forms radial columnar clusters or granular crystals in the groundmass. Opague minerals include pyrite and magnetite in most sections. Chalcopyrite is tentatively identified in two sections (3040,3041), but it may be present in other samples. Polished sections should be used for positive identification and mineral relationships of the opaque minerals. The magnetite and pyrite occur as granular disseminations with little or no structural control. They are commonly associated with chlorite-rich areas. With oxidation pyrite invariably develops a thin limonitic or hematitic rim while the magnetite remains fresh.

The original rocks were all volcanic flows, pyroclastic units, or subvolcanic intrusive bodies. Bulk compositions vary from andesitic to rhyolitic with most samples falling in the andesitic to dacitic range. They appear to have a calc-alkalic magmatype affinity, but the pervassive alteration and destruction of original ferromagnesian phases makes this association only speculative. Roughly, the samples consist of 5 andesitic flows, 4 andesitic pyroclastic units, 1 andesitic subvolcanic intrusive, 2 andesitic to dacitic flows, 2 andesitic to dacitic pyroclastic units, 3 dacitic flows, 1 dacitic pyroclastic unit, and 3 dacitic subvolcanic intrusive units. In addition 6 samples have been thoroughly altered obliterating any evidence for their mode of origin, however, they are all very felsic volcanics (dacitic to rhyolitic). Nearly all of the samples are porphyritic with phenocrysts of plagioclase and quartz and coarse clots or patches of sericite and/or chlorite. Original ferromagnesian minerals have been totally destroyed in all sections except S2194(relict biotite), and S14, 3045, 3070(relict actinolite). The plagioclase displays well-developed twinning and zoning. Except for the marked absence of relict or primary mafic minerals, the samples ~~are~~ appear to be typical propylitized volcanics. Many of the rocks were originally glassy, and the samples now contain devitrified glass or relict glassy textures.

X-ray diffraction patterns were obtained from 14 whole rock plugs in the hopes of more precisely identifying some of the fine-grained alteration phases or delineating possible mineral zonations in such minerals as chlorite and sericite. The results are mixed. The chlorites vary from Mg-Fe to Fe-Mg chlorites with no obvious pattern or distribution. They vary even on thin section scale. The chlorites have an intermediate amount of aluminum based on the d(001) spacings that vary from 14.14 to 14.26 Å . The white mica most closely matches 2M muscovite. Pyrophyllite was looked for, but it was not found. The tourmaline most closely matches dravite, the Mg end-member of the tourmaline series. However, its pleochroism suggests that there is some iron present in the structure, probably as a minor amount of the schorl molecule. Kaolinite is positively identified in section 3049 where it is intergrown with very fine-grained sericite.

The presence of actinolite and secondary biotite was confirmed in section 3070 by X-ray. The biotite contains some of the phlogopite molecule (Mg-rich).

The following thin section descriptions are placed in sequential order for three separate groups. Group I includes 3038, 3039, 3040, 3041,3043,3044,3045,3048,3049. Group II includes S12, S14, S14A, S15, S 16, 3069, 3070, 3071, 3077, 3082. Group III samples include RC2127, RC2128,RC2130,RC2223,RC2224,RC2225. In addition there is one isolated sample, S2194, a dike(?) rock. Both Groups I and II are very similar to each other in lithologies and alteration. Group III displays similar lithologies and alteration, but they contain fewer opaque minerals. Sections S2194 and RC2130 are virtually identical.

Overall the alteration exhibited by all three groups is consistent in intensity and bulk composition. Of the three alteration types, propylitic and sericitic are probably the result of hydrothermal circulation and are probably related to mineralization. The sporadic and weak development of secondary biotite and K-spar veining of some plagioclase phenocrysts (RC2130, S2194) appear to be related to magmatic cooling effects (K-spar) or perhaps as a contact metamorphic effect such as the incipient development of an hornfels(biotite). If the biotite and K-spar do represent potassic alteration, it is only weakly developed in these sections. There does not appear to be a consistent zonation of alteration types within the examined samples.

Respectfully submitted,

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Consulting Geologist
November 24, 1976

THIN SECTION - ~~S2194~~

SAME AS RC2130
0+7 thin Section S 2194

Rock Name and Alteration: Porphyritic Dacite intrusive, Propylitic

General description: The rock is a porphyritic dacite with a fine-grained granular groundmass. It is probably a subvolcanic intrusive, and it has undergone propylitic alteration. It is nearly identical to section RC2130. Phenocrysts consist of individual crystals and glomeroporphyritic clots of plagioclase, resorbed quartz, and patches of chlorite ± epidote ± sphene ± magnetite that are probably pseudomorphic after biotite. There are a few shreds and irregular books of relict magmatic biotite. The plagioclase is weakly propylitized (<5% replaced) by very fine-grained flecks of sericite, granular epidote, and minor chlorite. They are weakly to moderately (up to 40%) replaced by wispy stringers, veinlets, and patches of orthoclase as in section RC2130. The veinlets cannot be traced into the groundmass suggesting the K-spar replacement is a magmatic rather than an hydrothermal effect. Original ferromagnesian phenocrysts are 90+% altered to chlorite ± epidote ± sphene ± magnetite with a few relict shreds of biotite. As in section RC2130, there is some very fine-grained secondary(?) biotite intergrown with epidote. Quartz phenocrysts are anhedral to subhedral and contain numerous two phase fluid inclusions. The groundmass consists of fine to medium-grained granular quartz, plagioclase, and orthoclase with interstitial chlorite and epidote. Magnetite occurs as fine to medium-grained disseminated granular crystals within the groundmass and associated with chlorite. There are a few iron oxide pseudomorphs after fine-grained granular pyrite(?), but there is no relict sulfide. There are no veinlets within the section. The rock is a weakly propylitized porphyritic dacite with 30-35% phenocrysts.

Mineralogy: Individual occurrences are very similar to section RC2130.

Quartz (42%)- as in section RC2130

Plagioclase (35%)- phenocrysts are strongly zoned, synneusis twins; composition ranges from AN 15 to AN 30; weakly propylitized; veined by magmatic(?) K-spar (unaltered); in groundmass as anhedral granular crystals and subhedral laths, weakly propylitized.

Chlorite (7%)- as in RC2130

Orthoclase (5%)- as veinlets and patchy replacements of plagioclase, usually cannot be traced into groundmass; as a groundmass phase in anhedral granular crystals, partially sericitized, minor replacement of groundmass plagioclase.

Mineralogy (cont'd)

Epidote (4%)- forms columnar crystals and aggregates, intergrown with chlorite and trace amounts of secondary(?) biotite; minor groundmass phase; replaces plagioclase.

Opaque minerals (5%)- mainly as disseminated granular magnetite; about 1% iron oxide pseudomorphs after pyrite(?); see general description.

Sphene (1%)- as in RC2130 and earlier sections.

Biotite (<1%)- subhedral to irregular shreds, corroded phenocrysts; replaced by chlorite ± sphene ± epidote ± magnetite; relict magmatic biotite.

Comment: The rock is a porphyritic dacite that has been propylitized. Orthoclase veining and replacement of plagioclase is probably a magmatic effect because veins are not traceable into groundmass. K-spar is unaltered. The section is nearly identical to RC2130. The granular groundmass suggests a shallow intrusive origin for the rock.

THIN SECTION - RC2127

Rock Name and Alteration: Porphyritic Andesite flow, Propylitic
Dacite tuff(?), Sericitic-Propylitic

General description: The rock consists of two separate lithologies; one is a porphyritic andesite flow unit, and the other is a quartz and sericite-rich rock with a faint relict tuffaceous texture. The contact is irregular but sharp. The quartz-sericite tuff appears to be incorporated within the flow unit, but the evidence is not unequivocal. The andesitic flow consists of phenocrysts (~25%) of weakly propylitized plagioclase and equal sized patches of chlorite that may be either pseudomorphic after mafic phases or filled amygdules. The plagioclase is 10 to 40% replaced by chlorite, sericite, calcite, and minor epidote along microstructures. The groundmass is a fine-grained holocrystalline, dense intergrowth of subhedral plagioclase laths with interstitial quartz and chlorite and lesser amounts of sericite, sphene and rutile. It has been weakly propylitized. Pyrite forms fine to medium-grained disseminated anhedral crystals that are sometimes associated with chlorite. It is partially oxidized and rimmed by iron oxide. Magnetite forms fine to medium-grained disseminated granular crystals and aggregates. There is one medium-grained radial cluster of tourmaline crystals within anhedral quartz grains. Some pyrite is intergrown with the tourmaline. Near the contact with the second lithology, a few patches of partially recrystallized fine-grained quartz are set in a finer grained matrix than the remainder of the andesite. There are also a few microphenocrysts of quartz. Both may the result of a chilling effect.

The second rock type, a felsic tuff(?), consists of fine-grained quartz, sericite, and lesser chlorite. Texturally, it resembles section 3077, but it contains less chlorite. Quartz is subrounded and anhedral while subhedral flakes and wispy aggregates of sericite and chlorite are interstitial to the quartz. Some patches of very fine-grained sericite are probably pseudomorphic after feldspar. Larger patches of sericite ± chlorite ± sphene may be altered lithic fragments. The overall appearence of the rock is tuffaceous. Coarser quartz grains are concentrated in a band across the slide, perhaps reflecting relict bedding. Pyrite occurs as fine-grained replacement remnants within iron oxide pseudomorphs. It is not common. Iron staining occurs along microfractures. There is one veinlet consisting of quartz and minor sericite. The anhedral quartz contains only a few two phase fluid inclusions.

Mineralogy

Lithology I: Porphyritic Andesite

Plagioclase (35%)- similar to plagioclase in other andesite units; weakly propylitized; composition about AN 20; random orientation of phenocrysts and groundmass laths.

THIN SECTION - RC2127

Mineralogy (cont'd)

Quartz (32%)- as individual fine-grained anhedral crystals interstitial to plagioclase and as medium-grained irregular patches that tend to mantle plagioclase; similar to other andesite sections.

Chlorite (20%)- similar to earlier andesite descriptions.

Sericite (5%)- as fine-grained flakes within plagioclase; interstitial to quartz and plagioclase in groundmass.

Opaque minerals (3%)- same as other sections; magnetite > pyrite.

Rutile (4%)- disseminated fine-grained granular crystals; commonly with chlorite.

Calcite (1%)-as fine-grained anhedral crystals within the groundmass and in plagioclase; usually associated with chlorite,

Tourmaline (trace)- as one radial cluster of medium-grained columnar crystals; similar optically to other sections with tourmaline; pyrite is intergrown with this cluster.

Lithology II: Dacite tuff(?); Except as noted below, individual mineral occurrences are similar to sections 3040, 3077, 3082, etc.

Quartz (50%)- see earlier descriptions.

Sericite (37%)- interstitial to quartz; extremely fine to fine-grained subhedral flakes; fine-grained pseudomorphs(?) after original groundmass feldspar grains and possibly lithic fragments.

Chlorite (10%)- very similar to 3040, 3077, and 3082.

Sphene (2%)- as fine grained granular crystals in coarse sericite psedomorphs after lithic fragments(?); disseminated throughout the section.

Opaque minerals (<1%)- iron oxide forms fine to medium-grained pseudomorphs after anhedral to subhedral pyrite; minor remnant pyrite; iron stained microfractures.

Veinlet- consists of fine to medium-grained quartz with minor sericite; sutured quartz grain boundaries; sericite as fine subhedral flakes and wispy aggregates; few two phase fluid inclusions.

Comment: Lithology I is a weakly propylitized porphyritic andesite flow with trace tourmaline. The tourmaline again appears to

Comment (cont'd): be dravite optically. Could not confirm by XRD because of insufficient amount. Lithology II is probably a sericitized dacite tuff that is similar to sections 3040, 3077, 3043, S16, and 3082. It appears to be incorporated within the andesite flow. The mutual contact may be a chilled zone within the andesite as evidenced by the finer matrix in that area, however, the textural evidence is not conclusive.

THIN SECTION - RC2128

Rock Name and Alteration: Porphyritic Dacite intrusive, Propylitic

General description: The rock is a fine to medium-grained propylitized porphyritic dacite subvolcanic intrusive with phenocrysts of quartz and plagioclase and clots or patches of chlorite that are probably pseudomorphic after amphibole. The groundmass consists of fine to medium-grained granular quartz, anhedral to subhedral plagioclase and orthoclase, and interstitial chlorite and sericite. Phenocrysts comprise about 15% of the rock. Plagioclase is 10 to 70% altered to chlorite, sericite, and calcite while orthoclase is <50% altered to sericite. Chlorite ± sericite ± rutile form irregular patches that in part may be pseudomorphic after amphibole. There is a minor amount of tourmaline forming columnar crystals within both quartz-rich groundmass and plagioclase phenocrysts. Pyrite is the only opaque mineral forming minor anhedral medium-grained crystals that are moderately oxidized with rims of iron oxides. A few microfractures and grain boundaries are iron stained, but there are no throughgoing fractures or veinlets.

Mineralogy:

Quartz (35%)- forms medium to coarse-grained anhedral phenocrysts; partially resorbed with a few inclusions of groundmass and sericite; a few two phase fluid inclusions; groundmass grains as fine to medium-grained subrounded granular crystals; incipient recrystallization; forms bulk of groundmass.

Plagioclase (26%)- similar to other sections; weakly to strongly propylitized (10 to 70% replaced) with development of chlorite, calcite, and sericite along microfractures and as patchy replacements; composition about AN 20.

Orthoclase (5%)- as fine-grained anhedral crystals within groundmass; interstitial to quartz and plagioclase; replaced by very fine-grained sericite; appears magmatic.

Chlorite (22%)- generally the same as in previous descriptions; as medium to coarse intergrowths with sericite, calcite, and rutile, possibly pseudomorphic after amphibole.

Sericite (5%)- fine-grained replacements of plagioclase and orthoclase; interstitial to groundmass phases.

Calcite (3%)- as fine anhedral grains within plagioclase; minor associate of chlorite in patches after amphibole(?).

Rutile (2%)- as in previous sections; occurs with the coarse chlorite patches.

Mineralogy (cont'd)

Tourmaline (1%)- as medium to coarse-grained columnar, often radiating clusters; similar to 3043 and 3044; usually within quartz-rich areas of the matrix; replaces sericite and in one case plagioclase phenocrysts; also occurs within chlorite ± calcite patches; no relation to fractures, veinlets or iron oxide.

Iron oxide (1%)- as rims and replacements of pyrite, see general description.

Comment: The rock is a weakly to moderately propylitized porphyritic dacite. The relatively coarse groundmass and its granular texture suggest the rock is a subvolcanic intrusive. The rock is texturally similar to RC2130, but there are some mineralogic differences. They may be the same unit, but 2128 is somewhat more altered. The tourmaline is probably dravite based on its optical properties and similarities to sections 3043 and 3044.

THIN SECTION - RC2130

Rock Name and Alteration: Porphyritic Dacite intrusive, Propylitic

General description: The rock is a propylitized porphyritic dacite with phenocrysts of plagioclase and quartz and chlorite ± clinozoisite pseudomorphs after mafic phenocrysts. The matrix is fine to medium-grained consisting of granular quartz, plagioclase and orthoclase with interstitial chlorite and clinozoisite. The plagioclase is weakly propylitized (<10%) with sporadic replacement patches of chlorite, clinozoisite, and sericite. More importantly, plagioclase phenocrysts are extensively replaced and veined (30 to 80%) by stringers and irregular patches of orthoclase. The K-spar cannot be traced into the groundmass suggesting the replacement took place prior to crystallization of the groundmass, i.e., a magmatic rather than an hydrothermal effect (similar to S2194). Original ferromagnesian phenocrysts (amphibole and/or biotite) are 100% replaced by chlorite + clinozoisite. Some granular aggregates of clinozoisite contain a trace amount of very fine-grained secondary biotite. The groundmass is weakly propylitized. There are only minor amounts of medium-grained granular magnetite associated with chlorite and a few iron oxide pseudomorphs after pyrite(?) with a sporadic distribution. There are no veinlets within the section. Phenocrysts comprise about 35% of the rock.

Mineralogy

Quartz (50%)- similar to RC2128; anhedral resorbed phenocrysts and granular groundmass crystals, forms bulk of groundmass; very few fluid inclusions.

Plagioclase (31%)- very similar to RC2128 and S2194; composition varies from AN 15 to AN 30; weakly propylitized; strongly replaced and veined by orthoclase (probably magmatic) as in S2194.

Chlorite (10%)- main component of ferromagnesian pseudomorphs, fine to medium-grained columnar crystals; associated with clinozoisite ± sphene; optically similar to chlorite in groundmass; interstitial to quartz and feldspars im matrix.

Orthoclase (5%)- as veinlets and patchy replacements of plagioclase, not traceable into groundmass; anhedral grains within groundmass; partially sericitized; minor replacement of matrix plagioclase; appears magmatic.

Clinozoisite (2%)- as columnar crystals and aggregates associated with chlorite occasionally with a trace amount of intergrown secondary(?) biotite; granular crystals within plagioclase and groundmass.

THIN SECTION - RC2130

Mineralogy (cont'd)

Sphene (1%)- as sporadic anhedral crystals; often associated with chlorite.

Opaque minerals (1%)- see general description.

Comment: The rock is a weakly propylitized dacite with phenocrysts of plagioclase, quartz, and mafic pseudomorphs. It is almost identical to section S2194 displaying the same type of K-spar replacement of plagioclase. Again the replacement is probably a magmatic effect because the K-spar is restricted to plagioclase phenocrysts and groundmass grains. Replacement veinlets do not extend into the groundmass, and there are no veinlets cutting the section that contain secondary K-spar. The biotite associated with either clinozoisite (this section) or epidote (S2194) is very minor and texturally is different from secondary biotite in sections 3070, 3071, RC2223, and RC2225. Samples RC2130 and S2194 are essentially the same lithology. Section RC2128 is texturally similar, but it lacks the K-spar replaced plagioclase phenocrysts. Unless field evidence is to the contrary, I think RC2128 is not the same unit as 2130. The granular nature of the groundmass in this section suggests a subvolcanic intrusive origin for this unit.

THIN SECTION - RC2223

Rock Name and Alteration: Porphyritic Andesite flow(?), Potassic(?)

General description: The rock is an altered porphyritic andesite flow (?) unit with phenocrysts of plagioclase, minor quartz, and relatively coarse irregular clots or patches of chlorite within a fine-grained felsitic matrix. Feldspar laths define a weak pilotaxitic texture. Plagioclase phenocrysts are weakly propylitized (0 to 25%) and replaced by calcite, sericite, and chlorite, and minor secondary biotite. The groundmass is also weakly propylitized. One corner of the section contains abundant very fine to fine-grained secondary biotite within the groundmass and as a minor replacement of plagioclase. Aside from the presence of biotite, there is no obvious textural or mineralogic difference between this part and the remainder of the section to explain the biotite. Both magnetite and pyrite are present as disseminated fine grains, but pyrite is generally coarser and rimmed by iron oxide. The pyrite is not abundant. There is one quartz and calcite veinlet cutting the section. The quartz forms medium to coarse-grained subhedral to anhedral crystals with both single and two phase fluid inclusions that tend to follow microstructures within the quartz. Calcite fills open spaces or vugs along the central portion of the veinlet. There are no alteration selvages or sulfides with the veinlet.

Mineralogy

Plagioclase (35%)- weakly propylitized, generally similar to previous sections; composition AN 13 to AN 35; replaced by secondary biotite in the biotite-rich corner, replacement is along microstructures and is not pervassive.

Quartz (30%)- generally the same as other andesite sections; groundmass quartz contains a few inclusions of very fine-grained chlorite and rutile.

Chlorite (25%)- generally as in other andesite descriptions; coarse patches of chlorite ± sphene ± rutile ± epidote ± magnetite ± quartz are either vesicle fillings or pseudomorphs after ferromagnesian minerals.

Secondary biotite (3%)- as very fine to fine-grained subhedral flakes within the groundmass in one corner of the slide; minor replacement of plagioclase along microstructures; appears in equilibrium with groundmass phases; no obvious reason for its localization; overall the andesite is homogeneous except for the biotite.

Calcite (2%)- similar to other calcite-bearing sections; minor replacement of plagioclase; groundmass phase; asscoiated with chlorite patches.

Mineralogy (cont'd)

Sphene and rutile (2%)- as in previous descriptions.

Opaque minerals (2%)- similar to previous descriptions; magnetite much more abundant than pyrite; pyrite is partially oxidized.

Veinlet- one quartz + calcite veinlet containing trace amounts of chlorite; quartz is fine to caorse-grained, anhedral to subhedral, margin of veinlet is fine-grained becoming coarser towards the center; originally vuggy with euhedral quartz faces, vuggs now filled with calcite along centerline of veinlet; no sulfides; calcite may be sporadically distributed away from the veinlet into the andesite, perhaps an extremely weak selvage?

Comment: The rock is a weakly propylitized porphyritic andesite flow that has a sporadic development of secondary biotite in one area of the groundmass. The biotite is similar to sections 3070 and 3071. Based on its presence, the rock might better be considered as potassically altered. There is no secondary K-spar. The biotite appears in equilibrium with the typically propylitic minerals-calcite, chlorite.

THIN SECTION - RC2224

Rock Name and Alteration: Andesitic to Dacitic Pyroclastic; Propylitic

General description: The rock is a volcanic breccia or coarse tuff with heterogeneous lithic fragments within a devitrified glassy matrix. The overall bulk composition is andesitic to dacitic, and the rock is weakly propylitized. Chlorite and sericite are the major alteration products and similar to the earlier descriptions. Opaque minerals are not abundant consisting predominantly of anhedral disseminated magnetite and trace amounts of anhedral and partially oxidized pyrite. Both are associated with chlorite patches within the lithic fragments. There are several irregular patches of fine to medium-grained quartz within the matrix that may either discontinuous veinlets or simply broken pieces of quartz-rich lithics incorporated within the matrix.

Mineralogy

Lithic Fragments (~75%)- There are two fragments of weakly propylitized porphyritic andesite with phenocrysts of plagioclase and quartz set in fine-grained matrices of quartz, plagioclase, chlorite, sphene, and minor amounts of epidote. Plagioclase is replaced by chlorite, quartz, and sericite, and there is some minor K-spar veining as in RC2130. There are a few patches of intergrown sericite and chlorite as in sections 3038, 3039 etc. The lithic fragments resemble RC2223 with more abundant quartz phenocrysts, and they were probably flows. A second type of lithic fragment is devoid of plagioclase phenocrysts, but it does contain quartz phenocrysts and patches of chlorite ± sphene ± quartz that may be pseudomorphic after mafic phases. The groundmass is siliceous consisting of anhedral fine-grained quartz and plagioclase with interstitial chlorite and sericite. A third variety is non-porphyrtic and is composed of intergrown quartz and plagioclase which is replaced by sericite. Chlorite and sericite are again interstitial phases.

Matrix (~25%)- The matrix consists of fine to medium-grained intergrown quartz, alkali feldspar, sericite, chlorite, and sphene. Grain boundaries are diffuse giving the matrix a felted appearence. It is probably the result of strong devitrification of original glass.

Comment : The rock is a volcanic breccia or coarse lithic tuff. All of the fragments and matrix contain sericite and chlorite. They are more abundant in the matrix than the fragments.

THIN SECTION - RC2225

Rock Name and Alteration: Andesitic to Dacitic Pyroclastic, Potassic(?)

General description: The rock is a fine to medium-grained volcanic breccia with heterogeneous lithic fragments set within a chloritic matrix. The rock is very complex in thin section, and it has undergone propylitic alteration. However, as in section RC2223, there is sporadic secondary biotite developed within a few of the fragments. The sample is texturally similar to RC2224, bu the matrix is more chlorite and magnetite-rich. The lithic fragments are quartz-rich and resemble the second and third varieties of RC2224. Opaque phases consist of medium-grained granular magnetite and lesser anhedral and partially oxidized pyrite. They are both closely associated with chlorite patches. There are a few veinlets consisting of medium-grained quartz and patches of chlorite. The interlocked quartz crystals contain a few two phase fluid inclusions. In general the veinlet is similar to other described quartz veins.

Mineralogy

Lithic fragments (~80%)- Lithic fragments all contain anhedral quartz grains in the groundmass or as microphenocrysts. Quartz occurs in irregular patches in a few fragments. Plagioclase occurs in varying amounts as fine to medium-gtrained subhedral phenocrysts and as fine-grained groundmass laths and granular crystals. Itt is moderately propylitized (up to 50% replaced) by calcite, chlorite, and sericite. It is also replaced by secondary biotite aong microstructures when it is present . Orthoclase (up to 5%) occurs as a minor groundmass phase in a few lithics, generally as anhedral crystals. It is moderately replaced by sericite ± clay. Chlorite, sericite, sphene, calcite, rutile, and magnetite are very fine to fine-grained interstitial phases. The lithics are all volcanic, but their modes of origin are obscure. They do not have typical flow textures. Secondary biotite occurs as a groundmass phase in two separate lithic fragments. One contains quartz microphenocrysts(?) and one doesn't, but they both are relatively fine-grained. The biotite is fine-grained, subhedral and has a brownish-green pleochroism. It replaces the lithic groundmass feldspars and quartz, but appears in equilibrium with chlorite. It is sporadically distributed in both fragments and appears similar to RC2223. The biotite makes up less than 5% of either fragment.

Matrix-(20%)- The matrix is a chlorite-feldspar intergrowth with abundant medium-grained granular magnetite. It is similar to the matrix in RC2224, but chlorite is more abundant. The feldspar is plagioclase with poorly developed albite-twins, and it is moderately replaced by calcite, sericite, and minor epidote. The chlorite tends to form coarse, patchy areas of radiating crystals. There are minor amounts of intergrown quartz and rutile.

THIN SECTION - RC2225

Comment: The rock is a volcanic breccia similar to RC2224. It is weakly propylitized, but two fragments do contain secondary biotite. The lack of biotite within the breccia matrix suggests that the secondary biotite developed within the lithic fragments prior to their incorporation within the breccia. At any rate, the secondary biotite is not pervassive.

THIN SECTION - 3038

Rock Name and Alteration: Dacitic pyroclastic(?), Propylitic

General description: The rock is a fine-grained patchy intergrowth of quartz, sericite, chlorite, and calcite. It is strongly altered and recrystallized destroying most original textures, however, there are relict fragmental textures and devitrified glass suggesting a pyroclastic origin for the rock. The alteration is pervassive with sericite replacing original feldspar and patchy areas in the groundmass. Chlorite forms radial clusters and is disseminated as fine patches throughout the slide. Pyrite is the only opaque present, and it occurs as disseminated anhedral crystals. Relict lithic fragments are present as sericitized patches with quartz+chlorite while the matrix consists of chlorite+calcite+devitrified glass. There is a trace amount of tourmaline in both the lithics and matrix. Lithic fragments comprise 60% of the section while the matrix comprises 40%.

Mineralogy

Quartz-(37%)- as very fine to fine-grained recrystallized grains in groundmass; forms patches of polygonal mosaics; intergrown with sericite and/or chlorite; main product of glass devitrification; only minor fluid inclusions.

Sericite (28%)-as fine to very fine-grained subhedral flakes and wispy aggregates; concentrated in irregular patches with quartz ± chlorite (probably lithic fragments); forms pseudomorphs after plagioclase; in lesser amounts in patches consisting of sericite+calcite+chlorite; intergrown as coarser flakes within chlorite-rich patches; associated with pyrite; minor devitrification product or replacement of glass.

Chlorite (22%)- medium to very fine-grained anhedral patches and subhedral radial clusters; rather uniformly distributed; as a matrix mineral with quartz+sericite patches; as coarser aggregates of pure chlorite±sericite±granular sphene±quartz; minor devitrification product of glass; no recognizable pseudomorphs after mafic minerals.

Calcite (6%)- as anhedral fine to medium-grained crystals associated with relatively sericite-poor areas; commonly with patches of chlorite + very fine-grained quartz (probably matrix for sericite-rich lithic fragments).

Devitrified glass (4%)-brownish areas of polygonally recrystallized very fine-grained quartz ± sericite ± chlorite; no shard-like forms, rather subrounded fragments; restricted to chlorite-calcite-quartz matrix.

THIN SECTION - 3038

Mineralogy (cont'd)

Pyrite (3%)- forms anhedral to subhedral crystals; fine to medium-grained; randomly disseminated; no veinlet association; unoxidized; usually rimmed or associated with sericite and/or chlorite.

Tourmaline (trace)- occurs as two subhedral crystals isolated within a sericitized lithic fragment and the chlorite-rich matrix; no veinlets.

Comment: The matrix for the sericitized lithic fragments was originally glassy, but it is now strongly devitrified and recrystallized although some relict vitric texture is preserved. The tourmaline is optically identical to sections 3043 and 3044. It is probably dravite, but this could not be verfied by X-ray because of its scarcity.

THIN SECTION - 3039

Rock Name and Alteration: Porphyritic Andesite flow, Propylitic

General description: The rock is a feldspar phyric flow(?) with a weak pilotaxitic to glomeroporphyritic texture. Phenocrysts consist of weakly propylitized plagioclase set in a fine-grained intersertal matrix of chlorite, plagioclase, alkali feldspar, quartz, sphene, and granular magnetite. There are also patches of sericite and/or chlorite that may be pseudomorphic after original mafic minerals, however no relict ferromagnesian phases were identified. The patches could conceivably be altered lithic fragments caught in the flow. Fine-grained patches of recrystallized quartz are uncommon, but they occur sporadically within the groundmass and within a few plagioclase phenocrysts. There are several subparallel veinlets of quartz ± pyrite that are cut by a veinlet of very fine-grained recrystallized quartz + chlorite + pyrite. Both types are rather discontinuous and narrow. Opaque minerals consist of abundant fine-grained granular magnetite disseminated within the groundmass and coarser grained, anhedral pyrite occurring as disseminations and filling quartz veinlets. The pyrite is partially oxidized and rimmed by minor iron oxide. The rock is a weakly propylitized porphyritic andesite flow(?) with 15 to 20% phenocrysts.

Mineralogy

Plagioclase (30%)- as a phenocryst and groundmass phase; weakly altered (<20%) to chlorite ± calcite ± sericite; phenocrysts anhedral to subhedral, glomeroporphyritic; microlites are lath-like; weak zoning and twinning; composition about AN 45; also replaced by fine-grained recrystallized quartz when cut by the fine-grained quartz veinlet.

Chlorite (26%)- as irregular patches intersertal to plagioclase, perhaps pseudomorphic after mafic phases; some appear to be amygdule fillings(?), radial aggregates; intergrown with sericite ± quartz as pseudomorphs or altered lithic fragments; replaces plagioclase; widely distributed; usually associated or in contact with pyrite.

Sericite (15%)- as very fine-grained flecks replacing plagioclase; intergrown with chlorite ± quartz in irregular patches; minor groundmass phase interstitial to plagioclase and chlorite.

Quartz (7%)- occurs within the groundmass as fine-grained anhedral grains, interstitial to plagioclase; occasional patches of recrystallized quartz in groundmass.

Sphene (3%)- forms fine-grained irregular granular aggregates; individual granules extremely fine-grained in matrix; commonly associated with chlorite-rich patches.

THIN SECTION - 3039

Mineralogy (cont'd)

Alkali feldspar (2%)- within groundmass only; fine-grained, anhedral; interstitial to other matrix minerals; replaced by sericite ± chlorite

Magnetite (10%)- occurs as fine-grained granular crystals disseminated in the groundmass; interstitial to plagioclase; no particular mineral association.

Pyrite (7%)- as fine to medium-grained crystals both disseminated in the groundmass and associated with quartz veinlets; generally coarser grained than magnetite; often in contact with sericite and/or chlorite; slightly altering to and rimmed by iron oxide along grain boundaries.

Veinlets - occur as two types: 1) earliest consists of anhedral quartz ± chlorite ± pyrite; forms several subparallel veinlets; no alteration selvage; contains minor 2 phase fluid inclusions in quartz; 2) cuts the first type; consists of very fine-grained recrystallized quartz ± chlorite ± pyrite; very irregular trend; quartz replaces plagioclase phenocrysts when they are cross-cut by the veinlet; both types of veinlets are narrow and discontinuous.

THIN SECTION - 3040

Rock Name and Alteration: Dacite(?), Sericitic

General description: The rock is a fine-grained sericitically altered felsic volcanic(?) consisting essentially of quartz, sericite, and chlorite. Igneous textures have been largely destroyed leaving only a few relict quartz phenocrysts(?) and sericite pseudomorphs after feldspar(?). Fine to medium-grained patchy intergrowths of sericite +chlorite occasionally with a reticulate pattern are fairly uniformly distributed across the slide, but they do not appear to be pseudomorphic after a mafic mineral. Anhedral granular pyrite and chalcopyrite are the only opaque minerals present. They form medium-grained, disseminated crystals that are unoxidized. They are usually associated with sericite and/or chlorite. There are no veinlets within the section. There is a trace amount of subhedral tourmaline associated with chlorite and sericite.

Mineralogy

Quartz (40%)- occurs as very fine to fine-grained subangular anhedral crystals; quartz bounds quartz in some cases, in others it is bordered by sericite and/or chlorite; overall granular or sugary texture; quartz is inclusion-free; a few subrounded medium-grained relict phenocrysts(?); some quartz is partially recrystallized.

Sericite (29%)- most commonly forms very fine to fine grained intergrowths with minor quartz and chlorite, pseudomorphic after feldspar; also forms irregular patches acting as a matrix for the anhedral quartz; coarser subhedral sericite is intergrown with chlorite, often in a reticulate pattern; occasional coarse flakes within groundmass; commonly in contact with pyrite; minor iron-staining.

Chlorite (25%)- tends to form columnar to sheath-like crystals and aggregates, intergrown with sericite in a reticulate pattern; as irregular shaped patches or aggregates within the groundmass; does not appear pseudomorphic after mafic phases; usually associated with pyrite.

Opaque minerals (3%)- consist of both pyrite and chalcopyrite as medium-grained anhedral crystals disseminated throughout the section; chalcopyrite predominates over pyrite; not associated with veinlets; relatively unoxidized, but there are a few iron oxide pseudomorphs after sulfides and minor amounts of iron staining; usually in contact with sericite and/or chlorite, also intergrown with fine quartz.

Sphene (2%)- occurs as very fine to fine-grained granules and granular aggregates often with a rectangular form disseminated throughout the section.

THIN SECTION - 3040

Mineralogy (cont'd)

Tourmaline (1%)- forms medium-grained subhedral crystals associated with sericite and/or chlorite, appears to be in textural equilibrium, no obvious replacement; optically similar to tourmaline in 3038, 3043, and 3044.

Comment: The rock is a felsic, probably dacitic, volcanic that has been strongly sericitized and chloritized. All of the original feldspar has been replaced by sericite while the mafic phases have been altered to chlorite. Original volcanic textures have been obliterated by the alteration, so the rocks initial mode of origin is undeterminable. The tourmaline is again probably dravite based on its optical properties. It is not abundant enough to detect by whole rock XRD techniques. The presence of chalcopyrite should be verified by polished section study.

THIN SECTION - 3041

Rock Name and Alteration: Porphyritic Dacite flow(?), Propylitic

General description: The rock is a propylitized porphyritic felsic volcanic with glomeroporphyritic clots of plagioclase phenocrysts, chloritized mafic phenocrysts, and minor quartz phenocrysts set in a fine-grained matrix of quartz and plagioclase. The rock is moderately propylitized with plagioclase altering to epidote, sericite, and chlorite and original mafic phases altering to chlorite, sericite, and minor epidote. Phenocrysts comprise about 20% of the section. The groundmass is a holocrystalline intergrowth of tightly locked anhedral quartz grains and subhedral plagioclase laths with interstitial sericite and chlorite as subhedral flakes and irregular clots. Opaque minerals consist of disseminated fine-grained granular magnetite and medium-grained anhedral crystals of pyrite and chalcopyrite(?) that are closely associated with chlorite and/or sericite. There are no veinlets in the section.

Mineralogy

Quartz (32%)- forms a few subrounded phenocrysts with minor single phase fluid inclusions; groundmass quartz as subangular anhedral crystals interlocked with plagioclase laths, fine-grained; unaltered.

Plagioclase (27%)- occurs as single phenocrysts and glomeroporphyritic clots, composition ranges from AN 22 to AN 32; crystals well zoned and twinned; weakly propylitized (<5 to 20%) with development of sericite, chlorite, and epidote along microstructures, inclusions of devitrified glass; grounmass plagioclase as laths, less altered, interlocked with quartz; a few phenocrysts with much devitrified glass appear about 75% altered with sericite filled microfractures.

Chlorite (20%)- as fine to medium-grained radial clusters and aggregates; commonly intergrown with sericite, ± epidote ± sphene as pseudomorphs after biotite and/or amphibole; replaces plagioclase; as isolated patches or clots within the matrix; some coarser chlorite patches are zoned with Mg-Fe chlorite rims and Fe-Mg chlorite cores; chlorite-sericite intergrowths are in textural equilibrium; associated with pyrite and chalcopyrite(?).

Sericite (15%)- as fine-grained replacements of plagioclase; as medium-grained flakes intergrown with chlorite after mafic phases; as isolated irregular patches within the matrix; interstitial to quartz and plagioclase; commonly associated with sulfides.

Opaque minerals (3%)- consist of disseminated magnetite, pyrite, and chalcopyrite(?); magnetite as finely disseminated granular

THIN SECTION - 3041

Mineralogy (cont'd)

Opaque minerals (cont'd)- crystals, no particular mineral association; pyrite and chlacopyrite(?) as medium-grained anhedral crystals; incipient oxidation, minor rims of iron oxide; similar to 3040 in appearence; strong association with chlorite ± sericite; sulfides more abundant than magnetite.

Sphene (2%)- forms fine-grained granular aggregates as in 3039 and 3040; medium to coarse-grained anhedral to subhedral crystals with chlorie-sericite pseudomorphs.

Epidote (1%)- as fine-grained granular crystals replacing plagioclase; intergrown with chlorite-sericite pseudomorphs; commonly occurs with sulfides.

Comment: The rock is a porphyritic dacite that has been moderately propylitized. Groundmass textures (very poorly aligned feldspar laths and granular quartz) suggest that the rock was originally a viscous flow or perhaps a subvolcanic intrusive. Presence of chalcopyrite should be verified by polished section.

THIN SECTION - 3043

Rock Name and Alteration: Dacite(?), Sericitic and Tourmalinization

General description: The rock is a fine-grained hypocrystalline, sericitized and tourmalinized felsic volcanic(?). Texturally it is similar to 3040 consisting of quartz, sericite, and chlorite with clots of fine-grained fibrous and radial columnar crystals of tourmaline. Igneous textures have been largely obliterated, however there are a few relict quartz microphenocrysts(?) and sericite pseudomorphs after feldspar, and there are patches of devitrified glass. Sphene is relatively abundant as medium-grained disseminated subhedral crystals. There are no veinlets or opaque minerals present.

Mineralogy

Quartz (30%)- forms fine-grained interlocked anhedral grains in the groundmass; irregular patches of 100% quartz, patches with quartz + minor sericite, patches with sericite quartz; a few microphenocrysts, subrounded; generally similar to 3040.

Sericite (15%)- as very fine to medium-grained subhedral flakes and aggregates; pseudomorphic after feldspar(?); irregular patches ± chlorite; interstitial to quartz in groundmass; similar to 3040; sericite-chlorite is in textural equilibrium, but sericite is replaced by tourmaline, contains numerous minute tourmaline needles when in contact with tourmaline.

Devitrified glass (7%)- as irregular brownish patches and amoeba-like area interstitial to or actually enclosing quartz-sericite-chlorite patches, behaves as a matrix; composed of extremely fine-grained quartz and wispy sericite; larger areas are more heavily sericitized; patches do not appear fragmental; replaced by tourmaline.

Chlorite (5%)- occurs as fine to medium-grained columnar crystals and radial clusters; as irregular patches and individual flakes interstitial to quartz; intergrown with sericite in patchy areas; no recognizable pseudomorphic forms; contains a few tourmaline needles, but not as replaced as sericite when in contact with tourmaline.

Sphene (2%)- as fine to medium-grained anhedral to subhedral crystals; rather uniformly distributed; no particular associations.

Rutile (1%)- as fine-grained granular crystals and aggregates within tourmaline rosettes, occasionally related to sphene.

Tourmaline (40%)- occurs as fine to medium-grained fibrous to columnar crystals, aggregates, and rosettes; coarser clusters

Mineralogy (cont'd)

Tourmaline(cont'd)- consist of radiating columnar crystals that are rimmed or capped by finer grained tourmaline producing a cock's comb effect, appear to radiate from vugs and replace groundmass (especially the finer grained tourmaline); also forms fibrous rosettes and individual grains within the quartz groundmass; no relationship to veinlets; original open spaces are not pyroclastic as the groundmass is uniform and not tuffaceous; tourmaline is intergrown with or contains replacement remnants of quartz, rutile, sericite, sphene, chlorite, and devitrified glass; minute needles of tourmaline commonly developed within sericite and chlorite near contact with main bodies of tourmaline; tourmaline is the dravite variety, Mg-rich.

Comment: The original rock was a felsic volcanic, probably a dacite. The devitrified glass may be a remnant flow feature. It is not of fragmental origin. Overall the sericitized rock is very similar to 3040. The tourmaline is dravite (verified by XRD), the Mg-rich end-ember of the tourmaline series. Pleochroism suggests the presence of iron in addition (schorl molecule). The combination of sericitization and tourmalinization has obscured the original mode of origin for this rock.

THIN SECTION - 3044

Rock Name and Alteration: Andesitic tuff, Propylitic and Tourmalinization

General description: The sample is a very fine-grained to medium-grained hypocrystalline rock with relict tuffaceous texture. It is strongly propylitized and tourmalinized with the development of sericite, calcite, and chlorite within plagioclase crystals, lithic fragments, and the devitrified glassy matrix. Tourmaline as as fine to coarse columnar crystals and aggregates is similar to 3043. Tuffaceous debris consists of quartz, sanidine, and plagioclase crystals and heterogeneous lithic (volcanic) fragments set in a devitrified glass matrix. The rock consists of about 60% fragments and 40% matrix. There are no relict shards or eutaxitic textures. Opaque minerals consist of fine to medium-grained anhedral to subhedral pyrite with minor rims of iron oxide and fine-grained granular magnetite associated with chlorite patches. The pyrite is generally disseminated, but some of it is related to associated with tourmaline. There are no obvious veinlets within the section, but some of the tourmaline rosettes may be developed along a structure of some sort.

Mineralogy

Sericite (30%)- as very fine to fine-grained wispy crystals and aggregates of interlocked sheaves; replaces plagioclase fragments, lithic fragments, and devitrified glass; intergrown with chlorite ± quartz; several areas of sericite + chlorite that may be either totally replaced resorbed and/or broken plagioclase crystals or lithic fragments; texturally in equilibrium with chlorite, but replaced by tourmaline

Quartz (23%)- forms fine to medium-grained broken microphenocrysts, subangular, unaltered; as extremely fine-grained anhedral granular crystals within devitrified glass and lithic fragments; fine to medium-grained partially recrystallized grains included or intergrown with tourmaline.

Chlorite (10%)- as very fine to fine-grained flakes and irregular aggregates; associated with sericite in lithic fragments, in devitrified glass, and occasionally with tourmaline; similar to groundmass chlorites in previous sections.

Calcite (10%)- occurs as murky, anhedral fine to medium-grained crystals within the devitrified matrix and some lithic fragments; replaces plagioclase; similar to 3038.

Rutile (3%)- forms very fine to fine-grained anhedral granular crystals and aggregates disseminated throughout the section,

Mineralogy (cont'd)

Opaque minerals (2%)- pyrite forms fine to medium-grained disseminated grains with narrow discontinuous rims of iron oxide; associated with some tourmaline rosettes; occurs within lithics and matrix often associated with chlorite and/or sericite; trace amounts of magnetite as fine-grained granular crystals found within chlorite patches.

Sanidine (1%)- as fine to medium-grained subrounded to broken and subangular microphenocrysts within the glassy matrix, unaltered.

Plagioclase (<1%)- medium-grained subhedral microphenocrysts; moderately propylitized (30 to 60%) with development of sericite, chlorite, and calcite; composition about AN 17.

Tourmaline (20%)- as fine to coarse-grained columnar crystals, aggregates, and rosettes similar to 3043 in overall appearence; some crystals with quartz grains are filling a veinlike structure, but it also occurs within the devitrified matrix away from the "vein"; also within a few of the lithic fragments.

Comment: The rock is a propylitized andesite tuff. Lithic fragments are heterogeneous, irregularly shaped, and strongly sericitized. They appear to have relict volcanic textures and to have lithologies similar to the previously described rocks, especially 3038. All of the fragments are subrounded and "tuff-sized". The devitrified matrix is extremely fine to fine-grained consisting of intergrown and interlocked quartz, sericite, chlorite, and rutile. There is very little, if any, relict glass, but the majority of the matrix was originally glassy. There no relict shard, eutaxitic, or flow textures. It is very similar to the matrix in section 3038. The rock can be considered a lithic-crystal tuff with a vitric matrix. The tourmaline is again dravite (verified by X-ray) with the same optic properties as in 3043. The veinlike structure may be a microfracture with tourmaline developing and replacing the tuff away from it. Some pyrite is associated with or intergrown with the tourmaline, but it is not abundant.

THIN SECTION - 3045

Rock Name and Alteration: Porphyritic Andesite flow; Propylitic

General description: The rock is a moderately propylitized porphyritic to glomeroporphyritic andesite flow with phenocrysts of plagioclase and partially to totally pseudomorphosed actinolitic hornblende set in a fine to medium-grained holocrystalline groundmass. Plagioclase is weakly to moderately replaced by chlorite, sericite, epidote, and calcite while actinolitic hornblende is nearly totally replaced by chlorite and calcite. The groundmass consists of tightly interlocked and randomly oriented plagioclase laths, quartz, alkali feldspar, chlorite, and minor epidote and calcite with an intersertal texture. The groundmass feldspars are propylitized. Opaque minerals include very fine to fine-grained disseminated granular magnetite and fine to medium-grained anhedral pyrite both as disseminated crystals and as grains associated with quartz + chlorite veinlets. Veinlets consist of narrow stringers of quartz + chlorite with lesser amounts of epidote and pyrite. There are no alteration selvages along the stringers. Phenocrysts comprise 15% of the rock.

Mineralogy

Plagioclase (45%)- as medium to coarse-grained individual phenocrysts and glomeroporphyritic clots; subhedral to euhedral; strongly zoned, but poorly twinned; compositionaranges between AN 15 and AN 40; weakly replaced (<10 to ~35%) by chlorite, calcite, epidote, and minor sericite, usually with strong microstructural control, but also as patchy replacements; some phenocrysts with growth zones and/or cores with numerous minute inclusions of totally devitrified glass(?); a few inclusions of anhedral pyrite; groundmass laths are fine to medium-grained, subhedral; randomly oriented with interstitial chlorite, epidote, quartz, alkali feldspar, magnetite, and sphene; weakly propylitized.

Chlorite (20%)- as fine to medium-grained individual crystals and radiating to columnar aggregates; pseudomorphic after amphibole, replaces plagioclase, within quartz + pyrite veinlets, fills amygdules(?) in groundmass, intersertal to plagioclase; associated with epidote, calcite, pyrite, and quartz.

Calcite (10%)- occurs as very fine to fine-grained anhedral crystals replacing actinolitic hornblende and plagioclase; commonly associated with chlorite; minor amounts in groundmass.

Actinolitic hornblende (7%)- as fine to medium-grained phenocrysts and microphenocrysts; subhedral; moderately to strongly replaced by chlortie + calcite; only minor amounts of relict amphibole.

Mineralogy (cont'd)

Quartz (5%)- occurs as very fine to fine-grained anhedral subrounded crystals and occasional small microphenocrysts; interstitial to plagioclase; as veinlet fillings associated with chlorite and pyrite.

Alkali feldspar (5%)- in the groundmass only; anhedral to subhedral very fine to fine-grained crystals; weakly propylitized; interstitial to plagioclase; probably magmatic.

Opaque minerals (4%)- consist of very fine to fine-grained disseminated granular magnetite within the groundmass (~1%) and as fine to medium-grained anhedral pyrite as disseminations in the groundmass, amoeba-like replacements of plagioclase, and as veinlet fillings associated with quartz and chlorite (~3%); pyrite usually associated with chlorite and epidote; some mantles feldspar laths, possibly magmatic.

Sphene (3%)- as very fine to fine-grained anhedral granular crystals and aggregates disseminated in the groundmass; associated with chlorite patches and pseudomorphs after amphibole.

Epidote (1%)- as fine to medium-grained anhedral granular crystals and columnar aggregates within plagioclase and chlorite; minor granular crystals in the groundmass.

Veinlets- several narrow anastomosing stringers (<25μ wide) of quartz, chlorite, and pyrite cut the groundmass and phenocrysts; no alteration seivages, but chlorite, pyrite, and minor epidote are preferentially developed within plagioclase phenocrysts transected by the stringers; pyrite crystals are usually wider than the veinlet replacing(?) the groundmass in part.

Comment: The rock is a propylitized andesite flow. There are no unusual or remarkable features within the slide.

THIN SECTION - 3043

Rock Name and Alteration: Porphyritic Dacite flow(?); Propylitic

General description: The rock is a moderately to strongly propylitized porphyritic dacite with sericite + calcite pseudomorphs after feldspar set in a fine-grained quartz and chlorite rich groundmass. Feldspar phenocrysts are 100% replaced. There are no obvious pseudomorphs after mafic phases, but there are a few chlortie + sericite + actinolite ± sphene clots that are suggestive of original amphibole. The groundmass is a fine-grained interlocked aggregate of anhedral quartz with interstitial sericite and chlorite (perhaps after feldspar), as well as minor amounts of anhedral calcite and veryfine-grained granular sphene and/or rutile. Pyrite occurs as fine to coarse grains with granular to amoeba-like forms. They commonly occupy the cores of sericite + calcite pseudomorphs. Minor iron oxide is developed as thin rims on pyrite and as iron-staining in the groundmass. There are a few iron oxide stained microfractures, but there are no veinlets. Texturally, the rock is similar to 3040, and it may be a more strongly propylitized equivalent to 3041. The rock originally contained about 40% plagioclase phenocrysts and 60% matrix.

Mineralogy

Quartz (30%)- as fine to medium-grained anhedral crystals, usually interlocked in the matrix; a few microphenocrysts(?); forms fine anhedral grains within sericite + calcite pseudomorphs, very similar to quartz in section 3040.

Chlorite (26%)- as very fine to fine-grained individual crystals and up to medium-grained clots or aggregates ± sericite; with sericite + calcite pseudomorphs after feldspar, associated with fine actinolite + sericite in pseudomorphs(?) after amphibole(?); interstitial to quartz as fine to very fine-grained radiating sheath-like clusters in the groundmass; rather uniformly distributed throughout the section; sometimes associated with pyrite; no replacement of sericite.

Calcite (20%)- as fine to medium-grained anhedral crystals with sericite ± chlorite in pseudomorphs after phenocrystic feldspar; in groundmass as anhedral fine-grained granular crystals, probably replacements of original groundmass feldspar; feldspar pseudomorphs consist of 50+% calcite and up to 20% chlorite + quartz + pyrite with sericite forming the remainder.

Sericite (15%)- very fine to fine-grained subhedral flakes and radial aggregates; commonly associated with chlorite and calcite in feldspar pseudomorphs; in groundmass as individual flakes and fibers interstitial to quartz, closely associated with pyrite; generally similar to the earlier sections.

THIN SECTION - 3043

Mineralogy (cont'd)

Pyrite (5%)- as fine to coarse-grained granular to amoeba-like crystals disseminated through the section; many occupy the cores of sericite + calcite pseudomorphs and have a similar appearence to pyrite in 3045; could conceivably be magmatic based on its vermicular and/or resorbed form; no veinlet association.

Actinolite (2%)- as fine subhedral needles intergrown with sericite and chlorite within clots or pseudomorphs after amphibole(?) that are coarser grained than most of the sericite and chlorite; actinolite is not in the groundmass.

Sphene and/or rutile (2%)- as very fine to fine-grained anhedral granular crystals and aggregates, some subhedral crystals (rutile); disseminated throughout the section; no particular associations.

Apatite (trace)- as fine to medium-grained subhedral crystals; usually with chlorite, not abundant.

Comment: There are no veinlets in the section. Some of the pyrite is partially oxidized forming narrow rims of iron oxide. Minor iron-staining especially along microfractures is probably a result of the oxidation. The rock is a strongly propylitized dacite flow(?). It is similar to, but more altered than sections 3040, 3041, and 3045.

THIN SECTION - 3049

Rock Name and Alteration: Porphyritic Dacite flow, Sericitic-Argillic

General description: The rock is a strongly sericitized and kaolinized porphyritic dacite flow with relict altered and corroded plagioclase(?) phenocrysts exhibiting a poorly developed pilotaxitic texture. The groundmass consists of very fine-grained quartz with interstitial sericite and chlorite. The original matrix was probably glassy, but it is now totally devitrified. The phenocrysts are totally pseudomorphosed by extremely fine-grained sericite + kaolinite ± chlorite ± quartz. Pyrite is the opaque mineral forming fine to medium-grained anhedral crystals both as disseminated granular crystals and as grains occupying the cores of some of the sericite + kaolinite pseudomorphs. It is unoxidized. Jarosite(?) occurs as small radiating aggregates of fine crystals or as fillings of short, discontinous vein-like structures. Texturally, the rock is similar to 3048, but it is more strongly altered. Originally, the rock contained 30 to 40% phenocrysts.

Mineralogy

Quartz (40%)- forms very fine to fine-grained anhedral crystals and interlocked aggregates within the groundmass; intergrown with interstitial sericite, kaolinite, and chlorite; probably a devitrification product; some anhedral quartz within sericite pseudomorphs.

Sericite (25%)- as extremely fine-grained to fine-grained subhedral flakes and aggregates of wispy crystals; pseudomorphic with kaolinite after subhedral feldspar (plagioclase?, 100% replacement); in textural equilibrium with chlorite; closely associated with kaolinite but can't really tell if it is a equilibrium or replacement relation because of the extremely fine grain size; in groundmass as fine flakes interstitial to quartz and chlorite.

Chlorite (15%)- occurs as very fine to fine-grained subhedral radiating flakes and aggregates; as irregular patches within sericite + kaolinite pseudomorphs; in the matrix as an interstitial mineral to quartz and sericite, subhedral flakes; also forms irregular to rounded patches or clots of pure chlorite within the groundmass, perhaps pseudomorphs or amygdule filling.

Kaolinite (12%)- as extremely fine-grained crystals intergrown with sericite as pseudomorphs after feldspar; minor amounts within the groundmass associated with sericite; can't tell its paragenesis with respect to sericite except for the strong spatial association; presence verified by X-ray.

Mineralogy (cont'd)

Pyrite (4%)- as fine to medium-grained granular crystals, disseminated; some within sericite + kaolinite pseudomorphs as amoeba-shaped crystals (as in 3048); one poorly developed area of elongated pyrite, perhaps a veinlet but no associated gangue; pyrite is unoxidized; no particular mineral associations.

Sphene (2%)- as very fine-grained anhedral granular crystals or aggregates; widely disseminated.

Jarosite(?) (1%)- as clots and patches of fine-grained radiating crystals; also in elongated but short, discontinuous vein-like zones, occasionally associated with pyrite; identification is tentative (not verified by XRD), conceivably could be iron stained sericite.

Apatite (trace)- as fine to medium-grained subhedral crystals associated with chlorite, similar to 3048.

Comment: The presence of kaolinite was verified by X-ray. It is probably hypogene in origin because of its intimate intergrowth with sericite and the presence of associated unoxidized pyrite. However, the ~~x-ray~~ diffraction pattern indicates that the kaolinite is not well crystallized suggesting rather low temperature formation. The original rock was probably glassy but it is now completely devitrified and recrystallized. The rock is similar to 3048.

THIN SECTION - S12

Rock Name and Alteration: Andesitic flow breccia(?), Propylitic

General description: The sample consists of two separate lithologies with a very irregular contact between them. X-ray diffraction patterns indicate no major differences in mineralogy, only variation in abundance and degree of crystallinity (grain size). Lithology I comprises the white aphanitic part of the thin section plug. It consists of a felted groundmass of fine-grained quartz, plagioclase, and chlorite with lesser sericite, clinozoisite, and sphene. There are a few partially propylitized plagioclase phenocrysts and a few clots of medium-grained chlorite. Both phenocrysts and groundmass are moderately propylitized. Pyrite is the only opaque mineral forming fine to medium-grained disseminated anhedral crystals. There is one narrow veinlet filled with chlorite and sphene. It does not have an alteration selvage. The rock is a faintly porphyritic, propylitized andesite flow(?). Lithology II is finer grained consisting of quartz, plagioclase, and more abundant chlorite set in a hypocrystalline matrix containing sericite and clinozoisite. There are lithic fragments similar to lithology I as well as patches of recrystallized fine-grained quartz that are discontinuously rimmed by sericite ± chlorite. The matrix is chlorite-rich with microlites of plagioclase and minor anhedral quartz grains and minute patches of incipiently recrystallized and devitrified glass. Pyrite is the only opaque present, and it tends to form more angular, coarser aggregates than in type I although it too is disseminated. There are no veinlets. The rock is andesitic in composition, weakly to moderately propylitized, and is probably a flow breccia. The contact between the two units is sharp and very irregular. It does not appear to be a chilled margin. Textural evidence within the two lithologies is not really diagnostic of any particular origin aside from "volcanic".

Mineralogy: The very fine grain size, felted textures, and general mixed nature of lithologies I and II preclude an accurate estimate of mineral percentages and obscure possible origins. X-ray diffraction patterns indicate major amounts of quartz, plagioclase, and chlorite (less in type I). Both are propylitized andesitic volcanics. The pyrite is about equally distributed between both lithologies, and it is commonly rimmed by thin elongated "books" of sericite and/or chlorite.

THIN SECTION - S14

Rock Name and Alteration: Andesite flow, Propylitic

General description: The rock is a very fine-grained microporphyritic, weakly propylitized andesite flow. Microphenocrysts consist of partially propylitized plagioclase and actinolitic hornblende laths. The groundmass is a dense, tightly interlocked growth of very fine-grained quartz, chlorite, plagioclase, hornblende, calcite, epidote, sericite, sphene, and devitrified glass, and it exhibits a pilotaxitic texture. There are several amygdules filled with chlorite and stilbite(?) or laumontite(?) ± minor quartz. Opaque minerals are minor with magnetite occuring as very fine-grained granular disseminations and pyrite forming rare anhedral fine-grained crystals. Both are partially oxidized and replaced by iron oxide. There are a few medium-grained intergrowths of chlorite and leucoxene(?) that are probably pseudomorphs after sphene and/or rutile. There are no veinlets within the section. Microphenocrysts comprise less than 5% of the rock.

Mineralogy

Plagioclase (46%)- occurs as very fine to fine-grained subhedral laths, both as microphenocrysts and groundmass; replaced by epidote, chlorite, minor clay(?); contain inclusions of devitrified glass; no twinning or zoning; weak pilotaxitic texture; composition in the albite-oligoclase range based on XRD pattern.

Chlorite (30%)- as very fine-grained anhedral flakes and granular aggregates in the matrix; replaces plagioclase and actinolitic hornblende; in part after or result of devitrified glass; in coarser aggregates filling amygdules, associated with zeolites; partially intergrown with or pseudomorphic after sphene.

Quartz (15%)- as anhedral very fine to fine crystals within the groundmass; intergrown with other matrix phases; typical.

Actinolitic hornblende (2%)- forms subhedral groundmass laths and a few microphenocrysts; replaced by chlorite; appear to be original magmatic phases, i.e., not pseudomorphs after pyroxene.

Sphene (4%)- as fine to very fine-grained granular disseminated crystals; several medium-grained crystals intergrown with chlorite in a reticulate pattern, perhaps originally rutile or ilmenite.

Opaque minerals (1%)- consist of very fine-grained disseminated granular magnetite, commonly with chlorite; also very minor anhedral pyrite; both partially oxidized and rimmed or replaced by iron oxide.

Mineralogy (cont'd)

Stilbite(?) or Laumontite(?)(1%)- is tentatively identified as fine to medium-grained blocky or radiating crystals within amydules; closely associated with chlorite ± minor quartz; not developed within groundmass; could not confirm with XRD because of small quantity.

Epidote (1%)- forms very fine-grained granular and columnar crystals; usually replaces plagioclase; minor amount within matrix.

Comment: The rock is a weakly propylitized andesite flow. The original matrix was glassy, but it is now totally devitrified producing finely intergrown quartz and chlorite. The optical identification of stilbite or laumontite is solid as can be. The optical properties fit either stilbite or laumontite, but they could not be detected by XRD. The zeolites may be a product of the alteration or perhaps late stage fluid activity within the volcanic.

THIN SECTION - S14A

Rock Name and Alteration: Andesite tuff, Propylitic

General description: The rock is a weakly propylitized andesitic fragmental volcanic, probably a tuff. Lithic fragments are subangular and texturally heterogeneous, but plagioclase phenocrysts and porphyritic textures are common to all of them. The fragments are andesitic to dacitic in composition, and there are no exotic lithologies. The lithics comprise about 90% of the rock. Varying amounts of chlorite, sericite, and calcite are developed within the matrix and fragments. The most abundant minerals are plagioclase, chlorite, and quartz. Most of the lithicsare similar to 3039, 3041, and 3045. The matrix is chlorite-rich. Opaques consist of fine to medium-grained anhedral and amoeba-shaped grains of magnetite and lesser amounts of anhedral granular pyrite that is partially replaced by iron oxide. They occur in both lithic fragments and matrix, but pyrite tends to favor quartz and chlorite-rich areas. Some of the magnetite occurs within irregular and discontinuous microfractures.

Mineralogy

Lithic fragments (~90%)- are weakly propylitized, subangular porphyritic andesite to dacite flow(?) units with predominant phenocrystic plagioclase and minor quartz; plagioclase phenocrysts range from AN 30 to AN 65 with most around AN 30; groundmass plagioclase as fine to medium-grained subhedral laths and microlites with pilotaxitic to randomly oriented textures; plagioclase is weakly propylitized and replaced by calcite, sericite, chlorite, and epidote generally along microstructures; minor anhedral quartz microphenocrysts, unaltered; occasional patches of medium to coarse-grained chlorite ± quartz ± magnetite and pyrite, probably filled amygdules; groundmass of the fragments is very fine to medium-grained, intersertal to al/triomorphic granular textures with quartz, chlorite, sericite, calcite, granular magnetite, epidote, and granular sphene interstitial to plagioclase; groundmass quartz occasionally recrystallized, other phases essentially identical to other descriptions; overall weakly propylitized.

Matrix (~10%)- lithics are caught in a very fine to fine-grained matrix of densely intergrown and locked chlorite, granular magnetite, quartz, and alkali feldspar(?) with calcite, sericite, and sphene; overall crystal shapes are irregular and wispy; probably originally glassy with minor crystal fragments, now largely devitrified and propylitized.

Comment: The rock is an andesitic lithic tuff that has been weakly propylitized. Opaques make up about 7% of the section. Pyrite is generally restricted to lithics while magnetite occurs also within the matrix.

THIN SECTION - S15

Rock Name and Alteration: Porphyritic Andesite to Dacite flow, Propylitic

General description: The rock is a moderately propylitized porphyritic andesite to dacite flow with altered phenocrysts of plagioclase set in a very fine to fine-grained matrix of chlorite, quartz, plagioclase, calcite, and sphene. It is very similar to section 3038. Plagioclase phenocrysts are weakly to moderately propylitized and are replaced along microstructures by calcite, chlorite, quartz, and by minor sericite, epidote, and pyrite. There are rather coarse patches of sericite + chlorite + quartz ± calcite ± sphene ± pyrite that may be altered lithic fragments, strongly replaced phenocrysts, and/or amygdule fillings(similar to 3038). The groundmass is tightly interlocked with randomly oriented subhedral plagioclase laths surrounded by intersertal chlorite, quartz, calcite, sericite, and sphene. It was originally glassy with perlitic cracks(?) that have been filled by partially recrystallized quartz. There are no other veinlets within the section. Pyrite is the only opaque mineral forming medium to coarse-grained anhedral, amoeba-sheped crystals disseminated across the slide both within the matrix and a few phenocrysts. There is no particular association with other minerals. The pyrite often contains inclusions of the groundmass. It is weakly oxidized with thin rims of iron oxide around most crystals. Phenocrysts comprise about 5% of the section.

Mineralogy: Except as noted below, individual occurrences are similar to section 3038.

Quartz (30%)- as very fine to fine-grained anhedral crystals in the groundmass; as narrow "veinlets" of recrystallized fine-grained crystals filling perlitic(?) cracks within the devitrified matrix.

Chlorite (20%)- forms coarse patches with sericite, perhaps altered lithic fragments, phenocrysts, or large amydule fillings; other occurrences as in 3038.

Plagioclase (18%)- weakly to strongly propylitized (10 to 100%) with calcite and chlorite as the major alteration products; composition about AN 35.

Sericite (15%)- see 3038

Calcite (7%)- as in 3038; replaces plagioclase and is within the groundmass.

Pyrite (6%)- as medium to coarse-grained anhedral crystals, subrounded and amoeba-shaped; contain groundmass inclusions; replaces some plagioclase phenocrysts; oxidized with minor iron oxide rims.

THIN SECTION - S15

Mineralogy (cont'd)

Sphene (4%)- as very fine-grained granular crystals and aggregates within the groundmass; occasionally associated with coarse chlorite + sericite patches; generally similar to other sections.

Comment: The rock was originally a glassy andesite or dacite flow or flow breccia(?) that now has a totally devitrified groundmass with preserved curving fractures (perlitic cracks?) filled with fine-grained recrystallized quartz. The rock is similar to section 3038 in overall texture and mineralogy.

THIN SECTION - S16

Rock Name and Alteration: Dacite (?), Sericitic

General description: The rock is a fine to medium-grained patchy intergrowth of quartz, sericite, and chlorite that has been strongly altered destroying most of the original volcanic textures. There are relatively coarse irregular patches of sericite + chlorite ± quartz within a very fine to medium-grained matrix of quartz, sericite, chlorite, and sphene and/or rutile. Tourmaline is present as columnar or granular crystals as in sections 3043 and 3044. The rock has a dacitic composition, and it has been strongly sericitized. It is very similar to sections 3038, 3040, and especially 3043. The fine-grained matrix may have originally been glassy, but it is now devitrified forming an extremely fine to fine-grained intergrowth of quartz and sericite. There are no obvious pseudomorphs after phenocrysts. Primary opaque minerals, if present, have been totally replaced by iron oxide forming patches and minor iron oxide-filled fractures. There are no veinlets within the section.

Mineralogy: This sample is nearly texturally and mineralogically identical to sections 3038, 3040, and 3043; see them for details.

Quartz (40%)

Sericite (30%)

Chlorite (25%)

Sphene and/or rutile (3%)

Tourmaline (1%)- as granular to columnar crystals similar to 3043 and 3044; occur in clusters associated with chlorite and quartz; replaces sericite when present; optically similar to other tourmalines.

Iron oxide (1%)- probably limonite, no well-formed pseudomorphs after original opaque minerals.

Comment: The rock is a strongly sericitized and weakly tourmalinized dacitic volcanic. As in the other sections 3038, 3040, and 3043 the alteration has obliterated original textures that might suggest the rock's origin. The tourmaline appears to be dravite optically. It was not verified by XRD because of insufficient quantity.

THIN SECTION - 3069

Rock Name and Alteration: Rhyolite(?), Sericitic

General description: The sample is a quartz-rich, sericitized, chloritized, and recrystallized felsic volcanic, probably a rhyolite or rhyodacite. It consists of a fine to medium-grained quartzose matrix with minor interstitial sericite and chlorite. There are occasional irregularly shaped patches of sericite (or illite?) that may be pseudomorphic after feldspar. The groundmass quartz has been mostly recrystallized. There are a few anhedral microphenocrysts of quartz, but there are no obvious feldspar or mafic phenocrysts or their pseudomorphs. Sericite + chlorite ± quartz form irregularly shaped patches that do not appear to be either pseudomorphs or altered lithic fragments. Opaque minerals are not present. Quartz-bearing veinlets lace the section. They contain minor chlorite ± sericite, and there some discontinuously developed selvages of sericite ± chlorite extending up to 0.5mm from the veinlets. The rock contains less than 2% phenocrysts.

Mineralogy

Quartz (72%)- as minor fine to medium-grained phenocrysts and microphenocrysts, subrounded, anhedral, minor resorption, and a few contain needles of actinolite(?); interiors contain numerous two phase fluid inclusions along microfractures or growth zones; groundmass quartz as very fine to fine-grained partially recrystallized anhedral crystals, tightly interlocked; most are equigranular, but some are elongated and somewhat coarser; no relict volcanic textures, but some areas of the groundmass contain wispy sericite and chlorite interstitial to the quartz.

Sericite (15%)- forms extremely fine to medium-grained subhedral crystals and patchy intergrowths, commonly associated with chlorite; in groundmass as individual flakes interstitial to quartz and as small patches perhaps pseudomorphic after feldspar.

Chlorite (10%)- as fine to medium-grained subhedral flakes interstitial to quartz; as patchy radiating clusters with or without sericite; chlorite in textural equilibrium with sericite.

Rutile (3%)- occurs in very fine to fine-grained anhedral granular crystals and aggregates and as occasional subhedral crystals; disseminated; no particular association with other phases.

Veinlets- consist of fine to coarse-grained anhedral to subhedral quartz crystals with sutured grain boundaries; vuggy areas

THIN SECTION - 3069

Mineralogy (cont'd)

Veinlets (cont'd)- and/or interstices filled with fine to medium-grained chlorite + sericite either alone or intergrown, minor replacement of quartz; no sulfides, secondary K-spar or biotite; a few small two phase fluid inclusions generally along grain boundaries and microstructures; veinlets are discontinuous varying rapidly in width; a sericitic selvage is developed up to 0.5mm wide sporadically along some of the veinlets; veinlets are predominatly quartz.

Comment: The sericite + chlorite irregularly shaped patches are similar to earlier sections. They have no obvious pseudomorphic form and their origin is obscure. The rock was originally rhyolitic, and it has undergone a weak sericitic alteration accompanied by recrystallization of the felsic groundmass. There is no textural indication for a mode of origin for this rock.

THIN SECTION - 3070

Rock Name and Alteration: Porphyritic Andesite flow, Potassic

General description: The rock is an altered porphyritic andesite flow or subvolcanic intrusive unit with abundant phenocrysts and glomeroporphyritic clots of actinolite and plagioclase set within an extremely fine to fine-grained holocrystalline, intersertal groundmass. The plagioclase phenocrysts display typical calc-alkalic features (resorption, zoning, glass inclusions) and are weakly replaced by minor chlorite, biotite, actinolite, epidote, and devitrification products of the originally glassy inclusions. Magmatic(?) actinolite is 0 to 50% replaced by fine-grained secondary biotite. The groundmass a fine-grained dense intergrowth of plagioclase, quartz, actinolite, granular magnetite, and abundant extremely fine-grained biotite. Opaque minerals consist of fine to medium-grained anhedral granular magnetite as disseminated grains and very minor anhedral pyrite with iron oxide rims. There are a few narrow veinlets of fine-grained quartz ± secondary biotite, but there are no alteration selvages. The rock consists of about 40% phenocrysts and microphenocrysts, and it has undergone potassic alteration (development of secondary biotite).

Mineralogy

Plagioclase (35%)- forms subhedral fine to medium-grained phenocrysts and laths, resorbed and subrounded phenocrysts; numerous inclusions of ~~devitried~~ devitrified glass within growth zones, occasionally nearly entire crystal contains inclusions, generally a thin outside rim of plagioclase without inclusions; weakly replaced (<10%) by very fine-grained biotie, chlorite, epidote, and actinolite; crystals strongly zoned, compositions range from AN 30 to AN 60; groundmass laths without glassy inclusions and relatively unaltered.

Actinolite (25%)- as fine to medium-grained phenocrysts and groundmass laths, subhedral; probably magmatic, but a few crystals look pseudomorphic after pyroxene, but no relict pyroxene identified; partially replaced (up to 50%) by fine-grained biotite along cleavages, fractures, and grain boundaries; tend to be glomeroporphyritic.

Secondary biotite (20%)- forms extremely fine to fine-grained replacements of plagioclase and actinolite phenocrysts and as a major constituent of the groundmass (perhaps replacing chlorite or original glass?); phenocrysts replaced along microstructures; groundmass biotite is pervassive; optically same as the biotite replacing plagioclase and actinolite; presence verified by XRD.

Mineralogy (cont'd)

Opaque minerals (12%)- magnetite predominates over pyrite as disseminated fine-grained granular crystals and occasional coarser anhedral grains, occurs within the groundmass and phenocrysts; pyrite as very minor fine to medium-grained anhedral crystals with rims of iron oxide, usually within or associated with actinolite phenocrysts.

Quartz (7%)- is anhedral; forms fine-grained crystals within the groundmass only; interstitial to plagioclase.

Sphene (1%)- forms very fine-grained disseminated granular crystals.

Veinlets- occur as narrow, irregular stringers of fine-grained anhedral quartz ± very fine-grained secondary biotite (often along the center of the veinlet); no alteration selvages or sulfides with the veinlets; very few fluid inclusions within the quartz.

Comment: The rock is an altered andesite flow or possibly a subvolcanic intrusive. The abundant fine-grained secondary biotite is suggestive of potassic alteration although the lack of veinlets and extensive development of biotite within actinolite implies a weak alteration. The biotite could conceivably be developed in response to thermal metamorphism caused by an intrusive at depth (incipient hornfels development). The biotite is replacing both the groundmass and actinolite laths indicating a relatively late stage for the biotite mineralization. The actinolite appears to be magmatic. Neither relict hornblende nor pyroxene was seen in the section. The presence of actinolite and biotite was verfied by XRD. The biotite X-ray pattern is transitional between phlogopite and biotite implying the biotite is relatively magnesium-rich.

THIN SECTION - 3071

Rock Name and Alteration: Porphyritic Andesite to Dacite flow, Potassic (?)

General description: The rock is a porphyritic andesite to dacite with a weak pilotaxitic texture that has undergone moderate alteration by the introduction of minor secondary biotite and hydrothermal(?) actinolite. It is probably a flow unit. Phenocrystic plagioclase is similar to 3070 in alteration and glass inclusions. Actinolite phenocrysts are more anhedral and/or resorbed than those in section 3070. They are weakly replaced by secondary biotite. The phenocrysts are poorly aligned in a groundmass of fine-grained anhedral quartz and plagioclase laths similar in texture to 3041. In addition there is fine-grained interstitial actinolite, secondary biotite, and chlorite. Opaque minerals consist of very fine to medium-grained granular disseminated magnetite and minor amounts of anhedral pyrite associated with actinolite and magnetite. Both opaques are partially replaced or rimmed by iron oxide. There are several narrow and irregular veinlets containing quartz, actinolite, and secondary biotite in varying amounts. There are no alteration selvages or sulfides associated with the veinlets. Phenocrysts make up about 25% of the section.

Mineralogy

Plagioclase (41%)- is essentially the same as section 3070; more sodic in composition, AN 13 to AN 30.

Quartz (25%)- forms fine-grained anhedral grains in the groundmass, interstitial to plagioclase; similar to 3041; as rare anhedral microphenocrysts.

Actinolite (15%)- as fine to medium-grained microphenocrysts and phenocrysts, crudely subhedral but very ragged, often with groundmass inclusions; weakly replaced by secondary biotite; associated with abundant fine-grained granular magnetite; groundmass actinolite is similar, replaced by biotite and/or chlorite; interstitial to plagioclase and quartz; appears to be primary, no relict ferromagnesian minerals within it.

Opaque minerals (7%)- generally similar to 3070; some tendency for magnetite to associate with actinolite phenocrysts; both pyrite and magnetite partially oxidized; neither with veinlets.

Secondary biotite (5%)- identical to section 3070; not nearly as abundant in either actinolite or groundmass.

Sphene (3%)- as in section 3070; may be associated with actinolite.

Mineralogy (cont'd)

Epidote (<1%)- forms fine-grained granular crystals replacing plagioclase and as a groundmass phase.

Veinlets- are narrow, irregular, and discontinuous consisting of varying amounts of quartz, actinolite, and secondary biotite; quartz is fine-grained, anhedral, contains minor minute fluid inclusions; actinolite forms subhedral fine-grained columnar crystals, occasionally altering to biotite, optically similar to other actinolite in the slide; no alteration selvages or sulfides.

Comment: The rock is an andesite to dacite flow unit that has undergone potassic(?) alteration. Secondary biotite has been developed within the groundmass and phenocrystic actinolite. It also replaces hydrothermal(?) actinolite occurring within quartz veinlets. The biotite appears to be paragenetically late. The sample is mineralogically similar to 3070 and texturally similar to 3041. The groundmass has an overall granular appearence and is much coarser-grained than 3070. It is possible that the sample could be a subvolcanic intrusive unit or a viscous flow.

THIN SECTION - 3077

Rock Name and Alteration: Dacite(?), Sericitic

General description: The rock is a fine-grained sericitically altered felsic volcanic consisting essentially of quartz, sericite, and chlorite. Alteration and recrystallization have destroyed all original textures except for a few relict quartz phenocrysts(?). It is very similar to section 3040 and the untourmalinized portion of 3043. There are patches of fine-grained sericite that may be pseudomorphic after feldspar, and there are irregularly shaped patches of sericite + chlorite (medium-grained) that do not appear to be pseudomorphic after any particular mineral or lithic fragment. The quartz is fine-grained and varies from areasoof mostly recrystallized quartz with only minor interstitial sericte + chlorite to areas of anhedral granular quartz crystals separated by abundant sericite and chlorite. There are no opaque minerals within the section, but some of the chlorite is iron stained. There is one iron stained fracture cutting the slide. The rock is a strongly sericitized and chloritized dacitic(?) volcanic.

Mineralogy: Except as noted, individual mineral occurrences are similar to sections 3040 and 3043.

Quartz (45%)- generally as described in 3040 and 3043; contains numerous two phase fluid inclusions; several coarser grains as microphenocrysts(?).

Sericite (35%)- as in 3040 and 3043; some fine-grained sericite patches look pseudomorphic after feldspar; in other cases sericite and chlorite are randomly intergrown; in some patches chlorite forms the core surrounded by a relatively thick rim of sericite; sericite-chlorite intergrowths appear in textural equilibrium.

Chlorite (18%)- forms fine to medium-grained subhedral flakes and radiating clusters that extend from unreplaced sericite; occasionally iron stained.

Rutile (2%)- as very fine to fine-grained anhedral to subhedral crystals and granular aggregates; disseminated; no particular mineral associations.

Comment: The rock is a strongly sericitized dacitic(?) volcanic. It is nearly identical to sections 3040 and 3043. Alteration and recrystallization has destroyed all original textures obscuring the mode of formation for the volcanic. There are no opaques in the slide, but there is some minor iron staining. There are no veinlets.

THIN SECTION - 3032

Rock Name and Alteration: Dacite(?), Sericitic

General description: The rock is a fine-grained intergrowth of quartz, sericite, and chlorite that is virtually identical to section 3040 and similar to but finer grained than 3077. It is a strongly sericitized and chloritized felsic volcanic(?) in which original textures have been largely destroyed leaving only a few relict quartz microphenocrysts(?) and sericitic patches as probable pseudomorphs after feldspar. Sericite forms fine to medium-grained flakes interstitial to anhedral fine-grained quartz. It is also intergrown with chlorite. Chlorite occurs as irregular, radiating clusters of medium-grained subhedral flakes that are intergrown stably with quartz and sericite.. Relatively coarse crystals of apatite are occasionally present within the chlorite clusters. Sphene and rutile are present in accessory amounts as in sections 3040 and 3077. There are no opaque minerals or veinlets within the section, however, there are a few iron stained fractures and patches of sericte + chlorite. The quartz in this section contains few fluid inclusions in contrast to 3077.

Mineralogy: Except where noted, all of the individual mineral occurrences are similar to sections 3040, 3043, and 3077.

Quartz (40%)

Sericite (36%)

Chlorite (20%)

Rutile (2%)- as in 3077; tends to be associated with chlorite.

Sphene (1%)- fine to medium-grained anhedral crystals, disseminated, but usually associated with quartz and sericite.

Apatite (<<1%)- forms fine to medium-grained anhedral to subhedral crystals usually associated with chlorite.

Comment: The rock was probably originally a dacitic volcanic. It has undergone strong sericitization and chloritization destroying its original textures. Its mode of origin is indeterminable. It is essentially identical to 3040, 3043, S16, and 3077.

NS-1 D. Decker July 77

200

400 recryst. qtz
chl interstitial to qtz

700 clean - fresh plag

~~1900~~ 1200 2nd Biot
~~700~~

North Santiam
thin sections
NS-1

by Kemp

550 unaltered andes → basalt flow
wk prop — plag + act, ~~good~~ good trachyte
minor chl + ser interstitial

450 andesitic flow
plag → ser
ser — ser + chl in gm
chl is Mg-Fe → Mg

400 dacitic flow?
tourmaline rosettes
ser — plag $\xrightarrow{90+}$ ser
qtz recryst
minor chl —

Freeport
323-2251

DON DECKER
AL LOPEZ

200 prob andes flow
strong ser + chl
lots of clay kaolinite ??
argillic-ser

orig intrusive?? dacitic?

900 - extremely chl-rich
select qtz, plag → ser
chl + ser in matrix
qtz-py-chl veinlet

ser

800 - dacitic flow?
chl-ser-epi
tourmaline rosettes

ser

750 andesitic flow?
cse tourmaline cut by chl veinlets, calc veinlet
chl Fe-Mg
ser + chl in gm and after plag

ser

some qtz as almost phenos

700 dacite
subvolcanic intrus
porphy plag
recrystall gm
epi-chl-cal
plag is fresh

prop

chl = Mg-Fe

650 sim to 700 slightly cser & alt
more ser
ser → plag

ser-prop

prop 1500 weakly prop andes flow
minor chl, epi calc, remnant qtz
veinlet of qtz-epi-calc-chl

K 1425 andesitic flow, sim to 1500
2° bio, chl
bio along fracture + veinlets
and clumps
plag → bio ± epi
chl pseudo after magmatic bio?

K 1200 andesitic flow
- sim to 1425
f.g. gm
2° bio
chl → Mg-rich

K 1100 relatively coarse grained flow or subvolc I, trachytic T
act-chl 2° bio
chl Mg-rich like 1200 poss 2nd BIOT

ser 1000 dacitic flow
ser-chl-epi in gm
veinlets of chl
patches of ser ± chl in gm not pseudo

010
Aug 84

1983 – andesitic flow (?)
plagioclase phenos → 2° biotite, act
much 2° bio in gm
chl in veinlets & gm
clumps of bio ± chl ± qtz
potassic? ↓ retro prop — minor K-spar in gm
Some epi + calc
* strong bio; ~~chl → bio~~ bio → chl — qtz-chl veinlet diss mt

1950 – sim to 1983 — andesitic-dacitic pyroclastic (flow breccia
2° bio, act, chl
py-calc-qtz
potassic ↓ retro prop — qtz-chl-cp veinlets
py
"ratty" act

1900 – sim to 1950 a little less bio
less act & chl – almost gone
mt-py, act fibs
recrystallized gm

weaker? Potassic little prop

200'

(1750) – andesitic-dioritic subvolcanic intrusive
actinolite
plag → K-spar (magmatic?)
prop — act → chl
chl Fe-Mg
v. little qtz

1700 sim to 1900, dacitic pyroclastic
recryst gm
2° bio
minor Kspar → plag — minor chl
plag → bio

Ruth mine - Marion County, Oregon

Sample no. H346 - polished section

Collected - August 4, 1976

Location - 45 ft. west (towards portal) from survey station 8; on no. 5 level; taken from north side of drift at waist level

Mineralogy - Sphalerite (37), chalcopyrite (7), galena (1), pyrite (2) and gangue (53). Numbers in parentheses are volume percent.

The dominant features of this section are the relatively coarse grain size of the sulfide minerals except for chalcopyrite which occurs as minute exsolution blebs (1-10 microns diameter) in sphalerite as well as coarser grains. Sphalerite shows euhedral outlines against coarse grained chalcopyrite. Chalcopyrite grains contain no sphalerite inclusions.

Pyrite occurs as isolated subhedral grains (10-900 microns diameter) in silicate gangue and in larger chalcopyrite grains; the pyrite grains are commonly shattered.

Galena occurs as rounded blebs in larger chalcopyrite grains, at chalcopyrite-silicate grains boundaries and as 100 micron diameter islands in sphalerite.

No definitive paragenetic relationships noted in this section.

Conclusions - The attached photographs show the textural relationships described above. Approximately 3-5 volume percent of the sphalerite is taken by the chalcopyrite blebs. It will likely be difficult to grind this ore sufficiently fine to liberate the chalcopyrite exsolution blebs and a modest copper content in a zinc flotation concentrate is to be expected.

Sample no. H347 - polished section

Collected - August 4, 1976

Location - 55 ft. west (towards portal) from station 8; 15 ft. above track on no. 5 level.

Mineralogy - Sphalerite (34), chalcopyrite (3), silicate and/or carbonate gangue (63), pyrite (trace), galena (trace), tetrahedrite ? (trace). Numbers in parentheses are volume percent.

No diagnostic paragenetic relationships were noted. Chalcopyrite occurs as isolated grains at gangue mineral grain boundaries and as 1-10 micron diameter exsolution blebs in sphalerite. Galena fills vugs around quartz (?) crystals and occurs as 300 micron diameter anhedral "islands" in sphalerite. Pyrite occurs as isolated subhedral grains (cubes) 100-300 microns in diameter in gangue, at sphalerite-gangue grains boundaries and as subhedral "islands" in larger chalcopyrite grains.

A medium gray mineral occurs as 2 anhedral grains at chalcopyrite-sphalerite grain boundaries. This mineral may be tetrahedrite.

Sample no. H349 - polished section

Collected — August 4, 1976

Location - no. 5 level; south wall of drift 2 ft. west (towards portal) from station 2.

Mineralogy - Sample is from pyritized felsic dike described in previous reports as a rhyolite (Rosenberg, 1941) or porphyritic rhyolite (U.S. Bur. Mines, 1943).

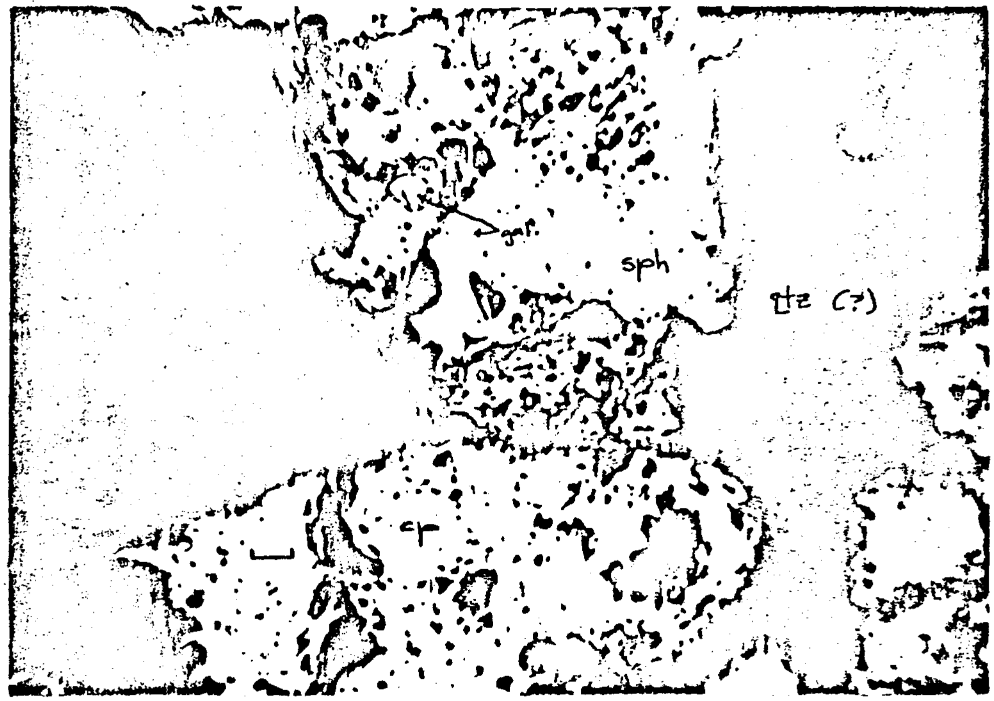
Sample contains 4 volume percent pyrite as irregular anhedral to subhedral grains; some pyrite grains veined by silicate (?) minerals. No other sulfides noted.

A geochemical analysis of this samples shows the following:

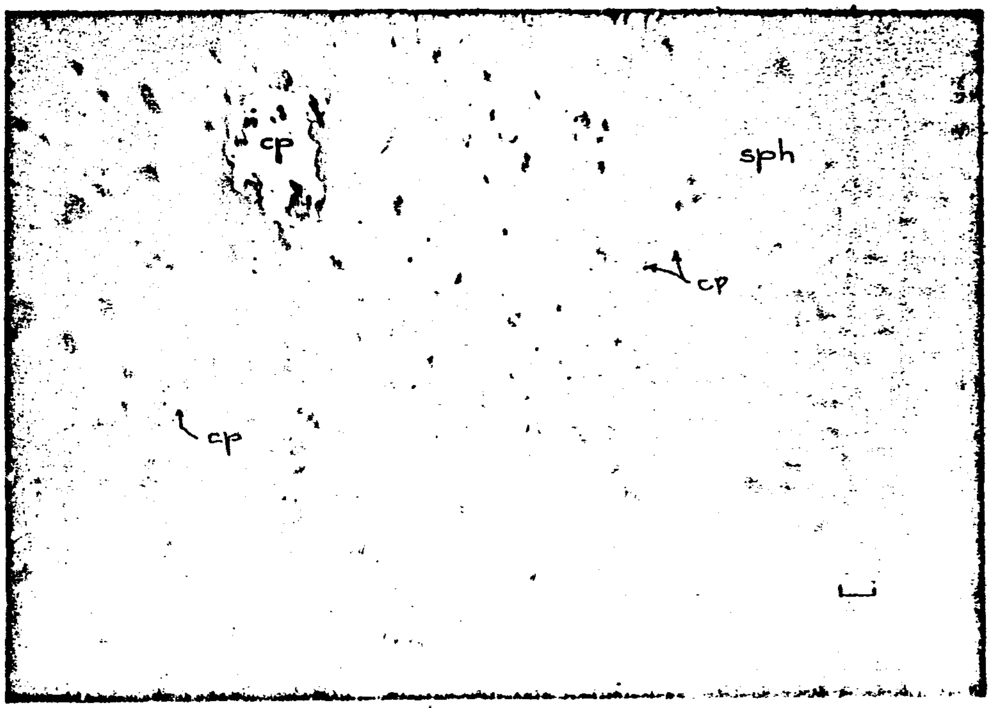
copper	-	305 ppm
lead	-	-10
zinc	-	45
gold	-	- 1
silver	-	- 1

(minus before value indicates "less than").

D.A. Hull



Photomicrograph of polished section number H346 showing texture of chalcopyrite, sphalerite, silicate gangue and minor galena in ore from Ruth mine, Marion County, Oregon. Scale bar is 100 microns long.



Photomicrograph of polished section H346 showing chalcopyrite exsolution blebs in sphalerite. Larger light colored grain is also chalcopyrite. Scale bar

NS-1

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 1 / 14

Project: North Santiam
Date: Feb 77
Sampler: D. Decker

State: Oregon
County: Marion
District: LESTER

Sample Number	Type	Description	NS-1 Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag
5600			3'-10'	160	-2.5	44	3.6	20	-.1	.2
X			10							
			20							
			30							
			40							
5601			50	120	-2.5	64	1.9	14	-.1	.2
			60							
			70							
			80							
			90							
5602			100	12	-2.5	20	.6	16	-.10	.4
			110							
			120							
			130							
			140							
5603			150	160	-2.5	66	2.4	16	-.10	.4

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 2 /

Project:

Date:

Sampler:

State:

County:

District:

Sample Number	Type	Description	NS-1 Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
~~5603~~			160								
			170								
			180								
			190								
5604			200	55	-2.5	42	1.3	14	-.10	-.2	
			210								
			220								
			230								
			240								
5605			250	50	-2.5	38	1.3	14	-.10	.2	
			260								
			270								
			280								
			290								
5606			300	125	5	32	3.9	18	-.10	.2	
5690			310	125	-2.5						

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 3 /__

ject: ____ State: ____

County: ____

Date: ____ District: ____

pler: ____

Sample Number	Type	Description	NS-1 Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
5691			320-330	325	-2.5						
5688			330	.205%	5						
5689			340	.130%	2.5						
5607			350	.205%	5	400	5.1	106	-.10	1.6	
5686			360	590	7.5						
5687			370	270	-2.5						
5684			380	.145%	2.5						
5685			390	.205%	2.5						
5608			400	960	2.5	610	1.6	364	-.10	2.8	
5682			410	380	-2.5						
5683			420	405	2.5						
5680			430	140	2.5						
5681			440	445	5						
5609			450	270	2.5	50	5.4	24	-.10	.2	
5678			460	455	5						
5679			470	460	2.5						

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 4 /

ject:

Date:

pler:

State:

County:

District:

Sample Number	Type	Description	NS-1 Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
5676			480	495	-2.5						
5677			490	540	7.5						
5610			500	.135%	2.5	46	29.3	10	-.10	.4	
5674			510	785	2.5						
5675			520	.140%	2.5						
5672			530	.210%	10						
5673			540	645	2.5						
5611			550	450	2.5	44	10.2	18	-.10	.2	
			560								
			570								
			580								
			590								
5612			600	575	2.5	40	14.4	18	-.10	.2	
			610								
			620								
			630								

REV 8/2/73 JAN 24 JULY 197

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 51

oject:
Date:
npler:

State:
County:
District:

Sample Number	Type	Description	NS-1 Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
			640-650								
5613			650	330	7.5	62	5.3	14	-.10	.2	
			660								
			670								
			680								
			690								
5614			700	165	2.5	48	3.4	10	-.10	-.2	
			710								
			720								
			730								
			740								
5615			750	235	5	74	3.2	18	-.10	.4	
			760								
			770								
			780								
			790								

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 61

ect:

ate:

ler:

State:

County:

District:

Sample Number	Type	Description	NS-1 Location	Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
5616			800	395	10	86	4.6	20	-.10	.4	
			810								
			820								
			830								
			840								
5617			850	68	2.5	68	1.0	18	-.10	.4	
			860								
			870								
			880								
			890								
5618			900	590	15	84	7.0	22	-.10	.6	
5654			910	910	12.5						
5655			920	.160%	17.5						
5652			930	960	15						
5653			940	.125%	17.5						
5619			950	.135%	15	40	33.8	20	-.10	.6	

REV 8/2/73 JRN

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 71/__

ject:
Date:
pler:

State:
County:
District:

Sample Number	Type	Description	NS-1 Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
5650			960	.100%	12.5						
5651			970	990	10						
5648			980	865	12.5						
5649			990	.145%	25						
5620			1000	.210%	15	48	43.8	16	-.10	.6	
5646			1010	.210%	7.5						
5647			1020	595	10						
5644			1030	800	7.5						
5645			1040	.180%	45						
5621			1050	.240%	65	70	34.3	18	-.10	1.4	
5642			1060	.160%	17.5						
5643			1070	590	17.5						
5640			1080	.130%	7.5						
5641			1090	625	15						
5622			1100	.115%	7.5	76	15.1	22	-.10	1.0	
[illegible]			[illegible]	[illegible]	[illegible]						

REV 8/2/73 JAN 24 JULY 1

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 8 /

Project:

Date:

Sampler:

State:

County:

District:

Sample Number	Type	Description	NS-1 Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
5639			1120	555	7.5						
5636			1130	425	2.5						
5637			1140	840	10						
5623			1150	.120%	20	230	5.2	18	-.10	2.0	
5634			1160	980	35						
5635			1170	.185%	10						
5632			1180	.110%	10						
5633			1190	.175%	10						
5670			1200	710	7.5	34	20.9	14	-.10	.8	
			1210								
			1220								
			1230								
			1240								
5671			1250	545	7.5	30	18.2	20	-.10	1.2	
			1260								
			1270								

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 9 /

Project:

Date:

Sampler:

State:

County:

District:

Sample Number	Type	Description	NS-1 Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
			1280								
			90								
5668			1300	765	7.5	38	20.1	16	-.10	1.0	
			10								
			20								
			30								
			40								
5669			50	970	7.5	40	24.2	14	-.10	1.0	
			60								
			70								
			80								
			90								
5666			1400	540	5	44	12.3	14	-.10	.8	
			10								
			20								
			30								

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 101

Project:

Date:

Sampler:

State:

County:

District:

Sample Number	Type	Description	NS-1 Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
			1440								
5667			50	695	5	32	21.7	14	-.10	.8	
			60								
			70								
			80								
			90								
5664			1500	.115%	7.5	.220%	.5	140	-.10	1.6	
5692			10	.110%	5						
5693			20	710	5						
5694			30	.170%	12.5						
5695			40	850	7.5						
5665			50	.130%	5	44	29.5	16	-.10	1.0	
5696			60	810	5						
5712			70	.125%	12.5						
5713			80	.225%	15						
5714			1590	.210%	12.5						

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 111

Project: ____________________

Date: ____________________

Sampler: ____________________

State: ____________________

County: ____________________

District: ____________________

Sample Number	Type	Description	NS-1 Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
5662			1600	915	12.5	48	19.1	14	.10	1.0	
5715			10	.105%	10						
5716			20	830	7.5						
5717			30	650	7.5						
5718			40	350	5						
5663			50	625	5	44	14.2	14	.10	1.0	
5719			60	330	5						
5720			70	750	7.5						
5721			80	.120%	20						
5722			90	940	10						
5660			1700	810	5	86	9.4	18	-.10	1.0	
5697			10	520	2.5						
5698			20	335	-2.5						
5699			30	220	-2.5						
5700			40	760	5						
5661			1750	.135%	7.5	42	32.1	20	-.10	1.6	

REV 8/2/73 JAN 24 JULY 1

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 121

Project: ______________________ State: ______________________
County: ______________________
Date: ______________________ District: ______________________
Sampler: ______________________

Sample Number	Type	Description	NS-1 Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
5701			1760	650	2.5						
5702			70	785	2.5						
5703			80	345	-2.5						
5704			90	505	-2.5						
5658			1800	540	2.5	24	22.5	18	-.10	1.6	
5723 ~~5705~~			10	500	5						
5724 ~~5706~~			20	.175%	12.5						
5725			30	780	5						
5726			40	180	2.5						
5659			50	230	-2.5	60	3.8	20	-.10	1.0	
5727			60	350	2.5						
5728			70	590	5						
5729			80	460	2.5						
5730			90	520	5	32	16.2	14	-.10	.6	
5656			1900	460	7.5	34	13.5	16	-.10	.8	
5731			1910	380	10	32	11.9	18	-.10	.8	

REV 8/2/73 JRN 24 JULY 1973

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 131

Project:

Date:

Sampler:

State:

County:

District:

MS-1

Sample Number	Type	Description	Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
5732			1920	570	2.5	32	17.8	18	-.10	.8	
5733			1930	880	5	34	25.9	16	-.10	1.0	
5734			1940	.485%	10	46	105.4	14	.15	2.0	
5657			1950	855	5	40	21.4	14	-.10	.8	
5705			1960	.175%	2.5	42	41.7	12	.10	1.4	
5706			1970	.180%	2.5	48	37.5	14	-.10	1.0	
5707			1980 - 83	.775%	12.5	56	138.4	16	.23	2.4	
5827			1983 - 1990	.425%	12.5	54	78.7	8	-.10	3.0	
5828			1990	.230%	2.5	42	54.8	6	-.10	0.8	
5829			2000	.675%	12.5	28	241.1	2	-.10	2.6	
5830			2010	.335%	5	28	119.6	4	-.10	1.4	
5831			2020	.395%	10	28	141.1	2	-.10	1.2	
5832			2030	.540%	10	26	207.7	2	-.10	1.4	
5833			20.40	.285%	5	40	71.2	6	-.10	1.2	
5834			2050	770	17.5	98	7.8	22	-.10	0.2	

REV 8/2/75 JRN 24 JULY 1975

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 13 /

Project: North Santiago

Date:

Sampler:

State:

County:

District:

NS-1

Sample Number	Type	Description	Location	Assay for: Cu						Au	
5656			1900-1910	460							
5731			1910	380							
5732			1920	570							
5733			1930	880							
5734			1940	.485%							
5657			1950	855							
5705			1960	.175%							
5706			1970	.18%			110'				
5707 / 5827		.232 / .297	1980 80-83 / 87-90 .7 / .425	.775% .53	.355%						
5828			1990	.23%							
5829			2000-2010	.675			.45% 60'				
5830			2010	.335							
5831			2020	.395							
5832			2030	.540							
5833			2040	.285							
5834			2050	770 ppm							

REV 8/2/78 JAN 24 JULY

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 141

Project:

Date:

Sampler:

State:

County:

District:

Sample Number	Type	Description	NS-1 Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
5835			2060	225	2.5	400	.5	58	-.10	0.2	
5836			2070	750	2.5	400	1.9	18	-.10	0.4	
5837			2080	195	7.5	286	.7	18	-.10	0.8	
5838			2090	32	10	130	.2	14	-.10	-0.2	
5839			2100-2113	18	2.5	268	.1	8	-.10	-0.2	
			~~10~~								
			~~2123~~								

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 1 / 13

Project: North Santiam

Date: Feb 77

Sampler: D. Decker

State: Oregon

County: Marion

District: LESTER

NS-2

Sample Number	Type	Description	Location	Cu	Mo	Zn	Cu/Zn	Pb	Au	Hg	
			0-10'								
			10-20								
			20								
			30								
			40								
5708			50	180	-2.5	50	3.6	12	.12	.4	
			60								
			70								
			80								
			90								
5709			100 -110	225	-2.5	146	1.5	60	.10	.8	
			110								
			120								
			130								
			140								
5710			150	70	-2.5	28	2.5	14	.10	.4	

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 2/__

Project: ______ State: ______

Date: ______ County: ______

Sampler: ______ District: ______

NS-2

Sample Number	Type	Description	Location	Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
			160-170								
			170								
			180								
			190								
5711			200	220	5	16	13.8	14	-.10	.4	
			210								
			220								
			230								
			240								
5735			250	360	2.5	22	16.4	16	-.10	.8	
			260								
			270								
			280								
			290								
5736			300	280	2.5	18	15.6	14	-.10	.8	
			310								

REV 8/2/75 JRN 24 JULY 1975

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 3 / __

Project:

Date:

Sampler:

State:

County:

District:

NS-2

Sample Number	Type	Description	Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Hg	
			320								
			330								
			340								
5737			350	840	5	46	18.3	18	.12	1.0	
			360								
			370								
			380								
			390								
5738			400	450	25	30	15.0	16	.17	.8	
			410								
			420								
			430								
			440								
5739			450	720	10	18	40.0	22	.10	.6	
			460								
			470								

REV 8/2/73 JAN 24 JULY 197

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 3 /___

Project: ______________________

Date: ______________________

Sampler: ______________________

State: ______________________

County: ______________________

District: ______________________

NS-2

Sample Number	Type	Description	Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Hg	
			320								
			330								
			340								
5737			350	840	5	46	18.3	18	.12	1.0	
			360								
			370								
			380								
			390								
5738			400	450	25	30	15.0	16	.17	.8	
			410								
			420								
			430								
			440								
5739			450	720	10	18	40.0	22	.10	.6	
			460								
			470								

REV 8/2/73 JAN 24 JULY 197

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 41

Project:

Date:

Sampler:

State:

County:

District:

NS-2

Sample Number	Type	Description	Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
			480								
			490								
5740			500	160	-2.5	28	5.7	48	-.10	.8	
5741			510	520	10						
5742			520	280	5						
5743			530	530	2.5						
5744			540	220	2.5						
5745			550	350	10	34	10.3	18	.12	.8	
5746			560	.160%	12.5	44	36.4	54	.12	1.0	
5747			570	.115%	10	42	27.4	20	.17	1.0	
5748			580	980	10	40	24.5	14	.17	.8	
5749			590	360	5	20	18.0	14	-.10	.8	
5750			600	960	15	36	26.7	46	.15	1.0	
5751			610	840	10						
5752			620	390	5						
5753			630	800	15						

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 5 /

Project:
Date:
Sampler:

State:
County:
District:

NS-2

Sample Number	Type	Description	Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
5754			640	860	5						
5755			650	270	2.5	16	16.9	18	-.10	.6	
5756			660	400	5						
5757			670	210	10						
5758			680	380	2.5						
5759			690	620	2.5						
5760			700	230	2.5	18	12.8	18	-.10	.6	
5761			710	760	7.5	20	38.0	14	.12	.6	
5762			720	910	5	20	45.5	16	.12	.6	
5763			730	570	2.5	16	35.6	14	.10	.8	
5764			740	560	2.5	14	40.0	14	.10	.6	
5765			750	370	-2.5	16	23.1	16	-.10	.6	
5766			760	460	7.5	12	38.3	16	-.10	.6	
5767			770	160	10	12	13.3	10	-.10	.4	
5768			780	430	10	16	26.9	22	-.10	1.2	
5769			790	430	10	14	30.7	12	-.10	.4	

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FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 61

Project:

Date:

Sampler:

State:

County:

District:

NS-2

Sample Number	Type	Description	Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
5770			800	590	7.5	4	147.5	6	-.10	.6	
5771			810	420	12.5	14	30.0	8	-.10	.8	
5772			820	50	17.5	18	2.8	16	-.10	.6	
5773			830	.135%	20	18	75.0	14	-.10	1.0	
5774			840	.450%	45	22	204.5	14	-.10	1.6	
5775			850	.580%	20	42	138.1	14	.12	1.0	
5776			860	.225%	30	24	93.8	12	.12	.6	
5777			870	.215%	17.5	20	107.5	16	.12	.8	
5778			880	670	5	18	37.2	14	-.10	.4	
5779			890	720	5	16	45.0	10	-.10	.4	
5780			900	950	12.5	18	52.8	12	-.10	.8	
5781			910	.140%	10						
5782			920	.120%	5						
5783			930	.125%	5						
5784			940	945	15						
5785			950	405	5	32	12.7	24	-.10	.8	

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 7 /

Project:

Date:

Sampler:

State:

County:

District:

NS-2

Sample Number	Type	Description	Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
5786			960	495	5						
5787			970	890	10						
5788			980	.135%	5						
5789			990	.115%	5						
5790			1000	.130%	5	28	46.4	18	-.10	.8	
5791			1010	900	7.5						
5792			1020	.125%	15						
5793			1030	830	20						
5794			1040	.135%	7.5						
5795			1050	.145%	10	34	42.6	20	.15	.6	
5796			1060	.140%	7.5						
5797			1070	.130%	7.5						
5798			1080	540	7.5						
5799			1090	530	5						
5800			1100	.160%	12.5	60	26.7	22	-.10	.6	
5801			1110	660	7.5	58	11.4	20	-.10		

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 8/

Project:

Date:

Sampler:

State:

County:

District:

NS-2

Sample Number	Type	Description	Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
			1120								
			1130								
			1140								
5802			1150	675	5	52	13.0	20	-.10	.8	
			1160								
			1170								
			1180								
			1190								
5803			1200	680	10	22	30.9	20	.10	.6	
			1210								
			1220								
			1230								
			1240								
5804			1250	845	7.5	20	42.2	18	-.10	.4	
			1260								
			1270								

REV 8/2/78 JAN 24 JULY 197

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 91

Project:

Date:

Sampler:

State:

County:

District:

NS-2

Sample Number	Type	Description	Location	Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
			1280								
			1290								
5805			1300	810	5	18	45.0	16	-.10	.4	
			1310								
			1320								
			1330								
			1340								
5806			1350	340	7.5	24	14.2	16	-.10	.2	
			1360								
			1370								
			1380								
			1390								
5807			1400	520	5	16	32.5	16	-.10	.4	
			1410								
			1420								
			1430								

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 101

Project:

Date:

Sampler:

State:

County:

District:

NS-2

Sample Number	Type	Description	Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag	
			1440								
5808			1450	410	10	20	20.5	18	-.10	.4	
			1460								
			1470								
			1480								
			1490								
5809			1500	290	2.5	20	14.5	16	.10	.4	
			1510								
			1520								
			1530								
			1540								
5810			1550	810	15	22	36.8	18	.10	.6	
			1560								
			1570								
			1580								
			1590								

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 11 1

Project:

Date:

Sampler:

State:

County:

District:

NS-2

Sample Number	Type	Description	Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag
5811			1600	775	7.5	30	25.8	18	.10	.4
			1610							
			1620							
			1630							
			1640							
5812			1650	785	25	64	12.	34	.15	.4
			1660							
			1670							
			1680							
			1690							
5813			1700	785	17.5	22	35.7	18	-.10	.4
			1710							
			1720							
			1730							
			1740							
5814			1750	.130%	5	16	81.	16	-.10	.2

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 21/__

Project: ____

Date: ____

Sampler: ____

State: ____

County: ____

District: ____

NS-2

Sample Number	Type	Description	Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag
			1760							
			1770							
			1780							
			1790							
.5815			1800	540	5	20	27	16	-.10	.2
			1810							
			1820							
			1830							
			1840							
.5816			1850	.115%	10	30	37	16	-.10	.6
			1860							
			1870							
			1880							
			1890							
.5817			1900	680	5	22	30.9	12	-.10	.2
5818			1910	480	5	20	39	10	-.10	.2

FREEPORT EXPLORATION COMPANY--SAMPLE LOG

Sheet 13 / __

Project: ________ State: ________
County: ________
Date: ________ District: ________
Sampler: ________

NS-2

Sample Number	Type	Description	Location	Assay for: Cu	Mo	Zn	Cu/Zn	Pb	Au	Ag
5819			1920	650	5	24	27.	14	-.10	.4
5820			1930	505	5	28	21.	14	-.10	.2
5821			1940	360	2.5	24	15.	14	-.10	.2
5822			1950	610	7.5	32	19	14	-.10	.2
5823			1960	915	10	40	22.8	14	-.10	.4
5824			1970	400	2.5	24	16.6	10	-.10	.4
5825			1980	285	2.5	30	9.5	12	-.10	.2
~~5828~~ 5826			1990	~~.230%~~ 300	~~2.5~~ 5	~~42~~ 24	12.5	~~6~~ 12	~~-.10~~ -.10	~~0.8~~ .2
~~5827~~			2005	~~1.45%~~	~~12.5~~	~~28~~		~~23~~	~~-.10~~	~~2.0~~
			2010							
			2020							
			2030							
			2040							
			2050							
			2060							
			2070							

OPERATING PLAN

FREEPORT EXPLORATION COMPANY (Operator)

LITTLE NORTH SANTIAM PROJECT

MARION COUNTY, OREGON

OPERATING PLAN

FREEPORT EXPLORATION COMPANY (Operator)

I. IDENTIFICATION

A. OPERATOR(S), LESSEES, ASSIGNS OR DESIGNEES

1. Freeport Exploration Company
2. P. O. Box 1911
   Reno, Nevada 89505
3. (702) 323-2251

B. FIELD REPRESENTATIVE

1. Enfield B. Bell, Vice President
2. Freeport Exploration Company
   P. O. Box 1911
   Reno, Nevada 89505
3. (702) 323-2251

OR

1. D. J. Decker
2. Freeport Exploration Company
   P. O. Box 992
   Mehama, Oregon 97384
3. (503) 854-3594

C. OWNERS OTHER THAN OPERATORS

1. Shiny Rock Mining Company
2. P. O. Box 132
   Mehama, Oregon 97384
3. (503) 897-2336

II. LOCATION

A. MINING DISTRICT

1. Lester Mining District,
   Little North Santiam drainage, Marion County, Oregon

Sparkle
Spokane
Star
Sue 1 and 2
Tennessee
Tiger
Tommy
Viking
Whet 1 through 21
White Bull
Santiam 1
Mandalay
Morning Star
Hewill-Mill Site
Starvation-Mill Site
Poorboy-Mill Site

The following patented lode claims:

Black Prince
Eureka 6
Eureka 7
Eureka 8
Eureka 12
King 4
Princess

C. TYPE OF CLAIMS

Lode

D. NUMBER OF CLAIMS

Unpatented Lode Claims - 246
Patented Lode Claims - 7
Unpatented Mill Site Claims - 3

E. GENERAL LOCATION MAP

Enclosed

F. CLAIM MAP

Enclosed

III. DESCRIPTION OF OPERATIONS

A. SURFACE DISTURBANCE MAP

Enclosed

B. NAME OF CLAIM GROUPS

The following unpatented lode claims:

Adventure 1 through 4
Ajax
Alex
Aloa 1 through 6
Anita 1 through 8
Babe
Bee Fraction
Bertha E
Big Ben
Big Boy 6 through 14 and 16
Blue Jay 1 through 12
Bonnie (also known as Bonie)
Buck
Bull Moose
Bull Moose Extension
Chipmonk 1 and 2 (also known as Chipmunk)
Claire
Dolores 1, 2, 3, 10, and 11
Donald
Donna
Elmira
Eureka 1 through 5, 9 through 12, and 14 through 21
Golden Bear
Grace 1 through 6
Halfway
Hazel 1 through 3
King 1, 3, 5, and 6
Laverne (also known as Royal)
Lucky
Lure 1 through 6
Matterhorn
New Hope 1 through 39
New Yorker
Oregon Bell (also known as Oregon Belle)
Paris
Paul
Paul Extension
Portland
Queen 2 and 3
Remar 1, 2, and 3
Ruth 1 through 14 and 17 through 36
Santiam 2 through 21
Santa Fe
Signal Hill
Silver Spring
Seattle
Seattle Extension

B. NARRATIVE OF PROPOSED OPERATIONS

NOTE: Narrative number designations refer to numbered map locations on surface disturbance map.

Area 1. This area will receive two drill holes. One will be drilled from the existing road (S80) and one will be drilled on an existing skid trail south of the main road.

Area 2. Three drill sites are proposed in this area utilizing the existing roads. Further evaluation may necessitate improvement and use of the existing skid trail north of S80.

Area 3. One drill site is proposed in this area. The site is approximately 1000 feet west of drill site 1 and will entail construction of a skid trail on the contour west from site 1.

C. OPERATING PERIOD

This operating plan is for operations to be carried out commencing about September 1977. As results of this evaluation are compiled, a plan will be submitted for more extensive work. The detailed mapping and sampling now in progress should be concluded by August 1, 1977, with the drilling evaluation starting after that time. Work will continue through to the winter if weather conditions permit or will resume in the spring if the program cannot be completed in the winter.

D. SURFACE RESTORATION MEASURES

1. Access roads - Construction, grading, draining, and bank seeding will be carried out as directed by the District Ranger and according to Forest Service regulations and standards.

2. Drill skid trails - Upon completion of drilling in areas where significant mineralization does not exist, drill skid trails and drill sites will be recontoured and planted to native vegetation.

3. Drill holes - All drill holes will be blocked according to Forest Service regulations.

4. Anti-litter measures - Drill crews are responsible for cleaning all drill sites. Trash barrels will be supplied and maintained by Freeport. Portable toilets will be supplied at the drill sites.

E. OTHER OPERATING PLANS

This operating plan is hereby submitted in response to a Forest Service letter dated March 8, 1977, and Regulations 36CFR 252.

F. GENERAL INFORMATION

1. Road access - Access to the operations will be via the Elkhorn-Elk Lake Road (S80) and spur roads to the Ruth, Morning Star, Eureka (Gold Creek), and Spokane claims. The Ceder Creek roads (S81 and S82) are also used to reach the New Hope claims.

2. Gates - As established in the Shiny Rock Mining Company Operating Plan, locked gates will be maintained at Gold Creek and on the Morning Star claim. Locking will be by one Freeport lock, one SRMC lock, and one Forest Service lock.

3. Timber - Through contractual agreement, Shiny Rock Mining Company shall have all rights and responsibilities attendant to the ownership; cutting; storing; growing; and removal of timber within the claim area.

IV. BOND REQUIREMENT

A. This operation will cause significant surface resource disturbance and is approved subject to furnishing a bond in the amount of ____________ ____________________ in the form of cash or surety.

B. A bond has previously been furnished by the Shiny Rock Mining Company in the amount of $11,000.00 for their operation.

PREPARED BY:______________________________ DATE: July 15, 1977

Enfield B. Bell
Vice President
Freeport Exploration Company

APPROVED BY:______________________________ DATE:________________

District Ranger

Note: 1. Approval of this operating plan does not constitute certification of ownership to any person named as owner herein.

2. Approval of this operating plan does not constitute recognition of the validity of any mining claim named herein, or of any mining claim now or hereafter covered by this plan.

APPENDIX

OPERATING CONSIDERATIONS

The mining property has several factors which bear on the viability of a mine. The entire area has been within a roadless study area since 1970 which came about through court action against the U.S.F.S. The F.S. published a management plan in April 1977 covering this area (U.S. Forest Service,1977). This plan proposes the majority of the main area of mineralization in Sections 29, 30, 31, and 32 be included in "Scenic Influence I and II" of the Land Use Allocations as defined on Page 497 of the management plan. This calls for management activities which will be visually subordinate to the characteristic landscape.

Also of concern is a proposal by Senator Hatfield of Oregon to include this area in the Hidden Wilderness. This proposal is contained in U. S. Senate Bill 658, known as the Oregon Omnibus Wilderness Bill. Mr. Atiyeh of SRMC has been discussing the boundaries and restrictions of this proposal with Hatfield's staff.

The Central Cascades Conservation Council recently published "A Hiker's Guide to Oregon's Hidden Wilderness". This council is an active lobby in the area and proposed an extensive area for wilderness study in the Forest Service Final Environmental Statement, p. 886.

SEP 28 1976

(83)

MONITOR GEOCHEMICAL LABORATORY

774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801

Phone (702) 738-3236

Certificate of Analysis

Date: August 25, 1976

Invoice #: #792

Client: Freeport Exploration
Box 1911
Reno, Nevada 89505 by D. Decker

Client Order No.:

Date Received: Aug. 16, 1976

Analysis: Au, Ag, Cu, Pb, Zn, Mo (Mo will be reported later)

Analytical Methods: Atomic absorption(Au, Ag, Cu, Pb, Zn): Mo(Colorimetricly)

cc: D. Decker

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm)	Pb(ppm)	Zn(ppm)	Mo(ppm)
RC-1	-.10	-.2	32	18	64	-2.5
-2	-.10	-.2	28	10	22	-2.5
-3	-.10	-.2	16	22	122	-2.5
-4	-.10	-.2	18	28	60	-2.5
-5	.10	-.2	22	8	100	-2.5
-6	.17	.4	104	28	148	-2.5
-7	.12	-.2	48	12	48	-2.5
-8	.26	-.2	184	72	156	-2.5
-9	.22	-.2	54	16	110	-2.5
-10	.27	-.2	76	14	40	-2.5
-11(A)	-.10	-.2	134	20	98	-2.5
-11(B)	.27	-.2	150	16	44	-2.5
-12	.19	.2	232	20	34	-2.5
-13	-.10	1.0	340	82	180	-2.5
-14	-.10	.2	585	32	50	-2.5
-15	.10	-.2	114	16	58	-2.5
-16	.10	.4	650	34	154	-2.5
-17	.19	-.1	62	20	36	-2.5
-18	.10	-.1	60	20	122	-2.5
-19	.11	-.1	36	22	74	-2.5
-20	-.10	-.1	3	10	136	-2.5
RC-21	.10	1.2	6	134	124	2.5

* Greater than 1000 ppm reported as percent (Assay)
** Break in numerical sequence

MONITOR GEOCHEMICAL LABORATORY

SEP 28 1976

774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801

Freeport Exploration
August 25, 1976: Inv. #792

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm)*	Pb(ppm)*	Zn(ppm)*	Mo(ppm)
RC-22	.34	658	.540%	.740%	.580%	115
-23	-.10	1.0	16	52	50	-2.5
-24	.27	8.6	230	625	320	2.5
-25	.24	.8	32	24	62	-2.5
-26	.22	.2	68	20	54	-2.5
-27	.10	-.1	26	32	80	-2.5
-28	.33	.2	232	16	44	-2.5
-29	-.10	-.1	80	18	102	-2.5
-30	-.10	.4	515	16	96	-2.5
-31	-.10	.2	3	10	108	-2.5
-32	.10	-.1	52	16	56	-2.5
-33	.27	-.1	3	10	92	-2.5
-34	-.10	-.1	66	10	84	-2.5
-35	-.10	1.8	585	22	30	22.5
-36	-.10	-.1	116	18	108	-2.5
-37	-.10	-.1	30	12	84	-2.5
-38	-.10	-.1	20	10	48	-2.5
-39	-.10	-.1	10	8	100	-2.5
-40	-.10	-.1	60	76	220	2.5
-41	.21	-.1	258	20	102	-2.5
-42	-.10	-.1	34	12	110	-2.5
-43	.27	39.0	.730%	.405%	8.15 %	+400
-44A	.16	-.1	96	48	600	7.5
-44B	.15	-.1	152	116	375	2.5
-45	.15	-.1	38	28	252	-2.5
-46	-.10	.2	30	20	128	-2.5
-47	-.10	.2	114	14	122	-2.5
-48	-.10	-.1	40	14	344	-2.5
-49	-.10	-.2	18	16	94	-2.5
-50	-.10	.4	50	12	84	-2.5
-51	-.10	-.2	825	102	480	5
-52	-.10	-.2	92	12	24	25
RC-53**	-.10	-.2	4	8	22	-2.5

* Greater than 1000 ppm reported as percent (Assay)

** Break in numerical sequence

SAMPLE#		Au(ppm*)	Ag(ppm*)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm*)
"	54	-.05	-0.1	180	2	56	-2.5
"	55	-.05	-0.1	130	2	11	-2.5
"	56	-.05	-0.1	56	2	46	-2.5
"	57	.05	-0.1	90	2	53	-2.5
"	58	-.05	-0.1	48	2	39	-2.5
"	59	-.05	-0.1	195	5	84	-2.5
"	60	-.05	-0.1	100	3	95	-2.5
"	61	-.05	-0.1	22	3	62	-2.5
"	62	-.05	-0.1	37	3	56	-2.5
"	63	-.05	-0.1	17	15	78	-2.5
"	64	-.05	0.7	90	280	860	-2.5
"	65	-.05	-0.1	44	50	135	-2.5
RC	66	-.05	0.9	105	51	110	-2.5
"	67	-.05	-0.1	130	3	54	-2.5
"	68	-.05	-0.1	60	3	91	-2.5
"	69	-.05	-0.1	43	10	260	-2.5
"	70	-.05	-0.1	84	3	77	-2.5
"	71A	-.05	-0.1	145	8	45	-2.5
"	71B	.05	-0.1	155	6	31	-2.5
"	72	-.05	-0.1	250	3	72	-2.5
"	73	-.05	-0.1	91	3	46	-2.5
"	74	-.05	-0.1	77	3	110	-2.5
"	75	-.05	-0.1	135	7	58	-2.5
"	76	-.05	0.6	90	135	215	-2.5
"	77	-.05	-0.1	11	7	110	-2.5
"	78	-.05	-0.1	145	3	30	-2.5
"	79	-.05	-0.1	91	4	87	-2.5
"	80**	-.05	-0.1	33	2	100	-2.5

SAMPLE#		Au(ppm*)	Ag(ppm*)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm*)
"	82	-.05	0.1	145	6	45	-2.5
"	83	.05	-0.1	53	8	23	-2.5
"	84	-.05	-0.1	10	4	43	-2.5
"	85	-.05	-0.1	48	3	115	-2.5
"	86	-.05	-0.1	51	3	79	-2.5
"	87	-.05	-0.1	31	3	42	-2.5
"	88	-.05	-0.1	77	7	57	-2.5
"	89	.05	-0.1	38	6	29	-2.5
"	90	-.05	-0.1	29	5	15	-2.5
RC	91	-.05	0.3	360	6	86	-2.5
"	92	-.05	-0.1	79	3	77	-2.5
"	93	-.05	-0.1	78	3	65	-2.5
"	94	-.05	0.4	54	26	265	-2.5
"	95	-.05	0.2	125	9	130	-2.5
"	96	.05	44.5	.760%	130	130	-2.5
"	97	.05	0.5	140	11	99	-2.5
"	98	-.05	-0.1	115	6	53	-2.5
"	99	-.05	-0.1	51	2	41	-2.5
"	100	-.05	-0.1	64	18	90	-2.5
"	101	-.05	-0.1	9	7	64	-2.5
"	102	-.05	0.1	120	8	83	-2.5
"	103	-.05	-0.1	23	2	83	-2.5
"	104	-.05	0.2	43	15	96	-2.5
"	105	-.05	0.3	120	8	220	-2.5
"	106	-.05	0.3	93	150	280	-2.5
"	107	.05	-0.1	57	4	94	-2.5
"	108	-.05	-0.1	38	30	98	-2.5
"	109	-.05	-0.1	37	5	120	-2.5
"	110	-.05	5.6	96	440	105	-2.5

SAMPLE#	Au(ppm*)	Ag(ppm*)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm*)
" 111	-.05	-0.1	40	7	87	-2.5
" 112	-.05	-0.1	59	3	69	-2.5
" 113	-.05	0.1	57	7	56	-2.5
" 114	-.05	0.1	75	3	79	-2.5
" 115	-.05	-0.1	38	2	120	-2.5
RC 116	-.05	0.2	27	7	67	-2.5
" 117	-.05	2.9	95	21.5	.120%	-2.5
" 118	-.05	0.2	27	29	48	-2.5
" 119	-.05	0.3	19	8	67	-2.5
" 120	-.05	0.2	80	5	145	-2.5
" 121	-.05	-0.1	69	8	180	-2.5
" 122	-.05	-0.1	24	5	18	-2.5
" 123	-.05	0.1	89	9	75	-2.5
" 124	-.05	0.2	62	20	135	-2.5
" 125	-.05	0.1	56	12	89	-2.5
" 126	-.05	-0.1	55	12	100	-2.5
" 127	.05	72.0	1.50%	740	.620%	-2.5
" 128	-.05	0.8	60	18	89	-2.5
" 129	-.05	0.2	130	8	165	-2.5

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm)	Pb(ppm)	Zn(ppm)	Mo(ppm)
RC-130	-.05	-0.1	24	6	41	-2.5
131	-.05	-0.1	11	8	47	-2.5
132	-.05	-0.1	30	3	54	-2.5
133	-.05	-0.1	21	19	46	-2.5
134	-.05	-0.1	65	3	52	-2.5
135	-.05	-0.1	45	12	125	-2.5
136	-.05	-0.1	80	9	110	-2.5
137	-.05	-0.1	59	26	155	-2.5
138	-.05	-0.1	29	6	19	-2.5
139	-.05	-0.1	65	8	72	-2.5
140	-.05	-0.1	57	9	125	2.5
141	-.05	-0.1	31	26	45	-2.5
142	-.05	2.7	57	240	56	2.5

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm)	Pb(ppm)	Zn(ppm)	Mo(ppm)
143	-.05	0.2	33	30	55	-2.5
144	-.05	-0.1	56	5	145	-2.5
145	-.05	-0.1	94	7	68	-2.5
146	-.05	-0.1	38	12	120	-2.5
147	-.05	-0.1	51	4	92	-2.5
148	-.05	-0.1	55	3	86	-2.5
149	-.05	-0.1	58	5	105	-2.5
150	-.05	-0.1	42	6	33	-2.5
RE-151	-.05	-0.1	29	8	70	-2.5
RC-152	-.05	-0.1	30	21	50	-2.5
153	-.05	-0.1	53	3	66	-2.5
154	-.05	-0.1	30	8	110	-2.5
155-A	-.05	-0.1	158	6	65	-2.5
155-B	-.05	2.8	33	26	42	-2.5
156	-.05	-0.1	47	7	71	-2.5
157	-.05	-0.1	68	12	74	-2.5
158	-.05	-0.1	69	5	59	-2.5
159	-.05	-0.1	63	4	39	-2.5
160	-.05	2.7	48	78	125	2.5
161	-.05	-0.1	81	6	81	-2.5
162	-.05	-0.1	46	27	155	-2.5
163	-.05	-0.1	22	9	30	-2.5
164	-.05	-0.1	53	6	57	-2.5
165	-.05	-0.1	28	6	22	-2.5
166	-.05	-0.1	55	5	38	-2.5
167	-.05	-0.1	68	6	87	-2.5
168	-.05	-0.1	116	7	69	-2.5
169	-.05	-0.1	33	6	48	-2.5
170	-.05	-0.1	42	3	26	-2.5
171	-.05	-0.1	87	4	32	-2.5
172	-.05	-0.1	33	6	32	-2.5
173	-.05	-0.1	130	6	90	-2.5
174	-.05	-0.1	48	15	98	-2.5
175	-.05	-0.1	39	4	67	-2.5
176	-.05	-0.1	67	3	57	-2.5
177	-.05	-0.1	127	3	75	-2.5
RC-178	-.05	-0.1	43	3	40	-2.5

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
RC-179	-.05	-0.1	112	3	27	-2.5
180-A	-.05	-0.1	136	6	53	-2.5
180-B	-.05	-0.1	87	3	38	-2.5
181	-.05	-0.1	116	5	112	-2.5
182	-.05	-0.1	21	2	41	-2.5
183	-.05	-0.1	51	4	68	-2.5
184	-.05	-0.1	102	3	63	-2.5
185	-.05	-0.1	95	6	99	-2.5
186	-.05	-0.1	44	6	114	-2.5
187	-.05	-0.1	36	3	53	-2.5
188	-.05	-0.1	100	3	41	-2.5
189-A	-.05	-0.1	99	3	36	-2.5
189-B	-.05	-0.1	104	3	80	-2.5
190	-.05	-0.1	69	3	41	-2.5
191	-.05	-0.1	70	3	46	-2.5
192	-.05	-0.1	35	6	12	-2.5
193	-.05	-0.1	56	2	21	-2.5
194	-.05	-0.1	14	10	15	-2.5
195	-.05	-0.1	100	3	59	-2.5
196	-.05	-0.1	154	2	65	-2.5
197	-.05	-0.1	94	3	50	-2.5
RC-198	-.05	-0.1	78	11	81	-2.5
RC-199	-.05	-0.1	43	4	57	-2.5
200	-.05	-0.1	71	2	17	-2.5
201	-.05	-0.1	75	10	62	-2.5
202	-.05	-0.1	106	3	124	-2.5
203	-.05	-0.1	83	8	67	-2.5
204	-.05	-0.1	27	2	67	-2.5
205	-.05	-0.1	29	2	59	-2.5
206	-.05	-0.1	62	5	12	-2.5
207	-.05	-0.1	20	3	57	-2.5
208	-.05	-0.1	152	5	38	2.5
209	-.05	-0.1	51	2	71	-2.5
210	-.05	-0.1	384	4	67	-2.5
211	-.05	-0.1	356	4	83	-2.5
212	-.05	-0.1	92	2	35	-2.5
213	-.05	-0.1	43	2	93	-2.5
214	-.05	-0.1	78	2	31	-2.5
215	-.05	-0.1	65	2	75	-2.5
216	-.05	-0.1	72	2	46	-2.5

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
217	-.05	-0.1	27	3	69	-2.5
218	-.05	-0.1	580	2	31	5
219	-.05	-0.1	32	3	87	-2.5
220	-.05	-0.1	104	5	48	-2.5
221	-.05	-0.1	59	3	80	-2.5
222	-.05	-0.1	30	7	15	-2.5
223	-.05	-0.1	43	5	53	-2.5
224	-.05	-0.1	53	13	41	-2.5
225	-.05	-0.1	65	8	59	-2.5
RC-226	-.05	-0.1	46	5	79	-2.5
RC-227	-.05	-0.1	55	6	74	-2.5
228	-.05	-0.1	198	7	27	-2.5
229	-.05	-0.1	130	5	30	-2.5
230	-.05	-0.1	272	3	39	-2.5
231	-.05	-0.1	406	7	58	-2.5
232	-.05	-0.1	38	3	55	-2.5
233	-.05	-0.1	62	3	63	-2.5
234A	-.05	-0.1	81	4	41	-2.5
234B	-.05	-0.1	43	2	55	-2.5
235	-.05	-0.1	37	2	30	-2.5
236	-.05	-0.1	67	4	23	-2.5
237	-.05	-0.1	79	2	60	-2.5
238	-.05	-0.1	38	2	50	-2.5
239	-.05	-0.1	39	5	63	-2.5
240	-.05	-0.1	50	4	88	-2.5
241	-.05	-0.1	81	3	73	-2.5
242	-.05	-0.1	128	9	29	-2.5
243	-.05	-0.1	69	4	51	-2.5
244	-.05	-0.1	41	4	165	-2.5
245	-.05	-0.1	51	3	57	-2.5
246	-.05	-0.1	56	4	142	-2.5
RC-247	-.05	-0.1	52	6	92	-2.5
RC-248	-.05	-0.1	63	32	102	-2.5
249	-.05	-0.1	46	2	50	-2.5
250	-.05	-0.1	136	6	106	-2.5

SAMPLE#	Au(ppm*)	Ag(ppm*)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm*)
RC 251	-.05	-0.1	235	8	43	2.5
" 252	-.05	-0.1	85	3	6	5.0
" 253	-.05	-0.1	59	3	47	-2.5
" 254	-.05	-0.1	63	3	52	5.0
" 255	-.05	-0.1	20	3	5	-2.5
" 256	-.05	1.8	62	3	37	-2.5
" 257	-.05	-0.1	86	3	72	-2.5
" 258	-.05	-0.1	22	78	46	-2.5
" 259	-.05	0.2	12	3	18	-2.5
" 260A	-.05	-0.1	34	3	90	-2.5
" 260B	-.05	-0.1	50	3	105	-2.5
" 261	-.05	0.1	57	3	114	-2.5
" 262	-.05	-0.1	80	11	84	-2.5
" 263	-.05	-0.1	51	3	122	-2.1
" 264	-.05	-0.1	48	4	27	-2.5
" 265	-.05	-0.1	30	3	55	-2.5
RC 266	-.05	-0.1	38	3	54	-2.5
" 267	-.05	-0.1	7	3	77	-2.5
" 268	-.05	-0.1	56	3	102	5.0
" 269	-.05	-0.1	74	3	70	-2.5
" 270	-.05	-0.1	31	4	67	-2.5
" 271	-.05	-0.1	52	4	115	-2.5
" 272	-.05	0.3	250	270	870	-2.5
" 273	-.05	0.1	64	9	305	-2.5
" 274	-.05	-0.1	51	11	215	-2.5
" 275	-.05	-0.1	46	9	102	-2.5
" 276	-.05	-0.1	33	3	70	-2.5
277	-.05	-0.1	36	4	79	-2.5
" 278	-.05	-0.1	45	3	75	-2.5
" 279	-.05	-0.1	76	19	685	-2.5

SAMPLE#	Au(ppm*)	Ag(ppm*)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm*)
" 280	-.05	-0.1	47	4	73	-2.5
281	-.05	-0.1	51	44	300	-2.5
" 282	-.05	-0.1	195	3	106	-2.5
d E282 RC 283	-.05	-0.1	117	12	300	-2.5
" 284**	-.05	-0.1	76	3	72	-2.5

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
RC-285	-0.5	-0.1	51	57	366	2.5
286A	-0.5	0.1	27	18	102	-2.5
286B	-0.5	0.3	60	20	112	-2.5
287	-0.5	0.2	94	20	62	-2.5
288	-0.5	-0.1	42	23	108	-2.5
289	-0.5	-0.1	58	21	86	-2.5
290	-0.5	-0.1	14	24	74	-2.5
291	-0.5	-0.1	35	29	72	2.5
292	-0.5	-0.1	90	18	78	-2.5

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm)*	Pb(ppm)	Zn(ppm)	Mo(ppm)
RC-501**	.22	5.4	.610%	396	.288%	200
-502	.50	.4	26	48	142	7.5
-503	.10	.6	296	18	70	5
HS-504**	-.10	.2	6	16	20	2.5
RC-505**	.27	.2	42	26	122	-2.5
-506	.27	.2	24	16	48	7.5
-507	.17	-.2	100	20	90	5
-508	-.10	-.2	18	18	64	-2.5
-509	-.10	.2	22	12	36	-2.5
-510**	-.10	.4	100	314	475	-2.5
RC-511	-.10	-.2	48	26	106	5
-512	-.10	-.2	40	20	68	2.5
-513	.15	.2	18	30	118	2.5
-514	-.10	-.2	22	16	94	5
-515	-.10	-.2	18	12	116	5
-516	-.10	.2	30	12	118	-2.5
-517	-.10	-.2	12	22	238	-2.5
-518	.17	36.0	.130%	78	126	25
-519	-.10	-.2	34	10	116	-2.5
-520	-.10	-.2	64	18	110	2.5
-521	-.10	-.2	14	6	58	7.5
-522	-.10	-.2	46	14	82	-2.5
-523	-.10	-.2	44	10	100	2.5
-524	-.10	.2	58	10	104	-2.5
-525	-.10	-.2	26	8	92	-2.5
-526	.10	.8	120	195	212	10
-527	.12	.2	56	84	120	2.5
-528	.10	.2	42	74	104	5
-529	-.10	.4	162	74	54	5
-530	-.10	-.2	38	46	64	2.5
-531	-.10	-.2	10	24	148	2.5
RC-532	-.10	.2	54	46	122	2.5

* Greater than 1000 ppm reported as percent (Assay)

** Break in numerical sequence

MONITOR GEOCHEMICAL LABORATORY
774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801

SEP 28 1976

Freeport Exploration
9/3/76: Inv. # 818

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
RC-533	.39	-.2	6	34	120	5
-534	.27	.4	82	110	372	2.5
-535	.22	.2	40	36	148	2.5
-536	.39	-.2	32	54	92	-2.5
-537	.21	3.2	18	162	392	5
-538	-.10	.8	3	16	106	-2.5
-539	-.10	.2	14	12	62	-2.5
-540	-.10	-.2	4	8	70	-2.5
-541	.20	-.2	26	12	76	-2.5
-542	-.10	.2	52	8	60	2.5
-543	.12	.4	44	22	66	2.5
-544	-.10	.2	22	16	88	-2.5
-545	.12	-.2	32	18	80	-2.5
RC-546 A	.12	-.2	42	14	50	5
546 B	-.05	-0.1	39	6	36	-2.5
547	-.05	0.6	81	372	.110%	-2.5
548	-.05	-0.1	32	13	91	-2.5
549	-.05	-0.1	144	9	144	-2.5
550	-.05	-0.1	56	11	92	2.5
551	.10	49.9	.535%	362	.115%	20
552	-.05	0.5	65	21	150	-2.5
553	-.05	5.8	200	322	154	25
554	-.05	0.3	132	17	158	-2.5
555	-.05	-0.1	50	7	89	-2.5
556	-.05	-0.1	36	21	24	2.5
557	-.05	-0.1	23	16	55	2.5
558	-.05	0.3	44	15	87	-2.5
559	-.05	2.3	30	108	196	7.5
560	-.05	-0.1	51	354	304	2.5
561	-.05	0.2	118	128	322	-2.5
562	-.05	-0.1	52	18	166	-2.5
563	-.05	1.2	126	780	.165%	-2.5
564	-.05	-0.1	57	12	148	-2.5

SAMPLE#	Au(ppm*)	Ag(ppm*)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm*)
" 565	-.05	-0.1	90	3	75	-2.5
566	-.05	-0.1	75	3	76	-2.5
" 567	-.05	-0.1	45	3	98	-2.5
" 568	-.05	0.5	55	154	390	2.5
" 569	-.05	0.9	77	240	220	2.5
" 570	-.05	-0.1	33	10	23	-2.5
RC 571	.10	21.9	.220%	190	360	-2.5
" 572	-.05	0.1	78	17	117	-2.5
" 573	-.05	-0.1	70	3	131	-2.5
" 574	-.05	-0.1	36	9	76	-2.5
" 575	-.05	4.0	160	12	56	-2.5
" 576	-.05	0.6	15	4	21	-2.5
" 577	-.05	-0.1	150	3	107	-2.5
" 578	-.05	-0.1	49	5	79	-2.5
" 579	-.05	-0.1	66	7	61	-2.5
" 580	-.05	-0.1	280	3	78	-2.5
" 581	-.05	-0.1	110	8	116	-2.5
" 582	-.05	-0.1	37	4	103	-2.5
" 583	-.03	-0.1	42	5	67	-2.5
" 584	-.05	-0.1	50	4	61	-2.5
" 585	-.05	1.1	31	187	590	-2.5
" 586	-.05	-0.1	20	4	64	-2.5
" 587	-.05	0.3	74	17	86	-2.5
" 588	-.05	-0.1	53	3	45	-2.5
" 589	-.05	-0.1	35	31	2	-2.5
" 590	-.05	-0.1	36	11	145	-2.5
591	-.05	-0.1	57	4	153	-2.5
" 592	-.05	3.9	187	770	.160%	-2.5
" 593	-.05	2.4	188	510	405	-2.5
" 594	-.05	-0.1	49	3	30	-2.5

SAMPLE#	Au (ppm*)	Ag (ppm*)	Cu (ppm*)	Pb (ppm*)	Zn (ppm*)	Mo (ppm*)
RC 595	-.05	0.3	19	3	63	-2.5
" 596	-.05	0.3	61	7	61	-2.5
" 597	-.05	-0.1	50	3	68	-2.5
" 598	-.05	-0.1	31	4	58	-2.5
" 599	-.05	-0.1	36	13	140	-2.5
" 600	-.05	-0.1	40	3	70	-2.5
" 601	-.05	-0.1	24	42	495	-2.5
" 602	-.05	-0.1	52	3	60	-2.5
" 603	-.05	-0.1	36	4	67	-2.5
**604	-0.5	-0.1	65	27	75	-2.5
605	-0.5	-0.1	112	20	65	-2.5
606	-0.5	-0.1	54	20	71	-2.5
607	-0.5	-0.1	44	17	94	2.5
608	-0.5	-0.1	65	18	72	-2.5
609	-0.5	-0.1	42	20	99	-2.5
610	-0.5	-0.1	74	24	75	2.5
611	-0.5	-0.1	35	20	94	-2.5
612	-0.5	-0.1	46	20	75	-2.5
613	-0.5	0.1	87	.175%	.570%	-2.5
614	-0.5	0.1	56	31	190	-2.5
615	-0.5	-0.1	14	14	155	-2.5
616	-0.5	-0.1	62	17	88	2.5

* **Greater than 1000 ppm reported as percent (Assay)**

** **Break in numerical sequence**

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
RC-1001	-.10	.4	18	18	114	-2.5
-1002	.15	-.2	38	18	116	5
-1003	-.10	-.2	36	26	164	2.5
-1004	.34	-.2	18	40	160	5
-1005	.31	-.2	12	18	118	5
-1006	-.10	-.2	40	50	120	2.5
-1007	-.10	-.2	3	15	100	-2.5
-1008	-.10	-.2	34	12	74	5
-1009	-.10	.2	60	68	210	5
-1010	-.10	-.2	42	14	120	2.5
-1011	-.10	-.2	38	14	100	5
-1012	-.10	-.2	10	12	108	-2.5
RC-1013	-.10	-.2	3	6	40	5

MONITOR GEOCHEMICAL LABORATORY

774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801

SEP 2 9 1976

Freeport Exploration
August 25, 1976: Inv. #792

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm)*	Pb(ppm)*	Zn(ppm*)	Mo(ppm)
RC-2001	.34	-.2	3	12	80	2.5
-2002	.10	1.2	8	16	70	2.5
-2003	-.10	.4	82	10	108	-2.5
-2004	.34	-.2	14	12	42	7.5
-2005	-.10	.2	4	12	90	-2.5
-2006	-.10	-.2	3	14	28	-2.5
-2007	-.10	-.2	3	38	86	-2.5
-2008	.12	-.2	6	14	98	-2.5
-2009	.29	-.2	4	14	40	-2.5
-2010	.14	-.2	4	26	76	-2.5
-2011	-.10	-.2	26	14	86	-2.5
-2012	-.10	-.2	12	10	122	-2.5
-2013	-.10	-.2	5	6	28	-2.5
-2014	.10	-.2	3	24	120	-2.5
-2015	-.10	.2	18	735	150	7.5
-2016	-.10	.4	32	70	166	-2.5
-2017	-.10	-.2	100	142	176	5
-2018	-.10	-.2	12	58	210	-2.5
-2019	.21	-.2	34	32	40	-2.5
-2020	-.10	-.2	8	46	54	-2.5
-2021	-.10	.2	84	74	58	-2.5
-2022	-.10	-.2	6	34	32	-2.5
-2023	-.10	-.2	16	96	46	-2.5
-2024	.12	-.2	40	48	118	-2.5
-2025	.10	.2	26	10	116	-2.5
-2026	-.10	-.2	14	18	128	-2.5
-2027	-.10	-.2	8	8	92	-2.5
-2028	.12	-.2	26	12	88	-2.5
-2029	-.10	-.2	18	12	86	-2.5
-2030	-.10	-.2	56	50	232	-2.5
-2031	-.10	-.2	26	14	114	-2.5
-2032	-.10	-.2	3	18	114	-2.5
-2033	-.10	-.2	18	6	36	-2.5
RC-2034	.10	-.2	14	12	80	-2.5

* Greater than 1000 ppm reported as percent (Assay)

** Break in numerical sequence

MONITOR GEOCHEMICAL LABORATORY

SEP 2 8 1976

774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801

Freeport Exploration
August 25, 1976: Inv. #792

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
RC-2035	-.10	.2	3	8	68	-2.5
-2036	-.10	-.2	3	8	54	-2.5
-2037	-.10	-.2	5	6	64	-2.5
-2038	-.10	-.2	34	76	180	-2.5
-2039	-.10	.4	20	6	70	-2.5
-2040	-.10	-.2	12	8	82	-2.5
-2041	-.10	-.2	8	22	30	-2.5
-2042	-.10	-.2	30	16	100	-2.5
-2043	-.10	-.2	10	10	90	-2.5
-2044	-.10	.2	16	4	14	-2.5
-2045	-.10	-.2	4	10	68	-2.5
-2046	.21	.2	26	30	70	2.5
-2047	-.10	.2	34	26	82	5
-2048	.22	.4	26	16	58	-2.5
-2049	-.10	.6	24	14	80	-2.5
-2050	-.10	-.2	34	12	38	5
-2051	-.10	.4	84	16	74	2.5
-2052	-.10	-.2	64	12	54	2.5
-2053	-.10	-.2	20	122	160	-2.5
-2054	.17	-.2	66	18	34	-2.5
-2055	.12	.2	36	10	82	2.5
-2056	-.10	.4	116	12	30	5
-2057	-.10	.2	184	16	92	2.5
-2058	-.10	-.2	6	16	110	-2.5
-2059	-.10	.8	8	20	132	-2.5
-2060	-.10	.4	30	32	100	-2.5
-2061	-.10	.6	52	58	90	2.5
-2062	-.10	.2	16	12	58	-2.5
-2063	.26	-.2	40	12	50	2.5
-2064	.17	1.0	204	30	50	-2.5
-2065	.29	-.2	138	24	78	2.5
-2066	.22	.4	404	80	146	5
-2067	1.71	91.0	21.5%	760	.115%	22.5
RC-2068	.45	1.2	765	28	52	2.5

* Greater than 1000 ppm reported as percent (Assay)

** Break in numerical sequence

MONITOR GEOCHEMICAL LABORATORY

SEP 28

774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801

Freeport Exploration
August 25, 1976: Inv. #792

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
RC-2069	.27	-.2	78	14	34	5
-2070	-.10	3.8	226	62	56	10
-2071	-.10	.2	36	8	40	10
-2072	.13	.4	104	14	122	2.5
-2073	.10	.2	138	14	62	-2.5
-2074	.21	.4	78	18	94	7.5
-2075	.15	.4	204	14	62	10
-2076	.21	-.2	32	34	138	5
-2077	.10	-.2	52	12	88	2.5
-2078	-.10	-.2	16	14	70	-2.5
-2079	-.10	-.2	48	4	100	-2.5
-2080	.10	-.2	58	14	124	2.5
-2081	-.10	-.2	62	30	104	5
-2082	-.10	-.2	26	14	92	2.5
-2083	-.10	-.2	66	16	136	7.5
-2084	.17	.4	130	14	252	10
-2085	-.10	.6	200	4	30	5
-2086	.11	.4	184	22	80	2.5
-2087	.26	.6	126	20	72	7.5
-2088	.13	.6	62	16	68	2.5
-2089	.13	.6	78	18	90	5
-2090	-.10	.2	52	22	68	-2.5
-2091	.24	.2	58	20	58	2.5
-2092	.26	.8	630	24	36	5
-2093	.22	.4	6	12	32	2.5
-2094	.10	.4	32	22	120	5
-2095	-.10	.4	88	18	84	2.5
-2096	-.10	-.2	36	12	90	2.5
-2097	-.10	-.2	90	44	160	-2.5

RC-2098	54	48	315	7.5	-.10	1.2
-2099	50	22	304	-2.5	-.10	.4
-2100	48	24	170	-2.5	-.10	.2
-2101	8	18	76	-2.5	.31	.2
-2102	212	16	190	2.5	-.10	.6
-2103	284	40	280	5	-.10	1.4
-2104	74	32	226	2.5	-.10	.4
-2105	40	20	130	-2.5	-.10	.4
-2106	18	12	182	-2.5	-.10	.6
-2107	.275%	94	314	2.5	-.10	3.4
-2108	600	44	226	-2.5	-.10	.6
-2109	20	10	80	-2.5	-.10	.4
-2110	104	20	234	-2.5	-.10	.2
-2111	32	40	150	-2.5	-.10	.2
-2112	18	14	60	-2.5	-.10	.4
-2113	24	20	64	5	.27	.2
RC-2114	104	14	56	2.5	-.10	.2

* Greater than 1000 ppm reported as percent (Assay)

** Break in numerical sequence

RC-2115	32	18	136	2.5	.26	.2
-2116	28	12	20	-2.5	-.10	.2
-2117	30	12	46	2.5	-.10	.2
-2118	146	16	76	2.5	-.10	.6
-2119	24	20	68	-2.5	.15	.2
-2120	66	12	14	-2.5	-.10	.2
-2121	60	18	28	-2.5	-.10	.2
-2122	22	30	30	25	-.10	.4
-2123	30	20	30	15	.17	.4
-2124	226	12	34	7.5	-.10	.2
-2125	310	16	48	7.5	-.10	.2
-2126	950	14	56	12.5	.10	.6
-2127	535	8	34	5	-.10	.8
-2128	238	10	40	-2.5	-.10	.2
-2129	232	10	68	2.5	-.10	.6
RC-2130	318	12	70	2.5	-.10	.4
-2131	398	28	116	10	-.10	.4
-2132	180	20	94	-2.5	.15	.4
-2133	12	14	82	-2.5	-.10	.4
-2134	42	20	114	5	-.10	.2
-2135	24	28	42	-2.5	-.10	.2
-2136	18	22	134	2.5	-.10	.2
-2137	46	28	114	2.5	.17	-.2
-2138	26	18	30	2.5	-.10	-.2
-2139	82	22	84	2.5	-.10	.4
-2140	730	22	66	2.5	.17	.4
-2141	144	16	66	2.5	.24	.6
-2142	180	22	78	7.5	-.10	.2
-2143	32	28	46	5	-.10	.2
-2144	56	26	58	2.5	-.10	.4
-2145	42	22	140	5	-.10	-.2
-2146	40	26	76	2.5	-.10	.2
-2147	26	22	88	2.5	.22	.2
Rc-2148	'4	28	58	-2.5	.36	.4
RC-2149	26	28	90	-2.5	.24	-.2
-2150	32	30	80	-2.5	-.10	.2
-2151	176	24	78	-2.5	-.10	.4

OPAL Ck.

MONITOR GEOCHEMICAL LABORATORY
774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801
Phone (702) 738-3236

SEP 2 1 1976

Certificate of Analysis

Date: September 19, 1976
Invoice #: #839
Client: Freeport Exploration
Box 1911
Reno, Nevada 89505 BY: D. Decker

File
– N. Santiam Geochem

Quayle Lusty
Manager

Client Order No.:
Date Received: Sept. 14, 1976
Analysis: Au, Ag, Cu, Pb, Zn, Mo
Analytical Methods: Atomic absorption: Colorimetric(Mo)
cc: D. Decker

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm)*	Pb(ppm)*	Zn(ppm)*	Mo(ppm)
Series RC2152	.58	-.2	2.75%	.310%	2.70%	25
2153	.10	-.2	9.75%	6.95 %	1.40%	5
2154	.55	.2	292	260	150	-2.5
2155	.41	-.2	122	66	138	-2.5
2156	-.10	.2	108	34	54	-2.5
2157	-.10	-.2	56	18	66	-2.5
2158	-.10	-.2	84	14	92	-2.5
2159	.14	-.2	132	16	102	-2.5
2160	.31	.4	50	38	70	5
2161	.43	-.2	24	14	56	-2.5
2162	-.10	-.2	64	12	36	-2.5
2163	-.10	-.2	70	28	104	-2.5
2164	.27	-.2	80	14	34	2.5
2165	.31	-.2	16	38	58	-2.5
2166	.17	.6	52	640	214	2.5
2167	-.10	-.2	3	22	78	-2.5
2168	.13	-.2	100	32	140	-2.5
2169	.34	10.0	334	.470%	.300%	45
2170	.21	18.2	.155%	.975%	.915%	10
2171	-.10	.4	3	180	.105%	-2.5
2172	-.10	1.6	108	730	266	17.5
2173	-.10	6.2	320	372	865	15

* Greater than 1000 ppm reported as percent (Assay)
** Break in numerical sequence

MONITOR GEOCHEMICAL LABORATORY

SEP 2 1 1976

774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801

Freeport Exploration
Inv. # 839: 9/19/76

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
Series RC2174	.14	6.8	168	.145%	168	12.5
2175	-.10	-.2	102	245	240	-2.5
2176	-.10	-.2	66	14	72	-2.5
2177	-.10	-.2	74	16	112	-2.5
2178	-.10	-.2	62	12	50	-2.5
2179	-.10	.6	96	10	64	-2.5
2180	-.10	.4	208	8	78	-2.5
2181	-.10	-.2	72	8	52	-2.5
2182	-.10	-.2	72	8	54	-2.5
2183	-.10	.8	26	30	144	-2.5
2184	-.10	.2	206	56	82	5
2185	-.10	-.2	50	6	52	-2.5
2186	-.10	.2	66	28	90	-2.5
2187	-.10	-.2	62	6	68	-2.5
2188	-.10	-.2	94	10	28	-2.5
2189	.10	-.2	78	6	34	2.5
2190	.27	.2	705	24	80	-2.5
2191	.24	-.2	635	152	206	5
2192	.13	-.2	218	24	64	-2.5
2193	.13	-.2	96	22	40	-2.5
2194	-.10	-.2	38	12	20	-2.5
2195	-.10	-.2	190	12	28	2.5
2196	.16	-.2	164	4	12	-2.5
2197	-.10	.8	.140%	48	104	-2.5
2198	-.10	-.2	44	8	6	-2.5
2199	.24	-.2	344	8	26	7.5
2200	-.10	-.2	60	102	210	-2.5
2201	-.10	1.0	106	58	74	40
2202	-.10	-.2	44	102	118	-2.5
2203	-.10	-.2	106	46	48	2.5
2204	.10	.4	42	38	144	-2.5
2205	-.10	.2	80	40	52	-2.5
2206	-.10	.4	88	76	118	-2.5
2207	-.10	-.2	62	18	76	-2.5

Stony R.D.

WEST Ck.

* **Greater than 1000 ppm reported as percent (Assay)**

** **Break in numerical sequence**

MONITOR GEOCHEMICAL LABORATORY

774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801

SEP 2

Freeport Exploration
Inv. #839: 9/19/76

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
Series RC2208	-.10	-.2	72	18	104	-2.5
2209	-.10	-.2	20	12	44	-2.5
2210	-.10	-.2	54	24	114	-2.5
2211	-.10	.2	114	24	66	2.5
2212	-.10	-.2	90	20	56	-2.5
2213	.14	-.2	46	48	90	-2.5
2214	-.10	-.2	28	16	48	-2.5
2215	-.10	-.2	70	12	42	-2.5
2216	-.10	-.2	64	12	64	-2.5
2217	-.10	-.2	44	20	80	-2.5
2218	-.10	-.2	30	14	90	-2.5
2219	-.10	-.2	68	16	84	-2.5
2220	.48	-.2	26	16	48	-2.5
2221	-.10	-.2	76	4	10	-2.5
2222	-.10	.2	370	12	46	-2.5
2223	-.10	.4	388	12	48	-2.5
2224	-.10	.4	370	18	48	-2.5
2225	.12	.4	.130%	14	46	5
2226	-.10	.2	74	16	50	-2.5

1½ 1 mi.

Battle Mt.

OCT 14 1976

MONITOR GEOCHEMICAL LABORATORY

774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801

Phone (702) 738-3236

Certificate of Analysis

Date: October 10, 1976

Invoice #: #880

Client: Freeport Exploration
Box 1911
Reno, Nevada89505 by: D. Decker

Client Order No.:

Date Received: 10/2/76

Analysis: Au, Ag, Cu, Pb, Zn, Mo

Analytical Methods: Atomic absorption: Colorimetric(Mo)

cc: D. Decker, Mehama, Oregon

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm)*	Mo(ppm)
RC-2227	-.10	.8	264	140	210	5
-2228	.14	1.0	320	75	114	2.5
-2229	-.10	2.3	374	67	196	-2.5
-2230	.26	.3	72	41	46	2.5
-2231	-.10	1.2	.198%	282	.700%	-2.5
-2232	.17	.4	48	26	104	-2.5
-2233	.33	67.0	1.18 %	.238%	.394%	65
-2234	.29	19.0	1.64 %	75	132	2.5
-2235	-.10	.5	196	35	68	-2.5
-2236	.10	.7	164	55	76	7.5
-2237	-.10	1.7	640	34	32	22.5
-2238	-.10	.4	40	14	34	-2.5
-2239	-.10	.4	44	14	56	-2.5
-2240	.10	.2	22	14	28	10
-2241	-.10	.4	54	68	164	5
-2242	-.10	.3	40	26	50	-2.5
-2243	.51	16.5	.216%	1.160%	5.30 %	10
-2244	.48	37.0	.178%	1.230%	5.35 %	10
RC-2245	1.27	1.1	56	120	260	-2.5

Mandalay

RUTH VEIN

* Greater than 1000 ppm reported as percent (Assay)

** Break in numerical sequence

Quayle Lusty
Manager

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
RC-2246	-.10	.4	145	44	284	-2.5
2247	-.10	.2	50	18	72	2.5
2248	-.10	.2	26	18	24	-2.5
2249	.15	.2	12	16	26	-2.5
2250	-.10	.2	38	16	16	-2.5
2251	-.10	.4	52	16	34	5
2252	-.10	.4	276	18	40	2.5
2253	-.10	.4	12	70	104	-2.5
2254	-.10	.8	58	24	28	2.5
2255	-.10	.2	38	16	18	-2.5
2256	-.10	.2	94	24	88	-2.5
2257	-.10	.2	46	20	44	-2.5
2258	.15	.4	110	24	104	-2.5
2259	.10	.2	22	14	32	-2.5
2260	.10	.4	54	20	98	-2.5
2261	-.10	6.6	46	715	.120%	10
2262	.15	.4	24	20	52	-2.5
2263	-.10	2.2	740	102	120	35
2264	.10	1.6	.135%	34	160	110
2265	.10	.6	92	70	410	10
2266	.10	1.0	44	550	.130%	5
2267	.10	.2	10	10	14	7.5
2268	-.10	.2	18	18	24	-2.5

SAMPLE#	Au(ppm*)	Ag(ppm*)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm*)
RC 2269	-.05	4.4	875	35	46	20
" 2270	-.05	0.2	13	22	78	2.5
" 2271	-.05	0.3	44	44	360	10
" 2272	-.05	0.1	40	20	93	7.5
" 2273	-.05	0.1	57	10	151	5
" 2274	.17	0.3	12	9	9	5
" 2275	-.05	0.2	74	11	85	7.5
" 2276	-.05	-0.1	20	9	37	7.5
" 2277	-.05	0.2	19	10	70	5
" 2278	-.05	-0.1	18	11	59	7.5
" 2279	-.05	0.3	21	13	80	2.5
" 2280	-.05	-0.1	30	7	34	5
" 2281	-.05	-0.1	13	4	4	5
" 2282	-.05	0.4	112	10	10	5
" 2283	-.05	0.6	48	6	106	7.5
" 2284	-.05	0.2	39	13	47	5
" 2285	-.05	-0.1	42	10	63	5
RC 2286	-.05	-0.1	91	8	895	-2.5
" 2287	-.05	-0.1	92	6	80	-2.5
" 2288	-.05	-0.1	175	6	70	-2.5
" 2289**A	-.05	-0.1	22	2	6	-2.5
RC-2289 B	-.05	-0.1	52	7	33	-2.5
2290	-.05	1.1	850	10	27	2.5
2291	-.05	0.1	195	7	40	2.5
2292	-.05	-0.1	210	12	120	-2.5
2293	-.05	-0.1	72	9	94	-2.5
2294	-.05	1.7	285	21	15	7.5
2295	-.05	-0.1	120	5	45	2.5
2296	-.05	-0.1	78	6	31	-2.5
2297	-.05	-0.1	31	6	51	-2.5
2298	-.05	0.2	105	5	120	-2.5
2299	-.05	-0.1	79	9	72	-2.5
2300	-.05	-0.1	68	6	88	-2.5
2301	-.05	-0.1	26	7	44	-2.5
RC-2302	-.05	-0.1	125	6	40	-2.5

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
**2303	-.05	-0.1	80	6	63	-2.5
2304	-.05	-0.1	110	10	118	-2.5
2305	-.05	-0.1	48	18	81	5
2306	-.05	0.6	97	77	74	25
2307	-.05	-0.1	98	57	140	2.5
2308	-.05	-0.1	42	47	150	-2.5
2309	-.05	-0.1	49	5	48	-2.5
2310	-.05	-0.1	112	19	100	-2.5
2311	-.05	-0.1	72	9	57	-2.5
2312	-.05	-0.1	55	5	76	-2.5
2313	-.05	0.5	104	30	77	-2.5
2314	-.05	-0.1	39	242	448	-2.5
RC-2315	-.05	-0.1	128	104	31	5
2316	-.05	-0.1	266	9	79	-2.5

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
** -3001	-.10	-.2	78	12	34	-2.5
-3002	.17	-.2	22	18	52	2.5
-3003	-.10	-.2	90	16	56	2.5
-3004	.15	-.2	150	32	64	2.5
RC-3005	-.10	.2	68	34	112	-2.5
RC-3006	.26	3.4	.255%	122	54	5
-3007	-.10	.6	84	12	64	5
-3008	.17	.4	14	14	44	-2.5
-3009	-.10	-.2	16	18	36	2.5
-3010	-.10	.2	28	12	54	5
-3011	-.10	.2	158	40	252	2.5
-3012	-.10	.4	70	34	178	-2.5
-3013	-.10	.4	60	26	208	2.5
-3014	-.10	-.2	36	16	80	-2.5
-3015	-.10	.2	42	38	138	-2.5
-3016	.24	.2	156	14	90	-2.5
-3017	.27	.8	394	12	62	12.5
-3018	.29	.4	74	18	70	2.5
-3019	.13	.4	34	28	256	-2.5
-3020	-.10	.6	32	36	256	-2.5
-3021	.12	.4	202	28	224	-2.5
-3021A	.19	3.0	475	22	50	5
-3022	-.10	.4	46	12	100	2.5
-3023	-.10	.8	68	20	102	2.5
-3024	-.10	1.0	82	16	152	-2.5
-3025	-.10	.2	24	16	72	-2.5
-3026	-.10	-.2	82	16	106	-2.5
-3027	-.10	.6	8	6	64	-2.5
-3028	-.10	.4	14	18	128	-2.5
-3029	-.10	.4	40	18	84	-2.5
-3030	.11	.2	34	10	42	2.5
-3031	-.10	.2	28	12	118	-2.5
-3032	.10	.2	62	22	110	5
-3033	.27	.4	54	32	50	2.5
-3034	.24	.2	38	14	112	5
-3035	.34	-.2	56	16	150	2.5
-3036	.38	2.6	905	158	82	17.5
-3037	-.10	.6	76	20	100	2.5
RC-3038	-.10	.2	6	8	26	-2.5

Gold Ck.

MONITOR GEOCHEMICAL LABORATORY

774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801

Freeport Exploration
August 25, 1976: Inv. #792

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm
RC-3039	.17	-.2	58	14	16	7.5
-3040	.17	.2	3	8	24	-2.5
-3041	.92	51.0	8.95%	400	.180%	30
-3042	.96	49.0	6.05%	220	.105%	17.5
-3043	-.10	1.6	555	386	354	5
-3044	-.10	.8	390	24	56	5
-3045	.27	7.2	.215%	.110%	.170%	12.5
-3046	.15	.6	108	18	28	2.5
-3047	.13	.6	252	8	68	2.5
-3048	.41	1.0	630	24	94	2.5
-3049	.26	.4	128	32	50	7.5
-3050	.27	.6	78	18	40	7.
-3051	-.10	2.8	194	368	180	7.
-3052	.15	.4	200	24	116	5
-3053	.29	.2	124	18	40	10
-3054	.79	32.8	.125%	.350%	.525%	115
-3055	.26	1.0	232	52	196	10
-3056	.27	-.2	40	14	36	5
-3057	.43	.2	124	20	46	7.
-3058	-.10	.4	314	8	16	10
-3059	.24	.6	96	14	54	-2.
-3060	-.10	.8	34	20	110	2.
-3061	.11	.4	38	16	122	5
-3062	.22	8.2	.195%	500	680	5
-3063	-.10	.8	.120%	122	660	2.
RC-3064	.31	.4	32	20	32	-2.

MONITOR GEOCHEMICAL LABORATORY

774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801

SEP 28

Freeport Exploration
August 25, 1976: Inv. #792

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
RC-3065**	-.10	.2	8	24	90	-2.5
-3066	-.10	.2	22	28	166	2.5
-3067	-.10	.2	34	18	48	2.5
-3068	-.10	.6	10	32	200	-2.5
-3069	-.10	.2	10	52	114	2.5
-3070	-.10	.2	28	26	98	-2.5
-3071	-.10	.2	70	26	54	2.5
-3072	.10	.6	50	50	132	7.5
-3073	-.10	.8	74	66	102	5
-3074	-.10	.2	40	22	64	2.5
-3075	-.10	-.2	50	22	164	2.5
-3076	-.10	.2	16	22	46	2.5
-3077	.11	.2	3	22	56	-2.5
-3078	-.10	-.2	36	18	56	2.5
-3079	-.10	-.2	36	16	64	2.5
-3080	-.10	-.2	30	46	56	5
-3081	-.10	-.2	182	22	110	2.5
-3082	-.10	.2	6	10	28	-2.5
RC-3083	-.10	.2	70	22	124	2.5
RC-3084**	.24	-.2	3	10	38	10
-3085	.12	5.8	855	52	46	22.5
-3086	.41	-.2	46	22	168	5
-3087	.36	1.6	324	48	148	12.5
-3088	.24	-.2	38	20	140	-2.5
RC-3089	.48	5.8	10	118	62	-2.5
RC-3090	.27	.2	20	16	58	10
-3091	.22	-.2	28	18	96	2.5
-3092	.17	.2	32	22	86	-2.5
-3093	.38	-.2	34	20	62	5
-3094	.29	-.2	22	18	80	-2.5
-3095	-.10	.6	46	170	182	-2.5
-3095A	-.10	.4	24	50	84	-2.5
-3096	-.10	.2	18	24	92	2.5
-3097	-.10	.2	3	40	154	-2.5
-3098	-.10	-.2	14	38	128	2.5
-3099	-.10	.2	38	226	82	2.5

?

Blk Horn RDG.

MONITOR GEOCHEMICAL LABORATORY

774 South 5th Street • P. O. Box 1901 • Elko, Nevada 89801

SEP 13 1976

Freeport Exploration
9/3/76: Inv. # 818

SAMPLE #	Au(ppm)	Ag(ppm)	Cu(ppm*)	Pb(ppm*)	Zn(ppm*)	Mo(ppm)
-3100	-.10	.2	272	56	66	7.5
-3101	.24	2.0	12	440	64	70
-3102	.22	.2	36	76	146	7.5
-3103	.41	.2	3	28	98	-2.5
-3104	.27	.4	4	96	60	5
-3105	.24	-.2	20	28	98	5
-3106	.19	.6	24	346	100	10
-3107	.24	.2	46	38	130	-2.5
-3108	.17	-.2	32	24	46	-2.5
-3109	.51	39.0	770	.580%	2.85%	150
-3110	.19	.2	90	110	314	7.5
-3111	.24	.4	54	194	400	2.5
-3112	-.10	-.2	18	22	160	-2.5
-3113	.38	-.2	3	22	130	-2.5
-3114	.39	-.2	76	26	202	-2.5
RC-3115	.60	1.2	4	22	58	2.5