Interoffice Communication

To P. H. Kirwin - Reno

From B. R. Berger - R & D - Ponca City

Date April 7, 1977

Subject Striped Hills Project - Petrography Interpretation

This memorandum is an addendum to the "Summary of Exploration, Striped Hills Project". The purpose is to further elucidate the variations in alteration assemblages that occur in the upper member of the Pennsylvanian-Permian Etchart Limestone in diamond drill holes SH-1, -2, -3, and -4. The upper member serves as a reference unit because it is the only stratigraphic unit that occurs in all four of the holes.

General Summary

The principal minerals present in the altered limestone are quartz, calcite, pyroxene (diopside?), tremolite, sericite, garnet, sphene, chlorite, biotite and actinolite. The volume percentages of each phase vary considerably due to several probable causes: (1) Sample selection bias; (2) Variations in original host rock composition; (3) Relative proximity to heat sources (e.g., dikes or sills); (4) Variations in the composition of hydrothermal fluids; and/or (5) Variations in the intensity of fracturing of the host rocks.

Quartz (1-70%) appears to be evenly distributed throughout the area tested in the drill holes. Calcite (5-90%) is ubiquitous, but the most marble occurs in SH-4. Calcite \pm quartz alters all of the other phases listed previously except chlorite. Pyroxene is the most abundant in SH-1 (5-30%) and SH-2 (1-10%) with relatively less in SH-3 (1-5%) and SH-4 (1-5%, except to 20% near the bottom of the hole). Tremolite is more abundant in SH-3 (1-50%) and SH-4 (1-60%) than in SH-1 and SH-2 (both, 1-10%). Sericite is only abundant in SH-3 (1-10%) and SH-4 (1-30%). Garnet and sphene are sporadic in all of the drill holes. Chlorite is ubiquitous throughout the drilled area along the latest stage veinlets. Biotite (1-5%) is only present in SH-1 and SH-2. Actinolite is rare in all of the drill holes, the most occurring in SH-2.

The age sequence (oldest to youngest) of veinlets generally follows the order listed below:

(1) Quartz ± pyrite ± molybdenite

(2) Quartz + K-feldspar + pyrite ± pyrrhotite ± molybdenite ± chalcopyrite

(3) Quartz + calcite ± tremolite ± sericite + pyrite ± arsenopyrite ± sphalerite ± galena ± chalcopyrite

(4) Calcite \pm quartz + pyrite

(5) Calcite ± chlorite ± pyrite

(6) Chlorite ± calcite

P. H. Kirwin Page 2 April 7, 1977

DDH SH-1
The alteration in this drill hole is comprised of the following:

Quartz (30-70%)
Calcite (10-70%)
Pyroxene (5-30%)
Tremolite (1-10%)

There are two distinct granularities of quartz and calcite. Detrital grains probably served as sites of nucleation for the larger grain size. Overgrowths, formed in the earlier stages of alteration, were resorbed during later stages of alteration leaving etched and pitted rims. Fine, anhedral grains occur as interstitial material, as rims around coarser grains, or as aggregates of intergrown calcite and quartz. Fluid inclusions are common in quartz, as are inclusions of apatite.

Pyroxene occurs as anhedra in fine grained aggregates. It is also present in quartz + calcite veinlets as scattered grains in the selvages. Pyroxene is commonly replaced by calcite and/or quartz.

Tremolite occurs as scattered grains throughout the hornfels and in vein selvages. It is only abundant in the selvages or in zones where several vein selvages coalesce. The grains are generally tabular and are elongated subparallel to the veinlets. Calcite and quartz commonly corrode the tremolite grain boundaries.

Sericite occurs as discontinuous, fine grained aggregates in selvages along quartz + calcite veinlets. It is also very abundant adjacent to quartz monzonite porphyry sills or dikes. In most cases, fractures appear to control the distribution of sericite.

Sphene is common as disseminated grains throughout the hornfels and along veinlets with tremolite + sericite selvages. It appears to be associated with intermediate stage silication as it is often surrounded by poikilitic quartz or calcite.

Garnet occurs as scattered grains except in skarn zones. It is slightly anisotropic in most sections. Frequently the garnet is replaced by calcite and quartz. Skarn zones (drill logs on file) consist predominantly of subhedral garnet (40-60%) with lesser amounts of calcite, quartz, pyroxene, epidote, and plagioclase.

DDH SH-2
The alteration in this drill hole consists of the following:

Quartz (20-70%)
Calcite (5-30%)
Pyroxene (1-10%)
Tremolite (1-10%)

P. H. Kirwin Page 3 April 7, 1977

The silication differs in this hole from SH-1 in that there is an apparent overall increase in the tremolite content and a decrease in the pyroxene content. The increase in tremolite is probably due to an apparent increase in quartz + calcite veinlets in SH-2 relative to SH-1, and this increase has caused a concomitant decrease in the amount of pyroxene. Additionally, samples were selected specifically to study the highly fractured and veined portions of the core.

Some of the hornfels contains up to 20% garnet as aggregates of subhedral crystals. Some compositional banding occurs, and the garnet frequently is interlayered with calcite.

Brown pleochroic biotite (1-5%) is present in some sections. It is probably a magnesian variety and possibly related to an early stage of magnesium metasomatism. A graphic intergrowth of K-feldspar and quartz occurs occasionally in the same zones as the biotite.

Tremolite (±actinolite) either encloses or replaces pyroxene. The tremolite also occurs as mattes of radiating crystals. Both pyrosene and amphibole alter garnet, commonly occurring along fractures and compositional boundaries.

DDH SH-3
The alteration in this drill hole consists of the following:

Quartz	(5-60%)
Calcite	(10-75%)
Pyroxene	(1-5%)
Tremolite	(1-50%)
Sericite	(0-10%)

Tremolite and/or sericite always occur in the hornfels as aggregates or clusters in a matrix of quartz and/or calcite. In many places the tremolite is partially replaced by coarse grained calcite. Occasionally, the tremolite is intergrown with quartz.

Pyroxene is a minor constituent of the hornfels, and evidence is lacking for a large scale replacement of pyroxene by amphibole or sericite.

Sericite appears to occur where calcite veining is more prevalent, whereas tremolite occurs where quartz + calcite veinlets are commong. The development of tremolite and sericite does not decrease with depth in the upper member of the Etchart Limestone, but they are mostly absent below the upper member.

DDH SH-4

The alteration in this hole presents the most complex picture, possibly due to (1) an increased thickness of the upper member limestone, (2) an increase in the number of quartz monzonite porphyry sills or dikes, (3) a

P. H. Kirwin Page 4 April 7, 1977

closer proximity to the source of the hydrothermal activity, and/or (4) a thicker sequence of altered rock.

The alteration in this drill hole is comprised of the following:

Quartz	(1-60%)
Calcite	(5-90%)
Pyroxene	(1-60%)
Tremolite	(1-60%)
Sericite	(1-30%)

Immediately below the Farrel Canyon thrust fault the rock consists of quartz (20-30%) and calcite (40-60%) with minor sericite and/or tremolite. Below about 1000 feet depth tremolite becomes very abundant (to 60%). Near 1300 feet depth there is a zone of pyroxene-quartz hornfels where pyroxene constitutes up to 60% of the rock. Below this zone sericite (10-30%) is scattered throughout the matrix of the rock. Marble is common below 1400 feet depth, and tremolite (5-30%) and sericite (1-30%) are present.

Alteration extends below the upper member limestone. Pyroxene (1-20%) increases in abundance below 1900 feet depth, and tremolite and sericite are primarily restricted to vein selvages and highly fractured zones.

Garnet and epidote occur as disseminated grains in the marble. Clots of base metals and these calc-silicate minerals occur infrequently, but the general zoning pattern of these clots is garnet - $(\pm pyroxene)$ - epidote - chalcopyrite + sphalerite $(\pm actinolite)$.

Conclusions

There appears to be a general zoning pattern to the alteration minerals in the upper member of the Etchart Limestone. The amount of hydrous alteration increases to the west and there is a general decrease in the amount of pyroxene. Whereas tremolite \pm actinolite and sericite are restricted to vein selvages in SH-1 and SH-2, they occur throughout the hornfels in SH-3 and SH-4. Additionally, the pervasive amphibole decreases with depth in SH-4. These relationships suggest that the hydrothermal source is west of the diamond drilling completed to date.

Byron R. Berger

da

SUMMARY OF EXPEORATION
STRIPED HILLS PROJECT
HUMBOLDT COUNTY, NEVADA

Byron R. Berger Continental Oil Company Minerals Department Reno District Office March, 1977

TABLE OF CONTENTS

	Page
Summary and Recommendations	1
Purpose of Report	3
Acknowledgments	3
Location and Land Situation	4
History and Production	4
Surface Geological Exploration	5
Etchart Limestone	5
Farrel Canyon Formation	7
Igneous Rocks	8
Structural Geology	9
Alteration	9
Metallization	11
Geophysical Exploration	11
Geochemical Exploration	14
Drilling Program	15
Rotary Drilling	15
ClamoDiamond Drilling	18
Discussion	23
Structural Relationships	23
Spatial Relationships of Alteration and Metallization	24
Geochemical Relationships	31
Interpretation	35
References Cited	40

FIGURES AND PLATES

Figure Number

1	Location map
2	Property map
3	IP contour map $(n = 2)$
4	IP contour map $(n = 4)$
5	Resistivity contour map (n = 2)
6	Resistivity contour map $(n = 4)$
7	Gradient array IP contour map
8	Gradient array resistivity contour map
9	1974 Geochemical survey contour map for copper
10	Drill hole location map
	Summary drill logs
11	SH 74-1
12	SH 74-2
13	SH 74-3
14	SH 75-1
15	SH 75-2
16	SH-1
17	SH-2
18	SH-3
19	SH-4
20	Perspective drawing of structural, stratigraphic and alteration relationships

Plate Number

Sites Striped Hills Rock Chip Geochemical Survey - Copper Striped Hills Rock Chip Geochemical Survey - Molybdenum Striped Hills Rock Chip Geochemical Survey - Lead Striped Hills Rock Chip Geochemical Survey - Zinc Striped Hills Rock Chip Geochemical Survey - Zinc Striped Hills Rock Chip Geochemical Survey - Manganese Striped Hills Geology of Samples Spatial Relationships of Alteration, Geochemist and Geology Along Section A-A' Spatial Relationships of Alteration, Geochemist and Geology Along Section B-B'	1	Geological Map
Geochemical Survey Maps 4 Striped Hills Geochemical Survey Sample Location Sites 5 Striped Hills Rock Chip Geochemical Survey - Copper 6 Striped Hills Rock Chip Geochemical Survey - Molybdenum 7 Striped Hills Rock Chip Geochemical Survey - Lead 8 Striped Hills Rock Chip Geochemical Survey - Lead 8 Striped Hills Rock Chip Geochemical Survey - Zinc 9 Striped Hills Rock Chip Geochemical Survey - Manganese 10 Striped Hills Geology of Samples 11 Spatial Relationships of Alteration, Geochemist and Geology Along Section A-A' 12 Spatial Relationships of Alteration, Geochemist and Geology Along Section B-B' 13 Spatial Relationships of Alteration, Geochemist and Geology Along Section C-C'	2	Ground Magnetic Contour
Striped Hills Geochemical Survey Sample Location Sites Striped Hills Rock Chip Geochemical Survey - Copper Striped Hills Rock Chip Geochemical Survey - Molybdenum Striped Hills Rock Chip Geochemical Survey - Lead Striped Hills Rock Chip Geochemical Survey - Zinc Striped Hills Rock Chip Geochemical Survey - Zinc Striped Hills Rock Chip Geochemical Survey - Manganese Striped Hills Geology of Samples Spatial Relationships of Alteration, Geochemist and Geology Along Section A-A' Spatial Relationships of Alteration, Geochemist and Geology Along Section B-B' Spatial Relationships of Alteration, Geochemist and Geology Along Section C-C'	3	
Sites Striped Hills Rock Chip Geochemical Survey - Copper Striped Hills Rock Chip Geochemical Survey - Molybdenum Striped Hills Rock Chip Geochemical Survey - Lead Striped Hills Rock Chip Geochemical Survey - Zinc Striped Hills Rock Chip Geochemical Survey - Zinc Striped Hills Rock Chip Geochemical Survey - Manganese Striped Hills Geology of Samples Spatial Relationships of Alteration, Geochemist and Geology Along Section A-A' Spatial Relationships of Alteration, Geochemist and Geology Along Section B-B' Spatial Relationships of Alteration, Geochemist and Geology Along Section C-C'		Geochemical Survey Maps
Copper Striped Hills Rock Chip Geochemical Survey - Molybdenum Striped Hills Rock Chip Geochemical Survey - Lead Striped Hills Rock Chip Geochemical Survey - Zinc Striped Hills Rock Chip Geochemical Survey - Manganese Striped Hills Rock Chip Geochemical Survey - Manganese Striped Hills Geology of Samples Spatial Relationships of Alteration, Geochemist and Geology Along Section A-A' Spatial Relationships of Alteration, Geochemist and Geology Along Section B-B' Spatial Relationships of Alteration, Geochemist and Geology Along Section C-C'	4	Striped Hills Geochemical Survey Sample Location Sites
Molybdenum Striped Hills Rock Chip Geochemical Survey - Lead Striped Hills Rock Chip Geochemical Survey - Zinc Striped Hills Rock Chip Geochemical Survey - Manganese Striped Hills Geology of Samples Striped Hills Geology of Samples Spatial Relationships of Alteration, Geochemist and Geology Along Section A-A' Spatial Relationships of Alteration, Geochemist and Geology Along Section B-B' Spatial Relationships of Alteration, Geochemist and Geology Along Section C-C'	5	
Striped Hills Rock Chip Geochemical Survey - Zinc Striped Hills Rock Chip Geochemical Survey - Manganese Striped Hills Geology of Samples Spatial Relationships of Alteration, Geochemist and Geology Along Section A-A' Spatial Relationships of Alteration, Geochemist and Geology Along Section B-B' Spatial Relationships of Alteration, Geochemist and Geology Along Section C-C'	6	
Striped Hills Rock Chip Geochemical Survey - Manganese Striped Hills Geology of Samples Spatial Relationships of Alteration, Geochemist and Geology Along Section A-A' Spatial Relationships of Alteration, Geochemist and Geology Along Section B-B' Spatial Relationships of Alteration, Geochemist and Geology Along Section C-C'	7	
Manganese Striped Hills Geology of Samples Spatial Relationships of Alteration, Geochemist and Geology Along Section A-A' Spatial Relationships of Alteration, Geochemist and Geology Along Section B-B' Spatial Relationships of Alteration, Geochemist and Geology Along Section C-C'	8	
Spatial Relationships of Alteration, Geochemist and Geology Along Section A-A' Spatial Relationships of Alteration, Geochemist and Geology Along Section B-B' Spatial Relationships of Alteration, Geochemist and Geology Along Section C-C'	9	
and Geology Along Section A-A' Spatial Relationships of Alteration, Geochemist and Geology Along Section B-B' Spatial Relationships of Alteration, Geochemist and Geology Along Section C-C'	10	Striped Hills Geology of Samples
and Geology Along Section B-B' Spatial Relationships of Alteration, Geochemist and Geology Along Section C-C'	11	Spatial Relationships of Alteration, Geochemistry, and Geology Along Section A-A'
and Geology Along Section C-C'	12	Spatial Relationships of Alteration, Geochemistry, and Geology Along Section B-B'
Longitudinal Section Between SH-1 and SH-2	13	Spatial Relationships of Alteration, Geochemistry, and Geology Along Section C-C'
	14	Longitudinal Section Between SH-1 and SH-2

SUMMARY OF EXPLORATION STRIPED HILLS PROJECT HUMBOLDT COUNTY, NEVADA

Byron R. Berger Reno District Office

SUMMARY AND RECOMMENDATIONS

The Striped Hills prospect consists of 141 unpatented lode mining claims. To date, five rotary and four diamond drill holes have been completed in addition to geologic mapping, 16.5 line miles of induced polarization geophysical coverage, 16.2 line miles of ground magnetics data, aeromagnetic coverage, and a rock chip/soil sample survey. All of these exploration data indicate the presence of a very large, sulfidebearing hydrothermal system which probably was caused by the intrusion of a quartz monzonite(?) stock. Alteration effects are evident in clastic and carbonate sediments and in quartz monzonite dikes or sills. Base-metal sulfide minerals occur in all rock types.

It is recommended that additional drilling be done to fully evaluate the mineral potential of the Striped Hills prospect. At least two drill holes should be completed to the west of the present exploration efforts. The holes should be drilled to a total depth of between 2000 and 3000 feet. In preparation for the selection of drill sites the following program is recommended:

- (1) Expand the ground magnetics coverage to the western edge of the SH claim block:
- (2) Conduct a gravity survey of the entire claim block area to

- determine the depth to bedrock under the alluvium and the possible location of the source intrusion; and,
- (3) Expand the rock chip geochemical survey to the south of the prospect area to better define the dispersion pattern.

SUMMARY OF EXPLORATION STRIPED HILLS PROJECT HUMBOLDT COUNTY, NEVADA

Purpose of Report

The Striped Hills copper prospect consists of 141 unpatented lode mining claims located in Humboldt County, Nevada. Pennsylvanian-Permian sedimentary rocks are intruded by Cretaceous(?) quartz monzonite dikes and a hypothesized buried intrusion. Hydrothermal alteration and metallization accompanied the intrusion of the igneous rocks resulting in the calc-silication and silicification of sedimentary rocks and the partial alteration of porphyritic intrusive dike rocks to phyllic and propylitic assemblages.

The purpose of this report is to (a) summarize all of the exploration activity to date, (b) evaluate the mineral potential of the prospect area, and (c) present recommendations for additional exploration.

Reports on file that are germain to this discussion are Berger and Brewer (1974), Miller and others (1974), Sadowski (1974), Berger (1975), and Simmons (1975), (1977).

Acknowledgements

The exploration activities and results presented in this report were carried out by several workers in addition to the author. Messrs. Wayne Brewer, Val Kranek, and Steve Kilbreath, temporary geologists, assisted in geochemical and geophysical field studies. Induced polarization surveys were conducted by the Geophysical Exploration and Exploration Research departments of Conoco in Ponca City, Oklahoma. Mr. Richard Simmons of the

Minerals Department helped set up and conduct the ground magnetics survey, as well as provide interpretation of aeromagnetic and magnetic susceptibility data from the drill core.

LOCATION AND LAND SITUATION

The Striped Hills prospect is located in Sections 1, 2, 3, 4, 10, 11, and 12, T39N, R42E, Humboldt County, Nevada (Figure 1). Access to the area is via eight miles of unimproved dirt road from the Getchell mine, and via several unimproved dirt roads in Eden Valley. The property consists of three contiguous, unpatented lode mining claims groups comprising 141 claims and fee land leased from the General Electric Company (Figure 2). The unpatented claim blocks include the following groups: Striped Hills 1-26, 87-99, 101-119, 201-215, 301-315, 407-415, 507-515, and 601-608; Burn Out 4-22; and, Dry Ridge 1-8. The leased fee land considered to be part of the project is located in S½ Section 11, and Section 13, T39N, R42E. Holding costs for the property are \$14,100 in annual assessment work and \$3,700 per year rent to the General Electric Company.

HISTORY AND PRODUCTION

The earliest known prospecting in the area was in the early 1920's (F. Barnes, pers. comm.). Silver ore was discovered in outcrop in Section 12 and a shallow inclined shaft was driven on a quartz vein. Copperbearing skarn in Section 11 was also explored with a shallow inclined shaft. Although no production records exist, some silver ore carrying values up to 200 ounces/ton was shipped (F. Barnes, pers. comm.). Small prospect pits on copper-bearing veins exist at several localities, but no production

is evident. During the late 1950's, Getchell Mine, Incorporated, prospected in the area around both of the shafts. Shallow wagon-drill holes were drilled in trenches around the copper-bearing skarn shaft, but there is no evidence that any claims were perfected.

A large color anomaly in the limestone terrain led to Conoco's interest in the property in 1974. Lode mining claims Burn Out 5-20 were located in May and June, 1974, and Dry Ridge 1-4 were leased from Mr. Fred Barnes of the Getchell Mine and Mr. John Etchart of Winnemucca, Nevada, in November, 1974. Exploration results led to the addition of some of the Striped Hills claims and Burn Out 4, 21-22 claims in February and March, 1975. Dry Ridge 5-8 were leased from Messrs. Barnes and Etchart in April, 1975. Additional Striped Hills claims were located in November, 1976, and January, 1977.

SURFACE GEOLOGICAL EXPLORATION

Geologic mapping at a scale of 1" = 500' showed the oldest rocks in the prospect area to be correlative with Middle Pennsylvanian to Early Permian (Plate 1) rocks mapped by Hotz and Willden (1964) in the Osgood Mountains. Elsewhere in Nevada these rocks have been referred to as the overlap assemblage (Roberts and others, 1958). They represent marine deposits laid down in basins developed after the mid-Paleozoic Antler orogeny. The Paleozoic rocks were intruded by quartz monzonite in late Mesozoic(?) time. The youngest rocks are Miocene(?) plateau basalts that cap the Striped Hills north of the prospect area.

Etchart Limestone

The Etchart Limestone is a formation of predominantly carbonate rocks

of Middle Pennsylvanian age and Late Pennsylvanian or Early Permian age (Hotz and Willden, 1964). In the Edna Mountain area, about 25 miles south of the prospect area, these rocks are assigned to the Highway and Antler Peak formations (Ferguson and others, 1952; Roberts, 1951). The bedding strikes north-easterly and dips 5-40 degrees to the northwest.

The formation consists chiefly of sandy limestone and limestone with some interbedded quartzite, dolomite, lenticular pebbly conglomerate beds, chert, and minor calcareous shale. Bedding is irregular throughout most of the unit and varies from thick to thin. Hotz and Willden (1964, p. 31) found the lithology to vary "... rapidly laterally as well as vertically, and individual units tend to be lenticular and discontinuous..."

In the prospect area, the Etchart Limestone has been divided into three members (Plate 1). The stratigraphically lowest member consists of poorly bedded, gray, bioclastic limestone with thin, discontinuous beds of chert and quartzite. A distinctive, chert- and quartzite-pebble conglomerate occurs near the eastern margin of the prospect area within the lowest member. The limestone is medium to coarse grained, moderately well-sorted, and contains mixed sand grains and small pebbles. The conglomerate consists of light gray to tan quartzite and chert pebbles and cobbles in a matrix of sandy limestone. The base of the lower member is not exposed in the prospect area. The top of the member is marked by a three to 20 foot thick-gray quartzite bed or series of thin quartzite beds. The middle member of the Etchart Limestone is a light red to tan weathering silty limestone. This member is predominatly calcareous, but contains some silt, shale, and quartzite beds. The color is due to 5-10% disseminated hematite, possibly an oxidation product of fine grained

pyrite. Petrographic examination shows the rock to consist chiefly of 50-60% calcite, 15-20% detrital quartz and minor other silicates, about 5% pyrite, and the iron oxide. Diamond drill results (DDH SH-1, -2, -3) suggest that this member is highly carbonaceous below the zone of oxidation. The total thickness of the middle member is approximately 600 feet. The upper member of the Etchart Limestone is thin-bedded gray limestone with minor chert and quartzite beds. The base of the member consists of interbedded gray, bioclastic limestone and red, silty limestone. The top of the member is not exposed, and its thickness is not readily determined throughout the region.

Farrel Canyon Formation

The Farrel Canyon Formation consists of chert, sandstone, shale, meta-volcanic rocks, and minor limestone of probable Pennsylvanian to Permian age (Hotz and Willden, 1964, p. 40). This age range is based on the lithologic similarity of the Farrel Canyon to the Pumpernickel and Havallah formations south of the prospect area. Bedding strikes northeasterly and dips 10-50 degrees to the northwest.

In the prospect area, the formation consists chiefly of chert and sandstone, often interbedded with lesser amounts of quartzite, shale, and limestone. The chert is generally light colored with thin, ribbon-like beds. The sandstone is well indurated and poorly bedded with alternating zones of shale and siltstone. Pebbly beds occur at some localities, the pebbles consisting of chert and quartzite. Mineralogy of the sandstone is quartz + feldspar + clay + white mica + chlorite + minor calcite. Altered volcanic rocks occur infrequently interbedded with the chert.

Presumably, the volcanic rocks were originally flow rocks of intermediate to basic composition.

Neither the top nor the base of the Farrel Canyon Formation is exposed in the map area. Additionally, poor exposures do not permit the stratigraphy and structure to be worked out in any detail. In general, however, the sandstone and shale are predominant in the southern part of the prospect area and chert predominates elsewhere.

Igneous Rocks

Two intrusive rocks of probable Cretaceous age are recognized in the prospect area; coarse grained, hypidiomorphic, leucocratic quartz monzonite dikes and medium grained, hypidiomorphic-inequigranular quartz monzonite porphyry dikes. The relative ages of these two rock types was not observed in outcrop, although the porphyry appears to intrude the coarse-grained variety in diamond drill hole DDH SH-2. The primary minerals in both types of dikes are plagioclase (about 40%), K-feldspar (about 30%), quartz (20%), biotite, and hornblende. The plagioclase (andesine) grains tend to be subhedral and show slight to moderate compositional zoning. Anhedral K-feldspar and quartz form interlocking zones between the plagioclase crystals. Biotite is the most abundant mafic mineral. The porphyritic rock contains phenocrysts measuring one to two mm in cross-section in a matrix of 0.05 to 0.2 mm crystals. By contrast, the quartz monzonite contains crystals of 1 to 5 mm with very little finer grained material.

Tertiary olivine basalt flows cap the ridge in the northeast corner of the claim block. The flows were extruded onto an erosion surface of gentle relief, and individual flows vary from 10 feet to about 30 feet in

thickness. The rock is porphyritic with phenocrysts of olivine and occasionally plagioclase in an aphanitic groundmass.

Structural Geology

The principal structural feature in the prospect area is the Farrel Canyon thrust which brings the Farrel Canyon Formation over the Etchart Limestone. The fault strikes northerly and dips approximately 35 degrees to the west. The fault has in part acted as a locus of intrusive activity as quartz monzonite dikes crop out at several localities along the trace. In the Osgood Mountains, the Farrel Canyon thrust is the uppermost fault in a zone of imbrication (Hotz and Willden, 1964, p. 74).

The trace of the thrust is marked by a linear array of valleys separating low hills of sedimentary rocks. Where the fault is exposed, mylonite can be seen in both the Farrel Canyon and Etchart formations. The greatest amount of deformation appears to be in the lower plate limestone where small, imbricate thrusts have developed as well as tight and locally overturned folds. The thrust fault transgresses bedding in the Etchart Limestone and probably does the same in the less well exposed Farrel Canyon Formation.

Alteration

An elliptical zone of hydrothermal alteration with minimum dimensions of 5400 feet long and 2000 feet wide occurs in the upper member of the Etchart Limestone and across the Farrel Canyon thrust into the Farrel Canyon Formation (Plate 1). The edges of the alteration zone are transitional into the fresh limestone, although the transition takes place rapidly over a distance of a few tens of feet. Bedding planes and fractures at various

angles to the bedding are important in the localization of the alteration around the periphery of the zone.

In outcrop the Etchart Limestone appears silicified. Petrographic study indicates that it is silicated, consisting of anhedral detrital(?) quartz (20-30%) with overgrowths of secondary quartz, clusters of fine-grained pyroxene (diopsidic?) (15-30%) and amphibole(?) (to 5%), and interstitial calcite (20-40%), and disseminated subhedral pyrite. The rims of the quartz grains are ragged and embayed by the pyroxene, suggesting that the silicification preceded the calc-silication. Epidote is occasionally found, particularly near the Farrel Canyon thrust.

Garnet skarn occurs in the Etchart Limestone in an inclined shaft in Section 11 (Plate 1). The calc-silication consists chiefly of massive subhedral garnet with lesser amounts of pyroxene and quartz. Blue-gray marble is adjacent to the skarn indicating strong bedding plane control of the alteration.

Minor quartz veins occur in Section 12 in the Etchart Limestone.

These veins are comprised of massive, milky quartz with selvages of quartz and sericite. The veins vary from a few inches to a few feet in width and occur along faults and fractures.

Alteration in the Farrel Canyon Formation is difficult to recognize due to the abundance of chert and quartzite. Calc-silication is evident in occasional, thin limestone beds intercalated with chert. The predominant silicates are pyroxene, epidote, quartz, and some tremolite. Sericite occurs in the matrix of arenaceous rocks in the southern part of the prospect area. Pyrite is ubiquitous, but is altered to various limonites on exposed rock surfaces.

The quartz monzonite dikes are variably altered. Weak to moderate quartz-sericite alteration is recognizable at most localities. Petrographic study indicates that most of the sericite occurs as coarse grains interstitial to quartz and feldspar and replacing finer grained plagioclase. Plagioclase phenocrysts show only a weak development of sericite in the center of the grains and along cleavage traces. Primary quartz grains appear to be recrystallized, and commonly surround plagioclase phenocrysts. Biotite is variably altered to chlorite + sericite + rutile. Calcite is a common interstitial alteration, and it also replaces portions of plagioclase grains. Pyrite is present, but is oxidized in most surface exposures.

Metallization

There are only minor base-metal occurrences in the prospect area, these occurring in the NE¼ Section 11 and NW¼ Section 12. Manganese occurs in the northern part of Section 14 and in E½ Section 10. The two main types of base metal occurrences in the Striped Hills are (1) silver-and copper-bearing minerals in quartz veins near and beyond the eastern limits of alteration, and (2) base metal- and tungsten-bearing minerals in skarn within the calc-silicate hornfels near the Farrel Canyon Thrust fault. Both types of occurrences are partially to wholly oxidized in outcrop. The copper minerals in the quartz veins are altered to arsenates and carbonates, and are altered to carbonates and silicate in the skarn.

GEOPHYSICAL EXPLORATION

Three induced polarization (IP) surveys have been conducted over the Striped Hills prospect. The Exploration Geophysics Department of Conoco

conducted a dipole-dipole (a = 500 feet) IP survey in June, October, and November of 1974. A total coverage of 13.1 line miles was obtained. The Geophysical Section of the Exploration Research Division of Conoco conducted a gradient array IP survey covering nine square miles in September, 1974. An additional 3.4 line miles of dipole-dipole coverage (a = 1000 feet) was obtained in September, 1976, using the Minerals Department party #2.

The dipole-dipole IP survey (Figures 3, 4, 5, 6) detected the presence of three zones of anomalous IP response (Sadowski, 1974). The zones trend northeast-southwest, one being coincident with the zone of hydrothermal alteration in the limestone, a second occurring west of the Farrel Canyon thrust, and the third due to buried sources occurring in the southwestern corner of the prospect area. The resistivity data led Sadowski (1974) to suggest that the carbonaceous shally limestone member of the Etchart Limestone acted as a barrier to the hydrothermal solutions channeling the solutions into the upper limestone member. Sadowski further suggests that a greater volume of reactive rock was available on the north and south sides of the magnetic anomaly that parallels the thrust fault than on the eastern side of the anomaly.

The gradient array survey outlined an area of strong IP response (Figures 7, 8) coincident with the altered area in the northern part of the prospect area and continuing to the southwest across the Farrel Canyon thrust. The resistivity data show an area of relatively greater conductivity over the altered limestone, but the conductivity decreases to the south and southwest. Miller and others (1974) suggest that strong em coupling distorts the IP anomaly to the west and masks smaller anomalies

that may exist in the eastern part of the surveyed area. However, the dipole-dipole surveys clearly delineate the eastern edge of the anomalous response zone.

The second dipole-dipole survey expanded the coverage to the west and provided additional information from greater depths. The survey confirmed the anomalous response west of the Farrel Canyon thrust indicated in the previous surveys and showed that (a) the anomalous zone extends at least an additional 7000 feet to the west, (b) the carbonaceous middle member of the Etchart Limestone is of finite thickness and is underlain by less conductive limestone, and (c) the anomalous zone extends into the upper plate of the Farrel Canyon thrust.

Ramifications of the induced polarization and resistivity data are

(1) the system is very large, measuring at least 6000 feet by 6000 feet;

(2) the lower carbonate unit of the Etchart Limestone is a reactive host rock that persists beneath the altered surface area; and (3) the anomalous zone may be a large, pyrite halo above a mineralized intrusive body.

A ground magnetics survey (Plate 2) was conducted over the Striped Hills and Burn Out claim blocks in September, 1976. A total coverage of 16.2 line miles was obtained. Data were collected at 200 foot intervals along traverse lines spaced 350 feet apart. A base station was monitored every three hours to provide data for a baseline and diurnal corrections. Magnetic activity on the sun was checked twice daily. Mr. Richard Simmons aided in the data acquisition and helped to interpret the results. The data suggest the presence of steeply-dipping dike-like bodies over the top of a much broader, buried body. The anomalies due to tabular bodies trend north-northwest. The larger buried body has the approximate dimensions of

6000 feet by greater than 6000 feet. The western extent of the larger magnetic body has not been delineated.

An aeromagnetic survey (Plate 3; altitude = 500 feet, line spacing 1320 feet) over the prospect area defined a positive, 180 gamma magnetic anomaly centered in Section 11 (T39N, R42E) and a positive 100 gamma anomaly at the west edge of the prospect near the corner of Sections 3, 4, 9, and 10 (T39N, R42E). These anomalies are attributed to the presence of one or more buried intrusions beneath the prospect area and resultant metallization. The eastern anomaly may be greater in magnitude than the western anomaly due to the outcropping of altered pyrrhotized sedimentary rocks and intrusive dike rocks or than might be expected from an intrusion without pyrrhotite. The smooth gradients on the north and south edges of the total anomalous area suggest that the causative body is symmetrical and dips gently north and south rather than having vertical sides.

Susceptibility measurements on drill core suggest that the pyrrhotite is the predominant source of the positive magnetic response.

GEOCHEMICAL EXPLORATION

Rock chip and/or soil samples were collected from a 100 foot radius around each claim corner of the Burn Out claim block in July, 1974. Assay data for copper (Figure 9) and molybdenum were obtained. The coverage was felt to be inadequate and another survey was conducted in December, 1976.

Rock chip samples were collected for the second geochemical survey

(Plate 4) at most outcrops throughout the prospect area. Soil samples

were collected (a) where ever rock material was available and soils were

deemed to be residual and (b) adjacent to selected samples of outcrops to

provide a basis for evaluating the soil geochemical values in areas where no outcrops can be found. All samples were assayed for copper, molybdenum, lead, zinc, and manganese.

The data from rock chip samples provide the most useful information and are shown on plates 5, 6, 7, 8, and 9. In a general way, the geochemical distributions show an overlapping crescent shaped pattern with zinc slightly more peripheral than the copper and molybdenum. The crescent wraps around a topographically low area in the west part of the property that may represent a zone of more intense hydrous silicate alteration and therefore more readily weathered.

The geochemical values for copper, molybdenum, lead, and zinc are generally low, although the anomalies are three to five times background. The highest zinc values (Plate 8) outline the outcrop area of the middle member of the Etchart Limestone (Plates 8 and 10) and probably reflect the high zinc concentration found in the carbonaceous unit regionally.

DRILLING PROGRAM

Rotary Drilling

On the basis of the geological, geochemical, and geophysical information available in 1974, four rotary drill sites were selected to test the character of the mineralization. Rotary, down-hole drilling was chosen to give a quick, preliminary evaluation of the project area and to help guide the selection of diamond drill sites. Eklund Drilling Company of Carlin, Nevada, did all of the drilling. One hole (SH 74-3) required redrilling, bringing the total to five holes.

All of the drill holes encountered altered and mineralized rocks.

Pyrite (1-10%) is the most pervasive sulfide present, though some chalcopyrite (less than 1%) is found in two of the drill holes (SH 74-3, SH 75-2). Megascopic alteration consists of quartz (to 100%) and diopside with occasional zones of garnet and epidote. No intrusive rocks were recognized in any of the drill holes. Refer to figures 10 through 15.

SH 74-1 was collared over an anomalous IP response more than five times background beneath Station 17½ on Line 13S. The hole was completed at 525 feet (Figure 11). Bleached and mineralized limestone was encountered from 300 to 390 feet between two carbonaceous limestone horizons. The general results of the drilling follow:

Hole: SH 74-1

Location: Section 11 (T39N, R42E)

Collar Elevation: 5632'
Depth to Bedrock: 0
Total Depth: 525'

Start: 12-3-74 Completion: 12-8-74

Assay Data:

Copper 55 ppm Molybdenum 8 ppm Lead 40 ppm Zinc 445 ppm

Zinc averages 0.135% from 310 to 320 feet and 0.12% from 385 to 390 feet. Silver ranges from 0.03 to 0.29 oz/ton from 300 to 320 feet, and 0.53 oz/ton from 385 to 390 feet. For the entire altered zone (300' - 390'), the average geochemical values are as follows:

Copper 78 ppm Molybdenum 9 ppm Lead 64 ppm Zinc 564 ppm

Drill hole SH 74-2 was collared over another IP anomaly greater than five times background near the intersection of Lines ON and 13W (Figure 12).

This hole was lost in a cavity at 340 feet. Bleached and altered (primarily silicified) limestone was encountered near the bottom of the hole. The results of the drilling are:

Hole:

Location: Section 12 (T39N, R42E)

Collar Elevation: 5812' Depth to Bedrock: 0 Total Depth: 340'

Start: 12-9-74 Completion: 12-16-74

Assay Data:

Copper: 58 ppm Molybdenum 5 ppm Lead 81 ppm Zinc 142 ppm

The most intense alteration is from 315 to 340 feet. For this interval silver averages 0.16 oz/ton, lead 945 ppm, and zinc 344 ppm.

SH 74-3 was collared east of the Farrel Canyon thrust to test the limestone-quartz monzonite contact. Two narrow tactite zones (15 to 20 feet and 184 to 190 feet) were intersected, and most of the limestone is silicified and pyritized. Broken ground caused abandonment of the hole at 190 feet. The results of the drilling are:

Hole: SH 74-3

Location: Section 11 (T39N, R42)

Collare Elevation: Approximately 5500' - 5800'

Depth to Bedrock: Total Depth: 190'

Start Date: 12-17-74 Completion: 12-19-74

Assay Data: Copper: 248 ppm

> Molybdenum 23 ppm Lead 6 ppm Zinc 107 ppm

From 0 to 30 feet copper averages 583 ppm with one five foot interval carrying 0.12%. Moly is 26 ppm for the same interval. The hole bottomed at 190 feet in tactite with 0.16% copper and 25 ppm moly.

The upper plate of the thrust and an anomalous IP response were tested in SH 75-1. Pyritized cherts were encountered to 450 feet total depth. The results of this hole are:

Hole: SH 75-1

Location: Section 11 (T39N, R42E)

Collar Elevation: 5471'
Depth to Bedrock: 0
Total Depth: 450'

Start Date: 1-3-75 Completion: 1-14-75

Assay Data:

Copper 70 ppm Molybdenum 1 ppm Lead 57 ppm Zinc 97 ppm

Lead averages 0.35% from 260 to 265 feet, and 280 ppm from 330 to 340 feet.

SH 75-2 (405 feet total depth) was an attempt to redrill SH 74-3 to test below the second tactite zone. Again the intrusion was not reached. The results of this hole are:

Hole: SH 75-2

Location: Section 11 (T39N, R42E)

Collar Elevation: 5501'
Depth to Bedrock: 0
Total tepth: 405'

Start Date: 1-15-75 Completion: 1-21-75

Assay Data:

Copper 159 ppm 10 ppm Lead 24 ppm 2inc 110 ppm

From 0 to 50 feet copper averages 338 ppm, and 392 ppm from 140 to 150 feet, all in silicated limestone. A 60 foot thick marble zone lies beneath the second silicated limestone intersection.

Diamond Drilling

On the basis of the earlier geological, geophysical, and geochemical

drilling program, two diamond drill holes totalling 1455 feet were completed between October and December, 1975. The Longyear Company did all of the drilling. Both HQ and NQ core was recovered. Refer to figures 16 and 17. Detailed drill logs are on file.

Both drill holes encountered altered Etchart Limestone and quartz monzonite porphyry dikes. As in the rotary drill holes pyrite is the most abundant sulfide though some pyrrhotite, molybdenite, and chalcopyrite were found. The molybdenite occurs chiefly in quartz veinlets with some K-feldspar. Although some chalcopyrite was found in the quartz veinlets, it occurs chiefly in skarn assemblages that selectively replace limestone beds.

DDH SH-1 was collared about 600 feet south of RDH SH 75-2. The purpose of the hole was to test the alteration in the limestone adjacent to a positive ground magnetic anomaly assumed to be a dike-like protrusion above the hypothesized, main igneous mass. This vertical hole was completed at 856 feet in black, carbonaceous limestone believed to be correlative to the middle member of the Etchart Limeston. The general results of the drilling follow:

Hole: DDH SH-1

Location: Section 11, T39N, R42E

Collar Elevation: 5489'
Depth to Bedrock: 20'
Total Depth: 856'
Oxide-Sulfide Interface: 50'

Start: 10-30-75 Completion: 12-10-75

Average Assay Data in ppm (weighted):

Interval	Copper	Molybder	num Lead	Zinc
0 - 20 20' - 43 43' - 73 73' - 124 124½' - 138 138 - 592 592' - 856	150 108 71 110 222	- 5 9 1 2 2 3 27 5	5 12 26 - 13	- 113 63 49 10 69* 252

^{*} Average 138' - 574'; Average 574' - 592' is 0.22%

DDH SH-2 was collared about 1200 feet south-southwest of DDH SH-1. The purpose of this hole was to test the alteration in the limestone and intrusive dikes on top of a positive ground magnetic anomaly. This vertical hole was completed at 599 feet in oxidized quartz-pyroxene hornfels possibly near the top of the black, carbonaceous limestone encountered in DDH SH-1. The general results of the drilling are as follows:

Hole:	DDH SH-2
Location:	Section 11, T39N, R42E
Collar Elevation:	5480'
Depth to Bedrock:	279
Total Depth:	599 '
Oxide-Sulfide Interface:	106'
10 10 75	0 7 1 1 2 10 00 75

Start: 12-12-75 Completion: 12-29-75

Average Assay Data in ppm (not weighted):

Int	erval	Copper	Molybdenum	Lead	Zinc
0	- 20'	_	_	_	-
20'	- 27'	70	1	10	40
27'	- 138'	167	5	11	21
138'	- 234'	247	8	18	43
234'	- 599'	224	23	24	69

The alteration and metallization encountered in SH-1 and SH-2 relative to that in SH 74-1 and SH 74-2 indicated that the hypothesized target intrusion-sediment contact was west of all of the drilling. DDH SH-3 and DDH SH-4 were located to provide more information on the alteration and

metallization trends in the effort to locate the target intrusion. Detailed drill logs are on file.

DDH SH-3 (Figure 18) was collared about 2500 feet southwest of SH-2. The site was selected on the basis of three factors: (1) a coincident positive magnetic high on both ground and air magnetic contour maps; (2) an anomalous induced polarization response; and, (3) an opportunity to test the Farrel Canyon Formation, obtain a dip on the Farrel Canyon thrust fault, and test the Etchart Limestone beneath the thrust. The hole was completed at 1626 feet in black, bioclastic limestone believed to be correlative to the lower member of the Etchart Limestone. The upper member of the Etchart Limestone was truncated by a major fault at 806 feet preventing its total thickness and extent of alteration to be fully explored. The general results of the drilling follow:

Hole: DDH SH-3
Location: Section 11, T39N, R42E
Collar Elevation: 5395'
Depth to Bedrock: 12'
Total Depth: 1626'
Start: 9-9-76 Completion: 11-19-76

Average Assay Data in ppm (not weighted):

Interva	l Copper	Interval	Molybdenum
155' - 501' - 6613' - 679' - 805' - 13	12' - 155' 47 501' 70 613' 112 679' 296 805' 87 357' 25 626' 11	0 - 12' 12' - 632' 632' - 7715' 715' - 1320' 1320' - 1626'	- 4 21 4 1

Interval	Lead	Interval	Zinc
0 - 12' 12' - 269' 269' - 344' 344' - 853' 853' - 976 976' - 1626	14 168 22 198 13	0 - 12' 12' - 193' 193' - 613' 613' - 679' 679' - 805' 8055 - 1469	82 175 0.33% 40 176 50

DDH SH-4 (Figure 19) was collared 1800 feet west-northwest of SH-1. The site was selected to give additional information along the northern edge of the positive aeromagnetic anomaly and to provide more data to the west of SH-1 and SH-2. The hole was completed at 2148 feet in partially altered carbonaceous limestone, considered to belong to the middle member of the Etchart Limestone on the basis of the presence of black, fine grained limestone below 1800 feet. The general results of the drilling are as follows:

Hole:	DDH SH-4
Location:	Section 2, T39N, R42E
Collar Elevation:	5285'
Depth to Bedrock:	185'
Total Depth:	2148 '
Start: 10-25-76	Completion: 2-4-77

Average Assay Data in ppm:

Interval	Copper	Interval Molybdenum
0 - 185' 185' - 871' 871' - 974' 974' - 1273' 1273' - 1404' 1404' - 1442' 1442' - 1726' 1726' - 2148'	78 309 124 45 398 104 38	0 - 185' - 185' - 871' 4 871' - 1319' 23 1319' - 1497' 3 1497' - 1726' 18 1726' - 2148 7
Interval	Lead	Interval Zinc
0 - 185' 185' - 383' 383' - 2148'	10 15	0 - 185' - 185' - 1570' 62 1570' - 2148' 146

DISCUSSION

All of the geological, geochemical, and geophysical exploration to date have indicated that the Striped Hills prospect area is a locus of hydrothermal activity. Both the clastic rocks in the Farrel Canyon Formation and the carbonate rocks in the Etchart Limestone are altered and contain abundant sulfide minerals.

The diamond drilling has provided more suitable information about structure, stratigraphy, alteration, and metallization than was gained from the rotary drilling program. All four of the diamond drill holes encountered partially to wholly altered porphyry dikes or sills and prograde and retrograde silicate alteration in clastic and limy rocks. Numerous cross-cutting veinlets are found in all rock types, and minor skarn zones were encountered in holes SH-1, -2, and -3 with pyrite ± pyrrhotite and some base-metal sulfides.

Structural Relationships

Figure 20 is a perspective drawing of the diamond drill holes showing the mutual relationships of the thrust fault, stratigraphy, and base of alteration. A straight line from SH-3 to SH-4 serves as a base line for the figure. The plane of the Farrel Canyon thrust fault has a more northerly strike and a shallower dip than either the bedding in the Etchart Limestone or the plane of the base of alteration. Additionally, the plane of the base of alteration dips more steeply than the bedding in the Etchart Limestone. This relationship indicates that the alteration is not wholly controlled by the Farrel Canyon thrust fault, in spite of a significant tectonic thinning in SH-3 of the upper member of the Etchart Limestone. Even if about 1000 feet of the upper member had been present

in SH-3, the plane of the base of the alteration would show a more north-westerly strike than the thrust fault.

The ramifications of these structural relationships are as follows: (1) the source of the hydrothermal alteration is situated west-northwest of the exploration completed to date; (2) the location of the source is the primary control on the alteration pattern; (3) the bedding in the sediments is a secondary control on the alteration pattern; and, (4) the Farrel Canyon thrust fault is a secondary control on the alteration pattern.

The upper member of the Etchart Limestone in SH-3 is considerably thinner than in the other diamond drill holes due to a major post mineral fault. The trace of the fault is not readily discernible from surface outcrop. The ground magnetics data suggest a north-northeast structural trend. Linear topographic features and surface lithologic changes in the Farrel Canyon Formation indicate a northwest-trending fault may be the important structure. Whatever the trend, the fault truncates the alteration. Another fault in SH-3 separates the middle and lower members of the Etchart Limestone. This fault may parallel the other structure or may simply reflect movement along an lithologic boundary.

Spatial Relationships of Alteration and Metallization

The alteration, geochemistry, and geology encountered in the diamond drill holes and some of the rotary drill holes are shown on plates 11, 12, 13, and 14. The alteration information is from both megascopic and petrographic examination. It appears that the present erosion surface transects the upper portions of the hydrothermal system. The dipoledipole (a = 1000') induced polarization survey data corroborate this fact

in that the anomalous response zone plunges to the north and west, suggesting that the distal edges of the hydrothermal system are exposed in the southern and eastern portions of the prospect area.

Farrel Canyon Formation. The Farrel Canyon Formation was encountered in SH-3 and SH-4. Somewhat different lithologies were found in each hole rendering a comparision of the alteration difficult to interpret. Chert, chert breccia, and sandstone predominate in SH-3, whereas shale (now biotite-quartz hornfels), sandstone, chert, and marl (altered to calc-silicate hornfels) are more abundant in SH-4.

The sandstones in SH-3 contain fine-grained quartz and sericite as replacement minerals in the matrix around detrital quartz and feldspar. The original rock composition was probably argillaceous quartz arenite. Calcite is present in the matrix both as interstitial grains and outlining coarser quartz and/or feldspar grains. The larger grains of all minerals commonly have etched rims. Shaly zones in the sandstone contain clots of secondary(?) biotite apparent in hand specimen as darker bands. Additionally, biotite occurs in poorly developed selvages along quartz veinlets. Tremolite is common as dispersed grains throughout the shaly rocks, and particularly occurs as selvages along veinlets in the sandstones. In SH-4 the sandstone matrices appear to be more intensely altered to quartz and sericite, and tremolite is more abundant. Secondary biotite occurs primarily around detrital biotite grains.

In SH-3 the chert and chert breccia near the top of the hole contain secondary quartz and calcite alteration in the fine-grained areas between the ribbon-like chert beds. Tremolite is primarily restricted to fracture surfaces and quartz-calcite or calcite-pyrite veinlets. Garnet, tremolite,

actinolite, and minor epidote occur in the chert deeper in the hole. Biotite is not generally present until quite close to the Farrel Canyon thrust. The calc-silicate minerals may reflect zones in the chert that were originally limy. The alteration in the chert in SH-4 is similar to that in SH-3 with the fine-grained interchert beds consisting of recrystallized quartz, tremolite, and minor secondary biotite.

The total sulfur content in the Farrel Canyon Formation is markedly higher in SH-3 than in SH-4. Calculated as FeS_2 , SH-3 averages 2.6% sulfide (standard deviation = 1.0%) and SH-4 averages 1.0 (standard deviation = 0.7%). This difference may be (a) related to the overall distribution of sulfur in the hydrothermal system, or (b) reflect the fact that there is more sulfide of all origins in the cherty rocks and these types are predominant in SH-3.

Pyrite and pyrrhotite commonly occur together in the Farrel Canyon clastic sediments, frequently in association with hydrous silicate minerals. Pyrite occurs both as small disseminated silvery, subhedral grains and as elongate yellowish anhedral grains along bedding planes, fractures, or veinlets. Pyrite is much more abundant overall than pyrrhotite. The pyrrhotite usually occurs as large, elongate, anhedral grains. It is not intergrown with the pyrite, but the phases are occasionally contiguous. Where base metal sulfides occur with the pyrite, the iron sulfide often appears brecciated with galena and/or sphalerite filling interstices. Some of the sphalerite grains contain small blebs of galena, and some chalcopyrite grains occur along cracks and cleavage traces in the galena. Chalcopyrite is also associated with pyrrhotite as discrete disseminated grains. Arsenopyrite occurs infrequently, and is brecciated

with pyrrhotite filling selected cracks. Fine grained magnetite occurs locally as disseminated, anhedral grains.

Etchart Limestone. The Etchart Limestone was encountered in all four of the diamond drill holes. Each of these holes tested the upper and middle members, and SH-3 penetrated part of the lower member. Therefore, definite conclusions can be reached regarding alteration zoning.

The upper limestone member has undergone at least three periods of alteration. The earliest phase was a thermal metamorphism and magnesian metasomatism of the limestone to a mineral assemblage of quartz + pyroxene + calcite \pm biotite. Pyroxene was most extensively developed in the peripheral parts of the hydrothermal system where the activity of water was relatively lower. SH-1 and SH-2 encountered considerable sections of quartz-pyroxene hornfels in comparison to SH-3 and SH-4. During a second phase of alteration, selected beds underwent contact metasomatism resulting in a skarn assemblage of garnet + pyroxene + quartz + calcite \pm epidote. Pyrite and pyrrhotite were formed in both calc-silicate and skarn alteration. The third phase of alteration consisted of the development of several sets of veinlets:

- 1. Quartz + pyrite ± pyrrhotite
- 2. Quartz + K-feldspar + pyrite ± pyrrhotite
- 3. Quartz + calcite ± tremolite ± sericite + pyrite
- 4. Calcite + pyrite
- 5. Calcite ± chlorite

The formation of these veinlets was accompanied by the development of hydrous calc-silicate minerals such as tremolite and actinolite, partially

as retrograde alteration products of prograde calc-silicates.

SH-1 and SH-2 show about the same degree of calc-silicate alteration. The rock contains two ages of quartz grains, one detrital (10-30%) and the other hydrothermal. The rock is composed of 40-50% quartz, 20-30% pyroxene, and 20-40% calcite. Away from the skarn zones garnet, where present, is generally less than 1%. It often occurs with pyroxene along selected sedimentary lamellae. Tremolite occurs occasionally, and is more abundant in SH-2 than in SH-1. The tremolite generally occurs in selvages along quartz-calcite veinlets; but, it also occurs as pseudomorphic mattes after garnet and/or pyroxene.

SH-3 and SH-4 encountered significantly less pyroxene and more tremolite than either SH-1 or SH-2. Additionally, there appears to be a greater amount of amphibole in SH-4 than in SH-3. Tremolite occurs with quartz and calcite throughout the rock as well as along veinlets, especially in poorly developed selvages. There appears to be a distinct association of calcite, tremolite, and pyrite. Garnet occurs infrequently as scattered grains, and green garnet was observed along a calcite veinlet. The hydrous silicate alteration does not appear to be directly related to the Farrel Canyon thrust fault, although the extent of hydrous alteration does decrease in the lowest 400-500 feet of SH-4. In this interval, the tremolite occurs with calcite along veinlets.

Sparse to numerous silicate and/or carbonate sulfide-bearing vein-lets cross-cut the core from all of the diamond drill holes; the veinlets transect all rock types in the prospect area. The veinlets show a complex sequence of formation (refer to list on previous page). The veinlets seldom follow bedding. The edges tend to be sharp, and are not always

marked by well developed selvages. The selvages generally consist of quartz or quartz + calcite ± tremolite.

Pyrite is the predominant iron sulfide phase in the Etchart Limestone, although pyrrhotite does occur. It appears that there is more pyrrhotite higher in the section than in the deeper parts of the drill hole. The disseminated pyrite is generally subhedral and fine-grained. Veinlet sulfides are normally elongate. The total sulfur content (calculated as FeS_2) for the altered upper member of the formation is higher in SH-1 -2, and -3 than in SH-4. SH-1 averages 1.5% (standard deviation = 2.2%), SH-2 averages 1.9% (standard deviation = 1.8%), SH-3 averages 2.2% (standard deviation = 4.2%), and SH-4 averages (to 1500 feet) 1.2% (standard deviation = 0.8%). The higher values occur in holes with a large variance. The middle member of the formation was encountered in SH-1 and SH-3 and contained 2.1% (standard deviation = 1.7%) sulfide and 2.3% (standard deviation = 1.1%) sulfide, respectively. The lower limestone member was encountered in SH-3, and the sulfide averaged 0.7% (standard deviation = 0.6%).

Molybdenite and chalcopyrite commonly occur along quartz veinlets in DDH SH-1 and SH-2. Sphalerite and galena occur in all four diamond drill holes. Except in SH-4, no base-metal sulfides were recognized stratigraphically below the upper limestone member. The rationof base metal sulfides to total sulfide is not known.

Quartz Monzonite. Medium to coarse grained quartz monzonite dikes or sills occur in all four diamond drill holes. The degree of alteration of the dikes is highly variable, although as a general rule the dikes in SH-3 and SH-4 are more highly altered than those in SH-1 and SH-2. In

SH-1 there are seven porphyritic dikes ranging in apparent thickness from two to 30 feet, and several minor occurrences of quartz monzonite mixed with quartz-pyroxene hornfels. The dikes display slight to moderate sericitic alteration of plagioclase and biotite. Garnet (1-5%) and calcite are disseminated throughout some dikes. Epidote and pyroxene occur along some veinlets. Molybdenite and rare chalcopyrite occur along quartz-pyrite-pyrrhotite veinlets. In SH-3 there are three dikes ranging in apparent thickness from three feet to 110 feet. Two phases of quartz monzonite are evident at the top of the hole. One is equigranular with biotite grains weakly altered to sericite + chlorite. Interstitial calcite is common and garnet and epidote occur as sporadic grains. The other phase is porphyritic. The quartz monzonite porphyry contains weak sericitic alteration, calcite, and minor epidote. Minor disseminated molybdenite and chalcopyrite occur in the more altered portions of the rock. Tremolite occurs as a replacement of plagioclase in shattered portions of the rock. In SH-3 two moderate to strongly altered porphyritic dikes occur with biotite and hornblende altered to sericite + chlorite ± rutile, with quartz, sericite, and calcite in the groundmass, and somewhat cloudy to strongly altered plagioclase due to sericite with slightly albitized rims. Ten porphyritic dikes were encountered in SH-4 ranging in thickness from three to 92 feet. Alteration varies from weak to strong. The cores of plagioclase grains are sericitized, and biotite shows slight to complete alteration to sericite ± chlorite ± rutile. Calcite is common as an interstitial mineral. Apatite is a common accessory mineral and appears in part to be secondary.

Pyrite (and some pyrrhotite) is ubiquitous. The total sulfide content

in SH-2 (calculated as FeS_2) of the 234 feet of quartz monzonite and quartz monzonite portion encountered at the top of the hole is 1.7% (standard deviation = 0.3%). The thickest dike in SH-4 (875' - 967') averages 1.8% (standard deviation = 0.6%) sulfide.

Intrusive contacts are well established in DDH SH-3 and SH-4. The contacts are flat or roughly parallel to bedding in hornfels indicating that the dike swarm in the prospect area is more sill-like.

Geochemical Relationships

Geochemical trends in the drill-hole assay data are poorly defined, but there does appear to be a general zoning pattern. The following table gives average assay data from the altered portions of the upper member of the Etchart Limestone arranged in general order from west to east:

Drill Hole #:	SH-4	SH-3	SH-2	SH-1	74-3	74-1	74-2
Element (ppm)							
Copper	140	159	224	135	248	55	58
Molybdenum	18	21	23	23	23	8	5
Lead	15	22	24	13	6	40	81
Zinc	100	40.*	69	69**	107	445	142
Manganese	407	717	604	565	_	-	_

^{*}Excepting interval from 613' - 679' which averages 0.33% **Excepting interval from 574' - 592' which averages 0.22%

Zinc and lead are most abundant near the eastern and southern edges of the zone of alteration. The only notable exceptions are DDH SH-1 and DDH SH-3. DDH SH-1 contains abundant zinc adjacent to the contact between the upper and middle members of the Etchart Limestone, and DDH SH-3 contains abundant

zinc immediately below the Farrel Canyon thrust fault in the upper member of the Etchart Limestone. The middle member is always enriched in zinc where it is unaltered or only weakly altered. Copper and molybdenum increase significantly to the west away from the distal eastern boundary of alteration, but do not show a definite pattern within the area containing the higher values. Manganese shows no overall pattern.

Geochemical data from two quartz monzonite dikes are shown in the following table arranged from west to east:

Drill Hole #:	SH-4	<u>SH-2</u>	<u>SH-1</u>
Element (ppm)			
Copper	309	167	98
Molybdenum	8	8	8
Lead	19	11	20
Zinc	55	21	75
Manganese	380	*	290

*No data available

Any interpretation of trends is tenuous, although there appears to be a general increase in copper content from east to west. This may be related to the increase in intensity of alteration mentioned previously.

Semi-quantitative emission spectrographic analyses were obtained on 100 composites from DDH SH-1 to SH-4. Each composite represents approximately 50 feet of drill core. The geometric means for selected trace elements are shown in the following table:

A. Farrel Canyon Formation

	Element (ppm	<u>SH-1</u>	<u>SH-2</u>	<u>SH-3</u>	<u>SH-4</u>
	Boron Barium Chromium Nickel Strontium Titanium Vanadium Zirconium			24 3199 82 41 107 1543 98 67	34 2487 123 37 142 1917 112 58
В.	Etchart Limestone	(upper member)			
	Boron Barium Chromium Nickel Strontium Titanium Vanadium Zirconium	22 224 195 59 165 1213 54 71	12 675 105 34 241 1471 66 64	12 1109 156 65 109 1012 64 91	24 481 216 49 236 1150 54 64
С.	Etchart Limestone	(middle member	^)		
	Element (ppm	<u>SH-1</u> *	<u>SH-2</u>	<u>SH-3</u> *	SH-4**
	Boron Barium Chromium Nickel Strontium Titanium Vanadium Zirconium	46 200 331 76 82 1431 61 76		52 213 150 48 93 1285 56 70	12 341 154 54 240 1442 45 75
D.	Etchart Limestone	(lower member))	*	
	Boron Barium Chromium Nickel Strontium Titanium Vanadium Zirconium			31 163 111 22 241 995 40	

*Unaltered

Zirconium

**Partially altered

54

Distinct trends are difficult to discern. Titanium is lower in the upper member of the Etchart Limestone in SH-3 and SH-4 than in SH-1 and SH-2. North-south trends in the upper member of the Etchart Limestone are possibly better developed with the increase of barium and vanadium from north to south and the decrease of boron and chromium from north to south. Nickel, strontium, titanium, and zirconium are erratically distributed in a north-south sense. If the geochemical data from the unaltered lower member of the Etchart Limestone in SH-3 represent a background, then barium, chromium, nickel, titanium, vanadium, and zirconium are enriched in the altered upper member limestone; boron is depleted; and, strontium shows a slight tendency towards depletion.

The altered Farrel Canyon Formation is enriched in boron, barium, titanium, and vanadium relative to the altered Etchart Limestone and is relatively depleted in chromium, nickel, strontium, and zirconium.

Arsenic is present in amounts exceeding 500 ppm in only a few samples, but it is definitely more abundant in SH-4 than in any other diamond drill hole. Bismuth and tin are less than the detection level of 10 ppm and tungsten less than 50 ppm in all of the composites.

Semiquantitative emission spectrographic data (arithmetic means) for iron, calcium, and magnesium are shown in the following table:

A. Farrel Canyon Formation

Drill Hole #:	<u>SH-1</u>	SH-2	SH-3	SH-4
Element (%)				
Iron Calcium Magnesium			5 1 1	0.7 1

B. Etchart Limestone (upper member)

		Drill Hole #:	•	<u>SH-1</u>	SH-2	<u>SH-3</u>	SH-4
		Element (%)					
		Iron Calcium Magnesium		3 5 2	4 6 2	3 8 4	3 8 2
С.	Etcha	rt Limestone ((middle	e member)		
		Iron Calcium Magnesium		3 4 2		2 4 2	3 11 2
D.	Etcha	rt Limestone	(lower	member)			
		Iron Calcium Magnesium				2 12 2	

The only significant variation in the altered upper member of the Etchart Limestone is found with calcium which increases from east to west, probably reflecting the greater volume of marble in SH-3 and SH-4. Both magnesium and iron are uniformly distributed.

The Farrel Canyon Formation is enriched in iron relative to the Etchart Limestone and depleted in calcium and magnesium.

INTERPRETATION

The Striped Hills prospect is located on a very large sulfide system which is hypothesized to be centered from 2000 to 4000 feet below the surface and west of the completed exploration efforts based on geological considerations and geophysical data. Hydrous retrograde alteration with associated chalcopyrite and molybdenite metallization indicate that the system has economic potential. Slightly to moderately altered porphyritic dikes or sills associated with the pervasive hydrothermal alteration stage

indicate the possible presence of a more massive mineralized body at depth.

Taylor (1976) studied the skarn in the main part of the Osgood Mountains and made several interesting observations. He noted that the skarns show preferential replacement of selected beds within all rock types encountered; i.e., not just the limestone, but also within hornfels and argillite. The amount of carbonate is considered an important factor. Three stages of formation of mineral assemblages were observed: (1) predominantly garnet with lesser amounts of pyroxene and accessory apatite, sphene, and pyrite; (2) stage 1 minerals are hydrated and carbonated with the development of the phases quartz, plagioclase, amphibole, epidote, sphene, calcite, and magnetite - quartz, amphibole, and calcite being the most abundant minerals; and (3) calcite predominates as the final stage mineral accompanied by chlorite and sulfide minerals.

The alteration sequence in the Striped Hills prospect area is similar, though there appear to be some significant differences. First, the Striped Hills alteration is much more widespread, and was preceded by a major magnesian metasomatic event. Second, the area was much more extensively fractured with the resultant development of numerous veinlets and breccia zones (e.g. annealed breccias and shattered sulfides along veinlets). Third, the deposition of sulfides took place over a longer time period and was not restricted to the retrograde alteration stage.

Evidence from productive skarns in porphyry copper deposits suggest that there are several critical factors in the development of ore. In general the following events occurred at various deposits: (1) early magnesium metasomatism of host sedimentary rock types with the development of the mineral assemblage quartz + diopside \pm phlogopite; (2) iron

metasomatism followed with the development of garnet and/or actinolite + tremolite ± epidote; and, (3) the argillic alteration of earlier formed calc-silicate minerals. Einaudi (pers. comm., 1976) considers these events to be sequential stages in an evolving hydrothermal system. Einaudi (1975) and Taylor (1976) do not consider temperature to be the important factor between these different stages. Sulfide deposition at Bingham Canyon (Reid, 1975) and Carr Fork (Einaudi, 1975) either accompanied or followed the iron metasomatism. Observations by the present author from rocks collected at Ely, Bingham, Pima, and Misson corroborate the spatial relationship of sulfides to the crystallization of hydrous calcsilicate minerals. Late stage argillic alteration does not appear to be a critical factor in all skarn deposits. Likewise, although actinolite is present at most deposits the Copper Canyon skarns are more characterized by tremolite (Theodore and Black, 1975). Einaudi (1975) reports that the Carr Fork actinolite contains about 29% of the ferrotremolite molecule.

In summary, the positive and negative aspects of the prosepct are as follows:

Positive Aspects

- (1) The hydrothermal system was large with minimum dimensions of 5400 feet by 4000 feet based on geological and geophysical evidence;
- (2) Sulfides were deposited by the system including pyrite, and pyrrhotite, with minor amounts of molybdenite, chalcopyrite, galena, and sphalerite;
- (3) Moderately altered (quartz-sericite-chlorite-calcite-pyrite) quartz monzonite porphyry dikes are abundant throughout the

most intensely altered area;

- (4) The host sedimentary rocks are calc-silicated (hydrous and anhydrous); and,
- (5) Numerous veinlets of several generations indicate the widespread, complex fracturing of all rock types.

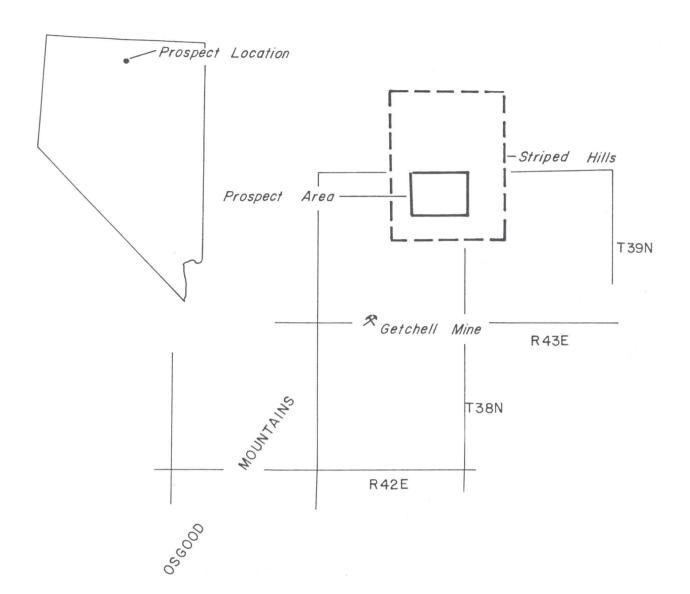
Negative Aspects

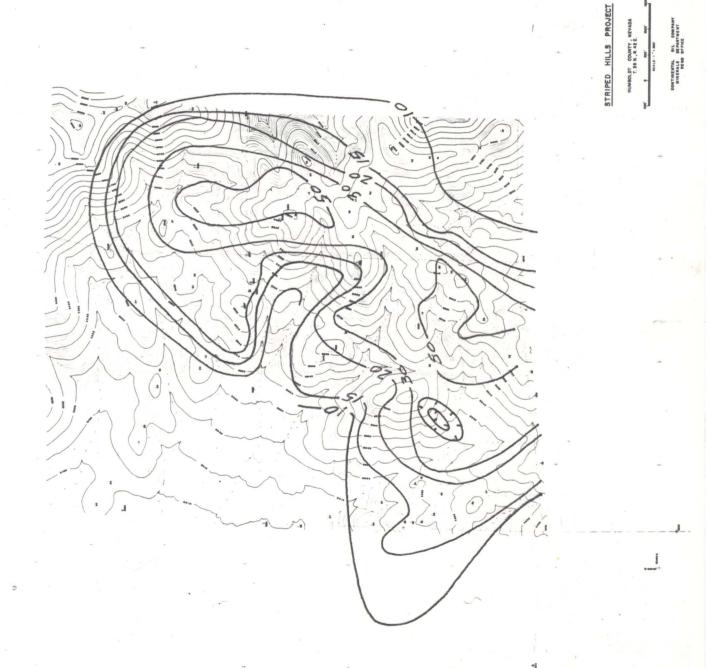
- (1) The system is deeply buried;
- (2) Only minor thicknesses of skarn with low base metal contents have been found to date; and,
- (3) No core intrusion has been identified to date.

At this stage of exploration, the positive aspects of the prospect outweigh the negative aspects. Additional exploration is needed to fully evaluate the economic potential of the Striped Hills region.

REFERENCES CITED

- Berger, B. R., 1975, Summary of exploration, Striped Hills Project, Humboldt County, Nevada: private report for Continental Oil Company.
- Berger, B. R., and Brewer, W., 1974, Striped Hills report of property examination: private report for Continental Oil Company, 4 p.
- Einaudi, M., 1975, Iron metasomatism of sedimentary rocks near the Bingham stock, in Guidebook to the Bingham mining district, R. E. Bray and J. E. Wilson, eidotrs: Soc. Econ. Geologists, p. 135-139.
- Ferguson, H. G., Roberts, R. J., and Muller, S. W., 1952, Geology of the Golconda quadrangle, Nevada: U. S. Geol. Survey Geol. Quad. Map GQ-15.
- Hotz, P. E., and Willden, R., 1964, Geology and mineral deposits of the Osgood Mountains quadrangle, Humboldt County, Nevada: U. S. Geol. Survey Prof. Paper 431, 132 p.
- Miller, D. E., Bahjat, D., and Chapman, W. L., 1974, Preliminary results of initial gradient array test Striped Hills prospect, Humboldt County, Nevada: Continental Oil Company research report no. 1204-2-3-74.
- Reid, J., 1975, Skarn alteration of the Commercial Limestone in the Carr Fork area, in Guidebook to the Bingham mining district, R. E. Bray and J. C. Wilson, editors: Soc. Econ. Geologists, p. 105-118.
- Roberts, R. J., 1951, Geology of the Antler Peak quadrangle, Nevada: U. S. Geol. Survey Geol. Quad. Map GQ-10.
- Roberts, R. J., Hotz, P. E., Gilluly, James, and Ferguson, H. G., 1958, Paleozoic rocks of north-central Nevada: Am. Assoc. Petroleum Geologists Bull., v. 42, no. 12, p. 2813-2857.
- Sadowski, R. M., 1974, Striped Hills project geophysical report: private report for Continental Oil Company, December, 3p.
- Simmons, R., 1975, Striped Hills ground mag interpretation: private report for Continental Oil Company, 1 p.
- _____, 1977, Striped Hills mag interpretation: private report for Continental Oil Company, February, 1 p.
- Taylor, B. E., 1976, Origin and significance of C-O-H fluids in the formation of Ca-Fe-Si skarn, Osgood Mountains, Humboldt County, Nevada: unpublished Ph.D. dissertation, Stanford University, 285 p.
- Theodore, T. G., and Blake, D. W., 1975, Petrochemistry of skarn in the Copper Canyon porphyry copper deposits, Lander County, Nevada: U. S. Geol. Survey Open-file Report No. 75-593, 14p.





CL of CL of



Figure 5
Resistivity (n=2)

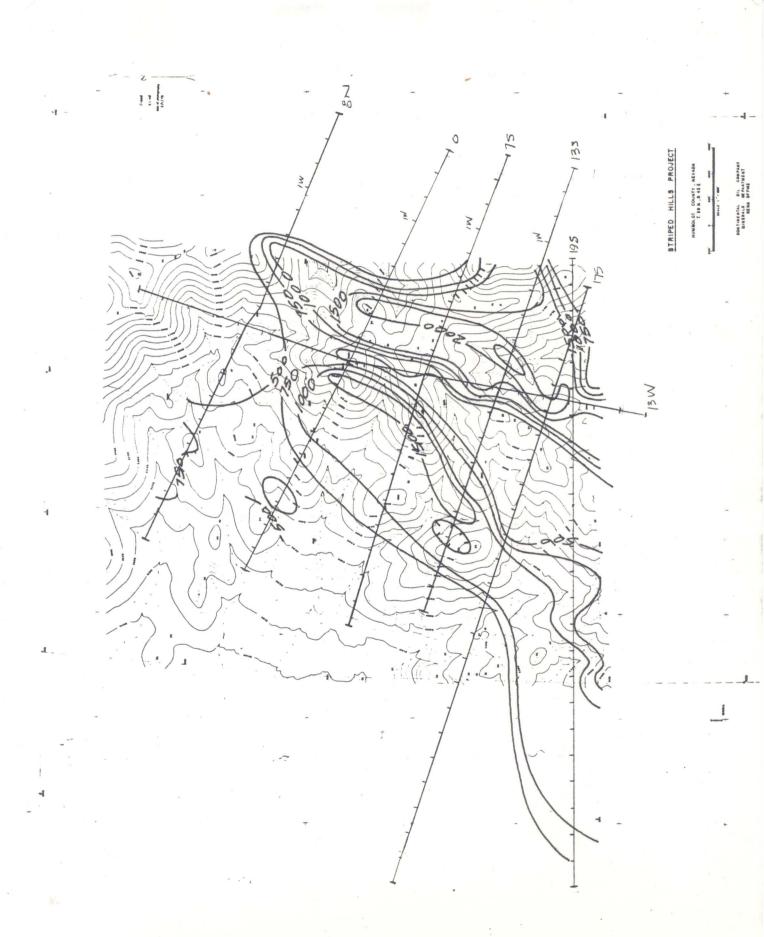
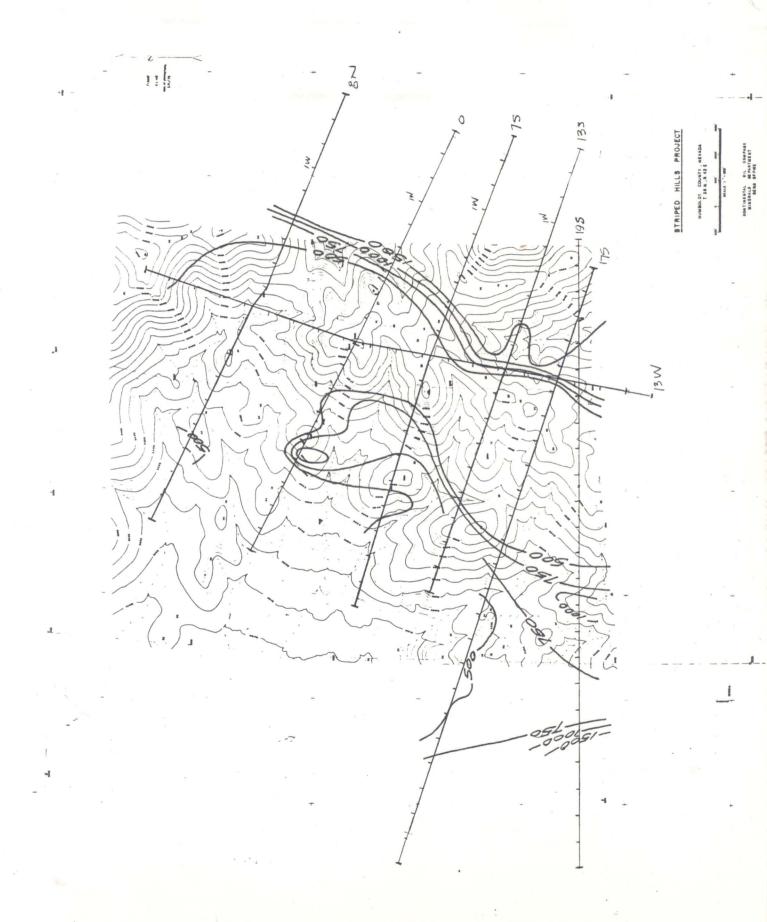
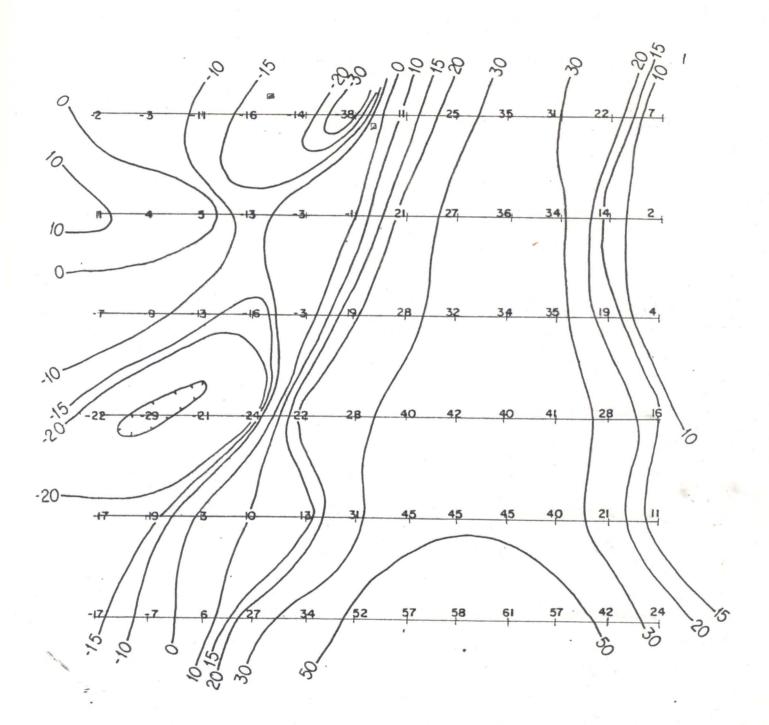
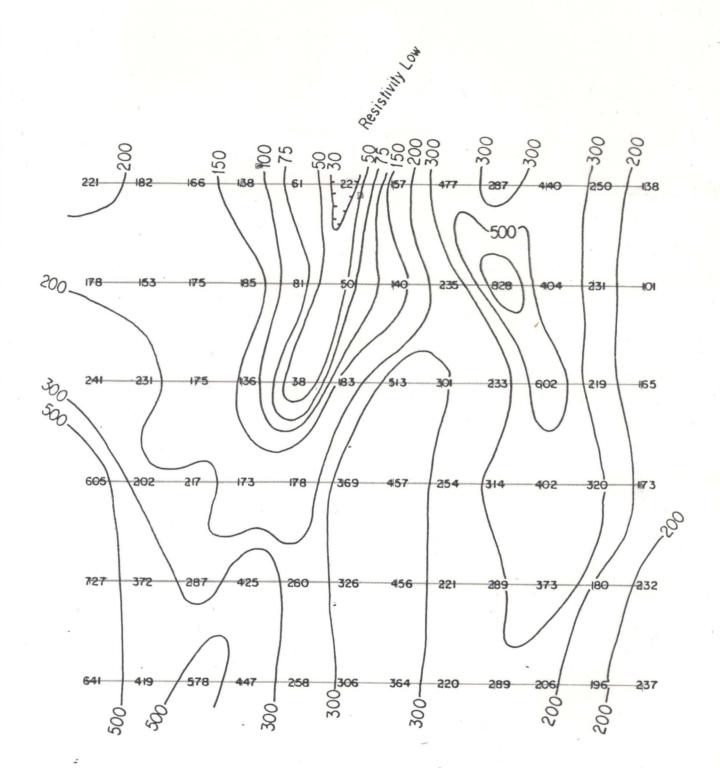


Figure 6
Resistivity (n=4)





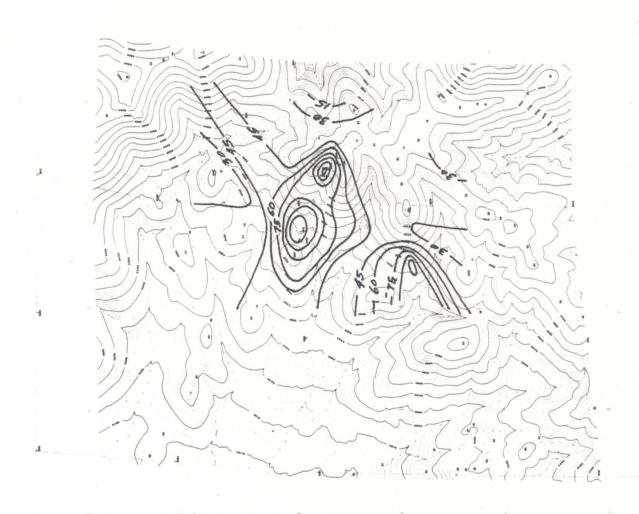
GRADIENT ARRAY PHASE ANGLES, STRIPED HILLS PROSPECT.



GRADIENT ARRAY RESISTIVITIES, 0.1 Hz. STRIPED HILLS PROSPECT, Sept., 1974

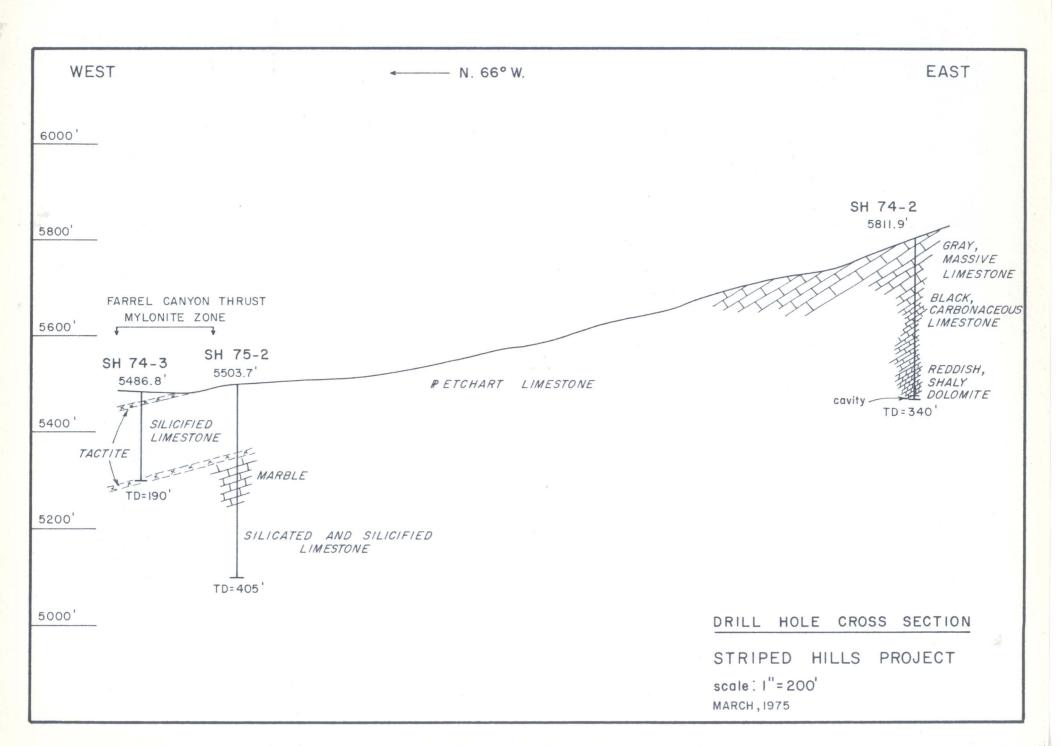
Figure 9

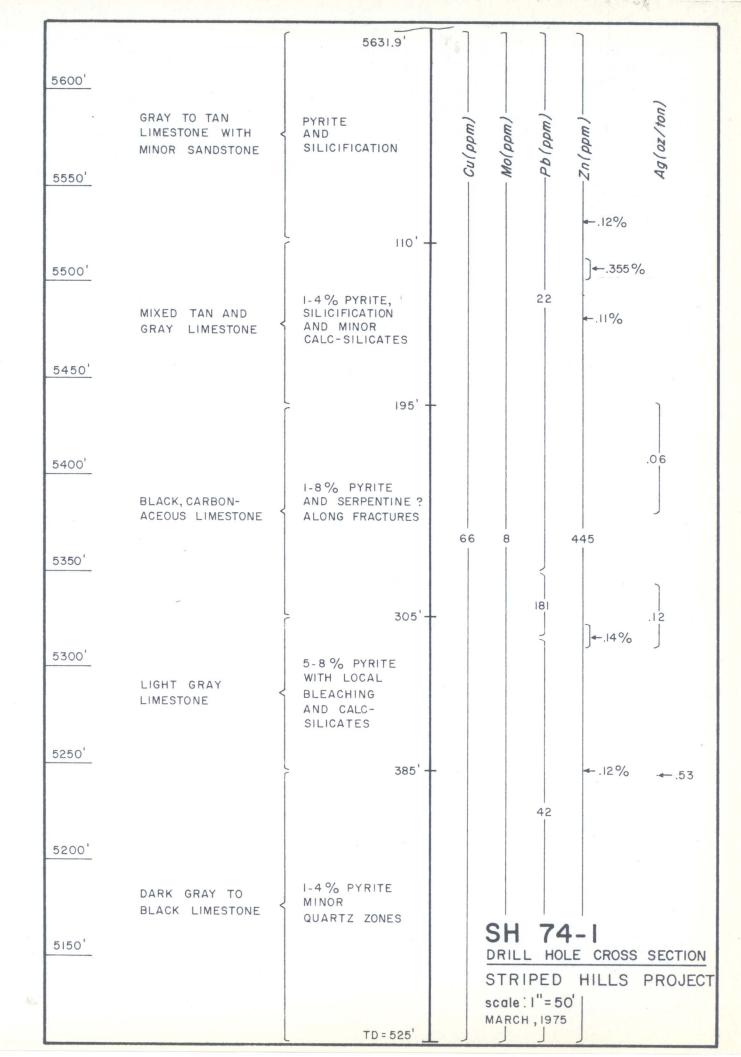
Geochemical Survey
Copper

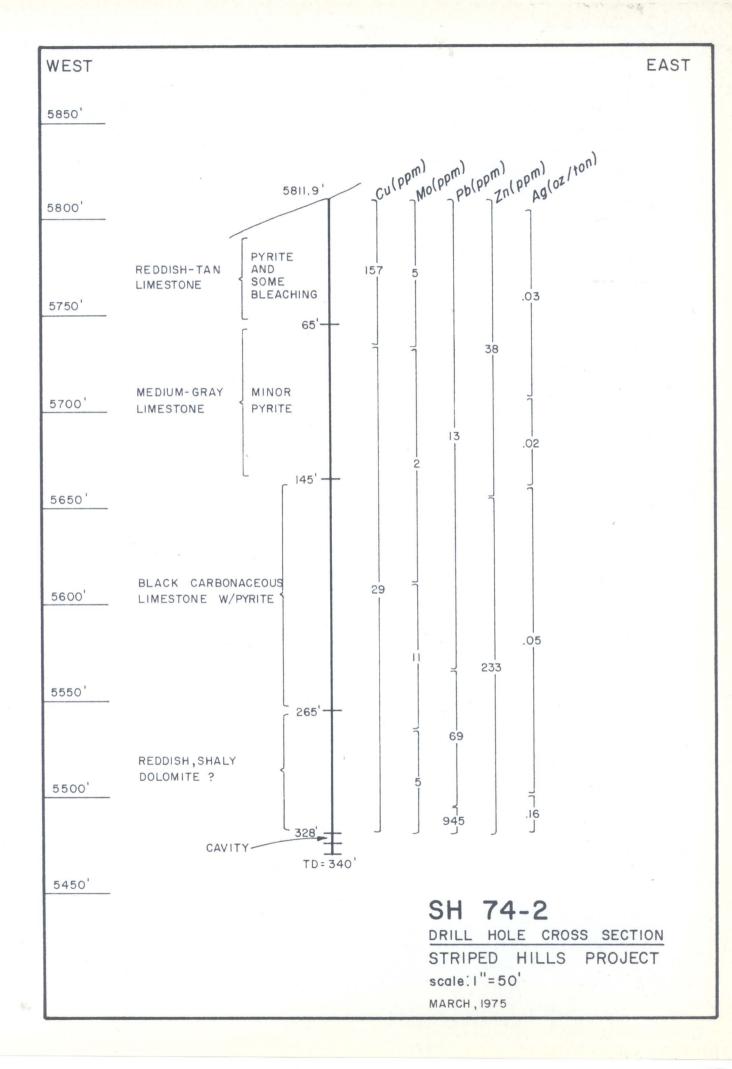


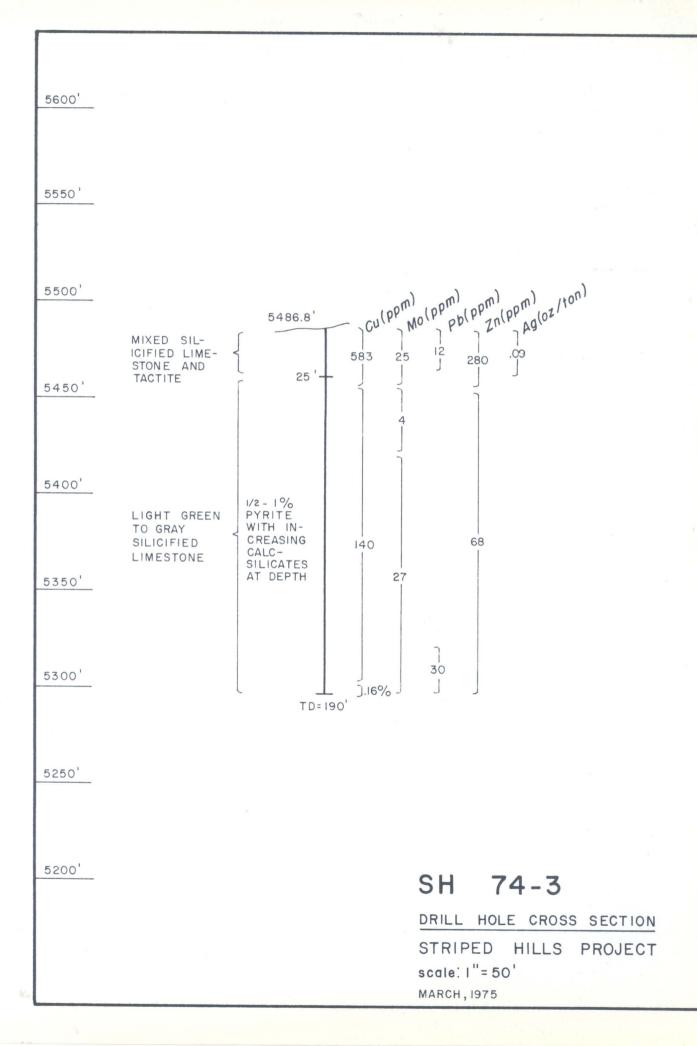
BATUS DOSAU

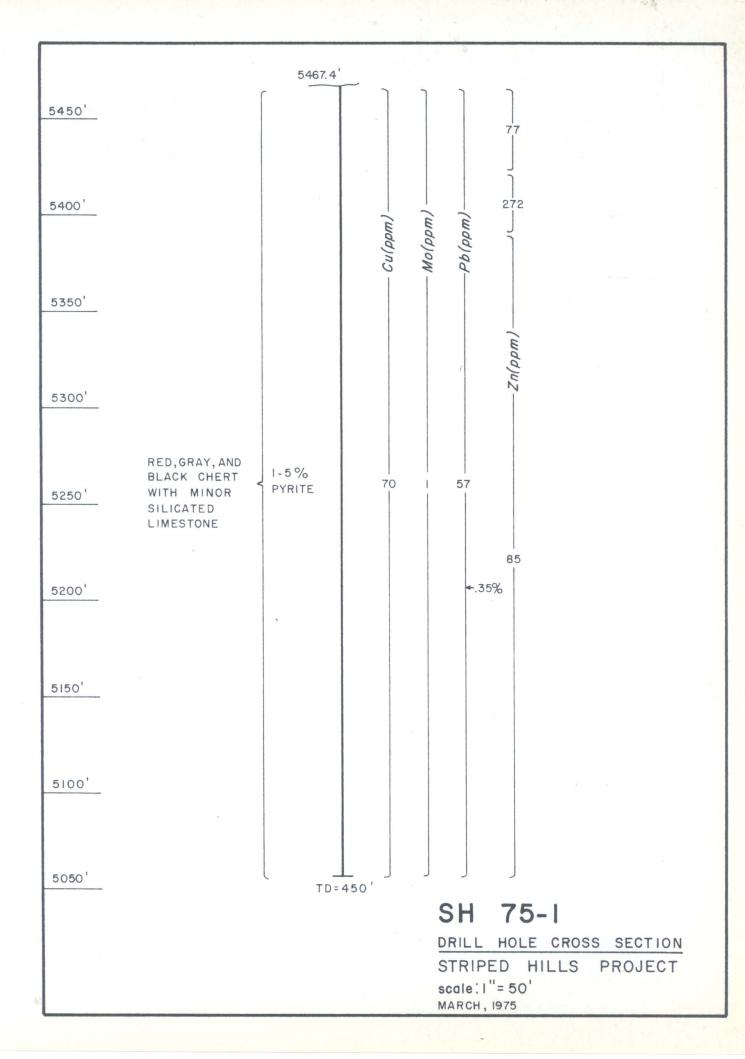
47,000 E.	48.000 F		49,000 E.	50,000 E.	
		74-3 075-2 5503.7'			50,000 N.
				74-2 ⊙ 58//.9′	49,000 N.
75-1 © 5467.4'					19,000 11.
					48,000 N.
	74-1 © 5631.9'				47,000 N.
		ST sca		OCATION MAP S PROJECT	
*/_		MIN	IERALS DEPART IO OFFICE		

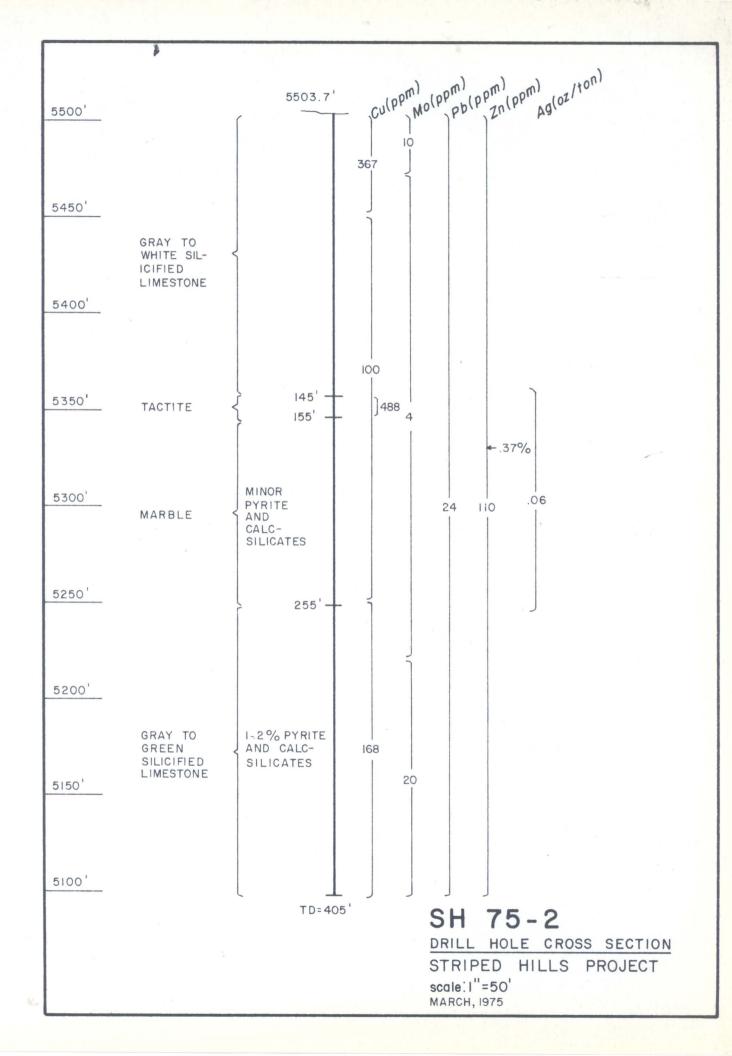


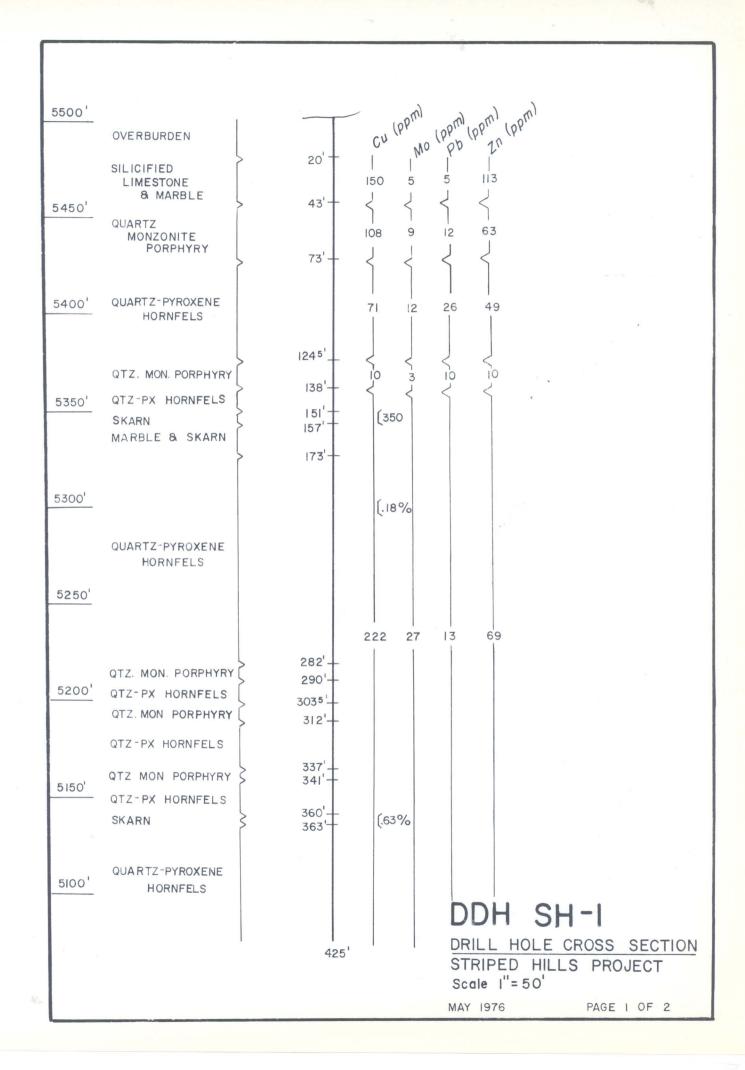


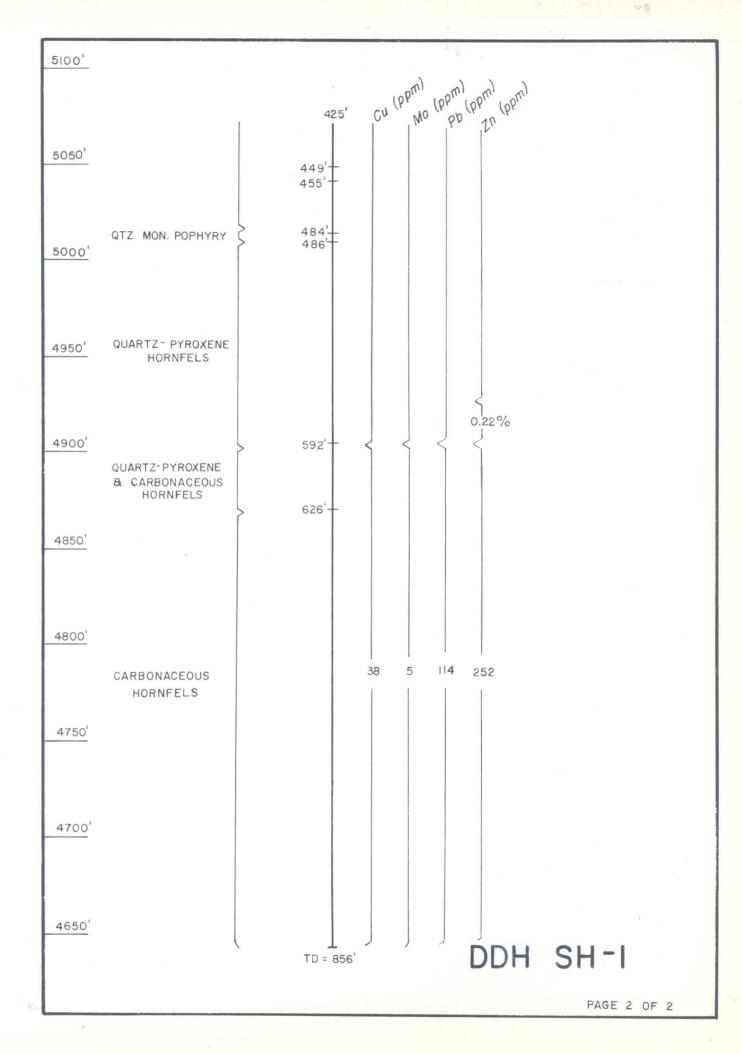


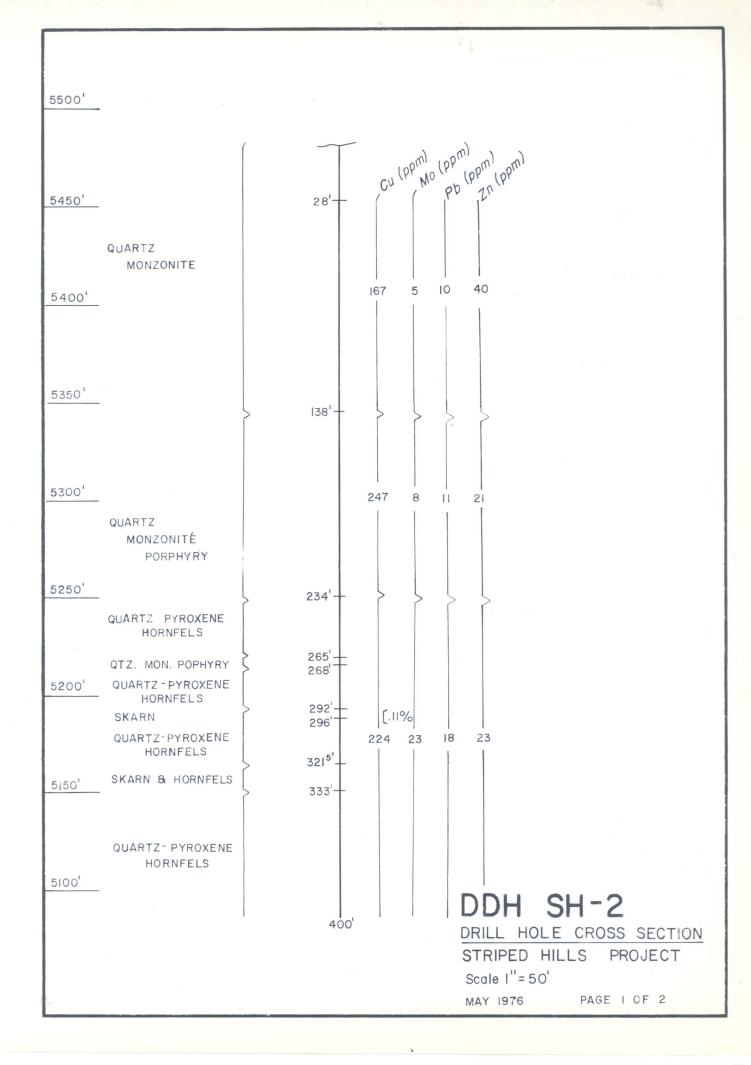


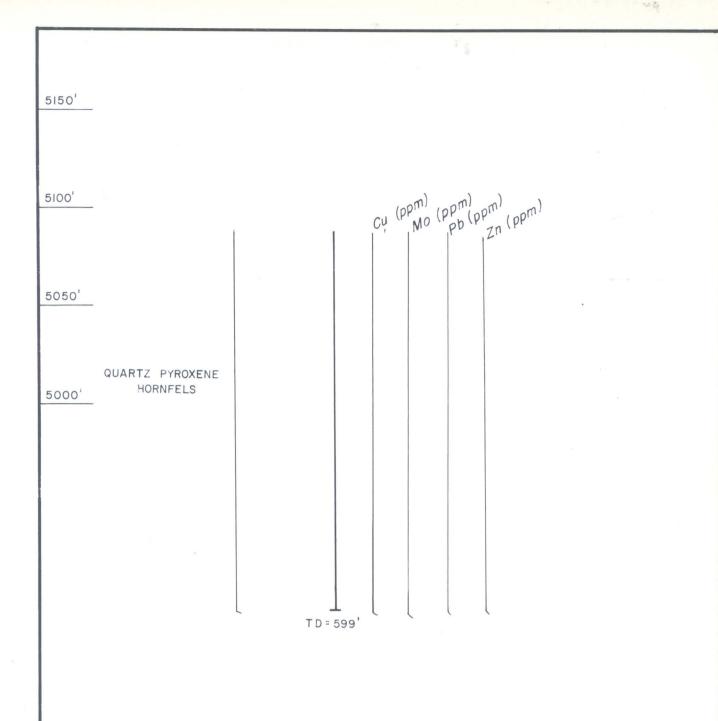


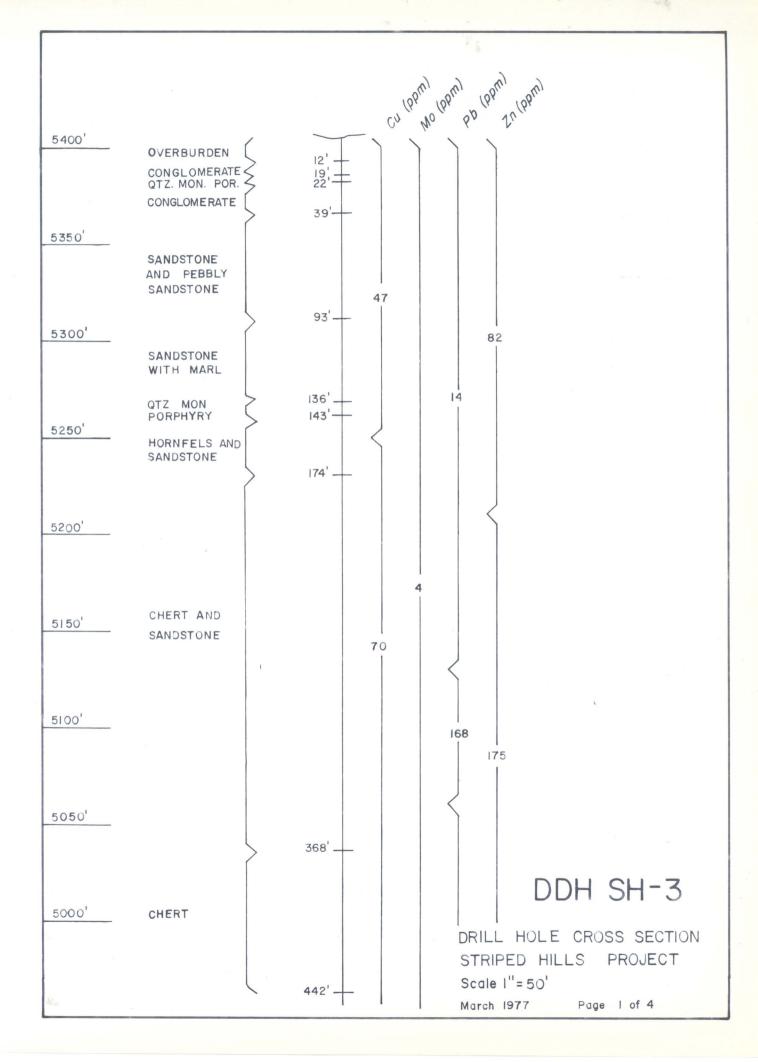


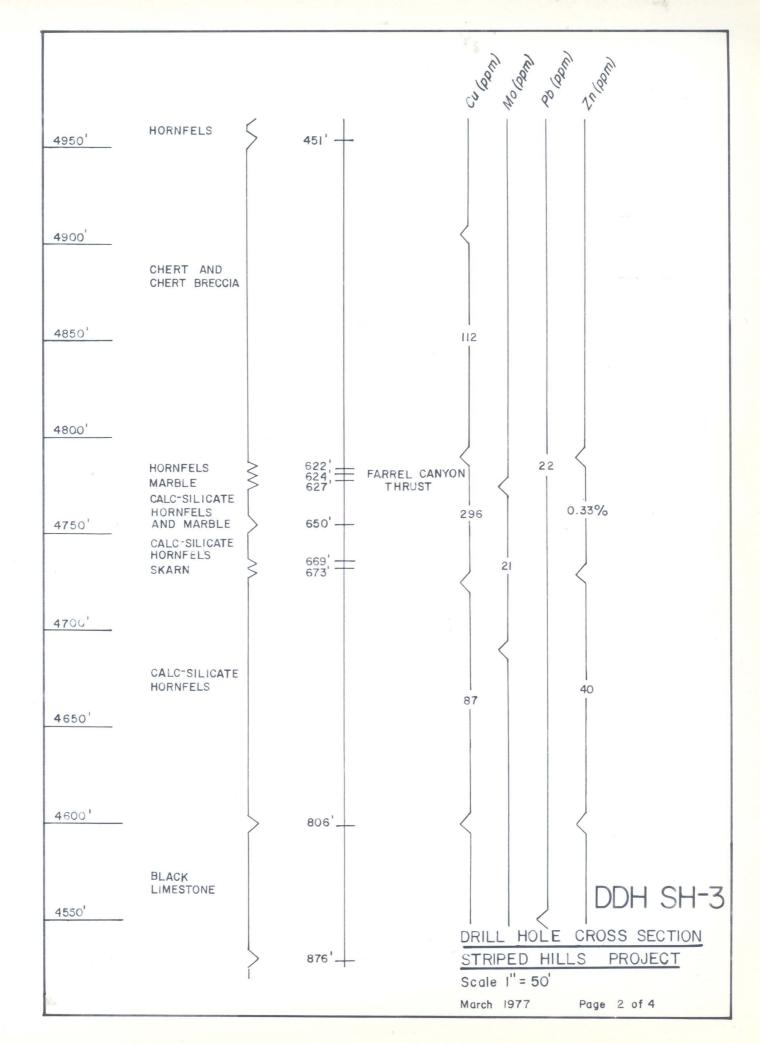


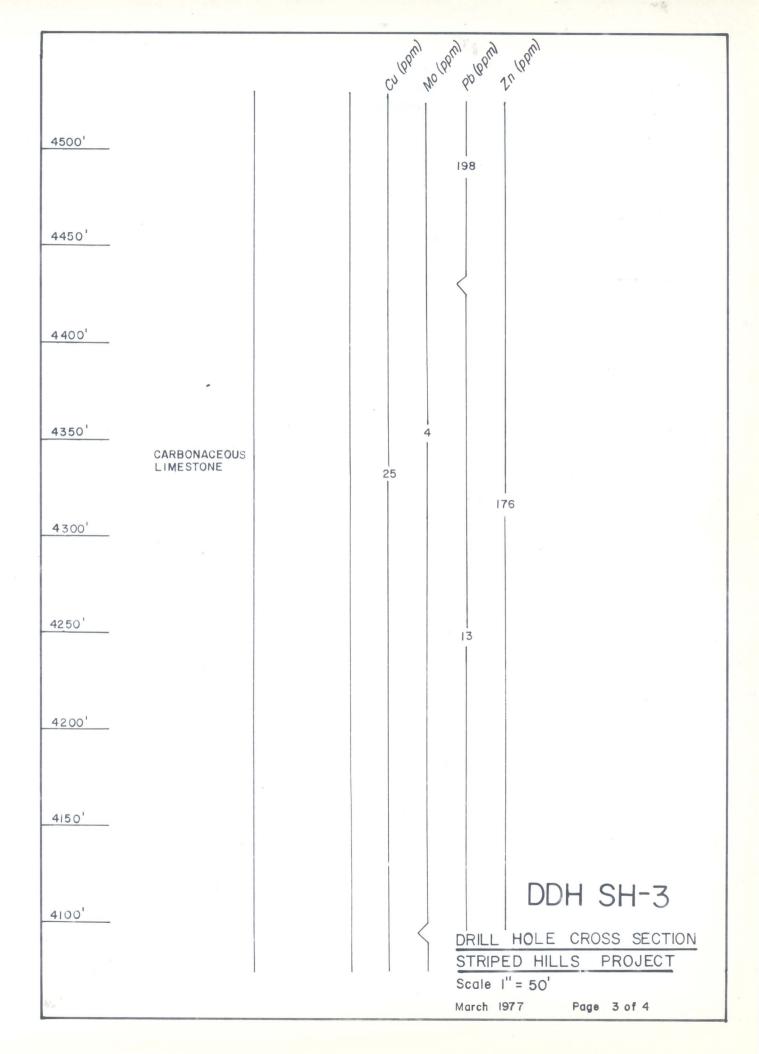


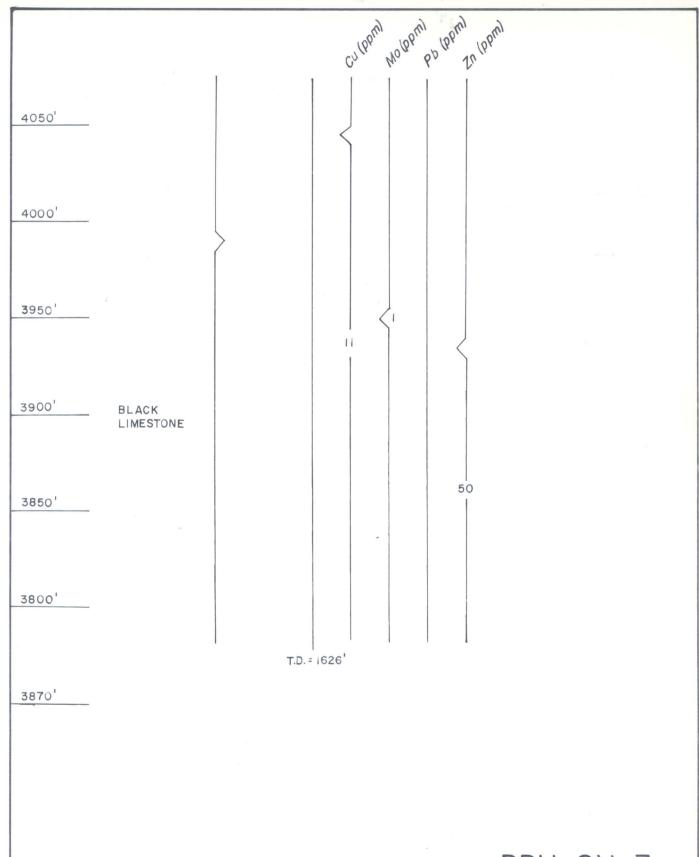








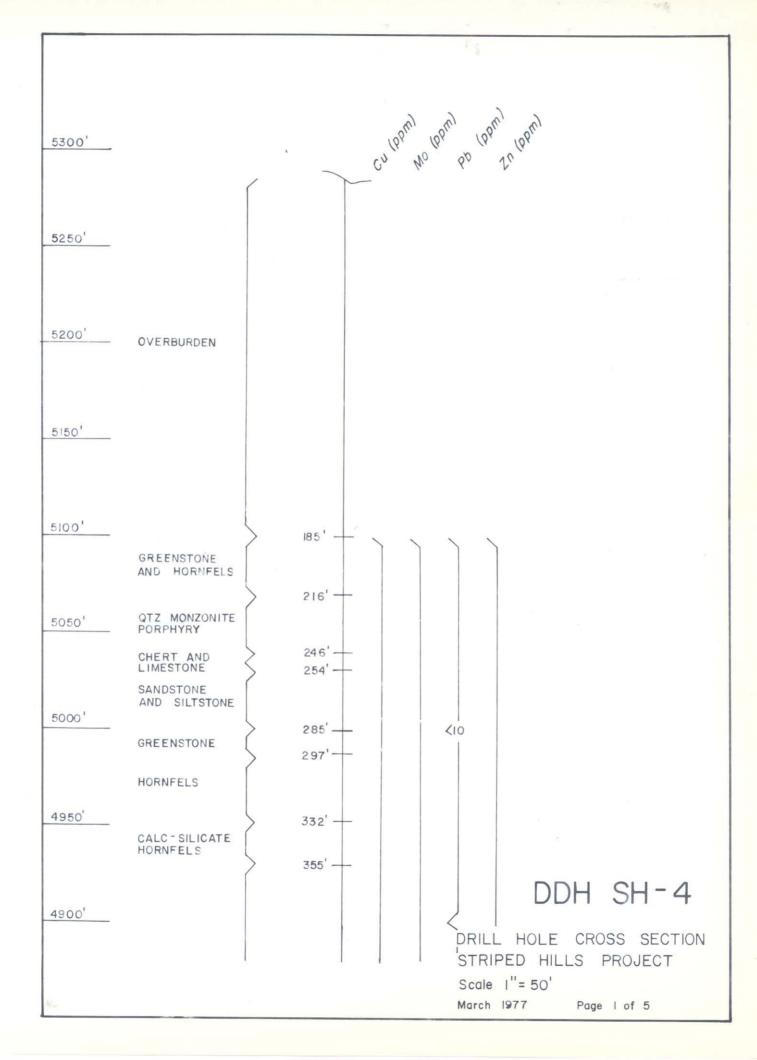


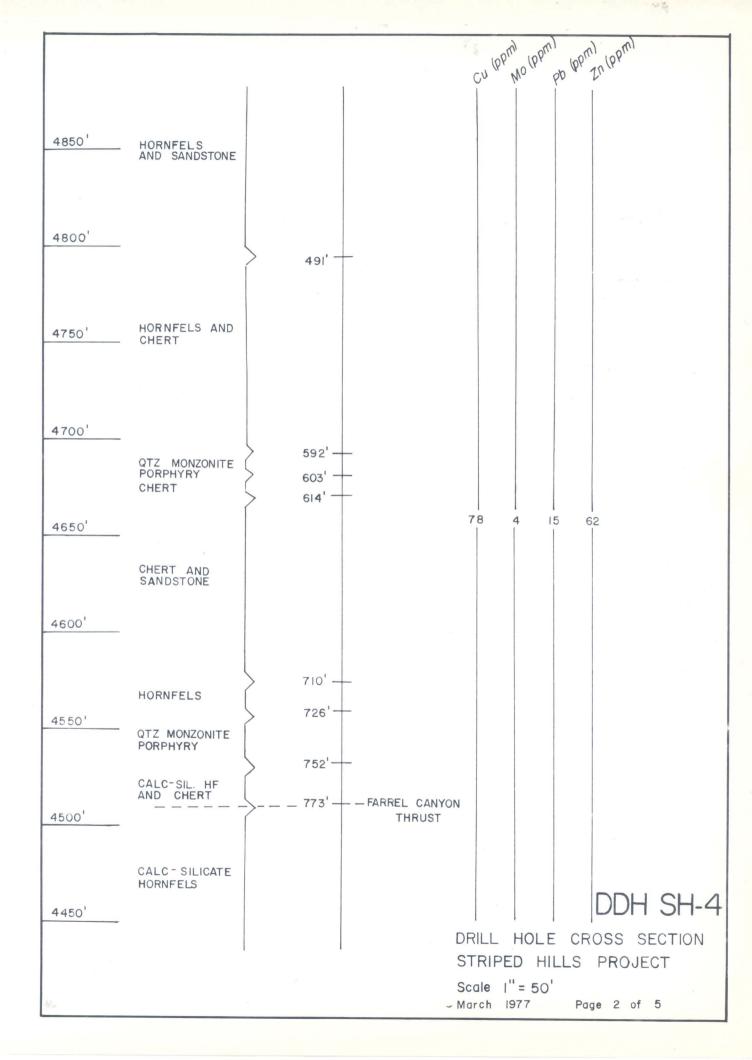


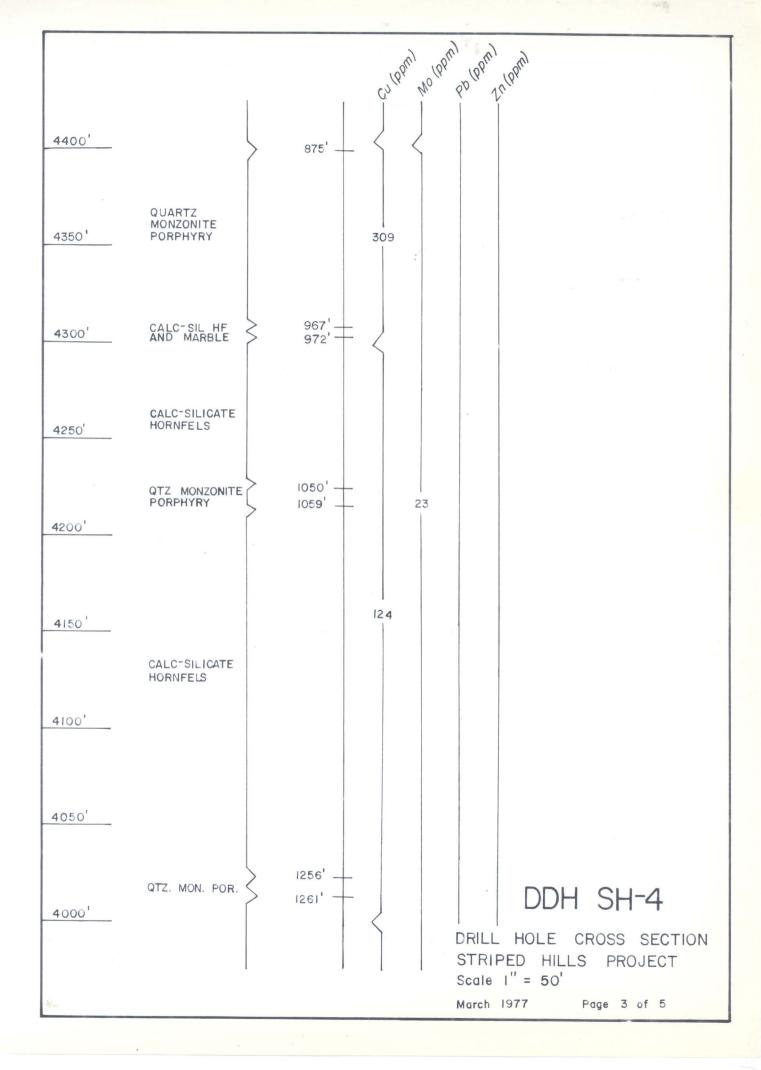
DDH SH-3

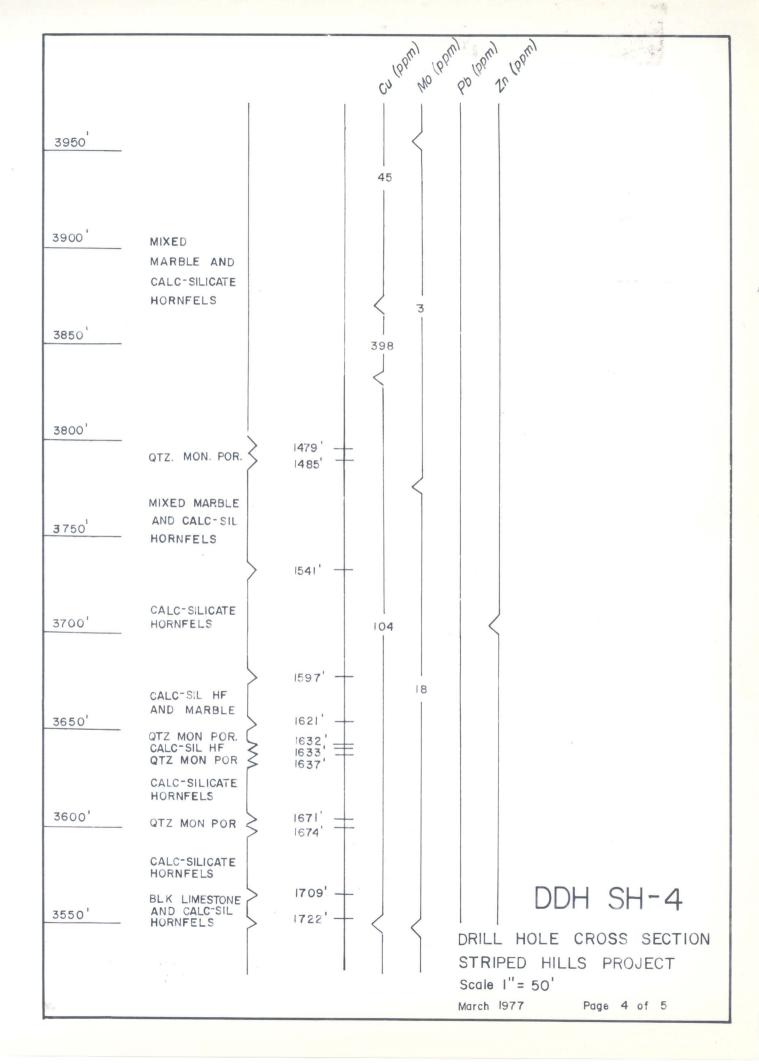
DRILL HOLE CROSS SECTION STRIPED HILLS PROJECT Scale |"= 50"

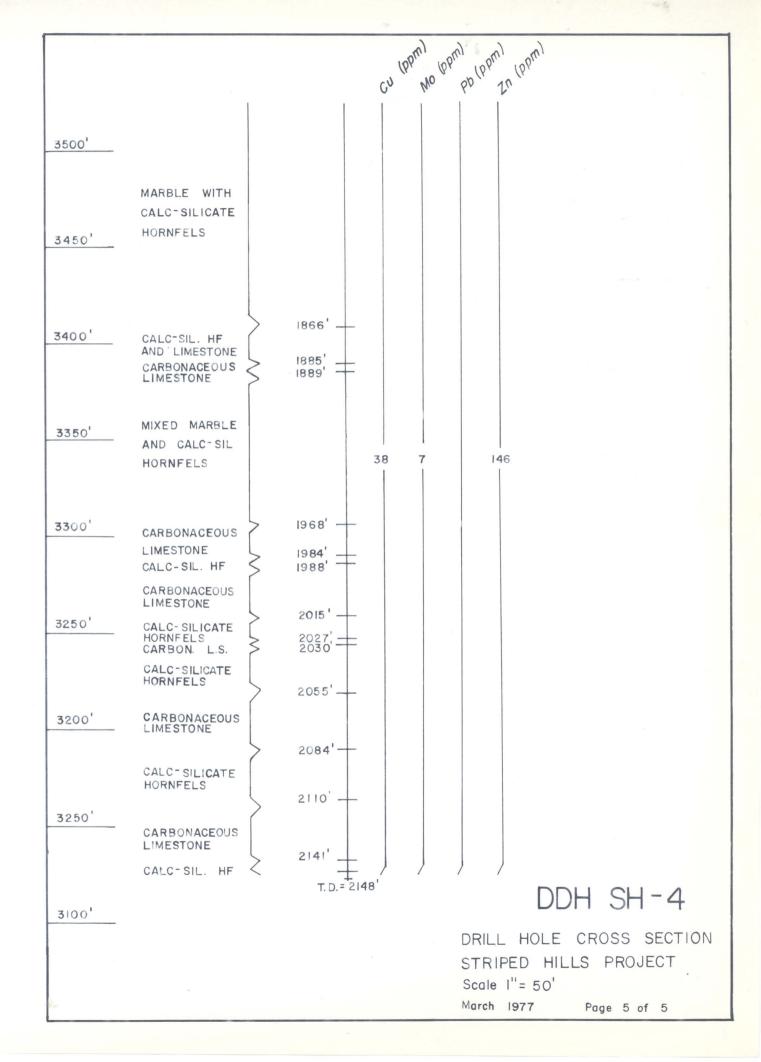
March 1977 Page 4 of 4

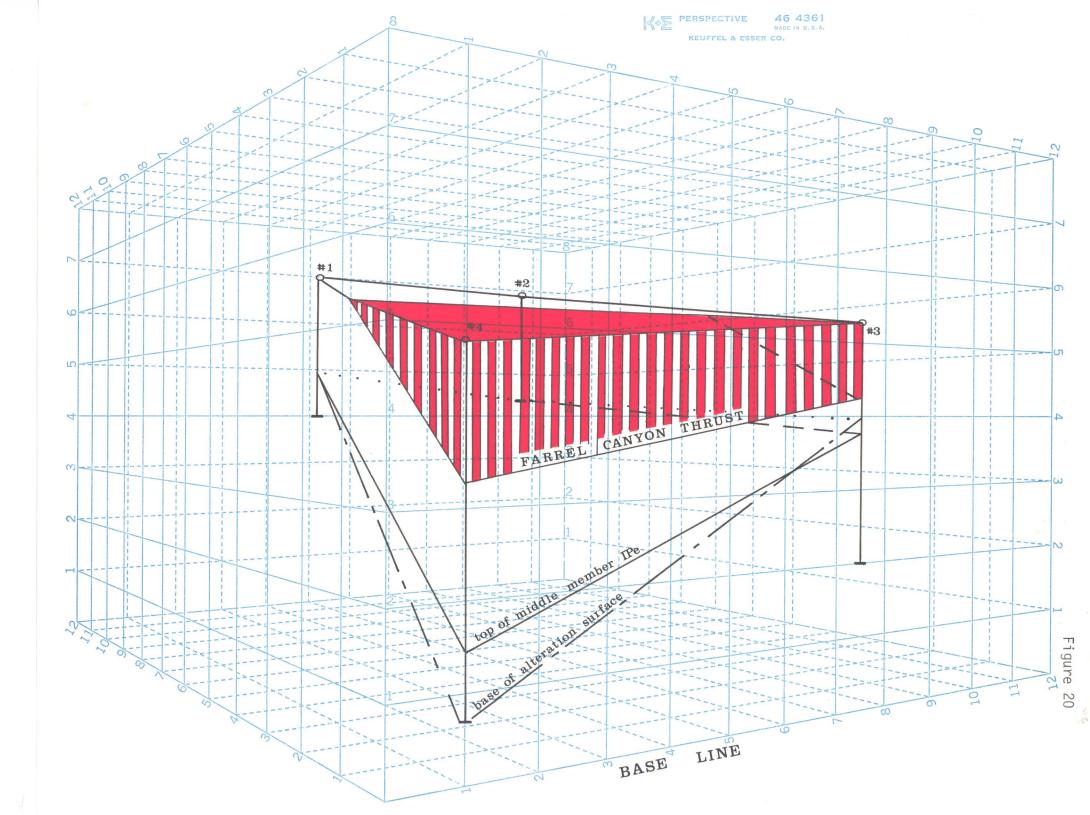


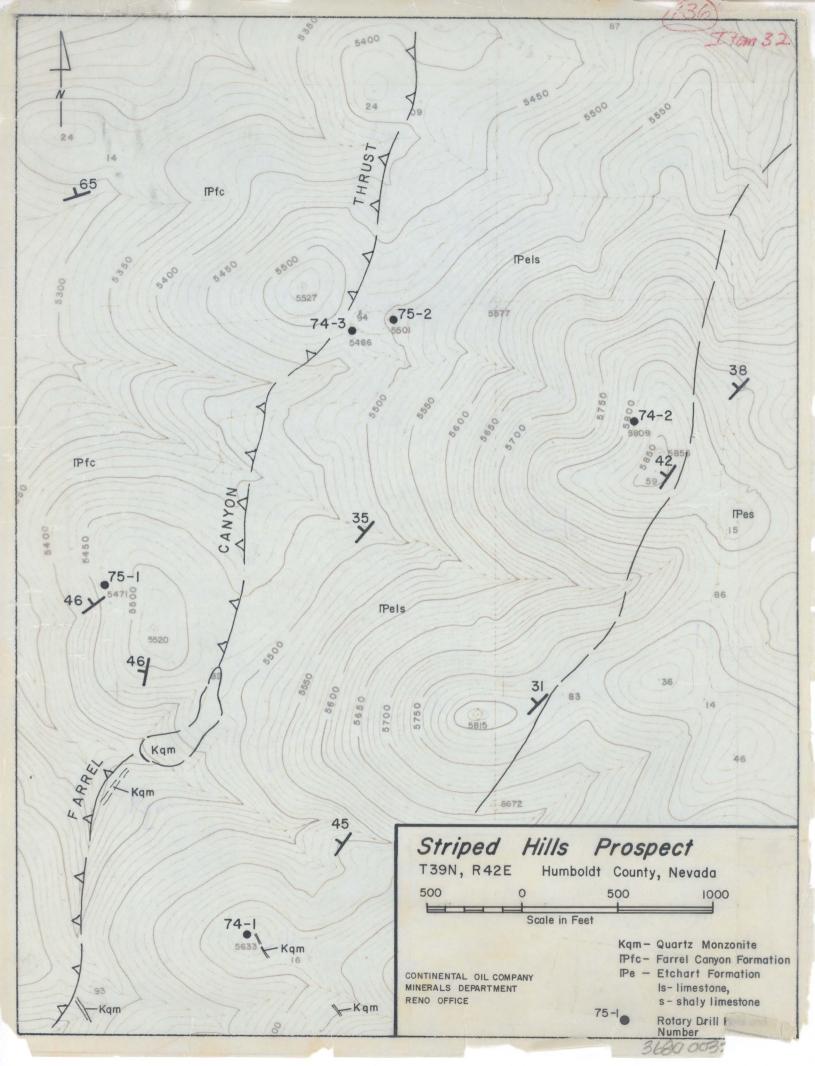












3680 0032



GEOCHEMISTRY OF SULFIDE CONCENTRATE SAMPLES
FROM DRILL HOLES SH-1, SH-2, SH-3, and SH-4
CONOCO STRIPED HILLS PROJECT
HUMBOLT COUNTY, NEVADA

by
Robert W. Bamford

Salt Lake City, Utah February, 1978

CONTENT

		Page
PRINCIPAL CONCLUSION	S AND RECOMMENDATIONS	1
INTRODUCTION		2
DISCUSSION		5
Opaque Mineral	Distribution	5
Geochemistry .		6
Ore Potential .		8
REFERENCES		9
	ILLUSTRATIONS	Page
, ,	% Sulfide, % Magnetite, and % +3.3 sp. gr. Heavy Liquid (HL) fraction less magnetite	10
	Copper, Molybdenum, Lead, Zinc, and Silver in sulfide concentrate	11
	Arsenic, Manganese, Cobalt, Nickel, and Iron in sulfide concentrate	12
	Bismuth, Tellurium, Indium, Tin, and Tungsten in sulfide concentrate	13
Figure 1/SH-2	% Sulfide, % Magnetite, and % +3.3 sp. gr. Heavy Liquid (HL) fraction less magnetite	14
Figure 2/SH-2	Copper, Molybdenum, Lead, Zinc, and Silver in sulfide concentrate	15
Figure 3/SH-2	Arsenic, Manganese, Cobalt, Nickel, and Iron in sulfide concentrate	16
Figure 4/SH-2	Bismuth, Tellurium, Indium, Tin, and Tungsten in sulfide concentrate	17
Figure 1/SH-3	% Sulfide, % Magnetite, and % +3.3 sp. gr. Heavy Liquid (HL) fraction less magnetite	18

		Page
Figure 2/SH-3	Copper, Molybdenum, Lead, Zinc, and Silver in sulfide concentrate	19
Figure 3/SH-3	Arsenic, Manganese, Cobalt, Nickel, and Iron in sulfide concentrate	20
Figure 4/SH-3	Bismuth, Tellurium, Indium, Tin and Tungsten in sulfide concentrate	21
Figure 1/SH-4	% Sulfide, % Magnetite, and % +3.3 sp. gr. Heavy Liquid (HL) fraction less magnetite	22
Figure 2/SH-4	Copper, Molybdenum, Lead, Zinc, and Silver in sulfide concentrate	23
Figure 3/SH-4	Arsenic, Manganese, Cobalt, Nickel, and Iron in sulfide concentrate	24
Figure 4/SH-4	Bismuth, Tellurium, Indium, Tin, and Tungsten in sulfide concentrate	25

APPENDICES

- A Geochemical Data, DDHs SH-1, -2, -3, and -4
- B Mineralogy of +3.3 sp. gr. Heavy Liquid (HL) fraction less magnetite

PRINCIPAL CONCLUSIONS AND RECOMMENDATIONS

- (1) The probability of discovering an orebody associated with known mineralization at the Striped Hills Prospect is low.
- (2) The mineralization tested by drill holes SH-1, 2, 3, and 4 probably consists of one or more small low-grade coalescent Cu skarn deposits closely zoned around and related in origin to quartz monzonite dikes, which are limited in number and spatial distribution. No large parent intrusion is likely to occur at shallow depths (<1000'?) within the immediate area.
- (3) Drill holes SH-1 and possibly SH-2 intercept the best grade mineralization likely to be found at Striped Hills. Geochemical and opaque mineral data suggest that ore potential decreases away from these drill holes down dip and along the strike of host sedimentary units. Limited CONOCO data on silicate alteration zoning also support this interpretation.
- (4) No additional work is recommended on extensions of the Striped Hill mineralization per se. However, data derived in this work suggest that if similar skarns occur in the area these will probably contain magnetite and that the magnetite content might roughly reflect contents of Cu and other ore metals. Thus the alternative of continued exploration in the district with primary emphasis on use of magnetic surveys should be evaluated.

INTRODUCTION

Results of geochemical studies of drill core samples from the CONOCO Striped Hills Project are reported below. The general goal of this work is the independent prediction of locations of centers of higher grade mineralization within the Striped Hills sulfide system. The approach involves determination of multi-element geochemical zoning and gradients using an enhancement technique for generation of the geochemical data (see below). Limited heavy mineral zoning data are also obtained. Interpretation of both data types is accomplished by comparison with generalized geochemical and mineralogical distribution models based on similarly derived data for known porphyry copper, porphyry molybdenum, and skarn deposits and their surroundings. Independence of the approach is reasonably assured since the ultimate data base for the models is probably unique both in character and comprehensiveness. As previously agreed upon, no specific information on either the models or the data base is to be discussed.

Enhancement of geochemical signatures is accomplished by separation and analysis of a non-magnetic heavy liquid (HL) fraction (+3.3 sp. gr.) from composite drill core sample pulps. This sample fraction (referred to as a sulfide concentrate) is a mixture of both vein and disseminated sulfides and oxides (usually <90% sulfides) which are largely of hydrothermal origin.

Removal of rock and alteration silicate materials relatively impoverished in hydrothermally derived trace elements results in a large (3 to more than 10 fold) systematic enhancement of trace element signatures relative to whole rock data without corresponding increase in geochemical noise. Other advantages of this approach relative to conventional whole rock and soil geochemistry include: (1) detection of useful trace element patterns at up to

twice the effective distance from ore, 2) significantly improved definition of chemical zoning and gradients relative to ore, and 3) the frequency addition of Bi, Te, As, In, Sn, W, Co, and Ni to the spectrum of trace elements which can be usefully incorporated into geochemical exploration schemes. Comparable enhanced data is obtained in surface geochemical surveys through use of modified chip-composite sampling techniques and analogous sample preparation procedures.

A total of 51 100-foot composite samples were prepared from short-interval assay pulps supplied by CONOCO. Sulfide concentrates were separated from these samples using heavy liquid media (+3.0 sp. gr. for the first sample in each hole and +3.3 sp. gr. thereafter). Magnetite and other magnetic materials were removed from the sulfide concentrates prior to analysis by means of a hand magnet. Binocular microscope examination of the sulfide concentrates showed four of the smaller samples to contain excessive relative amounts (>20%) of metal shavings. These samples were discarded.

The 47 remaining concentrate samples were analyzed for Cu, Mo, Pb, Zn, Ag, Mn, Co, Ni, and Fe by atomic absorption spectrophotometry (AAS) and for As by a colorimetric method. This analytical work and all sample preparation were carried out by Rocky Mountain Geochemical Corporation, Salt Lake City following specified procedures. Where AAS analyses were performed on samples of less than 100 mg and trace element contents were low, variably higher detection limits were obtained (see data Appendix A). Additional analyses for Bi, Te, In, Sn, and W were performed on 33 concentrate samples by COORS Spectro-Chemical Laboratory, Golden, Colorado, using optical emission spectrographic (OES) techniques.

All geochemical and heavy mineral data are plotted in bar graph form to provide simplicity and clarity of presentation. Use of computer graphics methods for the plotting ensures accuracy.

Interpretation is based on generally observed consistencies of sulfide concentrate geochemical data from other deposits, as described earlier. Determinations of geochemical and heavy mineral data trends between drill holes are made in the context of corresponding lithologic units or parts of lithologic units in order to minimize effects of differences due to variation in original rock reactivity in the interpretations. In doing this, it is necessary and probably reasonable to assume that the lithologic units did not originally display significant lateral variations in composition within the immediate prospect area. Where possible other characteristics (calc-silicate and hydrous alteration, etc.) of the Striped Hills mineralization described by CONOCO geologists were also evaluated in an attempt to provide converging lines of evidence. Information available, however, was limited to summary descriptions presented on two generalized cross-sections A-A' and C-C' (Berger, 1976-A) and did not add significantly to the interpretation.

Opaque Mineral Distributions

Total sulfide contents of rocks sampled at Striped Hills are relatively low, ranging from a trace to 1.3 wt.% and averaging about 1 to 2 wt.%. Total magnetite contents are of roughly the same magnitude. Total sulfides or total magnetite or both show pronounced concentration highs in the vicinity of quartz monzonite porphyry (QMP) dikes and are highest where the dikes are emplaced within the Etchart Limestone or near the Etchart-Farrel Canyon Formation contact (c.f. figures 1/SH-1, -2, -3, -4 with geologic cross-sections by Berger; 1976-A). Total sulfide and magnetite are very low within the Etchart Limestone in DDH SH-3 (figure 1/SH-3) indicating (a) that both minerals are mainly of hydrothermal origin and (b) that the intensity of mineralization has decreased markedly in SH-3, especially at depth. Both minerals display similar trends over a shorter interval at the bottom of DDH SH-4, suggesting that intensity of mineralization is also decreasing with depth in that hole. Pyrite-chalcopyrite ratios (calculated from sulfide concentrate copper values) are all greater than 40. Ratios are lowest for mineralization in drill holes SH-1 and SH-2 suggesting that this possibly represents the best grade mineralization to be found in the deposit.

The widespread association of magnetite with the better developed Cu sulfide mineralization provides in itself a fair indication that best parts of the prospect have already been tested. In many, although not all, skarn deposits, hydrothermal magnetite in sedimentary host rocks is essentially confined to higher grade parts of the deposit near contacts with the apparent parent intrusion.

Based on total sulfide, magnetite, and pyrite-chalcopyrite ratio data only, the mineralization at Striped Hills is indicated to be: fairly pyritiferous; weakly developed overall; decreasing in intensity with depth in vertical drill holes; without trend in intensity in the down dip direction except that pyrite-chalcopyrite ratio increases (between SH-1 and SH-4); decreasing in intensity and of limited extent along strike to the south (and to the north also based on alteration mapping - Berger, 1976-B); and closely related in origin, directly or indirectly, to the QMP dikes.

Geochemistry

Copper is relatively abundant compared to other metals of potential economic interest at Striped Hills, permitting tentative characterization of the mineralization as a Cu skarn. Other elements commonly exploited in skarn type deposits, such as Mo, W, and Ag, occur only in trace amounts typical of many Cu skarns. Thus the mineralization is probably not analagous to W-bearing skarns in the Osgood Mountains several miles to the southwest (Taylor, 1976).

Geochemical trends between or within the four drill holes dealt with in this evaluation, independently suggest that DDHs SH-1, -2, and -4 intercept some of the highest grade mineralization likely to be found in immediate Striped Hills area. Like total sulfide and magnetite (above), Cu and As $^{\pm}$ W, Sn, Ag, Bi, Te, and In show pronounced concentration highs in the vicinity of QMP dikes and are often highest in concentration where the dikes are emplaced within the Etchart Limestone or near the Etchart-Farrel Canyon Formation contact (c.f. figures 2/, 3/, and 4/SH-1,-2,-3, and -4 with geologic cross-sections by Berger; 1976-A). Where dikes are absent these elements remain low in concentration, even within the relatively reactive Etchart

Limestone, and increases concentrations of halo elements such as Pb, Zn, and Mn are observed (c.f. figures 2/SH-1, 2, 3 and 4 and #/SH-1, 2, 3, and 4).

Thus trace element trends downward in DDH SH-3 and possibly also in SH-4, and from DDHs SH-1, -2, and -4 to DDH SH-3 probably reflect zoning from higher grade (possibly highest grade) skarn mineralization to halo zone environments. This zoning takes place over relatively short distances supporting an earlier conclusions that the mineralization is probably weakly developed, of limited extent (at least laterally along strike and vertically downward), and is related in origin to the QMP dikes. Strong evidence for a genetic relationship between the mineralization and the dikes and the lack of mineralization in relatively reactive Etchart Limestone several hundred feet away from the dikes (e.g., see data for SH-3), make it unlikely that large hidden intrusion occurs nearby and is the source of the mineralization.

Trace element data fully corrected for silicate impurity contents (see Appendix B) in the sulfide concentrates indicate that DDHs SH-1 and SH-2 intersect what is clearly the best grade and most interesting Cu mineralization. Overall chemical and mineralogical characteristics (including alteration assemblages) of higher grade parts of this mineralization are similar to those of ore zones in many major Cu skarn deposits. In contrast mineralization intersected in DHHs SH-3 and in much of SH-4 is of lower grade and has overall characteristics of peripheral zones around skarn deposits. Note that even before application of corrections, drill hole SH-1 Ag and Cu values are some of the highest of the entire data set. Collectively these results suggest that ore potential decreases down dip from DDHs SH-1 and SH-2 within the sedimentary host rocks.

An aspect of geochemistry which may seem inconsistent with some of the conclusions made above is the apparent increase of Mo with depth in DDH SH-4 sulfide concentrate samples and the relatively poor correlation (compared to other high grade zone elements) of Mo with dike size and frequency of occurrence. This is, however, only apparent. It is due to the relatively broad dispersion of Mo compared to the distribution sulfides and is fairly common for skarn type mineralization.

Ore Potential

Opaque mineral and trace element distribution data for drill holes SH-1, -2, -3, and -4 indicate the probability of finding an orebody associated with known mineralization at the Striped Hills prospect is low. The data suggest that mineralization in the prospect area consists of one or more small coalescent skarn deposits closely zoned around and related in origin to QMP dikes, which are limited in number and spatial distribution. Drill holes SH-1 and possibly SH-2 intercept the best grade mineralization likely to be found at Striped Hills. If ore grade mineralization once existed as part of a larger original deposit, the data suggest it was probably located up dip from drill holes SH-1 and SH-2 and thus has been eroded. Although it is possible that an ore grade skarn might yet be found in the general vicinity of Striped Hills, it is unlikely that this would constitute an extension of mineralization discussed in this report.

No additional work is recommended on extentions of the Striped Hills mineralization <u>per se</u>. However, data derived in this work suggest that if similar skarns occur in the area these will probably contain magnetite and that their magnetite content might roughly reflect contents of Cu and other ore metals. Thus the alternative of continued exploration in the district with primary emphasis on use of magnetic surveys for locating and evaluating prospects should be considered.

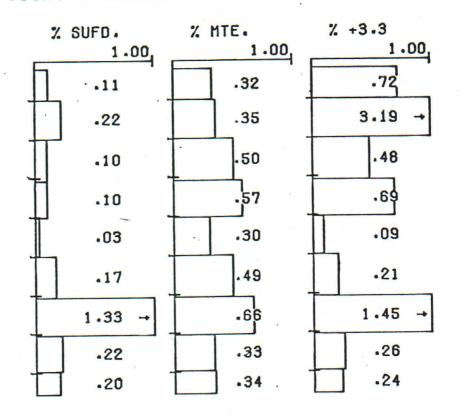
REFERENCES

- Berger, B., 1976-A, Spatial Relationships of Alterations, Geochemistry, and Geology Along Sections A-A' and C-C', Striped Hills Project: CONOCO Unpublished Cross-Sections.
- Berger, B., 1976-B, Geologic Map, Striped Hills Project: CONOCO Unpublished Map.
- Taylor, B. E., 1976, Origin and significance of C-O-H fluids in the formation of Ca-Fe-Si skarn, Osgood Mountains, Humbolt County, Nevada: Unpublished Ph.D. dissertation, Stanford University, California.

DDH SH-1

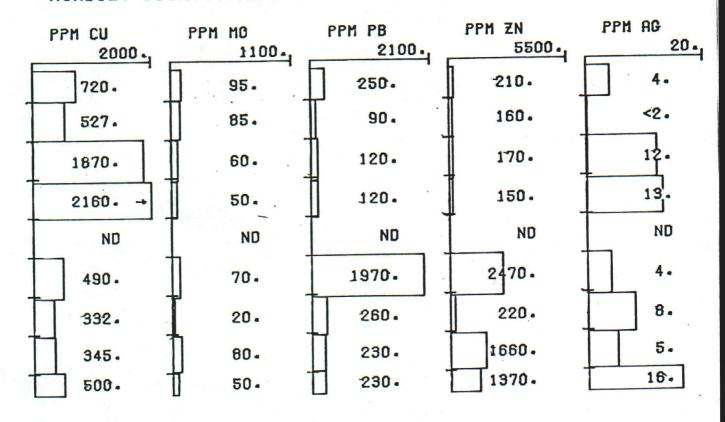
STRIPED HILLS PROJECT. HUMBOLT COUNTY, NEVADA

SAMPLE TYPE: VERT. SCALE: 250.0 FT./IN. (DEPTH SHOWN IN KILOFEET)



DDH SH-1

STRIPED HILLS PROJECT, HUMBOLT COUNTY, NEVADA



DDH SH-1

STRIPED HILLS PROJECT, HUMBOLT COUNTY, NEVADA

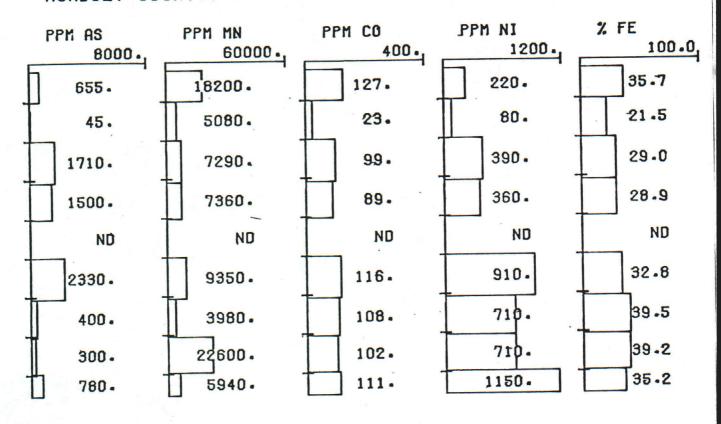
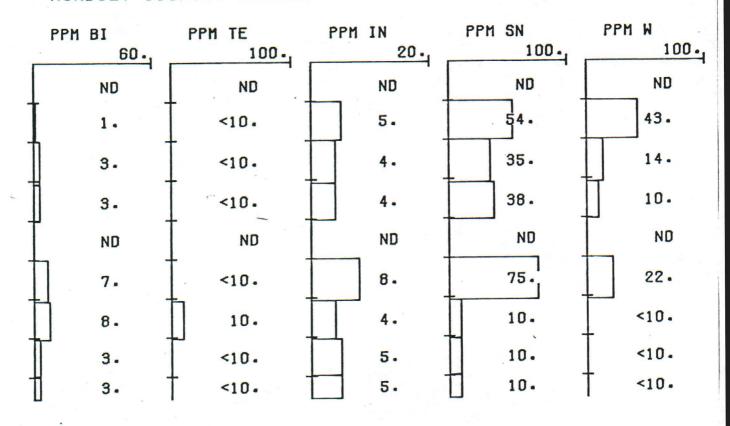


FIGURE 4

STRIPED HILLS PROJECT. HUMBOLT COUNTY, NEVADA



DDH SH-2

STRIPED HILLS PROJECT, HUMBOLT COUNTY, NEVADA

SAMPLE TYPE: VERT. SCALE: 250.0 FT./IN. (DEPTH SHOWN IN KILOFEET)

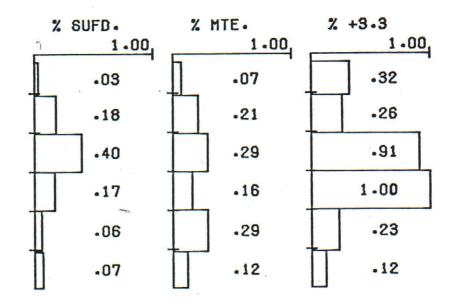


FIGURE 2

STRIPED HILLS PROJECT. HUMBOLT COUNTY. NEVADA

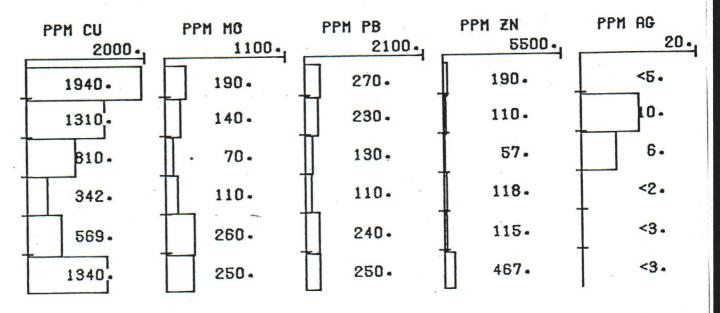


FIGURE 3

STRIPED HILLS PROJECT. HUMBOLT COUNTY. NEVADA

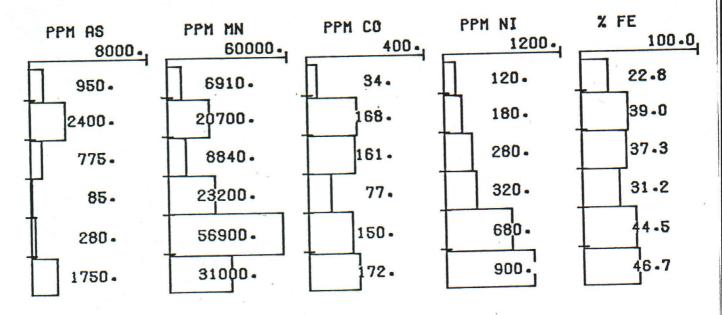


FIGURE 4

STRIPED HILLS PROJECT, HUMBOLT COUNTY, NEVADA

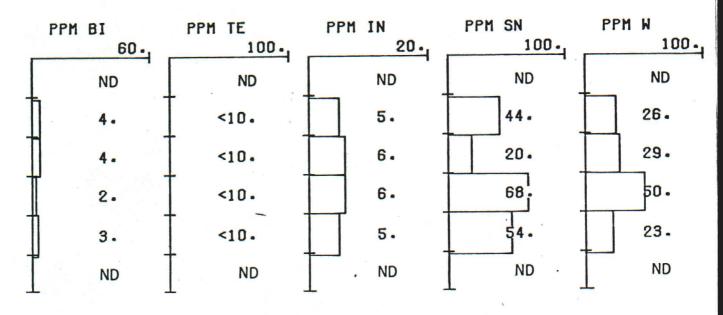
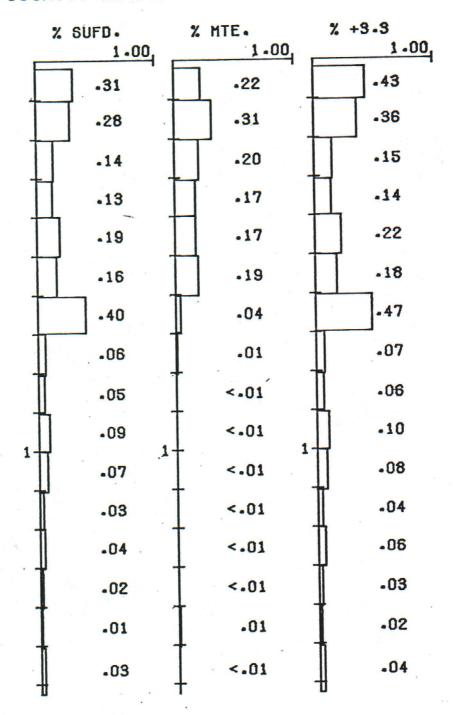


FIGURE 1

STRIPED HILLS PROJECT. HUMBOLT COUNTY. NEVADA

SAMPLE TYPE: VERT. SCALE: 250.0 FT./IN. (DEPTH SHOWN IN KILOFEET)



DDH SH-3

STRIPED HILLS PROJECT. HUMBOLT COUNTY. NEVADA

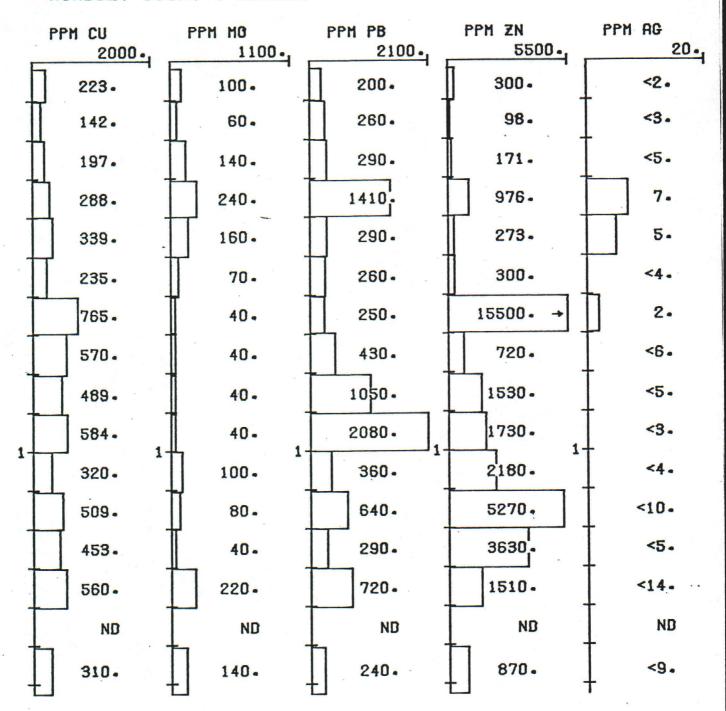


FIGURE 3

STRIPED HILLS PROJECT. HUMBOLT COUNTY. NEVADA

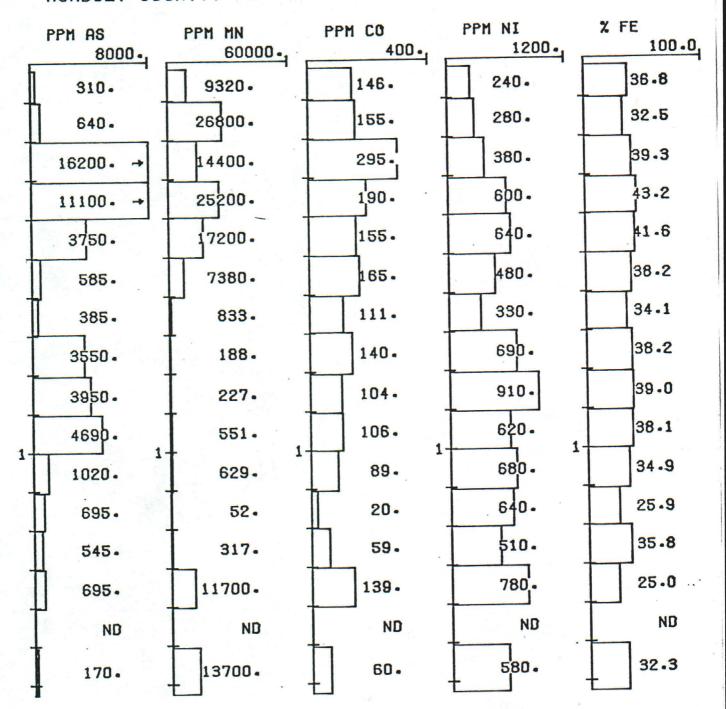
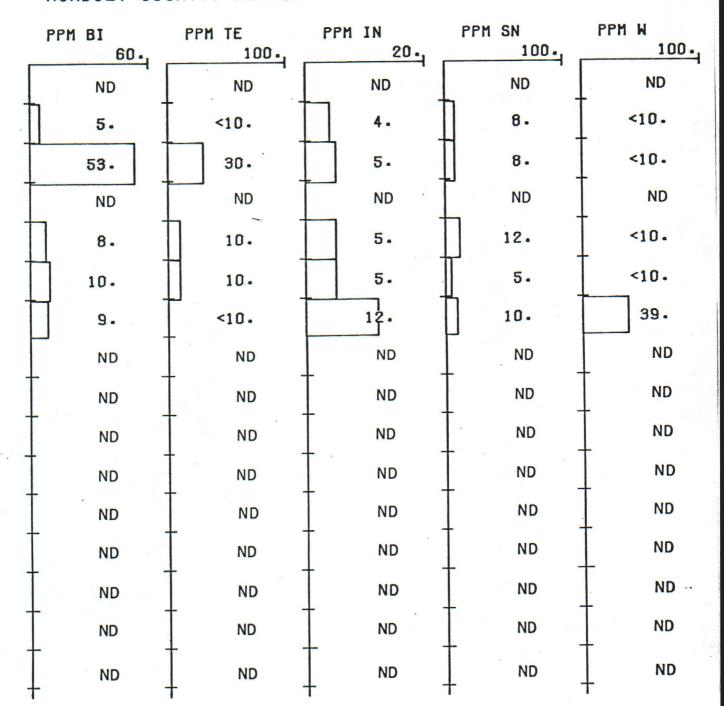


FIGURE 4

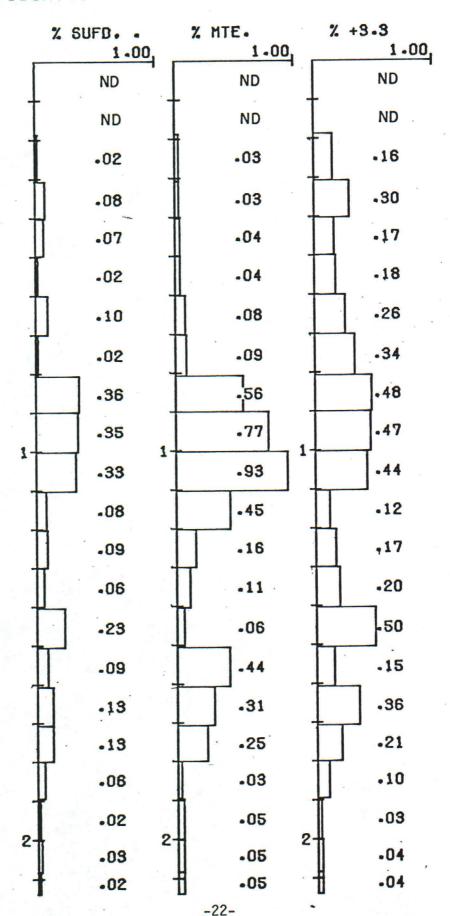
STRIPED HILLS PROJECT. HUMBOLT COUNTY, NEVADA



STRIPED HILLS PROJECT. HUMBOLT COUNTY. NEVADA SAMPLE TYPE:

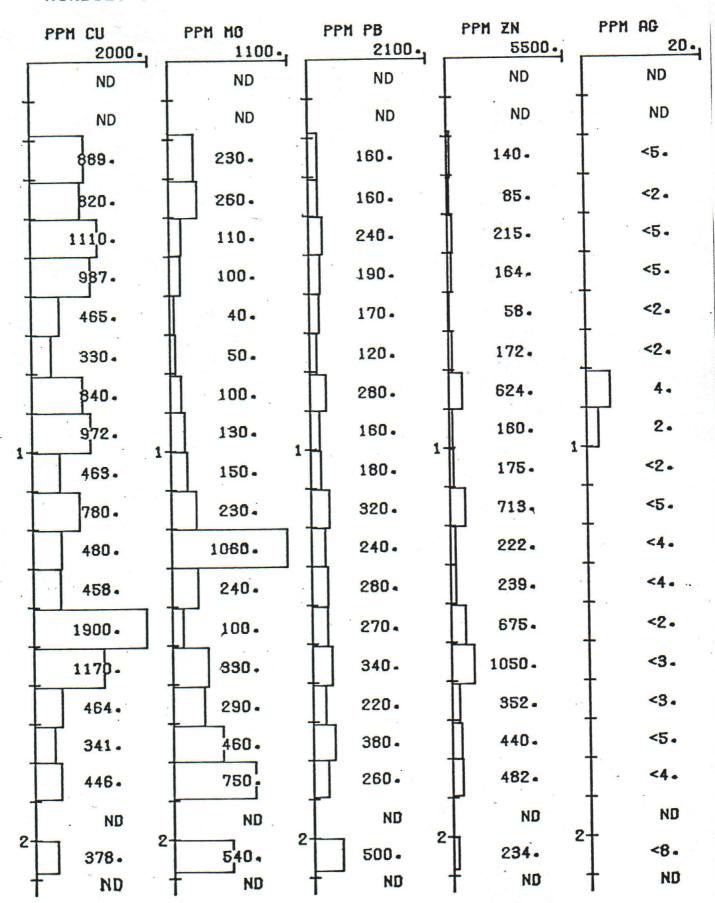
VERT. SCALE: 250.0 FT./IN.

(DEPTH SHOWN IN KILOFEET)



DDH SH-4

STRIPED HILLS PROJECT. HUMBOLT COUNTY. NEVADA VERT. SCALE: 250.0 FT./IN.
(DEPTH SHOWN IN KILOFEET)



-23-

DDH SH-4

STRIPED HILLS PROJECT. HUMBOLT COUNTY. NEVADA

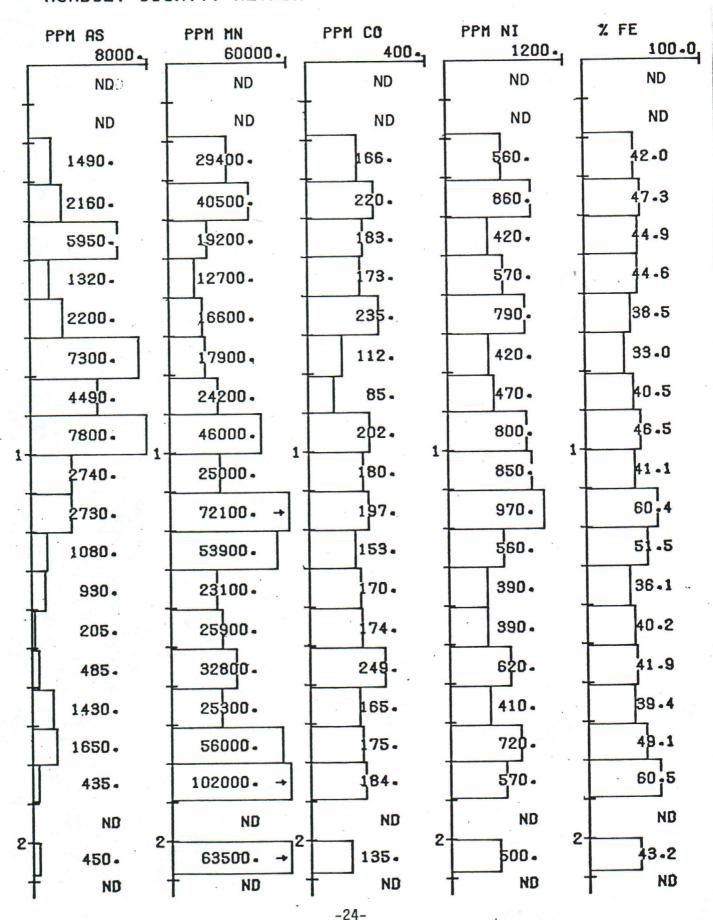
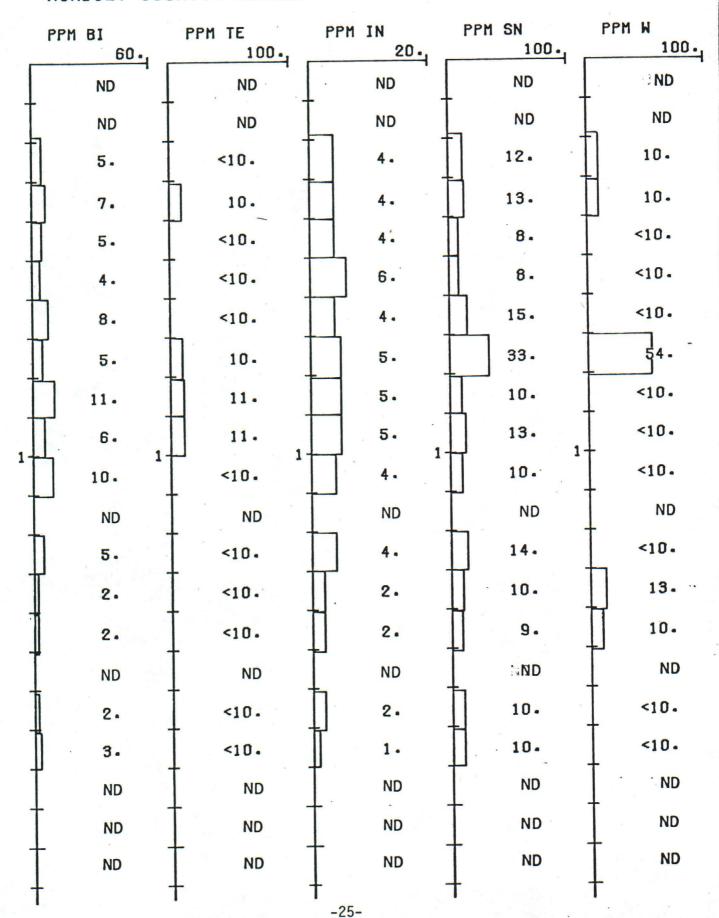


FIGURE 4

STRIPED HILLS PROJECT, HUMBOLT COUNTY, NEVADA



APPENDIX A

Geochemical Data, DDHs SH-1, -2, -3, and -4 $\,$



ROCKY MOUNTAIN GEOCHEMICAL CORP.

1323 W. 7900 SOUTH • WEST JORDAN, UTAH 84084 • PHONE: (801) 255-3558

Certificate of Analysis

Page	1	of	13
	•	٠.	***************************************

Date:

November 9, 1977

Client:

Robert W. Bamford

1138 Gilmer Drive:

Salt Lake City, UT

84105

Local Job No.:77-65-17

Foreign Job No.:....

RMGC Numbers:

Invoice No.: M 91805

Client Order No.:

none

Report On:

47 samples

Submitted by:

Robert W. Bamford

Date Received:

Analysis:

Lead, Zinc, Copper, Nickel, Manganese, Iron, Silver, Cobalt,

Molybdenum, Arsenic, Weight % Magnetite, Weight % +3.0,

Analytical Methods: Weight % +3.3, and Sample Weight

Arsenic determined colormetrically. The remaining elements

determined by atomic absorption.

Remarks:

cc:

enc.

file (2)

LRR/kv

Analytical Precision:

All values are reported in parts per million unless specified otherwise. A minus sign (—) is to be read "less than" and a plus sign (+) "greater than." Values in parenthesis are estimates. This analytical report is the confidential property of the above mentioned client and for the protection of this client and ourselves we reserve the right to forbid publication or reproduction of this report or any part thereof without written permission.

ND — None Detected

1 ppm — 0.0001%

1 Troy oz./ton — 34.286 ppm

1 ppm = 0.0292 Troy oz./ton

Client Robert W. Bamford		Date	11/9/77	RMGC Job No. 77-65-17	
Sample No.	weight %	weight % +3.3	weight % Magnetite	weight of sample Analyzed in grams	
0-100'	0.72		0.32	0.1261	
100-199'		3.19	0.35	0.1172	
199-308'	*	0.48	0.50	0.1008	
308-402		0.69	0.57	0.1117	
402-499'		0.09	0.30		
499-607'		0.21	0.49	0.0580	
607-704'		1.45	0.66	0.1000	
704-797'		0.26	0.33	0.1000	
797-856'		0.24	0.34	0.0610	

Page 3 of 13

				A			
Omple No	<u>.</u>	ppm Lead	ppm Zinc	ppm Copper	ppm Nickel	ppm Manganese	
SH - 1 20-100'	+3.0	250	210	720	220	1.82%	
100-199'	+3.3	90	160	527	80	5080	
199-308'	+3.3	120	170	1870	390	7290	
308-402'	+3.3	120	150	2160	360	7360	
499-607'	+3.3	1970	2470	490	910	9350	
607-704	+3.3	260	220	332	710	3980	
704-797'	+3.3	230	1660	345	710	2.26%	
797-856'	+3.3	230	1370	500	1150	5940	

Page 4 of 13

Sample No.	% Iron	ppm Silver	ppm Cobalt	ppm Molybdenum	ppm Arsenic
SH - 1 20-100' +3.0	35.7	4	127	95	655
100-199' +3.3	21.5	-2	23	85	45
199-308' +3.3	29.0	12	99	60	1710
308-402' +3.3	28.9	13	89	50	1500
499-607' +3.3	32.8	4	116	70	2330
607-704' +3.3	39.5	8	108	20	400
704-797' +3.3	39.2	5	102	80	300
797-856' +3.3	35.2	16	111	50	780

Page 5 of 13

ample No.	weight %	weight %	Weight % Magnetite	weight of sample Analyzed in grams
SH - 2 20-106'	0.32		0.07	0.0514
106-203'		0.26	0.21	0.1000
203-301'		0.91	0.29	0.1261
301-399'		1.00	0.16	0.1489
399-506'		0.23	0.29	0.1068
506-599'		0.12	0.12	0.0888

Date 11/9/77

RMGC Job No. 77-65-17

Page 6 of 13

ample No.	ppm Lead	ppm	ppm Copper	ppm Nickel	ppm Manganese
SH - 2					
20-106' +3.0	270	190	1940	120	6910
106-203' +3.3	240	110	1310	180	2.07%
203-301 +3.3	130	57	810	280	8840
301-399' +3.3	110	118	342	320	2.32%
399-506' +3.3	240	115	569	680	5.69%
506-599' +3.3	250	467	1340	900	3.10%

Date_11/9/77

RMGC Job No. 77-65-17

Page 7 of 13

Cample No.	% Iron_	ppm Silver	ppm ppm Cobalt Molybd	ppm enum Arsenic	
20-106' +3.0	22.8	- 5	34 190	950	
106-203' +3.3	39.0	10	168 140	2400	
203-301' +3.3	37.3	6	161 70	775	
301-399' +3.3	31.2	-2	77 110	85	
399-506' +3.3	44.5	~3	150 260	280	
506-599' +3.3	46.7	- 3	172 250	1750	

Page_____8__of__13

Cample No.	weight %	weight % +3.3	weight % Magnetite	weight of sample Analyzed in grams
SH - 3 19-102'	0.43		0.22	0.1167
102-202'		0.36	0.31	0.1000
202-306'		0.15	0.20	0.0585
306-399'		0.14	0.17	0.1042
399-501'		0.22	0.17	0.1099
501-603'		0.18	0.19	0.0681
603-697'		0.47	0.04	0.1033
697-805'		0.07	0.01	0.0465
805-904		0.06	-0.01	0.0506
904-1001'		0.10	-0.01	0.0826
1001-1105'		0.08	-0.01	0.0616
1105-1201'		0.04	-0.01	0.0251
1201-1302		0.06	-0.01	0.0552
1302-1403		0.03	-0.01	0.0180
1403-1506		0.02	0.01	
1506-1626'		0.04	-0.01	0.0294

Page 9 of 13

Cample No.	ppm Lead	ppm Zinc	ppm Copper	ppm <u>Nicke</u> l	ppm Manganese
SH - 3 19-102' +3-0	200	300	223	240	9320
102-202' +3.3	260	98	142	280	2.68%
202-306' +3.3	290	171	197	380	1.44%
306-399' +3.3	1410	976	288	600	2.52%
399-501' +3.3	290	273	339	640	1.72%
501-603' +3.3	260	300	235	480	7380
603-697' +3.3	250	1.55%	765	330	833
697-805 +3.3	430	720	570	690	188
805-904' +3.3	1050	1530	489	910	227
904-1001'+3.3	2080	1730	584	620	551
1001-1105+3.3	360	2180	320	680	629
1105-1201'+3.3	640	5270	509	640	52
1201-1302'+3.3	290	3630	453	510	317
1302-1403 +3.3	720	1510	560	780	1.17%
1506-1626 + 3.3	240	870	310	580	1.37%

Date 11/9/77 RMGC Job No. 77-65-17

Page 10 of 13

Sample No.	% Iron	ppm Silver	ppm Cobalt	ppm Molybdenum	ppm Arsenic
SH - 3 19-102' +3.0	36.8	-2	146	100	310
102-202' +3.3	32.5	-3	155	60	640
202-306' +3.3	39.3	- 5	295	140	1.62%
306-399' +3.3	43.2	7	190	240	1.11%
399-501' +3.3	41.6	5	155	160	3750
501-603' +3.3	38.2	-4	165	70	585
603-697' +3.3	34.L	2	111	40	385
697-805' +3.3	38.2	-6	140	40	3550
805-904 +3.3	39.0	- 5	104	40	3950
904-1001'+3.3	38.1	-3	106	40	4690
1001-1105'+3.3	34.9	-4	89	100	1020
1105-1201'+3.3	25.9	-10	20	80	695
1201-1302'+3.3	35.8	- 5	59	40	545
1302-1403'+3.3	25.0	-14	139	220	695
1506-1626'+3.3	32.3	~9	60	140	170

Sample No.	weight % +3.3	weight % Magnetite	weight of sample Analyzed in grams
SH - 4 187-307'	0.16	0.03	0.0571
307-402	0.30	0.03	0.1000
402-499	0.17	0.04	0.0546
499-600'	0.18	0.04	0.0578
600-701'	0.26	0.08	0.1000
701-807'	0.34	0.09	0.1000
807-900'	0.48	0.56	0.1137
900-1002'	0.47	0.77	0.1000
1002-1103'	0.44	0.93	0.1058
1103-1202'	0.12	0.45	0.0596
1202-1300'	0.17	0.16	0.0719
1300-1404'	0.20	0.11	0.0617
1404-1506	0.50	0.06	0.1089
1506-1607'	0.15	0.44	0.0823
1607-1707	0.36	0.31	0.0895
1707-1800'	0.21	0.25	0.0499
1800-1895	0.10	0.03	0.0773
1895-2001'	0.03	0.05	4.504
2001-2084	0.04	0.05	0.0278
2084-2140'	0.04	0.05	

Page 12 of 13

				y		
Cample No. SH - 4		ppm Lead	ppm Zinc	ppm Copper	ppm Nickel	ppm <u>Manganese</u>
187-307	+3.3	160	140	889	560	2.94%
307-402'	+3.3	160	85	820	860	4.05%
402-4991	+3.3	240	215	1110	420	1.92%
499-600'	+3.3	190	164	978	570	1.27%
600-701'	+3.3	170	58	465	790	1.66%
701-807'	+3.3	120	172	330	420	1.79%
807-900'	+3.3	280	624	840	470	2.42%
900-1002'	+3.3	160	160	972	800	4.60%
1002-1103'	+3.3	180	175	463	850	2.50%
1103-1202'	+3.3	320	713	780	970	7.21%
1202-1300'	+3.3	240	222	480	560	5.39%
300-1404'	+3.3	280	239	458	390	2.31%
1404-1506'	+3.3	270	675	1900	390	2.59%
1506-1607'	+3.3	340	1050	1170	620	3.28%
1607-1707	+3.3	220	352	464	410	2.53%
1707-1800'	+3.3	380	440	341	720	5.60%
1800-1895'	+3.3	260	482	446	570	10.2%
2001-2084	+3.3	500	234	378	500	6.35%



Page 13 of 13

SH - 4	Tron	ppm Silver	ppm Cobalt	ppm Molybdenum	ppm Arsenic
187-307' +3.3	42.0	-5	166	230	1490
307-402' +3.3	47.3	-2	220	260	2160
402-499' +3.3	44.9	-5	183	110	5950
499-600' +3.3	44.6	-5	173	100	1320
600-701' +3.3	38.5	-2	235	40	2200
701-807' +3.3	33.0	-2	112	50	7300
807-900' +3.3	40.5	4	185	100	4490
900-1002'+3.3	46.5	2	202	130	7800
1002-1103'+3.3	41.1	- 2	180	150	2740
1103-1202'+3.3	60.4	~5	197	230	2730
1202-1300'+3.3	51.5	-4	153	1060	1080
300-1404'+3.3	36.1	-4	170	240	930
1404-1506'+3.3	40.2	~2	174	100	205
1506-1607'+3.3	41.9	- 3	249	330	485
1607-1707'+3.3	39.4	-3	165	2,90	1430
1707-1800'+3.3	49.1	-5	175	460	1650
1800-1895'+3.3	60.5	-4	184	75 0	435
2001-2084'+3.3	43.2	~8	135	540	450

By Lawrence R. Reid (KV)
Lawrence R. Reid

TRO-CHEMICAL LABORATORY DIVISION OF COORS PORCELAIN COMPANY

GOLDEN, COLORADO, U.S.A.

303-279-6565 Ext. 3202

Mailing Address: P.O. Box 500 Golden, Colorado 80401

Analytical Report

TO: .Mr. Robert W. Bamford 1138 Gilmer Drive

84105 . Salt Lake City, Utah

LABORATORY NUMBER	93082	
DATE	12-1-77	
CUSTOMER ORDER NO.		

Sample I.D.	Tin	Tungsten	Indium	Bismuth	Tellurium
Conoco SH-1					
+ 3.0 20-100	15	> 200	5	3	< 10
Conoco SH-1 + 3.3					
100-199	54	43	5	1	< 10
199-308	35	14	14	3	< 10
308-402	38	10	14	3	< 10
499-607	75	22	8	7	< 10
607-704	10	< 10	14	8	10
704-797	10	< 10	5	3	< 10
797-856	10	< 10	5	3	< 10
Conoco SH-2					
+ 3.0	40	59	5	14	< 10
Conoco SH-2					4.10
+ 3.3 106-203	44	26	5	4	< 10
203-301	20	29	6	14	< 10
301-399	68	50	6	2	< 10
399-506	54	23	5	3	< 10
Conoco SH-3					
+ 3.0	8	< 10	5	5	< 10

> = Greater than

< = Less than

Results are reported in parts per million.

This report is rendered upon the conditions that it is not to be reproduced wholly or in part for advertising or other purposes over our signature or in connection with our name without special permission in writing.

Cools / SPECTRO-CHEMICAL LABORATORY

Frank B. Schweitzer, Ma

DISTRIBUTION: WHITE & PINK - Customer; GREEN - Numerical Files; CANARY - Customer Files

CTRO-CHEMICAL LABORATORY DIVISION OF COORS PORCELAIN COMPANY

GOLDEN, COLORADO, U.S.A.

303-279-6565 Ext. 3202

Mailing Address: P.O. Box 500 Golden, Colorado 80401

Analytical Report

TO: . Mr. Robert W. Bamford

LABORATORY NUMBER	93082	
DATE	12-1-77	
CUSTOMER		
ORDER NO.		

Sample	I.D.	Tin	T	ung	sten		Indi	um	Bism	uth		Tell	Luri	ım
Conoco	SH-3													
+ 3.3	102-202	8	*	< :	10		4		5			<	10	
	202-306	8		< :	10		5		53				30	
	399-501	12		<	10		5		8				10	
	501-603	5		<	10		5		1	.0			10	
	603-697	10			39		12		9		-	<	10	
Conoco	SH-4													
	187-307	12			10		4		5			<	10	
	307-402	13			10	*	4		7	•			10	
	402-499	8		<	10		4		5	٠.,		<	10	
	499-600	8		<	10		6		1			<	10	
	600-701	15		<	10		. 4		8	3		<	10	
	701-807	33			54		5		5	5			10	¥
	807-900	10		<	10		5		13				11	
	900-1002	13		<	10		5		6	5			11	
	1002-1103	10		<	10		4		10)		<	10	
	1202-1300	14		<	10		4		5	5		<	10	
	1300-1404	10		. 5	13		2		2	2		<	10	
	1404-1506	9			10		2		2	2		<	10	
	1607-1707	10		<	10		2		2	2		<	10	
	1707-1800	10		<	10		1		3	3		<	10	

< = Less than Results are reported in parts per million.

This report is rendered upon the conditions that it is not to be reproduced wholly or in part for advertising or other purposes over our signature or in connection with our name without special permission in writing.

Coots / SPECTRO-CHEMICAL LABORATORY

Frank B. Schweitzer Manager

DISTRIBUTION: WHITE & PINK - Customer; GREEN - Numerical Files; CANARY - Customer Files

APPENDIX B

Mineralogy of +3.3 sp. gr. Heavy Liquid (HL) fraction less magnetite

	WT. 76	WT. 76 TOTAL			-1	COM	POS		OF	HEAV				CONC	ENTRATE
FOOTAGE	TOTAL SULFIDE IN ROCK (SULFUR ANALYSIS)	SULFIDE IN ROCK (HEAVY LIQUID CONCENTRATION)	WT. % HEAVY LIQUID CONCEN- TRATE	25.EV	. 0.0	SULFIDES	LIMONITES	DARK CPAPUE MINERALS	SPHENE.	OTE, CALCITE,	EPIDOTE			METAL SHEVINGS	OTHER MILERALS
H-1)20-		0.11	0.72	1	1	15	3	25	31	25	Tr.			1	
100-199	Feet	0.22	3.19	1	,	7		5.	80	7	Tr.			/	Tr. M052
199-308		0.10	0.48	1	4	20	1 1 1	15	59	5	SWEETS TO TO			/	
308-402		0.10	0.69	1	1	15		7.	74	2	Tr.			2	
402-499		.0.03	0.09	1	1	35		7	35	1	2			20	
499-607		0.17	0.21	1	4	81		2	/	15				/	
607-704		1.33	1.45	4	1	92		5	TR.	2				/	50-1-1-
704-797		0.22	0.26	1	1	83		?		5.0	9.7		_	5	7º carbona- ceous mati
797-856'		0.20	0.24	1	1	82		7.9		7.2				/	3? 11
				Ц											
SH-2				Ц											
20-106		0.03	0.32	1	1	1	5	35	10	48				/	
106-203		0.18	0.26	1		7/		7	10	7				5	
203-301'		0.40	0.91	V	1	44		3	50	1				2	
301-399		0.17	1.00	1		17		5.2	62	5				/	
399-506		0.06	0.23	1		25	4.	5.	13	20	2?			5	
506-599		0.07	0.12	1		62		25	3	3	77.			7	
h h				Ц						_					
	18 (8) (3)	16.4	97,51	Ц		194			jed					_	
ric winds	Eliza Eliza			Ц								100		_	1.000
		99					8.								
		36.39		Ц							_	111			
de la Vierra	2000		312418	Ц				4	110					-	
						3 93							L		
				Ц					_		_		1	_	
		Server King		Ш	-				2 1					1	
				Ц		A S								1	
	1,54.57 5	Maria .													Tay Associated
3,4°C	Lo est						1						1		

COLOCO STRIPED HILLS PROJECT

TRATES (Less Magnetite)

	-	WT. 76				COV		TION						ONC	ENTRATE
	WT. %	TOTAL SULFIDE		Sp	Gr.		N N	(EST	-	11-	CUN	はり	<u>s)</u>		OTHER
SAMPLE	SULFIDE IN ROCK	HEAVY LIQUID CONCENT	WT. % HEAVY LIQUID CONCEN-		5.0.5	SULFIDES	THOMITE	DAEK OPHOLE MINERALS	SPHENE .	E CALCITE	EPIDOTE			METAL	MILLERALS
FOOTAGE	ANALYSIS)	TRATION)	TRATE	V V	7.33	3.1	LIM	28€	#33	T N S	IN.	AND AND ADDRESS OF		五	
19-102'		0.31	0.43		~	7/	1	7.2	3	17				1	
102-202'	14.7 ·	0.28	0.36	V		77	1,1	10	7	5				1	2.00
202-306'	1	0.14	0.15	1		91	٠	3	72	3	9. 1			3	
306-3991		0.13	0.14	V		92		3	2	/				2	
399-50/		0.19	0.22	/		87		3	1	2		88.7		7	
501-603		0.16	0.18	V		91		2	/	5				/	
603-697		0.40	0.47	V		86		5	5	3			1	/	
697-805'	A, AB.	0.06	0.07	~		85		10	1	3	•		_	/	
805-904		0.05	0.06	V		91		7	72	1				/	
904-1001		0.09	0.10	-		87		10	TK	3			_	77E.	
1001-11051		0.07	0.08	1		86		13	72.	1			_	TR.	
1105-1201		0.03	0.04	V		75		25		72,			_	TP.	
12013021		0.04	0,06	V		73		25		1			_	/	
1302-		0.02	0.03	~		75		20	TR.	72.				5	
1403-06'		0.01	0.02	"	L	59		25	1	5				10	
1506-1626'		0.03	0.04	~	L	78		17	72.	2			_	3	
														_	
					L									_	
				L	L				-				_	_	
					L								1	_	• 1 2
			A Section 1	L	L					_		_	1	-	
				L					_			_	-	-	7
	222			L		_				_		-	-	1	11.02
		1. S		L	L				_				-	1	(-10, 14, 17
3, 11, 1				L	L		L	_	_			_	-	-	
				L		-		_		_		_	-	-	
	Mark 1			L	L					_			1	1	
				L		_				L		1	1	_	
	L STANCE			L	L					_		_	_	_	
	Sec. 45.				1		1	1			1	1	1		

STRIPED HILLS PROJECT

(Less Magnetite)

	AND DESCRIPTION OF PERSONS ASSESSMENT	WT. 76		PARTIES AND	7			TION		HEAL	N L	JOU	D (CONCI	ENTRATE
*	WT. 76	TOTAL SULFIDE	1	50.0	Gr.			(EST			FUN	臣?	6)	1 1	ENTRATE
SAMPLE NUMBER	SULFIDE IN ROCK (SULFUR ANALYSIS)	HEAW LIQUID CONCENTRATION)	WT. % HEAVY LIQUID CONCENTRATE	U. 10.	>3.03	SULFIDES	LINONITES	DARK, COMPUE MINERAS	SPHEUF.	PSE, SEE,	EPIDOTE			METAL- SHAVALQS	MILLERALS
187-307		0.02	0.16	1		10	-	78	3	7	H		7	211	
307-402-	1	0.08	0.30	1		25		57	TR.	15				3	
102-4991		0.07	0.17	N	/	10		49	2	5			4.	4	
199-600		0.02	0.18	1	/	10		72	1	15		4		2	
600-701		0.10	0.26	N	/	40	21	41	2	17				2	2
701-807'		0.02	0.34	1	/	7		47	45	10				1	
807-900'		0.36	0.48	V	-	75		7	1	10				7	-
300-1002-		0.35	0.47	1		74		10:	TR.	12				4	100
1002-		0.33	0.44	1		75		5.2	3	15				2	
1202	3 72	0.08	0.12	1		67		3	TR.	5	T.E.			25	
1202-00	2 2	0.09	0.17	~	-	空	-	3	17	7	1?			20	
300-04		0.06	0,20	1		30		5	55	5	2	_	1	3	
1404-		0.23	0.50	1		16		15	50	7	R.		_	2	visible cpy
159607		0.09	0.15	1		58		10	5	20	3		_	4	"
1697-		0.13	0.36	1		36	_	7.	45	10	TR,	-	_	3	
1707-		0.13	0.21	1		62	~	5.7	2	25	/	_	1	5	
1800-		0.06	0.10	++		61	<u> </u>	7?	7R.	25	_	_	_	7	
1895-		0.02	0.03	+		8	+	2	_	5	-	1	\vdash	40	
2087-	14 Maria	0.03	0.04	++	-	75	+-	3		15	_	-	+	7	
2081-10		0.02	0.04	1		50	_	5		5	_	-	\vdash	40	
						_	_		_	-	_	-	+	+	
				\coprod	L	_	_				-	-	+		- Toward Laws
				\sqcup	H	_	-		-	+	-	+	+	+	
				\sqcup	-	_	_		_	+	-	+	+	-	
				1	-	\vdash	-	_	_	\vdash	\vdash	\vdash	+	+	
				\sqcup	-	\vdash	\vdash	-	_	+	-	+	+	+	
			 	1	-	╀	_	_	-	+	\vdash	+	+	+	-
		-		1	-	╀	4	-	-	+	\vdash	+	+	+	
				+	-	\vdash	\vdash	-	2	+	-	+	+	+	
				1											TTION OF SHOENTRA

STRIPED HILLS PRO

(Less Magnetite)