3210 0008

N. of 203
Item 8

COPPER CANYON

Mineral County, Nevada

A Porphyry Copper Prospect

C. Neil Upchurch

November 1977

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

ABSTRACT

To our knowledge this apparently large porphyry sulfide deposit has never been mapped in detail, or tested by either drilling or induced polarization. The larger mineralized area, as indicated by iron stained outcrops and geochemical surveying, measures up to 3000 feet across and 9000 feet long. The more intense copper mineralization, as indicated by a soil geochemical survey, occurs in a zone about 1500 feet by 3000 feet.

At the present, our knowlege of the prospect is limited. We propose additional geologic mapping and petrographic studies to solve some complex geologic and structural problems. These problems must be solved before any credible geologic hypotheses can be formulated.

This work should be followed by an induced polarization survey and test drilling if warranted by previous work.

LOCATION AND ACCESSIBILITY

The Tish Claims which constitute the subject property are in eastern Nevada in the northwestern part of Mineral County (See Figure 1). The approximate center of the property is in the northwest one-quarter of unsurveyed section 11, T. 10 N., R. 28 E. It lies on the unnamed north fork of Copper Canyon, about four miles east of the western shore of Walker Lake and about 19 miles northwest of Hawthorne. The nearest town from which access is convenient is Yerington which is about 24.5 miles northwest of the property. A 4-wheel drive vehicle or a truck is recommended for travel to the property. The relief extremes at and near the property range from about 5800 feet to about 8300 feet above sea level.

MUST BE WEST

PROPERTY AND OPTION AGREEMENT

The property which Cities presently has under option from Iso Nevada, Ltd. consists of a block of 47 unpatented lode claims (see Claims Map and Option Agreement in Appendix I).

According to the terms of the Option Agreement, Cities is obligated only to do assessment work up to July of 1979. Assessment work for the current assessment year has not been done as yet. A twenty-thousand dollar ($20,000.00) payment is due at that time. Annual payments are due each year thereafter for 10 more years, gradually increasing in amount to a payment of $645,000. in the last year. All payments are subject to adjustment in accordance with changes in the Consumer Price

CENTRAL DISTRICT

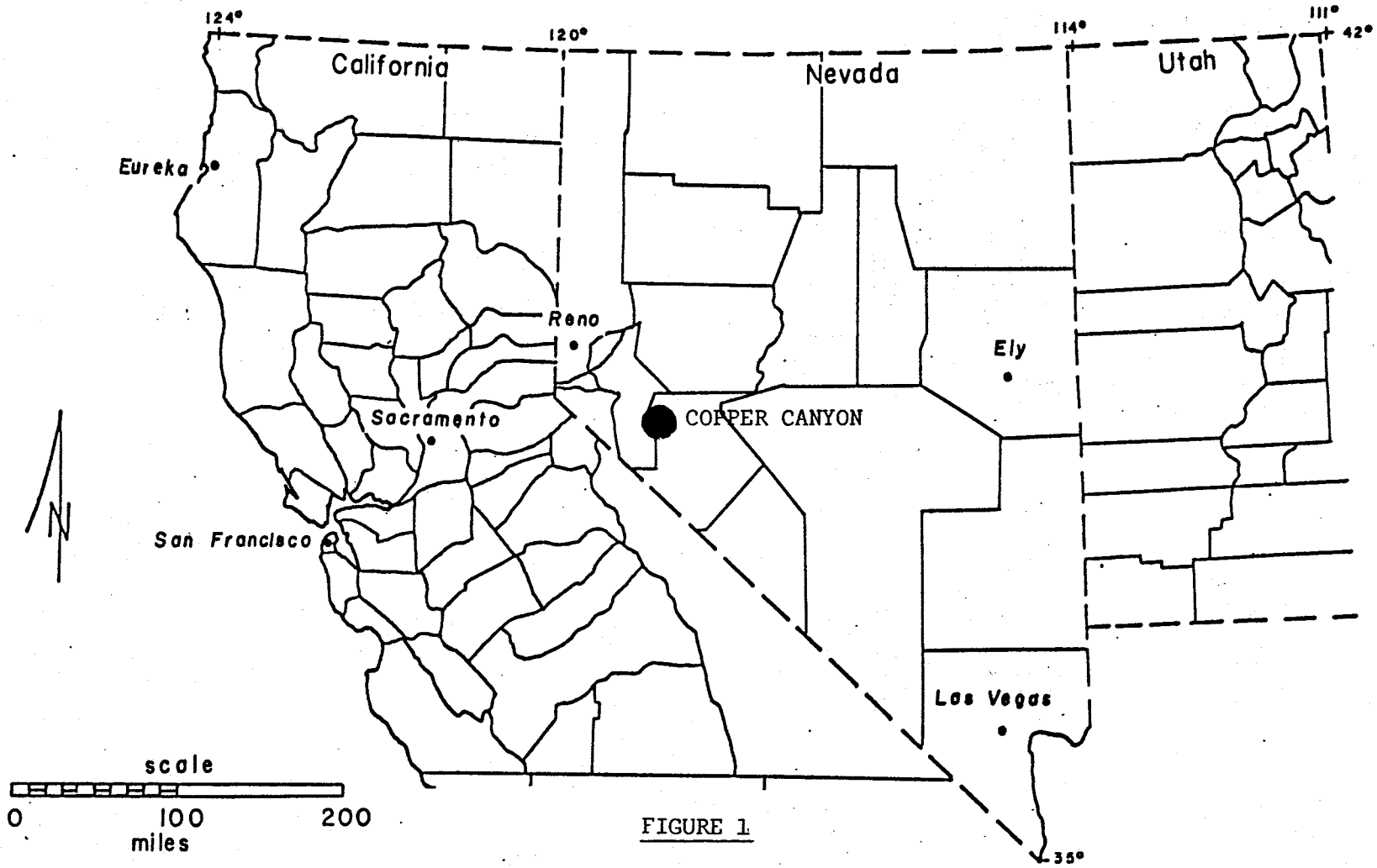


FIGURE 1

Location of Copper Canyon Project

Index. All payments are to apply toward a total purchase price of three million dollars ($3,000,000.00). If the company opts to buy out the agreement, the balance of the purchase price is also adjusted in accordance with the Consumer Price Index.

For further details see a copy of the complete Agreement in Appendix I.

PREVIOUS WORK

Several prospect pits and short adits are scattered within and near the property. They appear very old and were probably dug by early precious metal prospectors. Nothing is known of this apparent early work.

Anaconda recognized this disseminated sulfide zone some years ago, but due to other pressures they put off serious work on it for the future. In the meantime, Iso Nevada, Ltd. recognized it and located their present claims.

It is believed that no previous drilling or induced polarization work has been done on the property.

Iso has conducted geologic mapping, geochemical sampling, and ground magnetic surveying. We feel that the geologic mapping is not sufficient to resolve the kinds of information required to bring this type of deposit to the drilling stage. Their geochemical survey suffers from a too wide spacing between samples (600 feet), and uncertainty as to the type of samples taken and the sampling techniques used. A ground magnetic survey by Iso appears adequate, and will be of more value when more geology is available with which to correlate it.

GENERAL GEOLOGY

Full-scale mapping operations by Cities Service Minerals personnel had been underway for approximately eight days when it was prematurely terminated. The work we have accomplished thus far constitutes only a beginning and it has probably raised at least as many questions as it has answered.

Two geologic maps accompany this report. Figure 6 (in Pocket) is a generalized geologic map made by Iso Nevada, Ltd. This map is obviously based on very wide-spaced observations and therefore does not resolve the kinds of details which one needs to work with porphyry copper-type occurrences.

The geologic map by Cities (Figure 2) is too incomplete to be of very much value. However, this work did result in the establishment of some very useful facts.

Mapping to date has defined a group of premineral units consisting of equigranular intrusives and a sequence of metamorphosed volcanic and sedimentary rocks. These older units have been intruded by a sequence of porphyritic rocks. Most of them are felsic in composition but a few are probably intermediate. The group of probable intermediate composition includes both aphanitic as well as porphyritic textures. There are a minimum of three and probably more separate felsic porphyritic intrusives included with this sequence. One or more of these intrusives is genetically related to the disseminated sulfide deposit in the prospect area.

A breccia forms spectacular outcrops along and adjacent to the north fork of Copper Canyon. Many of these outcrops are heavily iron stained. The geologic map by Iso treats this breccia as a rock unit. It is, in fact, a structural unit which is superimposed over more than one rock type. It is tempting to think that this breccia is genetically related to the sulfide mineralization. However, we could find no evidence that this was the case. The breccia matrix consists of finely crushed rock cemented by transported iron oxide. No boxworks after sulfides were identified in the breccia matrix. However, such boxworks were found in some of the breccia fragments. Quartz veins which cut across breccia fragments do not continue into the matrix and are therefore pre-breccia in age. If this breccia were present when the hydrothermal system which deposited sulfide was operating, it would certainly have accepted quartz and sulfide into its vuggy matrix. We found no evidence that this had taken place. This breccia is therefore considered to be (1) tectonic in origin and (2) postmineral in age.

A sequence of unmetamorphosed volcanic and sedimentary rocks forms the youngest unit which has been recognized. These rocks contain important information relating to the postmineral tectonic history of the area. Orientations taken on bedding planes and flow banding indicate that bedrock in the prospect area has been tilted westerly by as much as 90°. Any hypothesis concerning the shape and position of possible ore in the prospect area should take this fact into consideration.

Further details on the individual rock units and some of their relationships with one another can be found in the "Explanation" of the Cities Geologic Map (Figure 2).

MINERALIZATION

Relic and fresh sulfide occurs in a vein and disseminated mode. The vein sulfide occurs either as fracture coatings with little or no other gangue minerals or as a constituent of quartz veins. Pyrite is the only sulfide mineral which has been seen in abundance. Traces of chalcopyrite were seen in a few places. In most places the vein and disseminated sulfide will constitute only about one percent of the rock. In a few outcrops, however, the total relic sulfide will reach a few percent.

In many places magnetite occurs as a vein mineral along with quartz and as fine grained disseminations near quartz veins.

The results of a limited bedrock geochemical survey indicate that the greatest concentration of copper lies in a zone about 1500 feet wide. This zone is in the northwestern part of the claim area (See Figure 3).

The soil geochemical survey is the most useful set of geochemical data we have. This survey includes 891 soil samples systematically located on a grid. Between 30 and 40 additional samples were taken as part of an orientation survey. Each sample was analyzed for copper, lead, and zinc.

The results of the copper analyses are illustrated in Figure 4. These results show that copper is distributed in an elongate belt running northwesterly and roughly paralleling the north fork of Copper Canyon. The best copper values occur in an elongate zone in the northwestern portion of the claim area. The anomaly here, represented by values greater than 186 ppm copper, is approximately 1500 feet by 3000 feet. The northwest end of this elongate zone is overlapped by postmineral volcanic and sedminentary material.

A 170-foot deep core hole which was drilled to satisfy assessment work requirements for the past assessment year is located in the southeastern portion of this anomaly. The core from this hole contained from 90 to 440 ppm copper. In several places scattered throughout the length of this core small amounts of covelite occurring as thin coatings on pyrite grains were seen. Traces of chalcopyrite were seen in a few places.

Anomalous zinc values in soils form a halo which wraps around the northeastern portion of the plus 186 ppm copper anomaly. A map showing these results was not prepared for this report. Anomalous values for both copper and zinc do not extend southwesterly away from the plus 186 ppm copper anomaly. It is assumed that a northwesterly striking fault lying on or near the trace of this portion of the north fork of Copper Canyon has terminated this anomaly to the southwest.

ALTERATION

Hydrothermal alteration effects were noted in many outcrops. Due to the limited size of the survey and lack of time to complete a petrographic study, no meaningful patterns of alteration were resolved. Alteration features recognized from our limited work include: (1) recrystallization of biotite, (2) vein envelope alteration of plagioclase to orthoclase, and (3) altèration of plagioclase and former mafic minerals to sericite. The possibility of albitization (lowering of plagioclase) was not adequately studied.

The above mentioned alteration features were observed mostly within the Felsic Porphyritic Intrusive unit.

WORK PROPOSED

Geologic Mapping

The structural complexity of the prospect, namely the tilting and possible segmentation and displacement of various parts of the sulfide system, coupled with its complex intrusive history, demand that the surface mapping be completed prior to the initiation of an induced polarization survey. Without an adequate geologic map and concept of the shape and orientation of a possible ore zone, induced polarization data are likely to add no additional meaningful insight to the problem.

Petrographic Study

A thin section study to provide data on the nature and intensity of the various types of alteration should run concurrently along with geologic mapping. Such a study should be evaluated using the Yerington-deposit of Anaconda as a comparison.

Induced Polarization Survey

An induced polarization survey should be designed to test one or more hypothetical shape and orientation models which have taken into account the geologic mapping and petrographic data. If the survey is conducted after geologic mapping, some short induced polarization lines may be designed to test for the presence of certain structures which may have been inferred.

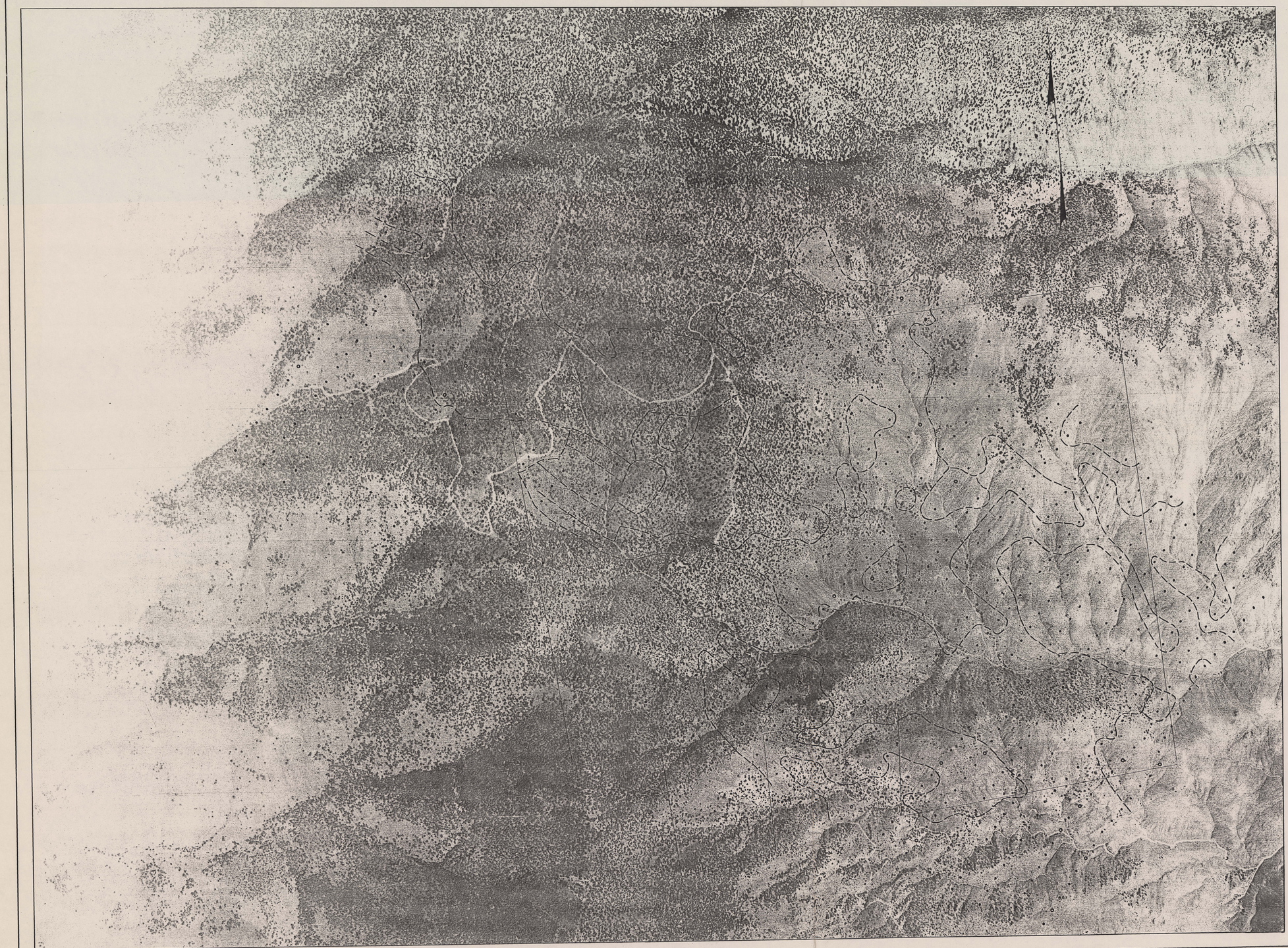
Drilling

It is unlikely that any geologic or geophysical work will be sufficiently negative that test drilling will not be necessary for a final evaluation. If we assume that a possible ore zone is laying on its side, and that one or more segments of it are represented by the plus 186 ppm copper anomaly in soils, then we could guess that a vertical drill hole, 1500 to 2000 feet long, may completely cross any ore zone which may be present. It is reasonable to assume that a minimum of two such well placed holes would be necessary to eliminate the reasonable chance of an economic ore zone.

SUMMARY AND CONCLUSIONS

Although our present knowledge of the property is limited, we feel that enough is known to easily justify all of the proposed work preceding drilling. We feel that it is possible but unlikely that the work preceding drilling will be sufficiently negative to warrant termination of the project.

It is felt that intensive geologic field studies should precede geophysical surveying and drilling. One of the more important features which the geologic work and subsequent formulation of hypotheses should take into account is the postmineral tectonic history of the area: namely, the westerly tilting.



COPPER

SOIL GEOCHEMICAL SURVEY

COPPER CANYON
Mineral County, Nevada

EXPLANATION

ppm Cu	
zero - 45	unsurveyed where sample points not shown
46 - 185	
186 - 499	
greater than 499	

These results are based on a Statistical Analyses on the analytical results from 891 soil samples. The samples were taken along roughly surveyed lines by Michael McFarlane (Party Chief) and John Hardy, between July 15 and August 22, 1977. Between 30 and 40 samples which were taken during an orientation survey by Chi-I Huang and Ralph Mulhollen in June and July, 1977, have been eliminated from the map and the statistical analysis.

The procedures for the soil survey were specified by Chi-I Huang. An attempt was made to take each sample from the lower A-horizon mineral soil, and to avoid the upper A-horizon soil containing organic material. Between 0.5 and 1.0 pound of material was collected at each site. In most places the A-horizon lay either directly over bedrock, or C-horizon soil materials. A relatively clay-rich B-horizon was seen in only a few places.

Undoubtedly, many samples represent materials which have been transported downslope a slynificant distance by creep or fluvial mechanisms, and some samples have been taken from over a parent material of talus.

Each geochemical zone on the map represents one or more populations of metal values defined by separate log normal distributions. Subdivisions are placed, according to judgment, at the more meaningful boundaries between certian populations. Some zones include a few sample points which are foreign to the group. In most places an attempt is made to select boundaries which are more likely to reflect boundaries in the underlying bedrock.

Sample Point Location	Metal Content With Respect to Geochemical Zone
○	Less than zone
●	Normal to zone
◎	Greater than zone

Scale Range

One Inch = 326 feet to 362 feet

1:3912 to 1:4344

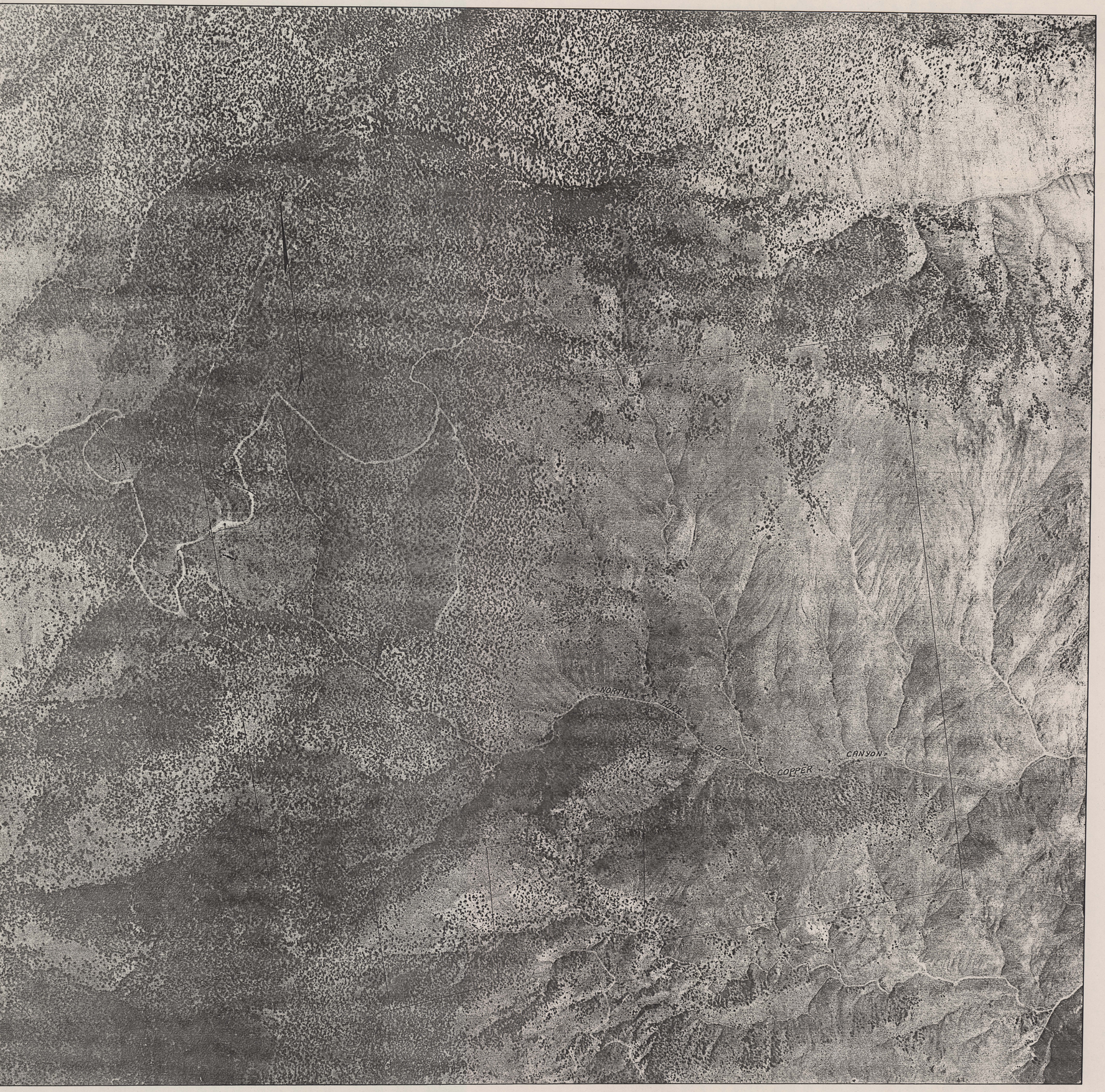
Bar Scale Drawn to one Inch = 348 feet

1:4176

0 1000 2000 Feet

Cities Service Minerals Corporation
November 1977

map 2 of 4
N. of 20



GEOLOGY

COPPER CANYON
Mineral County, Nevada

EXPLANATION

TERTIARY

Undivided Volcanic and Sedimentary Rocks

This unit consists mostly of volcanic flows and tuffs interlayered with a few tuffaceous sandstones and conglomerates. The stratigraphy of this unit and the petrography of the rocks it includes have not been studied closely.

The orientation of beds and flow bands indicates that it, and of course, older units as well, have been tilted westerly by as much as 90°

Breccia

This breccia consists of angular to subrounded fragments in a somewhat vuggy, iron oxide cemented matrix of finely crushed rock. The limonite cementing the matrix is believed to be transported. In many places it constitutes only a small portion of the outcrop area. In most outcrops where brecciated and unbrecciated rocks were observed, the breccia occurs as a thin tabular body and contains fragments identical to the surrounding outcrop.

Although this unit is strongly stained with iron oxide in many places, no boxworks after sulfide have been observed in the breccia matrix. However, such boxworks can be found in some of the breccia fragments. Quartz veins which cut across breccia fragments do not continue into the matrix and are therefore pre-breccia in age.

Because of its distribution pattern, monolithic nature, and the lack of relic sulfides or quartz in its matrix, this unit is considered to be (1) of tectonic origin and (2) postmineral in age.

Undivided Felsic Aphanitic Intrusives

Rocks included within this unit appear to be devoid of phenocryst. Rock colors range from dark to light grey. These rocks may or may not constitute a time unit. A few rocks fitting this description occur as thin dikes cutting across the felsic porphyritic intrusives and the Mesozoic diorites. A few outcrops contain disseminated pyrite, but none are known to contain anomalous amounts of copper. Although this unit is poorly understood, it is believed to be of postmineral age, and may be closely related in time to the felsic porphyritic intrusives.

Undivided Felsic Porphyritic Intrusives

This unit includes at least three and probably more separate intrusives. Sharp intrusive contacts were observed in many outcrops. Most of these rocks contain only phenocryst of plagioclase and mafic minerals. In most places the mafic mineral is biotite but in a few places it is amphibole. A few of the rocks in this unit contain quartz phenocryst in addition to the phenocryst of plagioclase and mafic minerals.

One or more of the intrusives is believed to be genetically related to the sulfide mineralization. At least two of the intrusives are mineralized and are therefore premineral in age. One or more intrusives may be postmineral in age.

This unit, as outlined on the map, includes small areas of other rock units which, for simplicity, are not shown. Phenocryst sizes measure from about one millimeter to a few millimeters in diameter. Groundmass grain sizes range from aphanitic to fine-grained.

Intermediate Intrusives

Medium to dark grey and greenish-grey rocks of probable intermediate composition occur as dikes and small irregular bodies cutting members of the felsic porphyritic and diorite units. Some of these rocks are porphyritic and some are aphanitic. They contain anomalous amounts of copper in many places and are therefore believed to be, at least in part, premineral in age. Some of them are known to be closely related in time to the felsic porphyritic intrusives. Rocks of this type constitute only a small fraction of most outcrops in which they occur. For simplicity they have been omitted from the geologic map.

Fine to Medium Grained Granite

These equigranular rocks contain only quartz and potassium feldspar in most places. In many places this rock displays an incipient graphic texture. The graphic texture and mineral composition suggest that it may not be of normal magmatic origin. It is similar to large sulite bodies which accompany some large stock or batholithic scale intrusives. Although very unlikely, this unit could represent a zone which has undergone intense potassic alteration, related to hydrothermal activity.

MESOZOIC

Metavolcanics

This unit consists mostly of hard, well-consolidated flows and tuffs which appear to have undergone green schist facies metamorphism. Most of them are felsic but a few may be of intermediate composition. Distinctly layered tuffaceous conglomerates are interlayered with the volcanics in a few places. Orientations on these beds are similar to those of the younger Tertiary sedimentary rocks of the "Undivided Volcanic and Sedimentary Unit."

Granodiorite

Many outcrops of granodiorite were observed along the base of the Copper Canyon North Fork and Copper Canyon proper east of the map area, but only one such outcrop is recorded. This outcrop, as well as many other similar ones contains an abundance of xenoliths which appear to have been derived from the diorite unit.

Diorite

This equigranular intrusive is fine to medium grained. Its color ranges from medium to dark greenish. Although this unit contacts well-mineralized felsic porphyries, it does not appear to have accepted important mineralization.

Medium Grained Quartz Monzonite

This equigranular intrusive contains plagioclase, potassium feldspar, and biotite. In most places it is light grey or pink.

Symbols

Strike and dip of sedimentary layers or flow bands in extrusive volcanics

Accurate ⁄ Approximate

Possible important faults

Significant Gauge Zones

Approximate Trace of Possible Fault

Fault Breccia Moderately Well Cemented by Iron Oxide

Contact accuracies

± 30 feet ± 50 feet ± 100 feet

Cities Service Minerals Corporation
November 1977

Geology by: C. N. Upchurch, F. N. Holabird, Larry Weis, Chi-I Huang, and R. D. Mulhollen, August and September, 1977

Scale Range

One Inch = 326 feet to 362 feet

1:3912 to 1:4344

Bar Scale Drawn to One Inch = 348 Feet

1:4176

0 1000 2000 Feet

map 3 of 4
N. of 203

COPPER

BEDROCK GEOCHEMICAL SURVEY

COPPER CANYON
Mineral Co., Nevada

EXPLANATION

Black area indicates approximate shape and size of outcrop area sampled	Color indicates ppm copper
	zero - 64
	65 - 270
	271 - 750
	Greater than 750

These results are based in part on a statistical analyses of 131 bedrock samples. It would appear that the geology is sufficiently complex that considering the statistical distribution of metal values alone is not enough to clearly distinguish between some zones believed to have undergone very different mineralization histories. Each color on the map represents one or more log normal populations of metal values. The subdivisons are placed at the more meaningful boundaries according to judgment. The division between 64 and 65 ppm copper is arbitrary and was selected by inspection of the map so as to better illustrate a division believed to be geologically meaningful.

The poor sample site distribution and lack of sample quantity, a shortcoming imposed by a lack of time, severely limits the usefulness of survey.

The samples were taken by compositing one or more pounds of bedrock chips from either a 20-foot or larger diameter circle or roughly equidimensional area, or a 20-foot or longer line traverse, depending upon the distribution of available outcrop. In some places, traverses ranging from 100 to 200 feet long were sampled. The location and approximate shape of the sampled outcrops are illustrated on the map.

Most of the samples were collected by C. N. Upchurch and F. N. Holabird. Some were collected by Larry Weis and Chi-I Huang, and a few by R. D. Mulhollen. The samples were collected at intermittent intervals from November 1976 through September 1977.

Some rock samples of record were collected by a method which did not attempt to obtain representation of a 20-foot diameter or larger area. These samples have been eliminated from both the map and the statistical analysis.

The results from about 100 samples taken early in 1976 by A. I. Betmanis for Iso Nevada, Ltd., were omitted from consideration because of uncertainty as to the type of material sampled and the techniques used to collect it. It is believed that this group of samples includes mostly float and possibly some outcrop.

Scale Range

One inch = 326 feet to 362 feet

1:3912 to 1:4344

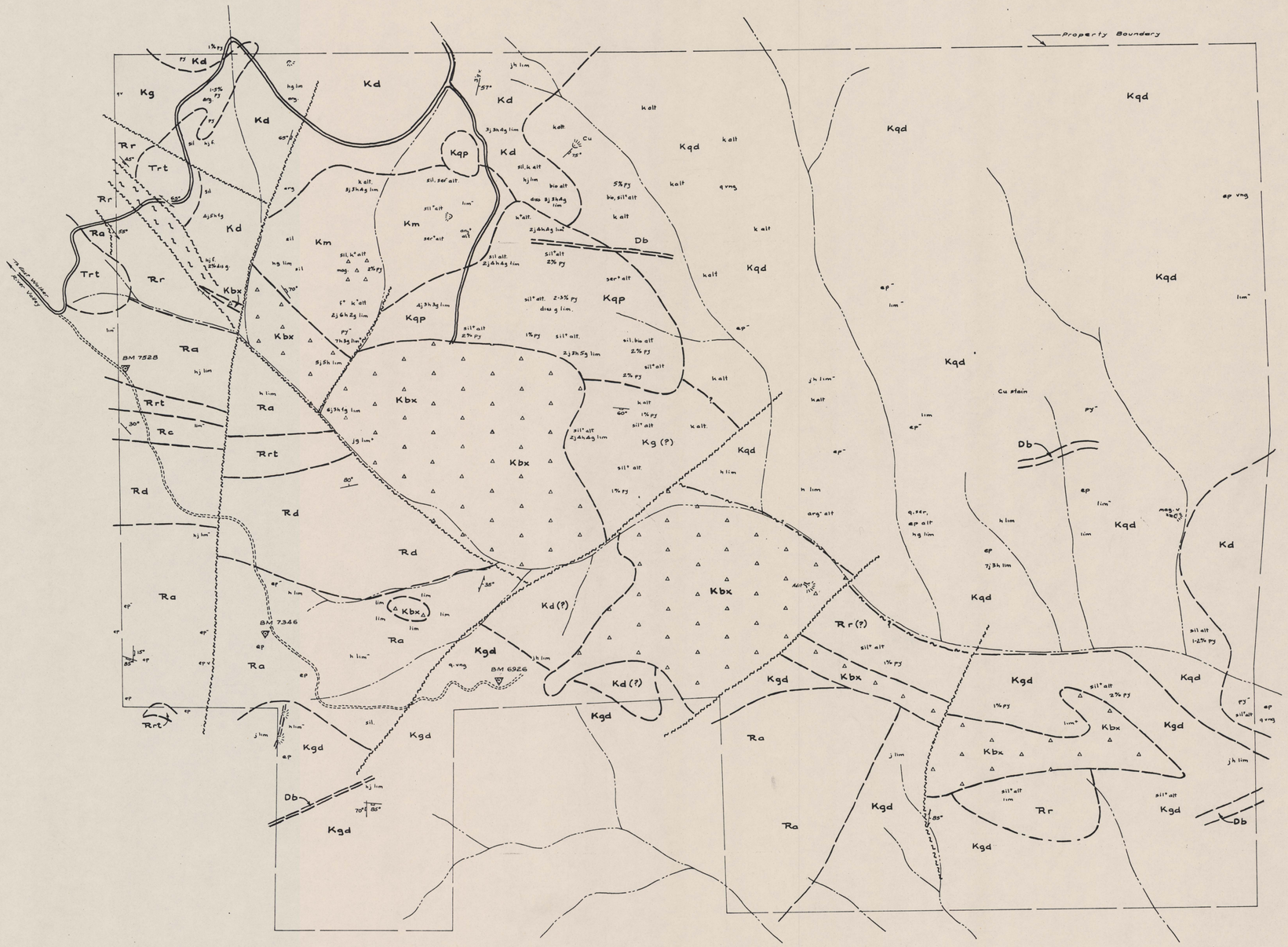
Bar Scale Drawn to one inch = 348 feet

1:4176

0 1000 2000 FEET

Cities Service Minerals Corp.
November 1977

map 4 of 4
N. of 203



LEGEND

TERTIARY	Trt	Rhyolite Tuff – Breccia
	Db	Diabase Dyke
	Kbx	Copper Canyon Breccia
LATE (?)	Kqp	Quartz Porphyry
	Km	Monzonite (could be strong K-spar altered Kqd)
CRETACEOUS	Kg	Microgranite
	Kd	Diorite – Microdiorite
	Kqd	Quartz Diorite
	Kgd	Granodiorite
	Rr	Rhyolite
	Ra	Andesite
TRIASSIC	Rrt	Rhyolite Tuff
	Rc	Chert
	Rd	Dacite

△ △	Breccia	Cu	copper
	Contact	py	pyrite
~~	Fault	lim	limonite
	Bedding	j	jarosite
	Shearing	h	hematite
	Fracturing	g	goethite
	Prospect Pit	aj 5 h / g	60% j, 30% h, 10% g estimate
	Prospect Tunnel	q	quartz
	Road	mag	magnetite
	Pack Trail	v, vng	vein, veining
	Drainage Channel	sil	silicification
▽	Government Bench Mark	k	K-feldspar

ser	sericite	ep	epidote
bio	biotite	alt	alteration
arg	argillaceous	+	strong - weak

ISO MINES LIMITED

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COPPER CANYON PROPERTY

Mineral County T10N, R28E Nevada

GEOLOGY MAP

200 0 500 1000

Scale 1 inch = 400 feet

A.I. Betmanis

February 1976

NJ 11-4/20

map 184
N. of 203