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GEOLOGY OF THE HUNTLEY-DANIEL PROPERTY, CROW SPRING AREA, ESMERALDA COUNTY, NEVADA

by

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CONTENTS

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SUMMARY

The Huntley-Daniel property, consisting of 310 unpatented mining claims, is located near Crow Spring in northern Esmeralda County, Nevada about 20 miles northwest of Tonopah, Nevada. This property has been leased by Homestake to prospect for disseminated copper deposits.

The Excelsior formation, comprised of low grade metamorphic rocks, forms a series of low hills across the property. It is intruded by granitic rock, and both the Excelsior and the granitic rock are uncomformably overlain by rhyolite and latite. The granitic rock appears to be a favorable host for porphyry copper type ore deposits because it locally shows hypogene alteration, copper staining, and residual boxworks after chalcopyrite. The two most favorable areas in the exposed granitic rock are associated with shear zones. One such shear zone is termed the Copper Queen shear zone. It trends northeasterly and has a strike length of about 1400 feet with an indicated width of about 800 feet. The second shear zone is called the Star shear zone: it is more extensive than the Copper Queen shear zone, having a strike length of nearly 2000 feet and a width of about 1000 feet. The Star shear zone trends east-west, and granitic rocks for 2000 feet beyond the western end of the Star shear zone appear quite favorable.

It is recommended that 5 holes, aggregating 4500 feet, be drilled to search for disseminated copper deposits. One hole is recommended in the Copper Queen shear zone and 3 holes in the Star shear zone and its westward extension. The fifth hole is recommended to explore granitic rock which underlies the Excelsior formation at shallow depth. If the first five holes show well mineralized rock, additional exploration should be undertaken in areas where the granitic rock is overlain by the Excelsior formation, volcanic rocks, or recent alluvial deposits.

INTRODUCTION

The Huntley-Daniel property near Crow Spring in northern Esmeralda County, Nevada has been leased by Homestake as a porphyry copper prospect. This report summarizes the result of mapping carried out on the ~~report~~ property during January and part of February, 1963. Mapping was done on aerial photographs flown specifically for the project at a scale of one inch to 500 feet.

A. P. Gilles is currently making a magnetic survey of the property and the results of his work will be presented in a later report.

LOCATION AND ACCESSIBILITY

The property, as shown in figure 1, covers parts of unsurveyed T.4N., R.39 and 40 E. and T.5N., R.39 and 40 E. in Esmeralda County, Nevada. It is accessible via 11 miles of dry-weather, dirt road which branches northwestward from U.S. Highway 6 and 95 at a point about 13 miles west of Tonopah, Nevada.

PROPERTY

The property consists of 309 unpatented lode mining claims in one contiguous block. A single claim, the Desert Wells claim which lies about one mile east-northeast from the main block of claims, is included in the lease agreement. No bedrock crops out on the Desert Wells claim and it is not considered in this report.

Legal details concerning the property have been fully presented in the completed lease-option agreement and will

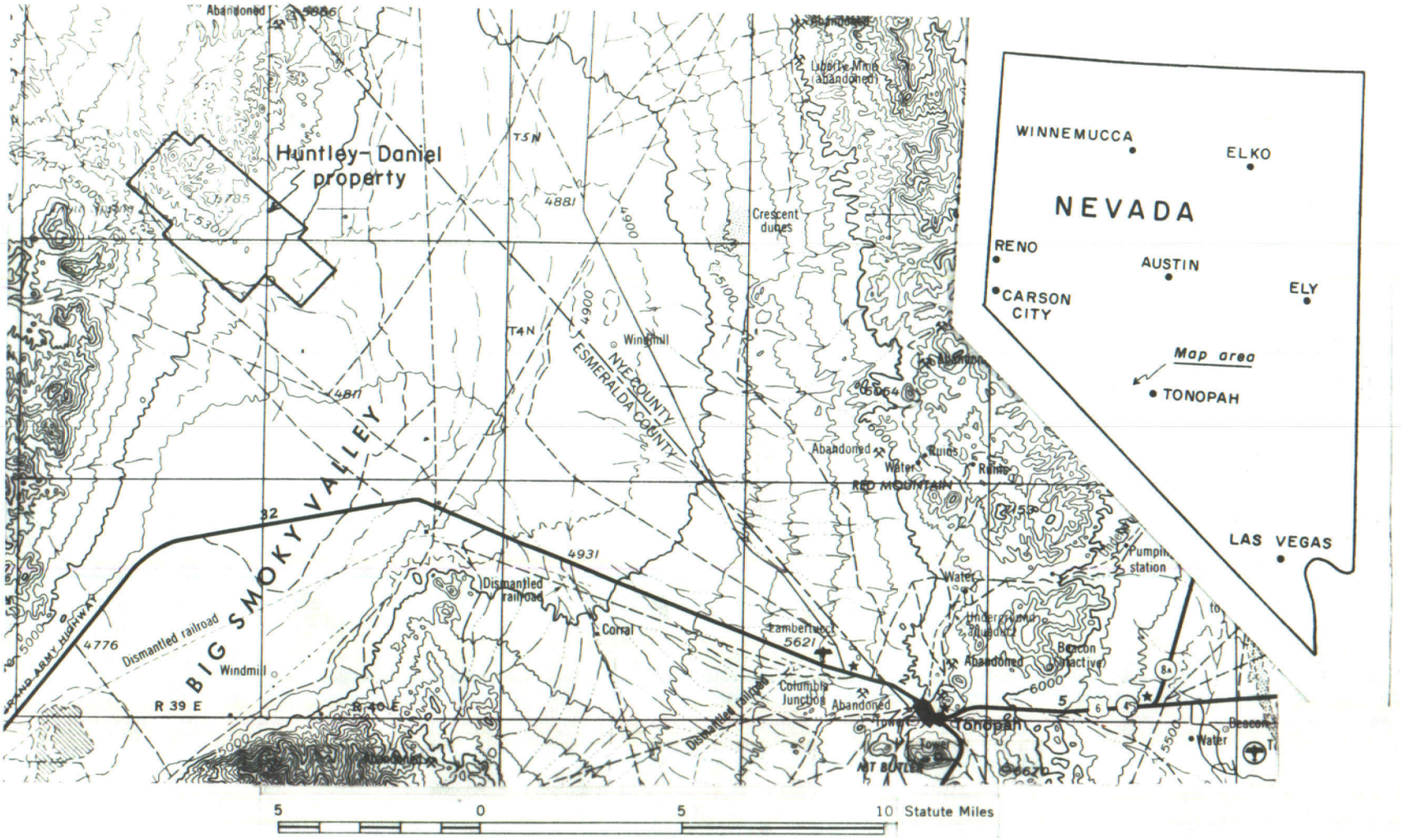

Figure 1.- Index map

not be repeated here. Observations during the field work indicate that the claims are in proper order with respect to staking and discovery work. A number of older, conflicting claims were noted in the field. All the conflicting claims appear to be abandoned, but pertinent data on them is presented in table 1.

Table 1.- Claims found in field survey that conflict with Homestake's leased ground in the Crow Spring area.

Claim Name	Date of Location	Locator(s)
Eagle Group	September 20, 1957	Vic Smith Russ Kirsan
Delux Group	January, 1955	Elton Parsons
Light Group	April to August 1957	S. H. Manor Sam Gamblin W. A. Silver A. R. Sanger
Wood Group	June 10, 1955	S. H. Manor
Moseley Group	August 25, 1919	J. W. Moseley
Gold Rush Group	February 1, 1925	John Hansen
Spache Group	February 1, 1925	Charles Jamison E. S. Harney
Margin Group	March 4, 1925	George A. Cole Ed Malley James Isachen
? Folivoer ?	March, 1922	James Donovan
Buctin Load	May 5, 1949	R. J. Camarino John Ferdmand Joe Hayden
Tenderfoot	January 5, 1925	Frank Richardson Ray Richardson
Unknown	November 21, 1921	Henry Engle
Titanic	April 3, 1922	C. J. Carr J. J. Carr Mary Morse
Maggie Taylor #1	Unknown	T. Johnson
Roadside Group	March 29, 1959	Lee F. Hand Neil Doherty
White Cloud #2	Unknown	Unknown
Blue Eagle Group	Unknown	Unknown

Marq(g)uret Group	October 17, 1928	T. Johnson
Sunset Group	February 1, 1925	W. H. Brandon E. G. Taylor
Etta Bell #1	April 9, 1932	W. B. Copus Etta Addington
Birddie	May 5, 1922	M. McWilliams
Genoa Group	Unknown	Unknown
Dewey	Unknown	Unknown
Hattie Classic	Unknown	Unknown
Last Chance	Unknown	Unknown
Unknown	January 31, 1925	L. ?(Bacaddessa)?
Prudence	Unknown	Unknown

PREVIOUS WORK

Prospectors have gone over the claim area since the early 1900's and because of its proximity to the old camp of Tonopah we can assume that many prospectors have examined the surface thoroughly. Turquoise, copper, and opalized wood were discovered by the early prospectors. Turquoise was subsequently produced intermittently and on a small scale until the mid 1950's; however, there is no recorded production and the turquoise now exposed is of poor quality. Prospectors excavated fragments of opalized wood, but none was of gem quality.

Shear zones impregnated with quartz and minor amounts of secondary copper minerals were prospected in shallow trenchs and shafts. About a dozen churn drill and wagon drill holes were put down on some shears to estimated depths ranging from 100 to 200 feet. These holes did not penetrate below the zone of oxidation, and no records were kept. Verbal reports indicate that assays in drill holes showed about 0.1 percent copper. No copper has been produced from the property.

The present owners made a brief geological study of the property and took a number of surface samples for assay. The results of this surface sampling will be presented in the section on mineralization and alteration.

GENERAL GEOLOGY

Lithology

Three main rock types are exposed on the property, and the distribution of each is shown on the appended geologic map. The Excelsior formation of Triassic (?) age is the

oldest unit exposed; it is intruded by granite and both are overlain by younger volcanic rocks.

The Excelsior formation crops out as a group of hills that extends northwesterly across the property. It consists of fine-grained clastic sediments and cherts that have been metamorphosed to quartzite and hornfels. Two types of quartzite constitute the bulk of the exposed Excelsior: one type is a dark, very fine-grained variety with moderate amounts of interstitial mica; the other type is lighter in color and coarser grained with little or no accessory minerals. The dark, fine-grained quartzite is probably the metamorphic equivalent of an argillaceous siltstone; whereas, the coarser grained, lighter colored variety probably represents metamorphosed chert. The Excelsior exposed on the northern part of the property contains much fine grained, dark, hornblende-rich hornfels.

Granitic rocks, which intrude the Excelsior formation, are exposed at the southeast end of the hills formed by the Excelsior. Granitic rock also crops out at several places within the Excelsior hills and undoubtedly occurs at shallow depth below bleached, brecciated Excelsior on the Mat 5, 7, and 9 claims and the Rex 7 claim. Fresh specimens of granitic rocks contain numerous phenocrysts of orthoclase, up to one inch long, set in a very coarse grained matrix of quartz, orthoclase, plagioclase and hornblende. The rocks have been regarded as ganite but one thin section was examined, and this single section showed sufficient plagioclase to indi-

cate that the intrusive, at least in places, grades to quartz monzonite. Later intrusive phases in the granite-quartz monzonite form irregular masses of aplite and fine-grained granite as well as dikes of very fine grained granite and diabase. Locally, the granite-quartz monzonite is highly altered, and this alteration will be discussed in a subsequent section of this report.

Volcanic rocks unconformably overly both the Excelsior formation and the intrusive rocks. In outcrop these volcanic rocks present a wide range of colors and appearances; however, nearly all are rhyolite or quartz latite and their glassy or tuffaceous equivalents. These rocks contain various proportions of quartz, sanidine, andesine, and biotite phenocrysts in a microcrystalline or glassy matrix. Some units contain pumice fragments or fragments of other rocks. In field mapping, it is not possible to distinquish the various rock types; accordingly, the volcanic rocks were separated on the basis of color differences and glass content. Light and dark volcanic rocks were mapped separately as were the rocks with a glassy matrix (vitrophyres). A distinctive purplish rhyolite appears to have been the first volcanic rock deposited over the erosion surface developed on the Excelsior formation and the granitic intrusive. An effort was made to map this rhyolite separately; however, it is indistinguishable from the other volcanic rocks where it has been bleached along fractures and fault zones. Outcrops of basalt were noted in the extreme western corner of the property

on the Ene 2 and 4 claims, but these outcrops were mapped with the darker volcanic rocks.

Structure

Structural history of the region is complex, but structural features on the property are mostly related to one of four main events. The earliest of these events appears to have been the folding and metamorphism of the Excelsior formation, presumably near the end of Mesozoic time. Intrusion of the granite followed, or was perhaps partly contemporaneous with, the first event. After a period of erosion, the volcanic rocks were deposited and the third event took place. The third event consisted of regional tilting toward the west so that the volcanic rocks dip to the west. This tilting may have begun while volcanic rocks were still being deposited. Finally, in the fourth main event, there was strong faulting along northerly and northwesterly directions.

Early folding.--The earliest structural features are the folds within the Excelsior formation. The exact pattern of folding has not been worked out due to the general absence of well-defined marker horizons and the lack of discernible bedding in the southeastern part of the exposed Excelsior. In general the fold axes appear to strike easterly. This folding may be in part related to the later intrusion of the granitic rocks, and doubtless some of the faults within the Excelsior originated at the time of folding. Metamorphism in the Excelsior appears to have been completed before the granitic rocks were intruded because no appreciable contact effects are observed close to the granitic rocks.

Intrusion of granitic rocks.--The intrusion of granitic rocks is regarded as the second main structural event. This intrusion was in places guided by preexisting faults in the Excelsior and probably also caused additional faulting and brecciation in the Excelsior. Brecciated areas indicating the presence of granitic rocks occur on the ~~Mat~~ Mat 5, 7, and 9 claims and the Rex 7 claim.

From the standpoint of porphyry copper deposits, the most important structures associated with intrusion of the granitic rocks are the shear zones that developed as the rocks cooled. Two such shear zones occur on the property. One shear zone is exposed on the Copper Queen 13, 14, 15, 17, and 19 claims near the southeastern limit of the exposed granitic rocks. This zone will subsequently be termed the "Copper Queen" shear zone. Individual shears within the Copper Queen zone strike to the north or northeast and dip steeply to the west or northwest. The second zone of shearing strikes easterly across the Star and Copper Queen 1 and 2 claims. Individual shears in this zone dip 60 to 65 degrees north. This shear zone will hereafter be referred to as the "Star" shear zone. Both the Copper Queen and Star shear zones have served to localize the mineralization and alteration which will be described in a following section of this report. In general, the fractures within the intrusive mass are parallel to one of the directions of shearing.

Deposition and tilting of the volcanic rocks.--Following the intrusion of granitic rocks, there occurred a period of erosion which exposed both the Excelsior formation and the

granitic rocks. The volcanic rocks were deposited unconformably on this erosion surface. The volcanic rocks themselves were deposited intermittently, and numerous disconformities occur within the volcanic section. These disconformities are marked by the presence of opalized wood directly overlain by vitrophyre units. The attitude of the volcanic rocks shows no appreciable variation across these disconformities. Tilting of the volcanics occurred after their depositon. This tilting was on an axis that trends almost due north, and the volcanic rocks were tilted an estimated 30 degrees to the west.

The presence of tilting in the volcanic rocks implies that both the Excelsior formation and the granitic rocks were also tilted to the west. If this is true, the southwest flank of the intrusive mass presently dips 30 degrees steeper than when it was first emplaced. This dip is estimated as being 60 to 70 degrees.

Faulting.--Final faulting in the area is a part of the Basin and Range fault system that occurs throughout the region. This faulting resulted in the uplift of the block that contains most of the Excelsior and granitic outcrops. The northeastern side of this block is rather well defined and is undoubtedly the site of a fault that drops any granitic rocks in the hangingwall below the depth to which they can be practically prospected.

The fault along the southwest side of the Excelsior-granitic block can be easily traced along the northwestern half of its length; however, southwesterly from the Copper

Queen 42 claim the position, and indeed the presence of the fault itself, is a matter of inference. If the fault does exist in its inferred position, it probably does not have a great amount of vertical displacement along its southeastern half.

Cross faults which cut the main faults bounding the Excelsior-granitic block cannot be traced into the volcanic rocks. This is probably because they do not have a great amount of displacement and die out quickly in the granular volcanic rocks. These cross faults may actually represent older faults which underwent minor renewed movement during Basin-Range faulting.

MINERALIZATION AND ALTERATION

No significant mineralization occurs in the Excelsior formation or the volcanic rocks. The Excelsior formation is locally bleached and slightly altered near contacts with intrusive rock and along faults, but this alteration is not easily distinguishable from primary variations in the formation. This discussion therefore concerns only the mineralization and alteration of the granitic rocks.

Fresh-looking specimens of the granitic rock show, in thin section, minor alteration with development of chlorite and epidote in the hornblende and formation of sericite in feldspars. This alteration is considered a result of normal deuteric processes and is not directly related to evaluation of the rock as a host for porphyry copper deposits. More intense alteration of the type commonly associated with

porphyry copper deposits is confined to the Copper Queen and Star shear zones. Each shear zone has a different type of alteration; however, the distinction may be partly artificial in that it may represent differences in the intensity of a single type of alteration and relative extent of exposure.

Alteration associated with the Copper Queen shear zone does not extend far from the individual shears. This type of alteration is characterized by the development of quartz veins in the shear and "jasperoid" in the adjacent rock; it will therefore be referred to as "silica alteration". Minor amounts of argillic alteration and brown, limonitic staining accompany the silica alteration. The presence of residual chalcopyrite boxworks and secondary copper minerals in very small amounts indicates that some copper was introduced with the silica alteration in the Copper Queen shear zone.

Alteration within the Star shear zone is more pervasive than that in the Copper Queen zone, and argillic alteration is more characteristic of the Star shear zone. It results in complete argillization of the feldspars and leaching of the mafic minerals. The turquoise deposits are associated with this type of alteration, and minor amounts of chalcopyrite boxworks occur within the numerous limonite-coated fractures. Outward from the main Star shear zone, argillic alteration gradually decreases and mafic minerals are not leached from the rock, but minor amounts of chalcopyrite boxworks occur along some limonite-coated fractures. Along the western projection of the Star shear zone, on the Star 3 and Copper Queen

37 and 39 claims, the argillic alteration appears to give way to more silicic-type alteration.

Granitic rocks exposed on the Copper Queen 42, 44, and 50 claims and the Dar 5, 7, and 9 claims exhibit what appears to be moderate argillic alteration and exceedingly minute chalcopyrite boxworks; however, these features may be actually related to an ancient erosion surface rather than to hypogene mineralization.

The present property owners undertook a limited surface sampling program, and although the distribution of their sample points does not permit contouring of the data, it does point out areas where the copper and molybdenum values seem anomalously high. A total copper content exceeding 300 parts per million (0.03 percent) is considered above average for random surface samples, as is a total molybdenum content above 20 parts per million (0.002 percent). On this basis, copper anomalies occur in three areas. One anomaly covers an irregular area in the unfavorable looking granitic rocks on the Copper Queen 5, 7, 9, and 10 claims; another anomaly coincides roughly with the Copper Queen shear zone. The third area with anomalously high copper content covers an elongate, east-west strip across the Dar 5 and 7 claims and the Copper Queen 42 claim, the area previously mentioned as probably representing an ancient erosion surface.

Molybdenum anomalies are broader and less distinct than the copper anomalies. One anomaly covers the Star shear zone and extends southeasterly across the Copper Queen 5, 6, 7, 8,

9, 10, 11, and 12 claims. The other anomaly covers the granitic rocks exposed on the Copper Queen 42, 44, and 50 claims and the Dar 5, 7, and 9 claims.

EXPLORATION POSSIBILITIES

Exploration for porphyry copper deposits on the Huntley-Daniel group of claims must be confined to areas where granitic rocks are exposed or lie at depths of a few hundred feet or less below the surface. Evaluation of the exposed granitic rocks indicates three favorable areas: (1) the Star shear zone, (2) the Copper Queen shear zone, and (3) the granitic rocks exposed on the southern part of the Copper Queen 42, 44, and 50 claims and the northern part of the Dar 5, 7, and 9 claims.

Granitic rocks might be found at shallow depth below the Excelsior formation, especially on the Mat 5, 7, and 9 claims and on the Rex 7 claim. Also, granitic rock might lie directly below the covered areas on the Holly, Dolly and Gordo groups of claims southeastward from the granitic exposures on the Copper Queen claims. Finally, granitic rock may not be deeply buried in the area southwest of the inferred fault that crosses the Copper Queen and Copper King claims. Southwest from this fault, however, the granitic contact probably dips rather steeply to the southwest so as to drop below the depth of practical exploration within a few hundred or, at most, a thousand feet horizontally from the fault. Evaluation of any thinly covered granitic rocks would depend upon geophysical work, drilling, or the results of exploration in exposed gra-

nitic rocks. For this reason, initial phases of exploration should be concerned with the areas of exposed granitic rocks.

RECOMMENDATIONS

The Huntley-Daniel claims do not appear to be favorable for the occurrence of large supergene enrichment copper deposits; this conclusion is based on the relative smallness of altered areas containing appreciable evidence of leached copper minerals. On the other hand, there is good evidence that primary, disseminated copper deposits might occur in the granitic rocks. Accordingly, it is recommended that 4 holes be drilled in the most favorable looking areas of granitic rock. The position of recommended holes is shown on the geologic map that accompanies this report. One hole is recommended in the Copper Queen shear zone on the Copper Queen 13 claim. Two holes should be drilled to test the Star shear zone, one on the Star claim to test the most intensely altered rock and another on the Copper Queen 39 claim to test the inferred extension of the zone into a less altered but apparently mineralized area. A fourth hole should be drilled on the Dar 7 claim to test the apparently altered and mineralized area to determine whether the effects noted here are due to ancient erosion and supergene processes or to hypogene mineralization. The first four holes should be planned for a depth of 1000 feet to test well below the zone of oxidation and to test for any trends toward a primary increase in copper content.

A fifth hole should be drilled on the Rex 5 claim to test granitic rock, that is sparsely exposed in that area. This

rock is well altered, but evidence for the presence or absence of copper mineralisation is inconclusive. This hole could be terminated at the end of a few hundred feet if the rock should prove unfavorable.

The first 5 holes with an estimated total drilling of 4500 feet should constitute the first stage of exploration. If this initial stage is unsuccessful or inconclusive, a second stage, to test unexposed granitic rocks, should be undertaken. The second stage of exploration would involve geophysical surveys or non-core drilling or a combination of the two to gain information as to the depth and mineral content of unexposed granitic rocks. Some bulldozer work should be undertaken during the second stage to determine the exact position of inferred faults in the Copper Queen and Copper King groups of claims.

Precise recommendations for the second stage of exploration will depend to some extent upon results of the magnetic survey which is currently in progress. Presently, it seems this second stage of exploration would be designed to cover the Mat, Rex, Holly, Dolly and Gordo groups of claims as well as the area immediately southwest of the inferred fault which crosses the Copper Queen and Copper King groups of claims.