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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ARIZONA
(MOHAVE COUNTY)
CHLORIDE QUADRANGLE
15-MINUTE SERIES

Topography by Lawrence Hankins, J. M. Holmes, Chester Lloyd, and William Knox
Surveyed in 1939

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Unimproved dirt
U. S. Route — State Route

APPROXIMATE MEAN DECLINATION, 1939

SCALE 1:62500

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona (West) rectangular coordinate system
1000-meter Universal Transverse Mercator grid ticks, zone 11, shown in blue

CHLORIDE, ARIZ.
N3515—W11400/15
1939

FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER 25, COLORADO OR WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

AREA S

GENERAL DESCRIPTION

This area of approximately 500 mi² is in northwestern Arizona in the Detrital Valley just east of the Black Mountains and west of the Cerbat Mountains in Mohave County. The valley under discussion is just over the Black Mountains from the Colorado River near the common boundaries of California, Nevada, and Arizona. This area is flown with aeromagnetic traverses at 300 ft above terrane, spaced at one-half mile. They have northeast-southwest orientation. The major town in the vicinity is Kingman which is just southeast of the area in SE21N17W. The other town of note is Chloride in north central 23N18W. The entire area is included within 21-29N17-21W.

The Cerbat Mountains along the eastern side of the valley in 22-25N are outcropping Precambrian gneiss with some Cretaceous andesites. From 26N these andesites and Quaternary basalts become more numerous to dominate the outcrop pattern northward through 28N. This is not to say that other intrusives, particularly isolated occurrences of Laramide granite, do not occur. Of particular noteworthiness in this connection is the location of the only significant ore body in the area, that of Duval Corporation in and around 24, 23N18W on the northern edge of a Laramide granite which, incidentally, is within a magnetic low as are most all disseminated copper mines in Arizona. Continuing with general geology, the Black Mountains on the western side of the valley are essentially Tertiary rhyolites in the south in and around 23N19W but become Precambrian schists and gneisses with NNW strike in 23-28N21W on their eastern flank. However, these in turn contain local areas of Laramide granites in NE25N21W and Cretaceous volcanics in 26-28N21W.

RESULTS

General

The Cerbat Mountain magnetic terrane in the northeast is very anomalous. Here the Precambrian is largely intruded and extruded by Cretaceous volcanics and Quaternary basalts. The strong, local anomalies of the basalts are clearly visible over outcrop in 25, 28N20W and the north-south body west of the highway in and around section 26. The gneisses are very variable magnetically as is customary. In this instance a susceptibility of 71 was measured in section 36, and a much larger one of 1386 was found in section 24. The Quaternary basalt field would appear to dominate the magnetic pattern eastward under fill into SE27N20W, SW27N19W, all of 26N19W, and NE26N20W in spite of the fact that much of the area in 26N has Cretaceous volcanics

mapped. The magnetic pattern indicates that tne rock identification may not be correct. Very high susceptibility measurements on basalts were found in 24 and 35, 26N19W of 2945 and 3721. Actually, even a Precambrian gneiss had a relatively high susceptibility of 1197 in 31, 26N18W. Precambrian gneiss takes over the outcrops from 25N southward in the Cerbat Mountains. The magnetic field from this crystalline rock is as diverse as usual but extremely flat in NW24N18W with anomalies increasing in the southern part of the township. Actually in the southern part the outcrop becomes diverse with Precambrian granites and schists mapped in the gneissic terrane. Also here is the first outcrop of Laramide rocks, a gabbro in 35, 24N18W. The introduction of Laramide extrusives into the Precambrian outcrops apparently is the origin of the outstanding positive closures in and around SW23N17W. Apparently the contacts with these intrusives are very important because of the location of the Duval ore body on one of them. Finally as regards the eastern border, it becomes much more complicated in the south, or south of a conspicuous northwesterly decreasing gradient, because of numerous injections of Laramide gabbro and finally Quaternary basalts in 22N17W.

Returning to the northern part of the Black Mountains along the western boundary of the area, one first finds a tight band of anomalies of northwest strike in SW28N21W which follows the northern plunge of Cretaceous volcanics overlaying Precambrian gneiss and Laramide intrusives. The main body of the latter intrusive may follow a narrow northwest striking positive anomaly, and the Precambrian gneiss may be correlated with a similar anomaly of more width. The more extensive area of outcrop of the Laramide granite with respect to its anomaly may mean that it is thin in the east. Of considerable interest in the north is the fact that the basinal area between these mountains and the Cerbat Mountains on the east is really quite anomalous along the boundary between ranges 20 and 21. These two particular anomalies may represent Laramide intrusives and might be of more interest than the absence of recommended areas on them indicates. The magnetic field in 27N21W would seem to represent magnetic segregation within the Precambrian schists. The questionable Laramide granite mapped in and around section 9 is in a magnetic low and would therefore be of distinct interest if the surface mapping is correct. Note the abandoned mine in section 8 on a positive magnetic anomaly. Incidentally, the schist gives a susceptibility of 728 in section 33. The magnetic field in 26N21W, just east of the crystalline outcrop, is quite featureless. A susceptibility of 112 was measured in welded tuffs in 19, 26N20W. This condition of the field off outcrop continues into 24N where Precambrian gneisses have a susceptibility of 1309 in section 8, making a very local circular outcrop or, in general, an anomaly pattern which is diverse befitting gneissic terrane. Immediately south of this and south of the highway begins the young igneous terrane of Tertiary rhyolites and Quaternary basalts with their conspicuous banded series of anomalies of intense highs and lows. These anomalies apparently extend northward into NE24N19W as well as occupying the southern part of that township and almost all the township to the south.

SEDIMENTARY ISOPACHOUS MAP

No great thickness of section is developed anywhere. Almost 2000 ft is found in a closure in 27N20W, and this principal sedimentary axis follows southeastward along strike to 2500 ft of sediments in 22N18W after going arcuately around the buried mountains in 23N19W. One interesting aspect interrupting the thin section on the east is the thick developed under the inferred Quaternary basalts along the west line of 25N19W where, however, no prospects can be developed because of the dominant character of the anomalies from the young, shallow volcanics.

Recommended Areas

6 and 7, 28N20W, 2, 28N21W, 18, 28N20W — Fair

It is quite probable that the positive anomalies adjacent to these areas of interest are caused by Laramide intrusives, so their contacts are of interest.

9, 27N21W — Fair

Questionable Laramide granite outcrop in magnetic low. It should be field inspected.

No. 1 — 31, 28N19W — Poor

The contact zone around the positive anomaly of unknown origin could be of interest.

No. 2 — 12, 27N20W — Poor

The basement is only several hundred feet deep here. This area occurs between a Quaternary basalt on the east and a Precambrian gneiss on the west with the intervening zone, Cretaceous volcanics. There are numerous old mines in the area, so apparently these volcanics are mineralized. Note that, if the positive anomaly to the northwest is due to Precambrian gneiss, the similar positive anomaly to the east in NW27N19W is probably attributed to the same rock type with the intervening small positive caused by Quaternary basalt.

No. 3 — 31, 26N20W — Poor

A small positive segregate in Precambrian schist in section

6 to the south has an adjacent low in this area.

No. 4 34, 26N20W Poor

This arcuate area of interest follows a narrow minimum which is, however, probably related to shallow magnetic materials such as gravels or flows.

No. 5 31, 26N19W Fair

If the large positive to the south is from an interesting intrusive at only 500 ft, this minimal area just north of it may be of interest.

No. 6 33, 26N19W Poor

The minimum here probably results from position between shallow volcanics.

No. 7 34, 26N19W Poor

Same as above.

No. 8 19, 25N20W Fair

A positive projecting eastward from the Precambrian schist terrane is interrupted by a local minimum. This may represent a buried eastward extension of Laramide granite.

No. 9 15, 25N19W Poor

The crystalline rocks are about 300 ft deep here. The area is minimal and south of a possibly interesting positive anomaly.

No. 10 30, 25N18W Poor

The magnetic pattern suggests that some young igneous rocks may not have been mapped here as the adjacent terrane is Precambrian gneiss. If it is gneissic, the anomalies projecting under the field represent segregations in the gneiss which ordinarily are not of interest.

No. 11 10, 24N20W Poor

From surface mapping the narrow positive here would also represent a segregate in Precambrian gneiss. Superior says this is over an east-west horst plunging eastward from the eastern edge of a Laramide granite in 24N21W.

No. 12 19, 24N19W Poor

This is on the edge of the crystalline rocks where they are dipping steeply southwesterly. The geology is completely unknown, but the magnetic low probably only represents relatively thick sediments.

No. 13 10, 24N19W Poor

The minimum here is probably just over an area intervening between Quaternary basalts.

No. 14 11, 24N19W Poor

Same as above.

No. 15 13, 23N20W Poor

Although young igneous rocks are mapped here, a susceptibility of 130 was measured on quartz monzonite just across the township boundary. If that is true, this minimum on the edge of the survey may be of some interest.

No. 16 17, 23N19W Poor

Basement is at 440 ft here. There is a sharp minimum in an area of probable Quaternary basalts or Tertiary rhyolites.

No. 17 10, 23N19W Poor

Same as above.

No. 18 6, 23N18W Poor

This northwest trending anomaly west of Chloride is on the edge of the crystalline rocks where they begin to dip steeply

southward. Precambrian gneiss crops out on the mountain edge. Incidentally, it has a susceptibility of only 11as sampled in section 5. The minimum probably only represents the contact where the sediments begin to thicken and is not of interest. There are minor shows and veins between Nos. 18 and 19 in 33 and 34, 24N18W.

No. 19 2, 23N18W Fair

There is an old mine in the northwestern part of this area. The sharp minimum is concentrated to the southeast and may represent a contact of Laramide granite with Precambrian gneiss. As this is in the vicinity of the Duval ore body, it is of more than usual interest. Check outcrop.

No. 20 14, 23N18W Fair

Same as above.

Nos. 21 and 22 26 and 28, 23N18W Good

The susceptibility computed from the positive anomaly, and not measured from the rocks, between these two areas of interest is 3040. Incidentally, the rock for the positive anomaly should be at a depth of 700 ft. This anomaly and the one to the east in and south of section 35 probably are due to intrusions of Laramide granite, judging from outcrop correlations in section 1. The incursion of the No. 22 minimum into the positive system and the general area of contact around the positive anomalies are of unusual interest in view of the proximity to the Duval ore body.

Nos. 23 and 24 12 and 24, 22N18W Fair

These minimal areas north and east of a small positive are in areas of relatively shallow basement and might represent contact areas with respect to a Laramide intrusive. Look for outcrop evidence in eastern parts.

No. 25 30, 22N17W Poor

This is in an area of outcrop where mineralization, if any, ought to show within a Precambrian terrane, intruded and extruded by Laramide granites and Precambrian basalts.

No. 26 5,21N18W Fair

This narrow minimal area is in an area of somewhat deep crystalline rock at 1000 ft where the geology is completely unknown. The positive anomaly of northeast plunge just south may originate from buried Laramide granite.

REVIEW OF

INDUCED POLARIZATION AND

RESISTIVITY DATA

EMERALD ISLE AREA

MOHAVE COUNTY, ARIZONA

FOR

PERRY, KNOX, KAUFMAN, INC.

PROJECT 0620

mining
geophysical surveys

Copy 2 of 2 to IMC

TABLE OF CONTENTS

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DESCRIPTION OF DATA	2

ACCOMPANYING THIS REPORT:

1 PRELIMINARY PLAN MAP
(FAIRDRAWN MAP NOT REQUESTED)

DISTRIBUTION:

ORIGINAL & 2 CC: A. J. Perry, Tucson

REVIEW OF
INDUCED POLARIZATION AND
RESISTIVITY DATA
EMERALD ISLE AREA
MOHAVE COUNTY, ARIZONA

FOR

PERRY, KNOX, KAUFMAN, INC.

INTRODUCTION:

Two geophysical surveys covering the titled area have been reviewed. The field work was contracted by GEOEX in February-April 1966 using 1000' dipoles, and McPhar in June 1968 using 500' dipoles. The GEOEX data is far superior in quality compared to the McPhar survey; hence, we have not relied heavily on the McPhar results.

The GEOEX survey includes four lines surveyed in two parts--the south half in February 1966, the north half April 1966. The complete coverage for both GEOEX surveys was conveniently presented in the April 1966 report. A study of these profiles east to west follows the summary.

SUMMARY:

Relatively shallow anomalous IP response occurs in a broad apparent E-W striking trend in the north half of the area. This broad trend appears to terminate against a N-S structure. West of the structure a narrow dike of high IP response strikes NE-SW. The N-S structure has some significance in the extent of alteration of rock in the area. East of the structure, rock resis-

tivities of 100-500 ohmmeters indicate a less altered state than west of the structure (and south of the dike-like IP trends) where resistivities of less than 100 ohmmeters are believed to reflect a much greater rock alteration characteristic. There is a higher average IP response at depth in this area as well. Anomalous IP response of 20-25 pfe occurs at a depth of 2000' in the area of station 0 to 2N on Lines 1 and 4. Anomalous response occurs at shallower depths of 600' and 1000' in the vicinity of station 2S on these same lines. The amplitude of response decreases to 10-15 pfe in this relatively shallow trend.

There must be a word of caution concerning the deep IP response on Lines 1 and 4 and that is, in low resistivity material the 3 Hertz upper frequency used could produce a pseudo-response from EM coupling. It is likely that part of the increase in response is real, but part must be considered coupling effects, which unfortunately increase with the increase in dipole separation.

DESCRIPTION OF DATA:

LINE 3, "a" = 1000'

The apparent resistivity values vary from 200 to 400 ohmmeters (data presented by GEOEX in ohm feet/2π). Throughout the line lower resistivities of slightly less than 200 ohmmeters occur in a thin surface layer. The resistivity values suggest a thin soil cover and/or weathered zone of up to 200', with bed-

rock below that depth throughout the line. The generally high resistivity suggests a less altered rock than will be seen to the west on Lines 1 and 4.

A broad zone of anomalous IP response occurs from 4.5N to 8.5N. This response zone lies at a depth of approximately 1000' and has a true response of 21 pfe units. Weakly anomalous response of 4 pfe occurs in the rocks above the anomaly.

A multiple IP response characteristic occurs south of a contact at 2.5S. This response comes close to surface and has a true response of 7.0 pfe. A weak, or small, IP response trend occurs at 1.5N and is of apparent limited significance.

LINE 2, "a" = 1000'

Resistivity values are noticeably lower, averaging 100-300 ohmmeters. A low resistivity trend of 100-160 ohmmeters occurs over a broad zone from about 1.5N to 10.5N. Layered resistivity characteristics south of 1.5N suggest low resistivity of 70 ohmmeters (alluvial cover) to a depth of 500'$\pm$, with high resistivity bedrock(?) of 300 ohmmeters below that depth. Resistivities of >300 ohmmeters lie north of 10.5N and reflect bedrock near surface. These rock resistivities overall are high and suggest a lesser degree of alteration in bedrock than will be seen farther west.

The anomalous IP response trend in the north half of the line occurs over about the same width as seen on Line 3. Irregular response characteristics occur at the contacts that suggest

interference from outside sources at 11N-12N and 2N-3N, or possibly a complex multi-layered or multi-body response to the zone. The depth to the top of the response zone is about 600', being closer to surface than the anomaly on Line 3. There are too many data points missing in the center of the anomaly to describe possible multiple characteristics at depth. A weak, but variable, response occurs south of a contact at 1.5S.

LINE 1, "a" = 1000'

The overall resistivity values continue to decrease as one goes west, with values averaging 50 to 200 ohmmeters on this line. A resistivity contact near 4N separates variable resistivities of 150-200+ ohmmeter rock to the north from low resistivity layered alluvial material to the south. The alluvial material south of 4N is bedded with 50 ohmmeters at surface to a depth of 400'; 150 ohmmeters material below that depth. The 150 ohmmeter material at depth may represent bedrock or the apparent effect of bedrock laterally to the east, north, and south. If the increase in resistivity is due to lateral effects, then low resistivity material could extend to considerable depth, reflecting 1) deep alluvial cover, or 2) highly altered rock whose low resistivity represents the invasion by ground water into the altered rock.

A near-surface dike-like IP response occurs centered at about 7N. The dike is about 1500' wide, and has an apparent

N'ly dip characteristic likely due to the angle of strike with respect to the line. The true response of the dike is estimated at 15 pfe.

South of the resistivity contact at 4N, the increase in IP response at depth could reflect a strong IP response of 20 pfe from a depth of 2000'. A shallow (600'$\pm$) response zone in the vicinity of 2S indicates a zone 1000' wide of about 10 pfe.

LINE 4, "a" = 1000'

Overall lower resistivity values occur on this line. A resistivity contact occurs at 3N, with higher resistivities of 120 ohmmeters to the north of the contact and 50-80 ohmmeters south of the contact. Higher resistivities of 200 ohmmeters occur north of a second contact at 7N.

Anomalous IP response in an apparent flat N'ly dipping dike occurs at 5N-6N. From the plan map it is evident that the northerly dip is false, being due to the strike of the body with respect to the line direction. South of the resistivity contact at 3N anomalous IP response at a depth of 2000' has a true response of 25 pfe. A relatively shallow response zone occurs in the vicinity of 2S where 15 pfe true response is estimated to occur at a depth of 1000'.

The two McPhar lines of 1968 ("a" = 500') show an erratic characteristic that makes one suspicious of the data. Also, a number of readings are missing that could indicate instrument

problems. A resistivity contact in the east half of the lines represents a change in rock type from high resistivity bedrock to the east to low resistivity rock to the west, also seen in the GEOEX survey. It is in the area of the low resistivity rock to the west that the GEOEX survey indicates the substantial increase in response at depth.

Respectfully submitted,

W. Gordon Wieduwilt

W. Gordon Wieduwilt
Geophysicist

Registered Professional Engineer (Geophysical)
CERTIFICATE NO.
8842
W. GORDON
WIEDUWILT
DATE SIGNED 6/10/76
Arizona U. S. A.

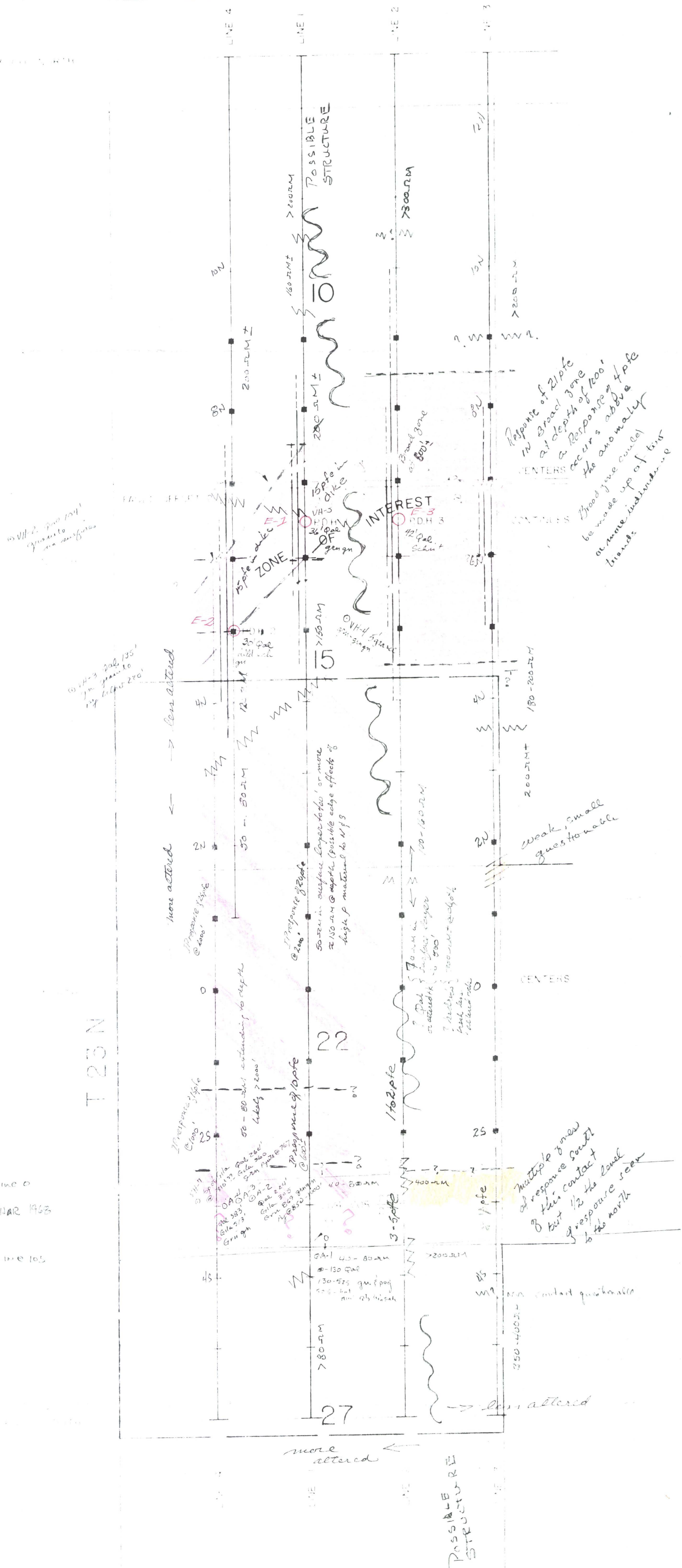
June 9, 1976
Tucson, Arizona

REVIEW of INDUCED POLARIZATION & RESISTIVITY SURVEYS
EMERALD ISLE AREA
MOHAVE COUNTY, ARIZONA
for
Perry, Knox, Kaufman, Inc.

JUNE 1976

R 18 W

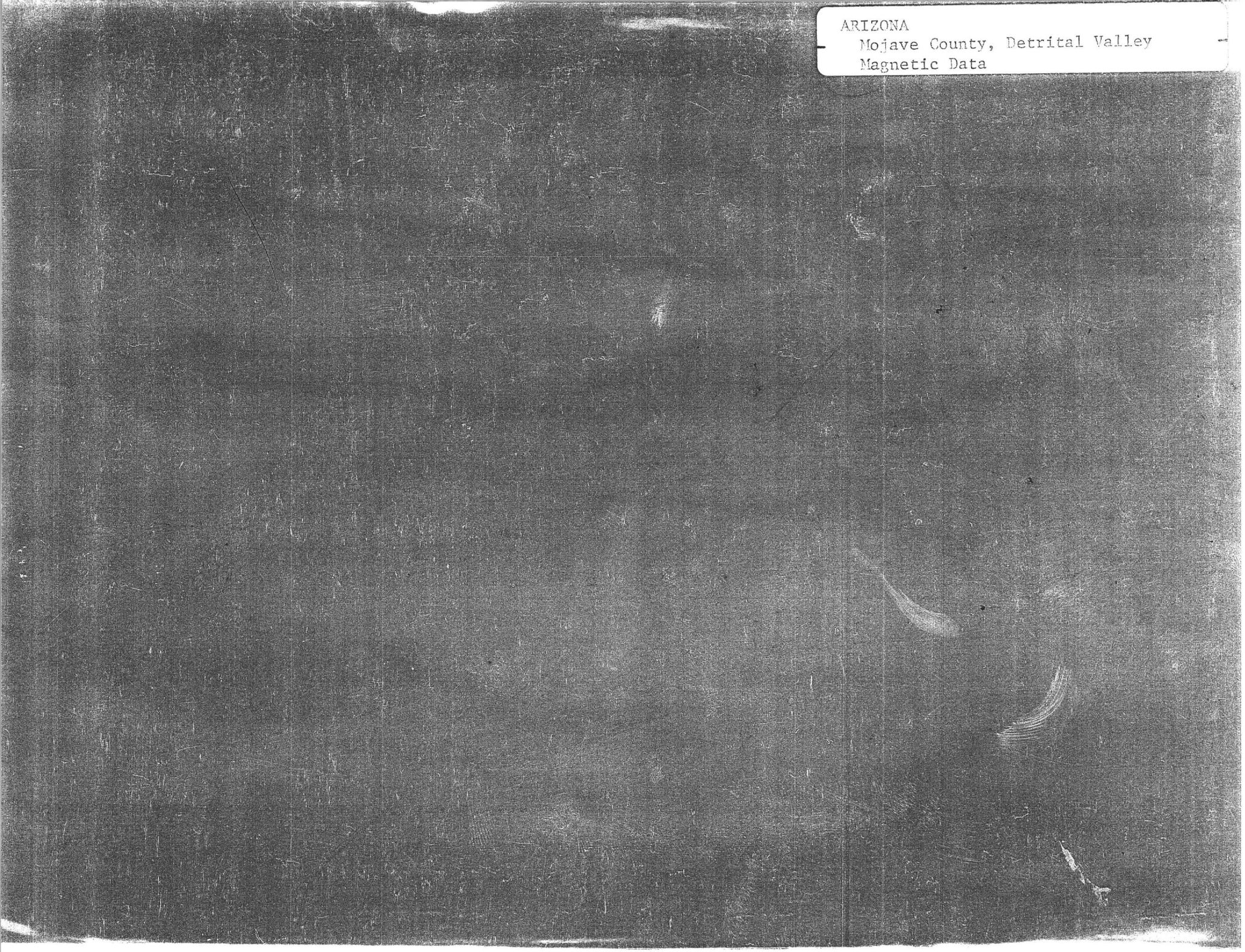
Registered Professional Engineer (Geophysical)
CERTIFICATE NO. 7602
W. GORDON WIEDUWILT
DATE SIGNED 6/10/76
Arizona U. S. A.



LEGEND

INDICATES PROPOSED DRILL HOLE

ARIZONA
Mojave County, Detrital Valley
Magnetic Data



AN INTERPRETATION OF

AIRBORNE MAGNETIC DATA

AREA S, DETRITAL VALLEY

MOHAVE COUNTY, ARIZONA

FOR

PERRY, KNOX, KAUFMAN, INC.

mining
geophysical surveys

AN INTERPRETATION OF
AIRBORNE MAGNETIC DATA
AREA S, DETRITAL VALLEY
MOHAVE COUNTY, ARIZONA

FOR

PERRY, KNOX, KAUFMAN, INC.

An interpretation of the airborne magnetic data in the area of Targets #21 and #22 of the titled property indicates the following:

a) Target #21 is essentially a deep alluvial basin which extends northwesterly off the attached sketch map. The basin is in excess of 3000' deep.

b) Target #22 is the low or trough feature of a magnetic anomaly due to a near-vertical magnetic body that lies SW of that target area. This magnetic body has a calculated susceptibility of 2400×10^{-6} cgs and occurs at a depth of less than 1500' from surface. A pediment(?) fault west of that magnetic body drops bedrock(?) to a depth of $2000' \pm$ west of that fault. A magnetic body at depth west of the fault has a calculated susceptibility of 2000×10^{-6} cgs. These calculated susceptibilities are similar enough to suggest that the same rock type lies across the pediment fault.

The roughly E-W trend of relatively high amplitude magnetic anomalies is the most prominent magnetic feature in the immediate area. This E-W magnetic trend appears to mark the south boundary of the deep basin. The trend of magnetic bodies continues east

into outcropping Precambrian gneiss and younger intrusives. It is not clear that the Precambrian gneiss or the younger intrusive is the magnetic source.

Several smaller magnetic features likely reflect near-surface bedrock. One is a magnetic body that lies between Targets #21 and #22. This body occurs at a shallow depth of ≪1000'. A second shallow body also lies to the north and is interpreted as a thin layer of magnetic material lying near surface. These shallow features are believed to mark the west edge of the pediment.

The attached sketch map shows the deep alluvial basin in yellow, while the more prominent magnetic features are shaded in red. Depth estimates were made from the profiles and are circled, while the estimates made from the contour map are underlined. The depth relationship of the various magnetic features was used to show the alignment of pediment faults.

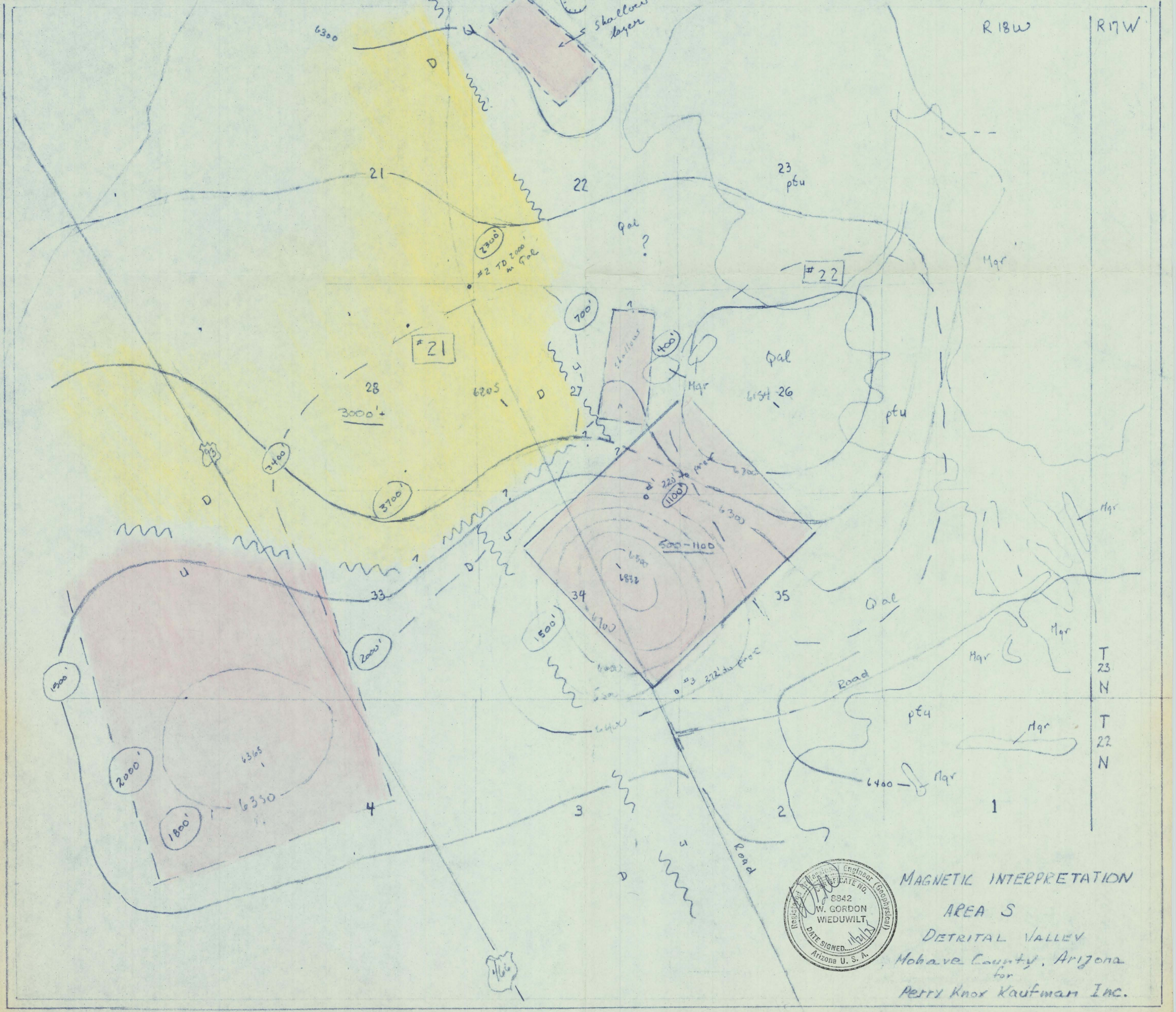
Respectfully submitted,

W. Gordon Wieduwilt

W. Gordon Wieduwilt
Geophysicist

November 21, 1975

Tucson, ARizona



MAGNETIC INTERPRETATION
AREA S
DETRITAL VALLEY
Mohave County, Arizona
for
Perry Knox Kaufman Inc.
R 18 W
R 17 W
T 23 N
T 22 N
Shallow layer
Shallow
6300
21
22
23
ptu
Qal ?
#22
#21
#2 TD 2000' in Qal
2300'
700'
400'
Mgr
Qal
6154
26
27
28
3000'+
6205
D
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3400'
3700'
220' to prec
1100'
6700
6300
500-1100
6800
6832
34
35
33
6700
1500'
2000'
1300'
6600
6500
6400
#3 272' to prec
Road
ptu
Mgr
6400
6365
6330
2000'
1800'
4
3
2
1
Qal
66
Registered Professional Engineer (Geophysical)
Certificate No.
8842
W. GORDON
WIEDUWILT
Date Signed
Arizona U. S. A.

KINGMAN

V502, EDITION 5
Prepared by the U.S. Army Topographic Command (CGSX), Washington, D.C. Compiled in 1956 by photogrammetric methods and from United States quadrangles, 1:62,500, 1950. Planimetry revised from aerial photographs taken 1954. Photographs field annotated 1954. Revised by the U.S. Geological Survey 1969.

Location of geodetic control established by government agencies is shown on corresponding 1:250,000-scale Geodetic Control Diagram

LEGEND

Figures in red denote approximate distances in miles between stars

POPULATED PLACES
Over 500,000 — LOS ANGELES
100,000 to 500,000 — OMAHA
25,000 to 100,000 — GALVESTON
5,000 to 25,000 — Laramie
1,000 to 5,000 — Grand Coulee
Less than 1,000 — Sun Valley

RAILROADS
Standard gauge, Single track, Double or Multiple
Narrow gauge

BOUNDARIES
International
State
County
Park or reservation

ROADS
Primary, all-weather, hard surface
Secondary, all-weather, hard surface
Light-duty, all-weather, hard or improved surface
Fair or dry weather, unimproved surface
Trail
Interchange
Route markers: Interstate, U.S., State

Landplane airport
Landing area
Seaplane airport
Dry lake
Woods-brushwood

Landmarks: School; Church; Other
Windmill; Mine
Spot elevation in feet
Marsh or swamp
Intermittent or dry stream
Power line

Scale 1:250,000

5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometers
5 0 5 10 15 Nautical Miles

CONTOUR INTERVAL 200 FEET

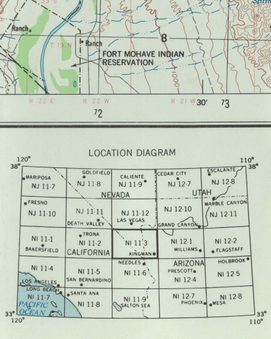
TRANSVERSE MERCATOR PROJECTION

BLACK NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 11

1965 MAGNETIC DECLINATION FROM TRUE NORTH FOR THIS SHEET VARIES FROM 15°30' (280 MILS) EASTERLY FOR THE CENTER OF THE WEST EDGE TO 15°00' (270 MILS) EASTERLY FOR THE CENTER OF THE EAST EDGE.

FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR WASHINGTON, D.C. 20242

LOCATION DIAGRAM



AEROMAG ANOMALY MAP
DETRITAL VALLEY

SECTIONIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

TOWNSHIP OR RANGE LINE
LAND GRANT BOUNDARY

● INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1972

GRID ZONE DESIGNATION: 11S

100,000 M. SQUARE IDENTIFICATION

NK	PK	QK
NJ	PJ	QJ

IGNORE the SMALLER figures of any grid number; these are for finding the full coordinates. Use ONLY the LARGER figure of the grid number; example: 380000

TO GIVE A STANDARD REFERENCE ON THIS SHEET TO NEAREST 1000 METERS

SAMPLE POINT: SEARCHLIGHT

1. Read letters identifying 100,000 meter square in which the point lies;
2. Locate first VERTICAL grid line to LEFT of point and read LARGE figure labeling the line either in the top or bottom margin, or on the line itself: Estimate tenths from grid line to point;
3. Locate first HORIZONTAL grid line BELOW point and read LARGE figure labeling the line either in the left or right margin, or on the line itself: Estimate tenths from grid line to point:

PK	8	9
	2	6

SAMPLE REFERENCE: PK8926

IF reporting beyond 10' in any direction, prefix Grid Zone Designation, as: 11SPK8926

KINGMAN, ARIZONA; NEVADA; CALIFORNIA

1954
REVISED 1969

STOCK NO. V502XNI113**05

Prepared by the Army Map Service (CGSX), Corps of Engineers, U.S. Army, Washington, D.C. Compiled in 1956 by U.S. Coast and Geodetic Survey by photogrammetric methods and from USGS quadrangle, 1:62,500, 1950. Planimetric detail revised by photo-planimetric methods. Horizontal and vertical control by USGS, USC&GS and USCE. Photography field annotated 1954. Limited revision by U.S. Geological Survey, 1963.

100,000-foot grids based on California coordinate system, zone 5, on Arizona coordinate system, west zone, and on Nevada coordinate system, east zone

10,000-meter Universal Transverse Mercator grid ticks, zone 11, shown in blue

LEGEND

ROAD DATA 1954 PARTIALLY REVISED 1963

Figures in red denote approximate distances in miles between stars

POPULATED PLACES

Over 500,000 — LOS ANGELES

100,000 to 500,000 — OMAHA

25,000 to 100,000 — GALVESTON

5,000 to 25,000 — Laramie

1,000 to 5,000 — Grand Coulee

Less than 1,000 — Sun Valley

RAILROADS — Single track, Double or Multiple

Standard gauge

Narrow gauge

BOUNDARIES

International

State

County

Park or reservation

ROADS

Hard surface, heavy duty — 3 LANES 4 LANES

More than two lanes wide

Two lanes wide; Federal route marker

Hard surface, medium duty — 3 LANES 4 LANES

More than two lanes wide

Two lanes wide; State, Interstate route markers

Improved light duty

Unimproved dirt

Trail

Landmarks: School; Church; Other

Horizontal control point; Windmill

Spot elevation in feet — 221

Marsh or swamp

Intermittent or dry stream

Power line

Landplane airport

Landing area

Seaplane airport

Dry lake

Woods-brushwood

Approximate road alinement

Scale 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometers

5 0 5 10 15 Nautical Miles

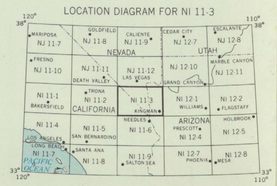
CONTOUR INTERVAL 200 FEET

TRANSVERSE MERCATOR PROJECTION

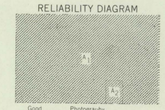
1960 MAGNETIC DECLINATION FOR THIS SHEET VARIES FROM 15°15' EASTERLY FOR THE CENTER OF THE WEST EDGE TO 15°00' EASTERLY FOR THE CENTER OF THE EAST EDGE. MEAN ANNUAL CHANGE IS 0°01' WESTERLY.

FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225 OR WASHINGTON, D. C. 20242

LOCATION DIAGRAM FOR NI 11-3



RELIABILITY DIAGRAM



A. Large scale topographic maps, photogrammetric survey 1950

1. Stereo compiled from 1954 aerial photography
2. Planimetry revised from 1954 aerial photography

TOWNSHIP OR RANGE LINE

LAND GRANT BOUNDARY

SECTIONIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

KINGMAN, ARIZONA; NEVADA, CALIFORNIA

1954

LIMITED REVISION 1963

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1968

Tucson, Arizona
July 17, 1975

To: Mr. J.B. Imswiler
IMC

From: A.J. Perry
Perry, Knox, Kaufman, Inc.

Subject: RECOMMENDATION FOR EXPLORATION - C.G. PATTERSON PROPERTIES, MOHAVE COUNTY, ARIZONA

Summary/Recommendation

The Mineral Park operations of Duval Corporation located north of Kingman, Arizona have produced copper and co-product molybdenum from relatively low grade ores since the mines inception in 1964. Recent exploratory drilling by that Company has led to the development of a second orebody situated about 3000' SSW of the original Ithica Peak Deposit.

Prospecting by Duval outside their Mineral Park properties has been limited but their drilling in 1965 and that of Alcoa in 1970 on lands controlled by Mr. C.G. Patterson, located north of and bordering Mineral Park was encouraging enough to warrant a recommendation by Duval geologists for additional work to test chalcocite possibilities -- a suggestion that was not followed by Duval management.

Reconnaissance geologic work by the author, supported by a limited rock chip geochemical survey has very possibly pinpointed a center of intrusion-mineralization on the C.G. Patterson property separate from that of Ithica Peak. There has been no test of the chalcocite possibilities of the intrusive center and only incomplete testing of the surrounding area. The possible presence of a substantial sized primary copper-molybdenum orebody at ±3500' depths in the central intrusive (conduit) area, the surface expression of which extends SE from Apex Hill NW/13-T23N-R18W should not be overlooked.

It is recommended that negotiations be undertaken with Mr. Patterson to acquire exploration rights to his properties.

Location

The C.G. Patterson properties of this study are located immediately north of and are contiguous with the Mineral Park holdings of Duval Corporation (see Figure 1). The area of principal interest, the NW$\frac{1}{4}$ of Sec. 13, is situated about 1$\frac{1}{2}$ miles NW of the Ithica Peak pit. These lands are in the western foothills of the Cerbat Mountains, northwest of Kingman, Mohave County. Elevations on the Patterson ground range from 4200 to 5200 feet and vegetation is typical of the high Arizona desert.

Access to the properties is from Kingman, via US 89, connecting with the old road to Chloride, then the Alum Canyon access road (the latter an improved dirt road maintained by only Patterson's assessment efforts). The total road distance from Kingman is about 23 miles. There is alternate access to the south side of the property over the Keystone Mine road which joins the paved access road to Mineral Park, just north of Duvals concentrator in N2/N2/24.

The Patterson properties may be within the limits of the Detrital Valley aeromagnetic survey, data from which is to be furnished by Superior Oil.

General Geology

The Wallapai Mining District is situated on the west side of the Cerbat Mountains, a range which extends from just north of Kingman 25 miles or more NW toward Lake Meade.

The Cerbats are composed primarily of Precambrian basement rocks, intruded by a 72 my quartz-monzonite porphyry all tilted to the east. Later eruptives are exposed on the west side of the range. The Sacramento fault, a typical Basin and Range normal fault, parallels the Range some 3 miles west of Ithica Peak and probably lowers any potential bedrock in Detrital Valley to depths excessive for current exploration.

At Mineral Peak a single phase quartz monzonite porphyry, the Ithica Peak porphyry, has passively intruded the complex Precambrian series in a text book example of concentric magma differentiation.

Precambrian joint sets with principal trends of northwest, northeast, and north provided loci for Laramide mineralization. Alteration was principally sericitic, overlapping into argillic and grading to propylitic. Sulfide mineralization of the type of interest to IMC-PKK was high in pyrite with lesser chalcopyrite and molybdenite providing a protore of grade about 0.15% Cu and 0.04% Mo; with the copper being upgraded in the zone of secondary enrichment by a factor of X3. Molybdenite was more stable and there is no increase in molybdenum grade.

The Ithica Peak orebody was initially said to contain 58 million tons of 0.76% Cu equivalent.

Geology - Mineral Potential of the C.G. Patterson Claims Area

The C.G. Patterson ground of principal interest is centered in the NW4/Sec. 13, NE/4 T23N R18W. See the attached simplified geologic map, Figure 2. This map shows a semi circular area

nearly 4000' across and open to the south which has been subjected to extreme hydrothermal alteration and intrusion by an equigranular Tertiary quartz monzonite. The amount of intrusive relative to basement rock exposed increases to a maximum in central NW/13 where the following tabulated additional features suggest a linear silicified rib which extends SE from the top of Apex Peak is a center of intrusion/mineralization.

Additional Favorable Features NW/13:

1. Area of most intense stockworks development.

2. Area of heaviest and most favorable limonite development (after chalcopyrite and chalcocite).

3. Area is surrounded by an inward dipping, arcuate, rhyolite dike system.

4. Area is surrounded by high pyrite-low copper zones.

5. Turquoise occurrences are situated around the east and south perimeter of the area.

6. It is within the zone of heaviest sericite alteration.

A portion of the geologic map of Dings, not referred to during PKK mapping is attached as Figure 3 to emphasize the separation of the Alum Gulch intrusive from that at Mineral Park. Duval has supplied Mr. Patterson with their graphic logs representing their investigations of both Alcoa and Duval drilling (copies attached). Reference to the logs will show that, with the exception of DDH5, all holes bottomed in Precambrian supporting Duvals' contention that the Alum Wash quartz monzonite is shallow seated. However, attention to Figure 2 and Duval's section (their Figure 2) will show a solid surface exposure of quartz monzonite between holes 3 and 4. There has been no test of the favorable silicified and especially attractive capping zone extending SE from Apex Hill. It is very possible that this zone could be the channelway or "root" for the Alum Creek intrusive. A test of this zone to depths of ±3500 feet by drilling might well yield protore copper/molybdenum of grades of economic interest. A schematic section showing possible at depth relationships is shown on Figure 4 .

Reference to report of R.D. Ellis (Duval) attached will show that Company's geologists thought the development of some chalcocite ores on the Patterson property possible. They recommended two additional test holes. A Duval hole location map furnished Patterson had plotted on it eight proposed holes, including three surrounding DH2 and five near DH5.

Discussion of Geochemical Survey

One hundred and seven rock chip samples were collected in the Alum Gulch area; 96 along three lines extending east-west, across the area covered by the Alum Gulch intrusive. Eleven samples were collected along a trial line extending across Precambrian terrain in west central Sec. 14 to establish background values. 59 of the samples (every other one except on the trial line) were submitted for geochemical analysis. Parts per million amounts detected for the elements copper and molybdenum are reported on sheets attached. They are also presented, color coded on illustrations attached as Figures 5 and 6 .

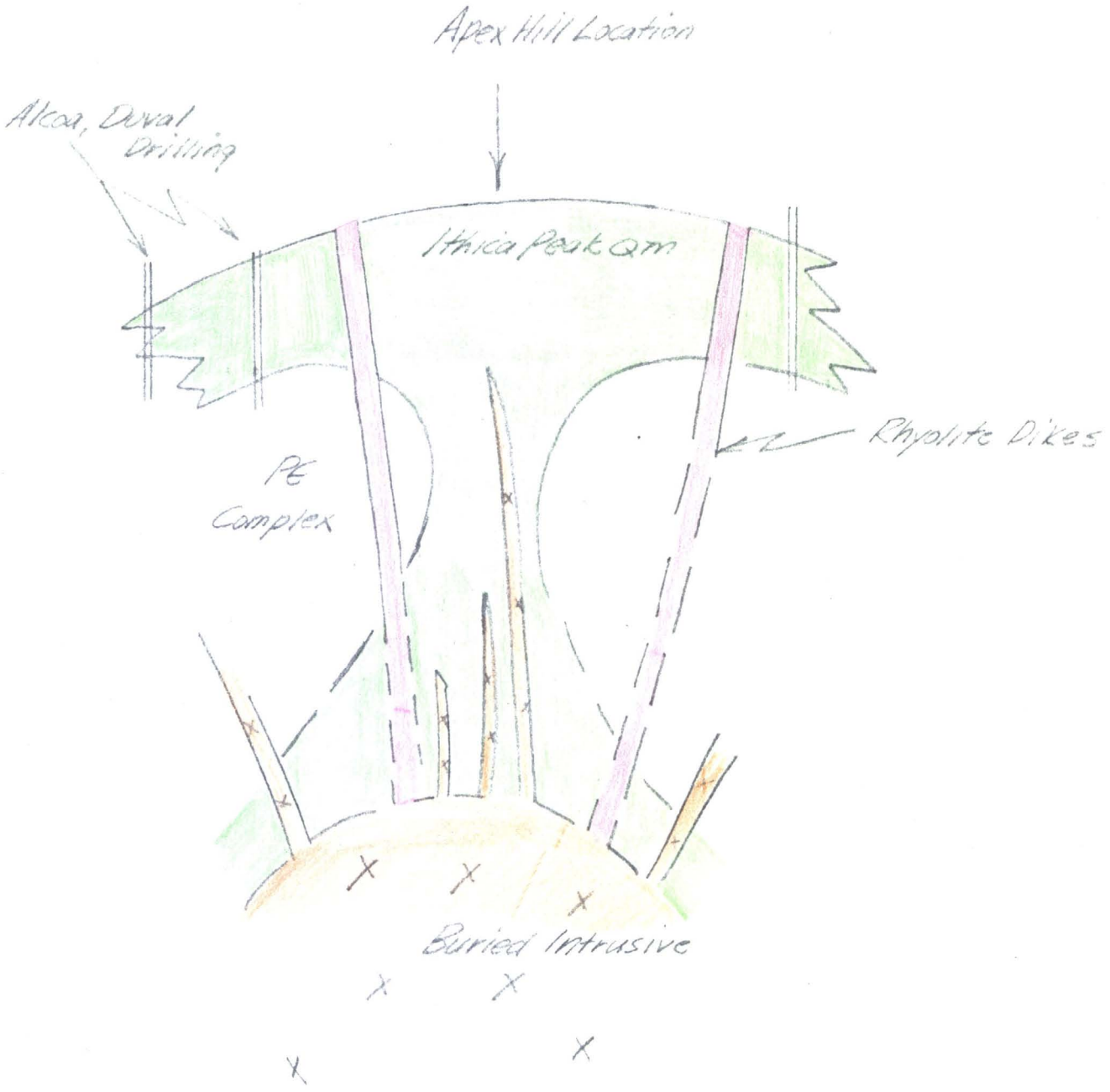
The favorability of the Apex Hill area is emphasized by the broader band of higher Mo values. As at Mineral Park[2], copper appears well leached, giving a very scattered pattern, probably having no relationship to potential ore areas. Both copper and molybdenum values at Alum Creek are much lower than those reported over the Ithica Peak orebody. These lower geochem values may result from the fact that at Alum Creek we are looking at an intrusion at a much higher level than at Ithica Peak -- as illustrated by the large amount of Precambrian "roof pendant" material exposed at the former location.

References

(1) Dings, McC. G; The Wallapai Mining District, Cerbat Mountains, Mohave County, Arizona; USGS Bull 978-E (1951)

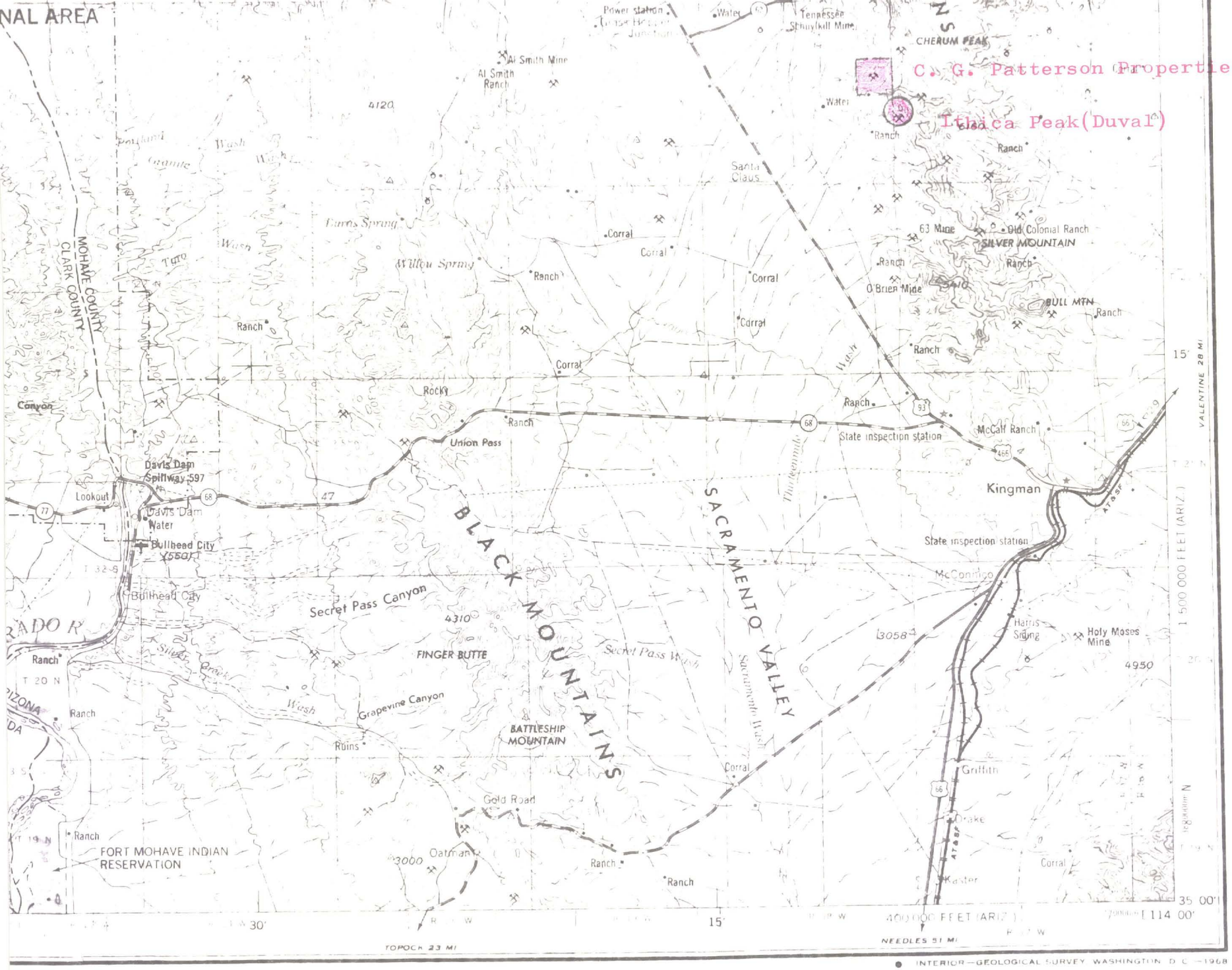
(2) Eidel, J.J., Frost, J.E. and Clippinger, D.M.; Copper-Molybdenum Mineralization at Mineral Park, Mohave County, Arizona; Vol. II. Graton-Sales Ore Deposits of the United States, 1933-1967.

(3) Thomas, Blakemore, E.; Ore Deposits of the Wallapai District, Arizona; Economic Geology, volume 44, pp 663-705 (1949)



Schematic Drawing
Showing Possible At Depth
Relationships – Apex Hill Area –
C.G. Patterson Properties

FIGURE 4 RJP 6/75

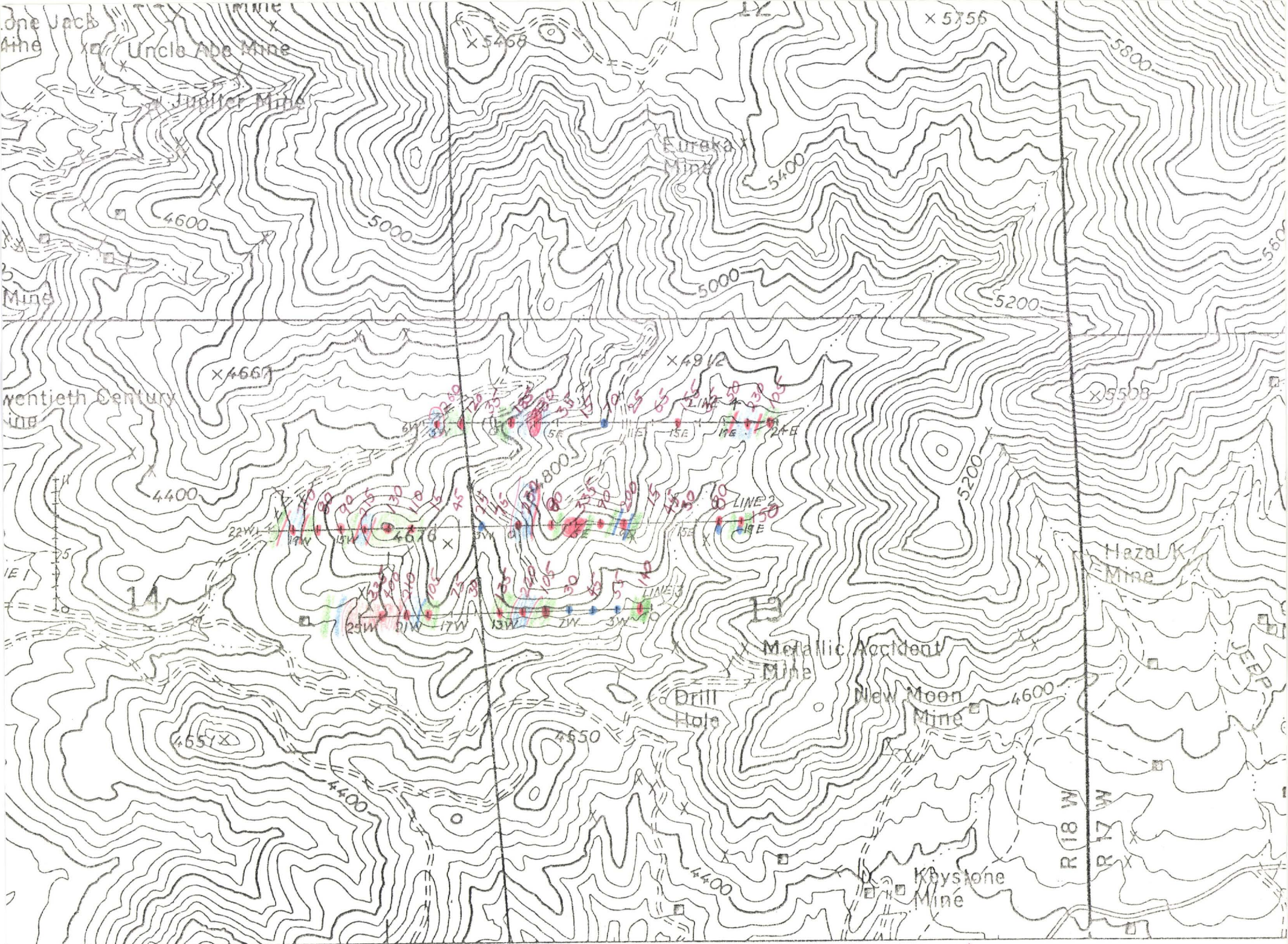


GENERAL LOCATION MAP
Fig. 1

LOCATION DIAGRAM FOR NI 11-3

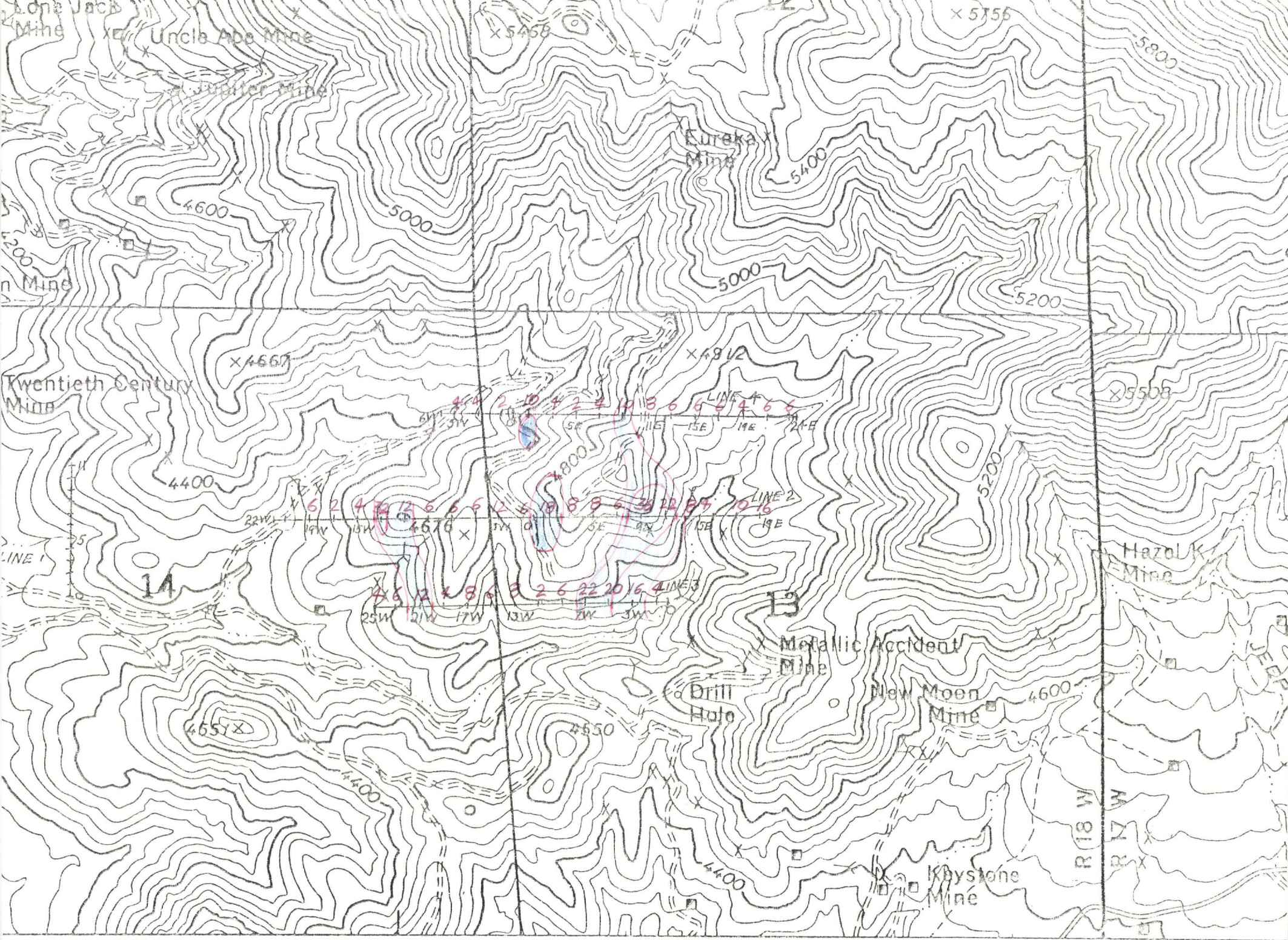
RELIABILITY DIAGRAM

SECTIONIZED TOWNSHIP

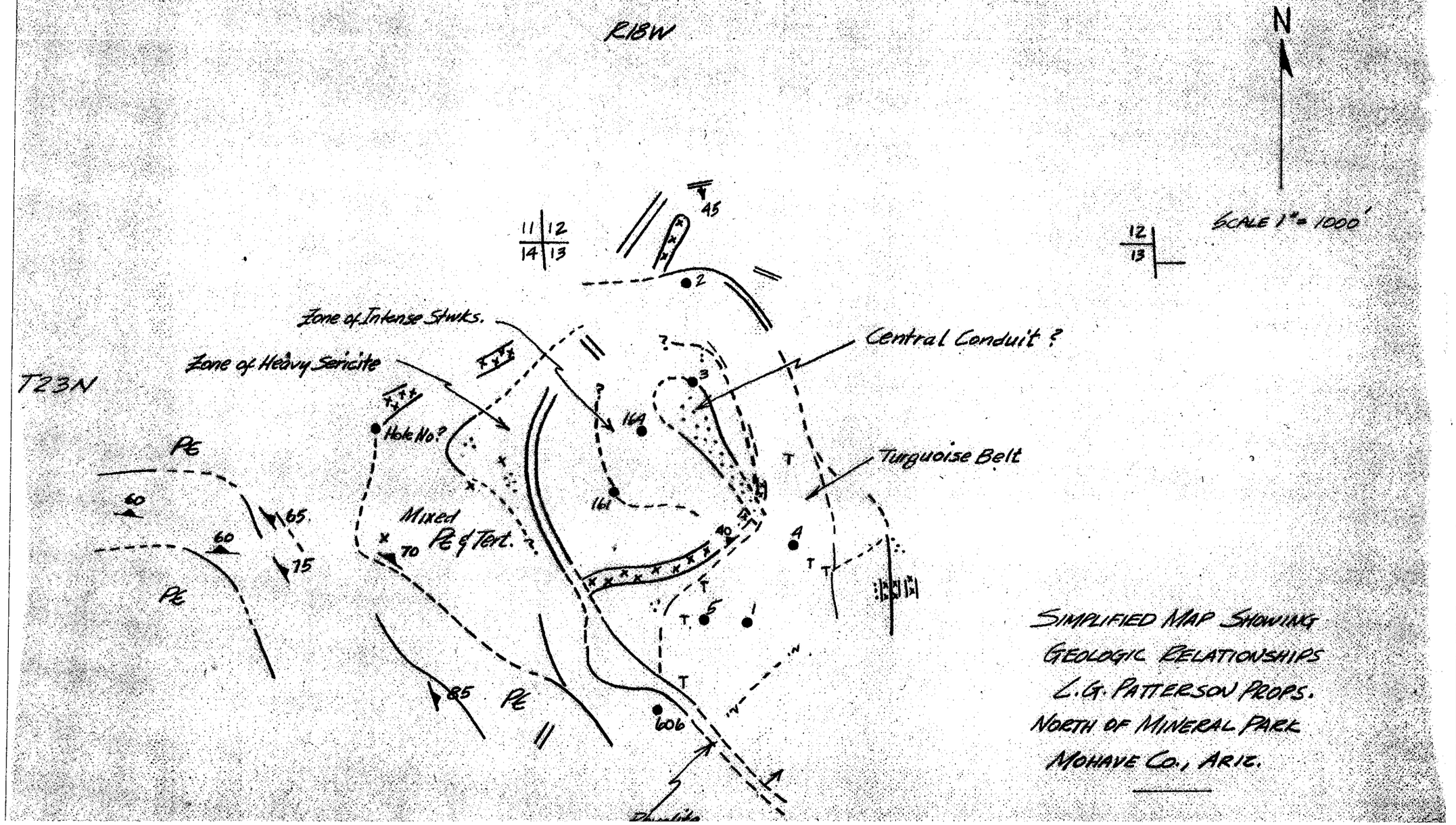


COPPER (ROCK) GEOCHEM (Values in ppm Cu.) FIG 6

Figure 3
Portion of Dings' Geologic Map - Walapai District



MOLYBDENUM (ROCK) GEOCHEM (Values in ppm Mo.) FIG 5


R18W
T23N
N
SCALE 1" = 1000'
11 12
14 13
12
13
45
2
3
164
161
606
Zone of Intense Stwks.
Zone of Heavy Sericite
Central Conduit ?
Turquoise Belt
Hole No.?
Mixed Pe & Tert.
Pe
60
65
75
70
A
5
1
T
SIMPLIFIED MAP SHOWING
GEOLOGIC RELATIONSHIPS
L. G. PATTERSON PROPS.
NORTH OF MINERAL PARK
MOHAVE CO., ARIZ.

SKYLINE LABS, INC.
Hawley & Hawley, Assayers and Chemists Division
1700 W. Grant Rd., P.O. Box 50106, Tucson, Arizona 85703
(602) 622-4836

Charles E. Thompson
Arizona Registered Assayer No. 9427

William L. Lehmbeck
Arizona Registered Assayer No. 9425

CERTIFICATE OF ANALYSIS

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm
1	PAT-1 1	5	4
2	2	5	2
3	3	5	2
4	4	5	2
5	5	5	2
6	6	15	2
7	7	100	2
8	8	5	2
9	9	15	2
10	10	40	2
11	PAT-1 11	15	2
12	PAT-2 1 E	230	18
13	3 E	80	8
14	5 E	335	8
15	7 E	90	6
16	9 E	200	36
17	11 E	15	22
18	13 E	45	8
19	15 E	30	4
20	17 E	80	10
21	19 E	150	16
22	1 W	75	6
23	3 W	25	12
24	5 W	45	6
25	7 W	15	6
26	9 W	110	6
27	11 W	130	12
28	13 W	215	32
29	15 W	90	4
30	17 W	80	2
31	PAT-2 19 W	210	6

TO:
Perry, Knox, Kaufman, Inc.
P.O. Box 12754
Tucson, Arizona 85732

Attn.: Mr. A. J. Perry

REMARKS:
Trace analysis

Page 1 of 2

CERTIFIED BY:

DATE REC'D:	DATE COMPL.:	JOB NUMBER:
6/23/75	6/30/75	751335

SKYLINE LABS, INC.
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Charles E. Thompson
Arizona Registered Assayer No. 9427

William L. Lehmbeck
Arizona Registered Assayer No. 9425

CERTIFICATE OF ANALYSIS

ITEM NO.	SAMPLE IDENTIFICATION	Cu ppm	Mo ppm
32	PAT-3 1 W	140	4
33	3 W	55	16
34	5 W	45	20
35	7 W	30	22
36	9 W	105	6
37	11 W	220	2
38	13 W	135	8
39	15 W	30	6
40	17 W	75	8
41	19 W	105	4
42	21 W	210	12
43	23 W	400	6
44	PAT-3 25 W	355	4
45	PAT-4 1 E	185	10
46	3 E	380	4
47	5 E	35	2
48	7 E	15	4
49	9 E	70	10
50	PAT-4 11 E	25	8
51	13 E	65	6
52	15 E	155	6
53	17 E	35	6
54	19 E	50	4
55	21 E	230	6
56	23 E	105	6
57	1 W	35	2
58	3 W	120	4
59	PAT-4 5 W	260	4

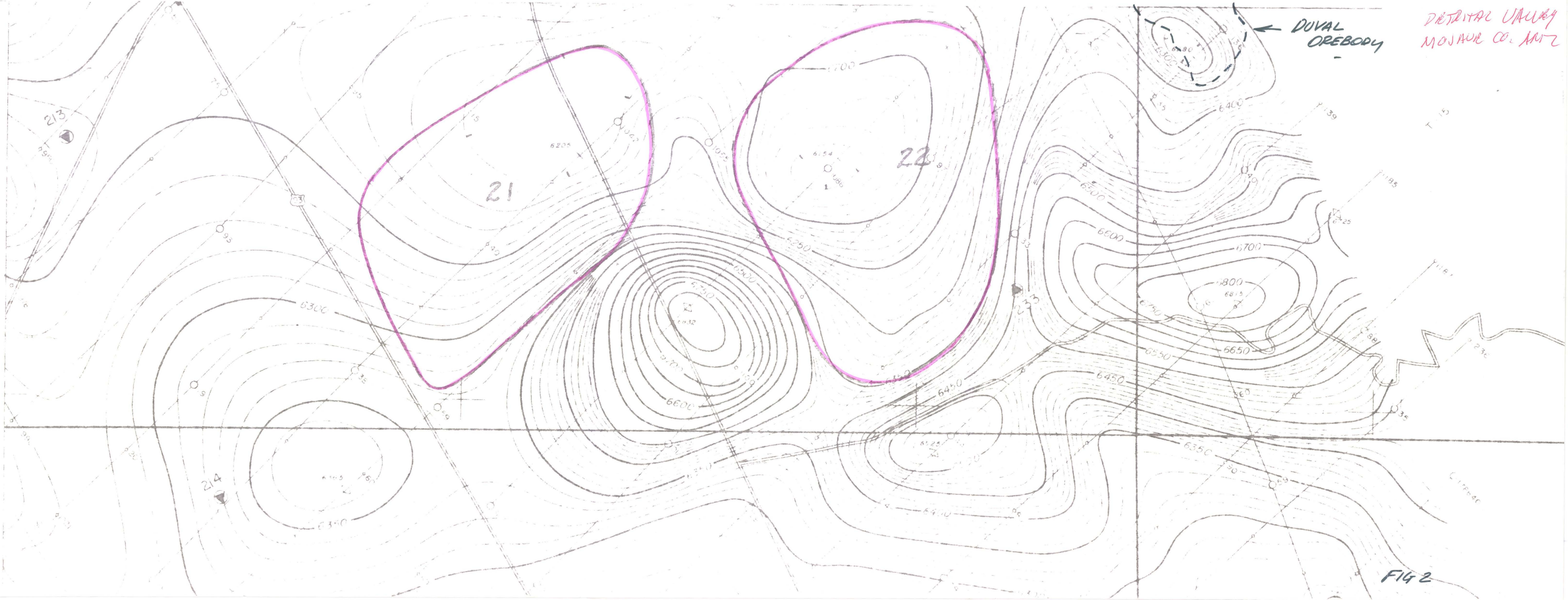
TO:

REMARKS:
Trace analysis

Page 2 of 2

CERTIFIED BY:

DATE REC'D:	DATE COMPL.:	JOB NUMBER:
6/23/75	6/30/75	751335



DETRITAL VALLEY
MOJAVE CO. ARIZ

DUVAL'S REPORT TO PATTERSON

REPORT: ALUM WASH GEOLOGICAL RECONNAISSANCE

Reconnaissance surface mapping to date (on a scale of 1" = 1000') has covered all of sections 13 and 23, the $SW\frac{1}{4}$ section 12, the $SE\frac{1}{4}$, $SE\frac{1}{4}$, section 11, all but the $NW\frac{1}{4}$ section 14, and section 24 west and north of Mineral Park Road. The area is roughly located between the Eureka and Hazel K Mines thence southwest to the front of the Cerbat Mountains (Plate 1).

GENERAL GEOLOGY

PreCambrian metasediments (?) and granitic intrusives make-up most of the Alum Wash and north and west of Mineral Park areas. They are grouped collectively as the Cerbat Complex and include crystalline rocks of granitic composition chiefly granite, gneiss, granodiorite, granite gneiss, hornblende-biotite schist and chlorite-biotite amphibolite. To simplify mapping I divided the preCambrian rocks into 2 types, those of granitic composition and the schists and amphibolites.

PreCambrian (?) pegmatite dikes are common. A concentration of them crop out in the foothills northeast of Niggerhead.

Tertiary rocks make-up approximately 5% of the area mapped. These include the Alum Wash quartz monzonite stock and numerous related rhyolite dikes, the largest is the Great White Dike.

Recent black to red ferrugenious conglomerate like that in Bismark Canyon also crops out along the central portions of Alum Wash and on the lower hillsides westward from the quartz monzonite stock. It is probably the result

of the transportation of iron and copper in solution derived from the quartz monzonite and then cementing colluvium and alluvium when chemical conditions required precipitation of the minerals.

Structural trends are the same as those encountered at Mineral Park, i.e. strikes are northwesterly 35-60°. No major faults were noted; however, definite variations from the usual in foliation trends were noted southwest and west of Niggerhead. The only intersection of structure occurs at the Eureka Mine where the Great White Dike intersects another rhyolite dike.

ECONOMIC GEOLOGY

The Keystone, New Moon, Hazel K and Eureka mines are the older mines which produced ore from the study area. They were located on large vein structures which "ran out" with depth and contained ore of a complex mineralogic character.

Strong erosion in Alum Wash has exposed a quartz monzonite stock. It has intruded the granitic rock of the Cerbat Complex and has itself been intruded by an andesitic dike. Surface mapping shows the quartz monzonite outcrop is smaller and more irregular in plan than at Ithaca Peak. Stockwork type veining is prevalent in the quartz monzonite and the cap rock is suggestive of porphyry copper mineralization. The stock has been explored by both Duval and ALCOA.

Alteration accompanying the Tertiary intrusion was strong and the pre-Cambrian granites adjacent to and surrounding the stock were bleached, strongly kaolinized (?) and in some cases silicified. The rocks crop out

within the Ithaca Peak alteration halo and additional alteration was included with the emplacement of the Alum Wash quartz monzonite. The combination of these two phases of alteration was effective in masking the identity of the nonfoliated preCambrian granites.

Subsurface Geology

Nine diamond drill holes were drilled in the Alum Wash vicinity. ALCOA drilled six holes after Duval drilled three. Three of the nine holes contained mineralization of any substance.

Three drill holes were collared in quartz monzonite and only one bottomed (?) in it. Cores from the holes indicate the monzonite to be shallow seated, spotty and highly irregular (figures 1 - 6). Also it contains more biotite than Ithaca Peak and numerous zenoliths of preCambrian rocks.

ALCOA's DDH #2 and 5 and Duvals DDH #164 encountered the only significant mineral values of the nine holes drilled. Number 2 was the most promising as it contained a 113 foot (64' - 177') interval assaying from .11% to 1.2% Cu with the average approximately .20% Cu. This mineral zone coincides closely with the quartz monzonite cut in the drill hole from 80 -160 feet (see figure 3). Number 5 cut a mineralized zone from 86 to 191 feet. The first 86 feet of that interval assayed .25% Cu, the remainder averaging .14% Cu. All of this within quartz monzonite (figure 1). Diamond drill hole 164 encountered mineral values averaging .15% Cu over the interval 250' - 350'. This zone occurring in near equal portions of quartz monzonite and quartz-feldspar gneiss (figure 5).

EXPLANATION OF CROSS SECTIONS

Rock Type Color Code

- Quartz monzonite
- Rhyolite
- Aplite
- Granite
- Granodiorite
- Schist
- Amphibolite

Scale

verticle = horizontal

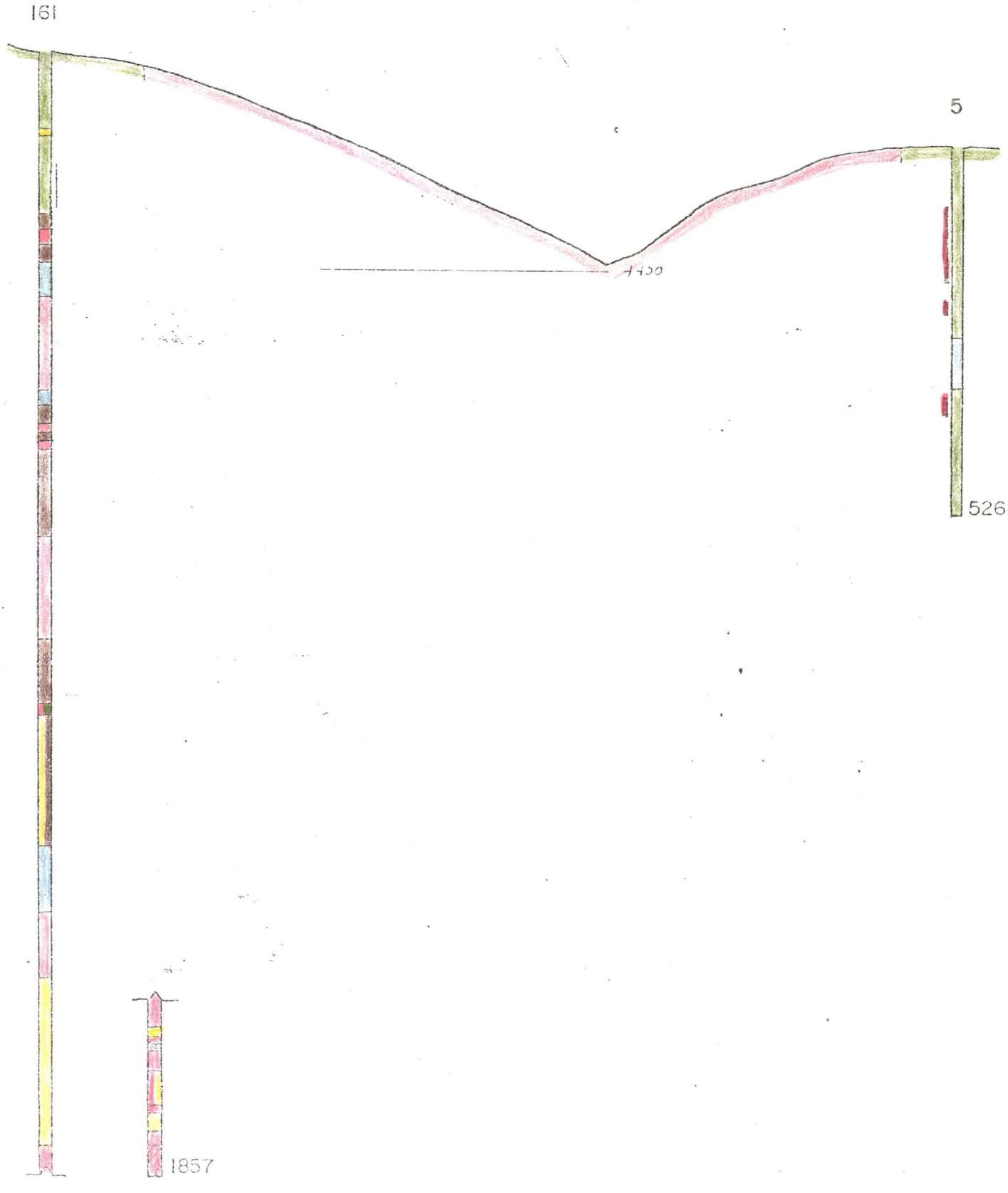


Figure 1

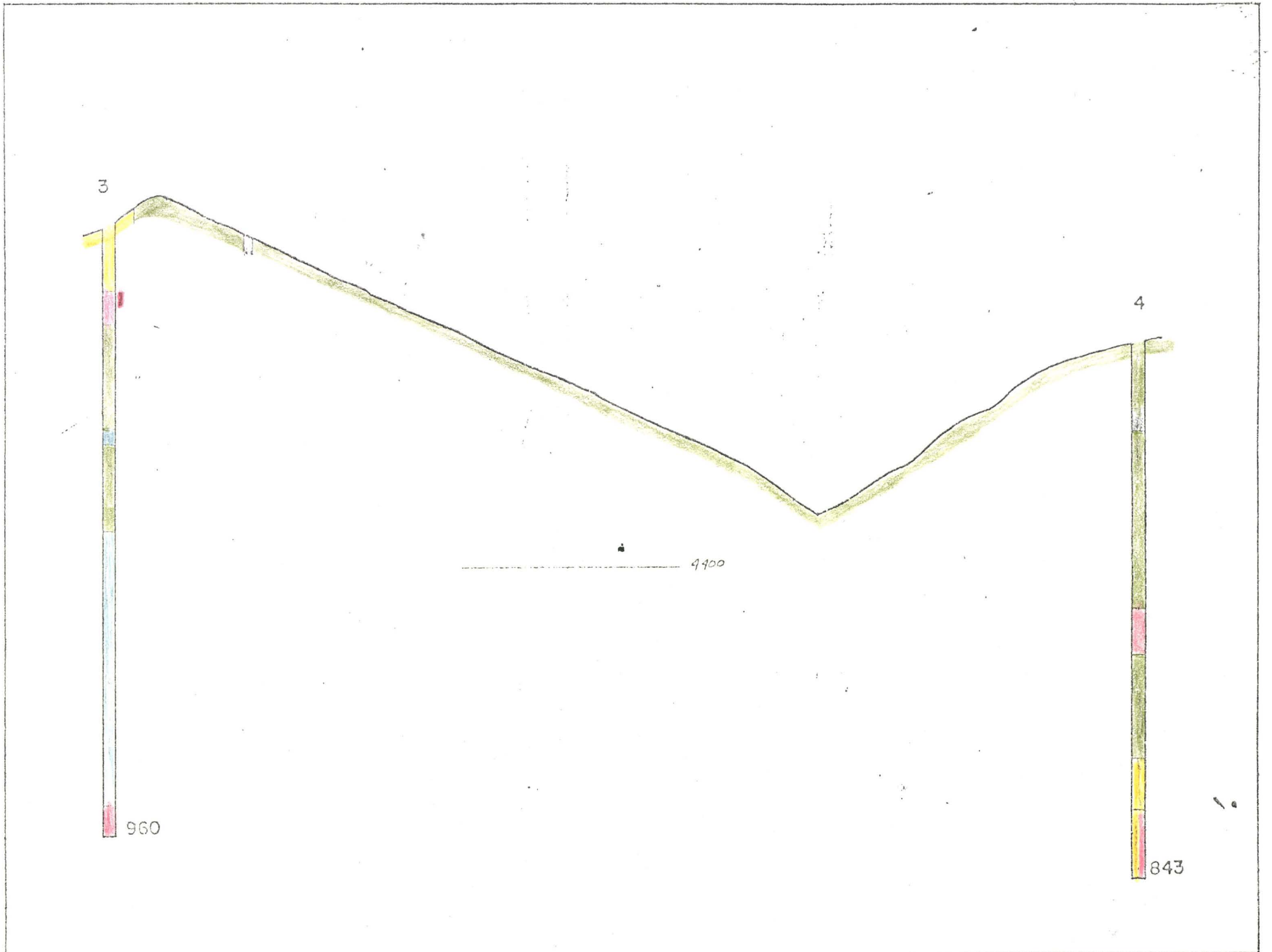


Figure 2

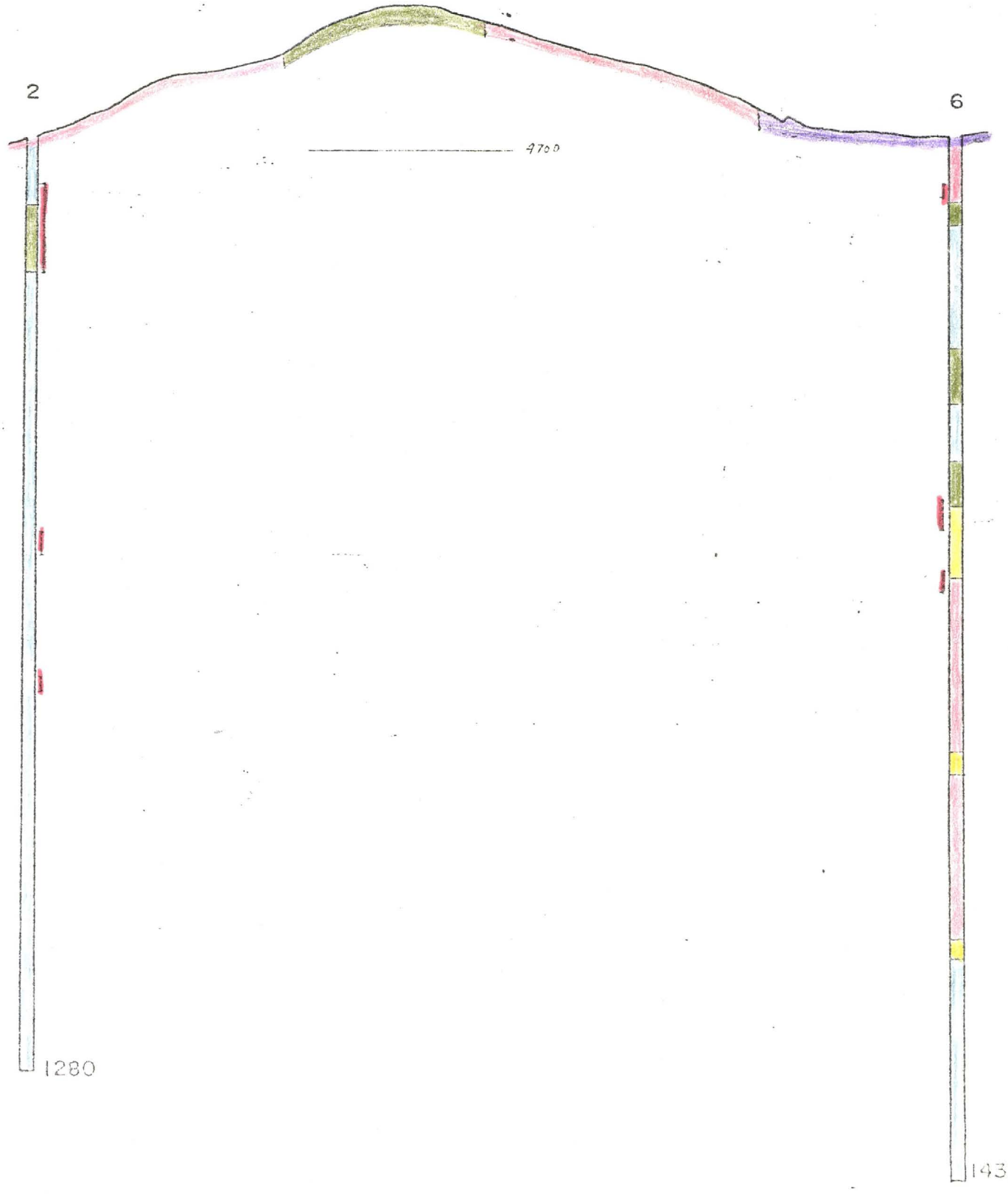


Figure 3

Figure 4

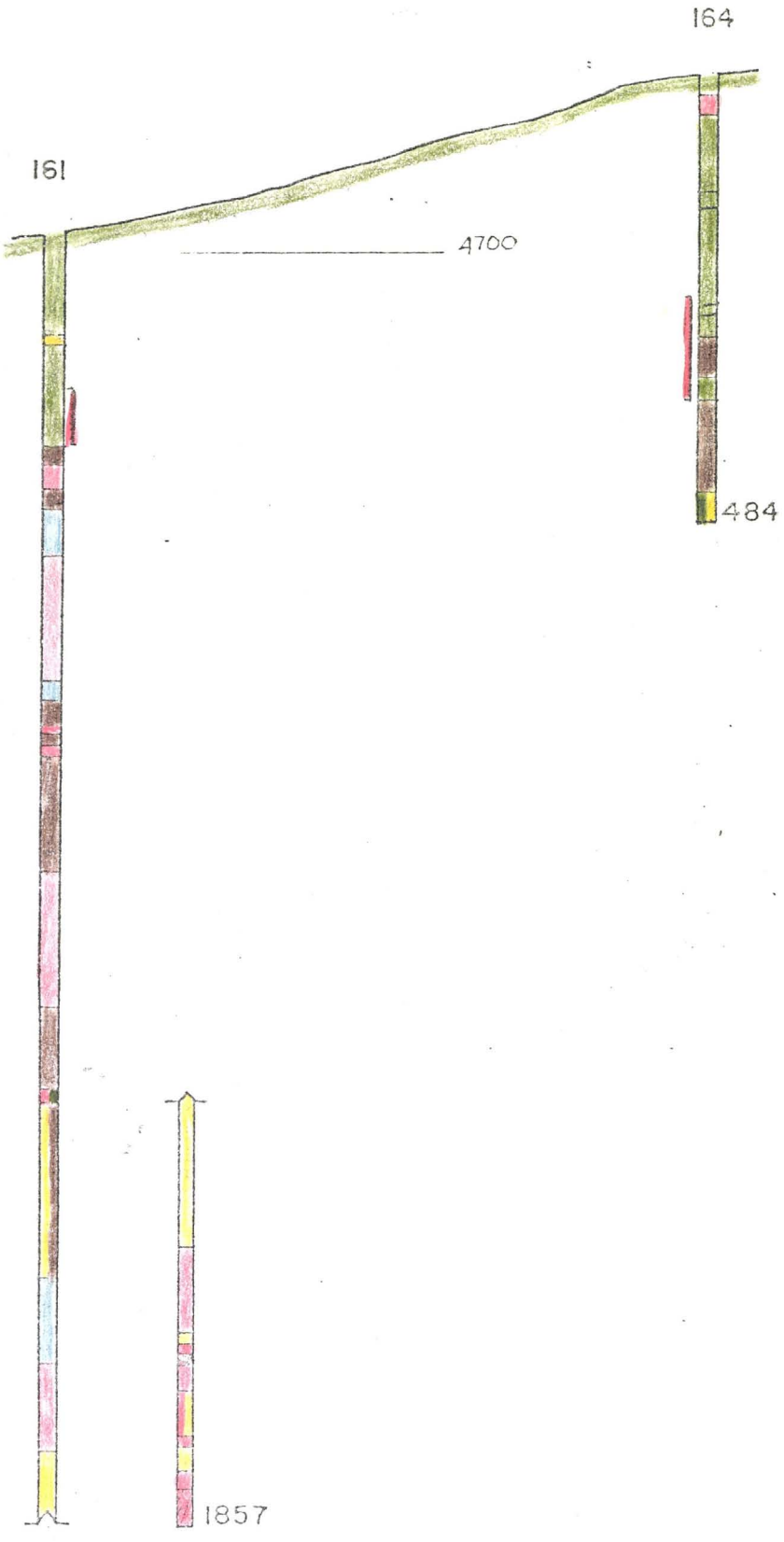


Figure 3

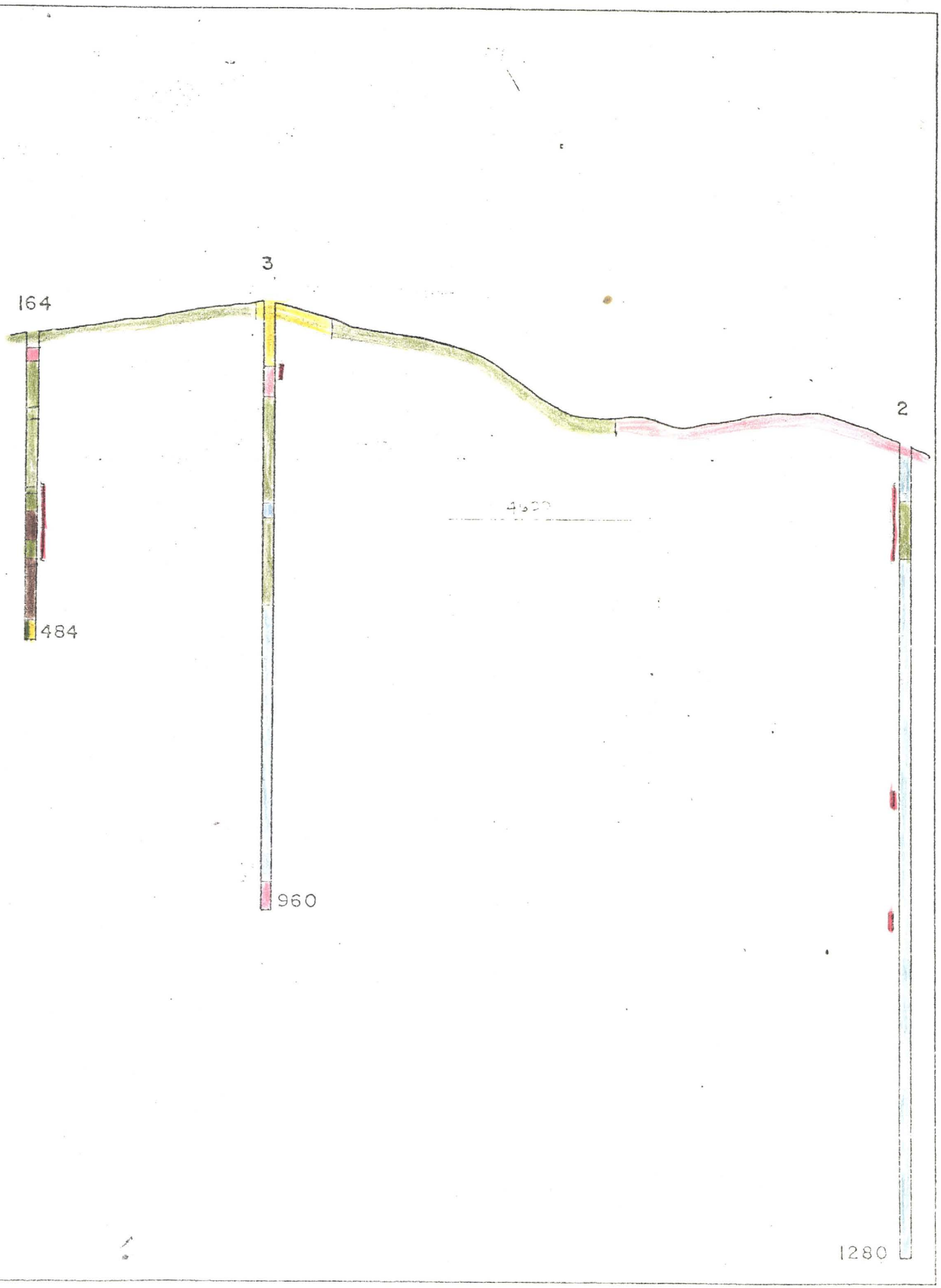


Figure 6

CONCLUSIONS AND RECOMMENDATIONS

Surface geology and subsurface drill data indicate one or two drill holes are necessary to permanently write off Alum Wash. These holes would be located approximately 500' west of ALCOA's DDH #2 and 970' N65°E of #2 (Plate 1).

The two holes would test the continuity of mineralization in DDH #2 eastward underneath the quartz monzonite ridge separating DDH #2 and #6 (see figure 3). This mineralized zone is fairly consistant from DDH 161 through DDH 164, 3(?) to DDH 2. Hole number 3 remains a question as it was drilled along the quartz monzonite between 164 and 2. It was collared in preCambrian schist however which could have had an adverse effect on the development of the secondary chalcocite mineral zone.

The proposed drill holes would prove or disprove Alum Wash as a possible area of porphyry copper mineralization necessary to replace Ithaca Peak ore in the future. The weak to moderate mineralized zone as shown by figures 5 and 6 could well be the far western margin of more significant mineralization trending northeasterly, 500 feet east of DDH 2 and 161.

The possibility that the above described mineralization exists should not be discounted and the proposed drilling should be done before Alum Wash is completely written off.

R. D. Ellis
Geologist

Tucson, Arizona
May 27, 1976

To: Mr. J. B. Imswiler - IMC

From: A. J. Perry - PKK

Subject: El Paso Natural Gas Company's Emerald Isle Property, Kingman, Arizona

Background

El Paso terminated copper leach operations at their Emerald Isle facility near Kingman in November 1975 after mining and processing (mostly by LPF method) 1.4 million tons of material, grade 1.07% Cu. During the final year and a half El Paso conducted in situ tests at Emerald Isle in cooperation with the USBM-- both within and outside the pit area. The tests are judged to be inconclusive-- in part at least, due to the shut-down of operations prior to completion of programmed testing. El Paso declares about 200,000 tons of broken but essentially unleached ore in the pit bottom-- grade 0.86% Cu, and perhaps 4.6 million tons available for leach beneath 200-300 feet of overburden west of the pit.

El Paso controls about 87 lode claims and fractions in the area-- some extending nearly 2 miles north of Emerald Isle. Disseminated sulfide mineralization is recognized both at depth near the pit and in an area west of the mouth of Alum Gulch.

Mr. W. T. Hollis, Director of El Paso Mining and Milling Company is interested in farming out the Emerald Isle and encouraging exploration of any other potential of the properties.

We are compiling essential data, preparing for a brief field examination and we have requested an independent interpretation of IP work done by Heinrichs and McPhar in the sulfide areas. Evaluation of the property should be complete in 2-3 weeks, depending on our consultants processing of the geophysical data. Our preliminary observations are recorded in this report.

Location

El Paso's holdings consist of 87 lode claims and fractions. Seven of the lodes, 15 millsites and 3 water well sites are under patent application. The lode claims are outlined on

Figure 1 . They extend northward from the Emerald Isle pit for about 2 miles. The property is situated south of Chloride and west of Duval's Ithica Peak copper-moly operation.

General Geology

The copper exploited at Emerald Isle occurs in the form of chrysocolla (the hydrous copper silicate). The ore is found in channels within the Gila conglomerate. Locally the Gila is covered by recent alluvium. The Gila lies unconformably on Pre-Cambrian rocks of variable composition-- principally gneissic granite at Emerald Isle. Figure 4 (a longitudinal section) illustrates how the mineralized Gila extends S85W-EW at -10 to 12° from the pit beneath increasing thicknesses of recent alluvium. The Sacramento Fault, a major Basin and Range fault would eventually interrupt a continuation of the Gila channel trend. This fault is interpreted by Wieduwilt as cutting thru the SW corner of Sec. 22 (based on Superior's magnetics data).

Locally, along faults, the oxide mineralization dips into the underlying bedrock. There is minor copper in the recent alluvium.

Sulfide mineralization was suggested at the Emerald Isle and further north in N2/15 by IP surveys conducted by Heinrichs and McPhar. Subsequent drilling by El Paso confirmed the presence of at least minor pyrite and possibly chalcopyrite as well as other base metals in stringers(veins) in the north area.

In Situ Tests

D'Andrea and Runke[1] describe the purpose of the in situ test work as: 1) to develop methods for leaching 200,000 tons of ore exposed in the pit bott m and 2)to develop techniques for leaching 1.5 million tons of ore under 200' of overburden adjacent to the pit. They describe the results as encouraging. An evaluation of - tests incomplete, and therefore inconclusive, might be more exact.

Phase I of the testwork, working on 15,000 tons of broken material in the pit bottom, containing 1% Cu produced 29,000# of copper in 114 days (248#/day) and provided a recovery of 9.7% of the contained copper. Acid consumption was 15#/#Cu; iron 4.7#/#Cu.

Following Phase I work, 100,000 tons of ore in the pit bottom was subjected to leach without blasting, for a period of about 7 months. Copper production amounted to 142,000# (765#/day).

1. D'Andrea, Dennis V. and Runke, S.M.; In Situ Leaching Research at the Emerald Isle Mine; draft of a paper to be delivered at the Fall Meeting-SME-Denver-Sept. 1976.

Acid consumption was 10#/#Cu and iron consumption was reduced to 2.75#. Leaching was terminated due to the low flow rates.

Subsequently the pit bottom was blasted but closing of the El Paso operation precluded completion of the tests.

Phase II work was conducted under 200' of overburden, west of the pit. Two test blasts were undertaken, the second after recovery tests indicated circulation was inadequate for leaching. After the second blast, fracture and permeability tests were done on drill core (indicated improved breakage and flow) but operations shutdown prevented additional pump tests.

Sulfide Mineralization

North Area-

Heinrichs Geoexploration Company conducted IP surveys in the area north of Emerald Isle in February-April, 1966, encountering an anomaly in N2/Sec. 15, west of Alum Gulch. The anomaly was interpreted as "a zone of disseminated sulfides, about 2000' wide, deepening to the east from less than 500 feet --- to greater than 1000 feet--". One to three percent sulfides were predicted. El Paso subsequently drilled three holes on Heinrich's recommendation (holes E-1 thru E-3). Sulfides were encountered at shallow depths throughout the area tested--possibly in amounts sufficient to account for the measured anomaly, although the quality of El Paso's logging is poor at best.*

The log of E-1 indicates some chalcopyrite in mixed Pre-Cambrian rocks in the interval 244-469'; but assays from 213' to the bottom of the hole do not bear out these observations of copper. Pyrite accounts for the majority of the sulfides logged. Galena and sphalerite were occasionally reported in narrow veins.

Emerald Isle Pit Area-

In September 1968 McPhar Geophysical Inc. conducted a brief IP survey in the Emerald Isle Pit area. Work was done using 500' dipole spacings and the frequency method. Two zones, both described as weakly anomalous, were measured at depths from 250 to 500' from surface.

In 1970 at least four holes were cored in the vicinity of the anomalous zones encountered on the west end of the two McPhar lines. (Holes A-1 thru A-4).

*We are awaiting confirmation of this fact by our geophysical consultant.

The most shallow of the four vertical holes penetrated to a depth of 613' -- below the maximum depth estimated by McPhar to be the top of the responsive zone. A review of the El Paso logs indicates a granite gneiss basement below the Gila conglomerate, except in hole A-1 where no Gila is present-- suggesting some abrupt displacement or scour (?) between A-1 and the other holes. Sulfides are present in all holes except A-4. The depths to the top of the sulfides reported (generally in trace to minor amounts) are 850' and 767' respectively in A-2 and A-3. Pyrite was reported at 323' in A-1. Trace amounts of chalcopyrite are reported and some minor copper is measured (generally $< 0.10\%$ Cu) in some holes. Some reports of MnO_2 coincide with good copper assays over intervals rarely exceeding 10'-- suggesting misidentification and the possible presence of chalcocite in well broken zones.

Alteration is observed in varying amounts in all holes but A-1. It is described principally as chloritic, and possibly argillic, at least locally.

There is no suggestion of other than very minor enrichment in bedrock at Emerald Isle -- and that for $<$ 30 feet. In hole A-3, 43' of 0.50% Cu is reported from a green-gray epidotized granite-- with the top being 55' below the bedrock contact and well within the oxide zone. Oxidation of a preferred, copper bearing unit is suggested.

Preliminary Conclusions

The oxide reserve at Emerald Isle is limited and most of it is under 200' of overburden. Assuming the maximum reserve of 4.6 million tons treatable by in situ methods, using a 40% recovery factor, only $7.6 million would be generated by exploitation. Such revenue would certainly not be of interest to IMC.

The Pre-Cambrian is geophysically anomalous in the Emerald Isle area and in N2/15. Sulfides are known to be present, at least in minor amounts. Bedrock is locally cupiferous, but just barely -- except for the thin oxidized zone of 0.50% Cu in A-3. Should this intercept represent mineralization in a sill or dike of a late intrusive, and were we able geophysically or otherwise to locate the mineralized source rock, we would have a viable exploration target.

FIGURE 4

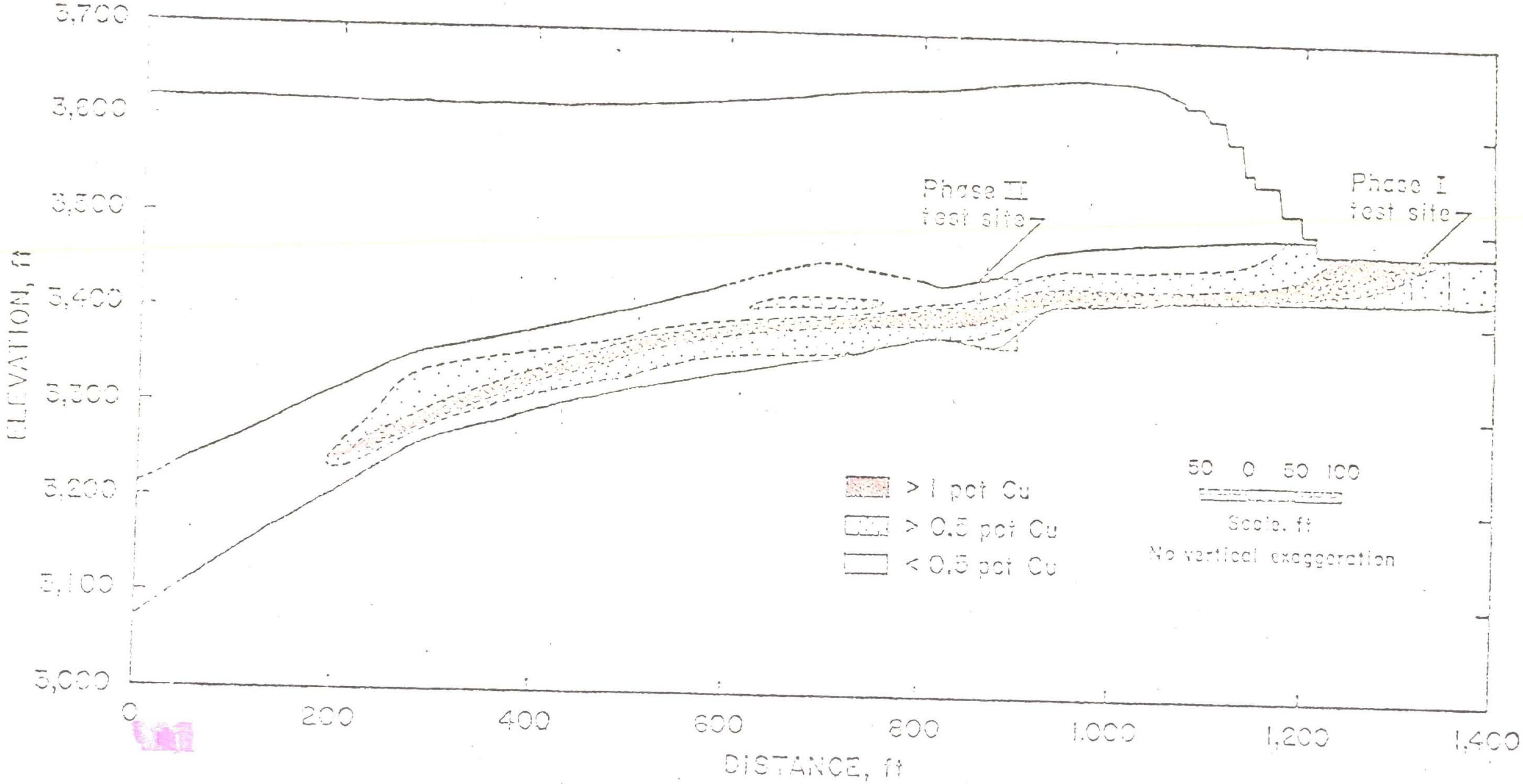
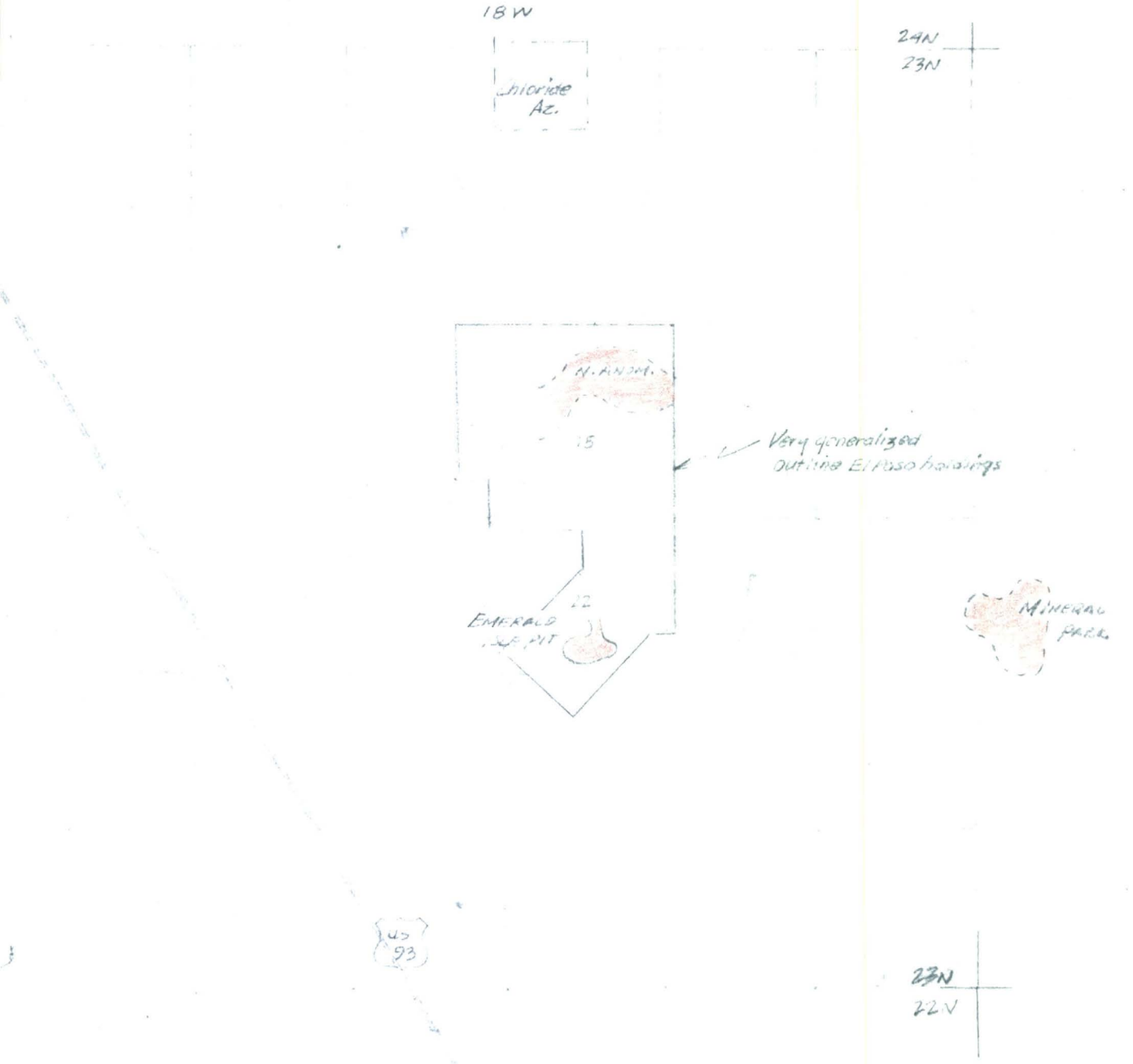


FIGURE 3. - Cross section through Emerald Isle mine.

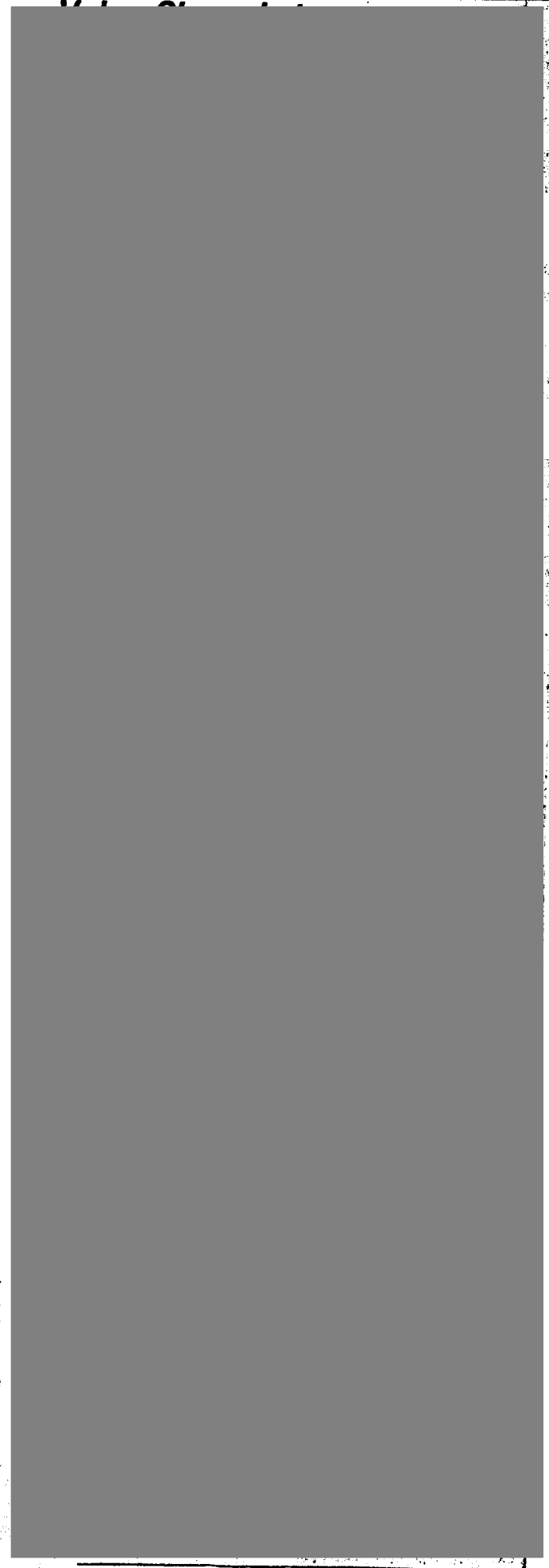


LOCATION MAP
EL PASO NAT. GAS CO.
PROPERTIES

1:62,500 FIGURE 1.

BRUCE -
THIS IS (WAS) OUR
COMPETITION AT AZUM
GULCH.

AL



We are in "elephant country" and have several untested though somewhat suspect anomalies. A check geophysical survey is warranted.

Recommendation

It is recommended that IMC-PXC contract for one line surveys of the north most anomaly (SE/10-NE/15) and the deeper anomaly (S2/15- N2/22) extending southward to check the narrow E-W body in S2/22.

It is estimated that these surveys could be completed at a contractor cost of $2600-3000., including mob-demob.

Discussion of MGS' Findings

Wieduwilt briefly summarizes his analysis of the Heinrichs' data -- highlighting the following:

1. A broad zone of IP response, with an E-W trend extends thru NE/15 and SE/10 and abuts a N-S fault (down to the west) near center 15. The rocks measured are less altered east of the fault -- well altered to the west. Depths to the anomaly are ±1000' on the eastmost survey line ie. E. side line of Secs 10 and 15, and at about 600' on Line 2, located 1200-1300' to the west. Wieduwilt discounts possibilities of coupling considering the higher resistivities reported, but he warns that the substantial changes of amplitude used during the survey could cause a higher apparent response.

2. West of the N-S fault, in NW/15, a shallow dike-like body some 1000-1500' in width extends to the SW.

3. In S2/15- N2/22 (diagonally shaded area of Wieduwilt) an anomalous area (25pfe) is measured below 2000'. MGS warns of possible coupling effects.

4. A narrow responsive body was measured on Lines 1 and 4 in SW/22 -- at ± 600'.

Reference to MGS's aeromag interpretation of a portion of Area S-Detrital Valley (Nov. 21, 1975) will show that Superior's low level magnetics suggested a major Basin and Range fault/fault sliver (Sacramento Fault) dropping west side bedrock to 3000 feet ± from surface -- the fault extending NNW thru 22 -- no doubt the same fault as now more accurately delineated by Heinrichs' resistivity.

PXC's Observations

1. The E-W trending higher sulfide area which is exposed in the low hills at the mouth of Alum Gulch- west central Sec. 14- does not trend directly into the broad northern anomaly of Heinrichs' (NE/15-SE/10) as was suspected, but rather into the area to the south of that anomaly, assuming no fault offset.

2. The Cerbat Mountains foothills east of the broad anomaly of (1) above (especially its northern edge) and the shallow pediment are pockmarked with propsect pits and shallow shafts which tested narrow sulfide zones along rock contacts, narrow shear zones and thin quartz veins. The quartz biotite gneiss and pegmatite of the pediment are not pervasively altered* but the mineralized zones do show trace to minor amounts of copper, suggesting the possibility of mineral leakage.

3. El Paso drilled to a TD of 507' in E-3. Based on Heinrichs' estimate of a somewhat more shallow depth to the top of the responsive zone than the estimate of MGS, E-3 may not have reached its objective.

   El Paso has made available to us a brief graphic log of E-3. Bedrock was encountered at 42'. The remainder of the hole was cored. Black and dark green schist predominate to just below 400' where banded mica schist and quartzite are encountered. There is some pegmatite. Sulfides were first noted at about 120'. They persist, apparently infrequently, to the bottom of the hole -- with mineralization described at weak below 460'. The frequency of mention of sulfides above 460' is less than below that level. Chalcopyrite ?is mentioned at about 490'.

   It is interesting that the logging geologist is the same one that indicated no Cpy in E-1 when the logger of the top part of that hole had noted that mineral several times.

---

* The metamorphism of the rocks exposed on the pediment is such as to make these rocks relatively impervious to any alteration generated by a buried intrusive.

Tucson, Arizona
June 28, 1976

To: Mr. J. B. Imswiler - IMC

From: A. J. Perry - Perry Exploration Company

Subject: Supplemental Evaluation- El Paso Natural Gas Company's Property, Kingman, Arizona

Summary

Mining Geophysical Surveys (MGS) has reviewed and reported on the IP and resistivity findings of contractors Heinrichs and Mc Phar who conducted independent surveys extending from El Paso's Emerald Isle Pit northward into S2/Sec. 10 (See Figure- MGS's report). Mc Phar's data appeared to MGS to be less than adequate for a meaningful interpretation. Heinrichs encountered anomalism in several areas, possibly reflective of sulfide mineralization.

El Paso's mineral holdings extend thru portions of several sections covering the Emerald Isle oxide copper deposit (origin still in question) and a substantial area of pediment NW of Duval's Mineral Park open pit copper/moly operation.

The anomalism detected over a broad area in NE/15 and SE/10 at depths of 600-1000 feet from surface could indicate as much as a 5% total sulfide in rocks unlike those exposed at surface-- but there could have been geophysical enhancement of a weaker anomalism. Widespaced occurrences of mixed sulfides (including trace to minor chalcopyrite) are present in the overlying exposed rocks. These dispersed sulfides could represent a weak halo over a more pervasively mineralized unit.

A deeper, but broader anomaly in S2/15 - N2/22 may be, for the most part, a product of electric coupling -- but this is uncertain.

An easterly trending narrow but relatively shallow anomaly in S2/22 is situated along the N. side of the Emerald Isle pit. Some sulfides carrying minor copper have been encountered in drilling into bedrock south and west of the Pit , but this anomaly is apparently untested.

A fourth anomaly, the SW trending, near surface dike like body in NW/15 was apparently tested by El Paso drill hole E-1 and possibly by E-2. It is interesting that the geologist logging the upper portion of E-1 recorded occasional chalcopyrite to 467'. A second geologist logging below that depth mentioned no chalcopyrite.

PERRY EXPLORATION COMPANY, Inc.

P. O. Box 12754 Tucson, Az.

June 28, 1976

Mr. J.B. Imswiler
Manager-Exploration W-USA
IMC
Suite 12, 390 Freeport Blvd.
Sparks, Nevada 89431

Attached are two copies of my supplemental thoughts re: El Paso's Emerald Isle properties. Previously we recommended no interest in any oxide potential that might remain in the Gila overlying bedrock.

This presentation deals with the sulfide potential of the bedrock of the area of El Paso's holdings. There are untested though in part suspect IP anomalies. Verification can easily be obtained with an inexpensive check geophysical survey-- est. cost- $2600-3000.

This is "elephant country" and we should not too hastily rule out the possibility that exploration by El Paso was not adequate.

I would be pleased to have your decision relative to this recommendation to undertake the check IP work at your earliest convenience.

A. J. Perry

Attachments (2)

P. S. Please use MGS's report (previously forwarded) for reference when analyzing our recommendation.

ARIZONA PROGRAM

- BEAR CREEK IS WILLING TO SPREAD OUR $60,000 OUT OVER TWO YEARS, i.e., $30,000/YR. ALTHOUGH THEY ~~ARE~~ WOULD LIKE TO DO A TOTAL OF $120,000, i.e., 60M BCM-6CM IMC DURING 1977.

- IF WE ARE NOT WILLING TO PROTECT OUR $42,500 INVESTMENT IN THE CORNITE PROJECT, THEN THERE IS NO POINT IN CONTINUING WITH THE ARIZONA PROGRAM, UNLESS WE ARE JUST LOOKING FOR PROPERTIES TO DEAL OFF TO SOMEONE ELSE. i.e., ARE WE WILLING TO BE INDEPENDENT PROSPECTORS (?)

- ~~EMERALD~~ ISLE IS A COPPER PROSPECT ADJACENT TO MINERAL PARK, ARIZONA. IT CURRENTLY BELONGS TO BC BASE CAS. WE NEED TO DO ~$3,000-$3,500 WORTH OF GEOPHYSICAL WORK TO ~~BE~~ MAKE A DECISION AS TO WHETHER TO FORGET IT OR PURSUE IT.

  - IF WE FORGET IT THIS WILL EFFECTIVELY CONCLUDE OUR PROGRAM IN THE DATRITAL VALLEY AREA, AND WE WILL SOMETIME SUBSEQUENTLY ~~SUPERIOR AND~~ TERMINATE OUR JV.

  - IF WE PURSUE IT, THIS WILL CERTAINLY ENTAIL SOME DRILLING ON THE ORDER OF 1-2,000 ft ie ~$15,000-$30,000 PER HOLE.

• CUPRITE PROPERTY.

(to include deep)

- MC is required to give written notice to BCMC of its intent to either continue to contribute or withdraw.

- If MC withdraws, we lose everything i.e., any right title or interest in the project + the $12,500 we have invested.

- If we continue, we must ~~decide~~ enter into a formal exploration + development agreement + we must contribute $60,000 within the next 2½ years in order to earn a vested interest in the ~~property~~ project.

- Once MC becomes vested we will never have less than a 15% net profits royalty if we never contribute another dollar.

- This is a major sulfide system that, unless we get lucky, will be drilled for years before it is abandoned or put into production. Once MC is vested BCMC will undoubtedly continue to farm in other participants at more lucrative entry fee until a determination is made. This ~~the~~ property will not be dropped by BCMC.

Far West

El Paso

- Bedrock sulfide potential
  IP survey #3600 - 3000
  W sidewall

- PXC recs:
  - One line survey of
    - Northernmost anomaly (SE/10 - NE/15)
    - Deeper anomaly (S2/15 - N2/22)
      To check narrow E-W body in S2/22

Note: I see no recommendation or statement in W sidewalls report to the effect that 1-line survey would give us the necessary answers. Where did this idea originate?

Are we beating a dead horse or is there really a chance?

Let's not kid ourselves.

Can we discuss this Friday?

During May, prelininary prospecting was undertaken in the Detrital Valley area, Mojave County. Perry scouted the projects of Mr. G. C. Patterson located immediately north of Duval Mineral Park operation. Blakestead worked in the area to the south of Mineral Park including the old Goldcolda area.

Cores from the three deepest holes drilled on the Patterson ground have been examined. The 7-1/2 mining topographical sheet of the area has been enlarged to a scale of 1" = 1,000 feet. A reconnaissance geological map will be prepared and a summary prepared as to the remaining mineral potential.

The agreement with Superior for use of the aeromagnetic data has not yet been forwarded for their ratification.

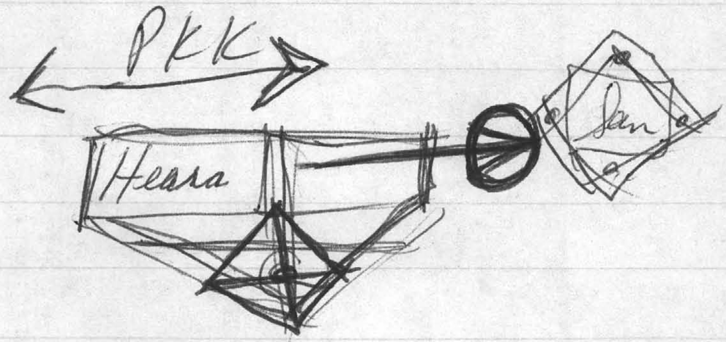
Blakestead examined the Mammoth-Black Queen Mines area (gold and silver), Supersittion Mining District, Maricopa, and Pinal Counties. Bob is fairly enthusiastic about the wide zones of shearing and mineralization despite only fair to poor initial sample results. There will be further study of the area.

Nora Colburn, formerly a geologist for Cyprus' Arizona operation, has been employed on a contract basis and is compiling geologic information on Western Yuma County.

Preliminary review of her work indicates some prospecting areas will be delineated. Miss Colburn will complete her work in about two weeks.

There are no new developments at Cuprite.

In May, Perry devoted 13 days to the project; Blakestead 11. Miss Colburn devoted the whole period to her own report.



Preliminary prospecting in Detrital Valley area
Penny scouted properties of Patterson
immediately north of Duval's Min Park.

Blakestead worked in area [illegible]
including old Golconda mine area

Cores from the 3 deepest holes drilled on the Patterson ground have been examined

The 1½' topo sheet of the area has been enlarged to 1" = 1,000 ft.

Recon geol map will be prepared & a summary printed as to remaining mineral potential.

The agreement c Superior for use of their aeromag data has not yet been forwarded for their ratification.

Blakestead examined the Mammoth-Black Dragon (Ag-Au) Superstition Mining Dist, Maricopa Co. & Pinal Co.

Bob is fairly enthusiastic about wide zones of shearing & mineralization despite only fair to poor initial samples

vesales.

Further study of area.

Nora Album, formerly Cyprus Geologist (Arizona) has been employed on a contract basis & is compiling geological info on western Yuma Co.

Preliminary review indicates some prospecting areas will be delineated.

~ 2 weeks to completion

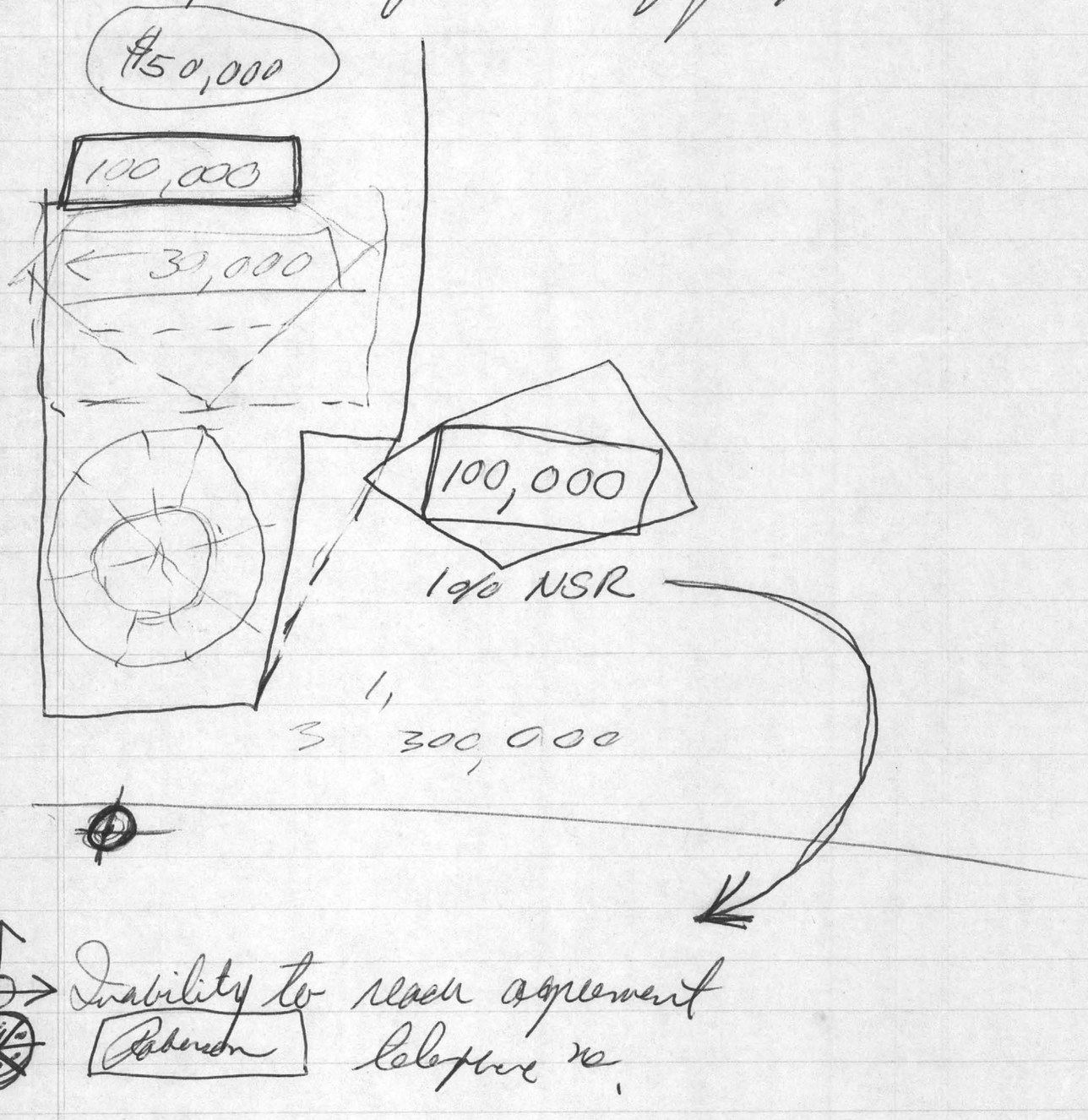
No new development @ Cuprite.

Jim Mary Jerry donated 13 days to Project, Blakstad II, Calhoun full time.

Dick Coates

Superior Contract

Designation of a mining prospect.



WR-3

(3)

• Detital Valley

Geo Terex

Can fly and interpret.

For 750–1000 mi^2 = 6^{00} per line mile to fly + compile

7½" sheet contour data all tapes + digital + analog machine contours, No photography.

$30–60,000 minimum depending on ½ or ¼ mile spacing. ≈ 1,000 mi^2.

#1. Visit Ron Tosdal @ Mineral Park (Dunal).

~~#2. Visit Shaft.~~ Decon one week

3. Prepare a bore

4. Denslok fine figures

5. Ice to shaft.

Need lead time.