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PERRY, KNOX, KAUFMAN, INC.

MINERAL EXPLORATION AND DEVELOPMENT

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2343 E. BROADWAY, SUITE 206
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TELEPHONE (602) 622-0582

SPOKANE, WASHINGTON
NORTH 20 PINES ROAD, SUITE 21
P. O. BOX 14336, ZIP 99214
TELEPHONE (509) - WA 4-0878

Tucson, Arizona
October 2, 1974

Mr. J.B. Imswiler
Manager of Explorations
Western USA
IMC
Suite 12
390 Freeport Boulevard
Sparks, Nevada 89431

Attached are two copies of our evaluation of Nucas Ltd.'s San Pedro pediment properties (Beth claims), Pinal County, Arizona.

This report reflects the conclusions of our phone conversation. If you have any questions please call.

Also attached are copies of the very preliminary material initially forwarded by Coryell to Bob Kayser. No other information provided by Nucas was retained.

A.J. Perry
PERRY, KNOX, KAUFMAN, INC.

AJP/sc

attach

REPORT

A REVIEW OF
AIRBORNE MAGNETIC DATA
BETH CLAIMS AREA
PINAL COUNTY, ARIZONA

for

Nucas Limited
Tucson, Arizona

ELLIOT GEOPHYSICAL COMPANY
Mining Geophysical Engineers
4653 East Pima Street
Tucson, Arizona 85712

Ref: CY1E
June 27, 1973

In accordance with your wishes, a study has been made of the airborne magnetic data available covering your Beth Claims Area and surrounding region in Pinal County, Arizona. This claims block is situated at approximately 32°— 43' N. latitude and 110°— 33' W. longitude, and within the confines of the Clark Ranch 7½ minute quadrangle sheet. In addition to studying the available airborne magnetic data, selected drill core samples from drill hole CCP-1 and CCP-3 were run in the physical property laboratory of ELLIOT GEOPHYSICAL COMPANY in order to determine their magnetic properties. This laboratory physical property work was reported to you in a separate physical property report, dated June 25, 1973. This physical property report is attached to this report for sake of completeness.

Pertinent references to this report are as follows:

1) Residual Aeromagnetic Map of Arizona, scale 1:1,000,000, W. A. Sauck and J. S. Sumner, 1970.

2) U. S. Geological Survey, Geophysical Investigations Map GP-419, Aeromagnetic Map of Mammoth Quadrangle Pinal and Pima County, Arizona, W. J. Dempsey and M. E. Hill, 1963.

3) Physical Property Report, ELLIOT GEOPHYSICAL COMPANY, letter to Kirby Coryell, Nucas Limited, June 25, 1973.

4) Undated Airborne Magnetic Map (selected portion), flown by Aerial Surveys, Salt Lake City, for Cyprus Mines Corporation, scale 1:24,000 at mean terrain clearance of 500 feet. This data covers predominately the low magnetic anomaly presented in sec. 19, T 8 S., R. 18 E.

5) Discovery and Exploration of the Kalamazoo Orebody, J. David Lowell, AIME meeting, New York, February 25-29, 1968. Paper preprint No. 68-I-3.

The airborne magnetic data available for the Beth Claims Area is available at the present time from two sources. U. S. Geological Survey, Geophysical Investigations Map GP-419 and a proprietary survey flown by Aerial Surveys for Cyprus Mines Corporation. The USGS data gives a broader range of coverage and in its entirety covers the Beth Claims Area. This data was flown at a mean terrain clearance of 1,000 feet whereas the restricted area of the Cyprus Mines Corporation was flown at a mean terrain clearance of 500 feet. However, the Cyprus data covers predominately the magnetic low anomaly located in sec. 19 of T. 8 S., R. 18 E. For this area, then airborne data is available from two flight levels.

Attached to this report and forming a part thereof is a reduced scale map of the northern portion of USGS Map GP-419. On this attached map, entitled "Index to Airborne Magnetic Anomalies and Drill Holes", are shown the pronounced airborne magnetic features that were studied in detail and the available deep drill holes in the area known to this writer at the present time. On the attached index map the positive airborne magnetic anomalies have been indicated in red and the negative (or low) airborne magnetic anomalies have been indicated in green. Each has been given a reference letter designation for subsequent referral.

In addition to the above named detailed airborne magnetic coverage of the Beth Claims Area, one should also consider the Residual Aeromagnetic

Map of Arizona which in a regional sense gives the general magnetic structure of the Beth Claims Area. The study of the map shows that the magnetic grain in the Tucson area and northward towards Florence, has a general strike direction of N. 45° W. with some suggestion of a magnetic disruption north of Tucson with a generalized strike of N. 45° E. Thereby this magnetic disruption of finite length apparently cross-cuts the general magnetic grain of southeastern Arizona. The general regional magnetic features and cross structure are clearly indicated on USGS Map GP-419.

A persual of the USGS Map and as originally pointed out by Mr. Kirby Coryell, suggests that the cross-cutting northeast-southwest magnetic structure that disturbs the general northwest-southeast magnetic grain has possible economic significance. In particular, the disturbed northeast-southwest magnetically indicated structure extends from two well known mineral deposits, the San Manuel Orebody and its neighboring Kalamazoo Orebody which occur predominately in association with magnetic low "A", as shown on the attached index map and the magnetically indicated cross structure extends to the vicinity of the Newmont Exploration Ltd./Exxon U.S.A. mineralized zone known as Copper Creek. The Copper Creek zone is not shown on the attached index map but is slightly off the east edge. It exists approximately in line with magnetic low zones "A", "B", and "D" and approximately 4 miles northeast of magnetic low zone "D". The location of the San Manuel Mineralized Orebody and its neighboring Kalamazoo Orebody have been clearly shown in the above referenced paper by J. David Lowell, 1968. The location of

these two orebodies lies just on the northern edge of magnetic low zone "A" and it would appear to be a safe assumption that this low zone, in some way, is associated with the mineralization.

If this concept is true, then the magnetic low zones of "B" and "D" along strike of the magnetic disruption zone may also have similar economic possibilities. Of lesser interest, but still possible is magnetic low zone "C" which is not on strike but could be genetically related to the other magnetic low zones.

Because of the two known orebodies, the San Manuel and Kalamazoo zones, much exploration activity has been performed in this area to the northeast and as known to this writer at the present time, there are two deep drill holes, MW-1 and BC-1, which were drilled by Bear Creek Mining Company and five drill holes designated CCP-1 through CCP-5, that were drilled by Cyprus Mines Corporation. Basic drill logs of these seven holes are available at the present time. It would appear to be a technically sound assumption that magnetic low anomaly "B" was a target for investigation by Bear Creek Mining Company and was the reason for the spotting of their drill hole MW-1 which was a deep hole but with discouraging economic indications. Bear Creek Mining Company also tested anomalous zone "D" with their drill hole BC-1 which also had uninteresting economic indications. Cyprus Mines Corporation also tested magnetic low zone "D" with their drill hole CCP-1 and magnetic low zone "C" with their drill hole CCP-2. Neither of these holes had any positive indications of economic mineralization.

Therefore, other organizations have been strongly interested in the magnetic low zones which in part form the magnetically indicated cross structure extending from the Kalamazoo Orebody to the Copper Creek district of the Newmont/Exxon exploration activities currently in progress. The question remains, have the magnetically indicated cross structure examplified by these magnetic low zones been properly tested in view of economic possibilities? This is the real purpose of this study of the airborne magnetic data although it must be emphasized that magnetic low zones are not in themselves valid geophysical targets, without other supportive data. From the magnetic point of view the real important conclusions derivable from a regional study of the magnetics is the existence of the magnetically indicated cross structure, which apparently cuts the main geologic fabric of this area. The economic conclusions is therefore that both ends of the cross structure have economic copper mineralization and therefore economic targets could very well be developed anywhere along the cross structure and the bounds of the cross structure can be defined by the magnetic data even though a given small magnetic anomalous feature, such as magnetic low zones "A", "B", and "D" are not in themselves necessarily indicative of specific drill targets. It should be pointed out clearly, this is an important concept, that the structure magnetically defined ~~it~~ has undoubtedly economic significance, but an attempt to derive specific drill targets based on the magnetic data is rife with insurmountable problems.

Negative magnetic closures or as more commonly called magnetic low anomalies are often times very misleading magnetic patterns. Magnetic low closures may be due to: 1) a drop in magnetic activity to normal background,

2) an anomalously negative area due to reversed natural remanent magnetization of sub-surface magnetic rocks, or 3) merely be the normal negative anomaly located on the magnetic north side of magnetized bodies. It sometimes requires a very careful scrutiny of regional magnetic data and a careful study of magnetic patterns in order to determine which of the three conditions have given rise to so called negative magnetic closures. Many explorationists today are obsessed with an over-interest in negative magnetic anomalies and incorrectly assume that these are all due to alteration patterns due to the destruction of magnetite in a magnetic environ such that the magnetite is oxidized to hematite, a relatively non-magnetic mineral. While this in theory is a possible cause of ~~a~~ negative magnetic anomalies it is by far not the most common source of such magnetic features. Besides alteration patterns with attendant destruction of magnetite in a magnetic environ, negative closures may be caused by non-magnetic rocks including volcanics and intrusive rocks that are normally considered to be magnetic. An example of this would be the tuff cored in the bottom of drill hole CCP-3 which had no magnetic response as reported in the attached physical property report dated June 25, 1973. Another common rock in the vicinity of the Beth Claims Area is Gila conglomerate which is usually non-magnetic, and every indication in this area would suggest that the Gila conglomerate present here is truly non-magnetic. Another rock anomaly found in the Beth Claims Area that is also non-magnetic is Oracle granite which is known to exist in the vicinity of the Kalamazoo and San Manuel Orebodies. The rock is also prevalent in Bear Creek Mining Company drill hole MW-1 and more than likely contributes to the low magnetic closure at this locale.

Therefore one must be very careful in analyzing an apparent magnetic structure consisting of magnetic lows which may have no economic meaning and do not in themselves generate viable drill targets. The magnetic lows which ~~area~~ are a predominate feature of the cross magnetic structure, extending from the Kalamazoo orebody to the Copper Creek area, may be reflecting deep seated structure of possible economic interest but such reflection is an indirect reflection. More directly, the magnetic lows are merely reflecting non-magnetic rocks or in other words, a lack of magnetite content in the rocks and overburden at these specific locations. The most prevalent possibilities creating these lows is deep filled trenches of Gila conglomerate. This in itself, while not direct evidence of ore mineralization, can suggest deep seated structural faulting and therefore gives viability to the cross structure as having possible economic potential.

A regional interpretation of the magnetic data strongly suggests that the magnetic lows, or negative closures, are merely normal background magnetic levels and therefore are reflecting rocks that are non-magnetic or lack magnetite. Therefore these background ~~levers~~ levels could be reflecting alterations and resultant magnetite destruction of formally magnetic rocks, ~~D~~d eep trenches of Tertiary gravels or Gila conglomerate, non-magnetic volcanics which are known to be present in the area from the drill core of drill hole CCP-1, or Oracle granite.

Magnetic low zone "A", associated with the Kalamazoo and San Manuel orebodies, is more than likely due to the presence of Oracle granite and other acid

intrusives, with the addition of possibly magnetite destruction of surrounding volcanics, due to the orebodies themselves. It cannot be ascertained definitely that alteration played a part in the formation of this magnetic low, but it is quite conclusive that the acidic intrusive rocks at this locale do significantly contribute to the magnetic low closure.

Magnetic low anomaly "B", based predominately on the data from Bear Creek Mining Company drill hole MW-1 suggests that Gila conglomerate to 1,000 feet and predominately Oracle granite to the order of 2,800 feet, have contributed to this magnetic low, being rocks of non-magnetite content as a rule.

Magnetic low anomaly "C", is also more than likely due to a deep trench of Tertiary gravels or Gila conglomerate to at least 2,000 feet according to the log of drill hole CCP-2. Other non-magnetic rocks may be present here further contributing to this low feature.

Magnetic low anomaly "D" has more data and can be more adequately explained. Predominately Gila conglomerate to 1,400 feet plus non-magnetic volcanics rocks from 1,400 feet to at least 3,400 feet are evident in the logs of Bear Creek Mining Company drill hole BC-1 and Cyprus Mines Corporation drill hole CCP-1. Of particular note is the physical property data run on core samples from drill hole CCP-1, which is included as an attachment to this report. It could be noted that the average magnetic susceptibility of the volcanics rocks from 1,600 feet to 3,400 feet is

385 x 10^{-6} cgs units, which for all intent in purposes are almost non-magnetic. This physical property data, in conjunction with the two drill logs, more than adequately explains this magnetic low closure and there is no suggestion that this in itself is a drill target ~~and~~ as there is no suggestion of any magnetite alteration indications.

In order to more conclusively analyze the magnetic lows, it is often times advisable to study the magnetic highs in order to determine what magnetic susceptibility levels in depth these structures are interpreted at. Here the purpose is to make a systematic study of the magnetic high zone and the data is reported here for completeness sake. Both the airborne magnetic data from the restricted survey by Cyprus Mines Corporation and the USGS data as reported on Map GP-419, has been utilized in this study. Quantitative magnetic interpretative techniques have been followed using accepted procedures.

On the attached index of anomalies, the magnetic high zones that have been studied quantitatively, are so indicated in red. The interpretation of these zones have resulted in the following average values, as presented in the following table.

Magnetic Anomaly Index Designation	Depth Below Ground Surface in Feet	Magnetic Susceptibility In 10^{-6} cgs Units
E	1,500	5,400
F	3,300	4,000
G	1,000	2,400
H	250	4,900
I	1,900	2,400
J	600	2,000
K	2,600	2,400
L	1,800	2,800
M	2,500	2,600
N	1,000	1,200
O	2,300	2,400

In general, these magnetic highs are more than likely reflecting intermediate volcanics that are buried at the depths indicated and containing magnetite to the level of ½ to 2 percent by volume. Of interest, these magnetic high zones for the most part surround the low zones in question, that define the magnetic cross structure. Therefore, at the depth of the magnetic low anomalies "B", "C", and "D", these zones are strongly suggestive as having been already tested by the existing drill holes.

Correlation of drill hole data from drill hole CCP-3 and CCP-4 suggest that Gila conglomerate and non-magnetic tuff, as reported in the attached physical property report to at least 2,000 feet in depth, correlates very well with the interpreted depth to magnetic rocks of 1,800 feet. This would suggest that below the tuffs there is another volcanic sequence of

which some are more-than-likely slightly magnetic. The indicated magnetic susceptibility level suggests perhaps one percent magnetite by volume.

In summary, the study of the airborne magnetic data available for the Beth Claims Area suggests strongly that the magnetic data is distinctly indicating a cross structure which is probably a reflection of an old structural break extending at least from the Kalamazoo orebody northeastward to the Copper Creek district. Unfortunately, our magnetic coverage in detail does not extend eastward as far as the Copper Creek district nor west of the Kalamazoo orebody and therefore we do not know how much further easterly or westerly this cross structure, as magnetically indicated, will persist. From the Residual Aeromagnetic Map of Arizona the cross structure does not apparently exist much further than that defined on the detail survey by the USGS and Cyprus Mines Corporation. It is important that this structure is there, that it is an indirect indication of possible economic mineralization, and that somewhere along the structure additional economic sulfide mineralized bodies could be located. On the otherhand, the airborne magnetic data, as presently available, by itself cannot point out specific target area warranting any drill testing. The magnetic low zones "A", "B", "C", and "D" are not in themselves necessarily indicative of specific targets, even though two major orebodies are associated with magnetic low zone "A". This does not however negate the possibility that along this structure somewhere, a major copper body may be located.

In order to derive more specific targets for possible drilling, other geophysical data or geological, or drill hole data needs to be correlated

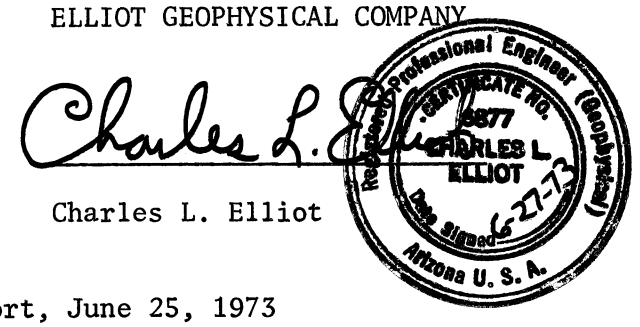
with the magnetic data in order to possibly obtain potential indications worthy of further exploration activities. In particular, from the geophysical point of view, gravity data might be important in studying the trench concept of this magnetically indicated cross-structure. Adequate gravity coverage properly performed and interpreted with subsequent correlation to the airborne magnetic data in particular, might map post mineral cover such as the Gila conglomerate, and separate Gila conglomerate magnetic behaviors from those of non-magnetic volcanic rocks. Between the two methods, it may be possible then to derive specific targets for exploration.

As part of this report there has been no attempt to integrate any other geological or geophysical data available other than the drill holes as specifically described previously in thisreport. In conclusion, the magnetically indicated cross structure is real, is economically important, and should yield possible deposits of economic sulfide mineralization, but specific drill targets cannot be derived from the data at hand and therefore, no drilling recommendations can be made in this report.

June 27, 1973
Tucson, Arizona

Respectfully submitted

ELLIOT GEOPHYSICAL COMPANY

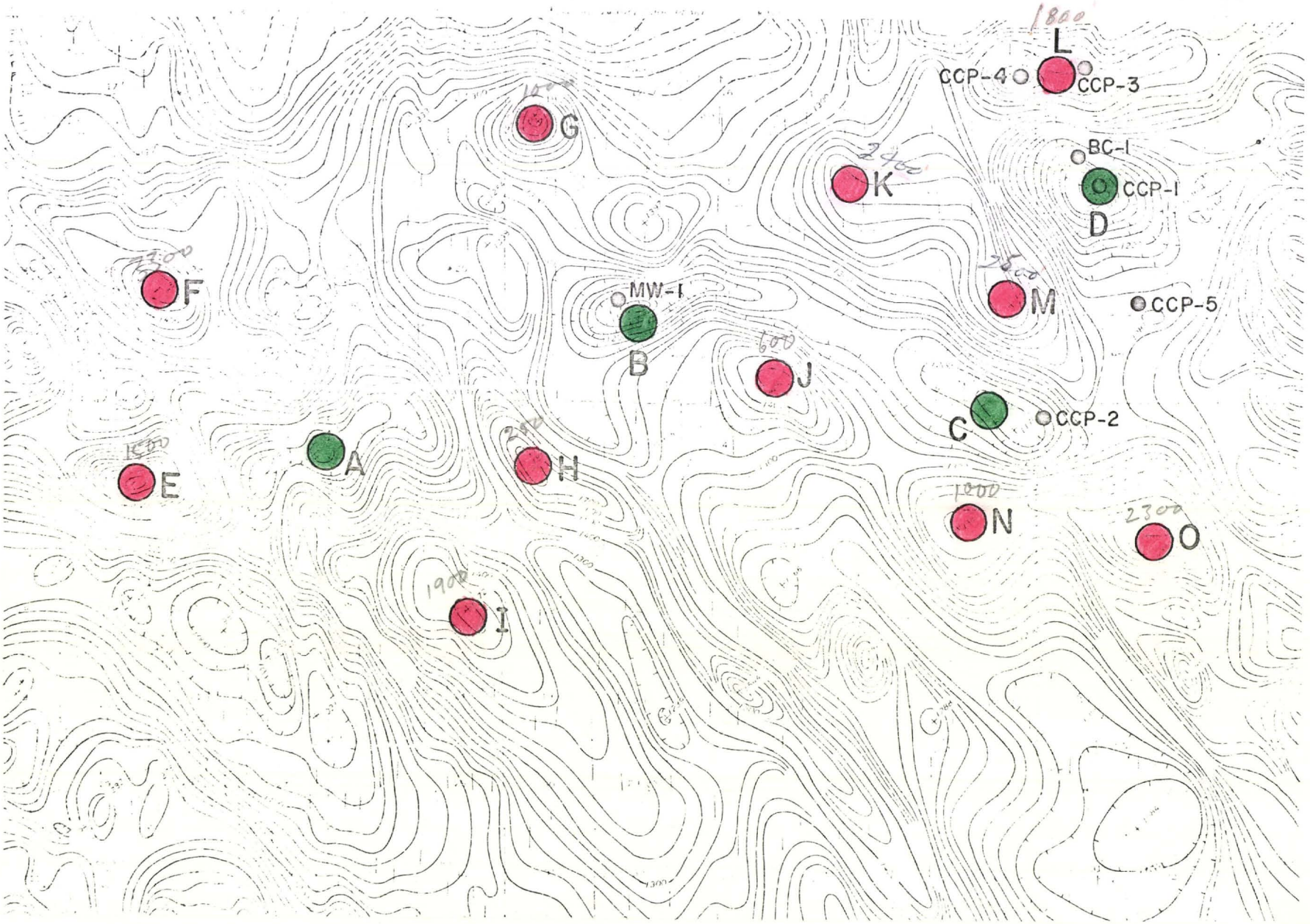


Charles L. Elliot

Attachment: Index Map
Physical Property Report, June 25, 1973
Distribution: Kirby Coryell (2 copies)

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

GEOPHYSICAL INVESTIGATIONS
MAP GP-419



INDEX TO AIRBORNE MAGNETIC ANOMALIES AND DRILL HOLES
REFERENCE: USGS GEOPHYSICAL INVESTIGATIONS MAP GP-419, 1963

Ref: CY

ELLIOT GEOPHYSICAL COMPANY

Mining Geophysical Engineers

4653 EAST PIMA STREET TUCSON, ARIZONA 85712 TEL. (602) 793-2421

June 25, 1973 Ref: CY1P

Nucas Ltd.
5140 East Burns Street
Tucson, Arizona 85711

Attention: Kirby C. Coryell

Dear Mr. Coryell:

Re: Physical Property Laboratory Determinations - Magnetic Susceptibility

The Beth Claims Area samples received from you on April 4, 5, and 20, 1973, have been run in the physical property laboratory to determine their magnetic susceptibility values.

The magnetic susceptibility measurements made in the physical property laboratory utilized a magnetic susceptibility bridge type instrument operating at a frequency of 400 hertz and following conventional physical property practices. The limits of detectibility of the bridge are approximately 20×10^{-6} cgs units. The results of the laboratory determination of magnetic susceptibility are reported in cgs units on the attached table.

The samples will be held in storage in the laboratory for 90 days to await your instructions on disposition.

Respectfully submitted,

ELLIOT GEOPHYSICAL COMPANY

Charles L. Elliot

CLE:bt
attachment: Table
Distribution: K. Coryell

ROCK PHYSICAL PROPERTY LABORATORY DETERMINATIONS

CORE SAMPLES

for

Beth Claims Area
Nucas Ltd.
Tucson, Arizona

Sample Number	Sample Depth In Feet	Magnetic Susceptibility in 10^{-6} cgs units
CCP-1	1642	0
CCP-1	2007	555
CCP-1	2250	535
CCP-1	2446	0
CCP-1	2768	500
CCP-1	2853	420
CCP-1	3195	745
CCP-1	3227	170
CCP-1	3300	365
CCP-1	3365	480
CCP-1	3398	460
DDH-3	1505	0

June 25, 1973
Ref: CY1P

Tucson, Arizona
October 2, 1974

TO: Mr. J.B. Imswiler - IMC

FROM: A.J. Perry - PKK

SUBJECT: Evaluation - San Pedro Pediment Properties of Nucas Ltd.

Summary

Nucas Ltd.'s proposal provides an opportunity for IMC to explore for one or more moderately to deeply buried, blind, porphyry type copper-molybdenum target(s), along $3\frac{1}{2}$ miles of the $5\frac{1}{2}$ mile long pediment covered belt between San Manuel-Kalamazoo and Copper Creek. Well developed aerial magnetic and gravity data provide information as to general trends and assist in estimating depths to bedrock but do not define possible mineralized areas. Photo geologic studies indicate numerous accurate structures are present in areas of post mineral cover. Such structures were apparently observed on pre-mining photos of nearby San Manuel and are thought by Nucas to reflext intrusive crackling and subsidence -- thereby indicating the presence of zones favorable for hosting porphyry type mineralization.

Three companies have drilled holes in the area currently held by Nucas. Only two of these borings have penetrated Pre-Cambrian basement. Alteration in the bedrock tests was of the propylitic type. Sulfide mineralization encountered was very weak. No assayable amounts of copper or molybdenum were encountered.

Nucas holds ±1000 claims (about 550 remain to be validated) and 7 State parcels covering an irregular area about one township in size. They propose that IMC take over exploration and carry thru to development -- with Nucas retaining a 25% carried interest with some rights for additional buy in.

Nucas' proposed next phase of work involves completing about 5 holes and drilling at 7 other locations. With the drilling required for claims perfection the cost of the proposed work could easily amount to $300,000.

Recommendation

The exploration opportunity available to IMC from Nucas would involve very substantial expenditures (the 3 previous exploring

groups -- including Nucas -- have spent +$500,000 in the Nucas area) in search of a poorly defined target(s). More well defined objectives can undoubtedly be pinpointed thru the current IMC-PKK effort.

It is recommended that IMC take no interest in the Nucas proposal at this time.

Background

Mr. Herbert Leopold, a limited partner of Nucas, Ltd., contacted Mr. Robert Kayser of IMC in Libertyville concerning the properties of Nucas situated on the San Pedro pediment. Mr. J.B. Imswiler requested that PKK examine the Nucas data on a consulting basis and report to IMC concerning the properties' apparent potential.

Extent of Evaluation

The writer devoted 4 days to office study of the voluminous data of Nucas and in preparation of this summary report. Honoring the request of Nucas, none of their compilations were reproduced. The Nucas land area is pediment covered and Nucas' general partner - geologist, Kirby Coryell, concurred that there was no purpose in making an on site examination.

The examination effort of PKK was preliminary. Considerable additional work would have been required before final recommendation had the Nucas opportunity appeared to have been tailored for IMC.

Location - Nucas Property Position

The Nucas property consists of an irregular block of better than a township in size covering portions of T8S Rs 17 and 18E (see Figure 1).

Nucas controls ±1000 claims and 7 State parcels ($4\frac{1}{2}$ sections of State land). About 450 of the claims are reported to have been validated. Mr. Coryell indicates that annual work is due on about $1\frac{1}{2}$ sections of State land in seven weeks ($9800 worth of work required).

The detail of the Nucas land situation was not examined.

Geology

The San Pedro pediment holdings of Nucas set astride the N35W trending San Pedro linear. This structural interruption extends from Bisbee thru San Manuel, Ray and Superior to Jerome. At Nucas this linear junctions with a N65-70E structural element which joins San Manuel-Kalamazoo (Magma Copper Company) to the Exxon-Newmont mineralized area at Copper Creek. This NE structural feature may be a part of a larger belt that passes thru Silverbell - San Manuel - Copper Creek and Morenci.

Adding to the attractiveness of the concealed bedrock area of Nucas' is the contact of the Pre-Cambrian Oracle Granite with the older Pre-Cambrian foliates of the Copper Creek area.

Overlying the Pre-Cambrian on the San Manuel side of the pediment area is the Cloudburst Formation. This is a volcanic sequence of variable character - in large part an agglomerate. This unit is thought to be the volcanic equivalent of the "just" post mineral dikes at San Manuel-Kalamazoo. The presence of Cloudburst probably indicates limited erosion of the Oracle surface subsequent to any possible mineral emplacement.

To the East, closer to the Copper Creek environment influence, Glory Hole volcanics overly the Pre-Cambrian. These rocks are pre-ore in age and were penetrated by at least two holes drilled on Nucas' lands.

Both the Cloudburst and the Glory Hole are overlain by the Gila conglomerage, a unit often of very coarse cobbles and of variable fragment composition. All post Pre-Cambrian lithologies only complicate attempts at geophysical interpretation.

Pre-Cambrian basement was penetrated in one Bear Creek hole and in a Cyprus hole later deepened by Nucas. Weathering was reported to be deep. Alteration was propylitic. Mineralization was restricted to minor pyrite and reported trace amounts of chalcopyrite. There are no assays available.

Drilling to date, combined with geophysical interpretation has probably defined the eastern limits of the Oracle granite batholith.

You are referred to the three principal publications cited in References for detailed geologic background.

Geophysics - Photogeology

Nucas based its initial interest in the San Pedro pediment area on observations made of magnetic configurations shown by USGS - GP - 419(3). This map shows similarities between some negative magnetic features buried beneath the pediment, east of Mammoth and the linear negative aeromag anomaly located in close proximity to San Manuel-Kalamazoo. These similarities had also been of interest to Nucas' exploration predecessors, Bear Creek and Cyprus Mines.

Nucas obtained copies of Cyprus' lower level aeromagnetic work over the pediment area as well as some high quality aeromag work of Superior Oil. Interpretation of these data by C.L. Elliot, consulting Tucson geophysicist, led to a recommendation for a gravity survey. Gravity work was accomplished by Heinrichs Geoexploration and Nucas. It was compiled and interpreted by Elliot. The magnetic and gravity data were composited. Elliot concludes that broad structural features (trends) connecting San Manuel with Copper Creek can be recognized but no specific drill targets can be defined.

Nucas engaged Dr. Thomas Mitcham, then a Tucson consulting geologist, to study the aerial photographs of the pediment area. Mitcham delineated numerous accurate photo lineaments some of which coincided with magnetic and/or gravity features.

He likened the accuate linears to some observed on pre-mining photos of the San Manuel-Kalamazoo area. According to Mitcham, these structures "may represent reflections of collapse in a crackle breccia in buried intrusive rocks, the collapse resulting from oxidation-leaching, or simply from late tectonic adjustments in the crackle breccia. Bodies of crackle breccia are considered as very favorable sites for porphyry copper deposits".

Drilling

Bear Creek Mining Company occupied a portion of the San Pedro pediment area in 1955 and reportedly drilled 2 holes.

Cyprus bored 8 holes in 1972. Nucas has deepened one Cyprus hole and drilled an additional 4 of a proposed 11 hole program -- completing none to basement. Bear Creek's holes were churn drilled. Cyprus and Nucas rotaried and took occasional spot cores.

A tabulation of the drill holes is attached - Figure 2.

Only two of the holes drilled to date penetrated basement -- holes MW-1 and CCP-1) although several located near Copper

Creek penetrated slightly mineralized Glory Hole volcanics.

A portion of Nucas' proposed test holes would be drilled to an estimated ±2000'. Other depths are estimated to be ±3500'.

Coryell indicates that rotary drilling has cost Nucas < $5.00/ft. to depths of 2000'. Holes drilled to 3000-3500' have cost < $10/ft.

Nucas' proposed holes were estimated to cost $225,000. With rapidly escalating drill costs and the increased number of claims validations necessary it is likely that a $300,000 expenditure would be required to complete Nucas' program.

References

1. Creasey, S.C.; General Geology of the Mammoth Quadrangle, Pinal Co., Arizona - USGS Bull. 1218 (1967)

2. Creasey, S.C., Jackson, E.D. and Gulbrandsen, R.A.; Reconnaissance Geologic Map of Parts of the San Pedro and Aravapai Valleys, South Central Arizona, USGS-MF-238 (1961)

3. Dempsey, W.J. and Hill, M.D.; Aeromagnetic Map of the Mammoth Quadrangle, Pinal and Pima Cos., Arizona, USGS-GP-419 (1963)

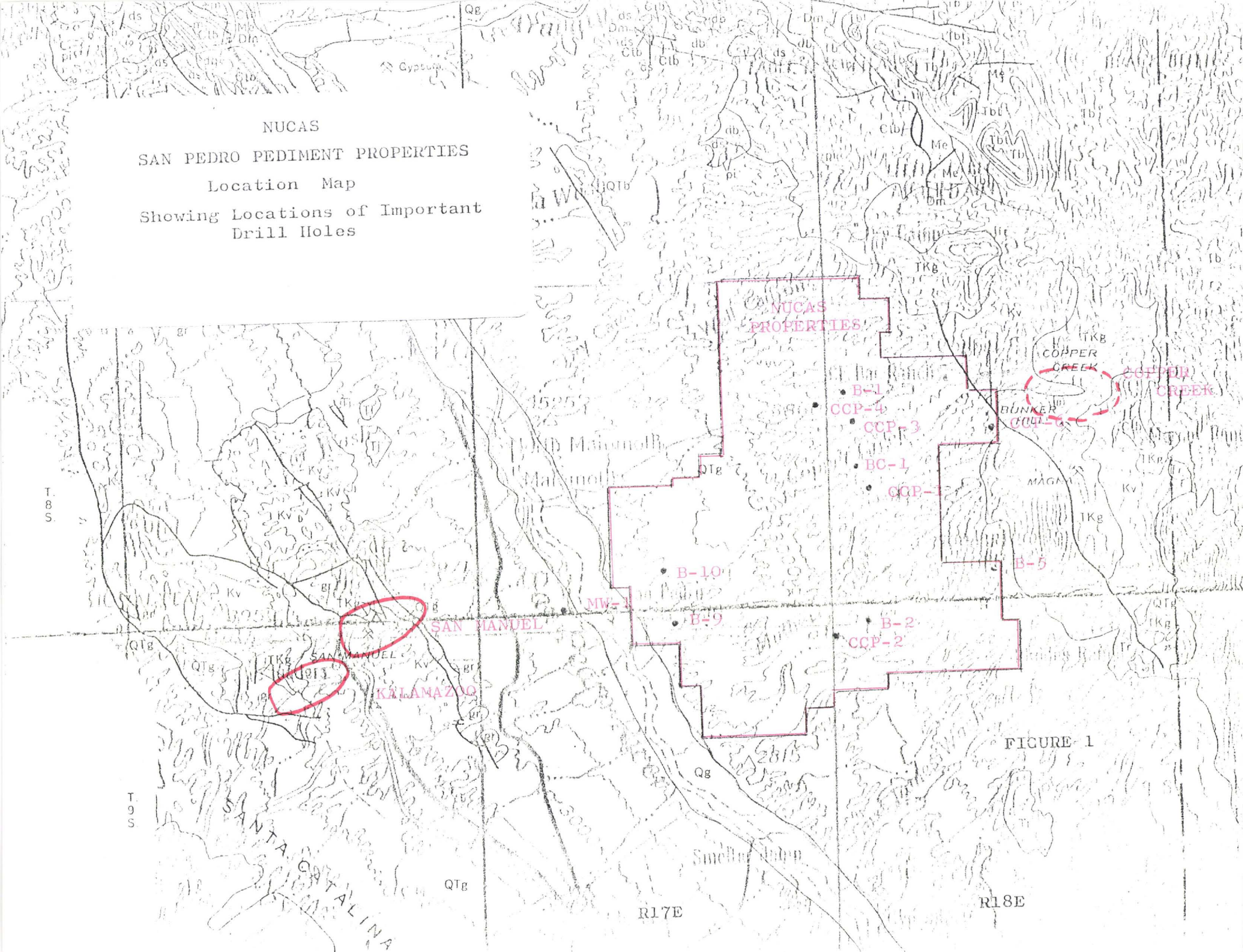

NUCAS
SAN PEDRO PEDIMENT PROPERTIES
Location Map
Showing Locations of Important
Drill Holes
NUCAS
PROPERTIES
B-1
CCP-4
CCP-3
BC-1
CCP-1
B-10
MW-1
B-9
B-5
B-2
CCP-2
COPPER
CREEK
BUNKER
CREEK
SAN MANUEL
KALAMAZOO
SANTA CATALINA
T.
8
S.
T.
9
S.
R17E
R18E
Qg
QTg
TKg
Kv
Tb
Tbl
Me
Dm
Ctb
ds
db
pt
gr

FIGURE 1

DRILL HOLE SUMMARY

Company	Hole No.	Total Depth	Deepest Formation Penetrated	Other
Bear Creek Mng. Co.	MW-1	2680	PG Oracle Granite @ 2320'	Py along sericite lined fractures. Drilled on flank of mag. low.
	BC-1	1939	Glory Hole volcanics(?)	Minor cpy reported 1150-1939' (not shown on log). On N flank mag. low. and on N65E gravity linear
Cyprus Mines	CCP-1	3398(later deepened +60' by Nucas)	PG Granite (upon deepening)	Prop. altn. of granite. Deep weathering of granite. Minor Py, Tr cpy. Poss intrusive (rhyolite) center penetrated above basement. Center of negative mag anomaly
	CCP-2	1980	Gila cgl(poss edge of lacustrine basin)	Drilled on negative mag anomaly
	CCP-3	1690	Rhyolite tuff	Located on mag positive
	CCP-4	2000	Gila cgl.	Located on mag positive
	CCP-5	600	Gila cgl.	(not plotted on location map)
	CCP-6	1196	Glory Hole volcanics	Some minor increase in Cu, Mo values (ppm) w/depth

DRILL HOLE SUMMARY

Company	Hole No.	Total Depth	Deepest Formation Penetrated	Other
	CCP-7	360	Gila cgl	(not plotted on map)
	CCP-8	360	Gila cgl	(not plotted on map)
Nucas	B-1	2832	Cloudburst cgl(?)	Drilled in accuate structural area on edge of mag and gravity lows.
	B-2	3605	Cloudburst cgl(?)	Drilled in circular structure. On end of mag positive nose.
	B-5	411	Glory Hole volcs.	Off edge GP data
	B-9	1690	Cloudburst cgl. @ 800'(?)	On large-indefinite mag feature. Many parallel NE trending structures.

REPORT

AN INTERPRETATION OF A GRAVITY SURVEY AND ITS CORRELATION WITH AIRBORNE MAGNETIC DATA AND DRILLING RESULTS

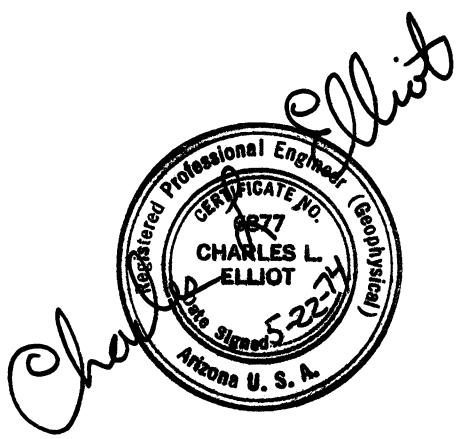
BETH CLAIMS AREA

PINAL COUNTY, ARIZONA

for

NUCAS, LTD.

TUCSON, ARIZONA



ELLIOT GEOPHYSICAL COMPANY
Mining Geophysical Engineers
4653 East Pima Street
Tucson, Arizona 85712

Ref: CY1E

A program has been conducted including improved data reduction of gravity data available from several sources, its interpretation and correlation with previous studies of airborne magnetic data and correlation with the current state of drilling for the Beth Claims Area and surrounding region in Pinal County, Arizona. This claim block is situated at approximately 32^{o} - 43' N latitude and 110^{o} - 33' W longitude and within the confines of the Clark Ranch 7½' quadrangle sheet. In addition to the gravity study, selected drill core samples from drill holes CC-P1, B1, and B5 were run in the physical property laboratory of ELLIOT GEOPHYSICAL COMPANY in order to determine their magnetic and density properties. This laboratory physical property work was reported in a separate physical property report dated May 16, 1974. This physical property report is attached to this report for sake of completeness. Pertinent references to this report are as follows:

1. Report - A Review of Airborne Magnetic Data, Beth Claims Area, Pinal County, Arizona for Nucas, Ltd., Tucson, Arizona. C.L. Elliot, ELLIOT GEOPHYSICAL COMPANY Ref: CY1E. June 27, 1973.

2. General Geology of the Mammoth Quadrangle, Pinal County, Arizona. USGS Bulletin 1218, 1967.

3. Physical Property Report - ELLIOT GEOPHYSICAL COMPANY. Letter to Kirby C. Coryell, Nucas, Ltd. May 16, 1974. Ref: CY2P.

4. Composite Aeromagnetic Gravity and Structure, San Manuel-Copper Creek Belt, Pinal County, Arizona. Beth Properties, Ltd. June 7, 1974.

5. Copper Creek Pediment Project - Geologic Map, Pinal County, Arizona. Cyprus Mines Corp. Scale 1 inch = 2000 feet. January 1973.

6. One suite of airborne magnetic sheets of total magnetic intensity, Superior Oil Company data with flight altitude 300 feet above mean terrain clearance, line interval 0.4 nautical miles, contour interval 20 gammas. Scale 1:24,000, 1964 and 1965.

7. Miscellaneous suite of drill logs, geologic data, geologic sections, etc. supplied by Kirby C. Coryell.

8. Suite of field notes, data reduction sheets, and other geophysical notes pertaining to gravity surveys of the area performed by Heinrichs Geoexploration Company, Tucson, Arizona for Cyprus Mines Corporation and Kirby C. Coryell and data gathered by Kirby C. Coryell.

The gravity data available for the Beth Claims Area was obtained from three or more separate surveys performed either by Heinrichs Geoexploration Company, Tucson, Arizona or by Kirby C. Coryell. This data had been reduced for customary corrections for drifts, elevation, latitude, and reference base station corrections by the staff of Heinrichs Geoexploration Company. The data, however, had not been corrected for topographic or terrain effects, which is customarily done with gravity data and is decidedly needed in the Beth Claims Area where topography is moderately rugged. Thereby, the initial

project by staff of ELLIOT GEOPHYSICAL COMPANY was to properly reduce the data and correcting it for topographic effects and to confirm all of the data reductions performed by staff of Heinrichs Geoexploration Company. Most elevations in the area except where ties were made to highway markers or established bench marks was by altimeter surveys or by picking elevations from standard 7½' quadrangle sheets. Therefore, the maximum noise in the data is more than likely due to elevation errors. A certain amount of smoothing of the data was necessary as were loop correcting factors necessary in order to make the data from the several separate surveys compatible with each other. This was performed as best as could be done with means available.

The calculated topographic effects for the area surveyed by the gravity method varied from about 0.27 to over 5.0 milligals across the area and this level of topographic correction had a severe effect on the gravity data and therefore there were areas in the original survey that could give rise to false anomalous indications or trends. All of the gravity terrain correction data was calculated using a density of 2.67 grams per cubic centimeter, a normal density for the crust of the earth. The gravity terrain corrections were performed on a digital computer model CDC 6400 at the University of Arizona using a formulation and program developed by ELLIOT GEOPHYSICAL COMPANY.

In accordance with common practice, terrain correction was performed by summarizing the effect of square vertical prismatic cells 1000 feet by 1000 feet within a squared area about each gravity station and out to a perpendicular distance of 25,000 feet. Special procedures were performed in order

to handle the close in terrain. By this technique, terrain corrections can be computed to an accuracy better than 0.1 milligals. This is sufficient accuracy equivalent to approximately one foot of elevation error in that it is grossly more accurate than the error noise resulting from the elevation control for the original gravity survey.

The original gravity data as supplied from the various sources was terrain corrected to final corrected Bouguer gravity values and the resulting corrected data has been plotted on a Bouguer gravity map attached to this report. On this map are shown the corrected gravity field with a contour interval of 1 milligal. The gravity values were reduced to an arbitrary reference base. Also on the map are shown the position of each gravity station that was recovered from the data and terrain corrected. Thereby, the reader has a visual presentation of the control data for the contour presentation.

In addition, copy of computer printout of all of the corrected data is presented in the Appendix to this report. This data includes the gravity station number, its north and east component listed in feet in accordance with the 1927 North American Datum 10,000 foot grid based on Arizona Coordinate System, East Zone. The calculated terrain correction is presented in milligals as well as the final corrected Bouguer gravity value in milligals.

Attached to this report and forming a part thereof are the following maps and data:

1. Bouguer Gravity Map, Beth Claims Area, Pinal County, Arizona for

Nucas, Ltd., Tucson, Arizona. Scale 1 inch = 2000 feet. May 1974. ELLIOT GEOPHYSICAL COMPANY Ref: CY1E.

2. Generalized Gravity Interpretation Showing the Principal Gravity Features, Current Drill Holes, and Structural Correlations. Scale 1 inch = 1 mile. May 1974. ELLIOT GEOPHYSICAL COMPANY Ref: CY1E.

3. One set of Computer Printout of tabulated gravity data including station, north and east positioning, computed terrain correction, and corrected Bouguer gravity values.

4. Physical Property Report, ELLIOT GEOPHYSICAL COMPANY letter to Kirby C. Coryell, Nucas, Ltd., May 16, 1974.

The Generalized Gravity Interpretation Map attached to this report is a reduced scale map of the Bouguer gravity map. On this attached map are shown the pronounced gravity features that were studied in detail and the available deep drill holes in the area currently completed. In addition, major structural trends and axis or features have been indicated with numbered circles for subsequent reference purposes in the text of this report.

Unfortunately, quantitative interpretive solutions of the gravity data are strongly dependent on good density information of the various rock units located within the area of the gravity survey. Gila conglomerate is one of the principal exposed rock units and this particular rock unit varies tremendously in cobble/clay content and in cobble/clay ratio. As a consequence its density can vary from 1.9 to 2.7 grams per cc depending upon the type of rock material that constitutes the cobbles and the amount of cobbles present

in the Gila conglomerate. Therefore, dependency on solutions involving Gila conglomerate cannot be absolutely accurate when density control of the Gila is not available.

Unfortunately, in most of the drilling in the area there were no core runs or the data is from old holes where the core is no longer available. At the site of drill hole B-1 the basic solution for the Gila was made and a density of 2.1 gm per cc was derived which is quite reasonable and a typical average value for the Gila. The rest of the density solutions were suitably adjusted to fit the known outcrop of the various rock units and their anticipated densities. Regardless all of the depth and density solutions depend greatly on the solutions of the Gila conglomerate density from drill hole B-1.

A further problem in the quantitative interpretation of the gravity of this area results from a lack of control across the predominate Gila conglomerate filled valley to crystalline bedrock on the west side of the valley. In following good gravity surveying practice, gravity data is normally extended from outcrop to outcrop across valleys and this greatly enhances solution of the density in that it provides bedrock control of known densities to guide interpretive solutions.

Further, the gravity survey had a limited lateral extent of approximately ten miles by ten miles which in turn is detrimental to good quantitative solutions in which lateral effects are so predominate. This can cause extreme gradients within the area of interest which can distort some of the gravity anomalous

features that are of particular interest in this area.

In general, the main features derivable from the gravity data are that there are two predominate structural directions within the area surveyed. The directions are approximately N 35° W, N 65° E, and a lesser direction of east-west. The predominant structural directions agree in a generalized way with the photogeological interpretation as performed by Dr. Thomas Mitcham as presented on the Composite Aeromagnetic, Gravity Structure, San Manuel/Copper Creek Belt map. In addition, the same structural directions are quite evident in the airborne magnetic data for the area. However, in the magnetic data the east-west structural direction is far more pronounced than is readily observable in the gravity data. We now have on hand more regional coverage of airborne magnetic data and predominately the regional structural direction is the N 35° W direction. Part of the concept of the Beth Claims area is that this regional structural direction has been disturbed in the belt from San Manuel to Copper Creek and this is exactly the area that has been surveyed by the gravity method. Therefore, our subordinate structural direction that extends northeasterly and easterly are perhaps of prime importance that resulted from the quantitative interpretation of the gravity data.

In the northeastern part of the gravity surveyed area is a steep gravity gradient climbing to a relative level of better than 60 milligals. This region is shown on the attached Generalized Gravity Interpretation Map as reference feature no. 1. This high gravity gradient climbs to outcropping bedrock geology which includes crystalline rocks of the basement. The solution density for these

basement rocks varied from 2.7 to 2.8 grams per cc, a not unrealistic value for crystalline basement rocks. The higher density material within the area surveyed and by fact that it outcrops creates a very steep gradient against the generalized lake bed Gila conglomerate filling the broad valley floor.

A similar positive gradient climbing back up to bedrock is reflected in the southwestern part of the area surveyed as shown by reference feature no. 2. Unfortunately, the data did not extend far enough west to tie the gravity data between the two bedrock outcrops which would have improved gravity solutions dramatically. The solution density for the crystalline basement outcrop to the east is depended strongly as pointed out on an average Gila conglomerate density of 2.1 grams per cc in the vicinity of drill hole B-1.

The airborne magnetic data also supports the centralized trough feature of the San Pedro Valley which is predominantly filled with lake bed sediments and Gila conglomerate with good magnetic contrasts against the outcrop basement to the northeast and southwest. In general, the gravity data shows that the trough along the San Pedro Valley dips northeasterly and southeasterly to the minimum gravity values in the area surveyed. To the northwest mapped as outcropped geology are fine-grained Gila lake sediments that form a large basin. The gravity values drop to a level of 42 milligals as shown at reference feature no. 3. Again there is insufficient data northwesterly to properly interpret the thickness and the density of the undoubtedly lake sediments of a more than likely thick sequence. There is insufficient data for a good quantitative solution to the northeast.

The similar trough to the southwest is quite evident in the data and reflects the lowest gravity values in the area surveyed. The minimum contour is down to 33 milligals or some 27 milligals less than the highest contour of 60 milligals in the northeastern part of the surveyed area over the crystalline basement outcrop. This trough to the southeast has an interpreted depth of 3500 to 3700 feet with more than likely Gila conglomerate at a solution density of approximately 2.1 grams per cc. The thickening of the Gila to the southeast is confirmed by the results of drill hole CCP-2 which had more than 2000 feet of Gila conglomerate. This drill hole bottomed in Gila conglomerate and therefore its true thickness is unknown at the drill site. A short distance to the northeast of drill hole CCP-2 is a newer drill hole B-2 which has 2500 feet of Gila conglomerate including an additional 1100 feet of alluvium which included volcanic tuff fragments with a clay matrix. Drill hole B-2 did reach volcanics of the Cloudburst formation below 3000 feet. However, drill holes CCP-2 and B-2 are several miles from the apparent bottom of the valley which is south of the southern limit of the gravity survey. Therefore, this trough of Gila or other lake sediments must be extremely deep and extensive.

Between the troughs reflecting thickening sequence of lake sediments as depicted at reference features nos. 3 and 4 lies a major northeasterly trending saddle structure of more dense material. This is centered at reference feature no. 5 and appears to extend from known Oracle granite outcropping to the southwest to an elongated northwest-southeasterly trending ridge structure which is indicated by reference feature no. 6. Reference feature no. 6 will be discussed in more detail in the next section. It is sufficient for our present purposes that there is strong evidence that the ridge structure is composed of Cloudburst

formation volcanics or some related dense rock. Therefore the saddle structure reference feature no. 5 is at least in part Oracle granite nosing out to the northeast from known exposures and ultimately changes to Cloudburst volcanics or other related volcanic rocks. There is drill hole support for this. Drill hole MW-1 was drilled near the edge of the saddle and it intersected Oracle granite and quartz monzonite porphyry at 1000 feet with an overlying Gila alluvium/conglomerate. The solution density for the Oracle granite complex was 2.64 grams per cc which is an excellent density value for Oracle granite. Therefore, it is reasonable to assume that the saddle at least as easterly as drill hole MW-1 is composed of Oracle granite beneath the exposed Gila.

Two miles to the southeast is a new drill hole, B-9, which had 740 feet of lake bed sediments followed by a 1000 feet of boulders and rock fragments of dark volcanics with a clay matrix. Kirby C. Coryell has suggested that the volcanic fragments resembling Cloudburst at drill hole B-9 which is off the main saddle could be a washin of Cloudburst boulders into the deeper lake bed Gila conglomerate trough in which drill hole B-9 was collared. If so then it is suggested that the Cloudburst volcanics extend across the saddle westerly to as far west as the relative position of drill hole B-9. Therefore somewhere within the saddle the rock type must change from Cloudburst volcanics or related rocks to the east to Oracle granite to the west.

A tentative divisional line would lie perhaps somewhere between drill hole MW-1 and B-9. This does not infer that Oracle granite does not exist below the Cloudburst formation farther to the east, as Oracle granite was recognized

at the bottom of drill hole CCP-1 which is farther to the east and the entire structure can have extensive Oracle granite beneath it. Be that it may, the eastern part of the saddle is more than likely contains some Cloudburst formation volcanics.

A prominent feature that is clearly recognizable in the gravity data as well as excellent correlation from the airborne magnetic data is reference feature no. 6. This elongated feature striking approximately N 35^{o} W parallel to the regional strike of this area appears to reflect a dense ridge containing magnetite that extends from an outcrop at the northern extremity of the gravity surveyed area which has been petrographically identified as Cloudburst formation according to Kirby C. Coryell. In addition, Kirby C. Coryell has pointed out that within the drill results to date that the Cloudburst formation does contain magnetite in general and wherever a drill hole has been drilled on magnetic positive anomalies, Cloudburst formation is intersected and when the drilling was performed in magnetic low areas no Cloudburst was intersected. Therefore, there is clear evidence that magnetite is a common component of the Cloudburst formation volcanics.

Also drill hole B-2 which is the only drill hole that is positioned on this ridge structure intersected Cloudburst volcanic fragments below 3000 feet. This gives us some support for the conclusion that this ridge is Cloudburst formation or other related rock unit.

Further, the gravity and the magnetic data suggests that this ridge structure

plunges to the southeast again supported by the drill results in which outcrop exist at the northern boundary of the gravity surveyed area and Cloudburst formation is probably at a depth in excess of 3000 feet towards the southeastern extent of the ridge. The ridge is probably not only plunging to the southeast but may structurally be offset southeasterly by the cross structure. This is in accordance with the generalized pattern of a northeasterly or easterly structure that intersects the predominate regional structure of the area which is northwesterly.

Therefore, it is proposed that this ridge is step-faulted downward as one progresses southeasterly. In the central zone the ridge had a depth of 500 to 800 feet. With a ridge density solution of 2.5 grams per cc, the ridge is approximately 3000 feet wide and is surrounded by Gila conglomerate or other lake sediments to a depth of 1800 to 2000 feet. This agrees quite well with other solutions on top of the saddle such as reference feature no. 5 and the drill results of drill hole CCP-4 which had at least 2000 feet of Gila conglomerate and drill hole B-1 which had 1800 feet of Gila conglomerate to a volcanic basement with a density of 2.70 grams per cc. All things considered, this is in excellent agreement.

While not directly related to this ridge structure, there is reported on both the geologic map of USGS Bulletin 1218 and the Copper Creek Pediment Project Geology Map of Cyprus Mines Corp. of an undifferentiated granite outcrop which occurred just at the southern extremity of the gravity survey and approximately near the proposed ridge structure. It would appear from the gravity data that this supposed very small granite outcrop is located in a density low area and therefore it is strongly suggested that this is a boulder of granite and not outcrop. There

is nothing in the gravity data that would suggest that this could possibly be a major outcrop feature. The gravity values are way too low in the vicinity of the mapped outcrop.

A localized but very pronounced gravity low anomaly is located at reference feature no. 7. This is a closed feature lying on the northeast side of the predominate Cloudburst formation ridge and approximately coincides with a strong airborne magnetic low which would center about drill hole CCP-1. Both the airborne magnetic low and the gravity low are suggesting a deep trough of very light density material such as Gila conglomerate or other sediments or an extensive thickness of light volcanic tuffs.

The drill results of drill holes CCP-1 and BC-1 are crucial to a better understanding and interpretation of reference feature no. 7. The logs of these two holes are quite different and therefore they suggest that a major structure has passed between these two drill holes which are only approximately one half mile apart. If so, this major structure which has been given reference feature no. 8 will be discussed below. It passes between drill holes BC-1 and CCP-1 and through the closed gravity low anomaly, reference feature no. 7. Drill holes BC-1 and CCP-1 both intersected tuff and overlying Gila conglomerate and therefore are reflecting reasonably light density material for at least the upper one or two thousand feet. Neither drill hole is located at the bottom of the gravity trench and it is predicted that within the trench that the Gila conglomerate and/or tuffs are extremely deep. Gravity solutions of the feature at reference feature no. 7 indicates a density of 1.9 to 2.1 grams per cc which are typical

densities for tuffs and Gila conglomerate. A quantitative interpretation of this negative gravity feature suggests a cylindrical type body elongated northeast-southwest approximately 4000 feet in diameter with a cover thickness of approximately 500 feet and a depth to the bottom of at least 2000 feet. This feature could possibly be a tuffaceous volcanic neck that has come up in a major cross structure, reference feature no. 8. This interpretation agrees in general with the drilling results of BC-1 and CCP-1 and had this gravity data been available before these drill holes had been drilled, proper geophysical analysis would have suggested that neither drill hole would have had much of a possibility of intersecting magnetite destruction in a magnetized media as was the original supposition. The low density at this locale negates such a conclusion and would down grade the interest in this feature.

Correlated with the gravity low reference feature no. 7 is a long lineament that has been given reference feature no. 8 and supported by the gravity low of reference feature no. 7 and is clearly indicated in the airborne magnetic data and the gravity data and forms in general the southern edge of the saddle structure that cross cuts the main northwesterly structural strike direction of the region. It has been placed between drill holes BC-1 and CCP-1 in order to account for the grossly different geology as logged in these two drill holes. With supportive evidence from magnetics and gravity, it would appear that this structure is real and its direction is closely controlled from the available geophysical and drilling data.

The northern boundary of the saddle structure reference feature no. 5 appears

to be east-west as depicted by reference feature no. 9. This east-west structure is clearly shown on the airborne magnetic data but is a much more subtle feature in the gravity data although there is a suggestion of it and therefore it does in part support the structure as defined by the airborne magnetics. Somewhere to the north the saddle has to have a boundary and the east-west structural break as depicted as reference feature no. 9 appears to be the best place to put this structure. This structure is particularly evident in the airborne magnetic data recently acquired from the Superior Oil Company which extended our known coverage to the north and therefore indicated the structure very clearly. It was not as evident in the previous work as reported in ELLIOT GEOPHYSICAL COMPANY report on the airborne magnetic data of June 27, 1973.

In summary, the study and interpretation of the gravity data available for the Beth Claims Area in conjunction with the available airborne magnetic data support the previous conclusion as presented in the ELLIOT GEOPHYSICAL COMPANY report on airborne magnetic data that a distinctly indicated cross structure perhaps reflecting old structural breaks extends at least from the Kalamazoo/San Manuel district northeasterly towards the Copper Creek district. Several very distinct gravity features have been recognized and been interpreted in the data and some of these features which correlate to the airborne magnetic data were not that clearly recognized in the airborne magnetic data. These various features are shown by reference numbers on an attached Generalized Gravity Interpretation Map.

The pronounced cross structure appears to be a density high saddle extending generally in the northeasterly trending direction and decreasing in width as

it progresses easterly. The saddle structure has been interpreted as being a combination of Oracle granite basement and Cloudburst volcanics or related rock unit with overlying Gila conglomerate and other lake bed sediments. There is good support for this in several of the available drill holes.

One of the pronounced features recognized in the gravity data which was not clearly indicated in the airborne magnetic data but with hind sight one can see the reflection of this feature is a northwesterly-southeasterly trending ridge of higher density and magnetite content.This ridge feature reference feature no. 6 extends from an outcrop of petrographically identified Cloudburst fragments at depth. The cross structure seems to have step-faulted this ridge deeper and deeper as the ridge progresses southeasterly. This is consistent with the drill results and is clearly suggested by the airborne magnetic data. In general, if the ridge is Cloudburst throughout, its length as is suggested, then perhaps the economic picture of this area is drastically changed.

Another gravity feature not fully appreciated in the airborne magnetic data was the gravity low trough reference feature no. 7. This is reflecting a very deep trough of very light Gila conglomerate and/or light volcanics such as tuffaceous volcanics. This correlates quite well with the results of drill holes BC-1 and CCP-1 and would have down graded the original reasoning for drilling these holes.

From the regional aeromagnetic and gravity coverage of Arizona, there is no suggestion that this cross structure extends much further east than the outcrop of Glory Hole volcanic in the crystalline basement to the northeast and east and

west of the outcrop in the San Manuel/Kalamazoo district. The important conclusion is that we have further geophysical support that a cross structure does exist in this area and that indirectly this is still a promising zone of possible development of economic mineralization. Therefore, somewhere along this cross structure additional economic sulfide mineralized bodies could easily have developed.

Be that it may, and even with the current extensive gravity and magnetic coverage and the drill results to date, the geophysical data does not indicate specific drill targets. Therefore no drill targets are recommended in this report as other geologic information and photo interpretation by Dr. Thomas Mitcham must be carefully integrated with the geophysical data in order to generate viable drilling targets. The gravity data properly reduced and corrected for topographic effects has grossly improved the geophysical picture of the Beth Claims Area. The gravity data has confirmed some of the preliminary conclusions as presented in the early report based solely on airborne magnetic information and it is believed that the gravity data has done a superior job in mapping the extent, depth, and location of post-mineral cover such as Gila conglomerate and lake bed sediments.

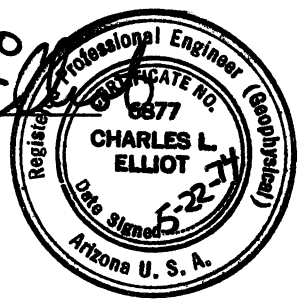
Generally, no further geophysical work is warranted in the area even though extending the gravity coverage to the west to outcrop would have improved the solution somewhat but it is not believed that additional work would materially change the structural patterns as presented based on the data currently available. Depths as solved from the gravity and airborne magnetics data are moderately

large; therefore, deep holes are required to test many of the features. This has been shown to be the case based on the drilling results to date, many of which did not get through the Gila cover to basement geology. No shallow drill tests appear viable and any further drilling must be carefully planned, taking into consideration all available geology, photogeology, and the geophysical results presented in this and the previous ELLIOT GEOPHYSICAL COMPANY report of June 27, 1973.

Respectfully submitted,

ELLIOT GEOPHYSICAL COMPANY

Charles L. Elliot



May 22, 1974
Tucson, Arizona

Attachments: Bouguer Gravity Map, Generalized Gravity Interpretation Map, Physical Property Report May 16, 1974, Computer Printout of the Gravity Data.

Distribution: Kirby C. Coryell (2 copies)

CLE:nd

ELLIOT GEOPHYSICAL COMPANY

Mining Geophysical Engineers

4653 EAST PIMA STREET TUCSON, ARIZONA 85712 TEL. (602) 793-2421

May 16, 1974 Ref: CY2P

Mr. Kirby C. Coryell
Nucas, Ltd.
5140 East Burns Street
Tucson, Arizona 85711

Dear Kirby:

Re: Physical Property Laboratory Determinations - Beth Claims Project

The seven core samples that were received on May 16, 1974 have been run in the physical property laboratory of ELLIOT GEOPHYSICAL COMPANY to determine the requested physical property determinations. The physical property methods run on these samples were volume magnetic susceptibility and wet bulk density.

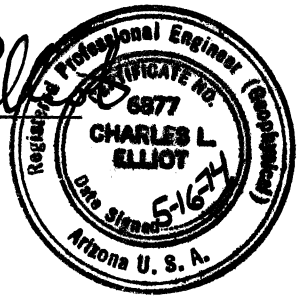
The physical property procedures were performed following conventional techniques of laboratory analysis and are described in the attachments. The resulting data from the physical property determinations, with the specific parameters and units employed for the measurements are presented on the accompanying table.

The samples were picked up by you.

Sincerely yours,

ELLIOT GEOPHYSICAL COMPANY

Charles L. Elliot



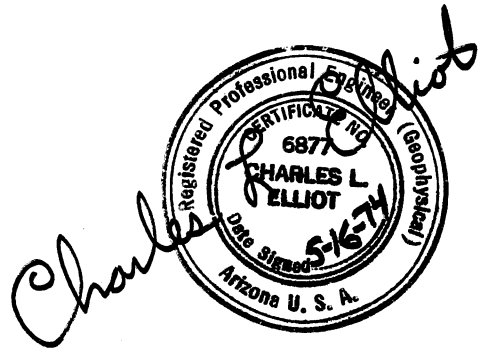
Attachment: Procedures for Volume Magnetic Susceptibility and Wet Bulk Density
Table

CLE:nd

ROCK PHYSICAL PROPERTY LABORATORY DETERMINATIONS

Nucas, Ltd. - Beth Claims Project

Sample Designation	Induced Polarization Response	Resistivity	Bulk Density grams/cc	Volume Magnetic Susceptibility 10^{-6} cgs units
CCP1-1746			2.25	700
CCP1-2509			2.54	1500
CCP1-2840			2.24	540
CCP1-3950			2.93	2600
CCP1-4003			2.64	0
B-1-2138			2.70	2700
B-5-411			2.72	250



Parameters: F_L = Hz F_H = Hz T= Secs t_D = millisecs t_W = millisecs

Ref: CY2P/5-16-74

PROCEDURES FOR THE DETERMINATION OF VOLUME MAGNETIC SUSCEPTIBILITY AND WET BULK DENSITY

The volume magnetic susceptibility measurements were made in the physical property laboratory utilizing a magnetic susceptibility bridge type instrument operating at a frequency of 400 Hertz. The limits of detectibility of the bridge are approximately 20×10^{-6} cgs units. Resulting data are presented in 10^{-6} cgs units of volume magnetic susceptibility. Sometimes susceptibility measurements are presented on a weight basis. The conversion is as follows:

$$k_{mass} = \frac{k_{volume}}{D}$$

where D = Density of the rock in grams/cc

Magnetic susceptibility measurements are normally made on drill core samples or when surface samples are submitted a small drill core is cut from each submitted surface sample to facilitate the determination of magnetic susceptibility. For other samples the surface samples may be broken to chip size which can be run with appropriate correction for the rock/void ratio of material. Also, submitted sand, mud, or chip samples can be utilized in determination of volume magnetic susceptibility with appropriate corrections for porosity and/or voids.

The density determination made in the physical property laboratory were determined following conventional laboratory procedures for determining bulk rock densities utilizing the bouyancy method. The accuracy of the bouyancy technique of density measurement is better than ±0.01 grams per cubic centimeter. The results of the laboratory density determinations are reported in grams per cubic centimeter. Densities are sometimes required in pounds per cubic foot or specific volume in cubic feet per ton. The relationships are as follows:

$$D_{lbs/cu\ ft} = (62.4)\ D_{gms/cc}$$

$$\text{Specific Volume}_{cu\ ft/ton} = \frac{32.15}{D_{gms/cc}}$$

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CY1E BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
BM-2619	2619.0	630450	901300	.34	44.83
BASE 1	2390.0	629000	896750	.39	47.64
BASE 2	2647.0	620450	891250	.37	45.23
CYP 1	2441.0	629450	897850	.39	48.32
CYP 2	2479.0	629200	899200	.36	46.15
CYP 3	2513.0	629850	900200	.41	45.42
CYP 4	2660.0	631300	902450	.32	45.10
CYP 5	2705.0	631850	903500	.33	45.01
CYP 6	2749.0	632550	904600	.36	44.87
CYP 7	2811.0	633350	905750	.43	45.15
CYP 8	2854.0	633600	906850	.46	44.10
CYP 9	2912.0	634000	908150	.49	43.25
CYP 10	2964.0	634400	909300	.55	43.31
CYP 11	3040.0	634900	910700	.62	44.74
CYP 12	3121.0	635250	911800	.70	46.94
CYP 13	3205.0	635600	913000	.80	47.70
CYP TP 1	3271.0	635500	913500	.75	48.62
BM-3395	3395.0	635250	914600	.97	48.32
CYP 14	3465.0	635100	915900	.90	47.06
CYP 15	3589.0	635600	916800	1.00	47.31
CYP 16	3638.0	635500	918100	1.09	48.04
CYP 17	3719.0	635500	919450	1.37	48.02
CYP 18	3829.0	636000	920200	2.03	48.56
TR1-1947	3860.0	636100	920500	2.25	47.54
CYP 19	3838.0	636100	921300	1.90	47.06
CYP 20	3855.0	636100	922450	1.79	46.22
CYP 21	3881.0	636500	923800	1.44	45.65
CYP 22	3964.0	637000	925100	1.96	46.85
BM-4016	4016.0	637450	925450	1.82	46.18
CYP 23	4047.0	638050	926500	1.85	46.73
CYP 24	4041.0	638300	927900	1.90	47.11
CYP 25	3976.0	638550	929050	1.93	48.05
CYP TP 2	3967.0	639550	930000	1.56	49.78
CYP 26	3864.0	639950	931000	1.72	50.35
CYP 27	3786.0	639600	932000	1.98	50.97
CYP 28	3654.0	638950	932900	2.02	50.79
CYP 29	3519.0	638350	933700	3.47	52.40
WSP-1	2390.0	626100	893250	.70	47.92
WSP-2	2490.0	622700	895150	.48	47.07
WSP-3	2462.0	624050	893600	.52	46.28

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CY1E BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
WSP-4	2454.0	621300	895800	.36	43.94
WSP 5	2431.0	619400	896800	.44	41.91
WSP-6	2438.0	617750	897500	.62	40.71
WSP-7	2565.0	621300	893650	.37	44.71
WSP 8	2709.0	619500	889800	.37	45.95
WSP 1W	2362.0	628400	894600	.38	47.23
WSP 2W	2357.0	628350	892950	.44	47.08
ESP 41	2392.0	627100	898400	.41	45.43
ESP 42	2402.0	624750	899500	.40	43.89
ESP 43	2403.0	622350	899600	.38	41.40
ESP 44	2414.0	620300	900400	.40	39.48
ESP 45	2443.0	618650	901850	.38	38.13
ESP 46	2456.0	616850	903000	.34	37.41
ESP 47	2483.0	614650	904050	.30	37.18
ESP 48	2483.0	613250	905000	.35	36.72
ESP 49	2600.0	616050	906150	.31	38.03
ESP 50	2694.0	617450	908450	.33	37.01
ESP 51	2778.0	618450	910950	.37	35.95
ESP 52	2945.0	618950	913450	.78	36.38
ESP 53	2935.0	618500	916450	.52	36.03
ESP 54	3112.0	619000	918800	.75	37.98
CCP-1	3455.0	629350	923200	1.14	43.92
CCP-2	3001.0	615300	920600	.57	35.80
CCP-5	3676.0	622000	926100	1.15	43.96
5-1	2360.0	631100	895450	.40	46.34
5-2	2351.0	633150	894150	.39	45.82
5-3	2371.0	635150	893400	.34	45.73
5-4	2880.0	640000	905100	.45	46.21
5-5	3080.0	642100	909650	.72	49.51
5-7	3360.0	646550	917700	1.60	51.93
5-8	3400.0	646500	918850	1.56	52.03
5-9	3320.0	640100	915700	1.14	48.06
5-10	2840.0	630800	908300	.44	43.11
5-11	2785.0	629350	908250	.47	44.01
5-12	2760.0	622500	910250	.87	41.51
5-13	2840.0	627200	909400	.38	43.36
5-15	3745.0	636900	917950	1.71	48.98
5-16	3158.0	638600	911000	.64	50.57
5-17	2920.0	638500	905700	.49	45.86
5-18	3738.0	629450	925450	2.00	45.09

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CYIE BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
5-19	3680.0	630200	927050	1.23	45.30
5-20	3703.0	628500	924250	2.49	45.90
5-21	3680.0	627250	922200	1.95	45.97
5-22	3686.0	625800	925700	1.35	45.00
5-23	3960.0	625500	930050	1.71	46.84
5-24	3760.0	622850	927400	1.22	42.83
5-25	3320.0	622750	922200	.78	42.30
5-26	3000.0	623800	884350	.43	49.51
5-27	2800.0	618400	887500	.37	47.14
5-28	2800.0	617650	887750	.34	47.39
5-29	3000.0	614450	889100	.56	48.93
BM-2919	2919.0	621200	886350	.38	47.78
36310601	2921.0	615900	888550	.34	47.20
5-34	2520.0	631450	885200	.64	47.62
5-35	2600.0	629400	883450	.85	47.65
5-36	2640.0	628050	882050	.99	47.22
5-37	2920.0	625250	883750	.41	48.27
5-40	2554.0	627750	902300	.39	44.45
5-41	3216.0	628500	914150	1.68	46.74
5-42	2720.0	626150	914650	1.92	43.74
5-43	2760.0	624900	915000	2.13	44.16
5-44	2640.0	622300	904400	.35	41.43
5-45	2500.0	619450	905600	.54	39.15
5-46	2560.0	615450	907300	.37	37.78
5-47	2720.0	615600	912550	.47	34.92
5-48	2880.0	614500	918900	.64	35.51
5-50	2960.0	614150	921800	.75	36.68
5-51	3655.0	614200	930900	1.43	42.33
5-52	3160.0	613100	926700	.77	39.16
5-53	3120.0	612800	923850	.57	37.80
5-54	2600.0	607750	912600	.34	34.23
5-55	2951.0	606000	925600	.53	38.73
5-56	2840.0	606350	923400	.66	38.05
5-57	2820.0	613150	916900	.45	34.72
5-61	3824.0	631850	929400	2.70	46.07
5-62	3760.0	631100	928850	1.33	44.57
5-63	3000.0	621050	917500	.87	40.28
5-64	2720.0	621200	913700	.81	39.47
5-65	2800.0	621200	915000	1.03	39.63
5-66	2920.0	621100	916500	.84	39.42

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CY1E BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
5-67	3520.0	638750	934500	5.25	55.66
5-68	3400.0	637350	932900	4.11	49.38
5-69	3360.0	636400	931700	2.82	45.79
5-70	3320.0	635300	930500	2.72	44.38
5-71	3280.0	633950	929200	2.69	44.54
5-72	3200.0	633200	927950	2.96	42.94
5-73	3160.0	632500	926600	2.66	42.97
5-74	3569.0	626600	919650	2.44	46.25
5-75	3520.0	629850	928200	1.67	45.09
5-76	3560.0	630300	929400	1.60	45.37
5-77	3600.0	630750	930950	2.58	46.56
5-78	3640.0	631000	932350	1.84	48.01
5-79	3720.0	632550	932600	1.20	46.84
5-80	3800.0	633400	933850	1.23	48.36
5-81	3920.0	635450	934500	1.31	51.02
5-82	4040.0	634200	933100	2.55	48.31
5-83	3945.0	633100	931500	2.73	47.08
5-84	3000.0	619900	918950	1.02	41.26
5-85	3080.0	620650	920850	1.35	41.14
5-86	3160.0	621750	922050	2.60	42.97
5-87	3200.0	622900	922050	1.62	43.12
5-88	3240.0	624100	922600	1.38	42.94
5-89	3320.0	625550	923250	1.55	45.12
5-90	3360.0	626400	924250	1.95	45.44
5-91	3440.0	627550	925600	1.05	44.21
5-92	3400.0	626900	926700	2.27	45.20
5-93	4055.0	628300	931750	2.14	47.17
5-94	4083.0	629650	933450	2.69	49.22
6-1	2960.0	641600	906750	.52	47.87
6-2	3040.0	642150	908700	.63	49.20
6-3	3080.0	642050	911450	1.16	49.25
6-4	3120.0	642050	912500	1.27	48.37
6-5	3240.0	643950	915100	1.41	47.37
6-6	3320.0	645700	916700	1.56	48.69
6-7	3440.0	646550	919800	1.78	51.78
6-8	3480.0	646800	920700	2.04	53.48
6-9	3480.0	646000	920800	2.26	52.21
6-10	3520.0	645750	921750	2.26	52.86
6-11	3560.0	645500	922700	1.83	52.79
6-12	3600.0	645950	923700	1.99	54.87

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CY1E BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
6-13	3640.0	646000	924700	2.11	56.95
6-14	3680.0	645750	926100	4.85	58.74
6-15	3680.0	650550	922500	1.49	63.21
6-16	3600.0	649050	923050	1.83	60.04
6-17	3560.0	648150	922600	1.60	57.09
6-19	3200.0	642950	914150	1.23	47.68
6-20	3400.0	640800	917500	1.16	48.30
6-21	3360.0	640400	916650	1.10	47.64
6-22	3520.0	641400	920350	1.40	48.31
6-23	3560.0	641650	921800	1.39	47.73
6-24	3600.0	641500	923000	1.51	47.90
6-25	3640.0	640850	923950	1.86	47.63
6-26	3680.0	640750	925000	1.96	48.20
6-27	3160.0	642400	913400	1.26	47.71
6-28	2360.0	653800	886250	.32	41.85
6-29	2400.0	653450	888050	.29	41.58
6-30	2480.0	652800	890450	.30	42.19
6-31	2560.0	653300	893100	.48	43.00
6-32	2640.0	653700	895700	.27	44.94
6-33	2720.0	654500	898150	.40	50.66
6-34	2760.0	655000	899300	.51	51.29
6-35	2800.0	655400	900550	.33	49.91
6-36	2840.0	656000	901600	.36	49.72
6-37	2880.0	656400	902800	.52	49.39
6-38	3480.0	641500	919450	1.20	47.76
6-39	3440.0	641150	918250	1.29	48.22
6-40	3547.0	637550	915400	1.37	48.44
6-41	3160.0	629100	914950	.82	47.99
6-42	3110.0	629550	915250	.73	48.04
6-43	3320.0	631250	914950	1.09	48.74
6-44	3480.0	632500	915650	1.57	50.03
6-45	3600.0	633550	917750	1.31	47.41
6-46	3240.0	631350	918200	1.07	45.01
6-47	3240.0	631000	917050	.87	43.70
6-48	3598.0	637400	930450	1.68	46.89
6-49	3400.0	635600	929750	1.96	44.76
6-50	3360.0	634500	927100	1.91	42.47
6-51	3976.0	637100	927300	2.60	47.22
6-52	2960.0	619050	918100	.75	38.84
6-53	2920.0	618300	917300	.69	37.42

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CYIE BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
6-54	2880.0	617800	916400	.59	36.50
6-55	2800.0	617300	914250	.63	35.76
6-56	2720.0	615600	912600	.48	34.59
6-57	2640.0	615800	910100	.52	36.37
6-58	2560.0	615450	907300	.37	37.98
6-59	2480.0	610050	905750	.35	35.66
6-60	2480.0	607450	907450	.35	35.00
6-61	2520.0	603450	912150	.77	34.10
6-62	2520.0	600500	913600	.38	33.06
6-63	2560.0	594450	920400	.42	31.47
6-64	2520.0	599200	915350	.46	32.56
6-65	2480.0	604300	909800	.44	34.68
6-66	3655.0	642150	924300	1.63	48.10
6-67	3720.0	643200	925300	1.69	51.03
6-68	3820.0	644200	926250	1.36	54.91
6-69	3760.0	644850	927550	2.13	56.30
6-70	3800.0	645400	928900	3.67	59.11
6-71	3880.0	645550	930000	3.49	60.43
6-72	4000.0	644050	930900	1.64	58.24
6-73	4109.0	642700	930350	1.05	55.62
6-74	3920.0	642200	929300	1.76	53.03
6-75	3800.0	640800	927300	1.12	50.05
6-77	3740.0	640350	926000	1.42	50.22
6-78	3320.0	640100	915100	.91	48.05
6-79	3240.0	639650	912400	.66	47.09
6-80	3200.0	639850	912800	.91	47.97
6-81	3160.0	639750	912050	1.09	48.27
6-82	3120.0	639150	910950	.75	48.92
6-83	3320.0	643750	916450	1.79	47.84
6-84	3400.0	643600	917700	1.36	48.29
6-85	2920.0	646550	907000	.77	49.75
6-86	2960.0	648100	907550	.82	47.26
6-87	3040.0	648750	909200	1.07	47.29
6-88	3080.0	648700	911000	1.87	46.82
6-89	3160.0	649650	912300	1.60	48.97
6-90	3200.0	650150	913700	1.98	49.93
6-91	3280.0	650300	915500	2.67	52.73
6-92	3360.0	651300	917300	2.06	55.34
6-93	3400.0	651800	918400	2.38	58.32
6-94	3840.0	650400	918500	2.13	57.95

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CYIE BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
6-95	3560.0	648350	917200	1.01	52.04
6-96	3480.0	647050	916250	1.24	49.87
6-97	3320.0	645350	914100	1.34	47.55
6-98	3240.0	645250	912500	1.43	48.07
6-99	3160.0	644550	911300	1.04	48.31
6-100	3080.0	644250	909700	.71	48.51
6-101	3000.0	645100	908550	.71	47.64
6-102	2880.0	645850	906250	.67	47.50
6-103	2800.0	644200	905050	.63	47.79
6-104	2680.0	643450	901650	.52	46.11
6-105	3080.0	642100	909650	.72	49.40
6-107	2800.0	639300	903250	.41	46.30
7-3	2480.0	617300	904000	.41	38.08
7-4	2520.0	617400	905100	.42	38.36
7-5	2600.0	617900	906100	.35	41.65
7-6	2472.0	614600	904050	.32	37.19
7-7	2572.0	615600	905300	.38	38.08
7-9	2560.0	616900	906900	.40	38.09
7-10	2440.0	617100	902750	.37	38.14
7-11	2460.0	618000	903500	.38	38.40
7-12	2480.0	618750	904300	.48	38.93
7-13	2480.0	628100	900250	.42	45.31
7-14	2600.0	627500	903700	.36	44.60
7-15	2680.0	628500	906000	.44	43.67
7-16	2785.0	629350	908250	.47	44.15
7-17	2868.0	625200	912900	.68	43.08
7-18	2800.0	623500	911600	.61	41.28
7-19	2760.0	622500	910250	.87	41.45
7-19A	2760.0	622500	910250	.87	40.86
7-20	2720.0	622050	909000	.42	39.83
7-21	2890.0	627200	909450	.56	44.34
7-22	2680.0	622600	905900	.32	41.38
7-23	2600.0	621800	903050	.38	40.55
7-24	2560.0	621250	901700	.41	40.43
7-25	3555.0	627950	934450	3.47	49.91
7-26	3520.0	627000	933900	3.27	48.83
7-27	3480.0	625650	933150	3.05	48.78
7-28	3435.0	625100	932800	3.07	48.62
7-29	3400.0	624350	932600	3.00	47.23
7-30	3360.0	623150	932300	2.76	46.08

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CY1E BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
7-31	3320.0	621750	932100	3.82	46.17
7-32	3280.0	620650	931600	2.74	44.39
7-33	3240.0	618900	930700	2.35	43.69
7-34	3200.0	618300	930100	2.67	42.91
7-35	3160.0	616750	928850	2.62	42.27
7-36	3120.0	615700	927850	1.93	40.00
7-37	3080.0	615050	926700	1.59	38.80
7-38	3040.0	614150	924900	1.16	38.52
7-39	3000.0	614300	924300	1.60	38.74
7-40	3000.0	614550	922400	.67	37.25
7-41	3080.0	615500	923250	.76	38.27
7-42	3120.0	616150	923250	.68	39.36
7-43	3200.0	617400	923800	.82	40.22
7-44	3240.0	618150	924300	.82	40.15
7-45	3320.0	618800	925450	.90	40.41
7-46	3400.0	619150	926550	.69	41.56
7-47	3440.0	620000	926700	.79	41.93
7-48	3480.0	620600	927300	.96	41.66
7-49	3560.0	622150	927900	.94	42.79
7-50	3640.0	623200	928700	.96	43.18
7-51	2800.0	618750	907750	1.02	38.81
7-52	2760.0	618250	907100	.64	39.34
7-53	2760.0	618400	911000	.35	35.36
7-54	3448.0	629350	923150	1.14	43.96
7-56	3440.0	610100	933700	1.17	37.91
7-57	3480.0	610600	934200	1.25	38.57
7-58	3520.0	611700	934950	1.50	38.80
7-59	3600.0	612850	935550	.92	41.05
7-66	3400.0	607400	935500	.72	36.57
7-67	3360.0	606750	934800	.89	36.62
7-68	3320.0	606100	933500	.69	37.01
7-69	3280.0	605400	933100	.95	36.96
7-70	3240.0	604500	932550	.78	37.54
7-71	3200.0	603750	931650	.87	37.43
7-72	3160.0	603300	930800	.71	38.44
7-73	3120.0	602700	930050	.65	38.74
7-74	3000.0	604050	927600	.54	39.21
7-75	3080.0	605350	928550	.76	39.68
7-76	3160.0	606900	929200	.90	40.36
7-77	3240.0	607700	930450	1.03	38.53

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CYIE BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
7-78	3320.0	609100	931300	.93	37.84
7-79	3400.0	609650	932550	.90	38.20
7-80	2520.0	610800	907200	.49	35.93
7-81	2560.0	611150	908700	.45	35.32
7-82	2640.0	611700	910300	.49	35.50
7-83	2680.0	612200	912000	.44	34.66
7-84	2720.0	612500	913700	.47	33.54
7-85	2760.0	613250	914450	.38	34.38
7-86	2800.0	614200	915700	.44	34.64
7-87	2840.0	614800	917250	.62	34.76
7-88	2520.0	606600	909350	.33	34.27
7-89	2560.0	606550	911350	.26	34.52
7-90	2600.0	607000	912900	.41	33.66
7-91	2640.0	607750	913900	.42	34.51
7-92	2680.0	608550	915000	.41	35.08
7-93	2720.0	609550	915450	.39	35.03
7-94	2760.0	611100	916200	.43	34.45
7-95	2800.0	612400	916500	.41	34.56
7-96	2840.0	613800	917450	.46	34.65
7-97	2880.0	615500	918900	.78	35.52
7-98	2920.0	614250	920100	.56	36.31
7-99	3120.0	619450	920700	.75	40.92
8-1	3200.0	619500	921600	.75	41.45
8-2	3280.0	620100	922600	.79	41.95
8-3	3360.0	621200	923650	.89	42.37
8-4	3440.0	621800	924600	.87	43.51
8-5	3520.0	622700	925500	.86	44.39
8-6	3560.0	623400	926300	.96	43.33
8-7	3640.0	624100	927450	1.05	44.55
8-8	2560.0	601250	916500	.38	32.98
8-9	2600.0	602400	917500	.42	34.02
8-10	2640.0	604000	919400	.50	34.07
8-11	2680.0	605900	919550	.57	34.75
8-12	2640.0	602750	919250	.53	33.72
8-13	2680.0	602900	920450	.46	34.86
8-14	2720.0	604300	921400	.52	35.33
8-15	2800.0	605650	923000	.66	37.17
8-16	2840.0	606400	923400	.68	38.03
8-17	2880.0	607250	923750	.74	38.07
8-18	2920.0	608000	924500	.80	37.98

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CYIE BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
8-19	2951.0	606000	925600	.53	39.00
8-20	2880.0	603250	925400	.55	38.33
8-21	2800.0	603900	923500	.49	37.48
8-22	2520.0	618700	905900	.80	38.22
8-23	3828.0	613400	934600	1.29	41.65
8-24	3760.0	613650	933650	1.25	41.94
8-25	3480.0	612450	932200	1.21	39.53
8-26	3400.0	611600	931150	.98	39.05
8-27	3360.0	611500	930550	.89	38.38
8-28	3280.0	610650	929300	.87	38.29
8-29	3200.0	609200	929050	.88	39.17
8-30	3120.0	607950	928100	.79	40.05
8-31	3040.0	607250	926800	.67	39.02
8-32	3000.0	608250	926450	.70	39.02
8-33	3040.0	609400	926050	.79	38.41
8-34	3160.0	610700	927150	.85	39.69
8-35	3240.0	611700	927650	.82	38.99
8-36	3560.0	612550	929900	1.37	40.42
8-37	3560.0	614550	932450	1.04	42.42
8-38	3655.0	614250	930900	1.45	42.23
8-39	3120.0	612150	925350	.74	38.54
8-40	3080.0	612300	924100	.87	37.93
8-41	3040.0	612650	922650	.64	37.34
8-42	3160.0	613100	926600	.77	38.73
8-43	3200.0	613250	927800	.95	39.17
8-44	3240.0	614150	929100	1.46	40.24
8-45	3280.0	615000	930200	2.22	41.60
8-46	3385.0	616250	930750	1.11	43.04
8-47	3360.0	617600	931100	1.31	42.93
8-48	3400.0	618350	932000	1.63	44.61
8-49	3440.0	619250	932500	1.54	46.92
8-50	2400.0	633900	896000	.47	45.76
8-51	2480.0	635100	898150	.50	45.01
8-52	2560.0	635550	900250	.76	44.81
8-53	2640.0	635300	901750	.51	45.46
8-54	2680.0	635650	903050	.55	45.85
8-55	2720.0	636500	904000	.64	45.43
8-56	2760.0	637250	904850	.67	44.98
8-57	2840.0	637850	906250	.81	44.51
8-58	2920.0	637850	907600	.62	44.19

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CY1E BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
8-59	2360.0	640000	891500	.68	45.28
8-60	2400.0	640700	893250	.53	44.43
8-61	2480.0	642450	895200	.54	43.77
8-62	2560.0	643150	897700	.49	42.94
8-63	2640.0	644150	898950	.44	44.42
8-64	2720.0	644800	900600	.45	46.71
8-65	2760.0	646500	901300	.55	48.65
8-66	2680.0	645550	899750	.52	45.48
8-67	2600.0	645150	897600	.45	43.04
8-68	2520.0	644500	895900	.53	43.00
8-69	2440.0	644400	893100	.49	43.71
8-70	2400.0	643100	892250	.60	43.82
8-71	2360.0	642150	890350	.39	44.45
8-72	2560.0	613500	897000	.43	40.04
8-73	2640.0	612050	895500	.44	42.44
8-74	2800.0	610850	891400	.49	48.06
8-75	2880.0	606600	890300	.69	51.39
8-76	2800.0	607700	891900	.49	49.46
8-77	2720.0	608800	893900	.48	47.93
8-78	2640.0	609500	896250	.63	44.13
8-79	2525.0	611300	899150	.41	39.36
8-80	2440.0	611950	901050	.44	37.90
8-81	2487.0	615750	898850	.37	39.64
8-82	3120.0	622200	918200	.89	43.54
8-83	3200.0	623250	918200	.81	46.26
8-84	3280.0	624350	918950	.89	45.53
8-85	3320.0	625000	919500	.95	45.03
8-86	3360.0	625550	920150	1.01	44.90
8-87	3440.0	626700	920700	1.16	45.09
8-88	2960.0	627300	914050	.73	45.47
8-89	2960.0	628100	916550	1.03	45.96
8-90	2960.0	629000	917450	1.37	44.81
8-91	3160.0	629500	916850	.96	46.84
8-92	3320.0	631250	917650	.99	46.93
8-93	3240.0	631000	917050	.87	46.38
8-94	2600.0	641750	899600	.73	44.23
8-95	2560.0	641000	899050	.58	44.08
8-96	2520.0	639650	897700	.40	42.97
8-97	2440.0	638800	895100	.44	43.77
8-98	2440.0	632600	887850	.47	44.01

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CYIE BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
8-99	2440.0	636250	885100	.66	46.41
9-1	2560.0	635450	882200	.57	47.70
9-2	2674.0	633650	880250	.95	47.08
9-3	2360.0	638200	886700	.55	47.44
9-4	2346.0	641900	884200	.47	42.46
9-5	2500.0	619200	905700	.64	39.11
9-6	2520.0	620200	906750	.67	39.03
9-7	2540.0	620700	908100	.96	38.92
9-8	2560.0	621200	909400	.93	38.62
9-9	2440.0	625300	901000	.57	44.65
9-10	2480.0	624900	902100	.49	44.17
9-11	2400.0	624900	900150	.50	43.26
9-12	2920.0	611800	921000	1.01	36.85
9-13	2880.0	611350	920250	1.08	36.07
9-14	2960.0	609950	919700	.49	35.20
9-15	2880.0	608950	919250	.61	35.23
9-16	2800.0	608200	919250	.84	34.61
9-17	2760.0	607600	919450	.73	35.55
9-18	2720.0	607100	920000	.69	35.46
9-19	2760.0	608300	920400	.98	35.89
9-20	2800.0	609100	921050	1.09	35.95
9-21	2920.0	610300	922150	1.19	36.45
9-22	3080.0	611100	924100	.92	37.37
9-23	3209.0	599250	933900	.43	36.59
9-24	3476.0	602300	935550	.86	36.74
9-25	3524.0	603250	937000	.89	36.08
9-26	3700.0	605150	938150	1.67	36.70
9-28	3120.0	597800	931850	.51	37.78
L1-S1	3840.0	638050	924650	.99	46.19
L1-S2	3890.0	637150	924700	1.30	46.06
L1-S3	3737.0	636050	924750	1.28	44.96
L1-S4	3614.0	635100	924800	1.43	44.66
L1-S5	3361.0	634150	924750	1.41	42.88
L1-S6	3291.0	633200	924800	1.27	43.46
L1-S7	3210.0	632050	924800	1.73	43.95
L2-S1	3729.0	638050	923150	1.10	46.40
L2-S2	3756.0	637150	923150	1.00	46.23
L2-S3	3811.0	636050	923150	1.45	44.55
L2-S4	3676.0	635050	923150	1.43	45.69
L2-S5	3489.0	634150	923150	1.34	45.02

TERRAIN CORRECTED GRAVITY DATA

ELLIOT GEOPHYSICAL COMPANY, TUCSON, ARIZONA

CYIE BETH CLAIMS AREA, PINAL COUNTY, ARIZONA 07/10/74

STATION NUMBER	ELEVATION	COORDINATES NORTH	COORDINATES EAST	TERRAIN CORRECTION	BOUGUER GRAVITY
L2-S6	3300.0	633200	923200	1.22	44.53
L2-S7	3221.0	632050	923150	1.27	45.11
L3-S1	3801.0	638050	921500	1.02	47.04
L3-S2	3739.0	637100	921450	.84	46.95
L3-S3	3818.0	636100	921550	1.49	46.57
L3-S4	3659.0	635700	921550	1.19	46.13
L3-S5	3600.0	634150	921550	1.15	45.91
L3-S6	3484.0	633150	921600	1.15	46.06
L3-S7	3348.0	632100	921650	1.11	45.35
L3-S8	3224.0	631150	921600	1.04	44.63
L4-S1	3736.0	638050	919950	.89	46.28
L4-S2	3590.0	637100	919950	1.01	47.58
L4-S3	3811.0	636100	919950	1.71	48.22
L4-S4	3673.0	635100	920000	1.15	47.30
L4-S5	3588.0	634100	920000	.99	46.72
L4-S6	3601.0	633150	920000	1.58	47.32
L4-S7	3412.0	632100	920000	1.21	46.33
L4-S8	3220.0	631150	920050	1.05	45.75
CYP 30	3560.0	638500	934000	3.28	53.48

R15E | R17E

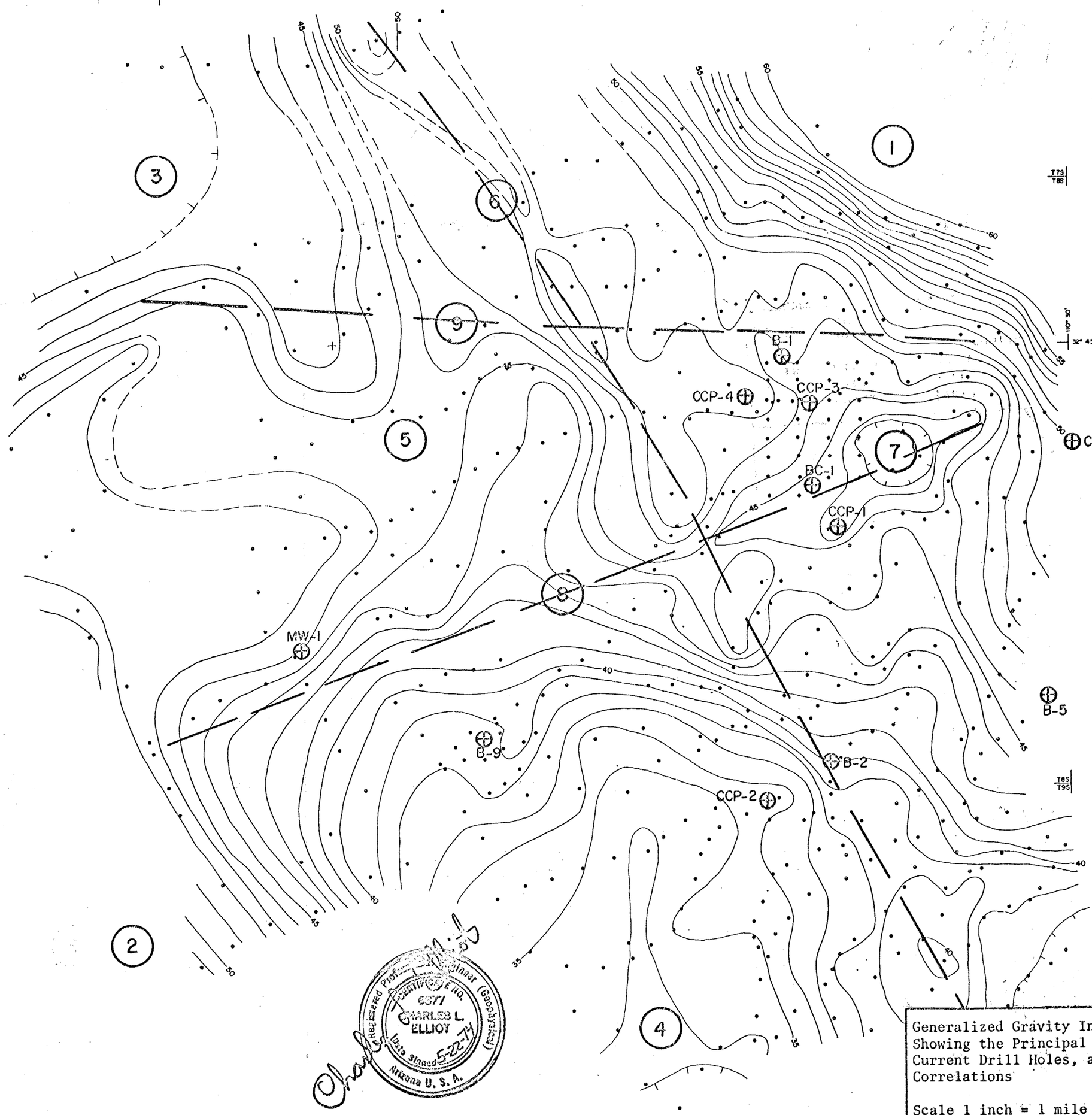
R17E | R18E

T7S / T8S

T7S / T8S

T8S / T9S

T8S / T9S



32° 45'

110° 30'

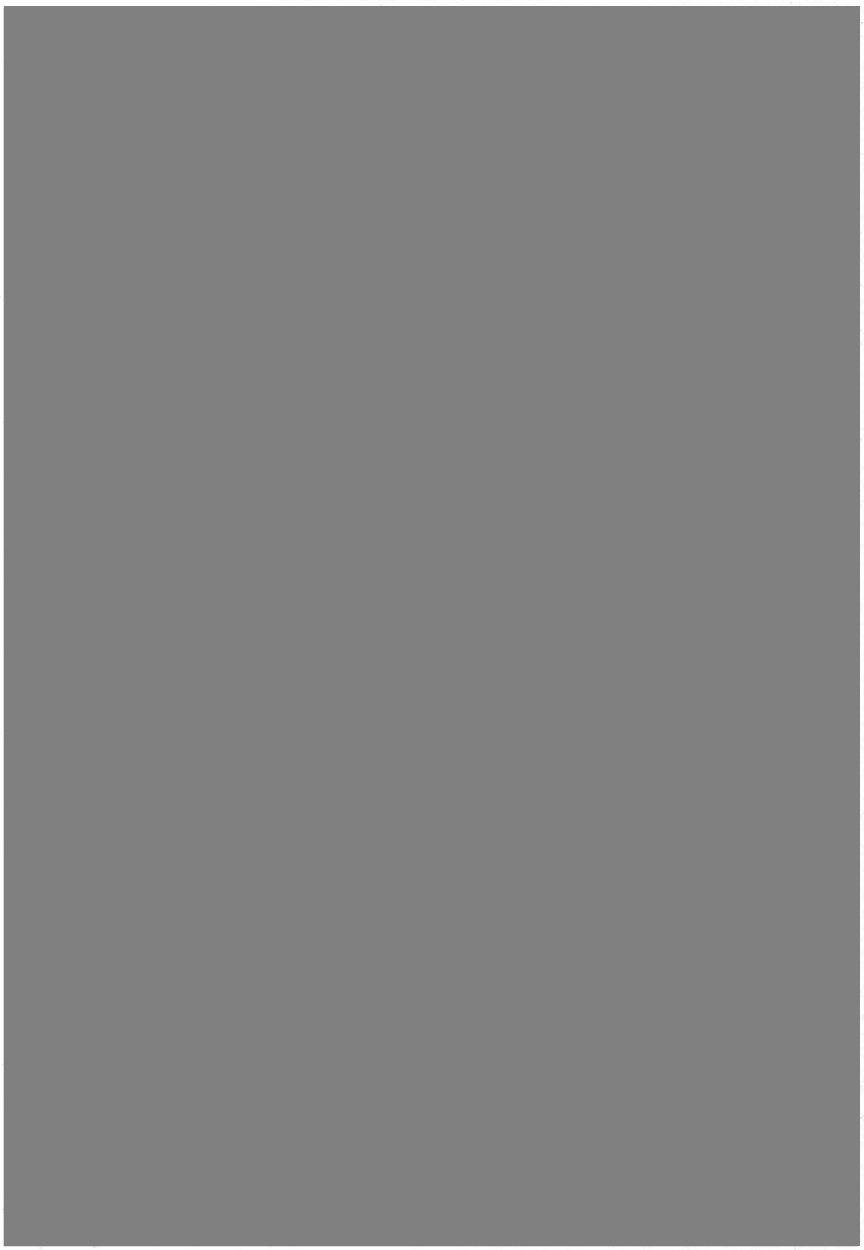
Generalized Gravity Interpretation Showing the Principal Gravity Features, Current Drill Holes, and Structural Correlations

Scale 1 inch = 1 mile May 1974

Ref: CYE

PIPE DEPOSITS OF THE COPPER CREEK AREA, ARIZONA.

TRUMAN H. KUHN.



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REPORT OF INVESTIGATIONS

UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

OLD RELIABLE COPPER MINE, PINAL COUNTY, ARIZONA[1]

By Thomas C. Denton[2]

CONTENTS

ILLUSTRATIONS

INTRODUCTION

The Old Reliable copper mine was first examined by Harlow D. Phelps, an engineer of the Bureau of Mines, in October and November 1942, in compliance with a request from the War Production Board, which furnished copies of assay maps of the 100- and 200-foot levels and requested that they be check-sampled. The author and R. M. Grantham and W. D. Hughes, engineers of the Bureau, made a second and more detailed examination later, after a number of manways had been opened that were inaccessible when the first examination was made.

1/ The Bureau of Mines will welcome reprinting of this paper provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Report of Investigations 4006."

2/ Mining engineer, Bureau of Mines.

Accessible mine workings were sampled and mapped during this later examination. A third examination was made by Charles A. Kumke, Bureau of Mines engineer, from September 17 to November 6, 1943, when a vertical raise extending 260 feet from the 100-foot level to the surface and passing through the approximate center of the ore body was sampled.

ACKNOWLEDGMENTS

In its program of exploration of mineral deposits, the Bureau of Mines has its primary objective the more effective utilization of our mineral resources to the end that they make the greatest possible contribution to national security and economy. It is the policy of the Bureau to publish the facts developed by each exploratory project as soon as practicable after its conclusion. The Mining Branch, Lowell B. Moon, chief, conducts preliminary examinations, performs the actual exploratory work, and prepares the final report. The Metallurgical Branch, R. G. Knickerbocker, chief, analyzes samples and performs beneficiation tests.

Special acknowledgment is due J. H. Hedges, chief, Mining Branch, Tucson Division of the Bureau of Mines, who directed the function of the Mining Branch in carrying out the investigation reported in this paper. Sampling and surveying of the Old Reliable mine was done by the author, Harlow D. Phelps, Chas. A. Kumke, Robert Grantham, and W. D. Hughes, all mining engineers of the Tucson Division of the Bureau.

Chemical analyses of samples taken by the Bureau, included in this paper, were made at the Bureau's laboratory, Reno, Nev., under the direction of A. C. Rice, acting supervising engineer. Metallurgical tests were performed in the Bureau's laboratory at Salt Lake City under the direction of H. G. Poole, engineer in charge of the ore-dressing unit.

LOCATION AND ACCESSIBILITY

The property is situated in sec. 10, T. 8 S., R. 18 E., Gila and Salt River meridian and base line, in the Copper Creek area of the Bunker Hill mining district, Pinal County, Arizona.

Access to the property is from Mammoth northeasterly by 11 miles of narrow, winding, unimproved road, which in a number of places has steep grades but is passable by automobile throughout. The town of Mammoth is in the San Pedro River Valley on State Highway 77. It has a population of about 500. Winkelman, 21 miles north of Mammoth by State Highway 77 and 35 miles northwest from the mine, is the nearest rail point. The Hayden copper smelter of the American Smelting & Refining Co. is 1 mile from Winkleman.

PHYSICAL FEATURES AND CLIMATE

The area in which the property lies is near the northwestern margin of the Galiuro Mountains, which are flanked on the west by the San Pedro River Valley and on the east by Aravaipa Creek. In the vicinity of the Old Reliable mine the topography is rugged. Altitudes range from 3,500 feet in the bed of Copper Creek to 5,650 feet at the top of a prominent lava flow.

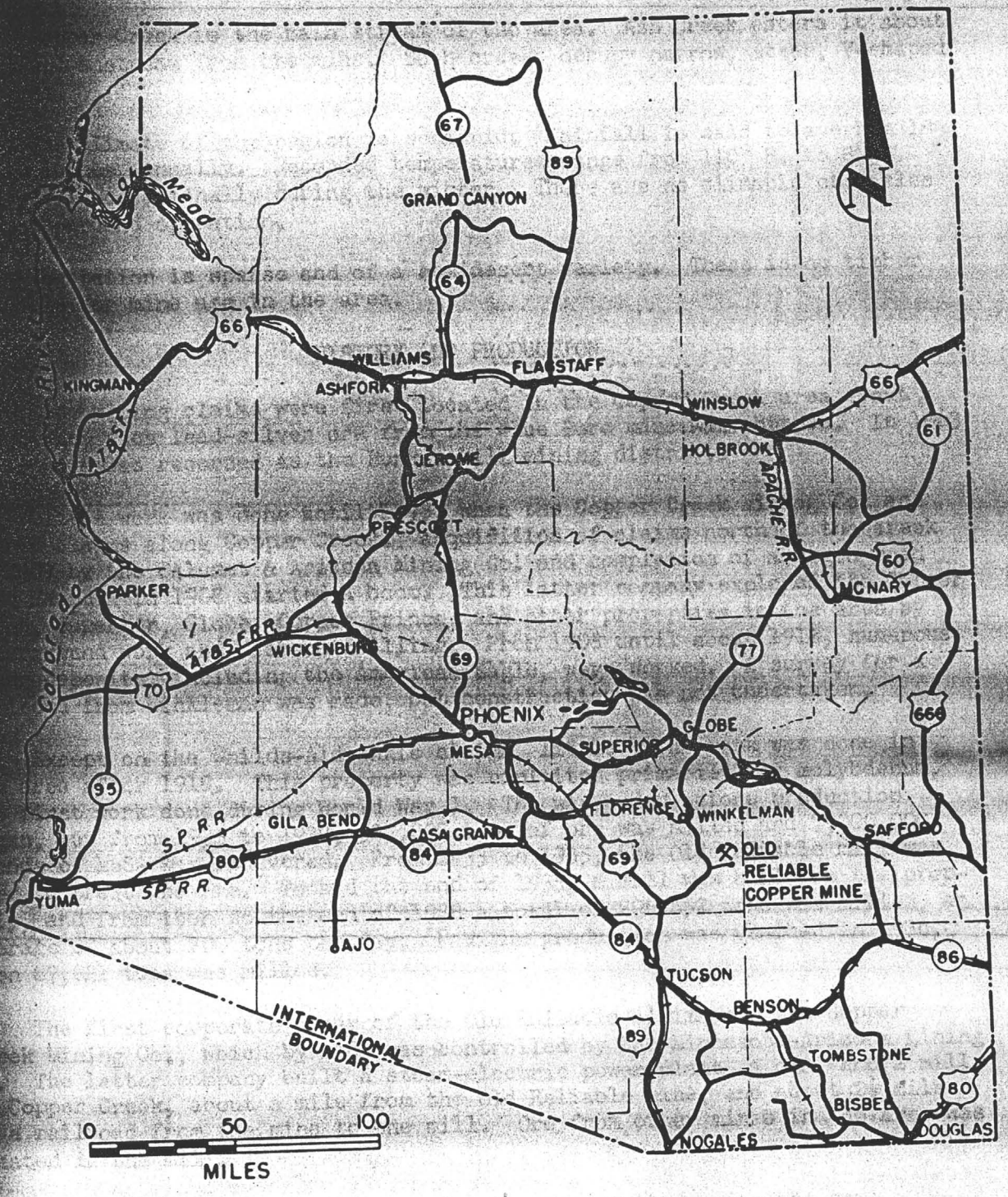


Figure 1.- Location map, Old Reliable copper mine, Pinal County, Arizona.

Copper Creek is the main stream of the area. Ash Creek enters it about [illegible] downstream from the mine. Both creeks occupy narrow, steep, V-shaped canyons.

The climate of the region is semiarid. Rainfall is said to average 18 to 20 inches annually. Recorded temperatures range from 110° F. to 8° F. Snow falls occasionally during the winter. There are no climatic obstacles to year-around operation.

Vegetation is sparse and of a semidesert variety. There is no timber suitable for mine use in the area.

HISTORY AND PRODUCTION

Lode-mining claims were first located in the Copper Creek area about 1863, when rich lead-silver ore from the Blue Bird mine was shipped. In 1863 the region was recorded as the Bunker Hill mining district.

Little work was done until 1893, when the Copper Creek Mining Co. acquired claims along Copper Creek. Acquisition of claims north of the creek in 1907 by the Calumet & Arizona Mining Co. and completion of a wagon road from Mammoth in 1908 started a boom. This latter company explored the Copper Giant, Superior, Globe, Copper Prince, and other properties in the area by underground work and diamond drilling. From 1908 until about 1918, numerous other deposits, including the American Eagle, were worked. A survey for a railroad from Winkleman was made, but construction was not undertaken.

Except on the Childs-Aldwinkle claims, little or no work was done in the area after 1918. This property was exploited primarily for molybdenum, the first work done during World War I. The war ended before production began, but from 1933 to 1938, 329,000 tons of ore was milled and 7,000,000 pounds of MoS_2 was recovered. From 1933 to 1935, the Old Reliable mill was used to treat the ore. Toward the end of 1935, a mill was built on the property, and from then to the end of 1938 a total of 296,652 tons was milled, an average of about 200 tons per day. Maximum production was reached in 1936, when 87,021 tons was milled.

The first corporate owner of the Old Reliable claims was the Copper Creek Mining Co., which by 1908 was controlled by the Minnesota-Arizona Mining Co. The latter company built a steam-electric power plant, a dam, and a mill on Copper Creek, about a mile from the Old Reliable mine, and about 2½ miles of a railroad from the mine to the mill. Ore from other mines in the area was treated in the mill.

In 1910, the Minnesota-Arizona Co. was reorganized under the name Copper State Mining Co., to which company the Old Reliable was transferred. In 1914, the new company replaced the steam plant with a Diesel-electric unit and revamped the mill. Ore from the American Eagle as well as from the Old Reliable was treated. The property operated until about 1919. Later, the mill was dismantled and the machinery was removed.

Production records are incomplete. The following table shows the approximate total metal produced from the Copper Creek area. Most of the 700,000 pounds of copper listed under Copper States Metals is believed to have been obtained from the Old Reliable from the treatment of about 30,000 tons of ore.

TABLE 1. - Production from Copper Creek area

Mineral	Childs-Aldwinkle[1]	Twin S - Blue Bird, 1863-1920	Blue Bird, 1926-1939
Molybdenum sulfide, pounds	6,946,782	-	-
Copper, pounds	5,859,033	-	200,000
Lead, pounds	-	-	4,000,000
Gold, ounces	723	-	-
Silver, ounces	26,938	-	119,000
Estimated production, value	-	$150,000	-

Mineral	Copper Prince 1937[1]	Clark Scanlon,[2] 1905-1930	Copper States Metals 1903-1916
Molybdenum sulfide, pounds	-	-	-
Copper, pounds	1,227,667	200,000	700,000
Lead, pounds	-	-	-
Gold, ounces	-	-	-
Silver, ounces	-	15,000	3/55,000
Estimated production, value	-	-	-

1/ According to W. C. Riggs.
2/ Univ. of Ariz. Bull. 140, p. 99 (apparently leasers; mine not given).
3/ Blue Bird.

PROPERTY AND OWNERSHIP

The Old Reliable property comprises five patented lode-mining claims covered by Mineral Survey No. 4059 and a number of adjacent claims. It is owned by the Copper States Metals Co., in which Martin E. Tew, of Copper Creek, Ariz., is said to be a majority shareholder.

DESCRIPTION OF THE DEPOSIT

Sediments in the area are believed to be of Cretaceous age. They consist of limestone, quartzite, conglomerate, shale, and sandstone, and are interbedded with and intruded by andesite, dacite and rhyolite. The sediments and an andesitic tuff are intruded by granodiorite. An extensive series of flat-lying basaltic flows overlies the complex. Mineralization is believed to be post-basalt. Several systems of faulting are in evidence in the area.

The Blue Bird ore occurred in a vein, and although many veins have been explored in the district, none except the Blue Bird have been productive.

With the exception noted, all production from the area has been from pipelike occurrences of breccia. About 125 of these pipes occur in the district, only a few of which have been productive.

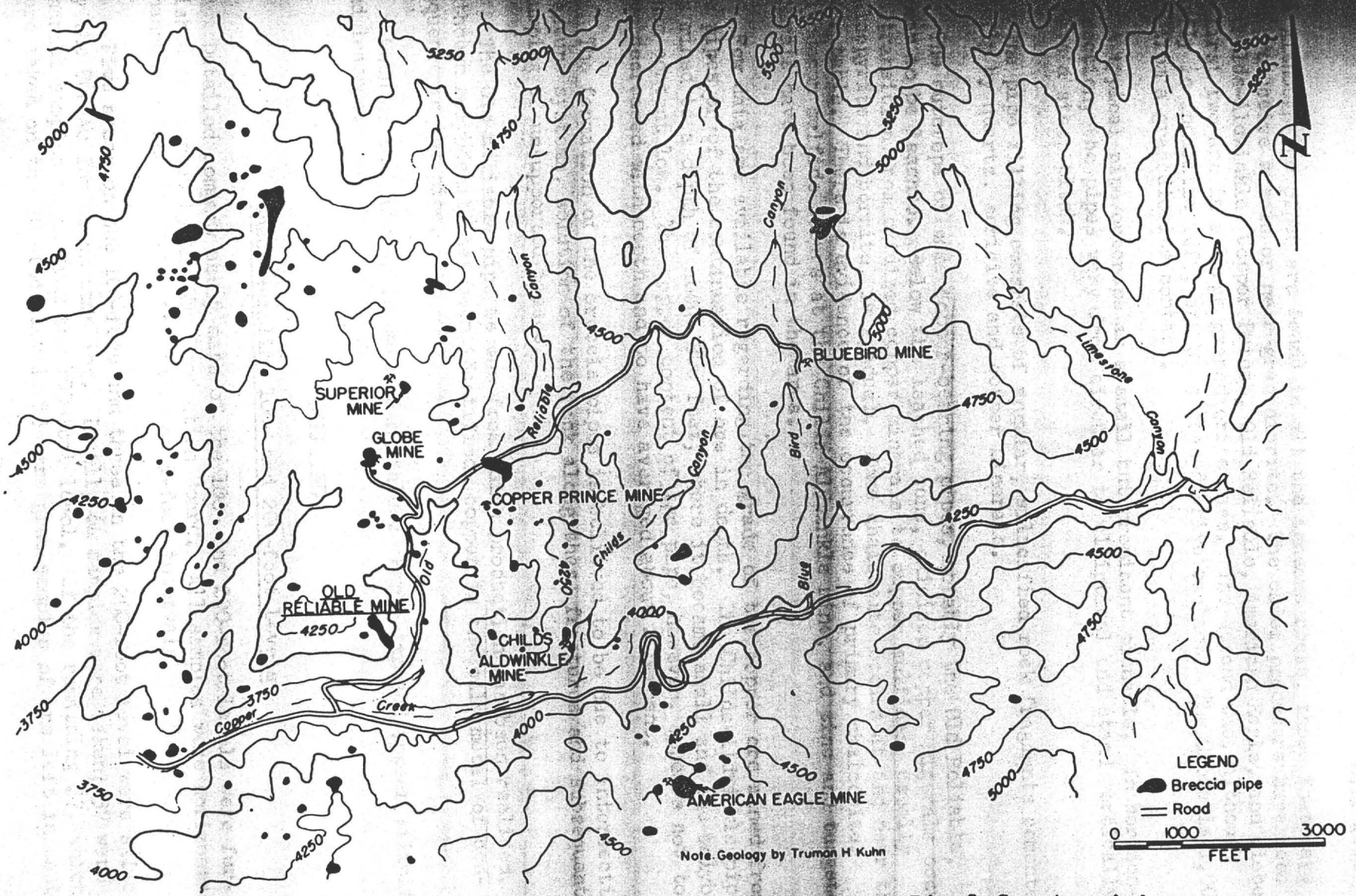


Figure 2.- General map of Copper Creek ore deposits, Pinal County, Arizona.

Although the pipes are found in all the igneous rocks, those that have been productive are in or near granodiorite. The chief producers have been the Childs-Aldwinkle, Copper Prince, Old Reliable, American Eagle, and Globe. The first two are in a large granodiorite mass. The second two, although chiefly in andesitic tuff, are at a granodiorite contact. The Globe is 1,000 feet from a granodiorite contact.

A typical pipe outcrops as a small but prominent pinnacle. In horizontal section, the pipes vary from circular to elliptical and stand vertically or have a steep pitch.

The pipe filling consists of angular, silicified rock fragments cemented chiefly by quartz, sericite and copper minerals.

The outcrops of some copper-bearing pipes, notably the Old Reliable, appear to be leached. Below the leached zone, oxidized copper minerals occur. The transition from oxidized copper minerals to copper sulfides, usually chalcopyrite and bornite, is gradual. Some chalcocite occurs at and near the water table. There is evidence of the occurrence of primary chalcocite. Molybdenum sulfide occurs at the Childs-Aldwinkle mine, and zinc and tungsten minerals have been found in the area.

Few data are available regarding the grade of the copper ore mined from the pipes or of the continuation of ore in depth. The Childs-Aldwinkle pipe was mined to a depth of about 800 feet, where it became small and the molybdenum content low. The copper content of the pipe, however, appears not to have decreased with depth and to have averaged about 2 percent.

The formation of the breccia pipes is believed to be due to intersecting fracture systems, solution of the rock along these fractures and subsequent slumping of unsupported masses.

The Old Reliable pipe is one from which production has been realized. Although molybdenite has been identified, copper is the only metal of consequence in the pipe.

Much of the outcrop is covered by talus. Parts exposed appear silicified and leached.

SAMPLING

Check-sampling 100- and 200-foot Levels

Detailed company assay maps of the 100- and 200-foot levels were furnished the Bureau by the War Production Board. All samples were horizontal channels 5 feet in length and taken at 5-foot intervals.

Five areas on the 100-foot and three on the 200-foot level were selected by the Bureau for check sampling. In all, 64 samples were taken; 37 were channel samples taken from the 100-foot level. Of the remaining 27, which were taken on the 200-foot level, 13 were grab samples of ore left in chutes

and 14 were channel samples. All channel samples taken by the Bureau are of 5-foot length. The location and analyses of these samples are shown on figures 3 and 4, together with the company assays.

Vertical Raise From 100-foot Level to the Surface

Beginning 2.5 feet below the collar, samples from opposite walls of the raise from the 100-foot level to the surface were taken at identical vertical five-foot intervals. In a few places, however, conditions made it necessary to omit a sample from one wall or the other. Each sample was a horizontal channel 5 feet long. Ninety-one samples were taken in the raise. The results of this sampling are shown on figure 6. A summary of analyses is tabulated below:

TABLE 2. - Grade of ore in raise.

From, feet	To, feet	Vertical distance, feet	Average grade, percent Cu	Cumulative from the level	
				Feet	Average grade, percent Cu
0 (on level floor)	43	43	2.17	43	2.17
43	98	55	0.31	98	1.13
98	133	35	1.70	133	1.28
133	223	90	0.51	223	0.97
223 (at raise collar)	260	37	0.22	260	0.86

Sampling Stopes Above 100-foot Level

Sampling was done in two stopes. The maximum height to which stoping was carried above the 100-foot level was about 80 feet. This height was reached in a stope about 100 feet in diameter, the back of which could not be reached without special stage construction. However, the top of the broken ore appeared to be largely material that had fallen from the back of the stope, and five grab samples of this material were taken. The point at which these samples were taken was north about 95 feet horizontally from the vertical raise. Three 10-foot channel samples were taken across the back of the south stope at an average horizontal distance from the vertical raise of 45 feet. The analyses for these samples are shown on figure 6.

Surface Sampling

Eight channel samples were taken at five widely scattered surface pits and cuts of leached and oxidized breccia. The analyses for these samples are shown on figure 5.

MINE WORKINGS

The Old Reliable mine has been opened on two levels 100 feet apart vertically. They are known as the 100-foot and the 200-foot levels. Access to each is by tunnel. A vertical raise extends from the 100-foot level to

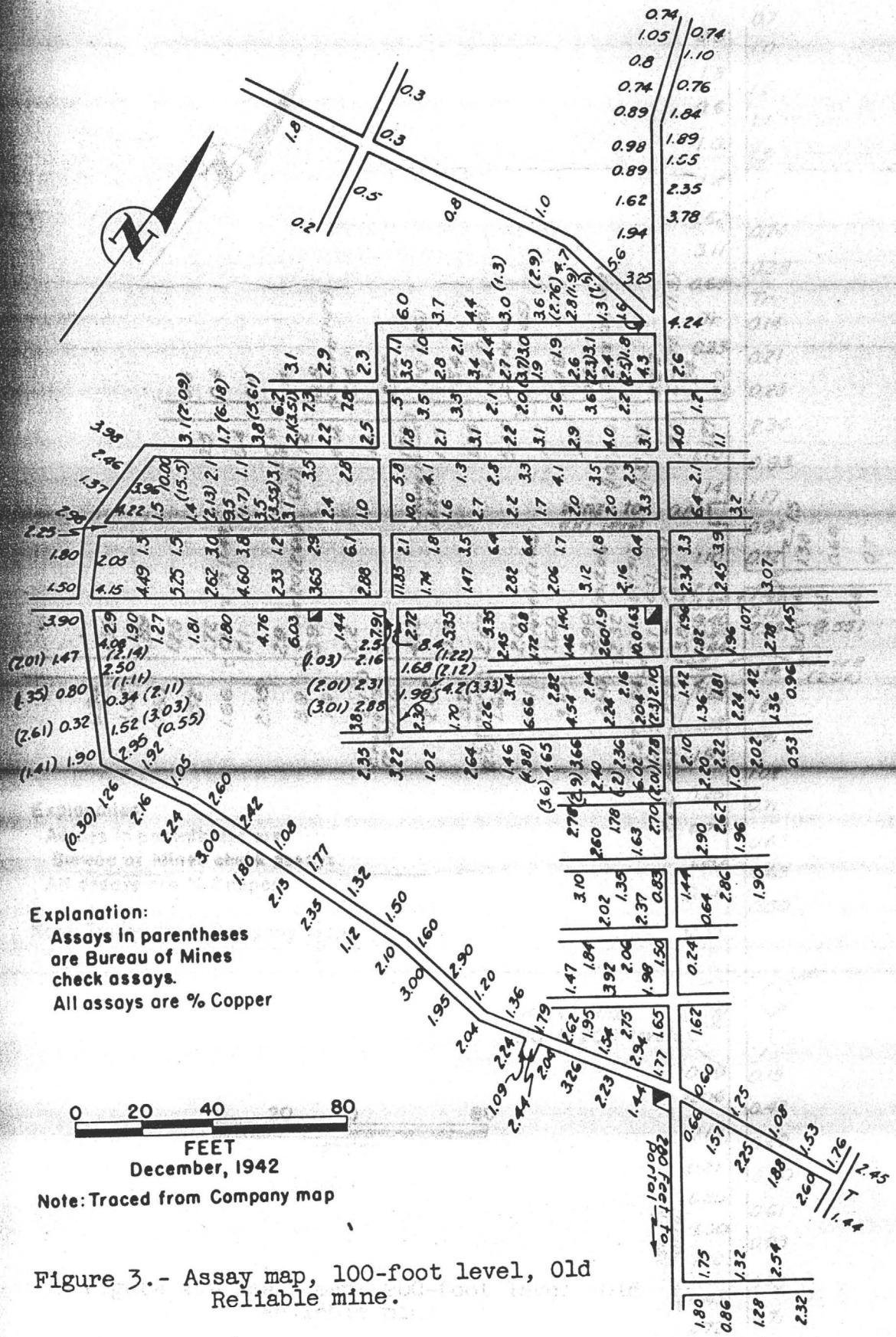


Figure 3.- Assay map, 100-foot level, Old Reliable mine.

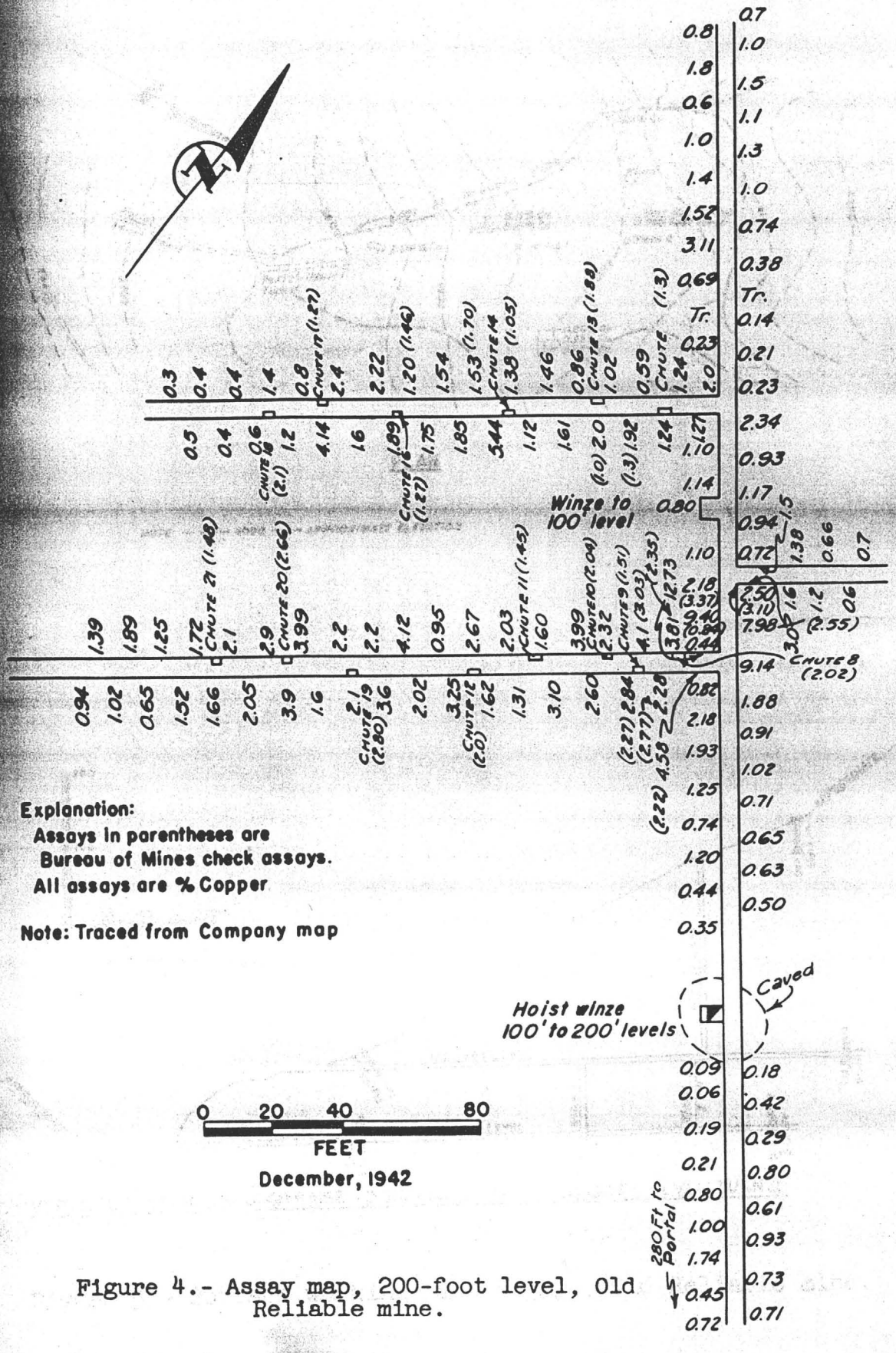
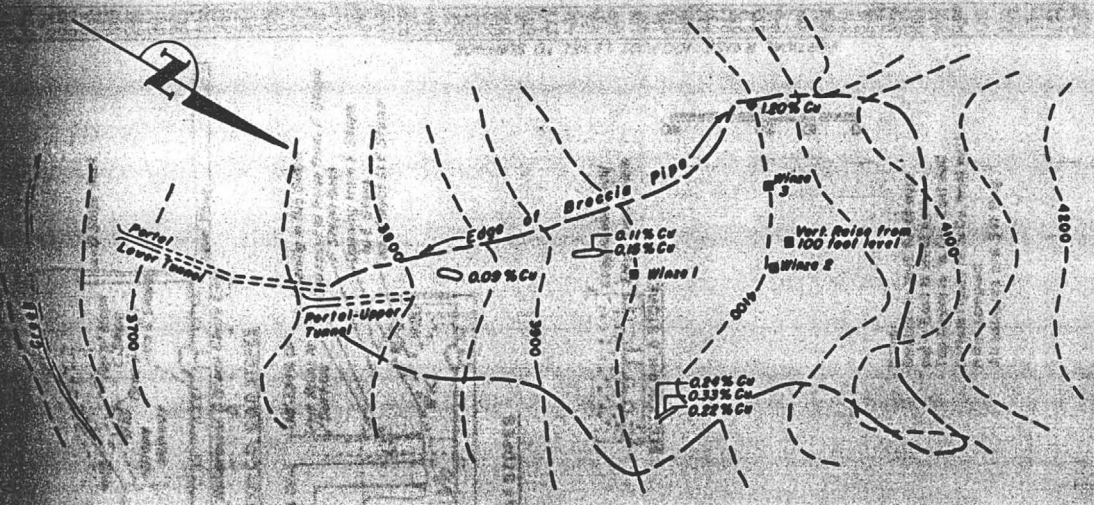
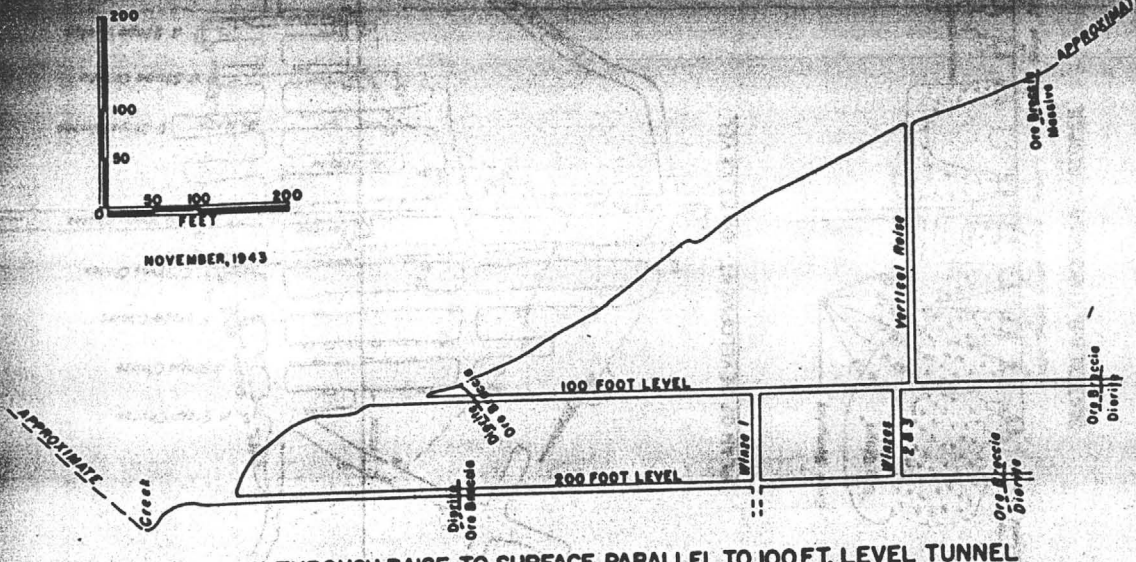


Figure 4.- Assay map, 200-foot level, Old Reliable mine.



PLAN

NOTE: — — 4000 — — APPROXIMATE ELEVATION



VERTICAL SECTION THROUGH RAISE TO SURFACE, PARALLEL TO 100 FT. LEVEL TUNNEL

Figure 5.- Surface workings and assays, Old Reliable mine.

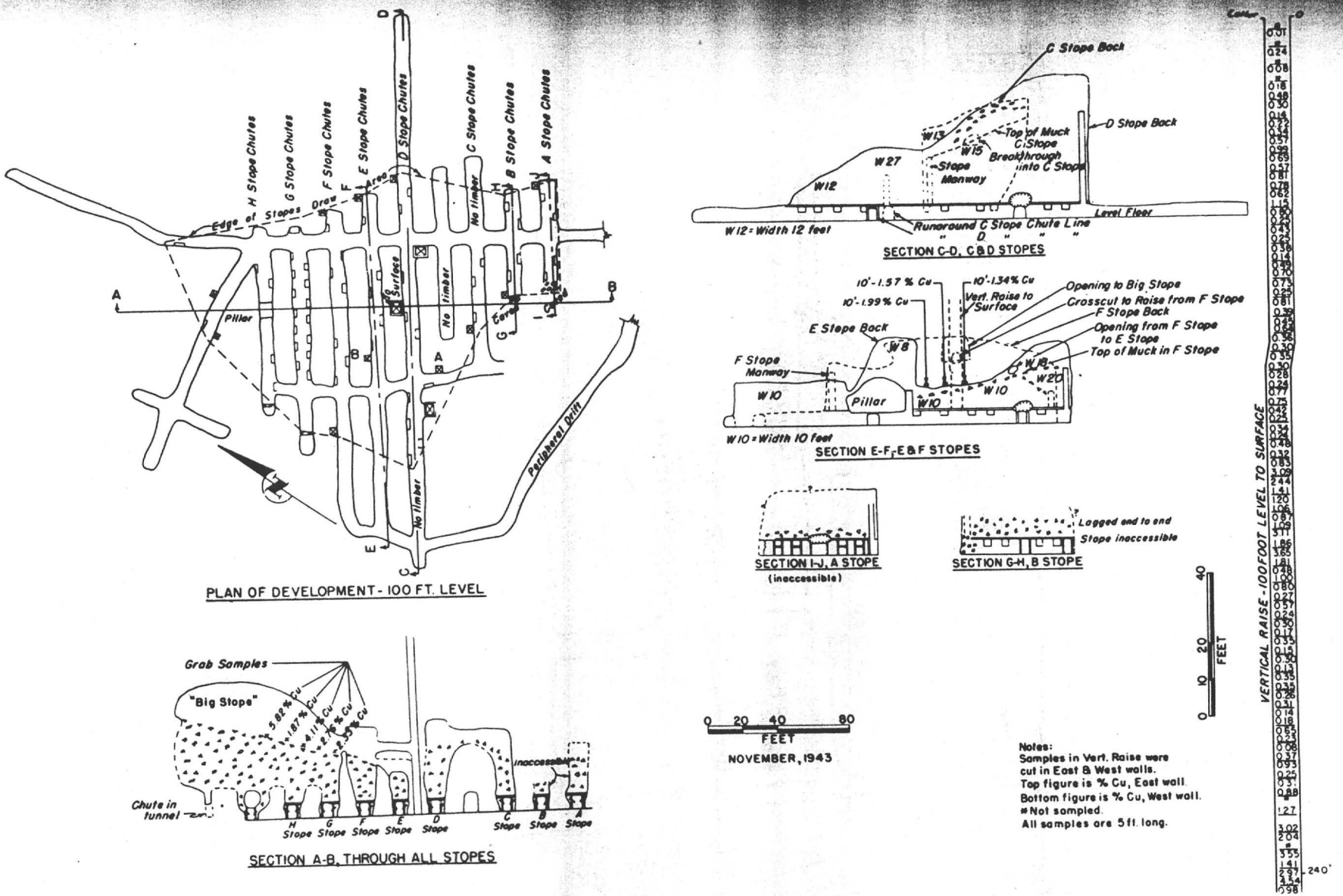


Figure 6.- Development on 100-foot level, stope assays and assays for vertical raise, Old Reliable copper mine, Pinal County, Arizona.

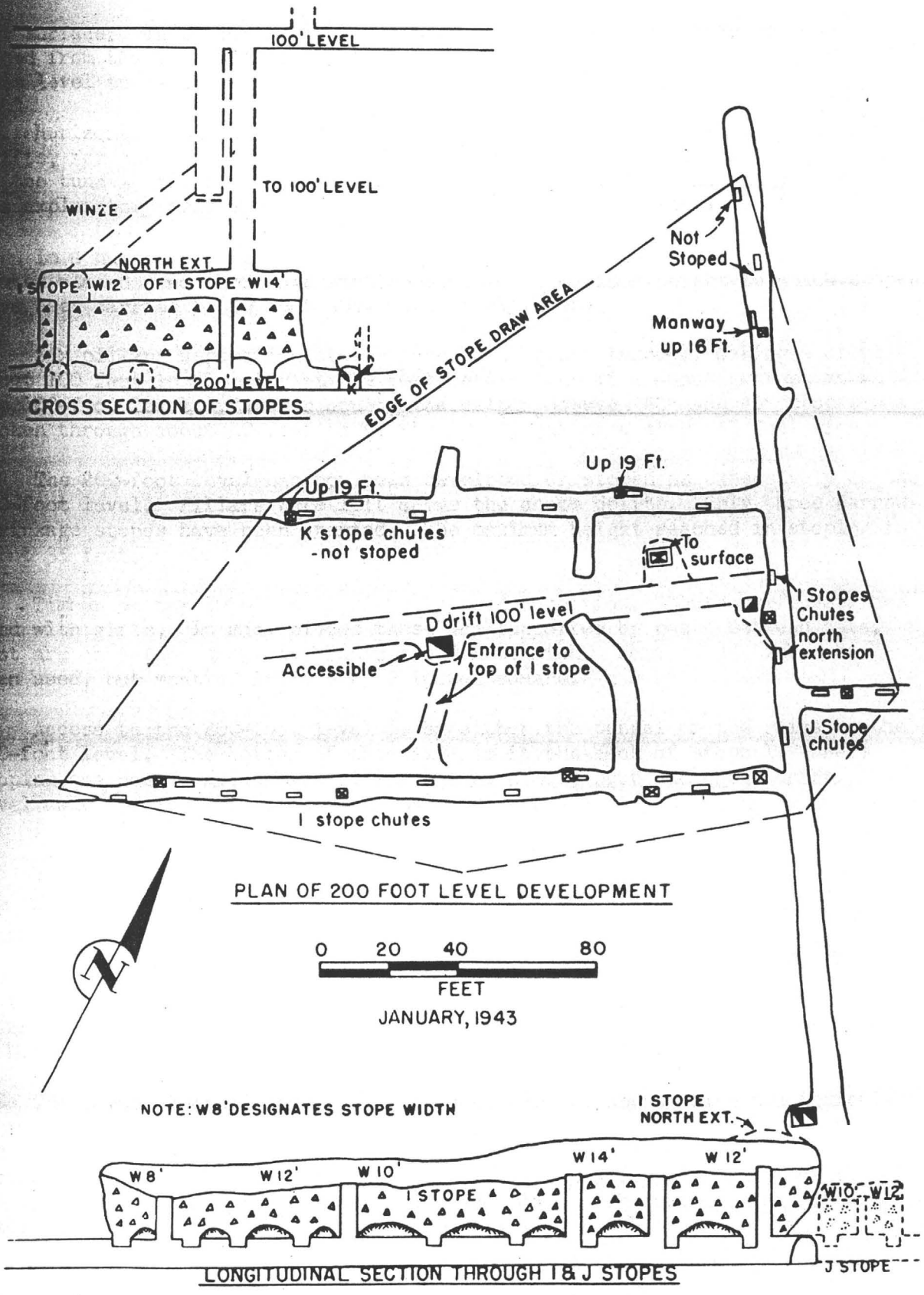


Figure 7.- Development on 200-foot level, Old Reliable mine.

...rface. These levels are connected by three vertical raises. Ore ...rom the 200-foot level was hoisted through one of these to the 100-...evel tunnel.

...orizontal development on the 100-foot level consists of parallel chute ..., for the most part on 20-foot centers at right angles to the direction ... tunnel, and a peripheral drift. In addition, near the tunnel portal ...loratory drifts that make acute angles with the tunnel.

...n a number of the chute drifts the backs have been raised, timber and ...s placed, and shrinkage stoping done. The maximum height to which stopes ...been carried is 80 feet above the level floor.

...Six pillars separating stopes have been broken through, making a stope ...100 feet in diameter at the north end of the mine about 40 feet above ...100-foot level. Farther south, the pillar between "C" and "D" stopes was ...oken through about 40 feet above the level, making a stope 50 feet wide.

...The 200-foot level has not been developed or stoped as extensively as the ...0-foot level. Pillars were left above the chute drifts. Only three narrow ...nkage stopes have been started. The maximum height reached in stoping is ...ut 35 feet.

...Timber on the 100-foot level is in good condition. Chute-drift sets are ...d with girts. In many places these are supported by posts between sets. ...ts are on 5-foot centers. Posts are 8 feet high. Some round timber has ...been used, but most of it is 8 by 8 inches square.

Access to the 200-foot level is by either the tunnel or the raise to the ...00-foot level. The bottom of the raise is in the back of stope 1. Where ...stoping has been done, a back pillar has been left over the chute drift. The ...level makes an insignificant quantity of water.

METALLURGICAL TESTS

Inspiration Copper Company Tests

Preliminary small-scale laboratory tests made by the Inspiration Copper Co. by their continuous, single-stage, leach-float method extracted 96 percent of the copper with a consumption of 98 pounds of 60° Be' sulfuric acid per ton of ore. The concentrate averaged 42.41 percent copper. The tests were made by W. G. Scott, leaching plant superintendent.

The sample tested assayed 4.42 percent copper, about twice the indicated average grade of the ore; 2.01 percent of the copper occurred as oxide and 2.41 percent as sulfide. A qualitative microscopic analysis showed the predominant sulfide mineral to be chalcocite. Some chalcopyrite and covellite and traces of bornite and tetrahedrite were found. The oxidized copper minerals were malachite and chrysocolla.

University of Arizona Tests

A small-scale laboratory test of a sample from the same source as that above was made by E. H. Crabtree, Jr. He obtained an indicated 90.5 percent of the total copper by the Inspiration single-stage, leach-float method in a concentrate assaying 34.0 percent copper; 73.6 pounds of sulfuric acid and 9.0 pounds of lime were required per ton of ore.

The sample tested assayed 3.0 percent copper, of which 1.70 percent was oxidized. The sulfide copper occurred chiefly as chalcocite with minor amounts of bornite and chalcopyrite. Oxidized copper appeared to occur chiefly as malachite. As received by Crabtree, the sample weighed about 100 pounds, and was virtually all minus 2-inch. The manner in which and the places from which it was taken are not known.

Bureau of Mines Tests

Small-scale laboratory tests were run on two samples from the 100-foot level, one having been taken by the Bureau as representative of mixed oxide-sulfide ore and the other of predominantly sulfide ore.

The mixed-ore sample weighed 328 pounds. It assayed 3.65 percent copper, of which 1.85 percent occurred as oxidized minerals and 1.80 percent as sulfide. By the single-stage, leach-float method, 89.7 percent of the total copper was recovered in a cleaner concentrate assaying 44.3 percent copper. Addition of a cleaner tailing raised recovery to 91.5 percent in a concentrate assaying 39.4 percent copper. A two-stage application of the leach-float method recovered 90.2 percent of the total copper in a concentrate assaying 39.9 percent copper. Acid consumption was 84 pounds per ton of ore.

The sulfide ore sample weighed 100 pounds. It assayed 1.20 percent copper, of which only 0.20 percent occurred as oxide. At minus 65 mesh, flotation recovered 78.0 percent of the copper in a 34.0 percent copper rougher concentrate. An additional 4.4 percent of the total copper was recovered in an oxide copper concentrate that was floated after removal of a pyrite concentrate. The combined concentrate assayed 24.4 percent copper and represented an over-all recovery of 82.4 percent.

OPERATING CONDITIONS

Water supply. - There are no perennial streams in the area, but between November 1 and June 1, Copper Creek has an appreciable, if unpredictable, flow. In Copper Creek Canyon, about 1 mile from and about 100 feet above the mine workings, is a debris-filled reservoir which is said to have a capacity of 784,000 cubic feet. Sufficiently above the mine to permit gravity flow, and about 1 mile distant, is a spring reported to have a minimum flow of about 40 gallons per minute. About 2,000 feet north of and above the mine is the Globe shaft, now filled with water. The Henderson ranch, on which are three wells each 200 feet deep, is about three-quarters of a mile distant and about 500 feet below the mine. The wells are said to have an aggregate flow of about 50 gallons per minute.

The Childs-Aldwinkle property, which is nearby, milled 200 to 250 tons of ore per day for several years by utilizing these sources of water. Although the mine appears to have made little water, it is now flooded and is itself a potential source of water.

A reliable source of unlimited water is the San Pedro River. About 10 miles of pipeline would be required, and a static head of approximately 1,400 feet would have to be overcome to utilize this source.

Power. - Power could be obtained by constructing a transmission line from a high-tension hydroelectric-transmission line at a point near Mammoth.

Equipment. - An old-model, 285-horsepower, McIntosh-Seymour full-Diesel engine direct-connected to a Crocker-Wheeler 200-kilowatt, 2,300-volt generator with switchboard is installed at the property. It is said to be in good condition. There are a few buildings at the property, which are in fair condition. Some rail remains at the mine.

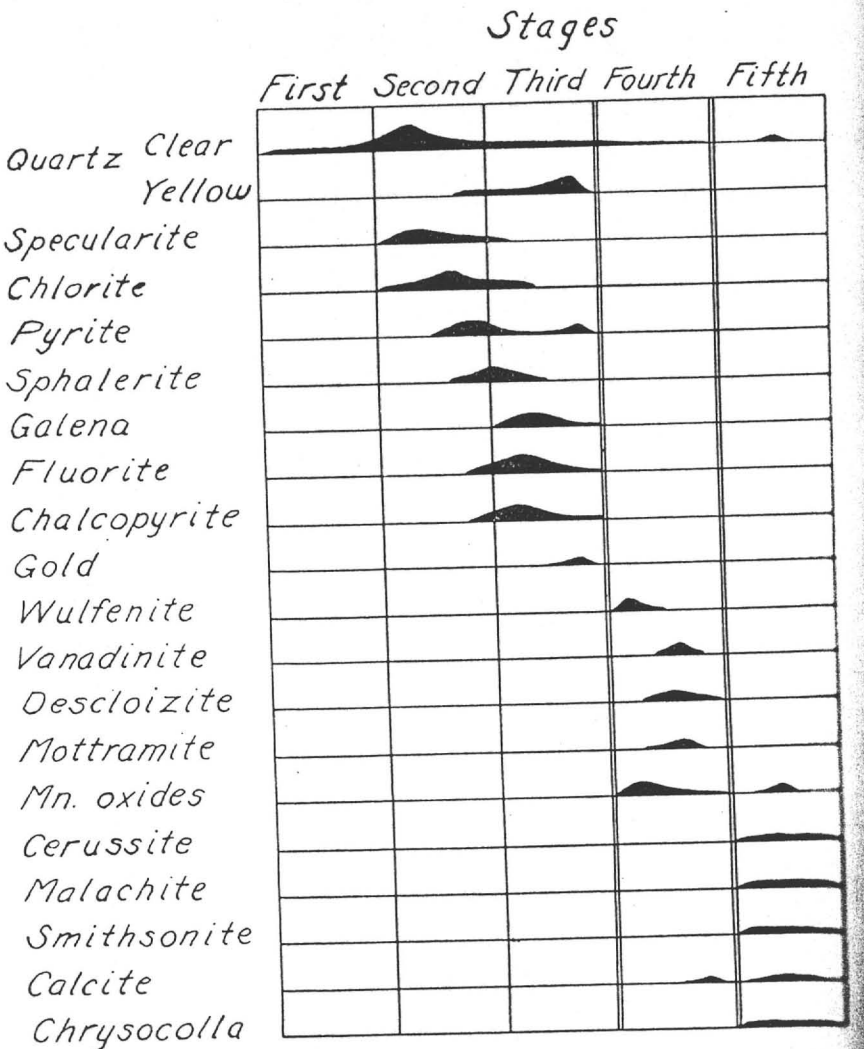


Figure 11.—Paragenetic relation of the vein minerals, Mammoth Mine, Pinal County.

The assemblage of minerals and the general character of the veins are both indicative of high temperature deposition at shallow depth.

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Childs-Aldwinkle Mine, Copper Creek, Arizona[88]

By Truman H. Kuhn[89]

Location

The Childs-Aldwinkle Mine is at Copper Creek, in the western part of the Galiuro Mountains near the center of the Bunker Hill mining district. The camp is accessible by 10 miles of road that branches eastward from the Tucson-Winkelman highway at Mammoth.

History and Production

The Bunker Hill district was discovered in 1883 by prospectors who were searching for gold and silver. Mining was attempted in 1897-98 by the Table Mountain Copper Company; in 1903-17 by the Copper Creek Mining Company and its successors, the Minnesota-Arizona Copper Company, and the Copper State Mining Company; and in 1907-9 by the Calumet and Arizona Mining Company.[90] Between 1917 and 1933 a little work was carried on by lessees. Production from 1905-16 was approximately 700,000 pounds of copper and $35,000 worth of silver, with a total value of $150,000.[91]

In 1933 the Arizona Molybdenum Corporation, headed by W. C. Rigg, purchased the Childs-Aldwinkle property and began mining molybdenum and copper ore. According to Mr. Rigg, the production of this mine from 1933 to July 1, 1938, was 6,454,321 pounds of molybdenum sulphide, 5,519,140 pounds of copper, 473 ounces of gold, and 19,167 ounces of silver.

Rocks

The canyon of Copper Creek, where it crosses the district, forms a small basin floored mainly by light gray granodiorite which in-

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[88] Paper prepared for, and originally presented at, the regional meeting of the A.I.M.&M.E. held at Tucson, Arizona, November 1-5, 1938.

[89] Graduate student, University of Arizona.

[90] Historical data largely from unpublished notes of J. B. Tenney.

[91] M. J. Elsing and R. E. S. Heineman, *Arizona Metal Production* (Univ. of Ariz., Ariz. Bureau of Mines Bull. 140, 1936), p. 99.

truded limestone of undetermined age, probably in Laramide time. It is partly covered by two lava flows, the younger of which caps Sombrero Butte, Table Mountain, and other prominent elevations.

Structure

The main structural features in the vicinity of the mine are strong east-west vertical faults and fractures; indistinct north-south vertical faults; a northwestward-trending fault with steep southwestward dip; and pipelike masses of breccia.

Two of the east-west faults are traceable, with a fair degree of certainty, through the mine (Pl. XXXIX). One separates the main ore body from its southern branch, and the other is associated with the northern branch. Both may be traced on the surface as part of a large fault zone.

On most of the levels an indistinct north-south vertical fault is apparently associated with the north-south elongation of the ore body. It has little gouge and is difficult to trace through the breccia. Other fractures and faults generally displace it only to a small extent.

A fault on the 700- and 800-foot levels strikes N. 60 degrees W., dips 65 degrees SW., and passes through the main and the northern branch ore bodies. It has not been recognized on the surface.

The pipelike mass of breccia consists of blocks of altered granodiorite, cemented with gouge, gangue, and ore minerals. The blocks range from an inch to 15 feet in diameter and average 6 to 12 inches. They are relatively small and closely spaced in the upper portions of the pipe.

The breccia pipe is of oval plan and almost vertical. It is bounded in most places by an irregular but rather sharp contact with massive granodiorite.

Ore Deposit

The Childs-Aldwinkle deposit, like most others in this district, is in a breccia pipe. The entire breccia mass, though it may be mineralized, is not all ore. The ore breccia in the central portion of the pipe grades outward into breccia that contains only pyrite in the lower part of the mine. In the upper 200 feet of the pipe the entire breccia was ore, but the outer rim was considerably richer than the core.

The ore minerals are confined to the cementing material where they occur as disseminations and lining of fractures. Some branches or offshoots from the main ore body have been followed, but others are too small to mine away from the main workings. There are two distinct oval-shaped outcrops of ore at the surface (Pls. XXXIX and XL) of which the northern was 270 by 150 feet and the southern 220 by 100 feet in diameter. They diminished about equally in relative size to a depth of 340 feet. For the next 50 feet, the northern ore body continued to diminish gradually, whereas the southern body decreased to one sixth the size of the northern or main ore body. From this point downward

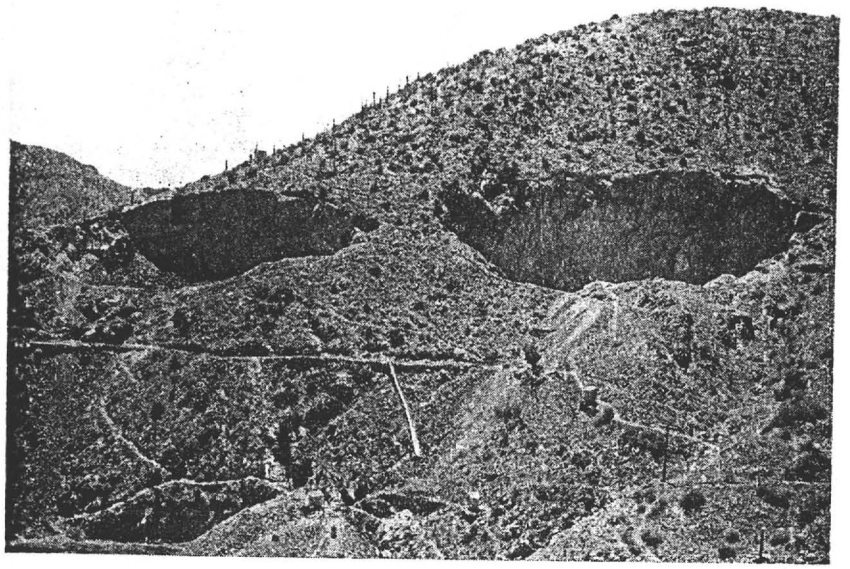

Plate XL.—Looking west at glory holes of Childs-Aldwinkle Mine.

the exact location of the southern ore body is unknown, but small masses of ore on the main levels suggest that it continues downward and joins the main ore body about 700 feet below the surface. At a depth of 800 feet the northern body pinched out. Below this point the breccia contains molybdenite, but as small, scattered grains.

At a depth of 350 feet, the main ore body branches as indicated in Plate XXXIX. In places it is connected with the smaller or southern branch by low-grade ore. At a depth of 760 feet, the northern branch increases in size and changes from vertical to a dip of 65 degrees E. At the present bottom of the mine, 850 feet below the surface, the ore follows a north-south fault along which the oval outline becomes much elongated. On the 700-foot level a mineralized zone 6 to 12 inches wide, high in molybdenite and bornite, is associated with the north-south fault.

Molybdenite, bornite, and chalcopyrite are the principal ore minerals. Treatment of the copper concentrates yields small amounts of gold and silver as well as arsenic, antimony, and traces of bismuth. Near the surface are oxidized minerals, molybdite, malachite, azurite, cuprite, and small amounts of native copper. Copper is very subordinate to molybdenum in the upper levels. Below about 650 feet bornite and chalcopyrite are important except in the lowest levels where the amount of copper diminishes considerably. The average molybdenite content

changes very little through the mine, and the amount of pyrite remains fairly constant.

The nonmetallic gangue minerals show the greatest variation. Near the surface quartz and calcite are the principal gangue minerals. On the main haulage level (300 feet below the surface) crystalline quartz is still abundant, but there are also crystals of orthoclase, with quartz in the open cavities, and calcite and gypsum. At a depth of about 600 feet a large amount of orthoclase and biotite, accompanied by numerous crystals of apatite, is present. Quartz is still present but in lesser amounts. On the 800 level orthoclase has diminished with a corresponding increase in biotite. At the present bottom of the mine (850 feet) the gangue is mainly coarsely crystalline quartz and biotite, with little orthoclase.

With increased depth the molybdenite crystals increase in size, changing from 0.04 to 0.12 inch in diameter to rosettes 1.8 inches in maximum diameter.

Wall-Rock Alteration

Although the country rock surrounding the breccia pipe appears fairly fresh, the ferromagnesian minerals have in part gone to chlorite and the feldspars to sericite. The alteration of the iron-bearing minerals to hydrous ferric oxide gives the outcrops their characteristic reddish color. The ore breccia in many places is cemented almost entirely with alteration minerals, particularly on the 600-foot level where the breccia blocks are held together with a green, finely divided chlorite. In the upper levels alteration is less evident, but sericite is present. Chlorite and sericite occur in the lower portion of the mine in approximately equal amounts.

Octave Mine[92]

By Eldred D. Wilson

Situation

The Octave Mine is at Octave in the Weaver district of southern Yavapai County. It is reached by about 10 miles of road that leads eastward from Congress Junction, a station on U.S. Highway 89 and the Phoenix branch of the Santa Fe Railway.

History and Production

This deposit probably became known in the sixties, shortly after the discovery of the Rich Hill placers, but, as a large

[92] Acknowledgments are due B. R. Hatcher, Carl G. Barth, Jr., M. E. Pratt, and A. E. Ring for much information upon the Octave area. Paper prepared for the regional meeting of the A.I.M.&M.E. held at Tucson, Arizona, November 1-5, 1938.

part of the gold was not free milling, little work was done upon it until the advent of the cyanide process. During the late nineties, according to local reports, a group of eight men purchased the property and organized the Octave Gold Mining Company. Between 1900 and 1905 the vein was mined to a depth of about 2,000 feet on the incline and for a maximum length of 2,000 feet along the strike. This ore was treated in a forty-stamp mill equipped for amalgamation, table concentration, and cyanidation. The total gold and silver production during this period is reported to have been worth nearly $1,900,000. In 1907 the property was bought by a stock company that built an electric power plant at Wickenburg, 11 miles away, and electrified the mine and mill. This company, however, failed to work the mine at a profit and ceased operations in 1912. In 1918 a group of the stockholders organized the Octave Mines Company, with H. C. Gibbs, of Boston, as president and carried on development of the Joker workings until 1922. In 1928 the Arizona Eastern Gold Mining Company, Inc., was organized. This company operated a 50-ton flotation plant on ore already blocked out in the Joker workings. After obtaining approximately $90,000 worth of concentrates from 9,100 tons of ore, operations were suspended in 1930. This ore contained nearly equal proportions by weight of gold and silver.[93]

The production from 1895 to 1925, inclusive, has been reported as $1,825,000 worth of gold and $75,000 worth of silver, a total value of $1,900,000.[94]

In 1934 the American Smelting and Refining Company obtained control of the property, equipped the mill late in the year, and began production from the Joker workings. According to figures published by the U.S. Bureau of Mines, the yield during 1934-36 was as follows:

1934	2,636 tons
1935	23,951 tons
1936	22,107 tons (estimated)

The ore mined during 1936 was reported to average 0.364 ounce of gold and 0.464 ounce of silver per ton, 0.240 per cent lead, and 0.030 per cent copper.

Topography and Geology

Here the rugged southwestern front of the Weaver Mountains rises abruptly for more than 2,000 feet above the desert plains.

The Octave Mine is at an altitude of 3,300 feet on a narrow pediment at the southwestern base of the range and 2 miles south of Rich Hill. This area is dissected by several southward-trending arroyos of which Weaver Creek, ¼ mile west of Octave, is the largest. Water for all purposes is brought through 7 miles of pipe line from Antelope Spring.

[93] Oral communication from H. C. Gibbs and M. E. Pratt.

[94] M. J. Elsing and R. E. S. Heineman, *Arizona Metal Production* (Univ. of Ariz., Ariz. Bureau of Mines Bull. 140, 1936), p. 103.

9-19-74

Mr. A. J. Perry
Perry, Gray, Kaufman, Inc.
P.O. Box 12754
Tucson, Arizona 85732

Al:

Enclosed please find data from Kirby Cargill on the Beth Property in the San Manuel - Copper Creek area of Pinal Co., Arizona. Please check this out as per our telephone conversation of yesterday, i.e., on a consulting basis.

Thank you.

Bruce

(J. Bruce Duswalter)

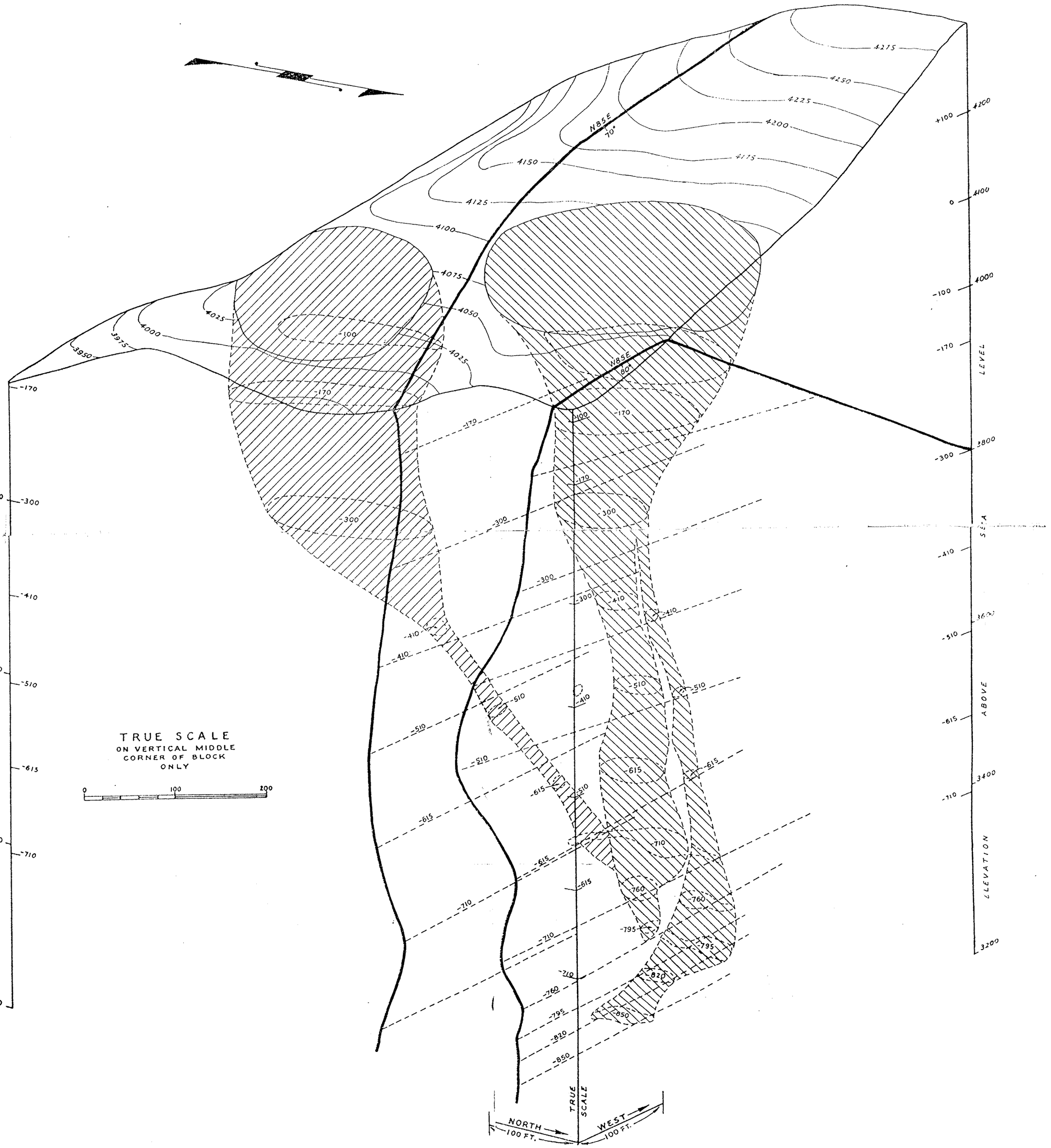

Plate XXXIX.—Stereogram showing principal relations at Childs-Aldwinkle Mine, Copper Creek.

NUCAS LTD.
KIRBY C. CORYELL, GENERAL PARTNER
5140 EAST BURNS STREET
TUCSON, ARIZONA 85711
(602) 325-2075

September 6, 1974

Mr. Robert Kayser
International Minerals Corp.
IMC Plaza
Libertyville, Ill. 60048

Dear Mr. Kayser:

Herb Leopold informs me you are interested in reviewing some of the data on our copper property in the San Manuel-Copper Creek area, and at his request I am sending you some of it, primarily reports by Chuck Elliot and Tom Mitcham. Chuck worked on the aeromagnetics for us, and a year or so later the gravity when it became available. He seems certain of a structural trend between the two districts, and Tom's photo studies confirm it. We consider it a potential mineral belt.

Our drilling to date proves the San Manuel basement environment to extend almost to the Copper Creek District; thus most of our property is underlain by the environment of the larger deposit, and the contact between the Oracle Granite and the schist trends discordantly across the favorable belt within our ground. A second strong structural zone, of strike similar to the San Manuel fault swarm, also crosses the belt, as demonstrated by the magnetics, gravity, and photo work. In addition to rejuvenations of older faulting that Tom sees in the Gila, he has been able to pick out a good number of circular structures in the Gila, some of which may represent collapse features. It is interesting that their occurrence is very largely confined to the belt, that a similar fault pattern exists in pre-mining photos over the south flank of the San Manuel ore body, the thickest and more intensely mineralized part, and that Tom has observed similar patterns in pre-mining photos over other porphyry deposits. In our most recent drilling we had the benefit of Tom's help, and chose the two better developed circular features that also had the benefit of local trends and structures, as prime targets; unfortunately these proved to be in relatively deep parts of the property and the holes were stopped at 2832 and 3605, without our having the money left in this program to complete them. Chuck's prediction at B-2, the 3605 hole, is 3700 feet plus or minus 500 to basement.

On page 10 of Chuck's gravity report he discusses the composition of the basement ridge trending ENE. Unfortunately his comments are based on an over-simplified log of hole B-9; he had no way of knowing the upper 400 feet or so of Cloudburst was a fanglomerate granitic in cobble content rather than cobbles of Cloudburst lava composition, so the ridge should provide

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relatively shallow drilling to the true basement for some distance to the east. Enclosed is a petrographic report from part of this drill interval; that most of the Oracle fragments are variably altered is interesting.

Tom Mitcham recently has left consulting and is heading a joint effort of Cerro Corp. and Rio Amex. This coming Friday he meets with a Rio Amex executive, and has asked if I would refrain from offering the property to others until the following Monday. He states he would like to see his principals have some part in the property, but since he's heading a new effort, he has no feel at the moment as to whether they'd like to tackle something so large by themselves in their first move. If you have any interest in it, it well could be they would welcome a joint venture. However, as it presently stands, I told Tom I would wait for his answer, and thus I cannot offer the property to anyone else until September 16.

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Holes entering the basement have demonstrated deep and thorough weathering, such that enrichment should have occurred in most areas, and where ever should have been preserved by subsequent cover. The primary grade at both ends of the belt is around 0.7% copper.

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While exploration of the area may at first thought seem expensive by past standards, it is only of about average expense for those particular programs that have been successful the past 10 or 15 years. The shallow areas of recognizable merit were perforated long before. Should our specific targets fail, and it seems very unlikely all of them will, any exploration will help track down the major ore body or bodies that by all odds should occur within the belt.

Should you have any interest in discussing the area with Elliot or Mitcham, please feel free to do so, but after September 16 unless we discuss the matter in the meantime. I hope the enclosed material will provide some basis for you to determine any further interest in investigating the property. I'm sorry I cannot supply you with more specific information for a week or so, per Mitcham's request to determine if his principals would prefer to take it on by themselves. It is my understanding Rio Amex supplies the drilling money, Cerro the staff and their files on past work; therefore Tom should be able to get a firm decision Friday from the Rio executive. I suspect they will prefer to have another partner, as Tom has indicated their initial efforts were to be on a modest scale, so modest in fact that only in the last week or so has he been sounding out Cerro as to whether they could handle it in any manner.

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I will keep you and Herb informed of proceedings, and am looking forward to visiting with you over a complete set of the data should you be interested in doing so and should events permit.

Very truly yours,

Kirby C. Coryell

Kirby C. Coryell
GENERAL PARTNER

KCC/ml

Review of Exploration Plans
BETH, NANCY, LYN, AND PHIL CLAIM AREA

Nucas Ltd. - Sucan Ltd.

Bunker Hill District
Pinal County, Arizona

by

Thomas W. Mitcham

January 21, 1974

INTRODUCTION

At the request of Kirby C. Coryell, General Partner of Nucas Ltd., this review is undertaken with the sole purpose of providing Nucas and Sucan partners and those of Copper Drillers Ltd., an affiliated partnership, with an unbiased evaluation of subject property and of the appropriateness of the attached first-phase exploration outlined program by Mr. Coryell.

It is understood that this review will be distributed only to the above partners and that its use, without my permission, will be confined to the stated purpose-- providing the partners with my opinions on the property and the proposed exploration program.

The review is derived from the present data base which is an impressive body of data, data reductions, and analyses. The data involved are magnetic, gravity, geologic, and photogeologic. The data are recorded on various maps and in various reports, including one previously submitted by the writer (11-5-73), and data reductions are compiled on a single map (scale: 1:24000) by Mr. Coryell.

GEOLOGIC SETTING

The Precambrian Oracle batholith of south-central Arizona has approximate dimensions of 35 miles (N-S) by 75 miles (E-W). Laramide plutons, commonly with associated copper mineralization, tend to occur in the vicinity of its contact. The property under discussion covers the contact zone of the southeast "corner" of the Oracle batholith.

Older rocks and structures (including the batholith contact) on the property are almost entirely concealed by postore cover: volcanics, Gila Conglomerate, and younger sediments. However, to varying degrees, buried older structures can be detected through the cover by applications of magnetics, gravity, and photogeology. The latter is explained by recurrent movement on old structures effecting identical or similar structures in cover rocks.

Considering structures reflected through cover, those in outcropping older rocks, and those geomorphically reflected, the marked structural grain on the property and in its vicinity is N30-40°W. Structures with other strike directions can be considered anomalous, and these include ENE directions which can be projected from known porphyry copper deposits near the property boundaries, i.e., San Manuel to the southwest and Copper Creek to the northeast. Other anomalous structures are those which strike northerly and northeast, as well as those with arcuate strikes.

The arcuate-striking structures may represent reflections of collapse in a crackle breccia in buried preore rocks, the collapse resulting from oxidation-leaching, or simply from late tectonic adjustments in the crackle breccia. Bodies of crackle breccia are considered as very favorable sites for porphyry copper deposits.

ORE TARGETS

Intersections of an anomalous structure with a regional grain structure (N30-40°E), or intersections of one or more anomalous structures, are considered as favorable porphyry copper ore targets on the property. The targets selected by Mr. Coryell, as reflected by his proposed drilling sites, fit the above definition of a favorable target. Further, he has attempted to avoid excessive drilling depths based on interpretations of gravity and magnetic data.

Although all proposed holes are on valid targets, I would rank them as follows, starting with the most promising: B-1, B-2, B-9, B-6, CCP-3, B-10, B-8, B-11, B-7, B-3, B-5, B-4.

CONCLUSION

The targets selected by Mr. Coryell are valid in that their net potentials represent reasonable risks. Also, the program as outlined (total cost $225,000) appears to a fair and reasonable risk venture.

Respectfully submitted
January 21, 1974

Thomas W. Mitcham
6644 N. Amahl Place
Tucson, Arizona 85704

TWM/cm
Attach.

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Beth, Nancy, Lyn, and Phil claim area of Nucas Ltd. - Sucan Ltd.

Bunker Hill District, Pinal County, Arizona

Proposed Program:

Hole No.	Approx. Location	Type	Est. Depth	Est. Cost
B-1	SW S7 T8S R18E	Rotary	2832' < 3500'	$35,000.00
B-2	NE S6 T9S R18E	Rotary	3605' < 3500'	35,000.00
CCP-3	NW S18 T8S R18E	DD	ext. 1690' to ± 2500'	15,000.00
B-3	NE S22 T9S R18E	Rotary	< 2000'	Average cost est. at ±$7000. Total est. cost $65,000.00; will also validate 80 new claims
B-4	SE S15 T9S R18E	"	"	
B-5	NE S33 T8S R18E	" — 411'	"	
B-6	NW S12 T9S R17E	"	"	
B-7	NE S11 T9S R17E	"	"	
B-8	NE S3 T9S R17E	"	"	
B-9	SW S34 T8S R17E	" — 1690'	"	
B-10	NW S27 T8S R17E	"	"	
B-11	SE S26 T8S R17E	"	"	

Total exploratory drilling costs:	$150,000.00
Costs of validating ± 300 additional claims	35,000.00
Road building and drill site preparation	15,000.00
Additional state land fees	5,000.00
Misc. and contingencies.....	20,000.00
	$225,000.00

It is anticipated about 9 of the 12 holes will reach the pre-tertiary, or possibly mineralized, basement. Ten of the 12 holes will explore curved or circular features, detected from aerial photos, that have some chance of reflecting local subsidence of the younger cover caused by compaction of brecciated and oxidized mineralized rock of the basement. These arcuate features generally have a close spatial relationship with favorable linear trends as defined by photo interpretation, magnetic patterns, and gravity patterns. As the drilling progresses, some hole locations might be modified by features revealed, such as local unexpectedly great or little depths to basement, or great or little favorability for nearby mineralization.

Kirby C. Coryell 1-19-74

WESTERN PETROGRAPHIC

thin section of ± 100 cuttings

Sample No.: B-9 840-1200'

Name: Drill cuttings (composite sample)

This sample contains numerous fragments of Oracle Granite showing various stages of alteration. In many fragments, all of the "normal" minerals (such as quartz, K-feldspar, plagioclase, biotite, etc.) are present, while other fragments may contain just one or two different minerals. Typical fragments and alterations are as follows:

1. Oracle granite, in which biotite has largely been altered to chlorite; plagioclase has largely been altered to kaolinite and sericite.

2. Oracle granite, fresh except along fractures, where the biotite has been chloritized; secondary muscovite is present in this zone.

3. Plagioclase crystals, apparently from Oracle granite: largely altered to sericite and kaolinite.

4. Oracle granite; the plagioclase has been about 50% altered to clays.

5. Oracle granite; biotite is fresh, plagioclase only slightly altered to clays.

6. Plagioclase crystals, apparently from Oracle granite: strongly altered to sericite and clays.

7. Similar to No. 6.

8. Oracle granite; biotite largely chloritized; plagioclase largely altered to sericite and clays.

9. Plagioclase crystal, apparently from Oracle granite: largely altered to clays.

In addition to Oracle granite fragments, there are also numerous fragments of volcanics, quartzites, and gneisses. There is also one fragment of quartz monzonite porphyry, in which the ferromagnesian minerals have been chloritized; the plagioclase shows only very slight alteration to clays.

THOMAS W. MITCHAM
6644 N. Amahl Place
Tucson, Arizona 85704

mining geologist

phone: (602) 297-4070

July 20, 1974

Mr. Kirby C. Coryell
Beth Properties Ltd.
5140 E. Burns Street
Tucson, Arizona 85711

Re: Beth Property
Pinal County, Arizona

Dear Mr. Coryell:

I shall attempt herewith to review the present exploration status of subject property and to offer some conclusions on subsequent exploration possibilities.

Setting in reference to regional structure.-- The property is on a knife-edge linear (about N70°E) passing through the El Tiro orebody at Silver Bell, the San Manuel-Kalamazoo orebody, the Newmont-Exxon Copper Creek orebody, and the Morenci orebody. It is also within the San Pedro structural belt which includes the copper deposits at Bisbee, San Manuel, Ray, Superior, and Jerome. Further, the property covers the contact of the Precambrian Oracle batholith. The vicinity of this contact appears to influence the localization of porphyry copper deposits at Sacaton, Florence, Ray, and San Manuel.

Structural features on the property.-- Regionally, the predominant structural grain is N35°W, about the same direction as the strike of the San Manuel fault swarm and one of the prominent structural directions on the property, as derived from airborne magnetic data and gravity surveys (Charles L. Elliot, 5-22-74). Other structural directions derived from magnetic and gravity studies are approximately N65°E and E-W, the latter particularly from magnetic data. These directions represent a local disturbance of the regional structural grain.

Older (preore) rocks on the property are generally buried under a thick blanket of postore cover rocks. Structural features in this cover, mapped photogeologically, are probably reflections of structures in the older rocks. Two prominent strikes are recognized among these elements: N50°E and arcuate. Minor E-W elements are also observed in the cover rocks.

In summary, structures on the property with the following strikes are considered anomalous: N50-65°E, E-W, and arcuate. Certain arcuate structures and intersections of anomalous structures are considered as favorable to ore localization.

Drilling to date.-- Only 4 (2 drilled by Nucas) of the holes drilled to date have penetrated possible ore-bearing rocks beneath cover rocks, the cover being thicker than anticipated. Some holes, well located from the point of view of the present data base, were stopped in cover before reaching possible ore-bearing rocks. Hole B-2, for example, was bottomed in cover rocks at a depth of 3,605 feet.

Rock alteration conditions encountered in the 4 holes which entered older rocks were either weak or non-pervasive, suggesting that each of these holes is at least 3,000 feet horizontally from ore.

Studies by Jay Savera of Western Petrographic considerably aided in the recognition of rock alteration as well as in the distinction between older rocks and cover rocks.

Targets on the property.-- The property, which covers the favorable belt between the San Manuel orebody and the Copper Creek district, remains largely untested. Considering the large size of the property, adequate space exists in which to harbor more than one buried porphyry copper deposit within its boundaries. At its present stage of development, the exploration potential on the property is probably as good as that of any other prospect being explored in Arizona at the present time. However, the targets would be deep, and the depths are difficult to predict at the present time.

Some holes might be suggested at the present time to test favorable targets. Listed in order of indicated probability of intersecting mineralization, I would suggest the following sites: Hole B-2 (deepening of), NW¼NW¼NW¼ Sec. 25 T8S R17E, B-10 (new hole), Hole B-1 (deepening of). The probability that older rocks are more shallow at the B-10 site makes it advisable to attempt a test there before testing at the other 3 sites.

Very truly yours,

Thomas W. Mitcham

TWM/wj

October 4, 1974

Mr. Kirby C. Coryell, General Partner
Mucas Ltd.
5140 East Burns Street
Tucson, Arizona 85711

Dear Mr. Coryell:

As you are presently aware, your submittal of the San Manuel - Copper Creek property of Mucas Ltd. to R. B. Kayser was referred to me for action. At my request, all of the data made available by you has been reviewed by Mr. A. J. Perry of Perry, Knox, Kaufman, Inc. and I have discussed this review with Mr. Perry.

Although this property certainly has merit as a long range exploration project, it is my opinion that it does not meet IMC's present objectives. It is possible that future changes in our program will call for another review of the situation. If this proves to be the case, we will contact you at that time.

Thank you for giving us an opportunity to review your data.

Very truly yours,

J. Bruce Imsviler
Manager - Exploration
Western U.S.A.

:btr

cc: Messrs. R. B. Kayser
A. J. Perry

INTER-OFFICE CORRESPONDENCE

COPIES TO: D. L. Everhart
P. O. Sandvik

TO J. B. Imswiler

FROM R. B. Kayser

DATE September 11, 1974

SUBJECT Arizona Copper Prospect

Don Everhart and Pete Sandvik are out of the office for several days so I am taking the liberty of forwarding a letter and several reports pertaining to a copper prospect in Arizona to you for your review. These reports were sent to me through a Mr. Herb Leopold, who is a contact that was generated through our oil and gas exploration activities. Leopold has an interest in the company which is presenting this prospect to IMC. Other than the fact that I know Tom Mitcham fairly well and I know Chuck Elliot by reputation, I have no inside information on the quality of this prospect. Leopold has informed me that there is some urgency in reviewing this because Tom Mitcham is presenting it at the same time to Cerro Corporation and Rio Amax.

If you need more information or want to pursue the terms of the deal, I think that a direct contact to Kirby Coryell will probably be the best approach. If you need any additional information please let me know and I will see what I can dig up.

R. B. K.

R. B. Kayser/mp
Enc.

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September 6, 1974

Mr. Robert Kayser
International Minerals Corp.
R.C Place
Libertyville, Ill. 60048

Dear Mr. Kayser:

Herb Leopold informs me you are interested in reviewing some of the data on our copper property in the San Manuel-Copper Creek area, and at his request I am sending you some of it, primarily reports by Chuck Elliot and Tom Mitcham. Chuck worked on the aeromagnetics for us, and a year or so later the gravity when it became available. He seems certain of a structural trend between the two districts, and Tom's photo studies confirm it. We consider it a potential mineral belt.

Our drilling to date proves the San Manuel basement environment to extend almost to the Copper Creek District; thus most of our property is underlain by the environment of the larger deposit, and the contact between the Oracle Granite and the schist trends discordantly across the favorable belt within our ground. A second strong structural zone, of strike similar to the San Manuel fault swarm, also crosses the belt, as demonstrated by the magnetics, gravity, and photo work. In addition to rejuvenations of older faulting that Tom sees in the Gila, he has been able to pick out a good number of circular structures in the Gila, some of which may represent collapse features. It is interesting that their occurrence is very largely confined to the belt, that a similar fault pattern exists in pre-mining photos over the south flank of the San Manuel ore body, the thickest and more intensely mineralized part, and that Tom has observed similar patterns in pre-mining photos over other porphyry deposits. In our most recent drilling we had the benefit of Tom's help, and chose the two better developed circular features that also had the benefit of local trends and structures, as prime targets; unfortunately these proved to be in relatively deep parts of the property and the holes were stopped at 2332 and 3605, without our having the money left in this program to complete them. Chuck's prediction at B-2, the 3605 hole, is 3700 feet plus or minus 500 to basement.

On page 10 of Chuck's gravity report he discusses the composition of the basement ridge trending ENE. Unfortunately his comments are based on an over-simplified log of hole B-9; he had no way of knowing the upper 400 feet or so of Cloudburst was a fanglomerate granitic in cobble content rather than cobbles of Cloudburst lava composition, so the ridge should provide

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KCC/nl

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Bunker Hill District
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by

Thomas W. Mitcham

January 21, 1974

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Respectfully submitted
January 21, 1974

Thomas W. Mitcham
6644 N. Amahl Place
Tucson, Arizona 85704

TWM/cm
Attach.

NUCAS LTD.
KIRBY C. CORYELL, GENERAL PARTNER
5140 EAST BURNS STREET
TUCSON, ARIZONA 85711

(602) 325-2075

Beth, Nancy, Lyn, and Phil claim area of Nucas Ltd. - Sucan Ltd.

Bunker Hill District, Pinal County, Arizona

Proposed Program:

Hole No.	Approx. Location	Type	Est. Depth	Est. Cost
B-1	SW S7 T8S R18E	Rotary	2832' < 3500'	$35,000.00
B-2	NE S6 T9S R18E	Rotary	3605' < 3500'	35,000.00
CCP-3	NW S18 T8S R18E	DD	ext. 1690' to 2500'	15,000.00
B-3	NE S22 T9S R18E	Rotary	< 2000	Average cost est. at ±$7000. Total est. cost $65,000.00; will also validate 80 new claims
B-4	SE S15 T9S R18E	"	"	
B-5	NE S33 T8S R18E	" — 411'	"	
B-6	NW S12 T9S R17E	"	"	
B-7	NE S11 T9S R17E	"	"	
B-8	NE S3 T9S R17E	"	"	
B-9	SW S34 T8S R17E	" — 1690'	"	
B-10	NW S27 T8S R17E	"	"	
B-11	SE S26 T8S R17E	"	"	

Total exploratory drilling costs:	$150,000.00
Costs of validating ± 300 additional claims	35,000.00
Road building and drill site preparation	15,000.00
Additional state land fees	5,000.00
Misc. and contingencies	20,000.00
	$225,000.00

It is anticipated about 9 of the 12 holes will reach the pre-tertiary, or possibly mineralized, basement. Ten of the 12 holes will explore curved or circular features, detected from aerial photos, that have some chance of reflecting local subsidence of the younger cover caused by compaction of brecciated and oxidized mineralized rock of the basement. These arcuate features generally have a close spatial relationship with favorable linear trends as defined by photo interpretation, magnetic patterns, and gravity patterns. As the drilling progresses, some hole locations might be modified by features revealed, such as local unexpectedly great or little depths to basement or great or little favorability for nearby mineralization.

Kirby C. Coryell 1-17-74

THOMAS W. MITCHAM
6644 N. Amahl Place
Tucson, Arizona 85704

mining geologist

phone (602) 297-4070

July 20, 1974

Mr. Kirby C. Coryell
Beth Properties Ltd.
5140 E. Burns Street
Tucson, Arizona 85711

Re: Beth Property
Pinal County, Arizona

Dear Mr. Coryell:

I shall attempt herewith to review the present exploration status of subject property and to offer some conclusions on subsequent exploration possibilities.

Setting in reference to regional structure.-- The property is on a knife-edge linear (about N70°E) passing through the El Tiro orebody at Silver Bell, the San Manuel-Kalamazoo orebody, the Newmont-Exxon Copper Creek orebody, and the Morenci orebody. It is also within the San Pedro structural belt which includes the copper deposits at Bisbee, San Manuel, Ray, Superior, and Jerome. Further, the property covers the contact of the Precambrian Oracle batholith. The vicinity of this contact appears to influence the localization of porphyry copper deposits at Sacaton, Florence, Ray, and San Manuel.

Structural features on the property.-- Regionally, the predominant structural grain is N35°W, about the same direction as the strike of the San Manuel fault swarm and one of the prominent structural directions on the property, as derived from airborne magnetic data and gravity surveys (Charles L. Elliot, 5-22-74). Other structural directions derived from magnetic and gravity studies are approximately N65°E and E-W, the latter particularly from magnetic data. These directions represent a local disturbance of the regional structural grain.

Older (preore) rocks on the property are generally buried under a thick blanket of postore cover rocks. Structural features in this cover, mapped photogeologically, are probably reflections of structures in the older rocks. Two prominent strikes are recognized among these elements: N50°E and arcuate. Minor E-W elements are also observed in the cover rocks.

In summary, structures on the property with the following strikes are considered anomalous: N50-65°E, E-W, and arcuate. Certain arcuate structures and intersections of anomalous structures are considered as favorable to ore localization.

Drilling to date.-- Only 4 (2 drilled by Nucas) of the holes drilled to date have penetrated possible ore-bearing rocks beneath cover rocks, the cover being thicker than anticipated. Some holes, well located from the point of view of the present data base, were stopped in cover before reaching possible ore-bearing rocks. Hole B-2, for example, was bottomed in cover rocks at a depth of 3,605 feet.

Rock alteration conditions encountered in the 4 holes which entered older rocks were either weak or non-pervasive, suggesting that each of these holes is at least 3,000 feet horizontally from ore.

Studies by Jay Savera of Western Petrographic considerably aided in the recognition of rock alteration as well as in the distinction between older rocks and cover rocks.

Targets on the property.-- The property, which covers the favorable belt between the San Manuel orebody and the Copper Creek district, remains largely untested. Considering the large size of the property, adequate space exists in which to harbor more than one buried porphyry copper deposit within its boundaries. At its present stage of development, the exploration potential on the property is probably as good as that of any other prospect being explored in Arizona at the present time. However, the targets would be deep, and the depths are difficult to predict at the present time.

Some holes might be suggested at the present time to test favorable targets. Listed in order of indicated probability of intersecting mineralization, I would suggest the following sites: Hole B-2 (deepening of), NW¼NW¼NW¼ Sec. 25 T8S R17E, B-10 (new hole), Hole B-1 (deepening of). The probability that older rocks are more shallow at the B-10 site makes it advisable to attempt a test there before testing at the other 3 sites.

Very truly yours,

Thomas W. Mitcham

TWM/wj